WTS TUTORING

LIFE SCIENCES

GRADE 12

CAPS PAPERS & SOLUTIONS

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- EXAMINATION GUIDELINES
- INSTRUCTIONS AND INFORMATION
- CAPS PAST PAPERS AND SOLUTIONS {2014 TO 2017}
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PUBLISHERS

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EXAMINATION GUIDELINES

1. INTRODUCTION

The Curriculum and Assessment Policy Statement (CAPS) for Life Sciences outlines the nature and purpose of the subject Life Sciences. This guides the philosophy underlying the teaching and assessment of the subject in Grade 12.

The purpose of these Examination Guidelines is to:

- Provide clarity on the depth and scope of the content to be assessed in the Grade 12 National Senior Certificate (NSC) Examination in Life Sciences.
- Assist teachers to adequately prepare learners for the examinations.

This document deals with the final Grade 12 external examinations. It does not deal in any depth with the School-Based Assessment (SBA).

These Examination Guidelines should be read in conjunction with:

- *The National Curriculum Statement (NCS) Curriculum and Assessment Policy Statement (CAPS):* Life Sciences
- The National Protocol of Assessment: *An addendum to the policy document, the National Senior Certificate: A qualification at Level 4 on the National Qualifications Framework (NQF), regarding the National Protocol for Assessment (Grades R–12)*
- The national policy pertaining to the programme and promotion requirements of the National Curriculum Statement, Grades R–12
- Circular S5 of 2013 which amends the Programme of Assessment contained in the CAPS policy document (page 70)

2. SPECIFIC AIMS FOR GRADE 12 (CAPS)

There are three broad subject-specific aims in Life Sciences which relate to the purposes of learning science as shown below.

SPECIFIC AIM	ELABORATION
Specific Aim 1	Relates to knowing the subject content
Specific Aim 2	Relates to doing science or practical work and investigations
Specific Aim 3	Relates to understanding the applications of Life Sciences in everyday life, as well as understanding the history of scientific discoveries and the relationship between indigenous knowledge and science

These specific aims are described in greater detail in the CAPS document (pages 13–18). It is important that these specific aims are addressed in both teaching and assessing.

3. ASSESSMENT IN GRADE 12

3.1 WEIGHTING OF COGNITIVE LEVELS FOR GRADE 12 (CAPS)

The following weightings apply to assessment tasks set for Grade 12:

CATEGORY	COGNITIVE LEVELS	PERCENTAGE
A	Knowledge	40
B	Comprehension	25
C	Application	20
D	Analysis, Synthesis and Evaluation	15

3.2 SEQUENCE OF TOPICS FOR GRADE 12 (CAPS)

The following sequence of topics is recommended for Grade 12 based on the progressive development of concepts through the different topics:

1. DNA: The Code of Life
2. Meiosis
3. Reproduction in Vertebrates
4. Human Reproduction
5. Genetics and Inheritance
6. Responding to the Environment (Humans)
7. Human Endocrine System
8. Homeostasis in Humans
9. Responding to the Environment (Plants)
10. Evolution
11. Human Impact (from Grade 11)

The question paper that assesses each topic and the weighting of each topic in the relevant paper is addressed in the CAPS document (page 73).

3.3 PROGRAMME OF FORMAL ASSESSMENT FOR GRADE 12 (CAPS)

Some changes have been made to the Programme of Assessment for Grade 12 from that which is specified on page 70 of the CAPS document. Refer to Circular S5 of 2013 for these changes.

Circular S5 of 2013 also provides a clear description of what is expected for a test, examination, assignment, project and a practical.

3.4 FORMAT OF THE QUESTION PAPER

The examination will consist of two question papers of 2½ hours and 150 marks each. Each question paper will have the following format:

SECTION	TYPES OF QUESTIONS	MARKS
A	Short answers, objective questions such as multiple-choice questions, terminology, matching items	50
B	A variety of questions types: two questions of 40 marks each, divided into 3–4 subsections	2 x 40 = 80
C	A mini-essay	20

4. ELABORATION OF CONTENT FOR GRADE 12 (CAPS)

A topic-wise elaboration follows, which merely outlines the basic content that needs to be covered. This content can be assessed at all four cognitive levels.

DNA: THE CODE OF LIFE Paper 2: 27 marks	**Term 1**	**2½ weeks**

CONTENT	ELABORATION
Introduction	❑ Revision of the structure of the cell with an emphasis on the ribosome, cytoplasm and the parts of the nucleus ❑ Nucleic acids consist of nucleotides ❑ Two types of nucleic acids: DNA and RNA
DNA: location, structure and functions	❑ Location of DNA: • Makes up the genes on chromosomes (nuclear DNA) • Present in mitochondria (mitochondrial DNA) ❑ Brief history of the discovery of the DNA molecule (Watson & Crick, Franklin & Wilkins) ❑ Three components of a DNA nucleotide: • Nitrogenous bases linked by weak hydrogen bonds: - Four nitrogenous bases of DNA: adenine (A), thymine (T), cytosine (C), guanine (G) - Pairing of bases in DNA occur as follows: A : T and G : C • Sugar portion (deoxyribose in DNA) • Phosphate portion ❑ The natural shape of the DNA molecule is a double helix ❑ Stick diagram of DNA molecule to illustrate its structure ❑ Functions of DNA: • Sections of DNA-forming genes carry hereditary information • DNA contains coded information for protein synthesis
DNA replication	❑ Process of DNA replication: • When in the cell cycle it takes place • Where in the cell it takes place • How DNA replication takes place (names of enzymes not required) • The significance of DNA replication
DNA profiling	❑ Definition of DNA profile ❑ Uses of DNA profiles ❑ Interpretation of DNA profiles

CONTENT	ELABORATION
RNA: location, structure and function	❑ Location of RNA: • mRNA is formed in the nucleus and functions on the ribosome • tRNA is located in the cytoplasm ❑ RNA plays a role in protein synthesis ❑ Structure of RNA: • A single-stranded molecule consisting of nucleotides • Each nucleotide is made up of a sugar (ribose), phosphate and a nitrogen base • Four nitrogenous bases of RNA: adenine (A), uracil (U), cytosine (C), guanine (G) ❑ Stick diagram of mRNA and tRNA molecules to illustrate their structure
Protein synthesis	❑ The involvement of DNA and RNA in protein synthesis: • Transcription - The double helix DNA unwinds. - The double-stranded DNA unzips/weak hydrogen bonds break - to form two separate strands. - One strand is used as a template - to form mRNA - using free RNA nucleotides from the nucleoplasm. - The mRNA is complementary to the DNA. - mRNA now has the coded message for protein synthesis. • mRNA moves from the nucleus to the cytoplasm and attaches to the ribosome. • Translation - Each tRNA carries a specific amino acid. - When the anticodon on the tRNA - matches the codon on the mRNA - then tRNA brings the required amino acid to the ribosome. (Names of specific codons, anticodons and their amino acids are not to be memorised.) - Amino acids become attached by peptide bonds - to form the required protein. ❑ Simple diagram to illustrate transcription and translation in protein synthesis

MEIOSIS Paper 1: 11 marks & Paper 2: 12 marks	**Term 1**	**2 weeks**

CONTENT	ELABORATION
Introduction	❑ Revision of the structure of a cell with an emphasis on the parts of the nucleus, the centrosome and the cytoplasm ❑ Structure of chromosomes: • Chromosomes consist of DNA (which makes up genes) and protein • The number of chromosomes in a cell is a characteristic of an organism (e.g. humans have 46 chromosomes) • Chromosomes which are single threads become double (two chromatids joined by a centromere) as a result of DNA replication ❑ Differentiate between: • Haploid (n) and diploid (2n) cells in terms of chromosome number • Sex cells (gametes) and somatic cells (body cells) • Sex chromosomes (gonosomes) and autosomes ❑ Revision of the process of mitosis

CONTENT	ELABORATION
Meiosis – The process	❑ Definition of meiosis ❑ Site of meiosis in plants and in animals ❑ Meiosis is a continuous process, but the events are divided into different phases for convenience ❑ Events of interphase: • DNA replication takes place • Chromosomes which are single threads, become double • Each chromosome will now consist of two chromatids joined by a centromere • DNA replication helps to double the genetic material so that it can be shared by the new cells arising from cell division ❑ The events of the following phases of Meiosis I, using diagrams: • Prophase I - Including a description of crossing over • Metaphase I - Including the random arrangement of chromosomes • Anaphase I • Telophase I ❑ The events of each phase of Meiosis II, using diagrams: • Prophase II • Metaphase II - Including the random arrangement of chromosomes • Anaphase II • Telophase II
Importance of meiosis	❑ The importance of meiosis: • Production of haploid gametes • The halving effect of meiosis overcomes the doubling effect of fertilisation, thus maintaining a constant chromosome number from one generation to the next • Mechanism to introduce genetic variation through: - Crossing over - The random arrangement of chromosomes at the equator
Abnormal meiosis	❑ Non-disjunction and its consequences ❑ Non-disjunction of chromosome pair 21 during Anaphase I in humans to form abnormal gametes with an extra copy of chromosome 21 ❑ The fusion between an abnormal gamete (24 chromosomes) and a normal gamete (23 chromosomes) may lead to Down syndrome
Comparison of mitosis and meiosis	❑ Similarities of mitosis and meiosis ❑ Differences between mitosis and meiosis

REPRODUCTION IN VERTEBRATES Paper 1: 6 marks	**Term 1**	**½ week**

CONTENT	ELABORATION
Diversity of reproductive strategies	❑ The role of the following reproductive strategies in animals in maximising reproductive success in different environments (using relevant examples): • External fertilisation and internal fertilisation • Ovipary, ovovivipary and vivipary • Amniotic egg • Precocial and altricial development • Parental care

HUMAN REPRODUCTION Paper 1: 31 marks	Term 1	3 weeks

CONTENT	ELABORATION
Introduction	❑ Revision of the schematic outline of the human life cycle to show the role of meiosis, mitosis and fertilisation
Structure of the male reproductive system	❑ Structure of the male reproductive system, using a diagram ❑ Functions of the testis, epididymis, vas deferens, seminal vesicle, prostate gland, Cowper's gland and the urethra
Structure of the female reproductive system	❑ Structure of the female reproductive system, using a diagram ❑ Functions of the ovary, Fallopian tubes, uterus lined by endometrium, cervix, vagina with its external opening and the vulva ❑ Structure of the ovary, using a diagram, showing the primary follicles, the Graafian follicle and the corpus luteum
Puberty	❑ Main changes that occur in male characteristics during puberty under the influence of testosterone ❑ Main changes that occur in female characteristics during puberty under the influence of oestrogen
Gametogenesis	❑ Formation of gametes (gametogenesis) by meiosis • Male gametes formed by spermatogenesis • Female gametes formed by oogenesis ❑ Spermatogenesis: • Under the influence of testosterone • diploid cells in the seminiferous tubules of the testes undergo meiosis • to form haploid sperm cells ❑ Structure of a sperm, using a diagram ❑ Functions of the parts of a sperm cell (acrosome, head with haploid nucleus, middle portion/neck with mitochondria and a tail) ❑ Oogenesis: • Under the influence of FSH • diploid cells in the ovary undergo mitosis • to form numerous follicles. • One cell inside a follicle enlarges and undergoes meiosis. • Of the four cells that are produced, only one survives to form a mature, haploid ovum. ❑ Structure of an ovum, using a diagram ❑ Functions of the different parts of an ovum (layer of jelly, haploid nucleus, cytoplasm)
Menstrual cycle	❑ The menstrual cycle includes the uterine and ovarian cycles ❑ Events in the ovarian cycle: • Development of the Graafian follicle • Ovulation • Formation of the corpus luteum ❑ Events in the uterine cycle: • Changes that take place in the thickness of the endometrium • Menstruation ❑ Hormonal control of the menstrual cycle (ovarian and uterine cycles) with reference to the action of FSH, oestrogen, LH and progesterone ❑ Negative feedback mechanism involving FSH and progesterone in controlling the production of ova

CONTENT	ELABORATION
Fertilisation and development of zygote to blastocyst	❑ Definition of copulation and fertilisation ❑ Process of fertilisation ❑ Development of zygote → embryo (morula and blastula/blastocyst) → foetus
Implantation, gestation and the role of the placenta	❑ Definition of implantation ❑ The role of oestrogen and progesterone in maintaining pregnancy ❑ Structure of the developing foetus in the uterus, using a diagram ❑ Functions of the following parts: • Chorion and chorionic villi • Amnion, amniotic cavity and amniotic fluid • Umbilical cord (including umbilical artery and umbilical vein) • Placenta

GENETICS AND INHERITANCE Paper 2: 45 marks	**Term 2**	**4 weeks**

CONTENT	ELABORATION
Introduction	❑ Mention of Mendel as the father of genetics
Concepts in inheritance	❑ Chromatin and chromosomes ❑ Genes and alleles ❑ Dominant and recessive alleles – The Law of Dominance ❑ Phenotype and genotype ❑ Homozygous and heterozygous
Monohybrid crosses	❑ Format for representing a genetics cross ❑ Mendel's Principle of Segregation ❑ Types of dominance: • Complete dominance – one allele is dominant and the other is recessive, such that the effect of the recessive allele is masked by the dominant allele in the heterozygous condition • Incomplete dominance – none of the two alleles of a gene is dominant over the other, resulting in an intermediate phenotype in the heterozygous condition • Co-dominance – both alleles of a gene are equally dominant whereby both alleles express themselves in the phenotype in the heterozygous condition ❑ Genetics problems involving each of the three types of dominance ❑ Proportion and ratio of genotypes and phenotypes
Sex determination	❑ 22 pairs of chromosomes in humans are autosomes and one pair of chromosomes are sex chromosomes/gonosomes ❑ Males have XY chromosomes and females have XX chromosomes ❑ Differentiate between sex chromosomes (gonosomes) and autosomes in the karyotypes of human males and females ❑ Representation of a genetic cross to show the inheritance of sex

CONTENT	ELABORATION
Sex-linked inheritance	❑ Sex-linked alleles and sex-linked disorders ❑ Genetics problems involving the following sex-linked disorders: • Haemophilia • Colour-blindness
Blood grouping	❑ Different blood groups are a result of multiple alleles ❑ The alleles I^A, I^B and **i** in different combinations result in four blood groups ❑ Genetics problems involving the inheritance of blood type
Dihybrid crosses	❑ Mendel's Principle of Independent Assortment ❑ Dihybrid genetics problems ❑ Determination of the proportion/ratio of genotypes and phenotypes
Genetic lineages/pedigrees	❑ A genetic lineage/pedigree traces the inheritance of characteristics over many generations ❑ Interpretation of pedigree diagrams
Mutations	❑ Definition of a mutation ❑ Effects of mutations: harmful mutations, harmless mutations and useful mutations ❑ Mutations contribute to genetic variation ❑ Definition of gene mutation and chromosomal mutation ❑ Mutations lead to altered characteristics in each of the following genetic disorders: • Haemophilia – absence of blood-clotting factors • Colour-blindness – due to absence of the proteins that comprise either the red or green cones/photoreceptors in the eye • Down syndrome – due to an extra copy of chromosome 21 as a result of non-disjunction during meiosis
Genetic engineering	❑ Genetic engineering uses biotechnology to satisfy human needs: • Stem cell research – sources and uses of stem cells • Genetically modified organisms – brief outline of process (names of enzymes involved are not required) and benefits of genetic modification • Cloning – brief outline of process and benefits of cloning
Paternity testing	❑ The role of each of the following in paternity testing: • Blood grouping • DNA profiles
Genetic links	❑ Mutations in mitochondrial DNA used in tracing female ancestry

RESPONDING TO THE ENVIRONMENT (HUMANS) Paper 1: 40 marks	**Term 2**	**4 weeks**

CONTENT	ELABORATION
Introduction	❑ The nervous system (involving nerves) and endocrine system (involving hormones) are two components that help us respond to the environment
Human nervous system	❑ The need for a nervous system in humans: • Reaction to stimuli (stimuli can be external and internal) • Coordination of the various activities of the body

CONTENT	ELABORATION
Central nervous system	❑ The brain and spinal cord are protected by meninges ❑ Location and functions of the following parts: • Brain - Cerebrum - Cerebellum - Corpus callosum - Medulla oblongata • Spinal cord
Peripheral nervous system	❑ Location and functions of the peripheral nervous system (cranial and spinal nerves)
Autonomic nervous system	❑ Location and functions of the autonomic nervous system (sympathetic and parasympathetic sections)
Structure and functioning of a nerve	❑ Functions of sensory and motor neurons ❑ Structure and functions of parts of sensory and motor neurons, using diagrams: nucleus, cell body, cytoplasm, myelin sheath, axon and dendrites
The simple reflex arc	❑ Definition of reflex action and a reflex arc ❑ Structure of a reflex arc and functions of each part, using a diagram: receptor, sensory neuron, dorsal root of spinal nerve, spinal cord, interneuron, motor neuron, ventral root of spinal nerve, effector ❑ Functioning of a simple reflex action, using an example ❑ Significance of a reflex action ❑ Significance of synapses
Disorders of the CNS	❑ Causes and symptoms of the following disorders of the nervous system: • Alzheimer's disease • Multiple sclerosis
Receptors	❑ Functions of receptors, neurons and effectors in responding to the environment ❑ The body responds to a variety of different stimuli, such as light, sound, touch, temperature, pressure, pain and chemicals (taste and smell). (No structure and names necessary except for names of the receptors in the eye and ear.)
Human eye	❑ Structure and functions of the parts of the human eye, using a diagram ❑ Binocular vision and its importance ❑ The changes that occur in the human eye for each of the following, using diagrams: • Accommodation • Pupillary mechanism ❑ The nature and treatment of the following visual defects, using diagrams: • Short-sightedness • Long-sightedness • Astigmatism • Cataracts
Human ear	❑ Structure of the human ear and the functions of the different parts, using a diagram ❑ Functioning of the human ear in: • Hearing (include the role of the organ of Corti, without details of its structure) • Balance (include the role of maculae and cristae, without details of their structure) ❑ Cause and treatment of the following hearing defects: • Middle ear infection (the use of grommets) • Deafness (the use of hearing aids and cochlear implants)

HUMAN ENDOCRINE SYSTEM Paper 1: 15 marks	**Term 3**	**1½ weeks**

CONTENT	**ELABORATION**
Introduction	❑ Difference between an endocrine and an exocrine gland ❑ Definition of a hormone ❑ Location of each of the following glands, using a diagram, the hormones they secrete and function(s) of each hormone: • Hypothalamus (ADH) • Pituitary/Hypophysis (GH, TSH, FSH, LH, prolactin) • Thyroid glands (thyroxin) • Islets of Langerhans in the pancreas (insulin, glucagon) • Adrenal glands (adrenalin, aldosterone) • Ovary (oestrogen, progesterone) • Testis (testosterone ❑ Negative feedback mechanism involving: • TSH and thyroxin (and the result of an imbalance: thyroid disorders) • Insulin and glucagon (and the result of an imbalance: diabetes mellitus)

HOMEOSTASIS IN HUMANS Paper 1: 11 marks	**Term 3**	**1 week**

CONTENT	**ELABORATION**
Introduction	❑ Homeostasis as the process of maintaining a constant, internal environment within narrow limits, despite changes that take place internally and externally ❑ The conditions within cells depend on the conditions within the internal environment (the tissue fluid) ❑ Factors such as carbon dioxide, glucose, salt and water concentration, temperature and pH must be kept constant in the internal environment (tissue fluid)
Homeostasis through negative feedback	❑ Negative feedback mechanism controlling the concentration of: • Glucose • Carbon dioxide • Water • Salts
Thermoregulation	❑ Structure of the skin, using a diagram, with an emphasis on the parts involved in thermoregulation ❑ Role of the following in negative feedback mechanism for controlling temperature/thermoregulation: • Sweating • Vasodilation • Vasoconstriction

RESPONDING TO THE ENVIRONMENT (PLANTS) Paper 1: 11 marks	Term 3	1 week

CONTENT	ELABORATION
Plant hormones	❑ General functions of the following: • Auxins • Gibberellins • Abscisic acid ❑ The control of weeds using plant hormones ❑ The role of auxins in: • Geotropism • Phototropism
Plant defence mechanisms	❑ Role of the following as plant defence mechanisms: • Chemicals • Thorns

EVOLUTION Paper 2: 66 marks	Terms 3/4	6 weeks

CONTENT	ELABORATION
Introduction	❑ Definition of biological evolution ❑ Difference between a hypothesis and a theory ❑ The Theory of Evolution is regarded as a scientific theory since various hypotheses relating to evolution have been tested and verified over time
Evidence for evolution	❑ Role of the following as evidence for evolution: • Fossil record – Link to Grade 10 • Biogeography – Link to Grade 10 • Modification by descent (homologous structures) • Genetics
Variation	❑ Definition of a biological species and a population ❑ A review of the contribution of each of the following to variation that exists amongst individuals of the same species: • Meiosis - Crossing over - Random arrangement of chromosomes • Mutations • Random fertilisation • Random mating ❑ Continuous and discontinuous variation
Origin of an idea about origins (a historical development)	❑ Ideas on evolution in the order of their origin are as follows: • Lamarckism • Darwinism • Punctuated Equilibrium
Lamarckism (Jean Baptiste de Lamarck – 1744–1829)	❑ Lamarck used two 'laws' to explain evolution: • 'Law' of use and disuse • 'Law' of the inheritance of acquired characteristics ❑ Reasons for Lamarck's theory being rejected

CONTENT	ELABORATION
Darwinism (Charles Darwin – 1809–1882)	❑ Darwin's theory of evolution by natural selection: • Organisms produce a large number of offspring. • There is a great deal of variation amongst the offspring. • Some have favourable characteristics and some do not. • When there is a change in the environmental conditions or if there is competition, • then organisms with characteristics, which make them more suited, survive • whilst organisms with unfavourable characteristics, which make them less suited, die. • The organisms that survive, reproduce • and thus pass on the allele for the favourable characteristic to their offspring. • The next generation will therefore have a higher proportion of individuals with the favourable characteristic. • In this way, the characteristics of a population gradually change over a long period of time.
Punctuated Equilibrium (Eldredge and Gould – 1972)	❑ Punctuated Equilibrium explains the speed at which evolution takes place: • Evolution involves long periods of time where species do not change or change gradually through natural selection (known as equilibrium). • This alternates with (is punctuated by) short periods of time where rapid changes occur through natural selection • during which new species may form in a short period of time.
Artificial selection	❑ Artificial selection involving: • A domesticated animal species • A crop species
Formation of new species	❑ Biological species concept: similar organisms that are capable of interbreeding to produce fertile offspring ❑ Speciation and extinction and the effect of each on biodiversity ❑ Speciation through geographic isolation: • If a population of a single species • becomes separated by a geographical barrier (sea, river, mountain, lake) • then the population splits into two. • There is now no gene flow between the two populations. • Since each population may be exposed to different environmental conditions/the selection pressure may be different • natural selection occurs independently in each of the two populations • such that the individuals of the two populations become very different from each other • genotypically and phenotypically. • Even if the two populations were to mix again • they will not be able to interbreed. • The two populations are now different species. ❑ Speciation through geographic isolation in ONE of the following: • Galapagos finches • Galapagos tortoises • Plants on different land masses (linked to continental drift) - Baobabs in Africa and Madagascar - Proteas in South Africa and Australia • Any example of mammals on different land masses
Mechanisms of reproductive isolation (Keeping species separate)	❑ A brief outline of reproductive isolation mechanisms that help to keep species separate: • Breeding at different times of the year • Species-specific courtship behaviour • Adaptation to different pollinators • Infertile offspring • Prevention of fertilisation

CONTENT	ELABORATION
Evolution in present times	❑ Any ONE example of natural selection and evolution in present times: • Use of insecticides and consequent resistance to insecticides in insects • Development of resistant strains of tuberculosis-causing bacteria (MDR and XDR) to antibiotics, due to mutations (variations) in bacteria and failure to complete antibiotic courses • HIV resistance to antiretroviral medication • Bill (beak) and body size of Galapagos finches
Evidence of common ancestors for living hominids, including humans	❑ Interpretation of a phylogenetic tree to show the place of the family Hominidae in the animal kingdom ❑ Characteristics that humans share with African apes ❑ Anatomical differences between African apes and humans, with the aid of diagrams, as it applies to the following characteristics: • Bipedalism (foramen magnum, spine and pelvic girdle) • Brain size • Teeth (dentition) • Prognathism • Palate shape • Cranial ridges • Brow ridges ❑ Lines of evidence that support the idea of common ancestors for living hominids including humans: • Fossil evidence: Evidence from fossils of different ages show that the anatomical characteristics of organisms changed gradually over time. • Emphasis on evolutionary trends provided by the anatomical features of fossils of the following three genera: - *Ardipithecus* - *Australopithecus* - *Homo* as well as: - The age of each fossil found/time-line for the existence of the three genera - The fossil sites where they were found: emphasis on the fossil sites that form a part of the Cradle of Humankind - The scientists who discovered them • Genetic evidence: mitochondrial DNA • Cultural evidence: tool-making
Out of Africa hypothesis	❑ Evidence for the Out of Africa hypothesis: • Fossil evidence: information on each of the following fossils that serve as evidence for the Out of Africa hypothesis: - *Ardipithecus* (fossils found in Africa only) - *Australopithecus* (fossils found in Africa only, including Karabo, Littlefoot, Taung Child, Mrs Ples) - *Homo* (fossils of *Homo habilis* found in Africa only; oldest fossils of *Homo erectus* found in Africa, while the younger fossils were found in other parts of the world) • Genetic evidence: mitochondrial DNA ❑ Timeline for the existence of different species of the genus *Homo* and the significant features of each type of fossil to illustrate the differences amongst them ❑ Interpretation of phylogenetic trees proposed by different scientists showing possible evolutionary relationships as it applies to hominid evolution

HUMAN IMPACT Paper 1: 25 marks	Term 4	2½ weeks

CONTENT	ELABORATION
The atmosphere and climate change	❑ Sources of carbon dioxide emissions and methane emissions (greenhouse gases) ❑ The greenhouse effect and its importance for life on Earth ❑ Difference between the greenhouse effect and the enhanced greenhouse effect ❑ Global warming: due to an increase in greenhouse gases (enhanced greenhouse effect) ❑ Effects of global warming: desertification, drought and floods ❑ Deforestation and its influence on the CO_2 concentration in the atmosphere ❑ Carbon footprint: ways of reducing our 'carbon footprint' ❑ Causes and consequences of ozone depletion ❑ Strategies to decrease ozone depletion
Water availability	❑ Influence of the following factors on the availability of water: • Construction of dams • Destruction of wetlands • Exotic plantations and depletion of the water table • Water wastage • Cost of water • Poor farming practices • Droughts and floods • Boreholes and its effects on aquifers
Water quality	❑ Factors that reduce water quality: • Eutrophication and algal bloom • Domestic, industrial and agricultural use – leading to pollution and disease • Mining • Alien plants, e.g. *Eichornia* • Thermal pollution ❑ Role of water purification in improving the quality of water ❑ Role of the recycling of water in improving the quality of water
Food security	❑ Definition of food security ❑ Factors that influence food security: • Human exponential population growth • Droughts and floods (climate change) • Alien plants and the reduction of agricultural land • The loss of wild varieties: impact on gene pools • Wastage • Genetically engineered foods • Poor farming practices such as: - Monoculture - Overgrazing and the loss of topsoil - The use of fertilisers - The use of pesticides

CONTENT	ELABORATION
Loss of biodiversity	❑ The importance of maintaining biodiversity ❑ Factors that reduce biodiversity: • Habitat destruction through: - Farming methods (overgrazing and monoculture) - Golf estates - Mining - Urbanisation - Deforestation - Loss of wetlands and grasslands • Poaching (e.g. rhino horn, ivory, 'bush meat') • Alien plant invasions ❑ Factors that reduce the loss of biodiversity: • Control of alien plant invasion using mechanical, chemical and biological methods • The sustainable use of the environment using any ONE of the following examples: devils' claw, rooibos, fynbos, the African potato (*Hypoxis*) or *Hoodia*
Solid waste disposal	❑ The need to reduce solid waste or find ways of managing it ❑ Aspects of solid-waste disposal: • Ways in which dumpsites can be managed for rehabilitation and prevention of soil and water pollution • The use of methane from dumpsites for domestic use, such as heating and lighting • The need for recycling • The need for safe disposal of nuclear waste

5. CONCLUSION

This Examination Guidelines document is meant to articulate the assessment aspirations espoused in the CAPS document. It is therefore not a substitute for the CAPS document which teachers should teach to.

Qualitative curriculum coverage as enunciated in the CAPS cannot be over-emphasised.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. Answer ALL the questions.
2. Write ALL the answers in the ANSWER BOOK.
3. Start the answers to EACH question at the top of a NEW page.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Present your answers according to the instructions of each question.
6. Do ALL drawings in pencil and label them in blue or black ink.
7. Draw diagrams, tables or flow charts only when asked to do so.
8. The diagrams in this question paper are NOT necessarily drawn to scale.
9. Do NOT use graph paper.
10. You must use a non-programmable calculator, protractor and a compass, where necessary.
11. Write neatly and legibly.

LIFE SCIENCES P1

NOVEMBER 2014

SECTION A

QUESTION 1

1.1 Various options are given as possible answers to the following questions. Choose the answer and write only the letter (A to D) next to the question number (1.1.1 to 1.1.10) in the ANSWER BOOK, for example 1.1.11 D.

1.1.1 The part of the brain that interprets impulses from the retina of the eye is the ...

A cerebrum.
B cerebellum.
C medulla oblongata.
D corpus callosum.

1.1.2 Which ONE of the following hormones is responsible for the development of secondary male characteristics?

A FSH
B Testosterone
C Oestrogen
D Progesterone

1.1.3 The number of chromosomes found in a human sperm cell is …

A 23.
B 22.
C 46.
D 47.

1.1.4 A patient suffers from an undersecretion of ADH. This will lead to ...

A a high concentration of sodium in the urine.
B the presence of glucose in the urine.
C decreased thirst.
D the formation of large volumes of urine.

1.1.5 Damage to the dendrites of a motor neuron in a reflex arc would probably prevent …

A a receptor from receiving a stimulus.
B synaptic contact with a sensory neuron.
C an impulse from being transmitted to an effector organ.
D an impulse from being transmitted to the spinal cord.

1.1.6 The part of the brain that regulates breathing is the ...

A medulla oblongata.
B cerebrum.
C corpus callosum.
D cerebellum.

1.1.7 Grommets may be used in the treatment of …

A astigmatism.
B cataracts.
C middle ear infections.
D long-sightedness.

1.1.8 Which ONE of the following is a response of the human body when adrenalin is released?

A Decreased oxygen intake
B Increased blood flow to the intestines
C Decreased blood flow to the muscles and heart
D Increased conversion of glycogen to glucose

1.1.9 In gamete formation in human females, each diploid cell forms …

A four diploid gametes.
B one diploid gamete.
C one haploid gamete.
D two haploid gametes.

1.1.10 Crossing-over and random arrangement of chromosomes occur respectively in …

A prophase II and metaphase II.
B prophase I and metaphase I.
C prophase II and anaphase II.
D prophase I and anaphase I. (10 x 2) **(20)**

1.2 Give the correct **biological term** for each of the following descriptions. Write only the term next to the question number (1.2.1 to 1.2.10) in the ANSWER BOOK.

1.2.1 The membranes which protect the central nervous system

1.2.2 A plant growth hormone that stimulates seed germination

1.2.3 The nervous system which consists of cranial and spinal nerves

1.2.4 A branch of the autonomic nervous system that decreases the heartbeat back to normal

1.2.5 The outermost extra-embryonic membrane surrounding the embryo

1.2.6 The hormone that regulates the salt concentration in the human body

1.2.7 The blood vessel in the umbilical cord that carries blood rich in oxygen and nutrients

1.2.8 The hormone inhibited by an increased level of thyroxin

1.2.9 The period of development of an embryo in the uterus, between fertilisation and birth

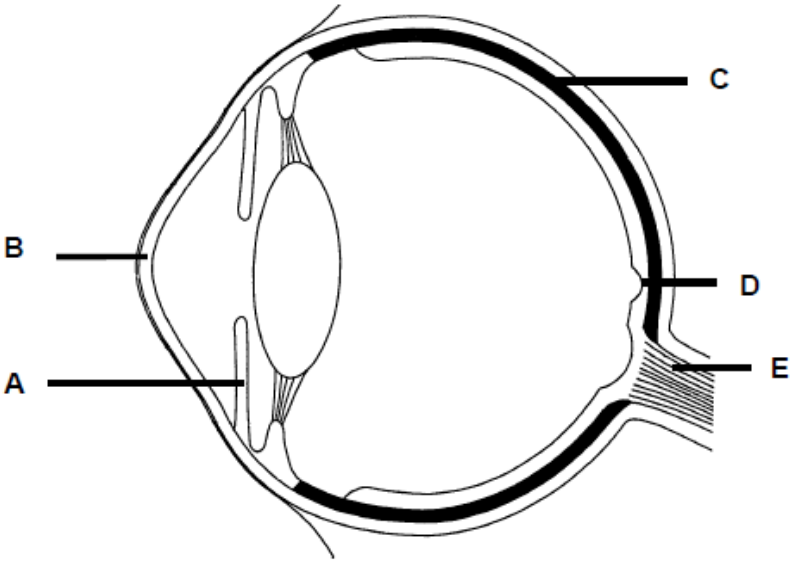
1.2.10 The structure in the head of a sperm cell that contains enzymes which break down the membrane surrounding the ovum (10 x 1) **(10)**

1.3 Indicate whether each of the statements in COLUMN I applies to **A ONLY**, **B ONLY**, **BOTH A AND B** or **NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B** or **none** next to the question number (1.3.1 to 1.3.5) in the ANSWER BOOK.

COLUMN I	COLUMN II
1.3.1 Embryo is nourished with yolk found in the egg	A: Ovipary B: Vivipary
1.3.2 Gas produced when organic matter decomposes	A: Chlorofluorocarbons (CFCs) B: Methane
1.3.3 Foetus is attached to the mother's uterus	A: Ovipary B: Ovovivipary
1.3.4 Young bird cannot feed or move independently after hatching	A: Precocial development B: Altricial development
1.3.5 Decreases biodiversity	A: Alien plant invasion B: Urbanisation

(5 x 2) **(10)**

1.4 The diagram below represents the structure of the human eye.



Structure of the human eye

Give the LETTER and the NAME of the part which:

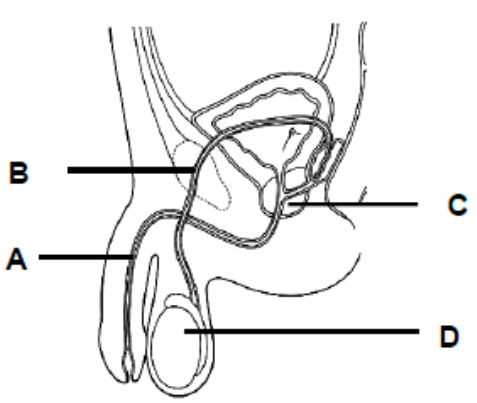
1.4.1	Regulates the amount of light entering the eye	(2)
1.4.2	Supplies food and oxygen to the eye	(2)
1.4.3	Transmits impulses to the brain	(2)
1.4.4	Contains cones and is the area of clearest vision	(2)
1.4.5	Assists in the refraction of light rays	(2)
		(10)

TOTAL SECTION A: 50

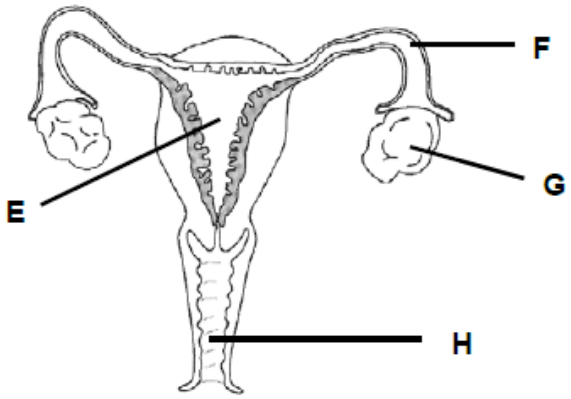
SECTION B

QUESTION 2

2.1 Study the diagrams below showing the male and female reproductive systems.



Male reproductive system



Female reproductive system

2.1.1 Identify parts **A**, **B** and **F** respectively. (3)

2.1.2 State ONE function of each of the following:

(a) The fluid produced by part **C** (1)

(b) Part **E** (1)

2.1.3 Give the LETTER ONLY of the organ where meiosis takes place in the:

(a) Male reproductive system (1)

(b) Female reproductive system (1)

2.1.4 Name the type of gametogenesis that takes place in the:

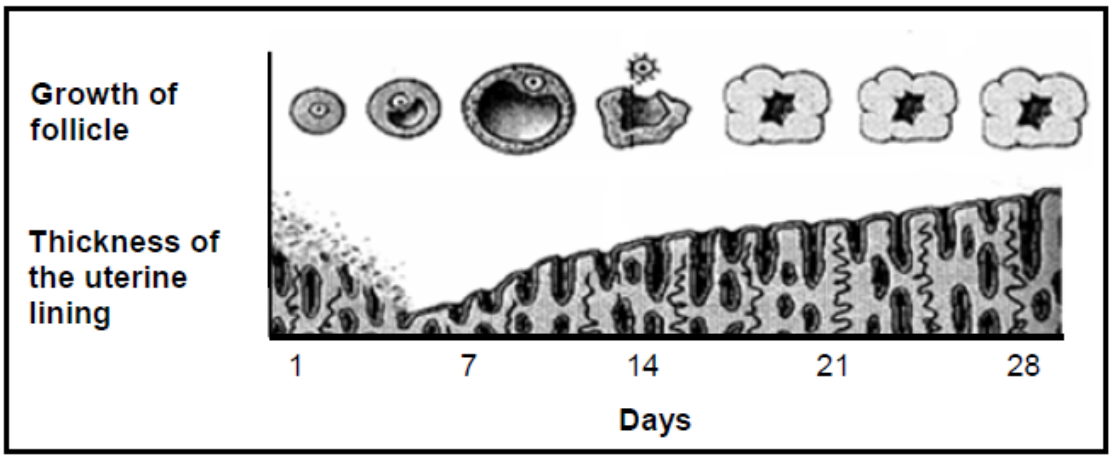
(a) Male reproductive system (1)

(b) Female reproductive system (1)

2.1.5 State TWO functions of part **H**. (2)

2.1.6 Explain why it is necessary for part **D** to be 'outside' the body in males. (2)
(13)

2.2 The diagram below shows some of the changes that take place during the menstrual cycle.



2.2.1 The menstrual cycle is controlled by hormones. Name ONE hormone which will increase in level between day 2 and day 10. (1)

2.2.2 Give ONE observable reason for your answer to QUESTION 2.2.1. (2)

2.2.3 Explain evidence from the diagram which indicates that fertilisation took place. (3)

2.2.4 Describe the developmental changes in the fertilised ovum until implantation occurs in the uterus. (5)

2.2.5 Some females use an ovulation monitor so that they can be aware of the days when they are fertile. These monitors measure the level of hormones in the blood.

(a) Why would females want to know when they are fertile? (1)

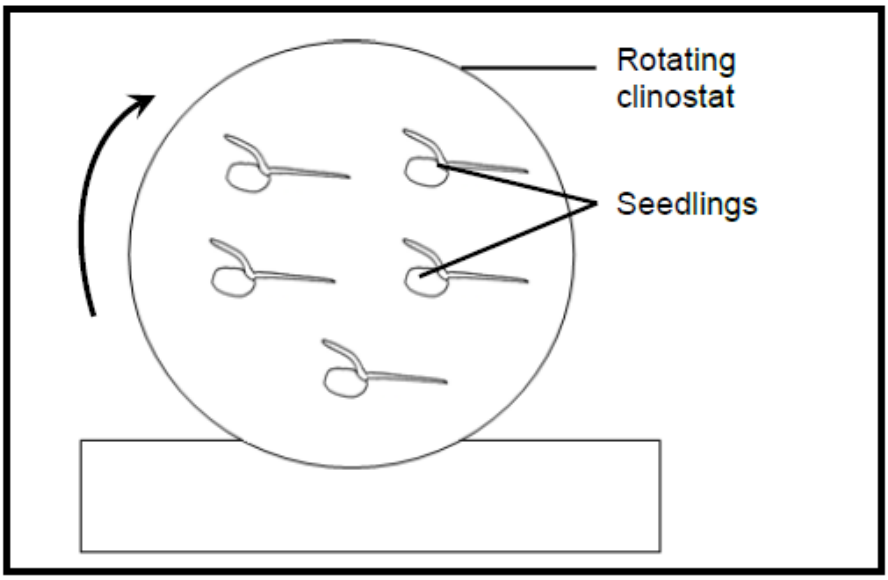
(b) Explain which hormone is likely to be monitored by the ovulation monitor. (3)

(15)

2.3 A learner conducted an investigation to determine the effect of auxins and the effect of gravity on root growth in pea seedlings. He used the following procedure:

- He germinated pea seeds for seven days.
- He then took a sample of 15 seedlings and divided them into 3 groups (A to C) of 5 seedlings each.
- In each group the 5 seedlings were placed **horizontally** on 3 different clinostats.

A clinostat is a device which has a disc that rotates at a constant speed.
A diagram of a clinostat is shown below.



- He removed the root tips of all 5 seedlings at the same length in group B.
- In groups A and B the clinostats were left stationary (no rotation).
- In group C the clinostat was allowed to rotate.
- All 3 clinostats were placed in a dark cupboard.

A summary of the learner's procedure is shown in the table below.

GROUP A	GROUP B	GROUP C
Root tips present	No root tips	Root tips present
Stationary clinostat	Stationary clinostat	Rotating clinostat

After two days the direction of root growth was observed.

2.3.1 Which TWO groups were used to obtain information about:

(a) The effect of auxins on root growth (1)

(b) The effect of gravity on root growth (1)

2.3.2 Explain why the apparatus was placed in a dark cupboard. (2)

2.3.3 Describe the expected results for each of groups **B** and **C** in this investigation. (2)

2.3.4 Explain the expected results for group **A**. (3)

2.3.5 State THREE ways in which the learner ensured a high level of validity for this investigation. (3)
(12)
[40]

QUESTION 3

3.1 A farmer conducted an investigation to determine which type of fertiliser would increase the yield of her wheat crop.

- She divided her farm into three 1 hectare plots and treated them as follows:

Treatment	Hectare A	Hectare B	Hectare C
Type of fertiliser	None	Contains nitrogen	Contains phosphorus
Amount of fertiliser (kg)	None	10	10

- She planted the same type of crop, namely wheat, during November each year for five years.
- She used water from a river which flows through the farm to irrigate her crop.
- She recorded the yield per plot for each year. The yield was measured by calculating the number of kilograms of wheat produced per hectare.

3.1.1 Identify the dependent variable in this investigation. (1)

3.1.2 Explain the purpose of including hectare **A** in this investigation. (2)

3.1.3 State ONE way in which the farmer could have increased the reliability of her results. (1)

3.1.4 If this investigation was carried out for more than five years, list THREE negative effects of planting the same type of crop over many years on the same plot of land. (3)

3.1.5 Explain how the excessive use of fertilisers can affect biodiversity if it is washed into the river. (4)
(11)

3.2 Read the passage below about food wastage around the world.

FOOD WASTAGE AROUND THE WORLD

Every year a third of all food for human consumption, about 1,3 billion tons, is wasted in the world. The UN Food and Agriculture Organisation (FAO) estimated that the carbon footprint of wasted food was equivalent to 3,3 billion tons of carbon dioxide a year. The FAO suggests that more efficient use of food could contribute to global efforts to cut greenhouse gases to limit global warming.

In the industrialised world, much of the waste comes from consumers buying too much and throwing away what they do not eat. In developing countries it is mainly the result of inefficient farming and a lack of proper storage facilities.

[Adapted from: *Reuters Daily News*, September 2013]

3.2.1 What is meant by the following terms:

(a) Carbon footprint (2)

(b) Food security (2)

3.2.2 Explain how wastage of food contributes to loss of energy and global warming. (4)

3.2.3 Use the information in the passage to suggest TWO ways in which food wastage could be reduced. (2)

(10)

3.3 The table below shows how body temperature is regulated by the hypothalamus by influencing heat production and heat loss.

BODY TEMPERATURE (°C)	HEAT PRODUCTION (JOULES PER SECOND)	HEAT LOSS (JOULES PER SECOND)
36,4	320	5
36,6	260	5
36,8	150	35
36,9	90	90
37,0	90	100
37,2	90	180
37,4	90	310

[Adapted from *Cambridge Biology*, 2002]

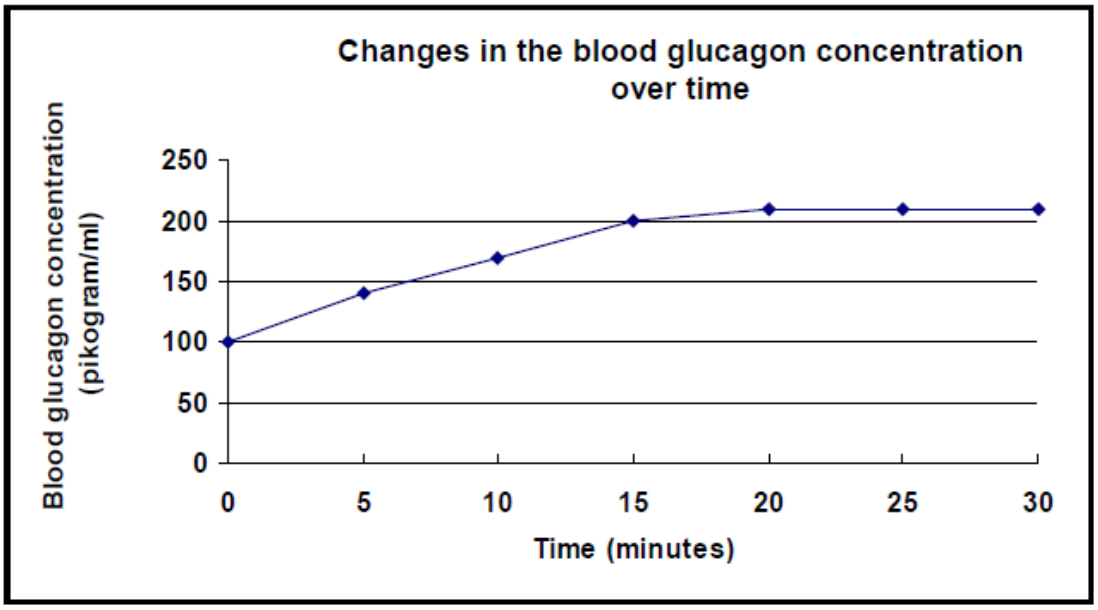
3.3.1 Are the blood vessels that supply blood to the skin constricted or dilated when the body temperature is 36,4 °C? (1)

3.3.2 Explain the advantage of the diameter of the blood vessels (constricted/dilated) mentioned in your answer to QUESTION 3.3.1. (4)

3.3.3 Heat loss is the greatest at 37,4 °C. Explain how the body is able to increase heat loss. (4)

(9)

3.4 Study the graph below showing the changes in the glucagon concentration during exercise.



3.4.1 Describe the trend for the changes in the glucagon level over time. (3)

3.4.2 Explain the changes in the level of glucagon from 0 to 10 minutes. (3)

3.4.3 Taking into account the pattern for glucagon concentration from 0 to 10 minutes in the graph above, what will you expect to happen to the insulin concentration for the same period? (1)

3.4.4 Explain why people with diabetes mellitus have very little glycogen in their liver and muscle cells. (3)

(10)

[40]

TOTAL SECTION B: 80

SECTION C

QUESTION 4

A goalkeeper in a soccer match prevented a goal from being scored when he dived to his right after the ball was kicked towards him. Just before he dived, he heard his team-mate shout, 'your ball'.

Describe how his eyes adjusted to see the ball as it travelled towards him and describe how he heard his team-mate and maintained his balance as he dived to save the ball.

Content:	**(17)**
Synthesis:	**(3)**

NOTE: NO marks will be awarded for answers in the form of flow charts, diagrams or tables.

TOTAL SECTION C:	**20**
GRAND TOTAL:	**150**

LIFE SCIENCES P2

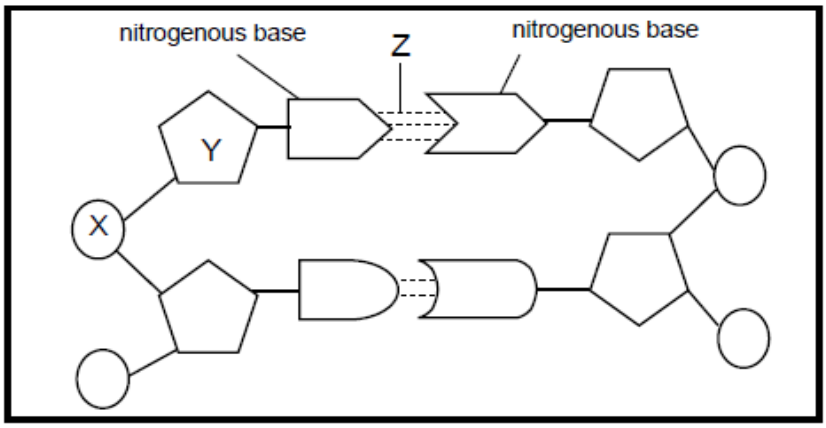
NOVEMBER 2014

SECTION A

QUESTION 1

1.1 Various options are given as possible answers to the following questions. Choose the answer and write only the letter (A to D) next to the question number (1.1.1 to 1.1.10) in the ANSWER BOOK, for example 1.1.11 D.

1.1.1 The diagram below shows part of a DNA molecule.



The correct labels for parts **X**, **Y** and **Z** respectively are ..

A deoxyribose sugar, phosphate and hydrogen bond.
B phosphate, deoxyribose sugar and hydrogen bond.
C ribose sugar, nitrogenous base and peptide bond.
D phosphate, ribose sugar and hydrogen bond.

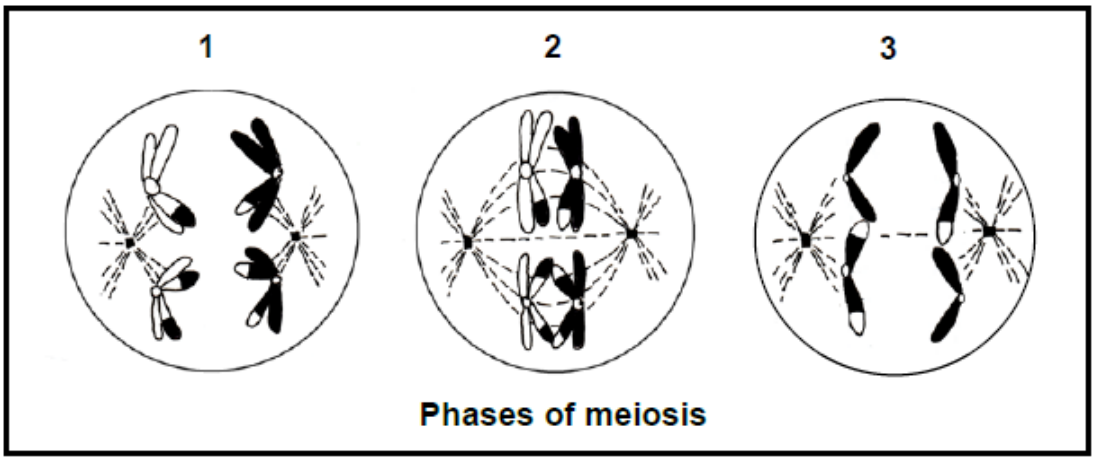
1.1.2 If 10% of the bases in a molecule of DNA are adenine, what is the ratio of adenine to guanine in the same molecule?

A 1 : 1
B 4 : 1
C 1 : 3
D 1 : 4

1.1.3 Lamarck's 'laws' of use and disuse and inheritance of acquired characteristics were ...

A rejected, because only characteristics that benefit offspring can be inherited.
B not rejected, because evidence shows that acquired characteristics can be inherited.
C rejected, because only characteristics that are coded for in the DNA can be inherited.
D not rejected, because Darwin's theory supports Lamarck's ideas.

1.1.4 The diagrams below represent different phases of meiosis.



Phases of meiosis

The correct order of the phases is ...

A 1, 2 and 3.
B 2, 3 and 1.
C 3, 1 and 2.
D 2, 1 and 3.

1.1.5 Two red-eyed fruit flies were mated and they produced 150 flies with red eyes and 48 flies with white eyes. From this information we can reasonably conclude that the ...

A white-eyed condition is recessive and both parents are heterozygous.
B red-eyed condition is dominant and both parents are homozygous for red eyes.
C white-eyed condition is recessive and both parents are homozygous for red eyes.
D red-eyed condition is recessive and both parents are heterozygous.

1.1.6 Which ONE of the following monohybrid crosses will result in a phenotypic ratio of 1 : 1? A cross where ...

A both parents are heterozygous.
B both parents are homozygous for the dominant characteristic.
C one parent is heterozygous and the other parent is homozygous recessive.
D one parent is heterozygous and the other parent is homozygous dominant.

1.1.7 Study the list below.

1. Fossils
2. Homologous structures
3. Biogeography
4. Genetics

Which ONE of the combinations of the above can be used as evidence for evolution?

A 1, 2 and 3 only
B 1, 2, 3 and 4
C 2, 3 and 4 only
D 1, 3 and 4 only

1.1.8 One reason why some people are opposed to genetic modification is that ...

A the use of herbicides is reduced.
B crop yields are improved.
C the taste and quality of food is improved.
D the potential impact on human health is unknown.

1.1.9 Homologous chromosomes are described as ...

A being similar in structure and coding for the same characteristics.
B a product of the division of chromosomes.
C identical daughter chromatids formed through DNA replication.
D two chromosomes that code for different characteristics.

1.1.10 Four different phenotypes are possible in the F_1-generation if the parents' blood groups are ...

A B and B.
B A and B.
C O and AB.
D AB and AB. (10 x 2) **(20)**

1.2 Give the correct **biological term** for each of the following descriptions. Write only the term next to the question number (1.2.1 to 1.2.10) in the ANSWER BOOK.

1.2.1 An allele that does not influence the phenotype when found in the heterozygous condition

1.2.2 A section of a DNA molecule that codes for a specific characteristic

1.2.3 The production of a genetically identical copy of an organism using biotechnology

1.2.4 The manipulation of the genetic material of an organism to get desired changes

1.2.5 The deliberate breeding of organisms for desirable characteristics selected by humans

1.2.6 The explanation that species experience long periods without physical change, followed by short periods of rapid physical change

1.2.7 The phase of meiosis during which homologous chromosomes separate and start moving towards opposite poles

1.2.8 The defect in cell division that leads to Down syndrome

1.2.9 The structure that is made up of two chromatids joined by a centromere

1.2.10 An explanation for something that has been observed in nature and which can be supported by facts, laws and tested hypotheses **(10)**

1.3 Indicate whether each of the statements in COLUMN I applies to **A ONLY**, **B ONLY**, **BOTH A AND B** or **NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B**, or **none** next to the question number (1.3.1 to 1.3.6) in the ANSWER BOOK.

	COLUMN I		COLUMN II
1.3.1	Discovered the shape of the DNA molecule	A: B:	Francis Crick James Watson
1.3.2	Each gamete receives only one allele for each characteristic	A: B:	Mendel's principle of segregation Darwin's theory of natural selection
1.3.3	An advantage of genetic modification	A: B:	Increases shelf life of food Increases resistance to disease
1.3.4	An example of a reproductive isolating mechanism	A: B:	Species-specific courtship behaviour Infertile offspring
1.3.5	Type of variation represented by skin colour in humans	A: B:	Continuous variation Discontinuous variation
1.3.6	A group of similar organisms that can interbreed to produce fertile offspring	A: B:	Species Genus

(6 x 2) **(12)**

1.4 About 70% of people get a bitter taste when a substance called PTC is placed on their tongue. They are referred to as 'tasters'. All other people are unable to taste PTC and are referred to as 'taste-blind'. The 'taster' allele is dominant and the 'taste-blind' allele is recessive.

Also in humans, normal skin pigmentation is dominant to the albino condition (no pigmentation).

The letters in the key below must be used to represent the alleles for the different characteristics above.

Key:
T – taster **t** – taste-blind **N** – normal skin pigmentation **n** – no skin pigmentation (albino)

A man who is heterozygous for both tasting PTC and skin pigmentation marries a woman who is taste-blind for PTC and is an albino.

1.4.1 State why the example above represents a dihybrid cross. (1)

1.4.2 Write down:

(a) The genotype of the woman (1)

(b) ALL the possible gametes of the man (2)

1.4.3 The man and woman have a child whose genotype is **ttNn**. What is the child's phenotype? (2)

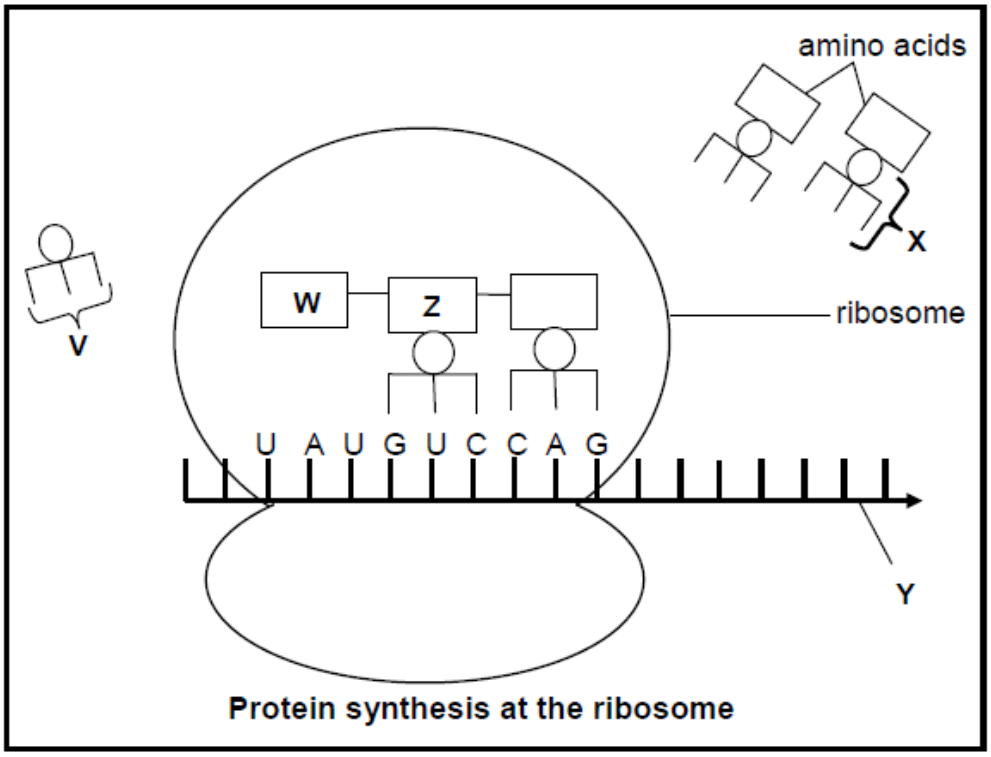
1.4.4 A man and a woman are only able to produce children with the genotype **TtNn**. The woman's genotype is **ttnn**. State the only possible genotype of the man. (2)
(8)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 Study the diagram below which shows a part of the process of protein synthesis.



Protein synthesis at the ribosome

2.1.1 Identify the stage of protein synthesis that is shown in the diagram above. (1)

2.1.2 Identify molecules **X** and **Y**. (2)

2.1.3 State the term for the group of three nitrogenous bases indicated by **V**. (1)

2.1.4 Give the nitrogenous bases on the DNA strand that codes for the bases UAU on molecule **Y**. (1)

2.1.5 Use the table below to identify amino acid **W**.

tRNA	Amino acid
GUC	glutamine
UAA	isoleucine
AUA	tyrosine
CCC	glycine
GGG	proline
CAG	valine

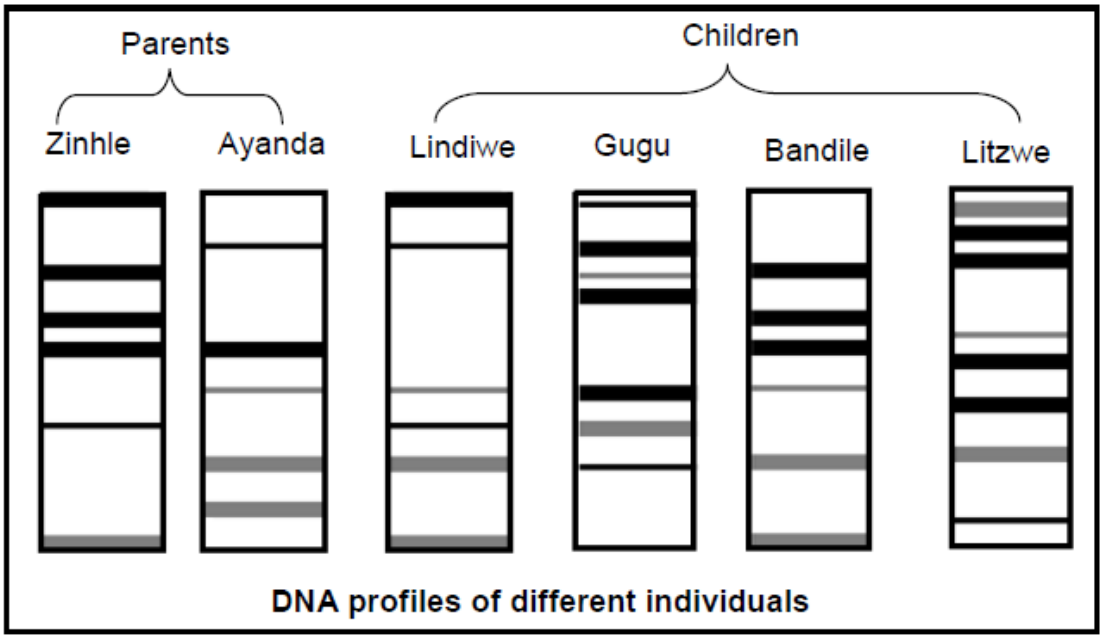
(2)

2.1.6 Name and describe the process that occurs in the nucleus to produce molecule **Y**. (5)

(12)

2.2 The diagram below shows the DNA profiles of six members of a family. The greater the similarity in the position of the bands in the DNA profiles of different individuals, the more closely they are related.

The parents, Zinhle and Ayanda, have four children. Two of the children are their biological offspring while the other two children are adopted.



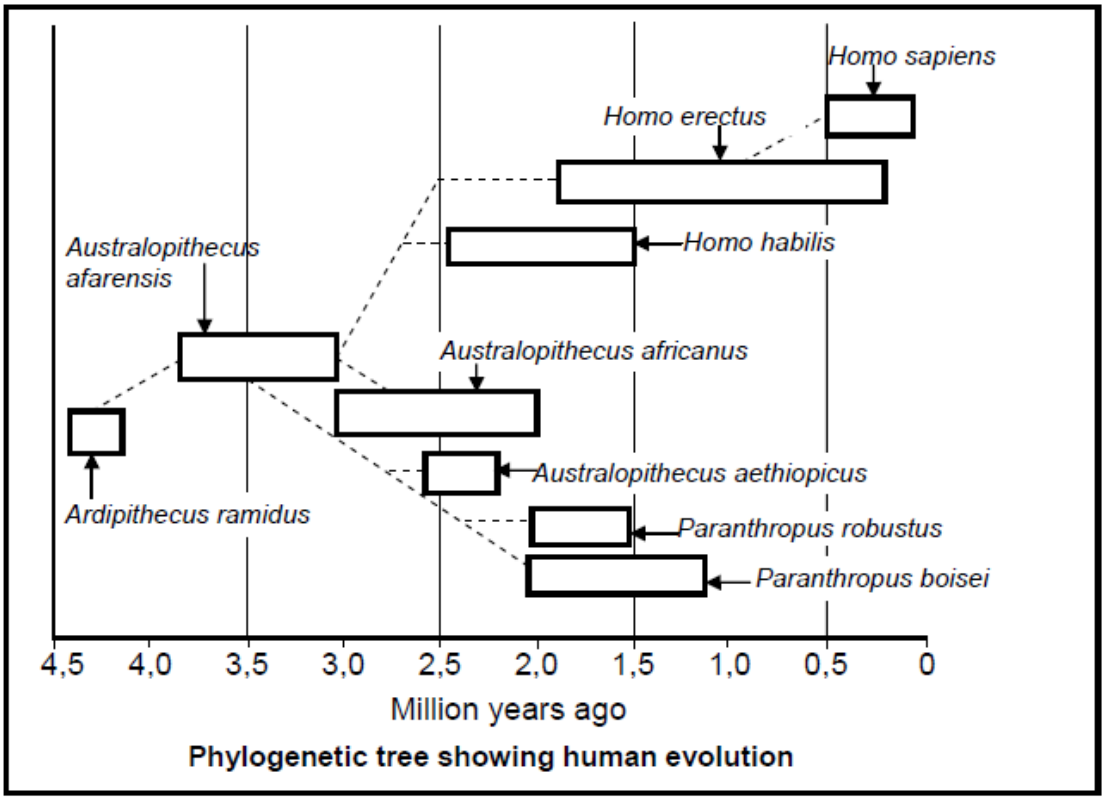
DNA profiles of different individuals

2.2.1 Which TWO children are the biological offspring of Zinhle and Ayanda? (2)

2.2.2 Give an explanation for your answer to QUESTION 2.2.1 using evidence from the DNA profiles. (2)

2.2.3 Apart from paternity testing, state TWO ways in which DNA profiling is of use to humans. (2)
(6)

2.3 Study the phylogenetic tree below showing a possible representation of human evolution and answer the questions which follow.



Phylogenetic tree showing human evolution

[Adapted from *Biology: Understanding Life*, Sandra Alters, 1995]

2.3.1 According to the phylogenetic tree, which organism, *Paranthropus boisei* or *Homo habilis*, appeared first on Earth? (1)

2.3.2 Name TWO species whose existence on Earth overlapped with that of *Homo erectus*. (2)

2.3.3 Which organism was the direct ancestor of *Homo habilis*? (1)

2.3.4 List FIVE characteristics that are shared by all the organisms in the above phylogenetic tree. (5)

2.3.5 How long did *Australopithecus africanus* exist on Earth? (1)
(10)

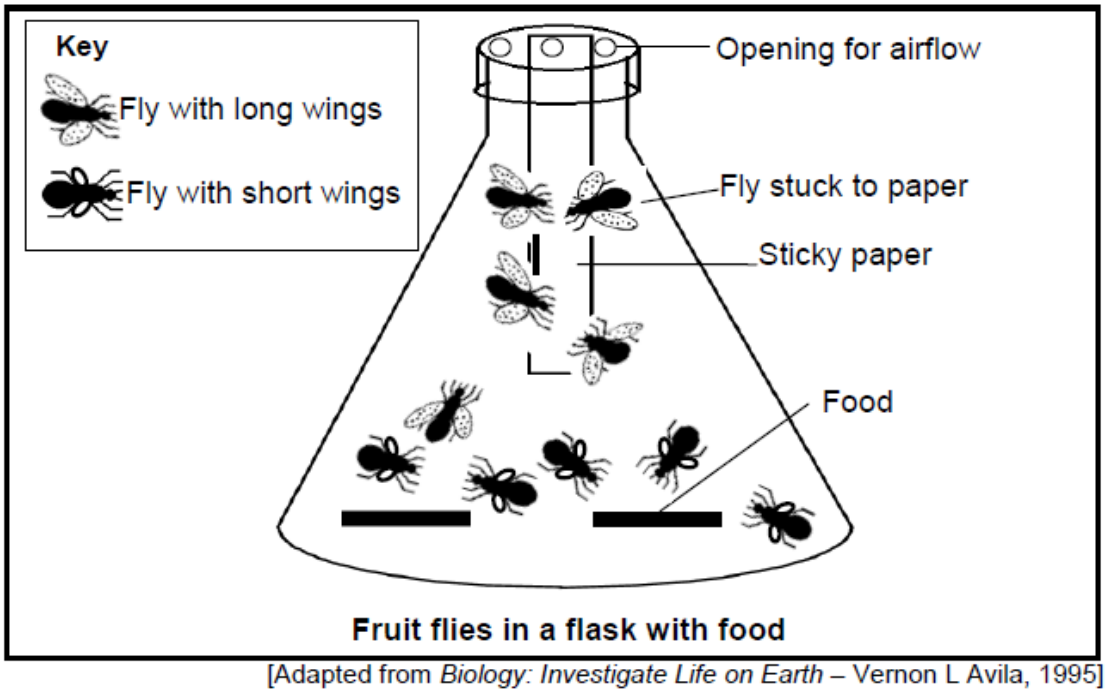
2.4 There is variation in the wing length of fruit flies (*Drosophila melanogaster*). Some have long wings and can fly while others have short wings and cannot fly.

An investigation was conducted to determine which flies would survive under certain conditions.

The following steps were carried out:

1. Five flies with short wings and five flies with long wings were placed in a flask.
2. Food was placed at the bottom of the flask.
3. The lid of the flask allowed airflow.
4. Sticky paper was suspended from the top of the flask. Flies that got stuck to the paper died.
5. The apparatus was left for 24 hours.

The results of the investigation are shown in the diagram below.



Fruit flies in a flask with food

[Adapted from *Biology: Investigate Life on Earth* – Vernon L Avila, 1995]

2.4.1 Formulate a hypothesis for the investigation. (3)

2.4.2 Explain why it is necessary to have openings for airflow. (3)

2.4.3 State TWO ways in which the reliability of the investigation could be improved. (2)

2.4.4 Other than the opening for airflow, explain TWO other precautions that should be taken in this investigation. (4)

(12)

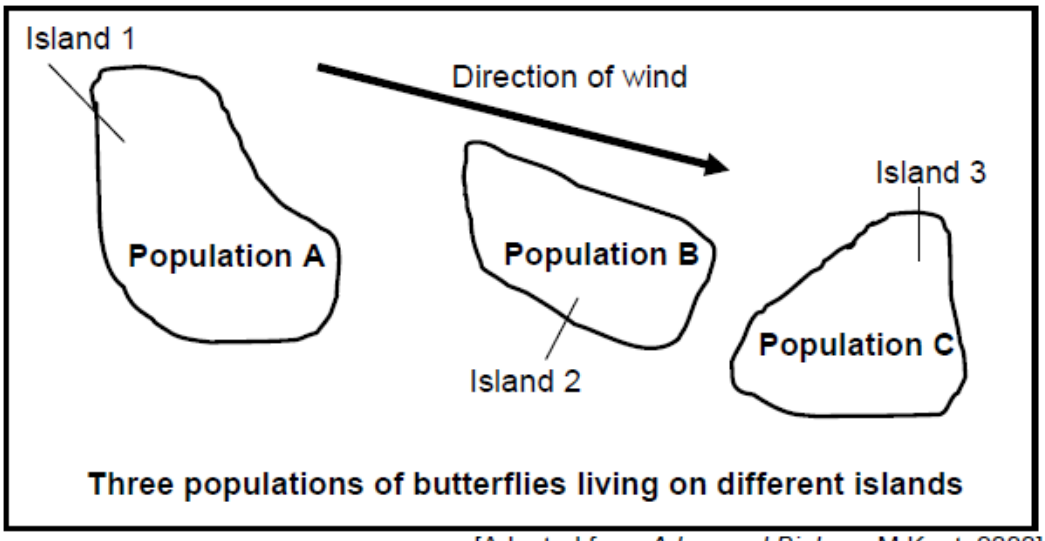
[40]

QUESTION 3

3.1 Three populations of butterflies, **A**, **B** and **C** live separately on three oceanic islands. The butterflies on Island 2 and Island 3 originated from Island 1.

The islands experience strong prevailing winds from the north-west throughout the year.

Populations **A** and **B** can interbreed and produce fertile offspring. Population **B** can mate with Population **C**, but the offspring are infertile. Mating does not occur between Populations **A** and **C** at all.



Three populations of butterflies living on different islands

[Adapted from *Advanced Biology*, M Kent, 2000]

3.1.1 How many species are represented by the three populations? (1)

3.1.2 Explain your answer to QUESTION 3.1.1. (2)

3.1.3 Use the information provided to explain how speciation might have taken place in the above example. (5)
(8)

3.2 Study the passage on evolution below and answer the questions that follow.

The 'Out of Africa' hypothesis suggests that primitive humans migrated from Africa to all other continents of the world about 1,8 million years ago. Scientists that studied some fossilised bones of early humans that lived in Europe concluded that humans were unable to digest cow's milk before 7 000 years ago.

A mutation occurred that resulted in some individuals of the human population living in Europe being able to digest cow's milk. This ability was beneficial as it provided additional nutrients all year round. Milk is a source of vitamin D and calcium.

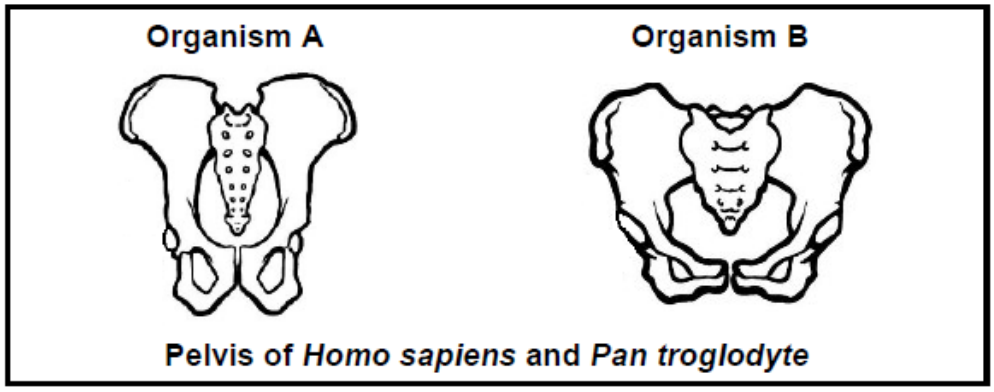
[Adapted from *Impact of Selection and Demography on the Diffusion of Lactose Persistence.* PLoS ONE 4(7) D O'Rouke, 2009]

3.2.1 State ONE advantage of being able to digest cows' milk to early humans that lived in Europe. (1)

3.2.2 Explain why the primitive humans that migrated out of Africa were unable to digest cows' milk. (2)

3.2.3 Apart from fossils, name ONE other type of evidence that can be used to support the 'Out of Africa' hypothesis. (1)
(4)

3.3 Study the diagrams below showing the pelvis of *Homo sapiens* and *Pan troglodyte* (chimpanzee). The diagrams are not drawn to scale.



Pelvis of *Homo sapiens* and *Pan troglodyte*

3.3.1 Which organism, **A** or **B**, is bipedal? (1)

3.3.2 Give ONE observable reason for your answer to QUESTION 3.3.1. (2)

3.3.3 Explain TWO advantages of bipedalism. (4)
(7)

3.4 The table below shows the cranial capacities of different species of primates.

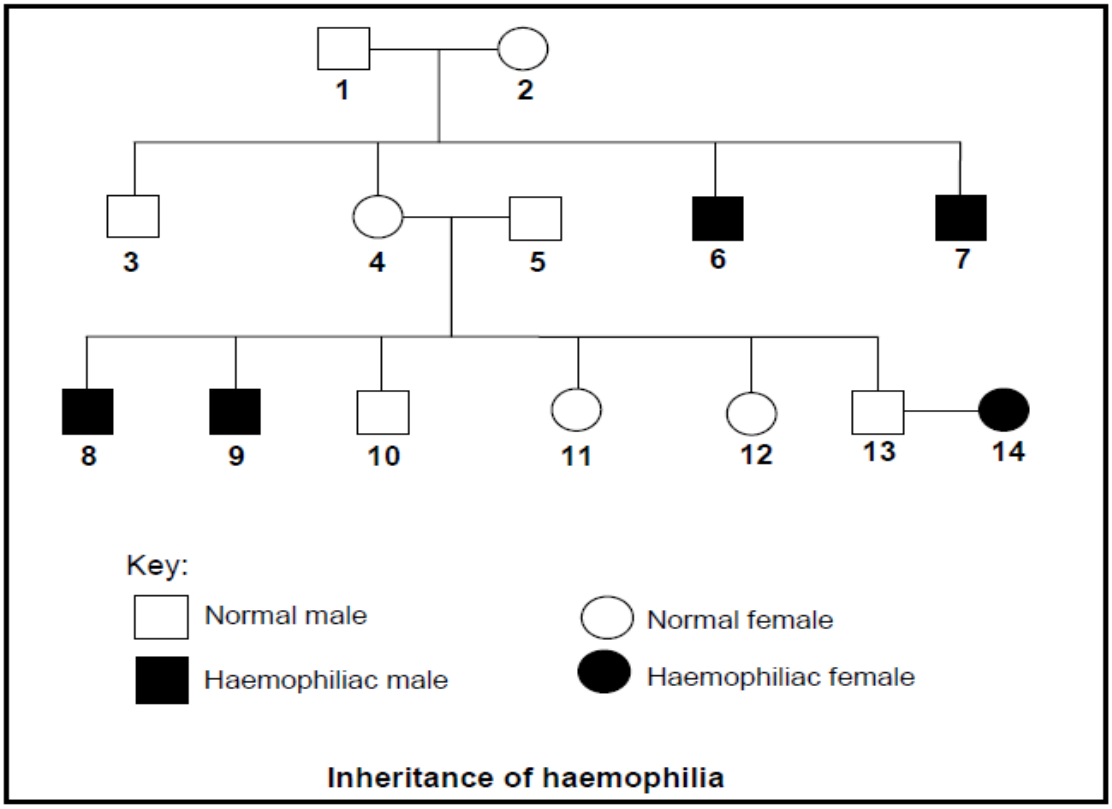
Species	Cranial capacity (cm^3)
Chimpanzee	400
Gorilla	550
Australopithecus sp.	500
Homo habilis	650
Homo erectus	1 000
Homo sapiens	1 500

[Adapted from *Advanced Biology*, M Kent, 2000]

3.4.1 State TWO advantages of the large cranial capacity of *Homo sapiens.* (2)

3.4.2 Draw a bar graph to represent the data in the table. (6)
(8)

3.5 The pedigree diagram below shows the inheritance of haemophilia in a family. The allele causing haemophilia is represented by X^h and the normal allele is represented by X^H.



Inheritance of haemophilia

3.5.1 Determine the:

(a) Phenotype of individual **4** (1)

(b) Genotype of individual **2** (2)

3.5.2 Explain why females have a smaller chance of suffering from haemophilia. (3)

3.5.3 Represent a genetic cross to show the percentage chance of individuals **13** and **14** having a haemophiliac son. (7)

(13)
[40]

TOTAL SECTION B: 80

SECTION C

QUESTION 4

Describe how meiosis and different types of mutations contribute to genetic variation and the role of this variation in natural selection.

Content: **(17)**
Synthesis: **(3)**

NOTE: NO marks will be awarded for answers in the form of flow charts, diagrams or tables.

TOTAL SECTION C: 20
GRAND TOTAL: 150

LIFE SCIENCES P1

FEBRUARY/MARCH 2015

SECTION A

QUESTION 1

1.1 Various options are given as possible answers to the following questions. Choose the answer and write only the letter (A to D) next to the question number (1.1.1 to 1.1.10) in the ANSWER BOOK, for example 1.1.11 D.

1.1.1 A light stimulus is converted into a nerve impulse in the ...

A iris.
B retina.
C optic nerve.
D choroid.

1.1.2 Which plant hormone promotes seed dormancy?

A Gibberellin
B Auxin
C Abscisic acid
D Growth hormone

1.1.3 The type of reproduction in which young develop from the eggs that are kept in the mother's body but do not receive nutrition from the mother:

A Vivipary
B Ovipary
C Ovovivipary
D Altricial

1.1.4 Which part of the human brain controls balance and equilibrium?

A Cerebrum
B Cerebellum
C Medulla oblongata
D Corpus callosum

1.1.5 DNA replication occurs during ...

A anaphase I.
B interphase.
C prophase I.
D prophase II.

1.1.6 Which of the following CORRECTLY represents the events involved in the secretion and action of ADH (antidiuretic hormone)?

	WATER LEVEL IN BLOOD RELATIVE TO NORMAL	AMOUNT OF ADH PRODUCED RELATIVE TO NORMAL	AMOUNT OF WATER REABSORBED BY KIDNEYS
A	Increase	Increase	Decrease
B	Increase	Decrease	Increase
C	Decrease	Increase	Increase
D	Decrease	Decrease	Decrease

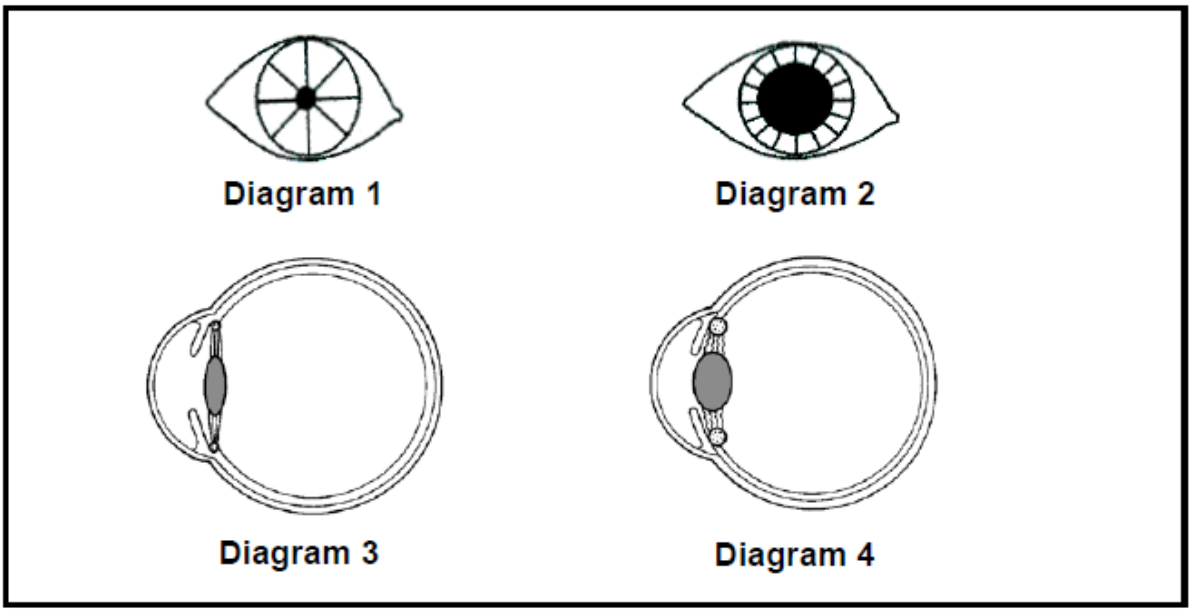
1.1.7 A worker spent about ten minutes in a walk-in freezer. Below are some of the changes that occurred in his body in response to the drop in external temperature.

(i) Blood vessels in the skin constrict
(ii) Brain reacts
(iii) Skin temperature changes
(iv) Temperature receptors in the skin detect changes

Which ONE is the correct sequence in which the changes occurred?

A (ii) → (i) → (iii) → (iv)
B (iii) → (i) → (iv) → (ii)
C (iv) → (ii) → (i) → (iii)
D (iv) → (i) → (ii) → (iii)

1.1.8 The diagrams below show the human eye under different conditions.



Which TWO diagrams above show the result when the ciliary muscles contract and the circular muscles of the iris relax?

A 1 and 3
B 3 and 2
C 1 and 4
D 4 and 2

1.1.9 A learner conducted an investigation to determine the percentage of people that are long-sighted.

The factor that is LEAST likely to affect such an investigation is the ...

A light intensity of the room in which the test was conducted.
B height of the people.
C age of the people in the sample.
D distance between the tool used to test the sight and the person being tested.

1.1.10 The data below represents the results of an investigation used to determine how the thickness of the lens changed as a pencil was moved away from the eye.

DISTANCE FROM EYE (cm)	THICKNESS OF LENS (mm)
10	4,0
20	3,6
30	3,2
50	2,9
100	2,6
150	2,6
200	2,6

[Adapted from *Complete Biology*, 2000]

The general conclusion that can be made from the data is that …

A as the distance from the eye increased up to 100 cm, the thickness of the lens increased, after which it remained constant.
B as the distance from the eye decreased, the thickness of the lens remained constant.
C as the distance from the eye increased up to 100 cm, the thickness of the lens decreased, after which it remained constant.
D the thickness of the lens increased with an increase in distance from the eye. (10 x 2) **(20)**

1.2 Give the correct **biological term** for each of the following descriptions. Write only the term next to the question number (1.2.1 to 1.2.10) in the ANSWER BOOK.

1.2.1 The structure in the ear that equalises the pressure on either side of the eardrum

1.2.2 Measurement of the total amount of carbon dioxide emissions of an individual, a defined population or a company per year

1.2.3 The type of pollution caused when water is released into a river after being heated in power stations or industries

1.2.4 The watery fluid that supports the cornea and the front chamber of the eye

1.2.5 The hormone produced by the Graafian follicle

1.2.6 The hormone responsible for the formation of the corpus luteum

1.2.7 The receptors in the ear that detect changes in the direction and speed of any movement of the body

1.2.8 A hormone which stimulates the secretion of thyroxin

1.2.9 The type of fertilisation associated with viviparous reproduction

1.2.10 The series of changes that take place in the shape of the lens and the eyeball in response to the distance of an object from the eye

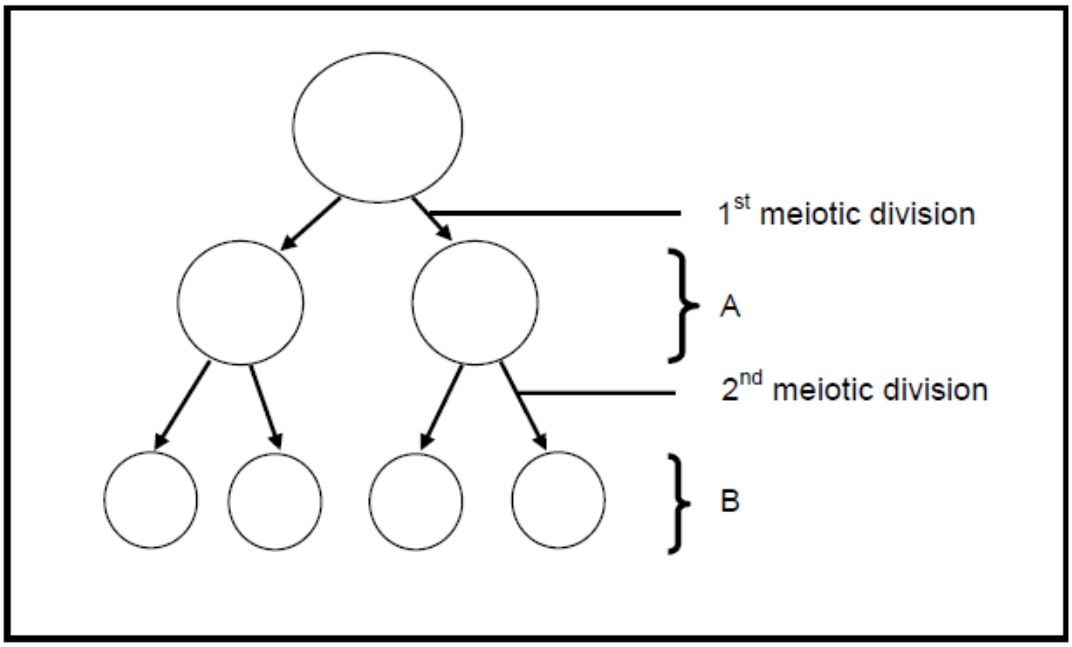
(10 x 1) **(10)**

1.3 Indicate whether each of the statements in COLUMN I applies to **A ONLY**, **B ONLY**, **BOTH A AND B** or **NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B** or **none** next to the question number (1.3.1 to 1.3.6) in the ANSWER BOOK.

COLUMN I		COLUMN II
1.3.1	May cause a decrease in the pH of the blood	A: excess glucose B: excess carbon dioxide
1.3.2	The part of the brain that connects the two hemispheres	A: cerebellum B: corpus callosum
1.3.3	A brain disorder that results in memory loss	A: Alzheimer's disease B: multiple sclerosis
1.3.4	A structure in the nervous system that detects a stimulus	A: effector B: receptor
1.3.5	A hormone secreted by the pituitary gland/hypophysis	A: testosterone B: thyroxin
1.3.6	A type of development in birds in which the young are capable of moving around soon after hatching	A: precocial development B: Altricial development

(6 x 2) **(12)**

1.4 Study the diagram below, which shows a process occurring in a human male.



1.4.1 Name the process by which male gametes in humans are formed through meiosis. (1)

1.4.2 Name the organ in males where the process mentioned in QUESTION 1.4.1 takes place. (1)

1.4.3 How many chromosomes will be found in each cell at:

(a) A (1)

(b) B (1)

1.4.4 Name TWO processes occurring during the 1st meiotic division that contribute to the genetic variation of cells **A**. (2)

1.4.5 How many cells at **B** will carry the Y-chromosome? (1)

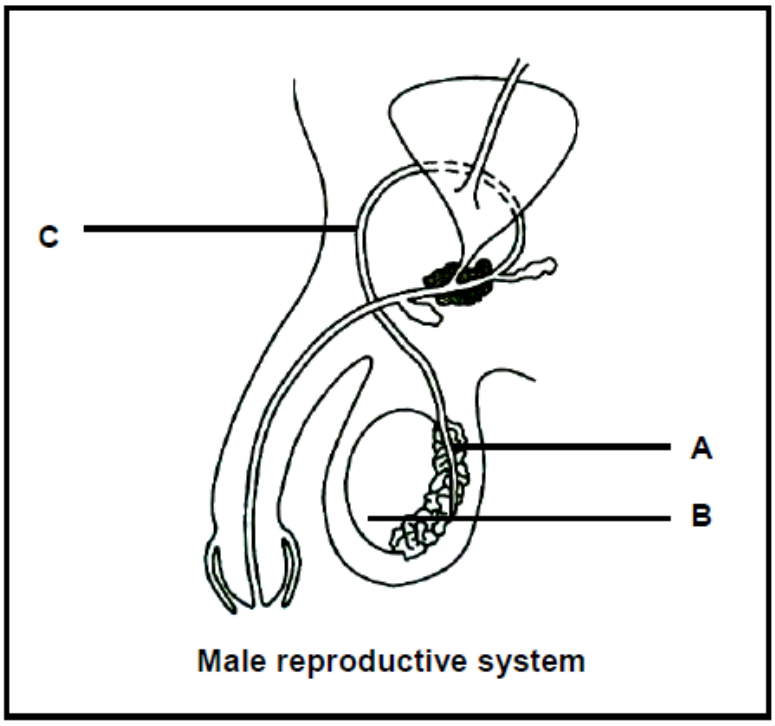
1.4.6 What are the mature cells at **B** called? (1)
(8)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 Study the diagram below.



Male reproductive system

2.1.1 Give labels for each of the following:

(a) A (1)

(b) B (1)

(c) C (1)

2.1.2 State ONE function of part **A**. (1)

2.1.3 Explain the consequences for reproduction if part **C** is surgically cut. (3)

2.1.4 Explain why it would still be possible for an HIV positive man to infect another person during sexual intercourse after part **C** is surgically cut. (2)
(9)

2.2 Describe how the different parts of the ear and brain allow for hearing to occur. **(7)**

2.3 Study the diagram of a reflex arc below.

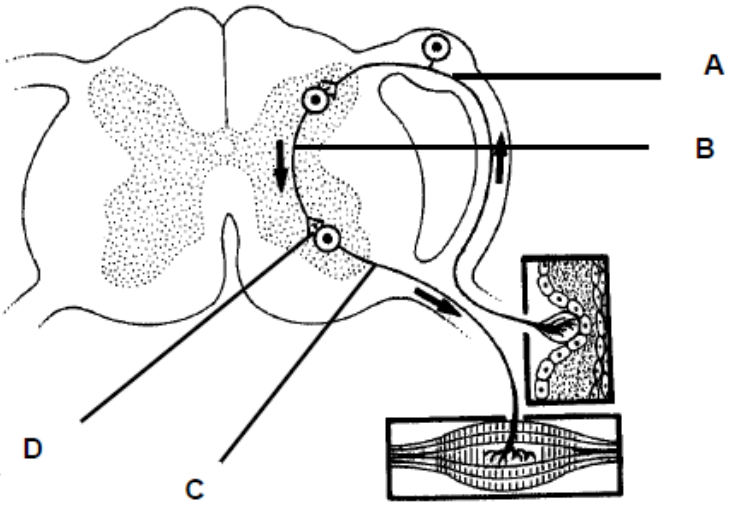


Diagram of a reflex arc

2.3.1 What is a *reflex action*? (2)

2.3.2 Label the following:

(a) The functional connection at **D** (1)

(b) Neuron **B** (1)

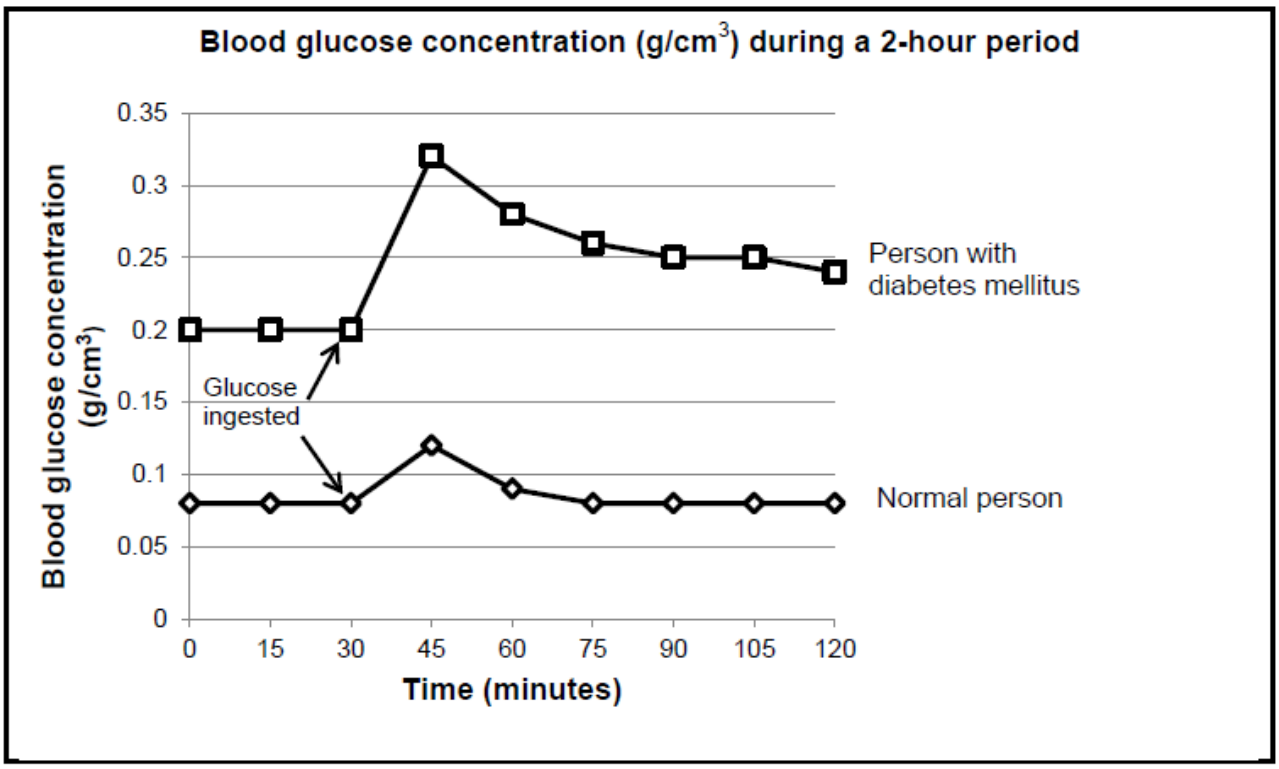
2.3.3 State the significance of the functional connection at **D**. (1)

2.3.4 Write down, in the correct order, the LETTERS ONLY of the neurons involved from the time a stimulus is received until a response takes place. (2)

2.3.5 Explain the consequences for a reflex action if neuron **C** is damaged. (2)

2.3.6 Draw a labelled diagram to represent the structure of neuron **A**. (5)
(14)

2.4 The graph below shows the blood glucose concentration in a normal person and in a person with diabetes mellitus. Both persons ingested 100 mℓ of glucose solution at 30 minutes.



[Adapted from *Cambridge Biology 2*, 2001]

2.4.1 What is the blood glucose concentration (g/cm^3) of the person with diabetes mellitus at 90 minutes? (1)

2.4.2 How many minutes after the ingestion of glucose did the glucose concentration reach its highest level in the normal person? (1)

2.4.3 Describe TWO differences in the pattern of the blood glucose concentration for the person with diabetes mellitus and a normal person. (4)

2.4.4 Explain the reason for the differences mentioned in QUESTION 2.4.3. (2)

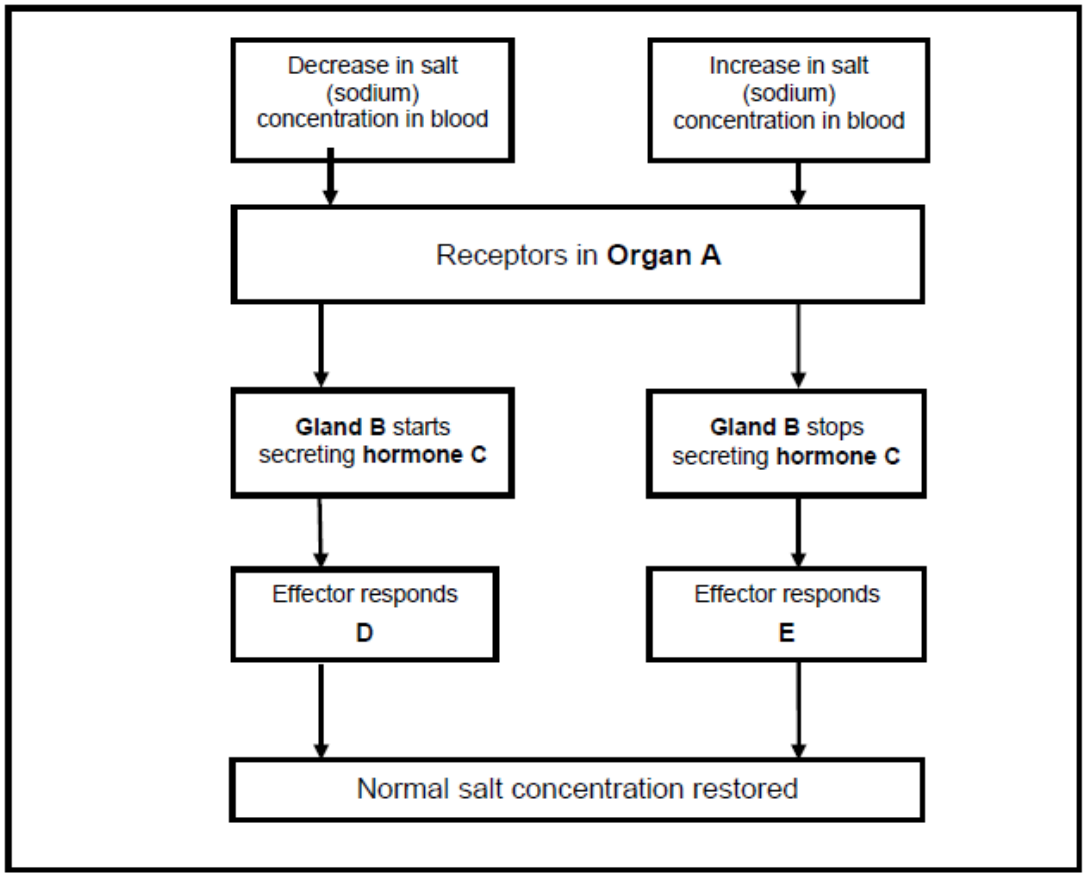
2.4.5 Name TWO hormones that have the opposite effect to that of insulin. (2)

(10)

[40]

QUESTION 3

3.1 Study the flow diagram below of a homeostatic mechanism used to regulate the concentration of salts in the human body.



3.1.1 Define *homeostasis*. (2)

3.1.2 Give the name of the following:

(a) Organ **A** (1)

(b) Gland **B** (1)

(c) Hormone **C** (1)

3.1.3 Describe the response by the effector at **D**. (2)
(7)

3.2 Read the passage below and answer the questions.

POPULAR DAM IS A BIOLOGICAL 'DESERT'

The Hartebeespoort Dam is situated in a residential area in North West. Unfortunately, it is rapidly becoming a biological 'desert' due to pollution by 2,7 million people living in the surrounding area, as well as the 720 megalitres of treated sewage water flowing into the dam. The inflow of treated sewage water increased the amount of phosphates present in the dam. This reduced the biodiversity of the dam resulting in only two plant species (water hyacinth and algae) and only three fish species (common carp, barbel and canary kurper) remaining in the dam, leading to an overpopulation of these species.

The Department of Water Affairs started a biological control programme to reduce the population of the remaining species so that other species could recolonise the dam. After a year the biodiversity of the dam increased.

[Adapted from *The Times*, 10 October 2013]

3.2.1 Based on the text above, explain what is meant by the term *biological 'desert'*. (1)

3.2.2 Explain why the increased phosphate levels caused a decrease in biodiversity. (3)

3.2.3 Explain how the reduction in biodiversity can affect the ecological balance in the dam. (4)

3.2.4 What is meant by *biological control*? (2)
(10)

3.3 The table below shows the global carbon dioxide emissions from fossil fuel combustion and some industrial processes in 2008.

COUNTRY	CARBON DIOXIDE EMISSIONS (%)
China	23
European Union	13
USA	19
India and Russian Federation	12
Other	33

[Adapted from www.environmentalprotectionagency.gov/climatechange]

3.3.1 Draw a pie chart to represent the data in the table. (6)

3.3.2 Explain the impact of the increased carbon dioxide emissions on the environment. (3)

3.3.3 Each country has been given a mandate to reduce its carbon dioxide emissions to reach a certain target. This is reviewed annually by the Conference of the Parties (COP), a United Nations organisation comprising 195 countries that meets to assess progress in dealing with climate change.

Explain TWO reasons why some countries are against reducing the carbon dioxide emissions by their industries. (4)
(13)

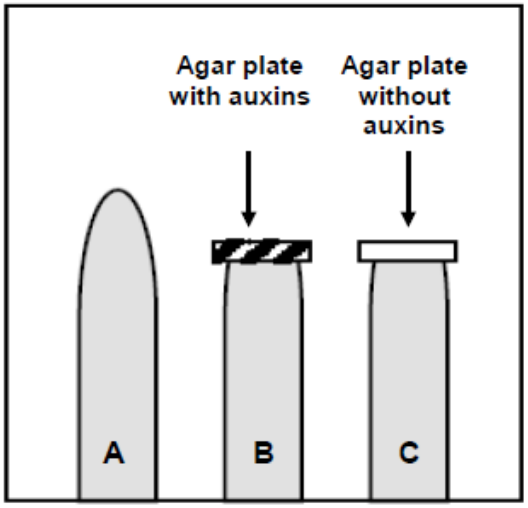
3.4 Thobeka investigated the effect of auxins on the growth of three plant shoots (**A**, **B** and **C**). The plant shoots were treated as follows:

- Shoot **A** – Not treated in any way
- Shoot **B** – Tip removed and agar plate with auxins placed on top
- Shoot **C** – Tip removed and agar plate without auxins placed on top

All shoots were exposed to the same light conditions.

NOTE: Agar is a jelly-like substance that allows auxins to diffuse through it.

The diagram below illustrates the set-up at the beginning of the investigation.



3.4.1 Identify the independent variable in this investigation. (1)

3.4.2 State TWO factors that must be kept constant in this investigation. (2)

3.4.3 Explain the results observed in:

(a) Shoot **B** after a few days (3)

(b) Shoot **C** after a few days (2)

3.4.4 Suggest TWO ways in which Thobeka could have improved the reliability of her investigation. (2)
(10)
[40]

TOTAL SECTION B: 80

SECTION C

QUESTION 4

The unicellular zygote undergoes many developmental changes until it becomes a multicellular foetus, nourished and protected by the mother.

Describe the changes that allow the zygote to eventually develop into a foetus and how this foetus is nourished and protected during the period of pregnancy.

Content:	**(17)**
Synthesis:	**(3)**

NOTE: NO marks will be awarded for answers in the form of flow charts, diagrams or tables.

TOTAL SECTION C:	**20**
GRAND TOTAL:	**150**

LIFE SCIENCES P2

FEBRUARY/MARCH 2015

SECTION A

QUESTION 1

1.1 Various options are given as possible answers to the following questions. Choose the answer and write only the letter (A to D) next to the question number (1.1.1 to 1.1.10) in the ANSWER BOOK, for example 1.1.11 D.

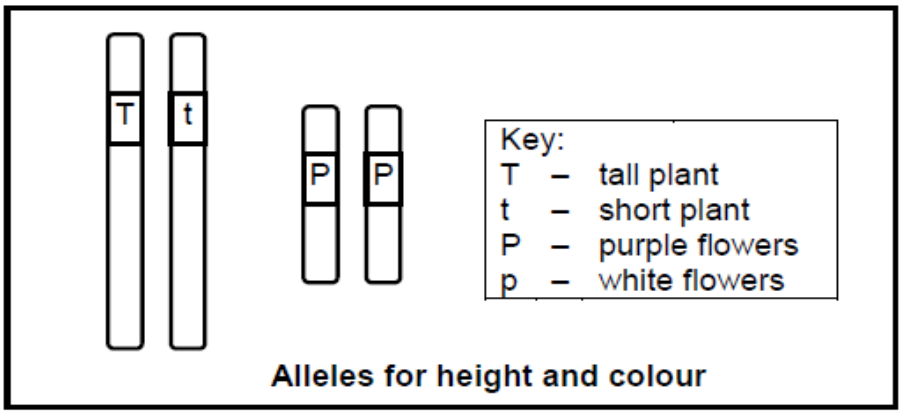
1.1.1 The shape of the DNA molecule was discovered by ...

A Franklin, using evidence obtained from Watson and Crick.
B Franklin, working independently of anyone else.
C Watson and Crick, working independently of anyone else.
D Watson and Crick, using some evidence obtained from Franklin.

1.1.2 Scientists have created a genetically modified zebrafish, a 'GloFish'. This fish has a gene that makes it glow in the dark. This gene was introduced into the species by ...

A interbreeding with another species of fish that is able to glow.
B removing the gene from a glowing fish and inserting it into a chromosome of the zebrafish.
C the process of natural selection.
D inbreeding.

1.1.3 The diagram below shows the alleles for height and flower colour in a flowering plant.



Alleles for height and colour

The plant is ...

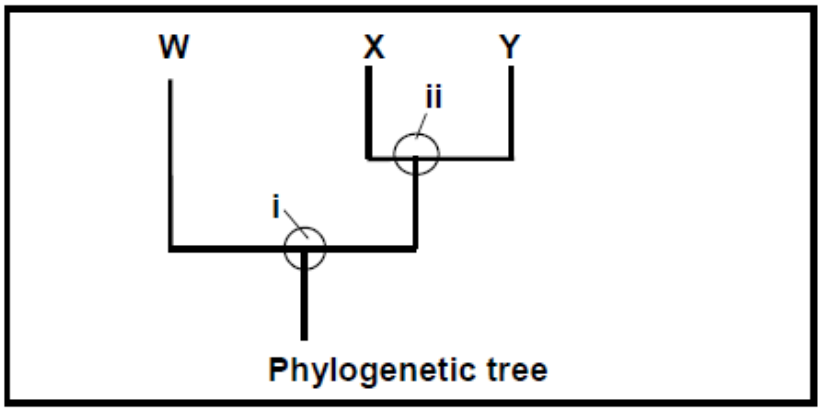
A homozygous dominant for height and heterozygous for flower colour.
B heterozygous for height and homozygous dominant for flower colour.
C homozygous recessive for height and homozygous dominant for flower colour.
D heterozygous for height and heterozygous for flower colour.

1.1.4 A phylogenetic tree represents …

A the number of species on Earth.
B only species that belong to the same genus.
C only organisms that are now extinct.
D possible evolutionary relationships.

1.1.5 The diagram below shows a generalised phylogenetic tree.

The different ancestors in the phylogenetic tree are represented by **i** and **ii**.



Phylogenetic tree

Which ONE of the following is the most appropriate conclusion that can be made from the phylogenetic tree?

A **ii** is a common ancestor of **X** and **Y** only.
B **i** is a common ancestor of **W** and **X** only.
C **W** and **X** are more closely related than **X** and **Y**.
D **X** and **Y** belong to the same species.

1.1.6 A messengerRNA (mRNA) molecule consists of 300 nitrogenous bases. The maximum number of amino acids that it can code for is ...

A 300.
B 150.
C 100.
D 30.

1.1.7 Which ONE of the following resulted from Gregor Mendel's experiments with pea plants?

A The 'law' of inheritance of acquired characteristics
B The principle of independent assortment
C The 'law' of use and disuse
D The theory of evolution

1.1.8 The modern human skull ...

A has small canines.
B has pronounced brow ridges.
C is prognathous.
D has a U-shaped arrangement of teeth on each jaw.

1.1.9 Which ONE of the following represents the correct order for the evolution of modern humans?

A *Ardipithecus* → *Australopithecus* → *Homo*
B *Australopithecus* → *Ardipithecus* → *Homo*
C *Homo* → *Australopithecus* → *Ardipithecus*
D *Ardipithecus* → *Homo* → *Australopithecus*

1.1.10 Which ONE of the following represents a trend in human evolution?

A More developed brow ridges
B Increased size of canines
C More developed cranial ridges
D More forward position of the foramen magnum (10 x 2) **(20)**

1.2 Give the correct **biological term** for each of the following descriptions. Write only the term next to the question number (1.2.1 to 1.2.10) in the ANSWER BOOK.

1.2.1 Similar structures on different organisms that suggest they have a common ancestor

1.2.2 The complete set of chromosomes in the cell of an organism

1.2.3 A bar code pattern formed from DNA

1.2.4 The condition that results from the absence of skin pigmentation

1.2.5 The bonds formed between amino acids

1.2.6 A representation of the number, shape and arrangement of all the chromosomes in the nucleus of a somatic cell

1.2.7 Openings in the nuclear membrane that allow mRNA to leave the nucleus

1.2.8 A copy of an organism that is genetically identical to the original organism

1.2.9 A tentative explanation of a phenomenon that can be tested

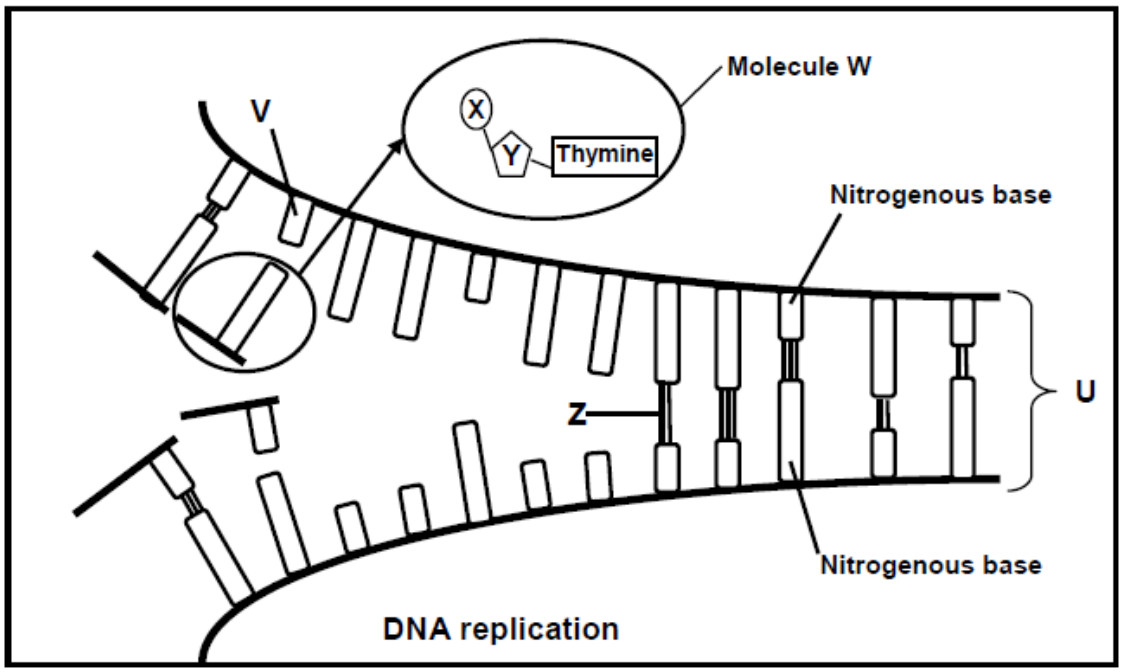
1.2.10 The distribution of species in different parts of the world (10 x 1) **(10)**

1.3 Indicate whether each of the statements in COLUMN I applies to **A only**, **B only**, **both A and B** or **none** of the items in COLUMN II. Write **A only**, **B only**, **both A and B**, or **none** next to the question number (1.3.1 to 1.3.6) in the ANSWER BOOK.

	COLUMN I	COLUMN II
1.3.1	Evidence for evolution	A: fossils B: genetics
1.3.2	Used as evidence for the 'Out of Africa' hypothesis	A: cultural evidence (tool making) B: mitochondrial DNA
1.3.3	The code for an amino acid on mRNA	A: codon B: anticodon
1.3.4	Example of a reproductive isolating mechanism	A: breeding at the same time of the year B: adaptation to different pollinators
1.3.5	Distinctive difference between the apes and the hominids	A: shape of the jaw B: shape of the spinal column
1.3.6	An example of discontinuous variation in humans	A: skin colour B: height

(6 x 2) **(12)**

1.4 The diagram below represents DNA replication.



1.4.1 Identify the following:

(a) Molecules **W** and **U** (2)

(b) Parts of molecule **W** labelled **X** and **Y** (2)

(c) Bond **Z** (1)

(d) Nitrogenous base **V** (1)

1.4.2 Where in the cell does this process take place? (1)

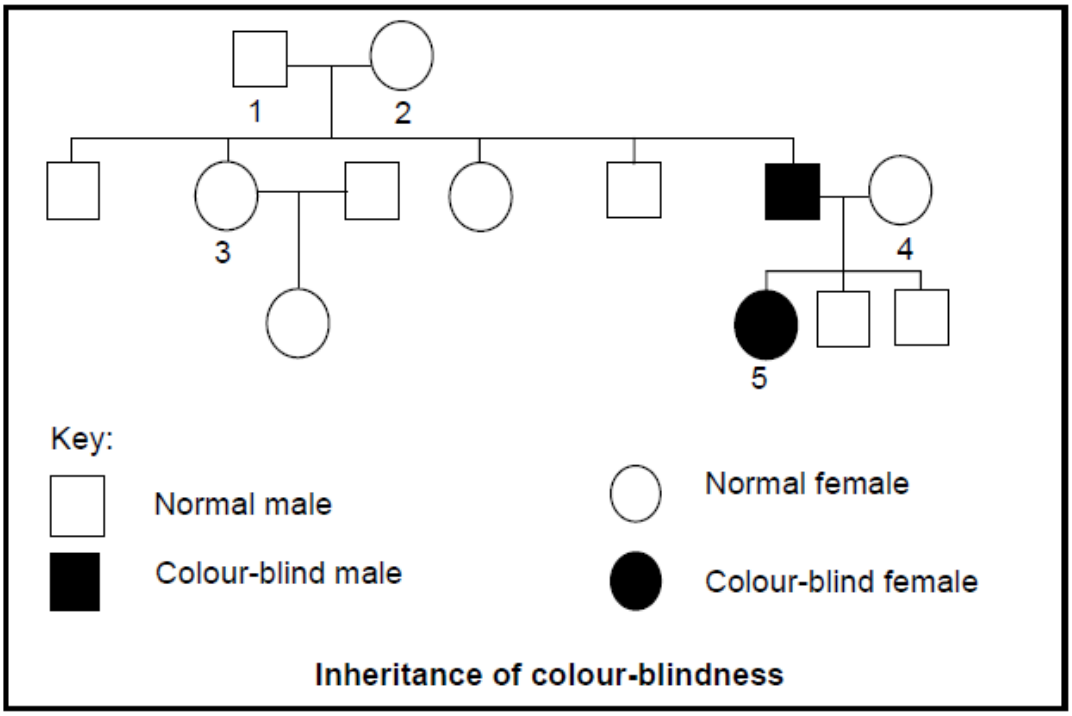
1.4.3 Name the phase of the cell cycle where replication takes place. (1)
(8)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 The pedigree diagram below shows the inheritance of colour-blindness (Daltonism) in a family. Colour-blindness is sex-linked and is caused by a recessive allele (**d**). The ability to see colour normally is caused by a dominant allele (**D**).



Inheritance of colour-blindness

2.1.1 How many of the male offspring of parents **1** and **2** were normal? (1)

2.1.2 State the genotype of:

(a) Individual **2** (2)

(b) Individual **5** (2)

2.1.3 A person with a recessive allele for colour-blindness may not be colour-blind. Explain why males with an allele for colour-blindness are always colour-blind. (4)

2.1.4 If individual **5** marries a normal male, what percentage of their daughters will have an allele for colour-blindness, but will NOT be colour-blind? (2)
(11)

2.2 In humans the allele for short fingers (brachydactyly), represented by **B**, is dominant over the allele for normal fingers (**b**). The allele for curly hair (**H**) is dominant over the allele for straight hair (**h**).

Andrew, with genotype **Bbhh**, married Susan, with genotype **bbHh**.

2.2.1 State how the phenotypes of Andrew and Susan differ from each other. (2)

2.2.2 Give ALL the possible genotypes of the gametes produced by Andrew. (2)
(4)

2.3 Mr and Mrs Phonela are concerned that their baby girl does not appear to resemble either of them. They suspect that the baby they were given at the hospital was not theirs. Mr Phonela is blood type **AB**, Mrs Phonela is blood type **B** and the baby they were given is blood type **O**.

2.3.1 Give the possible genotypes of:

(a) Mrs Phonela (2)

(b) The baby girl (1)

2.3.2 Explain why the baby girl with blood type **O** cannot be Mr and Mrs Phonela's daughter. (3)

2.3.3 Explain why the use of blood type for paternity testing is not conclusive. (2)

2.3.4 Using your knowledge of sex chromosomes, explain why the sex of a child is determined by the male gamete. (5)
(13)

2.4 An investigation was conducted by a scientist to determine if two plant populations, Population 1 and Population 2, belonged to the same species. The scientist collected seeds from each of the populations.

He used the following steps in his investigation:

- He planted 20 seeds from Population 1 and 20 seeds from Population 2 in two separate plots close to each other.
- The stamens of all the flowers of Population 1 were removed.
- Pollen from the flowers of Population 2 was used to pollinate the flowers of Population 1.
- The scientist harvested the seeds of the plants in Population 1.
- He grew these seeds under ideal conditions in a laboratory.
- None of the seeds germinated.

2.4.1 Explain the advantage of removing the stamens from the flowers of Population 1. (2)

2.4.2 What evidence indicates that the two populations do not belong to the same species? (1)

2.4.3 State TWO factors that the scientist would have kept constant in the laboratory. (2)

2.4.4 State ONE way in which the scientist could increase the reliability of his results. (1)
(6)

2.5 Describe how new species may form through geographic isolation. **(6)**
[40]

QUESTION 3

3.1 An investigation was conducted on the chances of women of different ages having a baby with Down syndrome as a result of errors in Meiosis I and Meiosis II.

The results of the investigation are shown in the diagram below.

Maternal age (years)	Incidence of Down syndrome (per 1 000 births)	
	Error in Meiosis I	Error in Meiosis II
<25	0,4	0,1
25–29	0,5	0,2
30–34	0,8	0,3
35–39	1,2	0,5
40+	5,9	1,9

[Adapted from *Developmental Biology Online: Human Meiosis 2014*]

3.1.1 Draw a histogram to represent the information in the table above regarding the error occurring in Meiosis II that leads to Down syndrome. (6)

3.1.2 Name the error during meiosis that could eventually result in a child with Down syndrome. (1)

3.1.3 According to the information in the table, is the error mentioned in QUESTION 3.1.2 more likely to occur during Meiosis I or Meiosis II? (1)

3.1.4 Over a five-year period a hospital recorded a total of 44 Down syndrome babies born to mothers who were forty years and older. How many of these babies were likely to have had the error that caused Down syndrome occurring during Meiosis II? Show ALL working. (3)
(11)

3.2 The table below shows a partial DNA sequence from a human, as well as a codon table that can be used to determine which amino acids are required to make a protein.

Base triplet number	1	2	3	4	5	6	7
Human DNA sequence	ATG	TGT	CCA	TTA	ACG	TGC	ACA

CODON TABLE	
Valine	GUU, GUG, GUA
Cysteine	UGU, UGC
Proline	CCA, CCU
Leucine	UUG, CUC, CUG, UUA
Threonine	ACG, ACA
Tyrosine	UAC, UAU

3.2.1 State ONE way in which the DNA molecule is biologically important. (1)

3.2.2 Name the codon that is formed from base triplet number **2** on the DNA sequence. (1)

3.2.3 Write down the names of the amino acids coded for by base triplets **6** and **7**. (2)

3.2.4 If a mutation changes base triplet **1** from ATG to ATA, why will this not change the protein formed? (2)

3.2.5 Describe the process of translation in protein synthesis. (5)
(11)

3.3 A farmer has an orchard of apple trees. Each apple produced expressed red and yellow colour equally (red-yellow apples). To extend his apple orchard, the farmer collected seeds from the red-yellow apples and grew them.

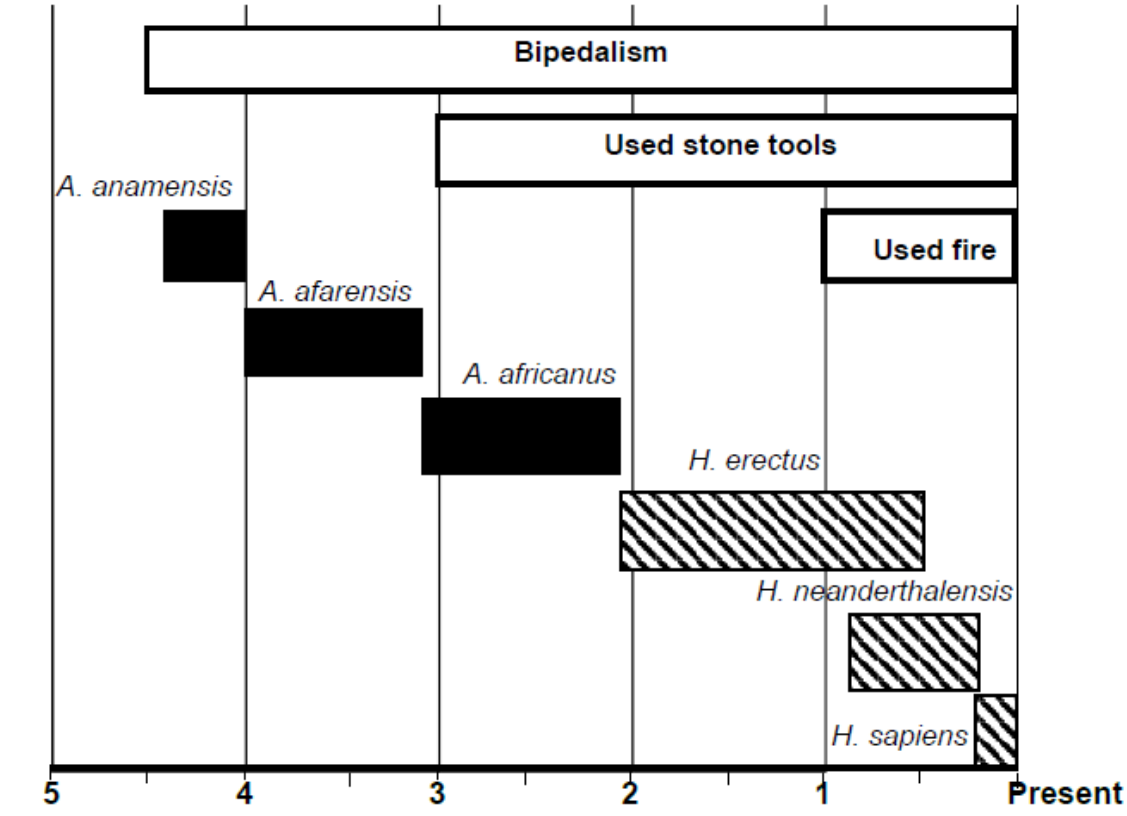
When the new trees matured, he found that some of the trees produced red apples (**R**), others produced yellow apples (**Y**) and the rest produced apples that were red-yellow.

3.3.1 Use a genetic cross to explain his results in the F_1 generation. (6)

3.3.2 What proportion of apples in the F_1 generation will be red-yellow apples? (1)

3.3.3 The farmer saw that the red-yellow apples sell the best. Name the phenotypes of the trees that he should cross in the future in order to ensure that any new trees will definitely produce only red-yellow apples. (2)
(9)

3.4 The diagram below represents the possible evolution of humans, as well as the time period for the development of bipedalism, the use of fire and the use of tools.



Possible evolution of humans in millions of years

3.4.1 Use the diagram above and identify TWO bipedal organisms that did not use stone tools or fire. (2)

3.4.2 How long after developing the ability to walk on two feet did pre-humans develop the ability to use stone tools? Show ALL working. (3)

3.4.3 Explain the significance of the characteristic of the skull which allowed for the development of the ability to use tools in the *Homo* species. (2)

3.4.4 Explain the relationship between the use of fire and changes in dentition in the *Homo* species. (2)

(9)

[40]

TOTAL SECTION B: 80

SECTION C

QUESTION 4

Describe how Lamarck and Darwin explained evolution, and compare Darwin's ideas to the ideas of Punctuated Equilibrium.

Content:	**(17)**
Synthesis:	**(3)**

NOTE: NO marks will be awarded for answers in the form of flow charts, diagrams or tables.

TOTAL SECTION C:	**20**
GRAND TOTAL:	**150**

LIFE SCIENCES P1

NOVEMBER 2015

SECTION A

QUESTION 1

1.1 Various options are given as possible answers to the following questions. Choose the answer and write only the letter (A to D) next to the question number (1.1.1 to 1.1.10) in the ANSWER BOOK, for example 1.1.11 D.

1.1.1 Which ONE of the following processes is responsible for the production of male gametes?

A Spermatogenesis
B Oogenesis
C Ejaculation
D Ovulation

1.1.2 The part of the central nervous system that protects the human body from serious injuries when a person steps barefoot on a thorn is the ...

A cerebellum.
B medulla oblongata.
C spinal cord.
D cerebrum.

1.1.3 When a person runs a race, sweating helps to …

A regulate the amount of salts in the body.
B control the amount of glucose in the body.
C cool the body through evaporation.
D regulate the amount of water in the body.

1.1.4 Which ONE of the following is the correct sequence in which impulses are transmitted in a reflex action?

A Receptor → sensory neuron → interneuron → motor neuron → effector
B Receptor → motor neuron → sensory neuron → interneuron → effector
C Receptor → motor neuron → interneuron → sensory neuron → effector
D Receptor → interneuron → sensory neuron → motor neuron → effector

1.1.5 Which ONE of the following is a function of adrenalin?

A Lowering blood pressure
B Promoting the conversion of glucose to glycogen
C Increasing skeletal muscle tone
D Causing the blood vessels of the skin to dilate

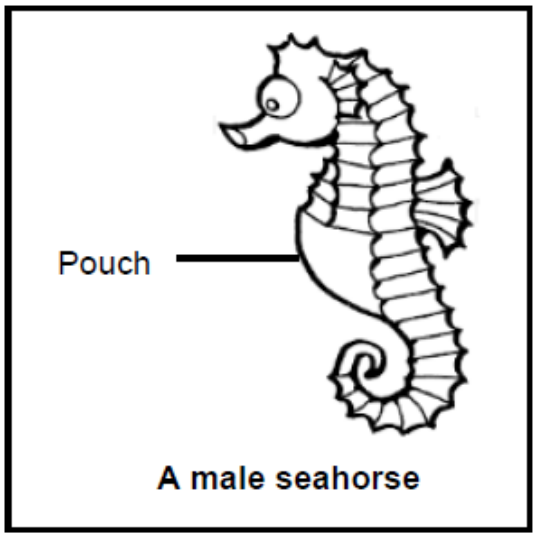
1.1.6 The following structures are part of the male reproductive system:

(i) Scrotum
(ii) Prostate gland
(iii) Seminal vesicles
(iv) Penis
(v) Testes

Which ONE of the following combinations of structures produces semen?

A (i), (ii) and (iv) only
B (i), (iii) and (v) only
C (ii), (iii) and (v) only
D (ii), (iii) and (iv) only

1.1.7 In seahorses the female deposits the eggs into a pouch in the male's body. The male then secretes sperm into the pouch. Fertilisation takes place in the pouch. The fertilised eggs develop in the pouch.



A male seahorse

What type of fertilisation and reproductive strategy does this represent?

A External fertilisation and vivipary
B Internal fertilisation and vivipary
C External fertilisation and ovipary
D Internal fertilisation and ovipary

QUESTIONS 1.1.8 AND 1.1.9 REFER TO THE INVESTIGATION BELOW.

An investigation was conducted to determine the effect of alcohol on reaction time.

The procedure was as follows:

- Fifty adult volunteers were used.
- Their reaction times were measured at the beginning of the investigation.
- They were each given alcohol to drink.
- Their reaction times were measured again after 30 minutes.

1.1.8 What is the independent variable in the investigation above?

A Number of volunteers
B Time after drinking alcohol
C Reaction time
D Alcohol in the body

1.1.9 The following factors were considered during the investigation:

(i) Age of the volunteers
(ii) Number of volunteers
(iii) Intake of alcohol
(iv) Tool used to measure reaction time

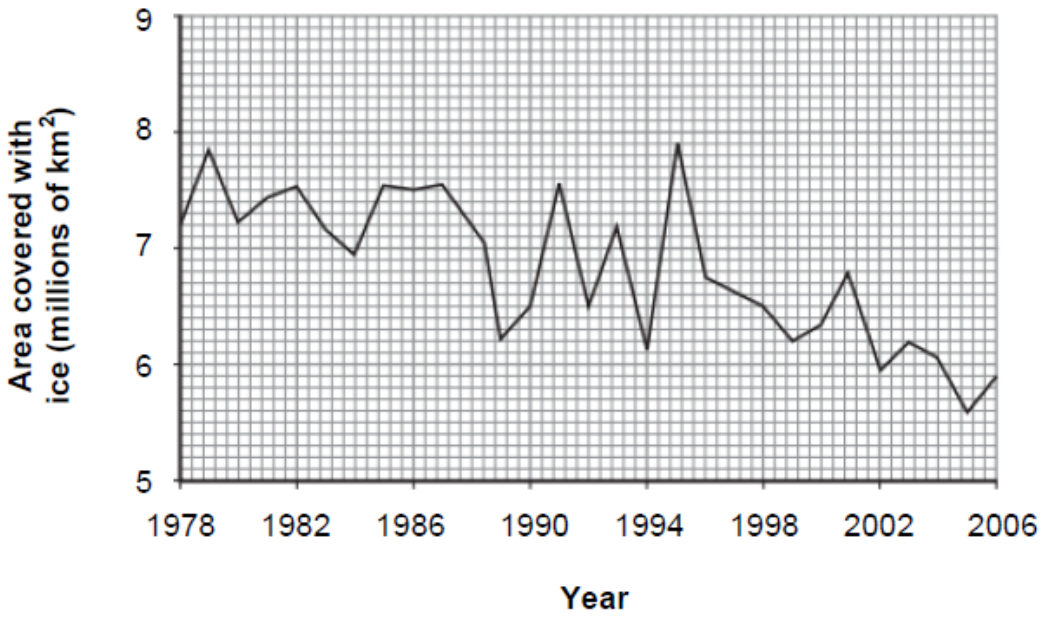
Which ONE of the following combinations of factors will affect the validity of the investigation?

A (i) and (ii) only
B (i), (iii) and (iv) only
C (i), (ii), (iii) and (iv)
D (ii), (iii) and (iv) only

1.1.10 Rising temperatures on Earth, as a result of the enhanced greenhouse effect, have led to the melting of ice in glaciers.

The graph below shows the results of an investigation that measured changes in the size of an area covered with ice in the Arctic region between 1978 and 2006.

Graph showing changes in the size of an area covered with ice in the Arctic region between 1978 and 2006



[Adapted from nsidc.org]

The difference between the size of the area covered with ice in 1978 and the size of the area covered with ice in 1998 is ... million km^2.

A 1,3
B 7,2
C 0,7
D 5,9

(10 x 2) **(20)**

1.2 Give the correct **biological term** for each of the following descriptions. Write only the term next to the question number (1.2.1 to 1.2.7) in the ANSWER BOOK.

1.2.1 The part of the brain that controls the heart rate

1.2.2 The maintenance of a constant internal environment in the body within certain limits

1.2.3 The plant growth hormone that promotes seed dormancy

1.2.4 A collective name for the membranes that protect the brain

1.2.5 A hormone that regulates the salt concentration in human blood

1.2.6 A layer in the atmosphere that is damaged by chlorofluorocarbons (CFCs)

1.2.7 A hormone that stimulates the maturation of sperm (7 x 1) **(7)**

1.3 Indicate whether each of the descriptions in COLUMN I applies to **A ONLY**, **B ONLY**, **BOTH A AND B** or **NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B** or **none** next to the question number (1.3.1 to 1.3.5) in the ANSWER BOOK.

	COLUMN I	COLUMN II
1.3.1	Requires the production of a large number of gametes to ensure survival of the species	A: External fertilisation B: Internal fertilisation
1.3.2	A type of development in birds where the young are incapable of moving and feeding themselves	A: Precocial development B: Altricial development
1.3.3	A plant defence mechanism against pathogens	A: Chemicals B: Thorns
1.3.4	A gland which produces substances that are transported to target organs by ducts	A: Endocrine gland B: Exocrine gland
1.3.5	Used by plants to reduce the chances of being fed upon by herbivores	A: Chemicals B: Thorns

(5 x 2) **(10)**

1.4 Each diagram below represents parts of the human eye.

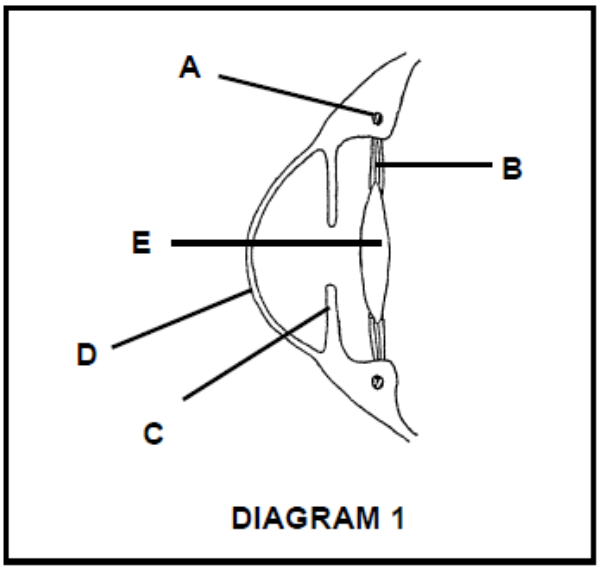


DIAGRAM 1

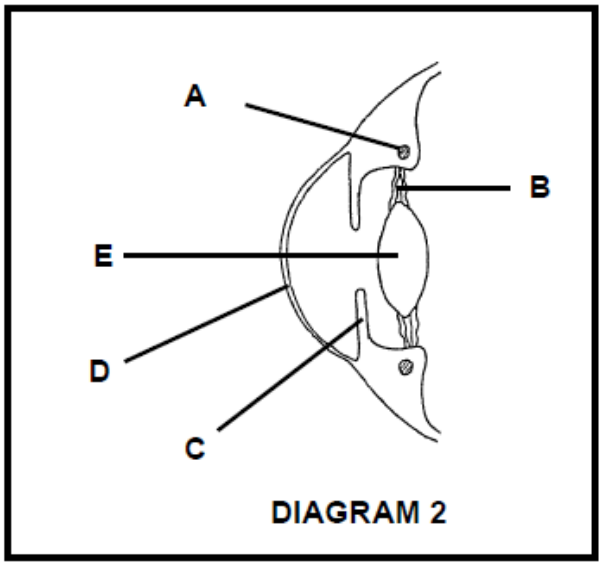


DIAGRAM 2

1.4.1 Give the LETTER and NAME of the part that:

(a) Contracts to change the shape of the lens (2)

(b) Controls the amount of light that enters the eye (2)

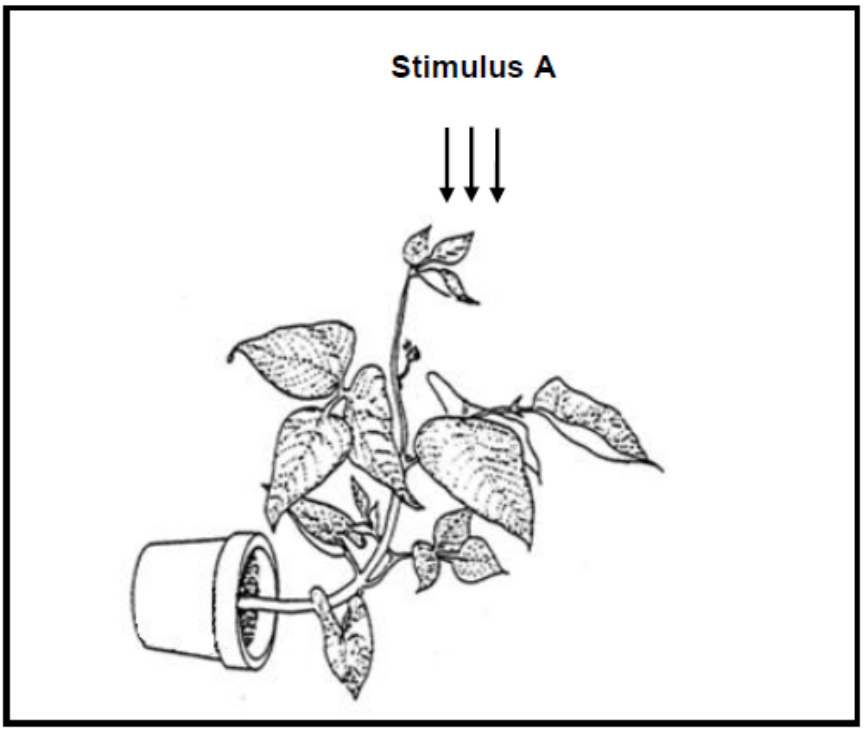
(c) Is protected by the conjunctiva (2)

1.4.2 Study DIAGRAM **1** and DIAGRAM **2**. What process is responsible for the change in the shape of the part **E**? (1)

1.4.3 Which diagram (**1** or **2**) represents the state of the eye when a person is reading a book? (1)

(8)

1.5 The diagram below shows the growth movement of a part of a plant towards a stimulus.



1.5.1 What growth movement is represented in the diagram? (1)

1.5.2 Identify the stimulus labelled **A**. (1)

1.5.3 Name the growth hormone that is responsible for the growth movement named in QUESTION 1.5.1. (1)

1.5.4 Will a high concentration of the growth hormone named in QUESTION 1.5.3 **stimulate** or **inhibit** growth in the roots? (1)

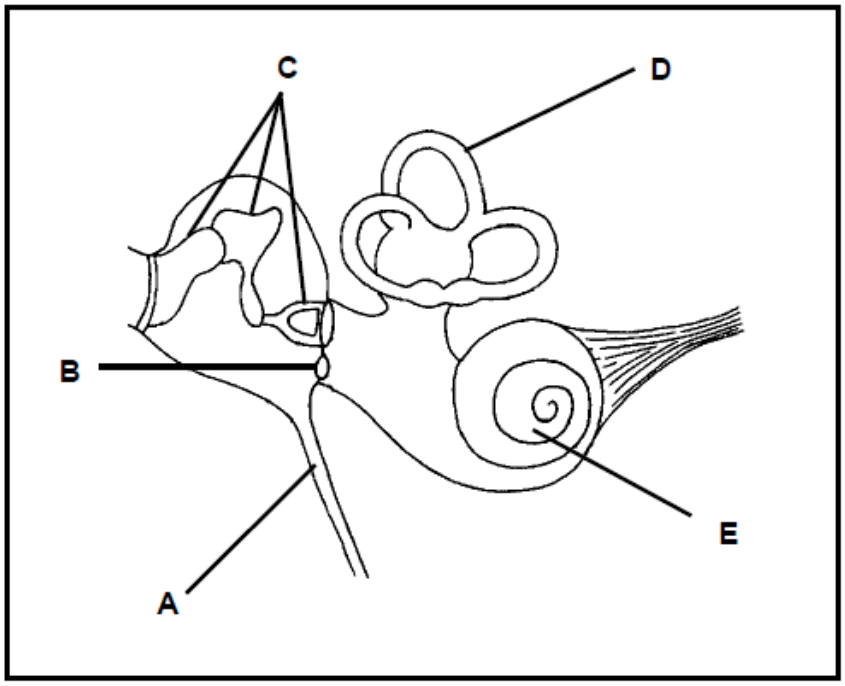
1.5.5 Name the phenomenon where the buds at the tip of the plant regulate the growth of the lateral branches. (1)
(5)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 The diagram below represents a part of the human ear.



2.1.1 Identify part:

(a) **A** (1)

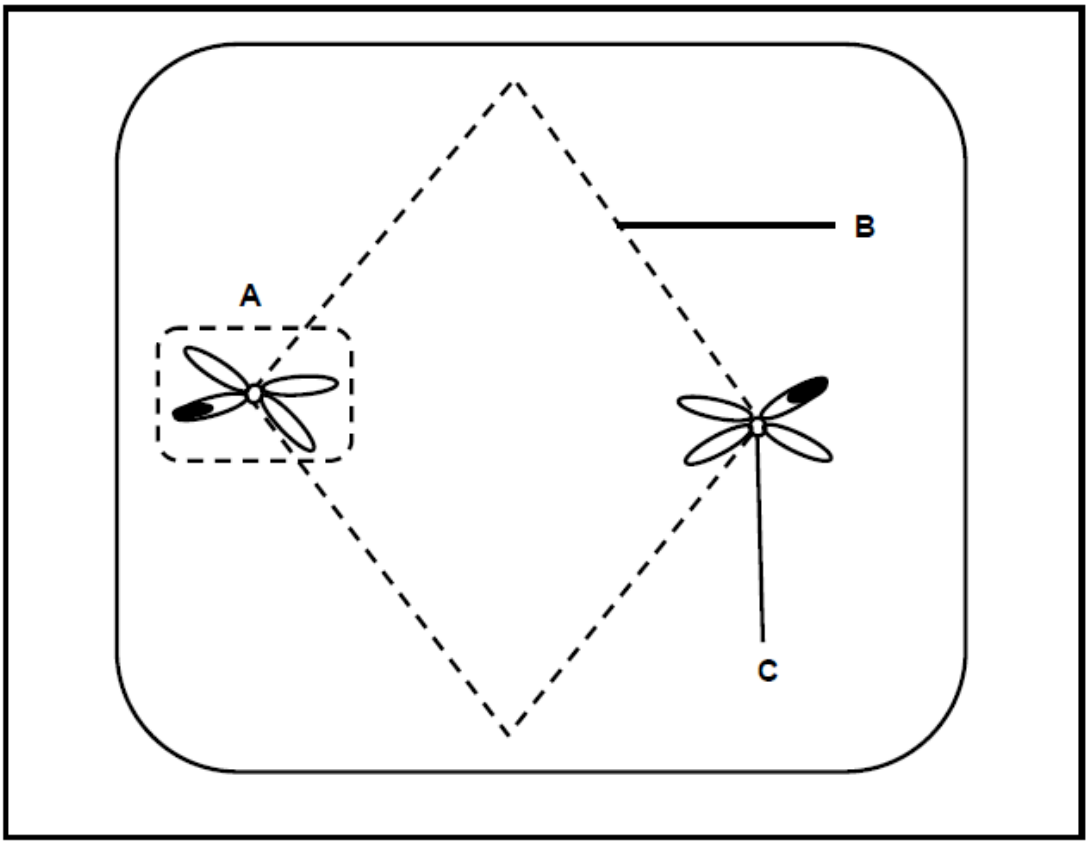
(b) **B** (1)

(c) **E** (1)

2.1.2 Explain the result if part **A** is blocked. (4)

2.1.3 Describe how part **D**, the semi-circular canals, plays a role in maintaining balance when the body changes speed and direction. (5)
(12)

2.2 The diagram below illustrates a phase in meiosis.



2.2.1 Identify part:

(a) **A** (1)

(b) **B** (1)

(c) **C** (1)

2.2.2 Identify the phase illustrated above. (1)

2.2.3 Give a reason for your answer to QUESTION 2.2.2. (2)

2.2.4 Draw a diagram of the cell above as it would appear during **anaphase I**. (4)
(10)

2.3 An investigation was conducted to determine the diameter of a healthy follicle in a human ovary during the menstrual cycle.

A sample consisting of 50 women aged between 20 and 25, with regular menstrual cycles, was used for this investigation.

The average changes in the follicle diameters of all 50 women during their menstrual cycles were measured and recorded.

2.3.1 Name TWO steps that were considered during the planning of this investigation. (2)

2.3.2 The following results were obtained from the investigation.

DAYS WHEN FOLLICLES WERE MEASURED	AVERAGE FOLLICLE DIAMETERS OF THE 50 WOMEN (mm)
5	6,9
10	13,3
13	18,8
14	22,0
20	3,4
25	2,6

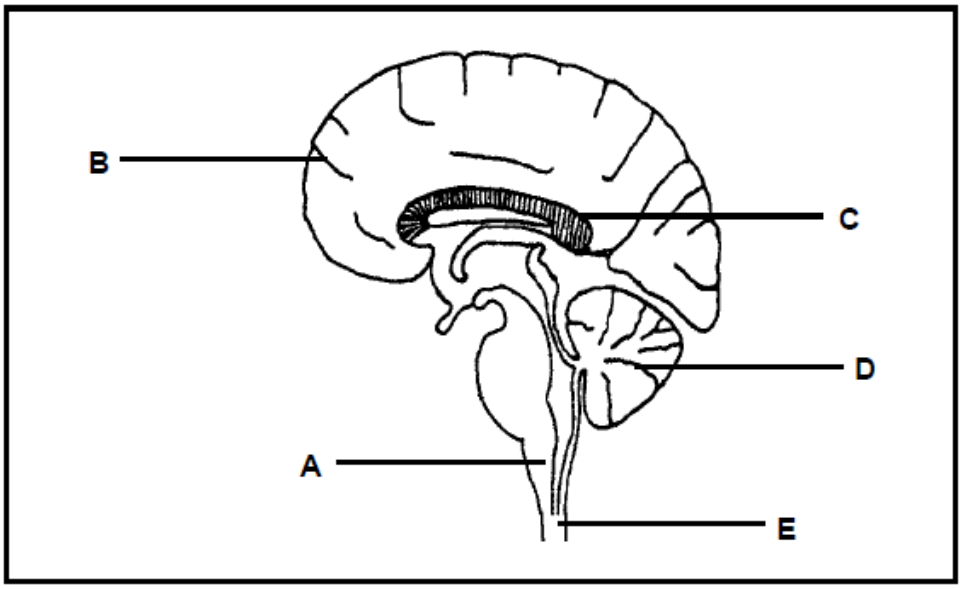
[Adapted from *Journal of Reproduction and Fertilisation*,1983]

Use the results and explain:

(a) The changes in the follicle diameters from day 14 to day 25 (3)

(b) How the results would probably differ if all 50 women used contraceptive pills that contained a high level of progesterone (3)
(8)

2.4 The diagram below represents the central nervous system in a human.



2.4.1 Identify part:

(a) **A** (1)

(b) **C** (1)

(c) **D** (1)

2.4.2 State THREE functions of part **B**. (3)
(6)

2.5 Describe the structure and the functioning of the autonomic nervous system. **(4)**
[40]

QUESTION 3

3.1 Describe how the human body restores the carbon dioxide concentration in the blood when it rises above normal levels. **(6)**

3.2 An investigation was conducted to compare the glucose concentration in the blood of two people, Mo and Thabiso, before and after ingesting glucose.

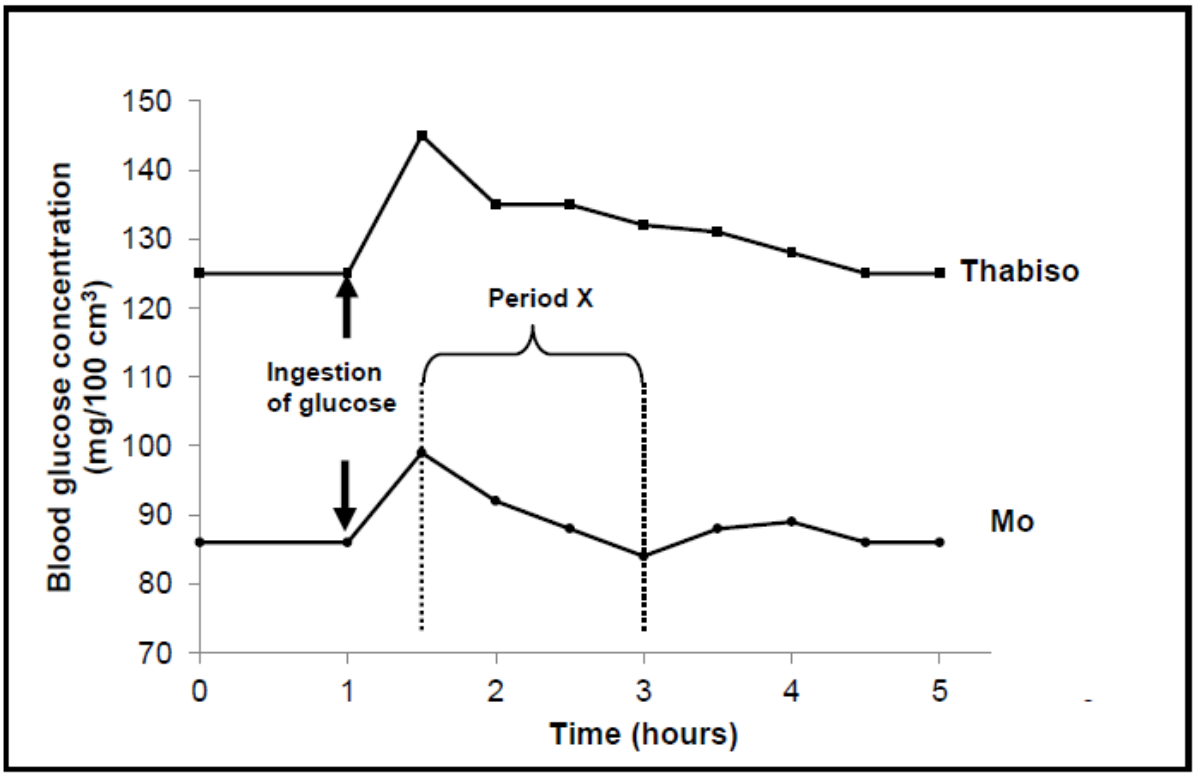
The following procedure was followed:

- The glucose concentration in their blood was measured at the start of the investigation and again 1 hour into the investigation.
- One hour into the investigation each of them was given 50 mℓ of a glucose solution to drink.
- For the next 4 hours after ingesting the glucose solution the glucose concentration in their blood was measured every 30 minutes.

The results are shown in the graph below.

The **arrows** indicate when they drank the glucose solution.

NOTE: The normal glucose concentration in blood is between 80 and 120 mg/100 cm^3.



3.2.1 Provide a suitable title for this graph. (2)

3.2.2 By how much did Thabiso's blood glucose concentration level increase (in mg/100 cm^3) after drinking the glucose solution? Show ALL working. (2)

3.2.3 How long did it take Mo's blood glucose concentration level to return to its original level after ingesting the glucose solution? (1)

3.2.4 (a) Who (Thabiso or Mo) has diabetes mellitus? (1)

(b) Give ONE observable reason for your answer to QUESTION 3.2.4(a). (1)

3.2.5 Explain the changes in Mo's glucose level during period **X**. (4)
(11)

3.3 Read the extract below.

HUNTING WILDLIFE FOR FOOD

An organisation, Trade Records Analysis of Fauna and Flora in Commerce (TRAFFIC), did an investigation to find out about the extent of the illegal killing of wildlife for use as bush-meat (meat from wildlife) and the influence of this on the environment.

The organisation reported that the illegal killing of wildlife, both for trade and consumption, had been on the increase in many African countries during the past two years. It also reported that some species, such as impala, were preferred to other species of wildlife.

One of the organisation's recommendations was that the hunting of wildlife should be legalised. This would enable governments in these countries to control the number of animals being hunted and also to restrict the age of animals that may be hunted. It also recommended that only those animals that were very old and weak in a population should be hunted.

[Adapted from an article 'Wildlife Under Siege', *Endangered Wildlife*, 2000]

3.3.1 What is the illegal hunting and killing of animals called? (1)

3.3.2 State ONE way in which humans destroy wildlife habitats. (1)

3.3.3 Give TWO reasons for the increase in the illegal killing of wildlife. (2)

3.3.4 Explain how the increase in the killing of wildlife will influence the environment. (3)

3.3.5 Explain why the organisation recommended that only very old and weak animals in a population should be killed if hunting is legalised. (3)
(10)

3.4 Read the extract below.

FOOD SECURITY IN SOUTH AFRICA

One of the challenges in South Africa is access to food by the poor. In 2009 Statistics SA conducted a survey to determine the percentage of households in each province that had access to food.

The results are shown in the table below:

PROVINCE	HOUSEHOLDS THAT HAVE ACCESS TO FOOD (%)
Western Cape	85
Eastern Cape	79
Mpumalanga	79
Free State	67
Northern Cape	75
North West	79
KwaZulu-Natal	77
Limpopo	88
Gauteng	82

South Africa seems to have adequate food access in urban areas, but the same cannot be said of households in rural areas. In rural areas prices of staple foods (e.g. maize and rice) are usually higher than in urban areas.

Increasing agriculture is the key to food security and poverty alleviation. The majority of people living in rural areas have access to land, but more still needs to be done to make household farming (growing crops for family use only) in these areas more efficient.

[Adapted from *Food Security*, Department of Agriculture, Forestry and Fisheries, March 2011]

3.4.1 What is meant by *food security*? (2)

3.4.2 Suggest ONE reason why food prices in rural areas are usually higher than food prices in urban areas. (1)

3.4.3 State TWO ways in which household farming could reduce poverty. (2)

3.4.4 Suggest TWO ways in which the Department of Agriculture can improve farming in the rural areas. (2)

3.4.5 DRAW a bar graph to compare access to food in the following three provinces, namely Limpopo, Northern Cape and Free State. (6)

(13)

[40]

TOTAL SECTION B: 80

SECTION C

QUESTION 4

Explain the structural suitability of the sperm cell for its function and describe its involvement in the formation of a zygote and the development of this zygote until implantation.

Content:	(17)
Synthesis:	(3)
	(20)

NOTE: NO marks will be awarded for answers in the form of flow charts, tables or diagrams.

TOTAL SECTION C:	**20**
GRAND TOTAL:	**150**

LIFE SCIENCES P2

NOVEMBER 2015

SECTION A

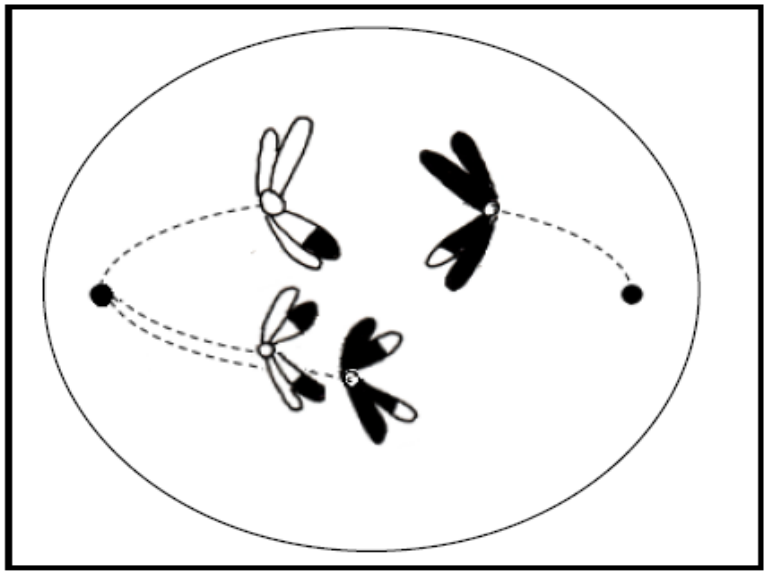
QUESTION 1

1.1 Various options are provided as possible answers to the following questions. Choose the correct answer and write only the letter (A to D) next to the question number (1.1.1 to 1.1.9) in the ANSWER BOOK, for example 1.1.10 D.

1.1.1 Cells that can differentiate into any type of cell are called ...

A sex cells.
B daughter cells.
C stem cells.
D haploid cells.

1.1.2 The diagram below shows a cell undergoing meiosis.



The diagram above shows ...

A non-disjunction in metaphase II.
B a chromosomal aberration that results in haemophilia.
C a chromosomal aberration involving chromosome pair number 23, leading to Down syndrome.
D non-disjunction in anaphase I.

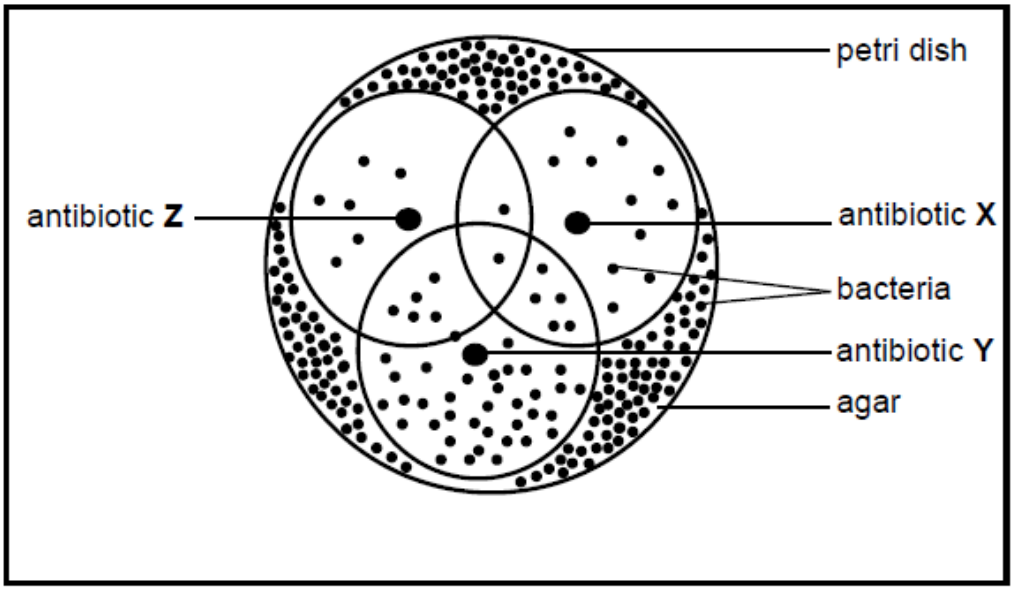
1.1.3 The DNA of different species only differs in the ...

A components of the nucleotides.
B sequence of the nucleotides.
C type of bond between the nitrogenous bases.
D type of sugar that it contains.

1.1.4 One strand of a DNA molecule has 60 adenine and 20 thymine molecules. How many adenine molecules are present in the double-stranded DNA molecule?

A 60
B 150
C 80
D 300

1.1.5 The diagram below shows the effect of three different types of antibiotic (**X**, **Y** and **Z**) on a single strain of bacterium growing on agar (nutrient jelly) in a petri dish. The three circles indicate the distance to where each antibiotic spread.



The correct order of the antibiotics, from most effective to least effective, is ...

A Z, X and Y.
B X, Y and Z.
C X, Z and Y.
D Z, Y and X.

1.1.6 A trait that has a range of phenotypes is an example of ...

A continuous variation.
B discontinuous variation.
C complete dominance.
D codominance.

1.1.7 In the most stable freshwater environments populations of *Daphnia* are almost entirely female and reproduce asexually. However, males are observed in low-oxygen environments or when food is scarce.

Based on these observations, a researcher suggests at the start of an experiment that:

Male *Daphnia* only develop in response to unfavourable environmental conditions.

This is an example of a/an …

A conclusion.
B hypothesis.
C theory.
D aim.

QUESTIONS 1.1.8 AND 1.1.9 REFER TO THE INFORMATION BELOW.

In pea plants yellow seed colour (Y) is dominant over green seed colour (y). Smooth seed texture (S) is dominant over wrinkled seed texture (s).

A student crossed a plant which had yellow wrinkled seeds with a plant which had green smooth seeds.

1.1.8 Which ONE of the following shows possible alleles present in a gamete that is produced by the plant with yellow wrinkled seeds?

A YYss
B yySS
C yS
D Ys

1.1.9 Which ONE of the following is a possible representation of the genotypes of the P_1 generation?

A YYSS x yyss
B Yyss x yySs
C YYSS x yySs
D Yyss x YySs

(9 x 2) **(18)**

1.2 Give the correct **biological term** for each of the following descriptions. Write only the term next to the question number (1.2.1 to 1.2.9) in the ANSWER BOOK.

1.2.1 Chromosomes that carry the same set of genes

1.2.2 Two or more alternative forms of a gene at the same locus

1.2.3 The structure responsible for pulling chromosomes to the poles of an animal cell during cell division

1.2.4 A phase in the cell cycle that occurs before cell division

1.2.5 A diagrammatic representation showing possible evolutionary relationships among different species

1.2.6 The type of vision shared by apes and humans that allows for depth perception

1.2.7 A genetic cross involving two characteristics

1.2.8 A genetic disorder characterised by the absence of a blood-clotting factor

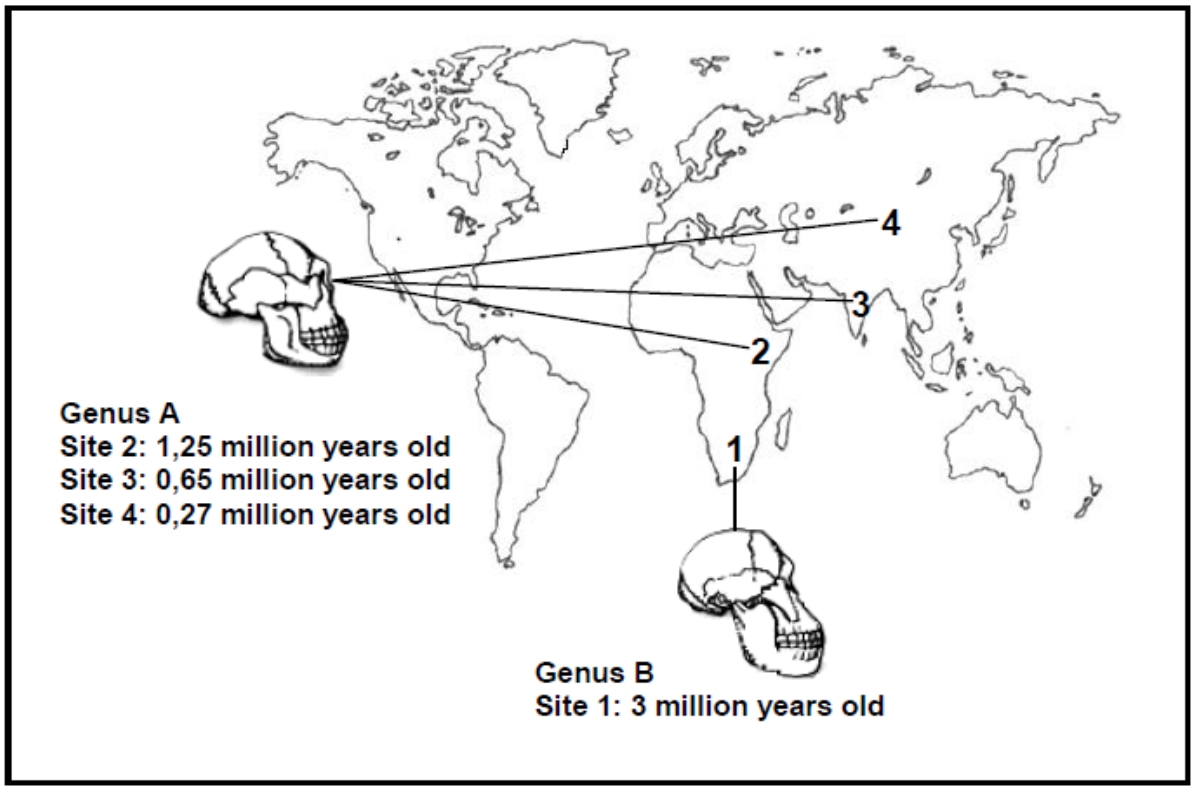
1.2.9 The present-day distribution of organisms **(9)**

1.3 Indicate whether each of the descriptions in COLUMN I applies to **A ONLY**, **B ONLY**, **BOTH A AND B** or **NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B**, or **none** next to the question number (1.3.1 to 1.3.4) in the ANSWER BOOK.

	COLUMN I	COLUMN II
1.3.1	Produced the first X-ray pictures of DNA	A: Watson B: Franklin
1.3.2	An example of biotechnology	A: Genetic modification B: Cloning
1.3.3	Law of inheritance of acquired characteristics	A: Darwin B: Lamarck
1.3.4	All the genes in all the chromosomes of a species	A: Genome B: Genotype

(4 x 2) **(8)**

1.4 The diagram below shows a world map indicating four sites (**1** to **4**) where hominid fossils, representing two different genera, have been found. Genus **A** was found at three sites and genus **B** at one site. The age of each fossil was determined using radiometric dating.



[Adapted from www.biologyreference.com]

1.4.1 Which genus (**A** or **B**):

(a) Represents *Australopithecus* (1)

(b) Had a more prognathous skull (1)

(c) Had smaller canines (1)

(d) Is more closely related to *Homo sapiens* (1)

1.4.2 Name TWO examples of fossils of genus **B** found at site **1** in South Africa. (2)

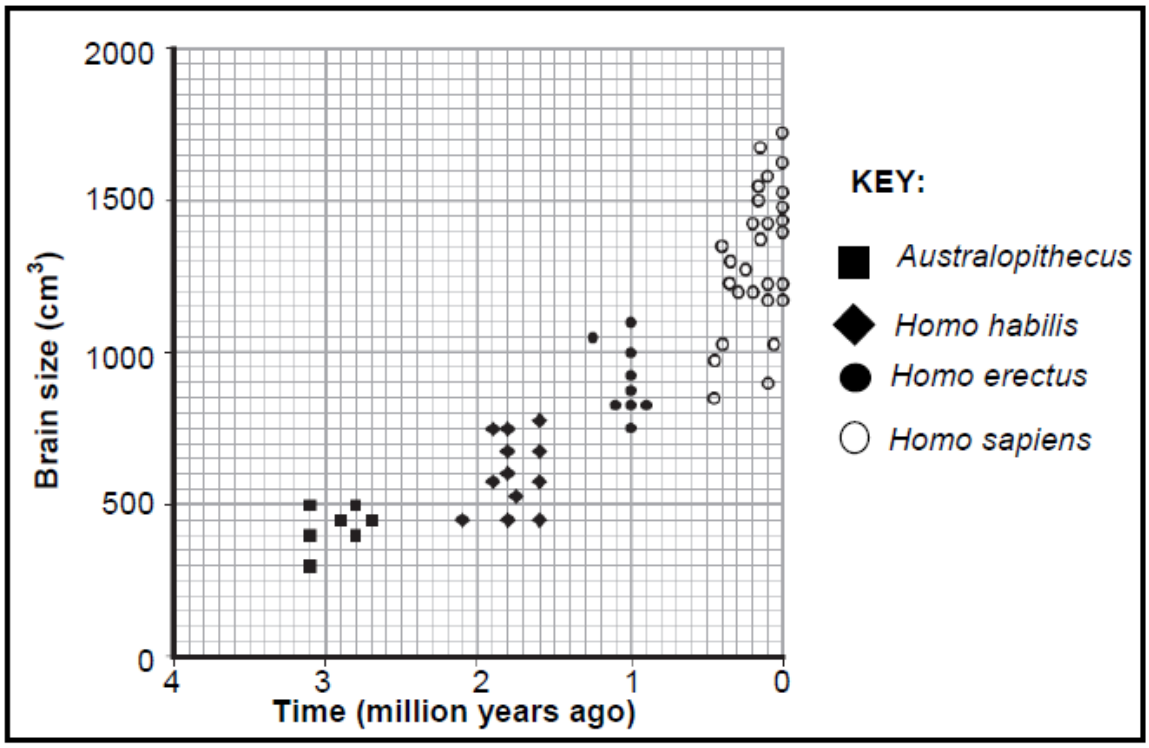
1.4.3 At which site, **1** to **4**, were the youngest fossils found? (1)

1.4.4 Other than fossil evidence, what other evidence can be used to support the Out of Africa hypothesis? (1)
(8)

1.5 Scientists estimated the brain sizes of *Australopithecus*, *Homo habilis*, *Homo erectus* and *Homo sapiens* by using the cranial capacity of fossil specimens. They then compared their results to the time that each hominid existed on earth.

The graph below represents the range of brain size and the time period that the hominid existed according to fossil evidence.

The results of the investigation are shown on the graph below.



[Adapted from *AQA-BLY1B-W-QP-NOV07 Unit 1b*]

1.5.1 According to the graph:

(a) When did the first *Australopithecus* appear (2)

(b) Which of the species shows the greatest variation in brain size (1)

1.5.2 Give the size (in cm^3) of the:

(a) Largest brain of *Australopithecus* (1)

(b) Smallest brain of *Homo sapiens* (1)

1.5.3 State TWO types of evidence, other than fossils, that support the idea that all hominids evolved from a common ancestor. (2)

(7)

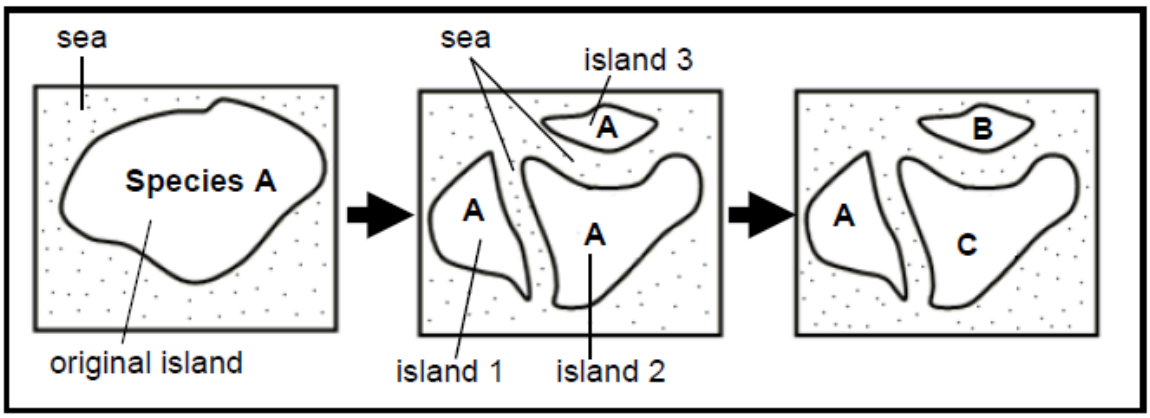
TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 The diagrams below represent the process of speciation in tortoises.

Over a period of time species **B** and **C** evolved from species **A**.



2.1.1 Explain why species **A** continued to exist on island **1**. (2)

2.1.2 Describe how species **B** and **C** evolved from species **A**. (6)
(8)

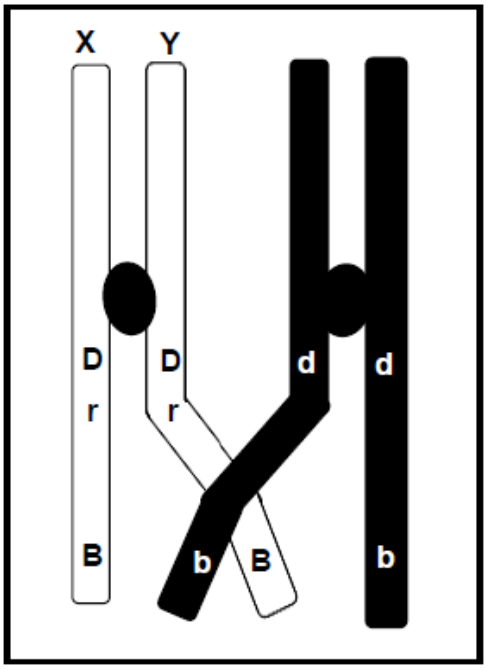
2.2 The father of a child can be determined by analysing blood groups.

2.2.1 Explain how an analysis of blood groups can be used to determine paternity. (5)

2.2.2 A man and a woman both have blood group **B**.

Use a genetic cross to show how it is possible for them to have a child with blood group **O**. (6)
(11)

2.3 The diagram below shows crossing over during meiosis.



2.3.1 Name the phase of meiosis during which the process represented above takes place. (1)

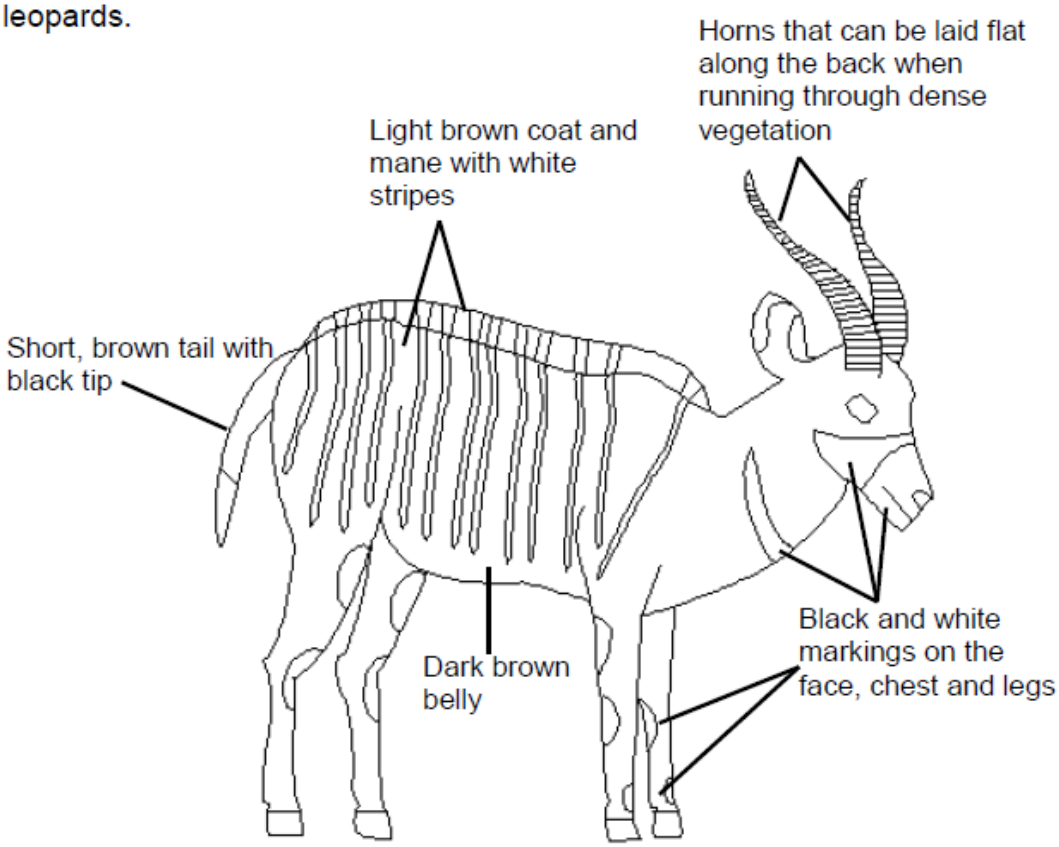
2.3.2 Describe the process of *crossing over*. (3)

2.3.3 Explain the importance of crossing over. (2)

2.3.4 Draw a diagram, giving the position of the alleles, to show the structure of chromatid **Y** after crossing over. (2)
(8)

2.4 The extract and the diagram below provide information about a type of antelope called a Bongo.

The Bongo is a large antelope species that is active at night and found in the dense jungles and forests of Africa. The dense forests have very little ground vegetation so the Bongo feeds in forest openings where new herbs and shrubs grow closer to the ground. They are preyed on by lions and leopards.



2.4.1 State TWO characteristics that help the Bongo to camouflage themselves in the dense jungle. (2)

2.4.2 Use your knowledge of natural selection and explain how the Bongo's ability to lay its horns along its back could have developed over the years. (5)
(7)

2.5 The characteristics of organisms can be changed through selective breeding and the genetic engineering process.

2.5.1 State TWO similarities between the *selective breeding process* and the *genetic engineering process*. (2)

2.5.2 Explain TWO reasons why some people may be against the use of genetic engineering. (4)
(6)
[40]

QUESTION 3

3.1 Read the extract below.

> The recent Ebola outbreak has international medical organisations on high alert. The Ebola virus is deadly because it causes uncontrolled bleeding. The virus is only spread through direct contact with body fluids. There is, however, concern as to whether the Ebola virus could mutate, thereby enabling it to be transmitted through the air. If this happens, the virus would spread more easily.
>
> This virus contains RNA only and when RNA is copied, many more mistakes are made than when DNA is copied. The Ebola virus, therefore, displays high mutation rates that generate lots of genetic variation.
>
> [Adapted from https://www.evolution.berkeley.edu]

3.1.1 State why viruses that contain only RNA show more genetic variation than viruses containing DNA. (2)

3.1.2 Use ONE example from the extract above to explain how mutations could increase the survival rate of the virus. (2)
(4)

3.2 The questions below are based on nucleic acids.

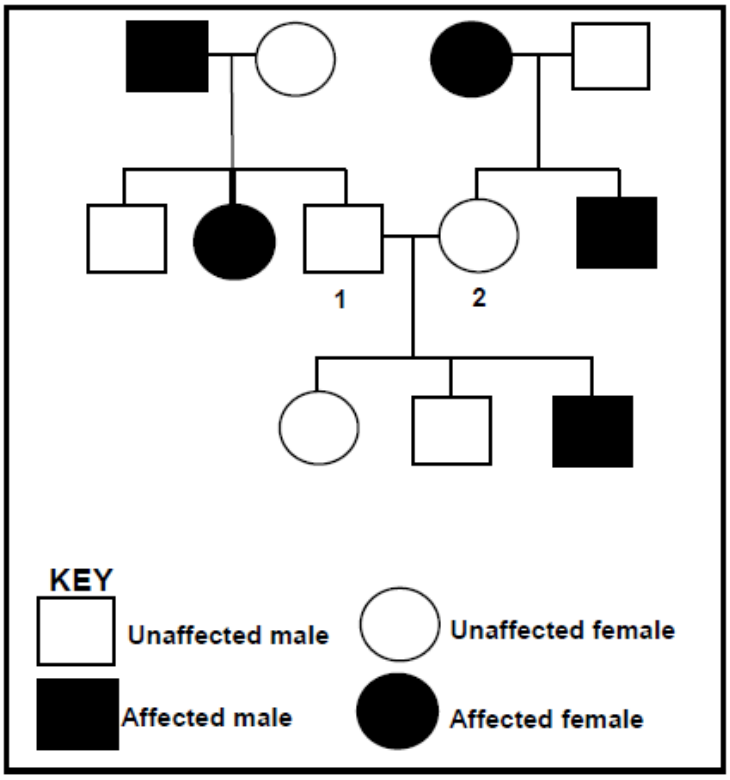
3.2.1 Tabulate THREE structural differences between DNA and RNA. (7)

3.2.2 State TWO uses of DNA profiling. (2)

3.2.3 Give TWO views against the use of DNA profiling. (2)
(11)

3.3 A lack of immunity to infections (agammaglobulinemia) is a sex-linked recessive genetic disorder in humans. The dominant allele is represented by X^A and the recessive allele is represented by X^a.

An individual with the disorder is described as affected and an individual without it is described as unaffected. The pedigree diagram below illustrates inheritance of this disorder.



3.3.1 Name the genotypes of individuals:

(a) **1** (2)

(b) **2** (2)

3.3.2 What percentage of the males in this pedigree diagram is affected? Show ALL working. (2)

3.3.3 Explain why any son of an affected female will always have this disorder. (3)
(9)

3.4 An investigation was done by Grade 12 learners to determine which chickens grow faster: chickens that are selectively bred for laying eggs or chickens that are selectively bred for meat production.

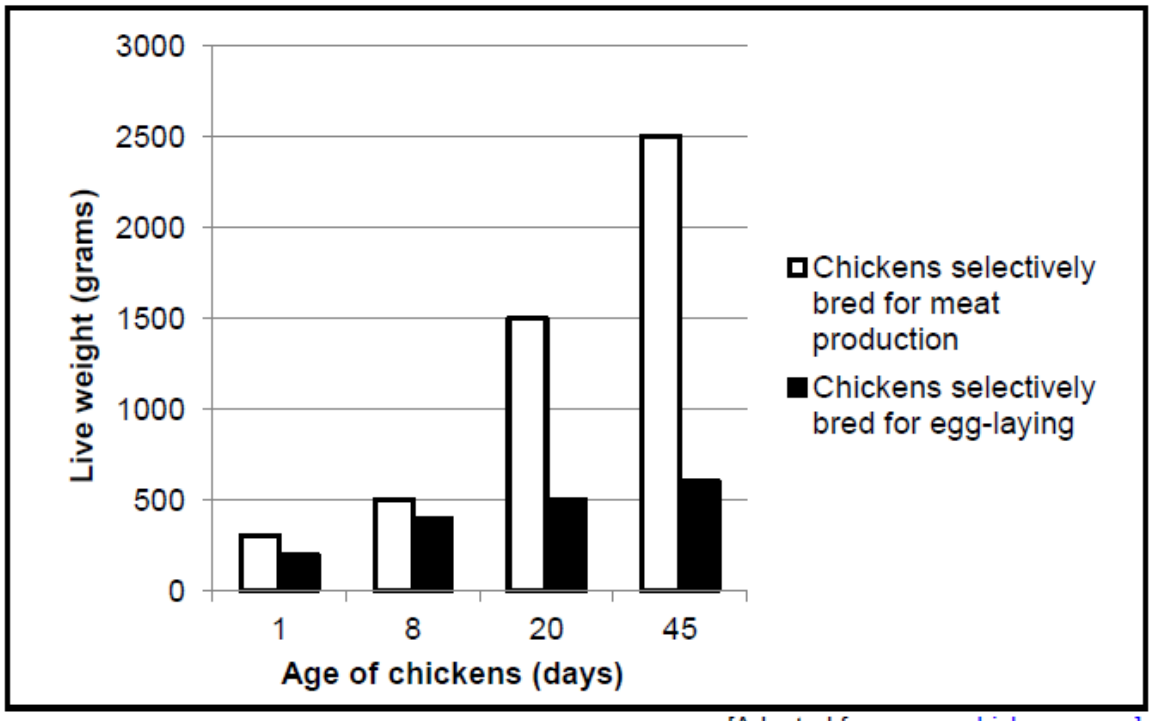
The following steps were carried out:

1. The learners bought 30 one-day-old chickens from a commercial supplier. Fifteen of the chickens had been selectively bred for laying eggs and 15 of the chickens had been selectively bred for meat production.

2. All the chickens were kept under the same environmental conditions. This included being fed the same chicken feed, made mostly from cereal grains and protein sources.

3. The chickens were weighed regularly for a period of 45 days.

The results of the investigation are shown in the graph below.



[Adapted from www.chicken.org.au]

3.4.1 Formulate a hypothesis for this investigation. (2)

3.4.2 State the independent variable in this investigation. (1)

3.4.3 Calculate the percentage weight increase of the chickens that were selectively bred for meat between day 8 and day 45. Show ALL working. (2)

3.4.4 State ONE advantage of repeating the investigation with 100 chickens. (2)

3.4.5 State THREE factors that the learners should keep constant in this investigation. (3)

3.4.6 Write a suitable conclusion for the investigation based on the results in the graph. (2)

3.4.7 State TWO benefits of the selective breeding of chickens, other than for increasing meat production. (2)

3.4.8 Explain ONE reason why selective breeding of chickens for better meat production may not be an advantage for the chickens if they were to live in the wild. (2)
(16)
[40]

TOTAL SECTION B: 80

SECTION C

QUESTION 4

Describe the process of protein synthesis and the way in which this process would be affected by a gene mutation.

Content: (17)
Synthesis: (3)
(20)

NOTE: NO marks will be awarded for answers in the form of tables, flow charts or diagrams.

TOTAL SECTION C: 20
GRAND TOTAL: 150

LIFE SCIENCES P1

FEBRUARY/MARCH 2016

SECTION A

QUESTION 1

1.1 Various options are provided as possible answers to the following questions. Choose the answer and write only the letter (A to D) next to the question number (1.1.1 to 1.1.10) in the ANSWER BOOK, for example 1.1.11 D.

1.1.1 The microscopic space between two adjacent neurons is a/an …

A axon.
B dendrite.
C synapse.
D cell body.

1.1.2 The following is a list of functions performed by different organs in an organism:

(i) Protection
(ii) Gaseous exchange
(iii) Nutrition
(iv) Excretion

Which ONE of the following combinations refers to the functions performed by parts of an amniotic egg?

A (i), (ii) and (iii) only
B (i), (iii) and (iv) only
C (ii), (iii) and (iv) only
D (i), (ii), (iii) and (iv)

1.1.3 An investigation was done to determine the effect of alcohol on the reaction time of a person.

Reaction time was measured by the time it took to catch a ruler.

The procedure was as follows:

- The person's reaction time was first measured in a room with bright light.
- The person was then given 200 mℓ of alcohol to drink.
- After 15 minutes the reaction time of the person was measured for the second time while he/she was in a room with dim light.
- Ten measurements were recorded each time and an average was calculated.

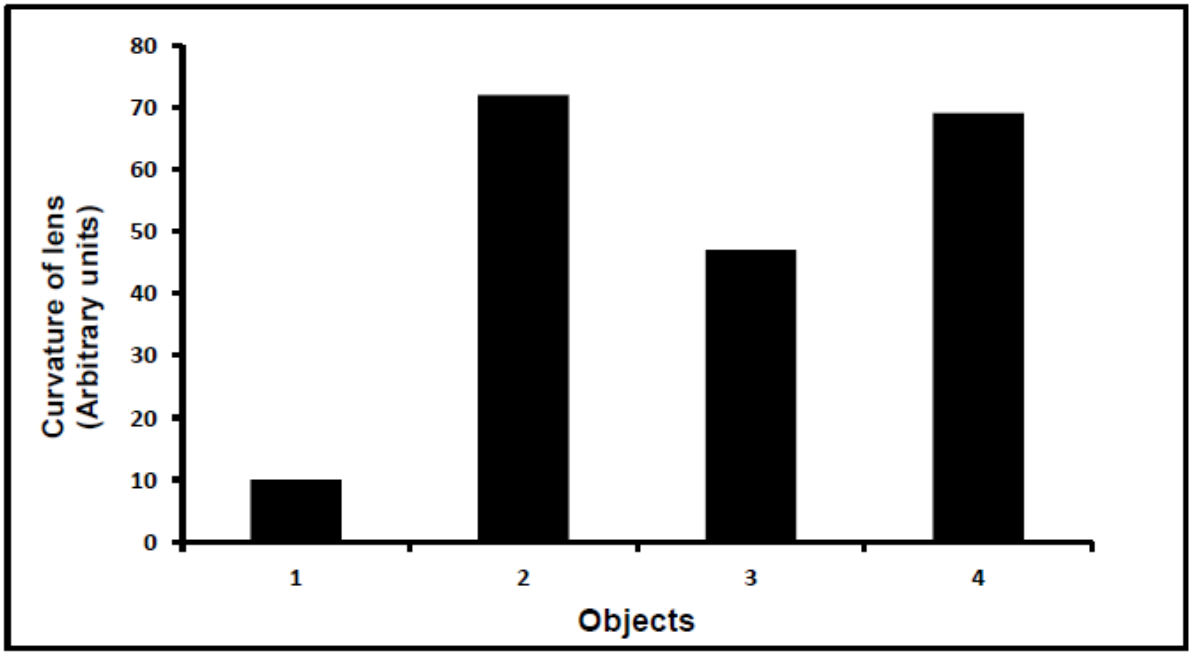
How was the validity of the investigation decreased?

A The person's reaction time was measured in the absence of alcohol the first time.
B Reaction time was measured by the time it took to catch a ruler.
C Reaction time was measured in different light conditions.
D Only ten measurements were recorded.

1.1.4 Which ONE of the following represents the CORRECT combination of a visual defect, its nature and the corrective measure?

	VISUAL DEFECT	NATURE OF DEFECT	CORRECTIVE MEASURE
A	Cataracts	Curvature of lens is uneven	Biconcave lenses
B	Short-sightedness	Lens cannot become less convex	Biconcave lenses
C	Astigmatism	Lens cannot become more convex	Surgery
D	Long-sightedness	Lens becomes cloudy and opaque	Biconvex lenses

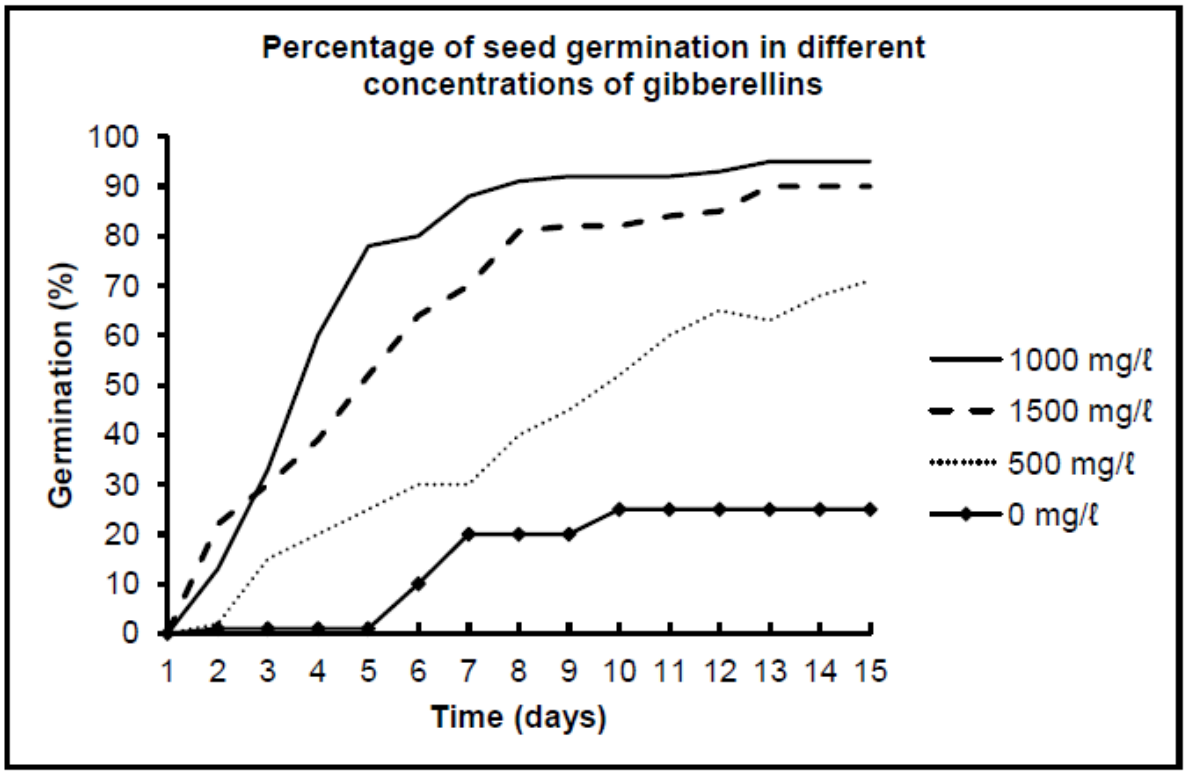
1.1.5 The graph below shows the curvature of the human lens when viewing objects at different distances.



Which ONE of the following objects is closest to the human eye?

A 1
B 2
C 3
D 4

1.1.6 The graph below shows the effect of different concentrations of gibberellins on the germination of seeds.



[Adapted from *HortScience* 44(3)]

One possible conclusion drawn from the results shown above, is that the …

A gibberellin concentration has no effect on the germination of the seeds.
B highest percentage of seed germination occurs at a gibberellin concentration of 1 500 mg/ℓ.
C highest percentage of seed germination occurs at a gibberellin concentration of 1 000 mg/ℓ.
D lowest percentage of seed germination occurs at a gibberellin concentration of 1000 mg/ℓ.

1.1.7 A gardener removes the apical buds from a rose bush in her garden regularly. As a result the rose bush will …

A produce more lateral branches.
B grow taller.
C remain the same size.
D produce fewer roses.

1.1.8 One of the dangers of landfills is the contamination of underground water sources. This is prevented by …

A covering the rubbish with a layer of soil.
B compacting the waste so that water cannot penetrate it.
C spraying water on the soil to keep dust levels down.
D lining the landfill with an impermeable barrier.

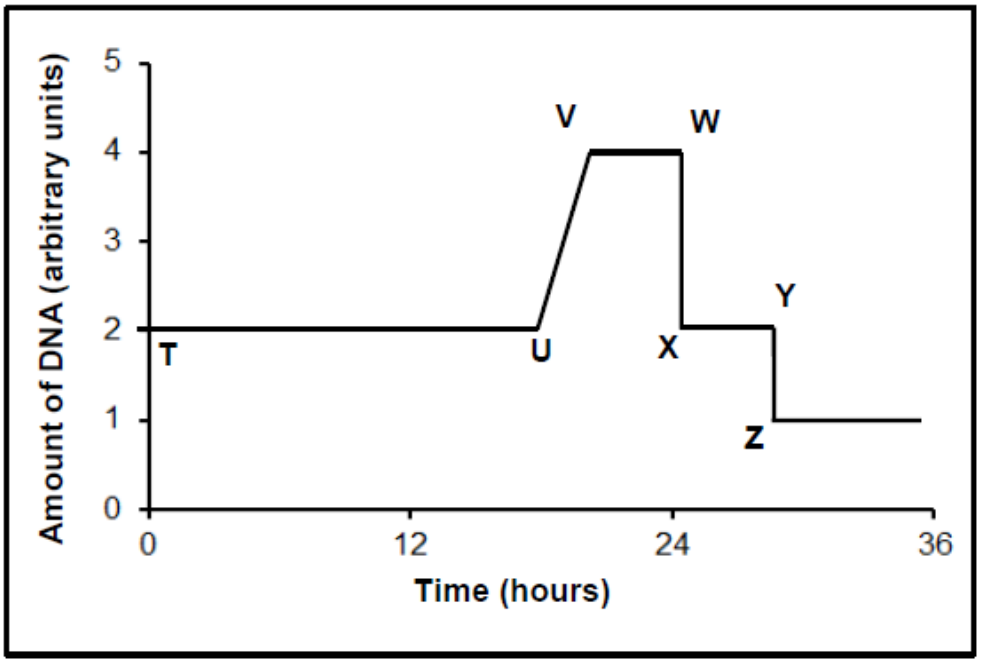
1.1.9 The following is a list of the factors affected by global warming:

(i) Veld fires
(ii) Biodiversity
(iii) Drought
(iv) Floods

Which ONE of the following combinations increases as a result of global warming?

A (i), (ii) and (iii) only
B (i), (iii) and (iv) only
C (ii), (iii) and (iv) only
D (i), (ii), (iii) and (iv)

1.1.10 The graph below shows changes in the amount of DNA present in a cell over a period of 36 hours.



[Adapted from www.slideshare.net]

Which ONE of the following parts of the graph represents interphase?

A T to V
B W to X
C V to Y
D X to Z

(10 x 2) **(20)**

1.2 Give the correct **biological term** for each of the following descriptions. Write only the term next to the question number (1.2.1 to 1.2.8) in the ANSWER BOOK.

1.2.1 A type of reproduction in humans where the foetus develops inside the uterus

1.2.2 Structures found only in animal cells that form the spindle during cell division

1.2.3 The movement of part of a plant in response to gravity

1.2.4 The amount of carbon dioxide produced by an individual per unit time as a result of his/her activities

1.2.5 The stage in humans when sexual maturity is reached in males and females

1.2.6 A change in the internal or external environment that will be detected by a receptor and converted into an impulse

1.2.7 Small tubes placed in the tympanic membrane to drain liquid from the middle ear

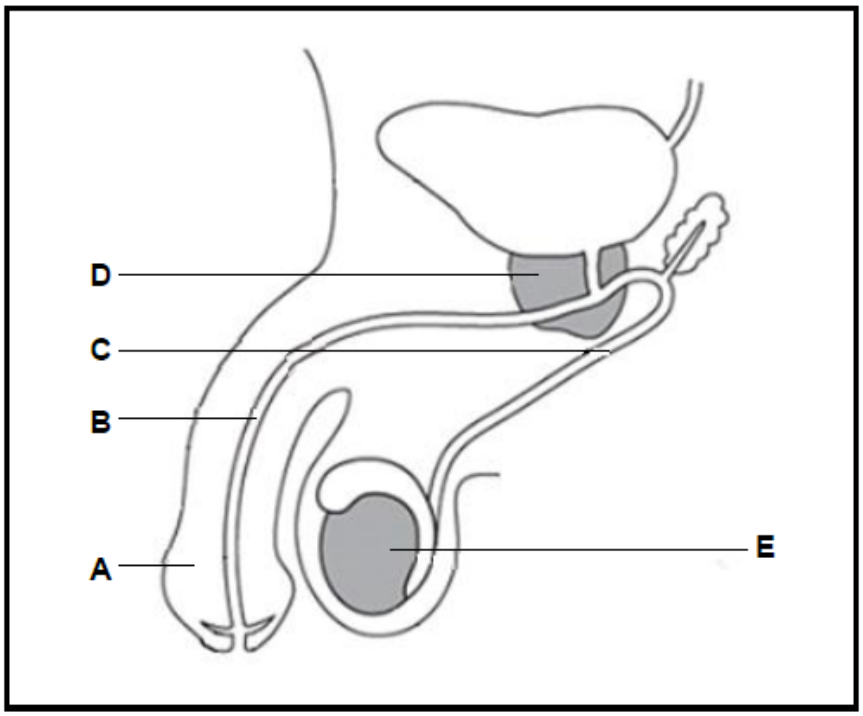
1.2.8 Part of the human ear that directs sound waves into the auditory canal (8 x 1) **(8)**

1.3 Indicate whether each of the statements in COLUMN I applies to **A ONLY**, **B ONLY**, **BOTH A AND B** or **NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B** or **none** next to the question number (1.3.1 to 1.3.4) in the ANSWER BOOK.

	COLUMN I	COLUMN II
1.3.1	A type of development in birds in which offspring are poorly developed at birth and are thus unable to feed themselves	A: Precocial development B: Altricial development
1.3.2	Forms the placenta	A: Chorionic villi B: Endometrium
1.3.3	The state of the blood vessels in the skin of a human when the environmental temperature is high	A: Constricted B: Dilated
1.3.4	Having access to enough food of good quality at all times	A: Monoculture B: Eutrophication

(4 x 2) **(8)**

1.4 The diagram below represents a part of the male reproductive system.



1.4.1 Give the LETTER and the NAME of the part that:

(a) Is used in copulation (2)

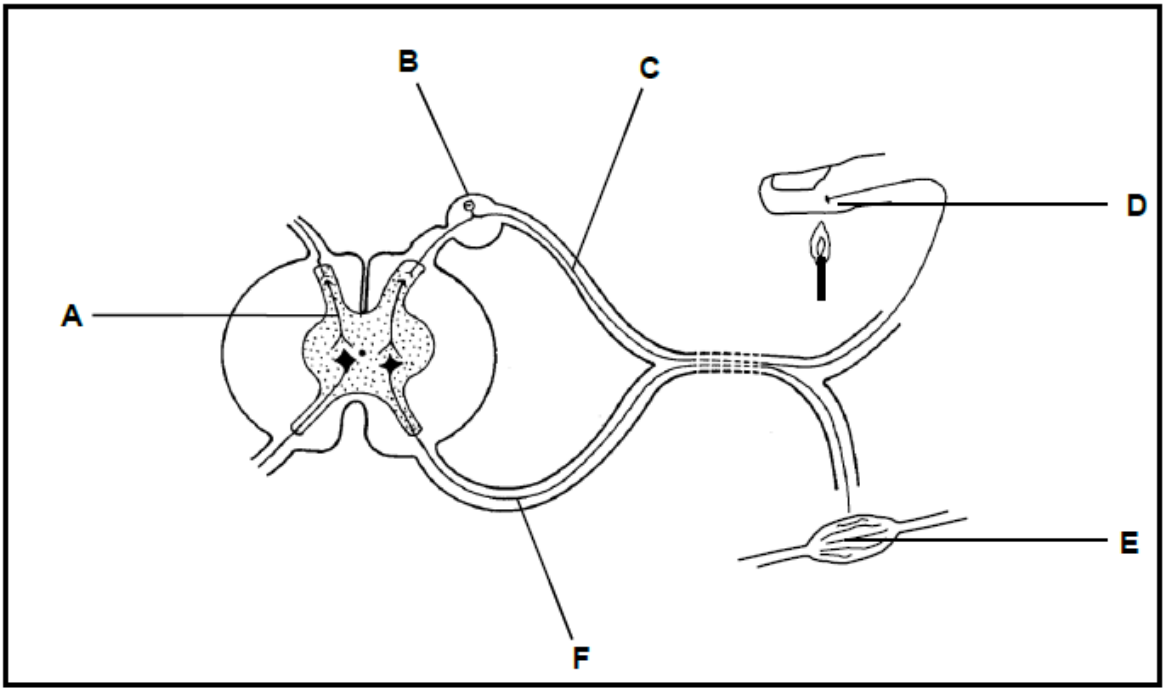
(b) Produces testosterone (2)

1.4.2 Give ONLY the LETTERS of the TWO parts in the diagram that:

(a) Contribute to the formation of semen (2)

(b) Provide a passage for the sperm cells (2)
(8)

1.5 The diagram below shows a reflex arc.



1.5.1 Give ONLY the LETTER of the part that represents the:

(a) Effector (1)

(b) Interneuron/Connector neuron (1)

(c) Sensory neuron (1)

1.5.2 Give the LETTER and NAME of the neuron in the diagram that is probably damaged if a person is able to detect the stimulus, but cannot respond. (2)

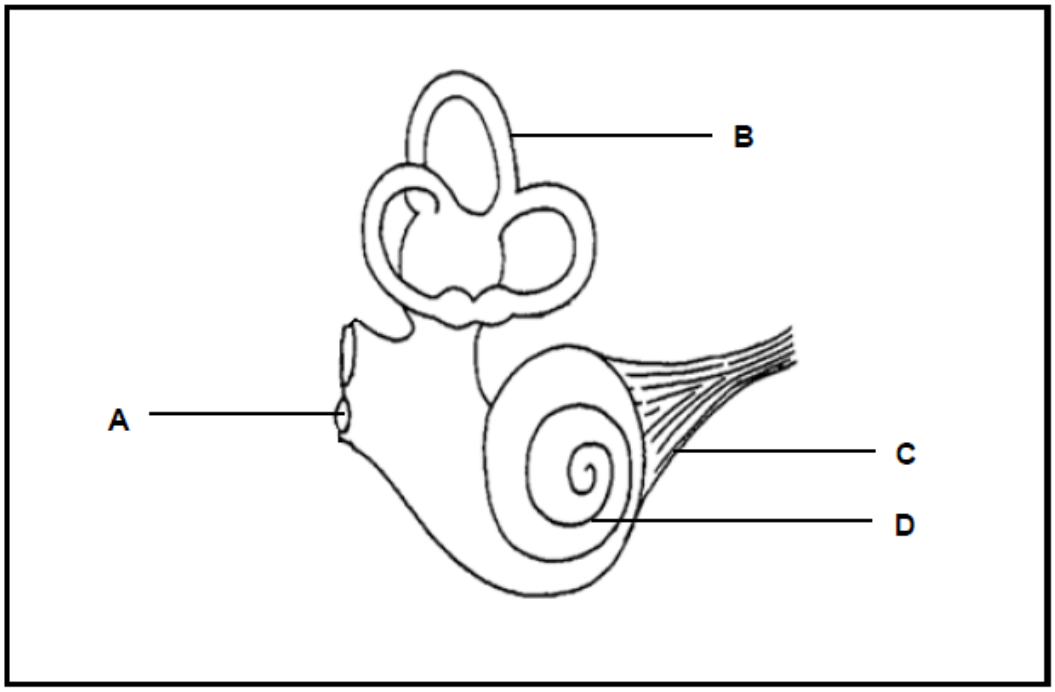
1.5.3 State if the nerve impulse travels from **D** to **E** or from **E** to **D**. (1)
(6)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 The diagram below represents a part of a human ear.



2.1.1 Identify part:

(a) **A** (1)

(b) **D** (1)

2.1.2 Name the receptors that are found in part **B.** (1)

2.1.3 Explain the consequence to the human body if:

(a) Part **C** is damaged (2)

(b) Part **A** becomes hardened (2)
(7)

2.2 Explain why people with middle-ear infections are usually advised not to travel by aeroplane. **(4)**

2.3 An investigation was conducted to determine the relationship between the ages of women, the number of pregnancies per month and the chances of miscarriages.

The results of the investigation are shown in the table below.

AGES OF WOMEN	PREGNANCIES PER MONTH (%)	MISCARRIAGES (%)
22	25	10
28	24	11
34	18	15
40	6	24
46	2	50

[Adapted from http://www.children.gov.on.ca]

2.3.1 Draw a line graph to show the relationship between the ages of the women and the percentage of pregnancies per month. (6)

2.3.2 Describe the relationship that exists between the ages of women and the chances of them miscarrying. (2)

2.3.3 According to the data obtained, if there are 12 pregnant women who are 46 years old, how many of them are likely to miscarry? Show ALL working. (2)

(10)

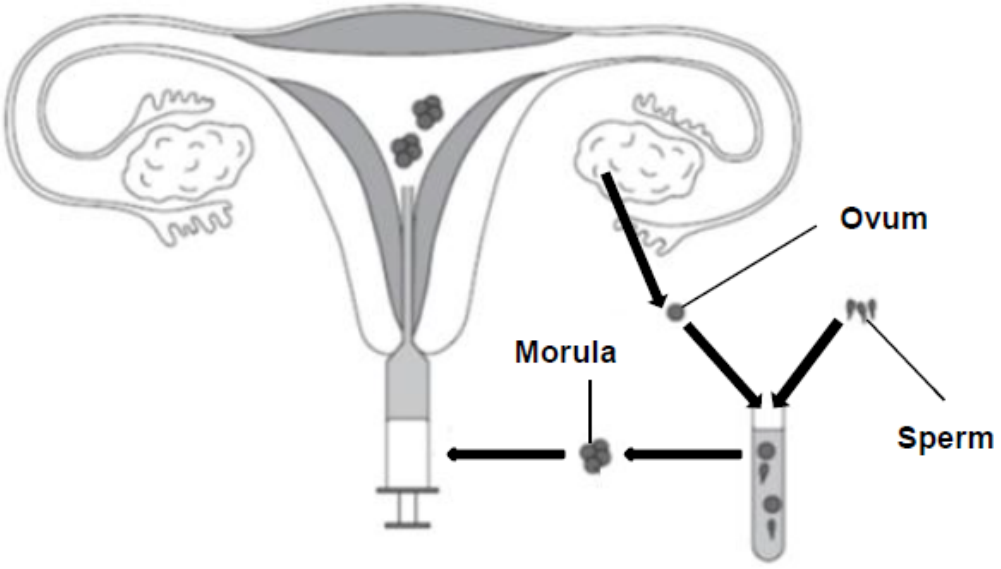
2.4 Read the extract below.

Anele found out that she had scar tissue blocking both her Fallopian tubes and therefore could not have a baby. She decided to try in vitro fertilisation (IVF).

The IVF procedure was performed as follows:

- Anele was given hormone supplements to stimulate the production of ova in the ovaries.
- The mature ova were then collected and placed in a test tube.
- Her partner was then asked to release his semen into a special container.
- The ova and the semen were then mixed in a test tube.
- The morulas that developed after a few days were then inserted into Anele's uterus.

The diagram below is a representation of how the procedure was done.



2.4.1 Explain why Anele's condition had prevented her from falling pregnant. (2)

2.4.2 Name ONE hormone that was:

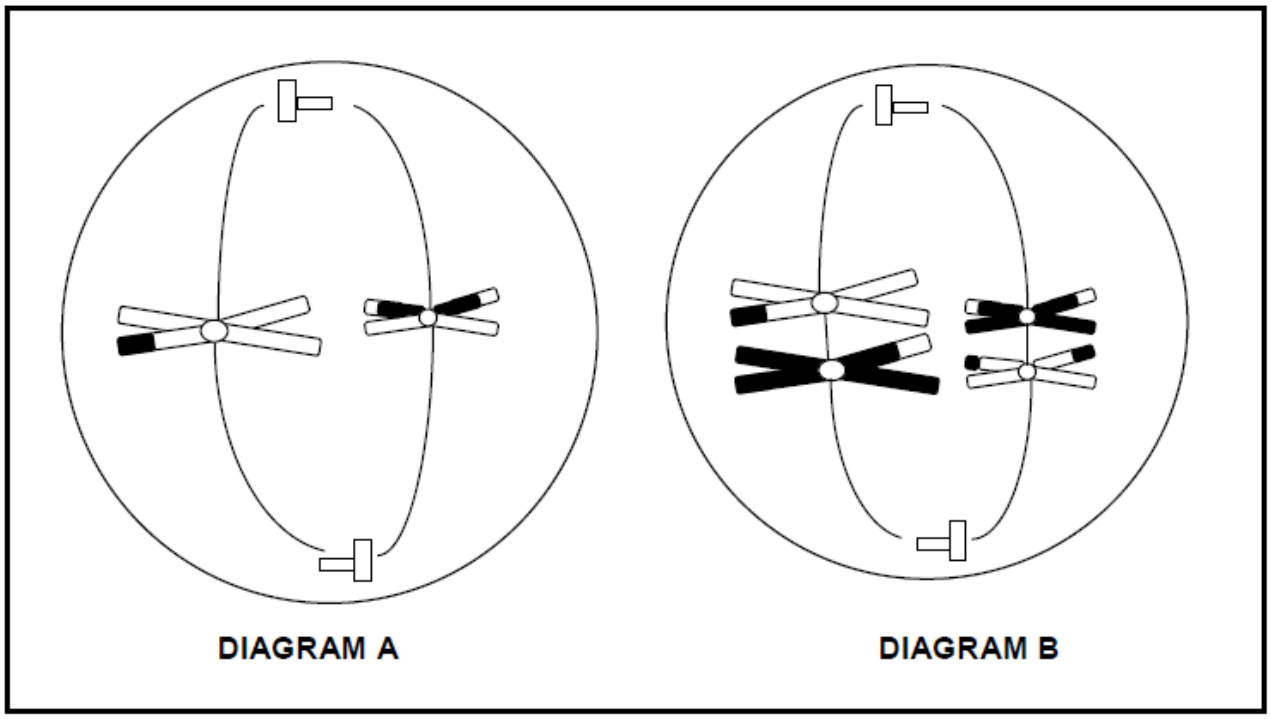
(a) Given to Anele to ensure that ova were produced in the ovaries (1)

(b) Produced by the developing follicles in the ovaries, as the ova were maturing (1)

2.4.3 Describe the events that take place in the test tube after fertilisation, until a blastocyst is formed. (4)

2.4.4 Explain ONE possible consequence for the developing embryo if the corpus luteum disintegrates immediately after implantation. (3)
(11)

2.5 The diagrams below show two phases of meiosis in an animal cell.



2.5.1 Identify the phase represented by **DIAGRAM B.** (1)

2.5.2 Explain why the homologous chromosomes in **DIAGRAM B** have a mixture of genetic material from each chromosome. (2)

2.5.3 Name the phase that will follow the one represented by **DIAGRAM A**. (1)

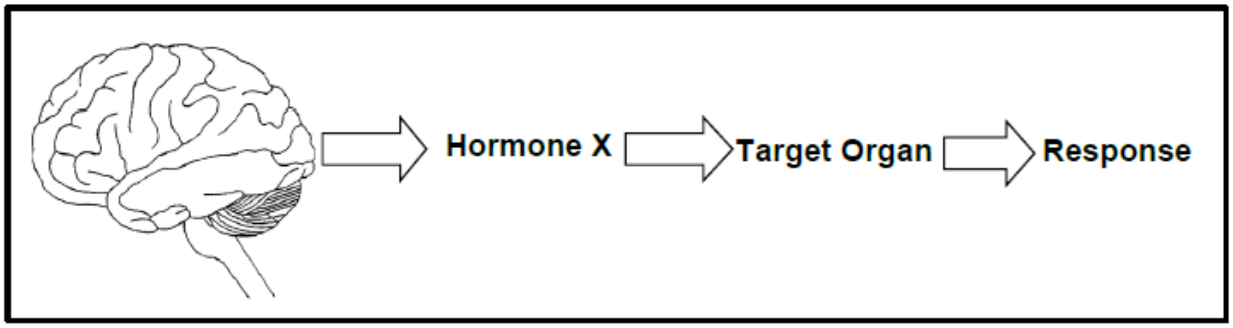
2.5.4 Describe the events that take place in the phase mentioned in QUESTION 2.5.3. (3)

2.5.5 Name ONE place in a human male where meiosis takes place. (1)
(8)
[40]

QUESTION 3

3.1 The diagram below represents one part of the negative feedback response that occurs when a person is dehydrated.

The decrease in blood volume, as a result of the excessive loss of water, is detected by the brain.



3.1.1 Identify the:

(a) Hormone **X** (1)

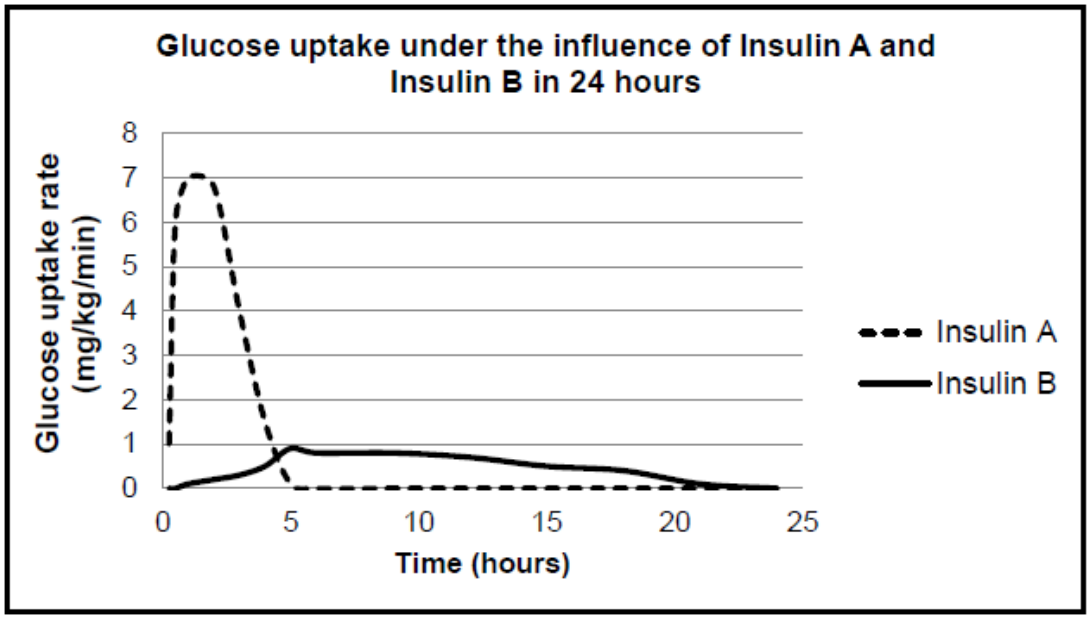
(b) Endocrine gland that secretes hormone **X** (1)

(c) Target organ (1)

3.1.2 Describe the negative feedback response that occurs when a person is dehydrated, after it has been detected by the brain. (4)
(7)

3.2 Some people with type I diabetes cannot produce insulin and therefore need to inject themselves regularly (insulin-dependent).

An investigation was done to determine the action of two types of insulin (**A** and **B**). The glucose uptake rate of cells, when using each type of insulin, was measured over time.



[Adapted from www.webmed.com]

3.2.1 Name the human organ that produces insulin. (1)

3.2.2 Using the information in the graph, state TWO differences in the functioning of insulin **A** and **B**. (4)
(5)

3.3 An investigation was done to determine the effect of different amounts of thyroxin on body weight in rats.

The procedure was as follows:

- 45 healthy female rats of the same species were used.
- They were divided into three groups of 15 each (Groups A, B and C).
- Their average body weight was determined and recorded.
- Group A was injected daily with methimozole which inhibits the production of thyroxin in rats.
- Group B was injected daily with DL-thyroxin which stimulates the production of more thyroxin than under normal conditions in rats.
- Group C was given no treatment.
- All three groups were exposed to the conditions above for 2 months.
- The average body weights of all the groups were determined weekly.

3.3.1 In the investigation identify the:

(a) Independent variable (1)

(b) Dependent variable (1)

3.3.2 State THREE factors that were kept constant during the investigation. (3)

3.3.3 Which group of rats (**A**, **B** or **C**) would be expected to gain the most weight? (1)

3.3.4 Explain your answer to QUESTION 3.3.3. (3)

3.3.5 In which group of rats (**A**, **B** or **C**) would the levels of TSH in the blood be low? (1)

3.3.6 Explain your answer to QUESTION 3.3.5. (2)
(12)

3.4 Read the extract below.

WATER CRISIS IN SOUTH AFRICA

The impact of the water scarcity will be one of South Africa's biggest problems soon. Recently a province had to switch off the water supply because the dams were 'so close on the edge'. It is stated that people are using more water than what's available; the demand is more than the supply.

About 37% of the clean, drinkable water is being lost through poor infrastructure (leaking pipes, dripping taps) and wastage. About 60% is used for irrigation.

Industries and mines also contribute to the water crisis by polluting our water bodies. They generate harmful waste which is sometimes dumped into water bodies, creating acid mine drainage. The impact of climate change also adds to the water crisis.

There is a suggestion that South Africa needs to work with neighbouring countries to come up with solutions. An example is to grow the agricultural products in neighbouring countries with a higher rainfall, and then South Africa imports these products.

[Adapted from mg.co.za/article and www.news24.com]

3.4.1 Refer to the extract and state TWO causes of the water crisis facing South Africa. (2)

3.4.2 State how importing agricultural products from neighbouring countries would reduce South Africa's water crisis. (1)

3.4.3 Explain how switching off the water supply would affect the industries that depend on water. (2)

3.4.4 The South African government could possibly solve the water crisis by increasing the cost of water.

Suggest TWO ways in which this solution could help to reduce the water crisis. (2)
(7)

3.5 Invasive alien plants can cause environmental problems in an area.

3.5.1 Explain the impact of invasive alien plants on:

(a) Food security (3)

(b) Water availability (2)

3.5.2 Explain ONE DISADVANTAGE of controlling invasive alien plants using the following methods:

(a) Biological method (2)

(b) Mechanical method (2)
(9)
[40]

TOTAL SECTION B: 80

SECTION C

QUESTION 4

Plants and animals are both able to sense and respond to light.

Explain how plant stems respond to unilateral light and describe the path taken by light through the human eye until it is converted into an impulse.

Content: (17)
Synthesis: (3)
(20)

NOTE: NO marks will be awarded for answers in the form of flow charts, tables or diagrams.

TOTAL SECTION C: 20
GRAND TOTAL: 150

LIFE SCIENCES P2

FEBRUARY/MARCH 2016

SECTION A

QUESTION 1

1.1 Various options are provided as possible answers to the following questions. Choose the correct answer and write only the letter (A to D) next to the question number (1.1.1 to 1.1.10) in the ANSWER BOOK, for example 1.1.11 D.

1.1.1 Which ONE of the following combinations results in genetic variation in organisms?

A Mitosis; sexual reproduction; mutations
B Meiosis; asexual reproduction; mutations
C Mitosis; meiosis; sexual reproduction
D Meiosis; sexual reproduction; mutations

1.1.2 The inheritance of one trait does not depend on the inheritance of another trait. This represents …

A Mendel's law of dominance.
B the law of codominance.
C the principle of variation.
D Mendel's principle of independent assortment.

1.1.3 In bees, females are diploid and males are haploid. Females and males produce haploid gametes.

This means that …

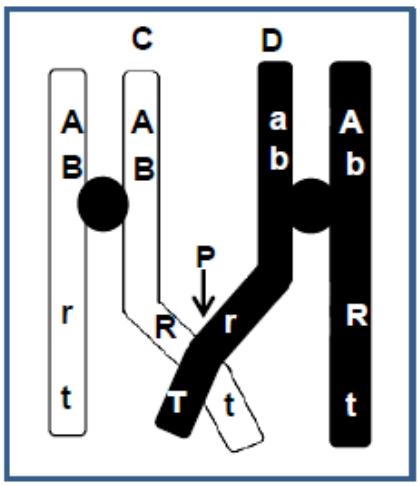
A females produce gametes by mitosis.
B males produce gametes by meiosis.
C males produce gametes by mitosis.
D females have half the number of chromosomes that males have.

1.1.4 In mice, the genotype **yy** produces grey fur and **Yy** produces yellow fur. The genotype **YY** results in death during the early embryonic stages.

A yellow female mouse is mated with a yellow male mouse. Which of the following shows the correct ratio of yellow to grey offspring that could be born alive?

A 1 : 1
B 1 : 3
C 2 : 1
D 3 : 1

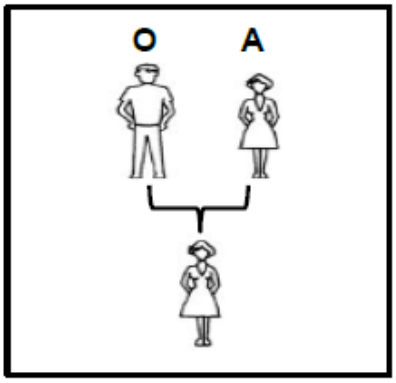
1.1.5 The diagram below shows crossing over.



Which ONE of the following combinations of alleles would be present in chromatid **C** after crossing over occurred at point **P**?

A Aart
B abrT
C ABRt
D ABRT

1.1.6 The diagram below shows the blood types of two parents.



The only possible blood type(s) of the offspring of the first generation (F_1) is/are …

A AB and O.
B A and O.
C A only.
D A and B.

1.1.7 The structure of DNA was determined by using X-ray pictures produced by …

A Watson and Crick.
B Franklin and Wilkins.
C Watson and Franklin.
D Crick and Franklin.

1.1.8 Brown eye colour in humans is dominant over blue eye colour. A man with brown eyes marries a woman with blue eyes. They have a son with brown eyes and a daughter with blue eyes.

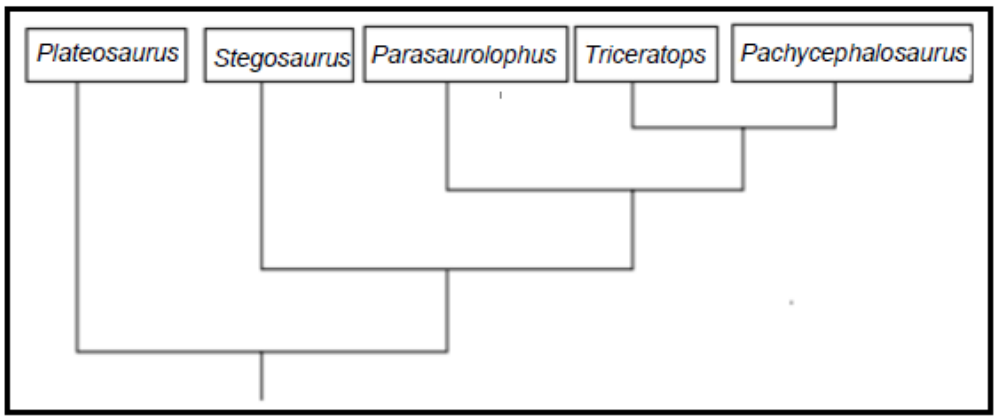
We can conclude that …

A the man is not the true father of the children.
B the man is heterozygous for eye colour.
C eye colour is sex-linked.
D both parents are homozygous for eye colour.

1.1.9 A possible explanation for an observation that can be tested is known as a ...

A fact.
B law.
C theory.
D hypothesis.

1.1.10 Common structural characteristics between groups of dinosaurs were used to construct the phylogenetic tree below.



The two groups of dinosaurs with the most characteristics in common are …

A *Triceratops* and *Pachycephalosaurus*.
B *Parasaurolophus* and *Triceratops*.
C *Stegosaurus* and *Parasaurolophus*.
D *Plateosaurus* and *Stegosaurus*. (10 x 2) **(20)**

1.2 Give the correct **biological term** for each of the following descriptions. Write only the term next to the question number (1.2.1 to 1.2.10) in the ANSWER BOOK.

1.2.1 The type of inheritance where the dominant allele masks the expression of the recessive allele in the heterozygous condition

1.2.2 The process by which genetically identical organisms are formed using biotechnology

1.2.3 A group of organisms of the same species in a specific habitat

1.2.4 The type of vision shared by apes and humans that allows for depth perception

1.2.5 The family to which humans belong

1.2.6 A human disorder caused by non-disjunction of chromosome pair 21

1.2.7 The stage of protein synthesis during which mRNA forms from DNA

1.2.8 Structures in different organisms that have a similar basic plan which suggests that they share a common ancestor

1.2.9 The position of a gene on a chromosome

1.2.10 The type of variation in a population with no intermediate phenotypes (10 x 1) **(10)**

1.3 Indicate whether each of the statements in COLUMN I applies to **A ONLY**, **B ONLY**, **BOTH A AND B** or **NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B**, or **none** next to the question number (1.3.1 to 1.3.3) in the ANSWER BOOK.

	COLUMN I	COLUMN II
1.3.1	Reproductive isolating mechanisms in plants	A: Flowering at different times of the year B: Adaptation to different pollinators
1.3.2	Evidence for evolution	A: Biogeography B: Fossil record
1.3.3	Found in African apes and humans	A: Claws instead of nails B: An opposable thumb

(3 x 2) **(6)**

1.4 The size and colour of unripe fruit in a plant species is genetically controlled. The allele for small fruit (**b**) is recessive to the allele for big fruit (**B**). The allele for yellow fruit colour (**g**) is recessive to the allele for green fruit (**G**).

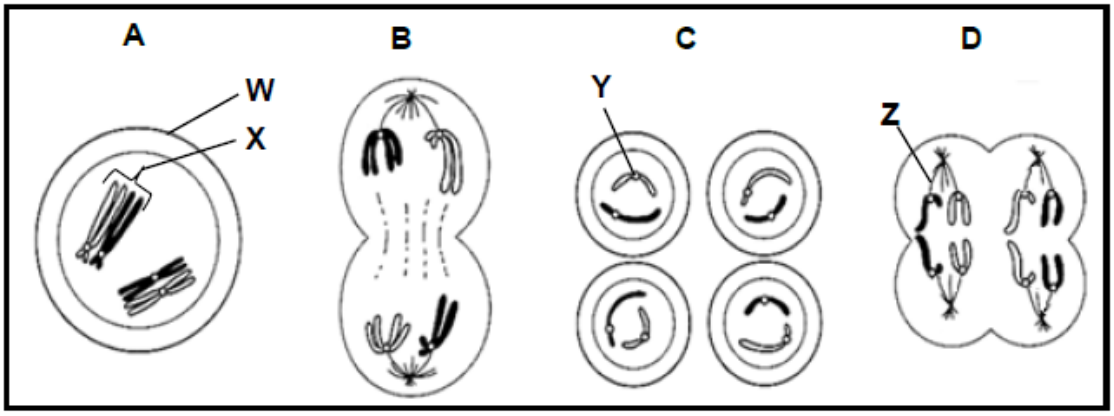
1.4.1 State:

(a) The phenotype of the plant with the genotype **BbGg** (2)

(b) ALL possible genotypes of the gametes produced by the plant mentioned in QUESTION 1.4.1(a) (2)

1.4.2 In a cross between two plants with genotypes **BBGG** and **bbgg** what percentage of the offspring will be homozygous for both characteristics? (2)
(6)

1.5 The diagrams below show different phases in meiosis.



1.5.1 Label structures **W** and **X**. (2)

1.5.2 How many chromosomes are present in each cell in:

(a) Phase **A** (1)

(b) Phase **C** (1)

1.5.3 Give only the LETTER of the diagram that represents anaphase II. (1)

1.5.4 State the function of structure **Y** and structure **Z**. (2)

1.5.5 Identify phase **C**. (1)
(8)

TOTAL SECTION A: 50

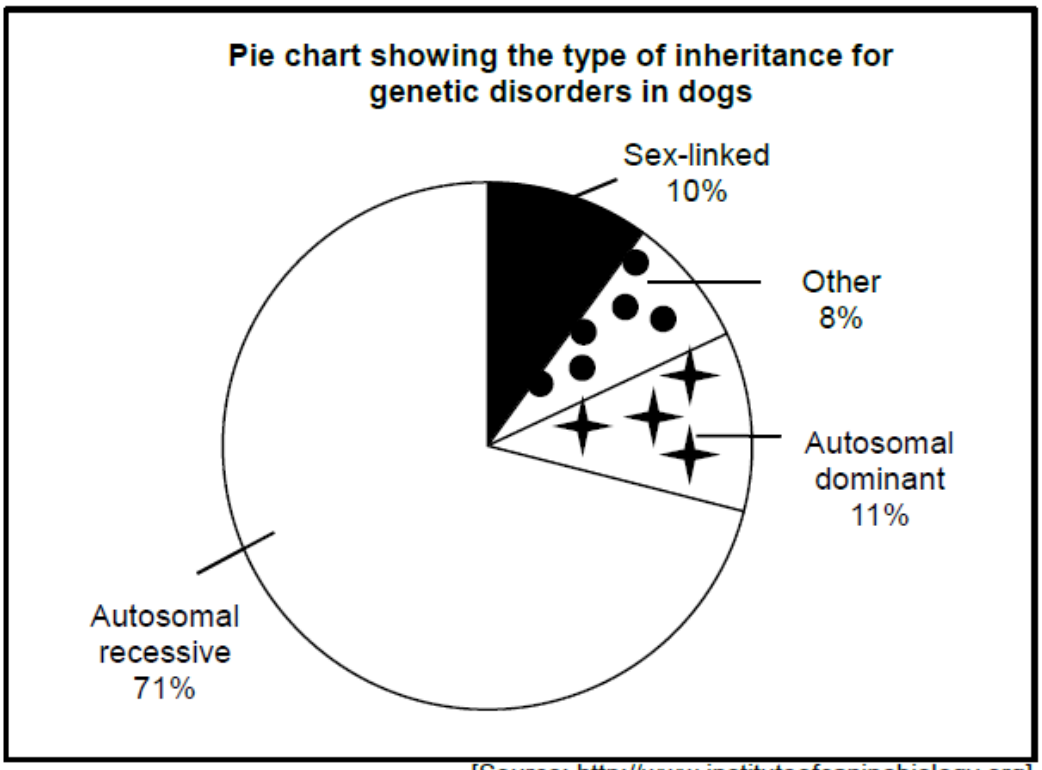
SECTION B

QUESTION 2

2.1 Scientists wanted to determine which type of inheritance accounted for most of the selected genetic disorders in dogs.

To do this they sequenced the genomes of a large number of dogs of the same breed that suffered from the genetic disorders.

The results of the investigation are shown below.



[Source: http://www.instituteofcaninebiology.org]

2.1.1 If 2 000 dogs were studied in this investigation, how many dogs had disorders that were caused by autosomal dominant inheritance? Show ALL calculations. (3)

2.1.2 State TWO ways in which the scientists could improve the reliability of their results. (2)

2.1.3 State ONE factor that was kept constant in this investigation. (1)

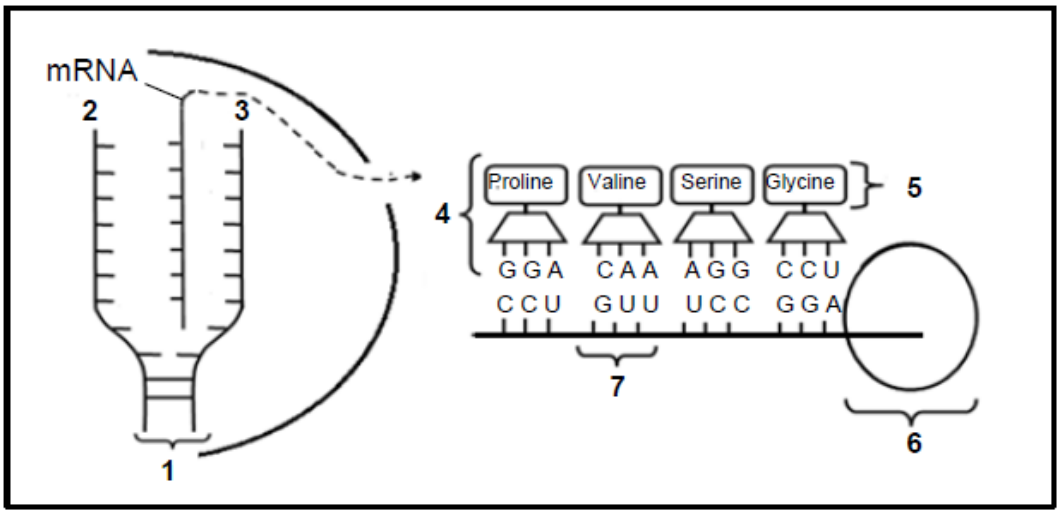
2.1.4 Explain why there is no need to keep the age of the dogs constant in this type of investigation. (2)

2.1.5 Provide a conclusion for this investigation. (2)
(10)

2.2 In dogs rough hair (**H**) is dominant to smooth hair (**h**). A heterozygous rough-haired dog is mated with a smooth-haired dog.

Represent a genetic cross to show the phenotypic ratio of the puppies. **(6)**

2.3 The diagram below represents two stages of protein synthesis.



2.3.1 Provide labels for:

(a) Molecule **1** (1)

(b) Organelle **6** (1)

2.3.2 Give only the NUMBER of the part which represents a:

(a) DNA template strand (1)

(b) Monomer of proteins (1)

(c) Codon (1)

2.3.3 Describe *translation* as it occurs at organelle **6**. (4)

2.3.4 Provide the:

(a) DNA sequence that codes for glycine (2)

(b) Codon for proline (2)

2.3.5 State TWO differences between a *DNA nucleotide* and an *RNA nucleotide*. (4)
(17)

2.4 Read the passage below and answer the questions that follow.

USE OF STEM CELLS

Dr Orly Lachan-Kaplan of Monash Immunology and Stem Cell Laboratories has used stem cell manipulation to create an ovary-like structure containing ova. Although it is not yet clear if the cells of this ovary-like structure are functional, she hopes that this method can be used to develop functional human ova.

[Source: http//monash.edu/news/releases/308]

2.4.1 Name ONE source of stem cells. (1)

2.4.2 Explain why the characteristics of stem cells make them useful in treating some disorders. (3)

2.4.3 Explain ONE possible advantage of creating an ovary-like structure. (3)

(7)

[40]

QUESTION 3

3.1 Errors that occur during DNA replication may sometimes lead to mutations.

3.1.1 Describe *DNA replication*. (5)

3.1.2 Describe how an error in DNA replication may lead to a gene mutation. (2)
(7)

3.2 The passage below refers to human evolution.

> Research, using DNA evidence, suggests that all modern humans arose from a single group of *Homo sapiens* that migrated from Africa 2 000 generations ago and spread throughout Europe and Asia over thousands of years.
>
> [Source: http://images.sciencedaily.com]

3.2.1 Name the hypothesis on human evolution that is described in the passage. (1)

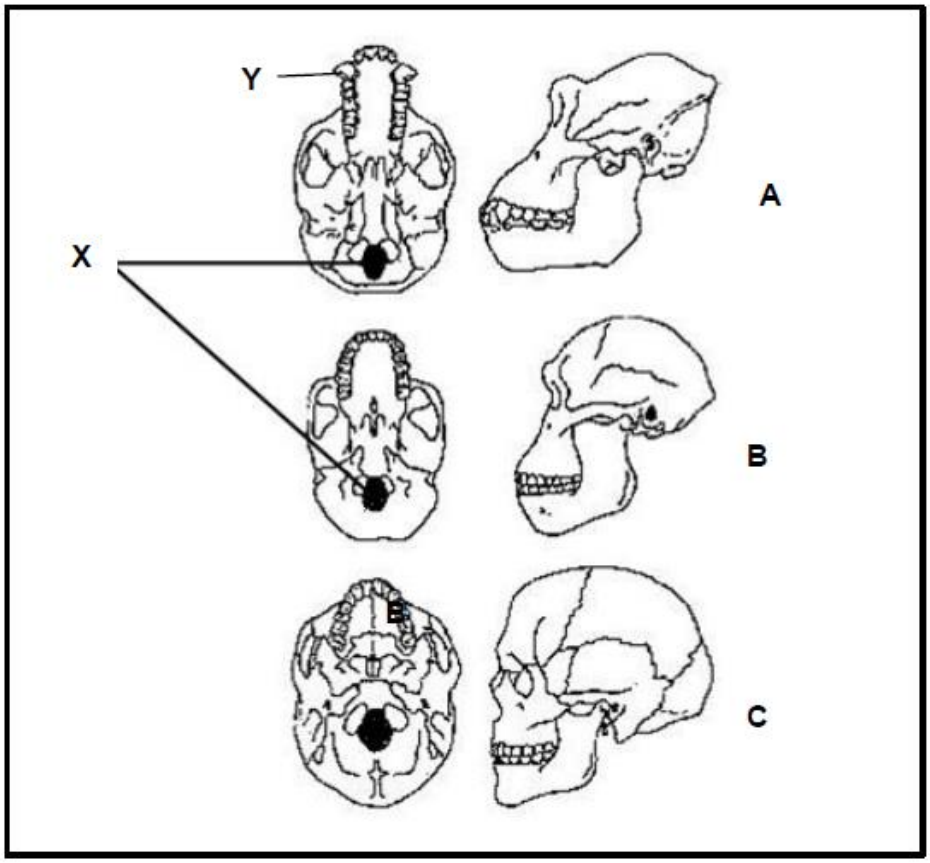
3.2.2 Name the type of DNA outside the nucleus that is analysed in support of the hypothesis named in QUESTION 3.2.1. (1)

3.2.3 Explain how the type of DNA named in QUESTION 3.2.2 is used to provide evidence for the hypothesis named in QUESTION 3.2.1. (3)

3.2.4 Apart from DNA evidence, state ONE other line of evidence that may be used to support the hypothesis mentioned in QUESTION 3.2.1. (1)
(6)

3.3 Describe how a new species is formed through geographic isolation. **(6)**

3.4 The diagram below represents the fossilised skulls of three different species of primates. They were either bipedal or quadrupedal (organisms that habitually walk on all four limbs).



3.4.1 Label part **X** and the type of teeth at **Y**. (2)

3.4.2 Explain the significance of the location of structure **X** in organism **C**. (3)

3.4.3 Which of the skulls (**A**, **B** or **C**) belongs to:

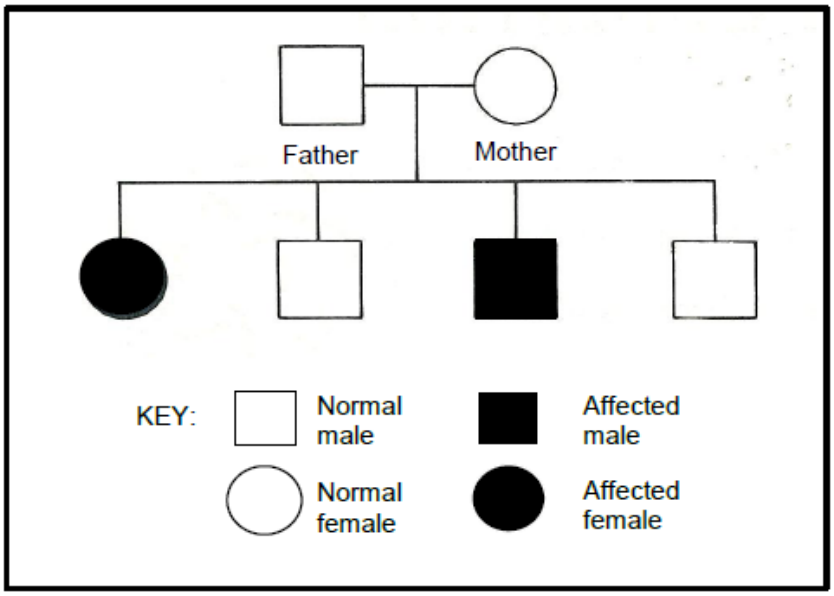
(a) An *Australopithecine* (1)

(b) A quadrupedal primate (1)

3.4.4 Explain how the change in the skull from **B** to **C** could indicate a change in intelligence. (3)

3.4.5 Tabulate TWO observable differences, other than those mentioned in QUESTIONS 3.4.2 and 3.4.4, between skulls **B** and **C** that represent trends in human evolution. (5)
(15)

3.5 The pedigree diagram below shows the pattern of inheritance of a certain genetic disorder controlled by a recessive allele. The dominant allele is represented by **N** and the recessive allele by **n**.



3.5.1 Explain why both parents must be heterozygous for this characteristic. (2)

3.5.2 Give the possible genotype(s) of the normal children. (2)

3.5.3 Provide evidence from the pedigree diagram to show that this characteristic is not sex-linked. (2)

(6)

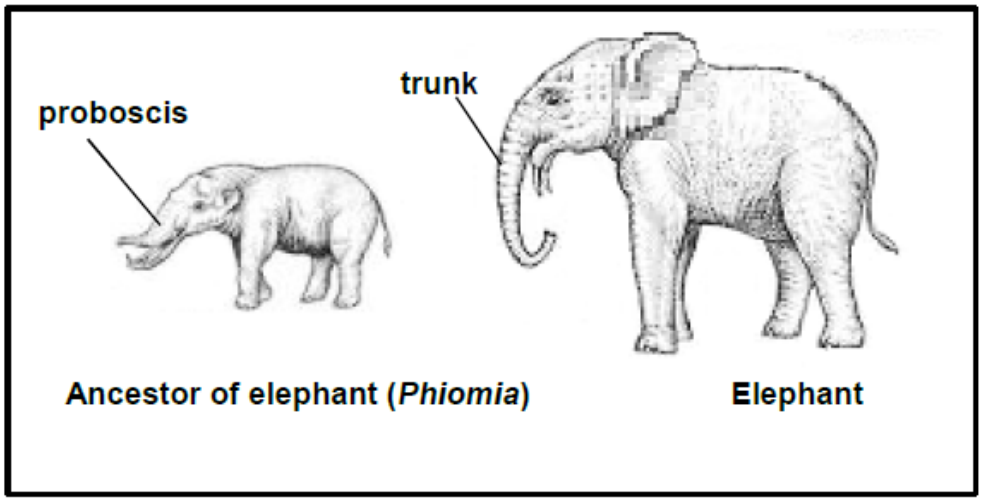
[40]

TOTAL SECTION B: 80

SECTION C

QUESTION 4

An ancestor of the elephant, *Phiomia*, had a long nose-like structure called a proboscis which evolved into the trunk of the elephant. The proboscis was used to gather leaves as food. The proboscis of *Phiomia* and the trunk of the elephant are shown below. The diagrams have been drawn to scale.



Explain the evolution of the elephant's trunk in terms of Lamarckism and Darwinism as well as the way in which an increase in the length of the trunk of the elephant could be achieved through artificial selection.

Content: (17)
Synthesis: (3)
(20)

NOTE: NO marks will be awarded for answers in the form of flow charts, tables or diagrams.

TOTAL SECTION C: 20
GRAND TOTAL: 150

LIFE SCIENCES P1

NOVEMBER 2016

SECTION A

QUESTION 1

1.1 Various options are provided as possible answers to the following questions. Write down the question number (1.1.1 to 1.1.10), choose the answer and make a cross (X) over the letter (A to D) of your choice in the ANSWER BOOK.

EXAMPLE:

.....	A	B	C	~~D~~

1.1.1 The part of the brain that receives nerve impulses from the semi-circular canals is the …

A cerebrum.
B cerebellum.
C hypothalamus.
D medulla oblongata.

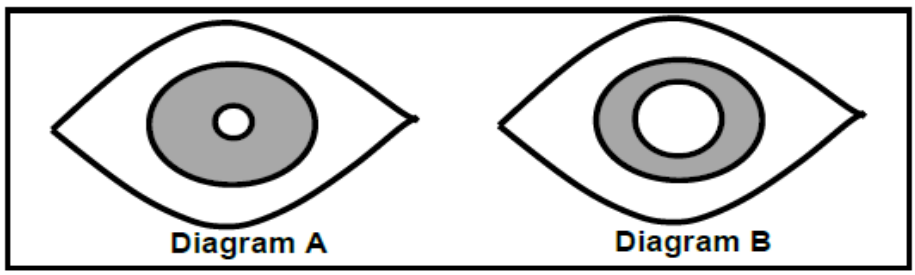
1.1.2 A light stimulus is converted into a nerve impulse in the ...

A iris.
B retina.
C optic nerve.
D sclera.

1.1.3 A human somatic cell has …

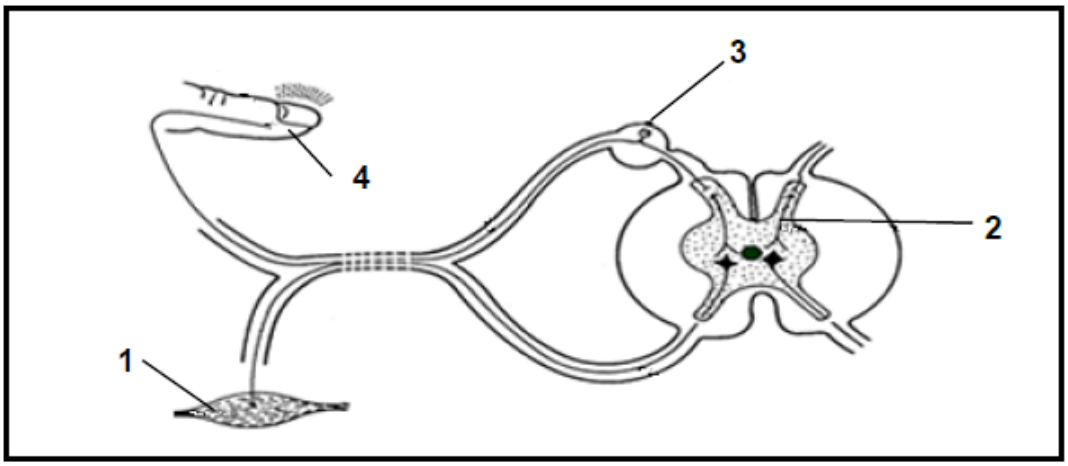
A 46 autosomes and 2 gonosomes.
B 2 autosomes and 44 gonosomes.
C 44 autosomes and 2 gonosomes.
D 23 autosomes and 23 gonosomes.

1.1.4 Which ONE of the following statements is CORRECT regarding the eyes represented in the diagrams below?



A Diagram **A** is looking at an object closer than 6 metres, while diagram **B** is looking at an object further than 6 metres.
B Diagram **A** is looking at an object further than 6 metres, while diagram **B** is looking at an object closer than 6 metres.
C The eye in diagram **A** is in dim light and the eye in diagram **B** is in bright light.
D The eye in diagram **A** is in bright light and the eye in diagram **B** is in dim light.

1.1.5 The diagram below shows a reflex arc.



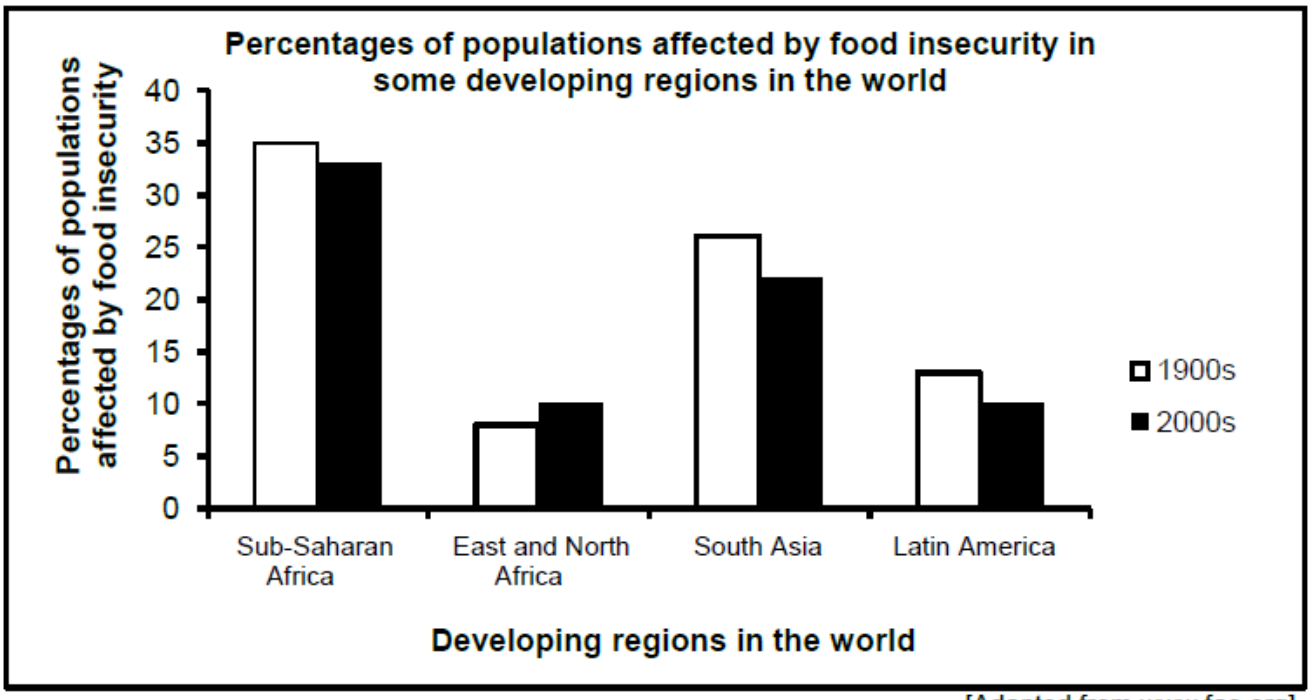
Which part represents the effector?

A 4
B 1
C 3
D 2

1.1.6 A person with middle-ear infection is usually advised not to fly in an aeroplane because the …

A maculae in the semi-circular canals are unable to receive the stimulus.
B round window is unable to absorb sound waves, leading to echoes.
C Eustachian tube is unable to equalise the pressure on either side of the tympanic membrane.
D optic nerve will be damaged, leading to hearing loss.

1.1.7 The graph below shows the percentages of populations affected by food insecurity in some developing regions in the world.



[Adapted from www.fao.org]

Which ONE of the above regions does NOT show improvement in its food security for the period shown?

A Latin America
B Sub-Saharan Africa
C East and North Africa
D South Asia

QUESTIONS 1.1.8 AND 1.1.9 REFER TO THE INVESTIGATION BELOW.

A scientist did an investigation on a healthy individual to determine the effect of drinking water on urine production.

The participant was requested not to eat or drink for four hours before the investigation began. The investigation was conducted over a period of three days.

The procedure was as follows:

- On day 1 the participant was given 600 mℓ of water to drink.
- On day 2 the participant was given 800 mℓ of water to drink.
- On day 3 the participant was given 1 000 mℓ of water to drink.
- For each day the amount of urine produced by the participant was measured and recorded over the next four hours, and an average was calculated.

1.1.8 Which ONE of the following CORRECTLY indicates the dependent and the independent variables?

	INDEPENDENT VARIABLE	DEPENDENT VARIABLE
A	The amount of urine produced	Time in hours
B	The amount of water drunk	The amount of urine produced
C	The amount of urine produced	The amount of water drunk
D	The people participating	Time in hours

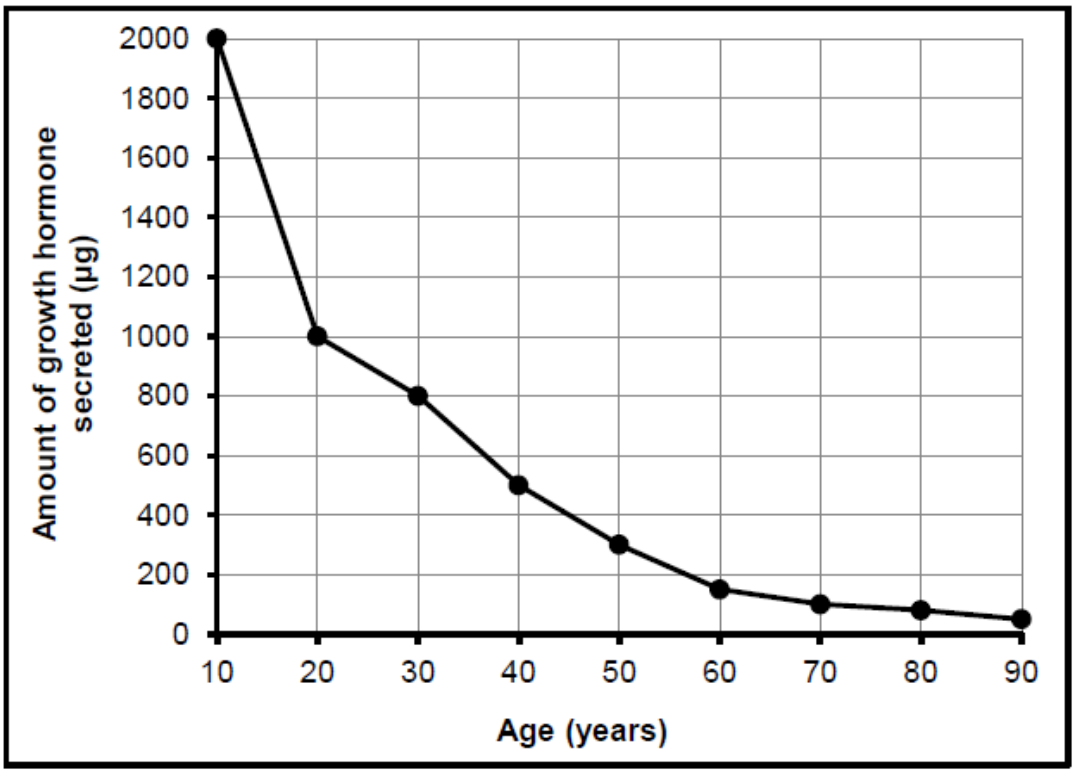
1.1.9 The list below contains some steps taken before and during the investigation.

(i) Permission was obtained to participate in the investigation.
(ii) The measuring tool to be used was decided upon.
(iii) Water was given to the participant to drink.
(iv) The amount of urine produced was measured.

Which of the steps above can be considered as part of the planning steps before conducting the investigation?

A (i), (ii), (iii) and (iv)
B (i) and (ii) only
C (ii), (iii) and (iv) only
D (iii) only

1.1.10 The graph below shows the relationship between the production of growth hormone and age.



A general conclusion that can be drawn from the results is that …

A growth hormone is not secreted after the age of 50 years.
B the amount of growth hormone secreted decreases with age.
C the amount of growth hormone secreted increases with age.
D the amount of growth hormone secreted remains stable over time. (10 x 2) **(20)**

1.2 Give the correct **biological term** for each of the following descriptions. Write only the term next to the question number (1.2.1 to 1.2.8) in the ANSWER BOOK.

1.2.1 The phase in the cell cycle when DNA replication occurs

1.2.2 The part of the peripheral nervous system that controls involuntary actions

1.2.3 A plant hormone that causes leaves to fall off trees in autumn

1.2.4 Measurement of the total amount of carbon dioxide emissions of an individual per year

1.2.5 The division of the cytoplasm through the constriction of the cell membrane at the end of cell division

1.2.6 The structure in the amniotic egg that stores wastes

1.2.7 The inner lining of the uterus where implantation of the embryo occurs

1.2.8 Part of the female reproductive system where fertilisation occurs

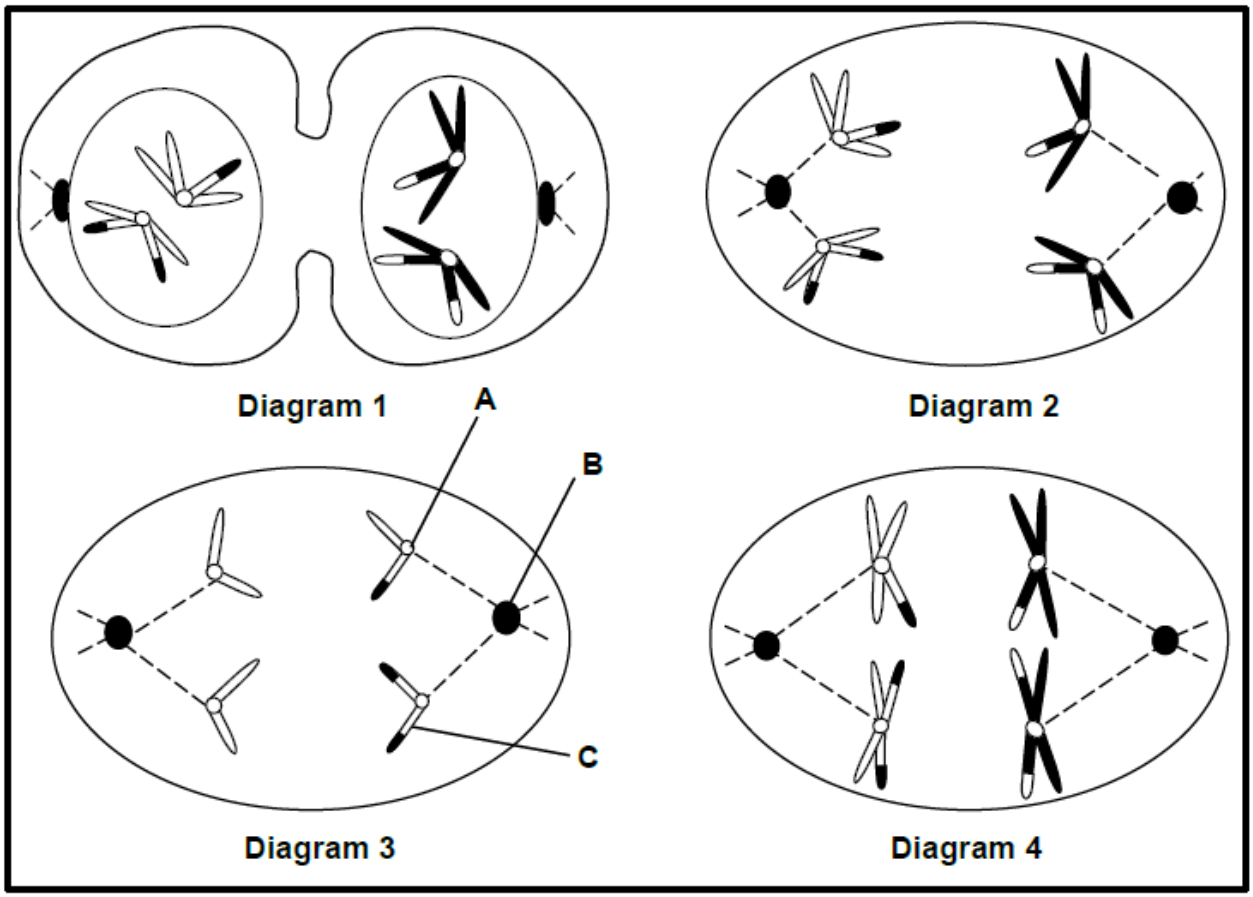
(8 x 1) **(8)**

1.3 Indicate whether each of the descriptions in COLUMN I applies to **A ONLY**, **B ONLY**, **BOTH A AND B** or **NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B** or **none** next to the question number (1.3.1 to 1.3.3) in the ANSWER BOOK.

	COLUMN I	COLUMN II
1.3.1	Female frogs lay eggs in water and the males spray sperm onto the eggs.	A: Vivipary B: Ovovivipary
1.3.2	The phase of meiosis when independent assortment occurs	A: Anaphase II B: Metaphase I
1.3.3	The type of development in vertebrates where the young are well developed and able to move at birth	A: Precocial development B: Altricial development

(3 x 2) **(6)**

1.4 The diagrams below represent some phases of meiosis in an animal cell.



1.4.1 Identify the following parts in Diagram 3:

(a) **A** (1)

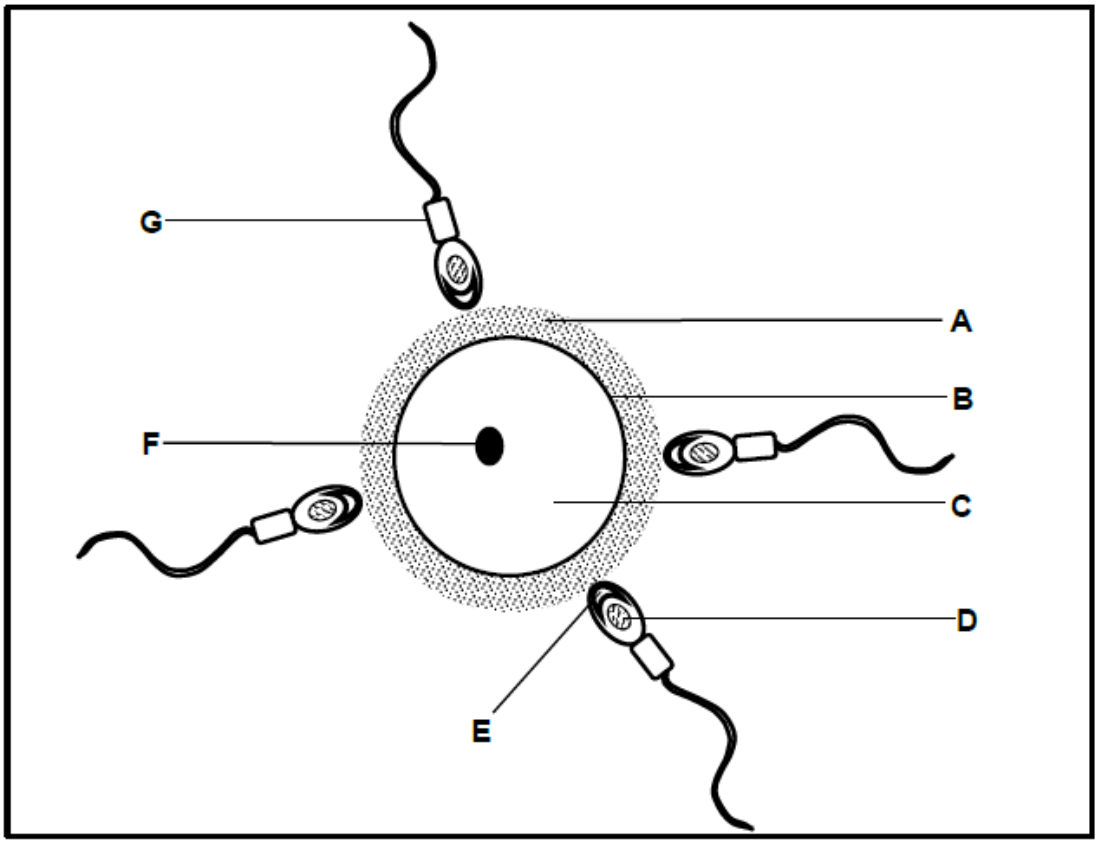
(b) **B** (1)

(c) **C** (1)

1.4.2 Using the diagram NUMBERS (1, 2, 3, 4) showing some of the phases, arrange the diagrams above in the sequence as they occur during meiosis. (2)

1.4.3 How many chromosomes were in the cell before meiosis began? (1)
(6)

1.5 The schematic diagram below shows a human ovum that is about to be fertilised. The diagram is not drawn to scale.



1.5.1 Identify part:

(a) **A** (1)

(b) **B** (1)

(c) **C** (1)

(d) **F** (1)

1.5.2 Give the LETTER and NAME of the part that:

(a) Contains the mitochondria (2)

(b) Contains enzymes required to penetrate the ovum (2)

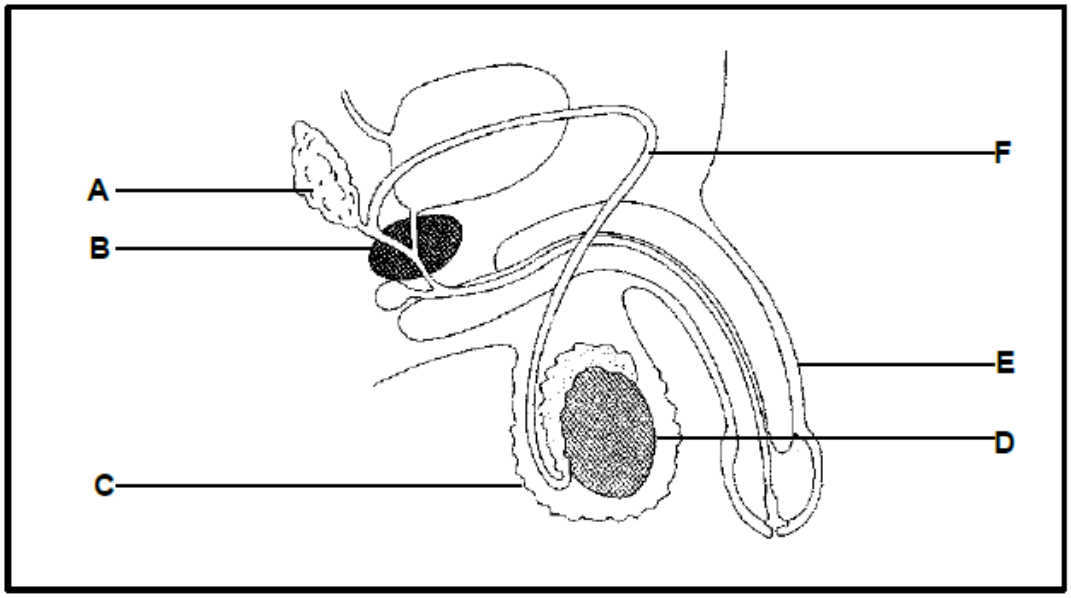
(c) Will enter the ovum during fertilisation (2)
(10)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 The diagram below represents the human male reproductive system.



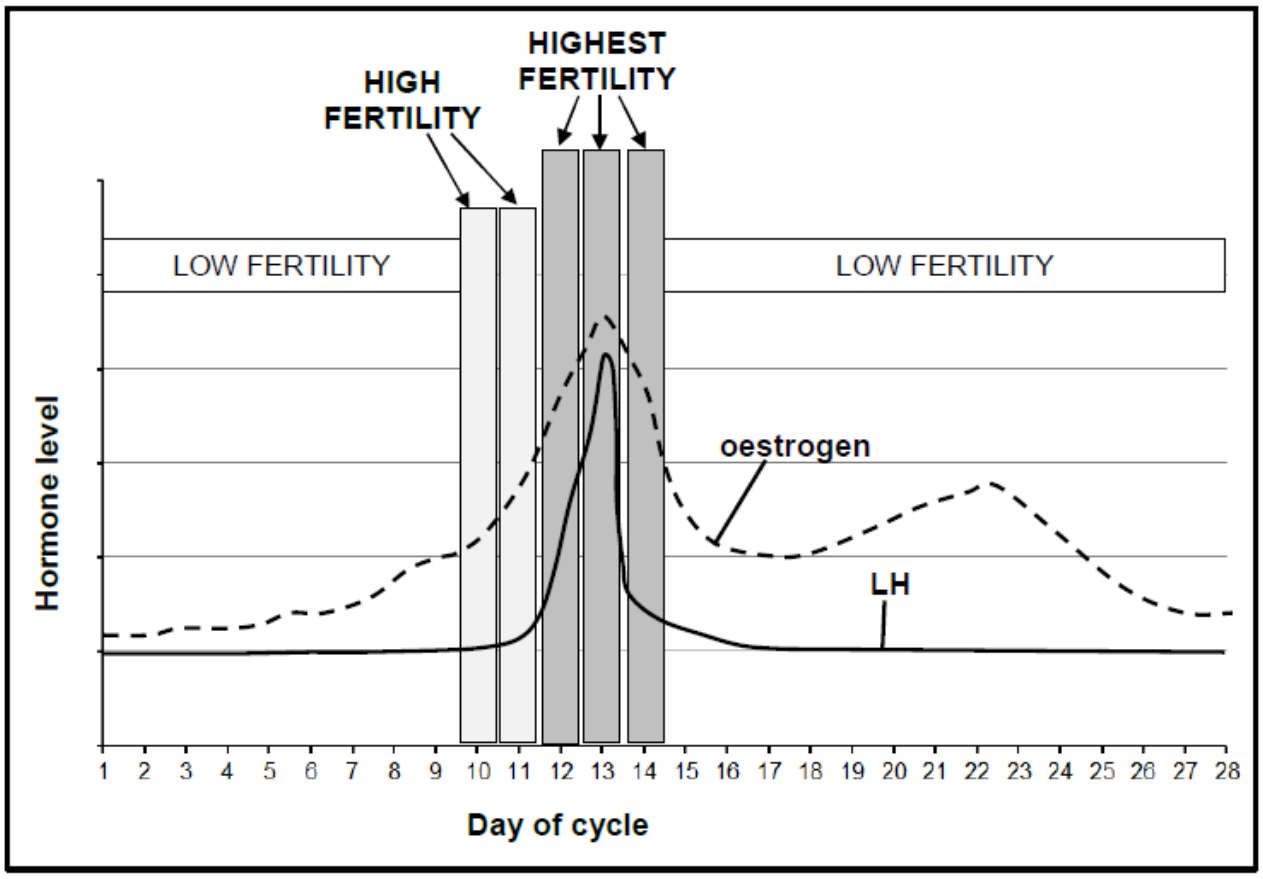
2.1.1 Identify part **A**. (1)

2.1.2 Write down the LETTERS only of TWO parts that contribute to the formation of semen. (2)

2.1.3 Explain the consequence on human reproduction if a male wears tight-fitting underwear all the time. (3)
(6)

2.2 A fertility monitor measures the concentration of oestrogen and luteinising hormone (LH) in a woman's urine. A fertile period is the time when the ovum is ready to be fertilised.

The graph below appears on the information sheet that is provided with the fertility monitor.



[Adapted from http://www.amazon.co.uk]

2.2.1 Name the gland that secretes LH. (1)

2.2.2 Explain why the fertility monitor measures the concentration of LH. (2)

2.2.3 Explain why some women would use a fertility monitor. (2)

2.2.4 What evidence in the graph indicates that a healthy follicle is developing in the ovary during the first half of the cycle? (2)

2.2.5 If a woman using the fertility monitor finds that her LH level peaks on day 17, between which days does she experience the 'highest fertility'? (2)

2.2.6 Explain why the fertility monitor does not measure the progesterone level in the blood to predict fertile days. (3)
(12)

2.3 An investigation was carried out to determine the effect of caffeine on body temperature and pulse rate. A group of 200 men participated in the investigation.

The procedure was as follows:

- At the start of the investigation each man's body temperature was measured, and the average of all the participants was calculated.
- Also, at the start of the investigation each man's pulse rate was measured, and the average of all the participants was calculated.
- The men each drank 100 mℓ of an energy drink containing the same amount of caffeine.
- Their body temperature was then measured every 15 minutes for a period of 1 hour, and an average of all the participants was calculated.
- Also, their pulse rate was then measured every 15 minutes for a period of 1 hour, and the average of all the participants was calculated.
- All the participants were seated during the period of investigation.

The table below shows the results of the investigation.

TIME (minutes)	AVERAGE TEMPERATURE (°C)	AVERAGE PULSE RATE (BPM)
0	36,6	76
15	37,4	91
30	38	95
45	37,8	89
60	37,4	89

[Adapted from www.meliordiscovery.com and http://homeostasiseleishabiology.weebly.com]

2.3.1 Describe the effect that caffeine had on body temperature and pulse rate after 15 minutes. (2)

2.3.2 How long after drinking the energy drink did the caffeine have its maximum effect? (1)

2.3.3 Caffeine causes vasoconstriction and an increase in metabolism.

Explain how these effects contribute to the temperature change that occurred. (4)

2.3.4 State TWO factors that were kept constant during this investigation. (2)
(9)

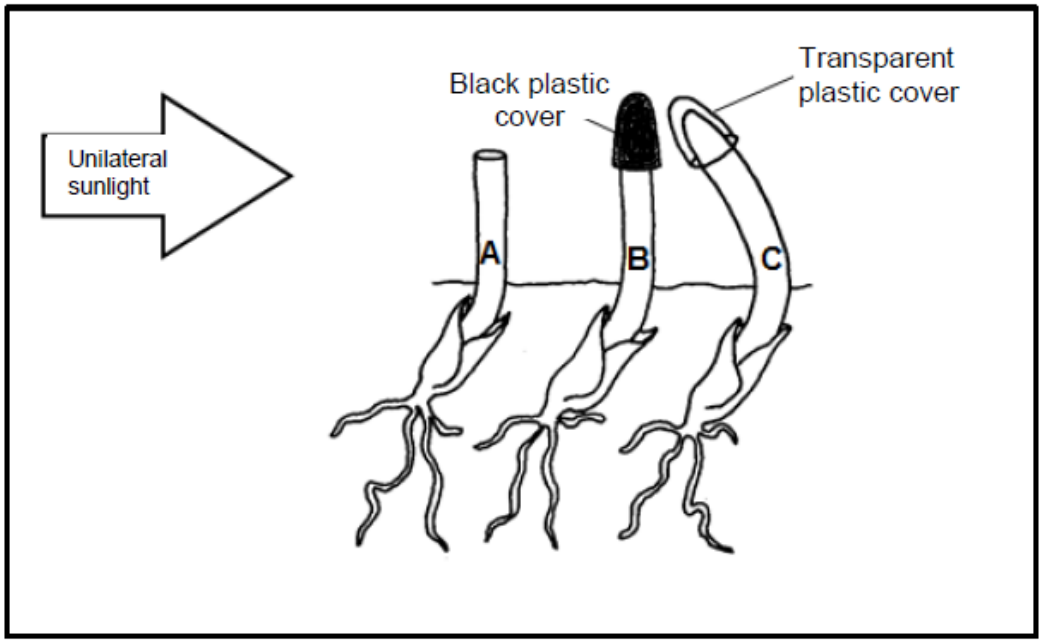
2.4 Describe how the blood glucose level in the human body is returned to normal when the glucose level decreases to below normal. **(4)**

2.5 The diagram below shows the results of an investigation carried out to determine the effect of auxins on the growth of coleoptiles (young shoots).

The procedure was as follows:

- Three coleoptiles were used.
- Coleoptile **A** had its apical bud removed.
- Coleoptile **B** had its apical bud covered with a black plastic cover.
- Coleoptile **C** had its apical bud covered with a transparent plastic cover.
- All three coleoptiles (**A**, **B** and **C**) were then exposed to unilateral sunlight.

The diagram below shows the results of the investigation.



2.5.1 Explain the results obtained, as shown by coleoptile:

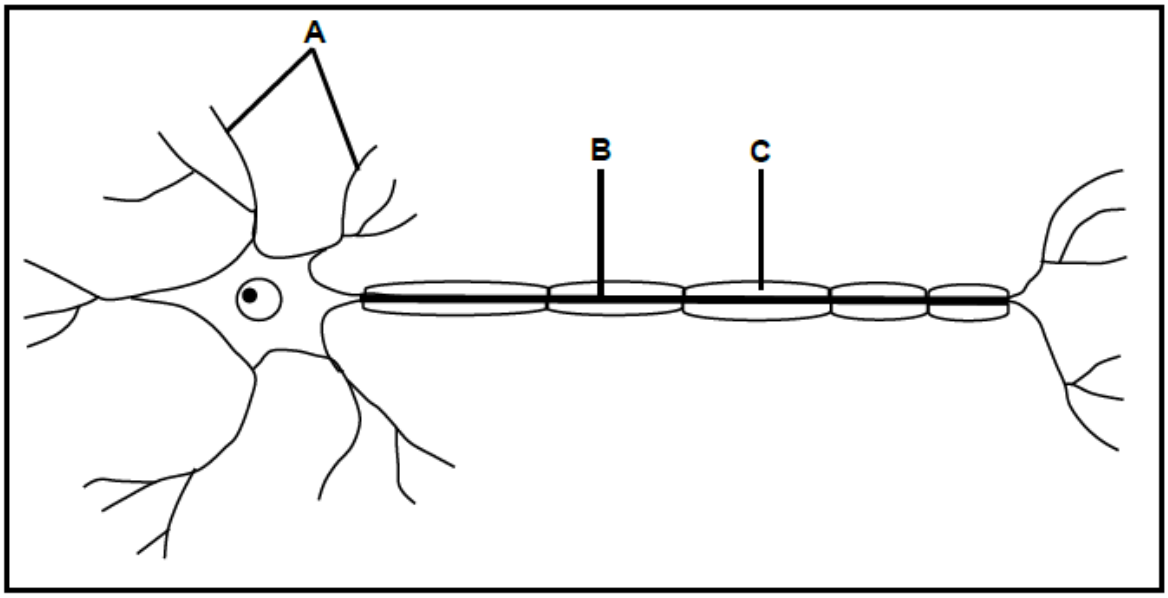
(a) **B** (3)

(b) **C** (4)

2.5.2 Explain why lateral branches will develop in coleoptile **A**. (2)
(9)
[40]

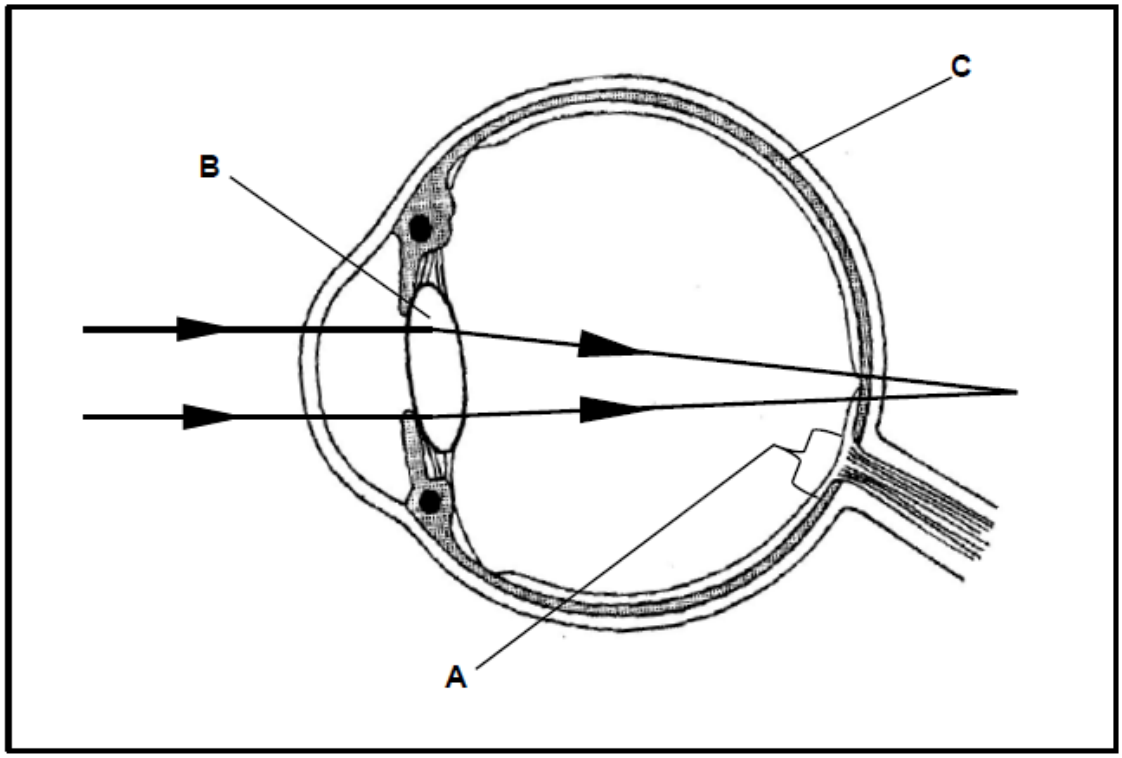
QUESTION 3

3.1 The diagram below represents a neuron in a human.



3.1.1	Identify the type of neuron represented in the diagram.	(1)
3.1.2	State ONE function of part **B**.	(1)
3.1.3	Explain the role of part **C** in the functioning of the neuron.	(2)
3.1.4	Explain the consequence for a reflex action if the neuron shown in the diagram is damaged.	(2) **(6)**

3.2 The diagram below illustrates how light refracted in the human eye leads to a visual defect.



3.2.1 Identify part:

(a) **B** (1)

(b) **C** (1)

3.2.2 Name the visual defect that is illustrated in the diagram. (1)

3.2.3 Describe the consequences of the visual defect in your answer to QUESTION 3.2.2. (2)

3.2.4 Explain the consequences if the light rays were to fall on part **A**. (3)

3.2.5 Explain TWO ways in which the lens is structurally suited to perform its function. (4)
(12)

3.3 Read the extract about GMOs below.

> Some fruits are usually harvested when they reach maturity and then undergo rapid ripening during storage and transportation. Others have to be harvested only when they are fully ripened.
>
> Normally farmers pick their produce while it is still green. However, fruits harvested prematurely (too early) tend to be poor in taste and their quality decreases as they are refrigerated and transported over long distances.
>
> A strategy used nowadays is to genetically modify the fruit trees by introducing a gene from another organism that delays the ripening process.
>
> [Adapted from www.ncbe.reading.ac.uk]

3.3.1 According to the extract, state TWO disadvantages for farmers if they pick their produce prematurely. (2)

3.3.2 Explain why the growth of these GM fruit trees will economically benefit the:

(a) Consumer (2)

(b) Farmer (2)

3.3.3 State TWO factors that, due to climatic changes, have a negative effect on food security. (2)
(8)

3.4 Read the extract below, which provides information on gasohol.

> Petrol is a fuel produced from crude oil. When petrol is burnt in engines it releases pollutants and greenhouse gases into the atmosphere. Since the early 1970s there has been a shortage of crude oil causing an 'oil crisis'.
>
> Petrol releases 34,8 megajoules of energy per litre.
>
> Gasohol is a mixture of 10% ethanol and 90% petrol. It can be used in most car engines without making any changes to the engine. It releases 23,5 megajoules of energy per litre. Gasohol is used in several countries. The use of gasohol can reduce carbon monoxide emissions by 20% to 30%. It can also decrease greenhouse gas emissions by an estimated 2% compared to using regular petrol. Ethanol evaporates easily and can increase certain atmospheric pollutants in warmer weather.
>
> The ethanol in gasohol is often obtained by fermenting sugar cane or maize. Ethanol made from maize is expensive and energy-intensive to produce. It is also important that the percentage ethanol should be correct, because if it is too high, it can damage rubber seals and paint on vehicles.
>
> [Adapted from www.wikipedia.org and www.encyclopedia.com]

3.4.1 State TWO advantages of using gasohol rather than petrol. (2)

3.4.2 Calculate the difference in the energy (in megajoules) released by petrol compared to that of gasohol. Show ALL working. (2)

3.4.3 Explain why the use of gasohol is regarded as a solution to the 'oil crisis'. (2)

3.4.4 Explain why it is better to use gasohol in countries with colder climates. (3)

3.4.5 Suggest ONE reason why food products such as sugar cane and maize should NOT be used to produce fuel. (1)
(10)

3.5 Describe how thermal pollution can impact on the quality of water and biodiversity. **(4)**
[40]

TOTAL SECTION B: 80

SECTION C

QUESTION 4

While walking in the bush Paul hears a sound which he thinks is the roar of a lion. He immediately runs to safety.

Describe how he hears the sound and describe the role of adrenalin to ensure that his muscles are able to function efficiently while he runs away.

Content: (17)
Synthesis: (3)
(20)

NOTE: NO marks will be awarded for answers in the form of flow charts, tables or diagrams.

TOTAL SECTION C: 20
GRAND TOTAL: 150

LIFE SCIENCES P1

FEBRUARY/MARCH 2017

SECTION A

QUESTION 1

1.1 Various options are provided as possible answers to the following questions. Write down the question number (1.1.1–1.1.10), choose the answer and make a cross (X) over the letter (A–D) of your choice in the ANSWER BOOK.

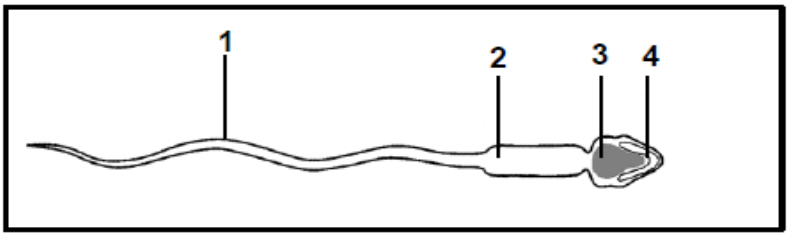
EXAMPLE:

1.1.11	A	B	C	~~D~~

1.1.1 After sperm cells have been produced in humans, they are stored in the … until maturation.

A penis
B urethra
C epididymis
D seminal vesicles

1.1.2 Which ONE of the following parts in the diagram of a sperm cell contains a haploid number of chromosomes?



A 1
B 2
C 3
D 4

1.1.3 Which ONE of the following plant hormones is responsible for the germination of seeds?

A Growth hormone
B Abscisic acid
C Gibberellin
D Auxin

1.1.4 The phase in meiosis in which individual centromeres split is called …

A anaphase I.
B anaphase II.
C metaphase I.
D metaphase II.

1.1.5 When Jane plays in the snow, her body maintains a constant core temperature by …

A vasodilation and sweating.
B vasoconstriction and shivering.
C sweating and shivering.
D vasoconstriction and vasodilation.

1.1.6 Which ONE of the following hormones prepares the human body to react to emergency situations?

A Insulin
B Aldosterone
C Adrenalin
D Growth hormone

QUESTIONS 1.1.7 AND 1.1.8 REFER TO THE INVESTIGATION BELOW.

An investigation was carried out to determine the fertility levels of healthy males in different age groups.

The procedure followed was as follows:

- 50 healthy males in each of the following age groups were asked to participate: 20–29, 30–39, 40–49, 50–59 and 60–69.
- Semen was collected from each of the males.

The number of active sperm cells present in the semen was counted for each man in each age group and averages were calculated.

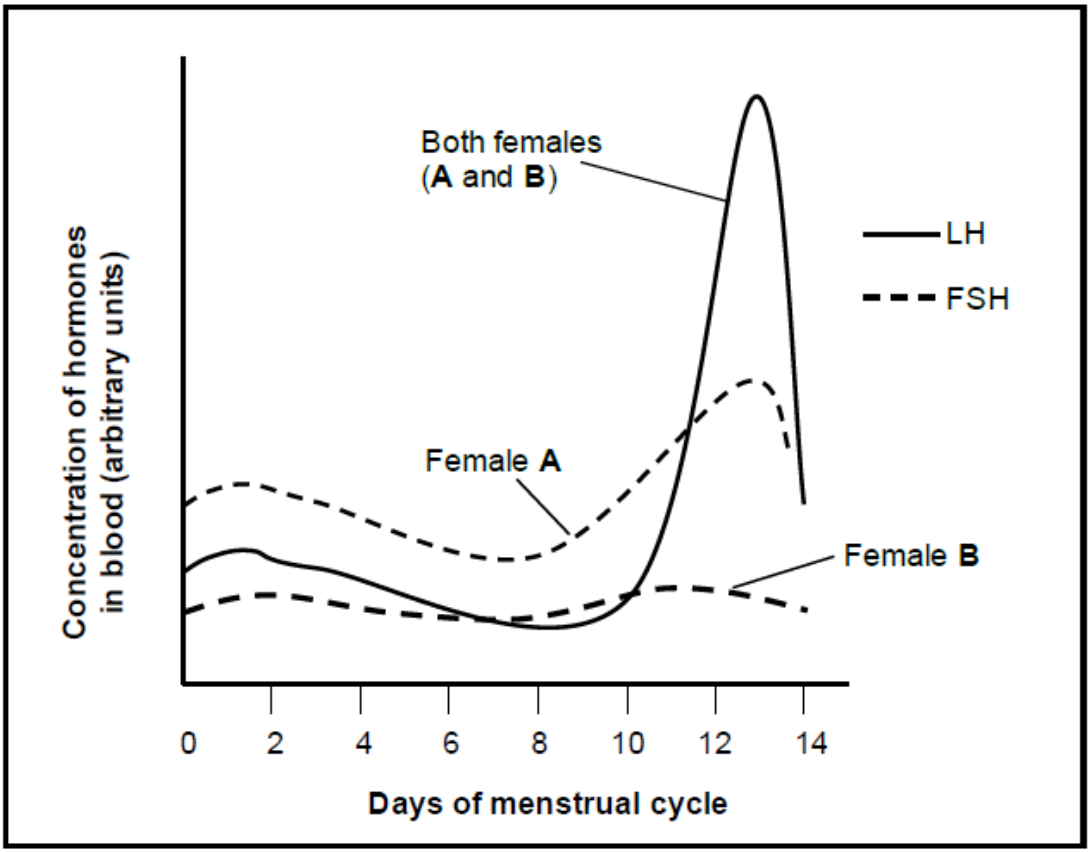
1.1.7 Which ONE of the following is the dependent variable in the investigation?

A Fitness levels of the males
B Age groups of the males
C Number of active sperm cells
D Amount of semen

1.1.8 Which ONE of the following variables was kept constant during this investigation?

A Number of participants in each age group
B Fertility levels of males in each age group
C Number of active sperm cells
D Age groups of the males

QUESTIONS 1.1.9 AND 1.1.10 REFER TO THE GRAPH BELOW. THE GRAPH SHOWS THE CHANGES IN THE CONCENTRATION OF FEMALE HORMONES (LH AND FSH) IN TWO FEMALES DURING THE FIRST TWO WEEKS OF THE MENSTRUAL CYCLE.



1.1.9 Which female will NOT ovulate on day 14?

A Female **A**, because the FSH levels are high
B Female **A**, because the LH levels are too high on day 13
C Female **B**, because LH inhibits the development of a follicle
D Female **B**, because a follicle did not develop in the ovary

1.1.10 Which ONE of the following statements is CORRECT regarding female **A**?

A FSH increases on day 14 because the Graafian follicle is secreting progesterone.
B FSH increases after day 9 as the pituitary gland/hypophysis is secreting progesterone.
C FSH decreases after day 4 to ensure that implantation occurs.
D FSH increases in the first two days to stimulate the development of a follicle. (10 x 2) **(20)**

1.2 Give the correct **biological term** for each of the following descriptions. Write only the term next to the question number (1.2.1 to 1.2.8) in the ANSWER BOOK.

1.2.1 The diploid cell formed by the process of fertilisation

1.2.2 A fluid that protects the human embryo against injuries and large-scale temperature changes

1.2.3 A disorder of the nervous system that is characterised by the breakdown of the myelin sheath of neurons

1.2.4 A hormone produced by the pituitary gland/hypophysis that stimulates milk production in human females

1.2.5 Having access to enough food on a daily basis to ensure healthy living

1.2.6 A blood vessel in the umbilical cord that transports nutrients to the foetus

1.2.7 A part of the neuron that conducts impulses towards the cell body

1.2.8 A disease that results from the body's inability to produce insulin

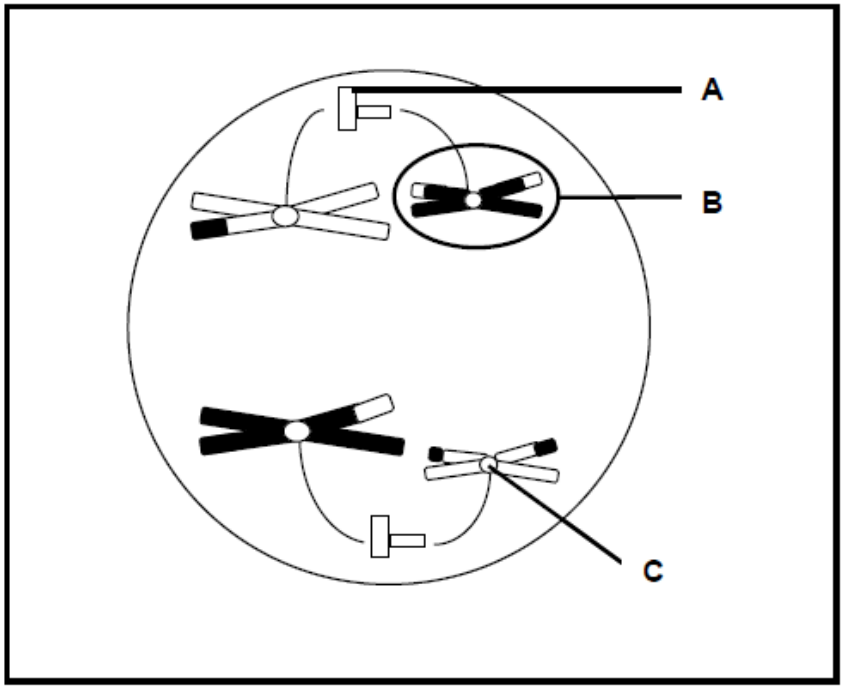
(8 x 1) **(8)**

1.3 Indicate whether each of the statements in COLUMN I applies to **A ONLY**, **B ONLY**, **BOTH A AND B** or **NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B**, or **none** next to the question number (1.3.1 to 1.3.3) in the ANSWER BOOK.

	COLUMN I	COLUMN II
1.3.1	The hormone that is in excess in a person that grows abnormally tall	A: ADH B: Thyroxin
1.3.2	The part of the autonomic nervous system that controls involuntary actions	A: Sympathetic B: Parasympathetic
1.3.3	A hormone that controls the salt content in a human body	A: Adrenalin B: Aldosterone

(3 x 2) **(6)**

1.4 The diagram below shows a phase of meiosis in an animal cell.



1.4.1 Identify:

(a) **A** (1)

(b) **B** (1)

(c) **C** (1)

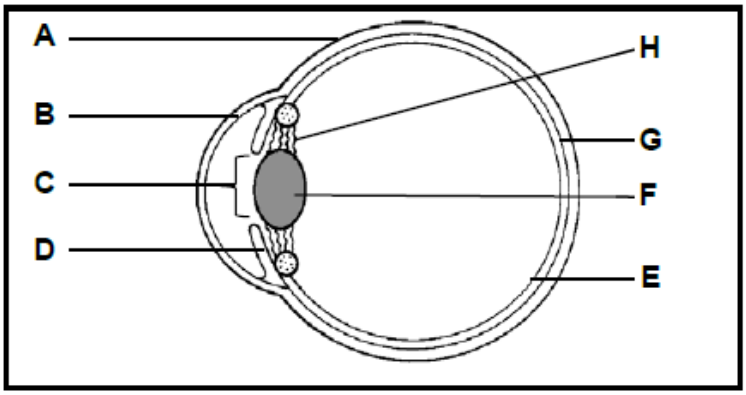
1.4.2 Which phase of meiosis is illustrated in the diagram above? (1)

1.4.3 Name the phase that follows the one represented in the diagram above. (1)

1.4.4 How many chromosomes were there in the cell above before the process of meiosis began? (1)

1.4.5 What is the specific name given to meiosis when it takes place in a human female? (1)
(7)

1.5 The diagram below represents a section through a human eye.



1.5.1 Identify:

(a) **A** (1)

(b) **B** (1)

(c) **C** (1)

1.5.2 Give the LETTER and NAME of the part that:

(a) Regulates the amount of light entering the eye (2)

(b) Contains a dark pigment that absorbs excess light in the eye (2)

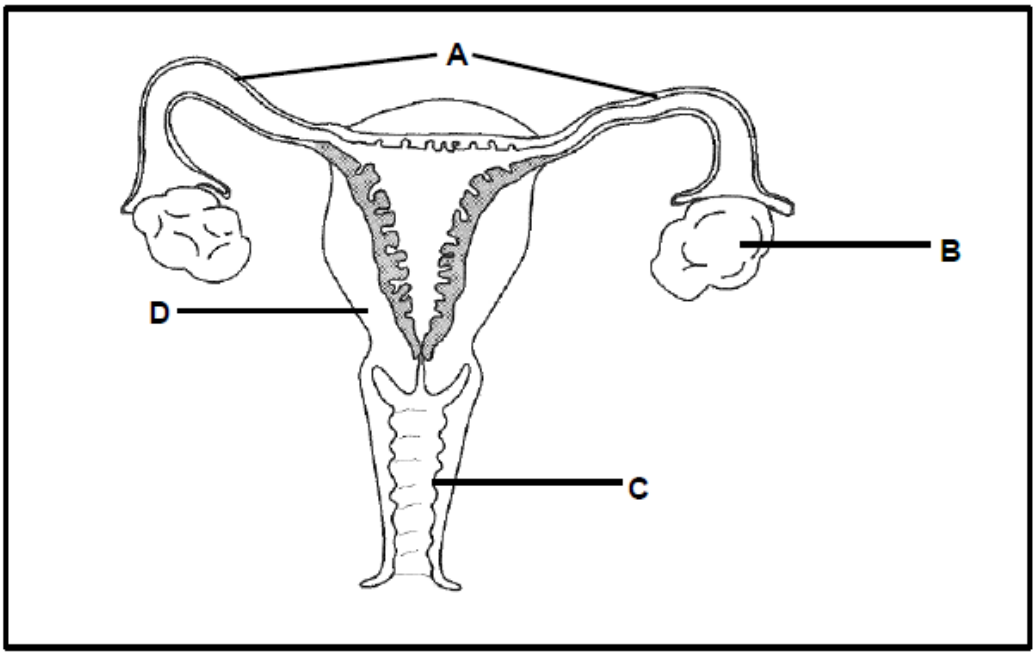
(c) Contains receptors sensitive to light (2)
(9)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 The diagram below represents the human female reproductive system.



2.1.1 Identify part **C**. (1)

2.1.2 State ONE function of part **D**. (1)

2.1.3 Name the hormone secreted by part **B** during the first week of the menstrual cycle. (1)

2.1.4 State how the hormone named in QUESTION 2.1.3 influences part **D**. (1)

2.1.5 During tubal ligation, part **A** is surgically cut or tied.

Explain how this procedure prevents pregnancy. (3)
(7)

2.2 An investigation was carried out to determine the effects of smoking during pregnancy on the baby's birth weight. Babies born weighing 2 499 g or less have a low birth weight.

The table below compares the percentage of babies with a low birth weight born to mothers who smoked with mothers who did not smoke in a certain city in 2009.

BIRTH WEIGHT (GRAMS)	PERCENTAGE OF TOTAL BIRTHS (%) IN 2009	
	MOTHERS WHO SMOKED	MOTHERS WHO DID NOT SMOKE
<1 000	0,7	0,2
1 000–1 499	0,9	0,3
1 500–1 999	2,2	1,1
2 000–2 499	7,1	3,2

[Adapted from www.ainw.gov.au]

2.2.1 Draw a histogram to represent the percentage of births in each weight group born to mothers who smoked. (6)

2.2.2 Why were babies that weighed more than 2 500 g at birth not included in the investigation? (1)

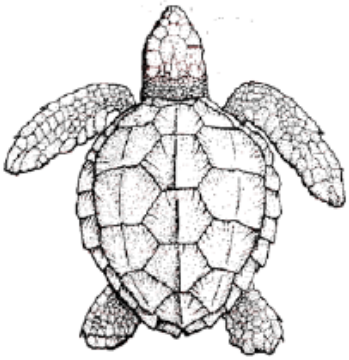
2.2.3 State a general conclusion for the investigation based on the data in the table. (2)

2.2.4 Describe how chemicals from cigarette smoke are able to reach the baby's blood from the mother's blood. (2)
(11)

2.3 Read the extract below.

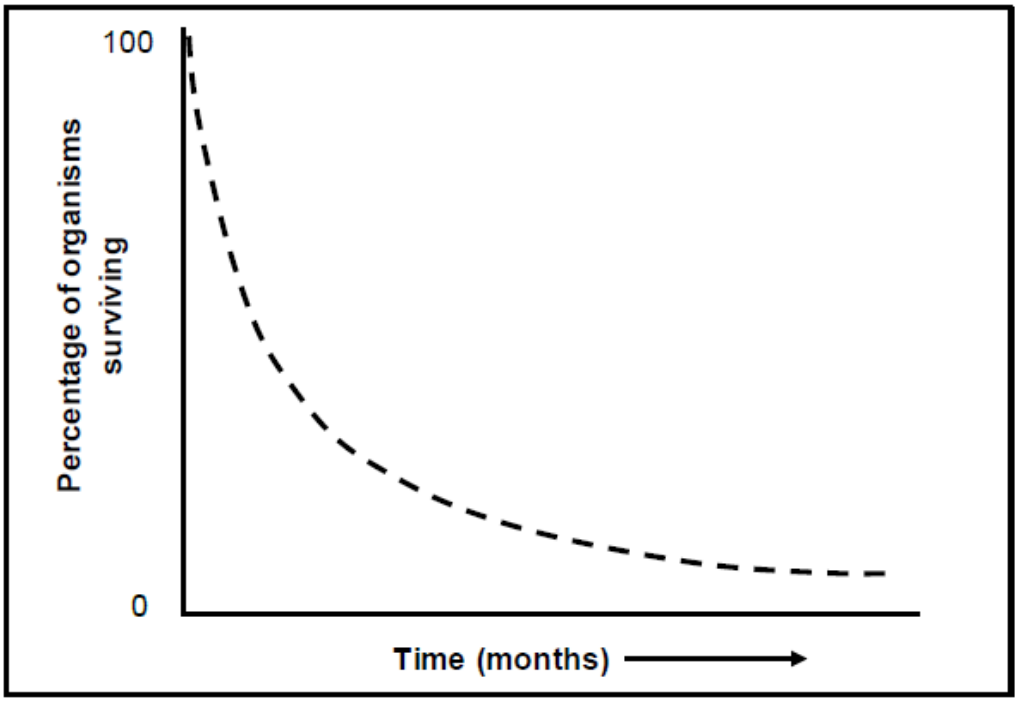
In a species of sea turtles (shown below), the females leave the water to lay their eggs in a nest on the beach. The female makes the nest by digging a hole with her hind legs. A female is known to lay about 100 or more eggs. After the eggs have been laid, the female covers the nest with sand to hide it from predators and leaves the eggs to incubate on their own.

It takes about two months for the hatchlings to emerge from the nest. The hatchlings must try to make it to the sea safely. Only about 10% of the hatchlings usually make it to the sea safely and survive to reproduce.



A sea turtle

The graph below shows the percentage of survivors in a sea turtle population over a period of time.



[Adapted from https://bioweb.uwlax.edu]

2.3.1 Write down whether the type of reproduction in sea turtles is **oviparous**, **viviparous** or **ovoviviparous**. (1)

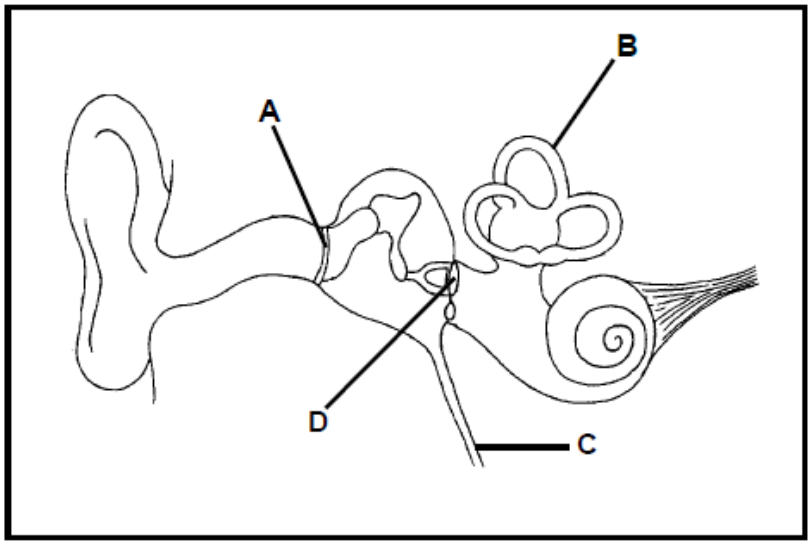
2.3.2 Give a reason for your answer to QUESTION 2.3.1. (1)

2.3.3 The shape of the graph would differ if there were parental care.

(a) Describe how the shape of the graph would differ if there were parental care. (1)

(b) Explain your answer to QUESTION 2.3.3(a). (2)
(5)

2.4 The diagram below represents parts of the human ear.



2.4.1 Identify parts:

(a) **B** (1)

(b) **C** (1)

(c) **D** (1)

2.4.2 Explain how parts **A** and **D** together are adapted to amplify sound. (3)

2.4.3 State ONE advantage of the middle ear being filled with air. (1)
(7)

2.5 Read the extract below.

A LINK BETWEEN CONCUSSION AND BRAIN DAMAGE

In 2002 a former American football player was found dead in his truck. The doctor who handled the autopsy discovered that the football player had severe brain damage and that his death was caused by repeated blows to the head or repeated concussions. He called this disorder chronic traumatic encephalopathy (CTE).

A more recent study was conducted which involved the brains of 165 people who played football at high school, college or professional level. The study found evidence of CTE in 131 of the brains.

[Adapted from www.wikipedia.org and www.theatlantic.com]

2.5.1 The part of the brain affected by CTE is the cerebrum.

State TWO possible symptoms of this disorder. (2)

2.5.2 State ONE way in which the brain is protected. (1)

2.5.3 Explain why CTE does not usually affect essential life processes such as breathing or heart rate. (2)
(5)

2.6 TSH and thyroxin are both secretions of endocrine glands, namely the pituitary gland/hypophysis and the thyroid gland respectively.

2.6.1 Where will you look for evidence to detect the levels of TSH and thyroxin in the human body? (1)

2.6.2 A high level of TSH is detected in the human body.

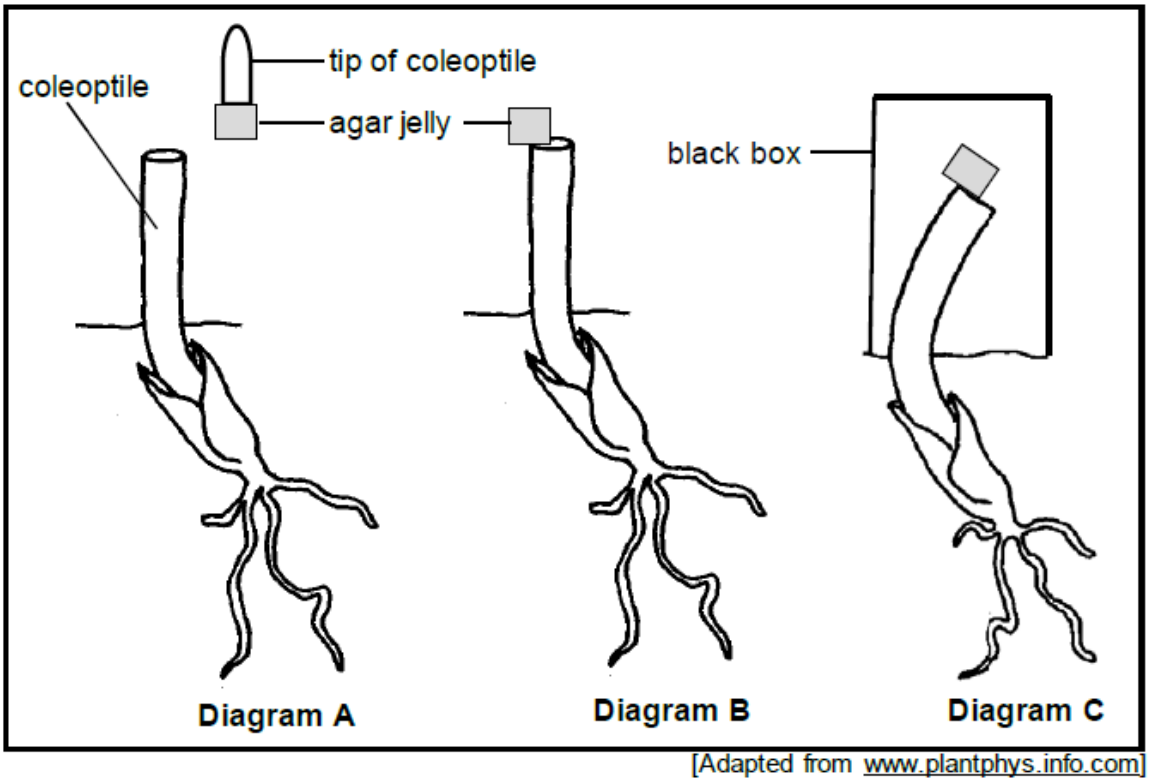
Explain TWO possible causes of high levels of TSH in the body. (4)
(5)
[40]

QUESTION 3

3.1 An investigation was carried out to determine the effect of auxins on the growth of coleoptiles.

The procedure was as follows:

- The tip of one coleoptile (young shoot) was removed and placed on a block of agar jelly, as shown in diagram **A**.
- After two hours the agar jelly was placed on the cut surface of the original coleoptile, as shown in diagram **B**.
- The coleoptile was covered with a black box and allowed to grow for two days, as shown in diagram **C**.



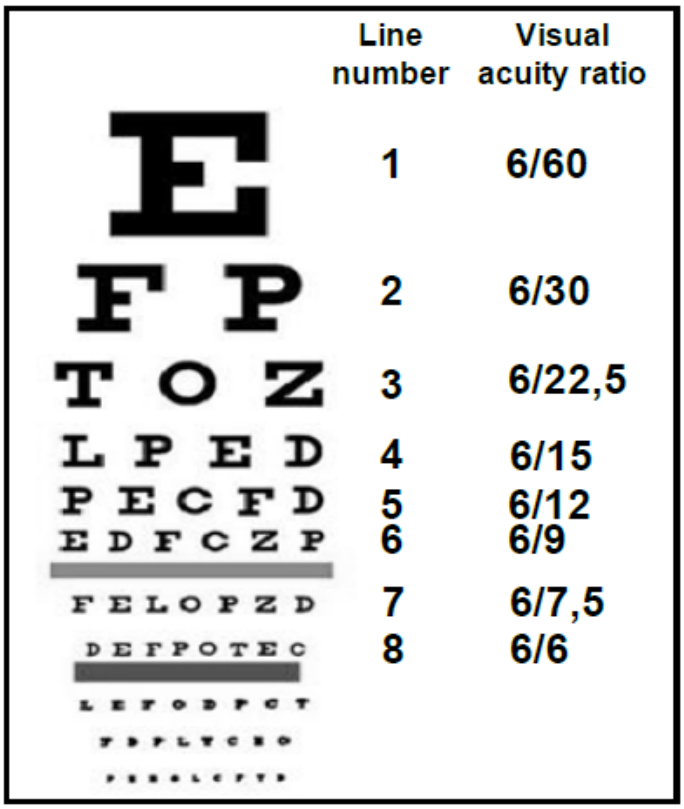
[Adapted from www.plantphys.info.com]

3.1.1 Explain why the tip of the coleoptile was placed on the agar jelly for two hours at the start of the investigation. (2)

3.1.2 Describe what occurred in diagram **C** to cause the coleoptile to bend even though no light was present. (4)

3.1.3 Describe a control for this investigation. (2)
(8)

3.2 The diagram below represents a typical Snellen chart that is used to estimate visual acuity (ability to see clearly). The extract explains how a Snellen chart is used.



A person, whose visual acuity is being tested, stands 6 m away from the chart. One eye is covered and he/she reads the letters of each row out loud, beginning at the top. The smallest row that can be read accurately indicates the visual acuity in that specific eye.

Visual acuity is expressed as a ratio and the line designated 6/6 is the smallest line that a person with normal acuity can read at a distance of 6 m.

When a person is having his/her visual acuity tested to obtain a driver's licence, special equipment is used that can present the letters in different patterns, arrangements and sizes.

[Adapted from www.wikipedia.org]

3.2.1 A person is only able to read accurately to the end of line 5 on the Snellen chart.

What is his/her visual acuity ratio? (1)

3.2.2 Explain ONE reason why the special equipment, which can present different patterns, arrangements and sizes of letters, is used when testing eyesight for a driver's licence. (2)

3.2.3 Some clinics have half-size charts that must be read at a distance of 3 m instead of 6 m.

Describe the process that occurs in the eye to ensure that the letters of the chart are in focus at 3 m. (4)
(7)

3.3 Read the extract below.

TONS OF FOOD THROWN AWAY EACH YEAR

In South Africa about 9 million tons of food per year is thrown away as waste, whilst around 13,8 million South Africans are food insecure. The drought that is currently affecting the country is expected to increase the number of food-insecure South Africans. This food wastage costs the economy of South Africa about R60 billion each year.

The table below shows food groups with their wastage costs.

Food group	Wastage costs (billion rands)
Fruit and vegetables	23
Meat	17
Seafood	8
Others	12

The highest volume of waste occurs when the food is transported, especially over long distances. Packaging and processing accounts for the second highest volume of waste.

[Adapted from *The New Age*, 1 February 2016]

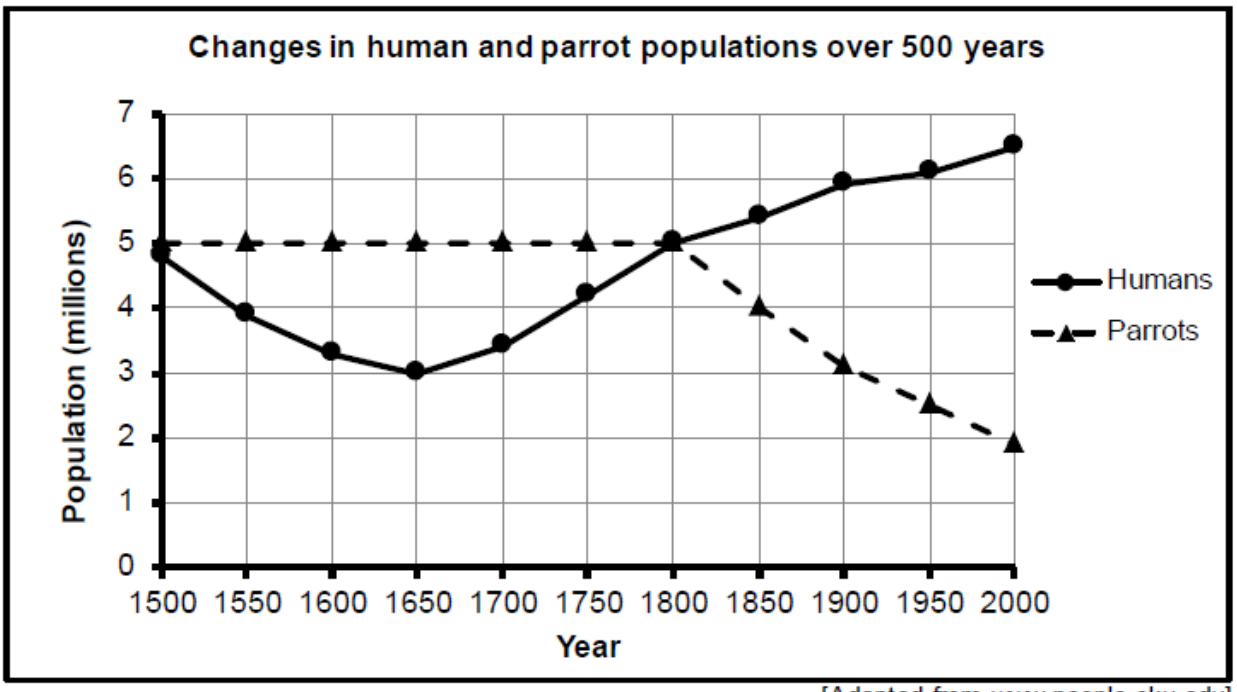
3.3.1 State TWO factors, according to the extract, that lead to the largest amount of food being wasted. (2)

3.3.2 Suggest TWO ways in which shopkeepers can reduce the amount of food going to waste. (2)

3.3.3 What percentage does seafood contribute to the total food wastage cost in South Africa? Show ALL your calculations. (2)

3.3.4 Explain TWO ways in which the drought is expected to increase the number of food-insecure South Africans. (4)
(10)

3.4 The graph below shows the changes in the human population and the population of parrots (a type of bird) in a certain country over a period of 500 years.



[Adapted from www.people.eku.edu]

3.4.1 When was the human population at 3 million? (1)

3.4.2 Describe the difference in the trends between the human population and the parrot population since 1800. (2)

3.4.3 Suggest TWO reasons for the trend described in QUESTION 3.4.2. (4)

3.4.4 If the current rate of decrease in the parrot population continues, explain how the organisms that feed mainly on the parrot population would be affected. (2)
(9)

3.5 Describe how the excessive use of fertilisers by farmers impacts on the quality of water. **(6)**
[40]

TOTAL SECTION B: 80

SECTION C

QUESTION 4

Nontobeko had been walking in the desert, without water, for two days, when she suddenly heard a sound behind her. She turned her head and saw a snake coming towards her. She became scared and turned around to run away. As she was running, she tripped and fell.

Describe how her body regulated water content during the two days and describe how her balance would have been restored after she fell down.

Content: (17)
Synthesis: (3)
(20)

NOTE: NO marks will be awarded for answers in the form of flow charts, tables or diagrams.

TOTAL SECTION C: 20
GRAND TOTAL: 150

LIFE SCIENCES P2

FEBRUARY/MARCH 2017

SECTION A

QUESTION 1

1.1 Various options are provided as possible answers to the following questions. Write down the question number (1.1.1–1.1.8), choose the answer and make a cross (X) over the letter (A–D) of your choice in the ANSWER BOOK.

EXAMPLE:

1.1.9	A	B	C	~~D~~

1.1.1 The process where one DNA molecule produces two identical DNA molecules is called …

A reproduction.
B replication.
C translation.
D protein synthesis.

1.1.2 A difference between DNA and RNA:

A RNA is double-stranded and DNA is single-stranded.
B DNA has a sugar-phosphate frame, whereas RNA does not.
C There are weak hydrogen bonds in DNA, but not in RNA.
D RNA has a helix structure and DNA is straight.

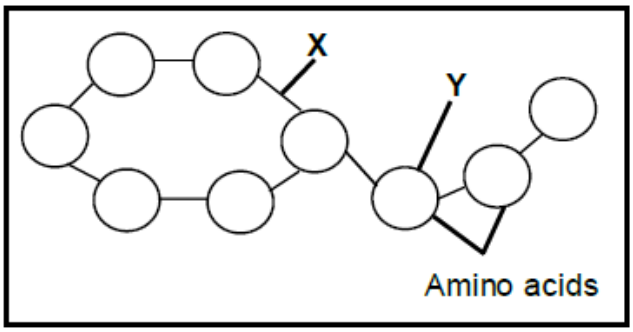
1.1.3 A pedigree diagram shows …

A how organisms evolve.
B the inheritance of characteristics over many generations.
C sex-linked characteristics only.
D the number of children in a family only.

1.1.4 A red flowering plant is crossed with a white flowering plant. All the offspring have pink flowers. When the two pink flowering plants are crossed, the next generation of flowering plants will have flowers that are …

A pink only.
B red only.
C white only.
D pink, red and white.

1.1.5 The diagram below represents the chemical structure of a protein.



X represents a …

A hydrogen bond.
B nitrogen base.
C peptide bond.
D mRNA molecule.

1.1.6 The difference between nucleic acids and nucleotides is that ...

A nucleic acids are building blocks of nucleotides.
B nucleotides are building blocks of nucleic acids.
C nucleotides are larger than nucleic acids.
D nucleic acids are found in the nucleus and nucleotides are found in the cytoplasm.

1.1.7 Which ONE of the following events occurs during metaphase I of meiosis?

A Homologous chromosomes arrange themselves at the equator
B Centrioles move to opposite poles
C Chromosomes arrange themselves singly at the equator
D Splitting of the cytoplasm

1.1.8 Comparisons of the amino acid sequences in a protein have been made between humans and a number of other organisms. The number of differences is shown in the table below.

ORGANISM	SHARK	KANGAROO	FISH	COW	LIZARD
Number of differences in amino acid sequences in a protein compared to humans	79	27	68	17	62

[Adapted from *AQA Biology 1998*]

The type of evidence for evolution in the table above is …

A fossil evidence.
B biogeography.
C cultural evidence.
D genetic evidence.

(8 x 2) **(16)**

1.2 Give the correct **biological term** for each of the following descriptions. Write only the term next to the question number (1.2.1 to 1.2.7) in the ANSWER BOOK.

1.2.1 A sudden change in the sequence/order of nitrogenous bases of a nucleic acid

1.2.2 Explanation of an observation that is supported by facts, models and laws

1.2.3 The breeding of organisms over many generations in order to achieve a desirable phenotype

1.2.4 The type of sugar found in an RNA molecule

1.2.5 Type of evolution involving long periods of time when species do not change and short periods of rapid change

1.2.6 The hypothesis which supports migration of human ancestors from the point of origin

1.2.7 The mineralised remains of organisms that have lived in the past

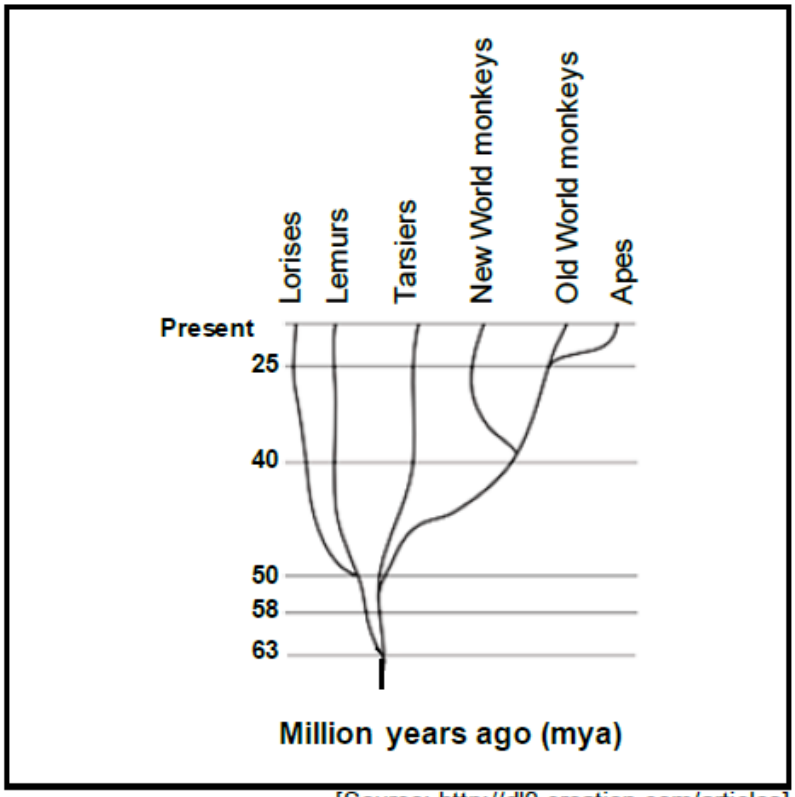
(7 x 1) **(7)**

1.3 Indicate whether each of the statements in COLUMN I applies to **A ONLY**, **B ONLY**, **BOTH A AND B** or **NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B**, or **none** next to the question number (1.3.1 to 1.3.3) in the ANSWER BOOK.

COLUMN I		COLUMN II	
1.3.1	Occurs during telophase of meiosis I	A: B:	Dividing of the cytoplasm Centrioles move to the opposite poles
1.3.2	Location of DNA	A: B:	Nucleus Mitochondria
1.3.3	Found in African apes and humans	A: B:	Claws instead of nails An opposable thumb

(3 x 2) **(6)**

1.4 The diagram below shows possible evolutionary relationships among primates.



[Source: http://dl0.creation.com/articles]

1.4.1 How many million years ago did the:

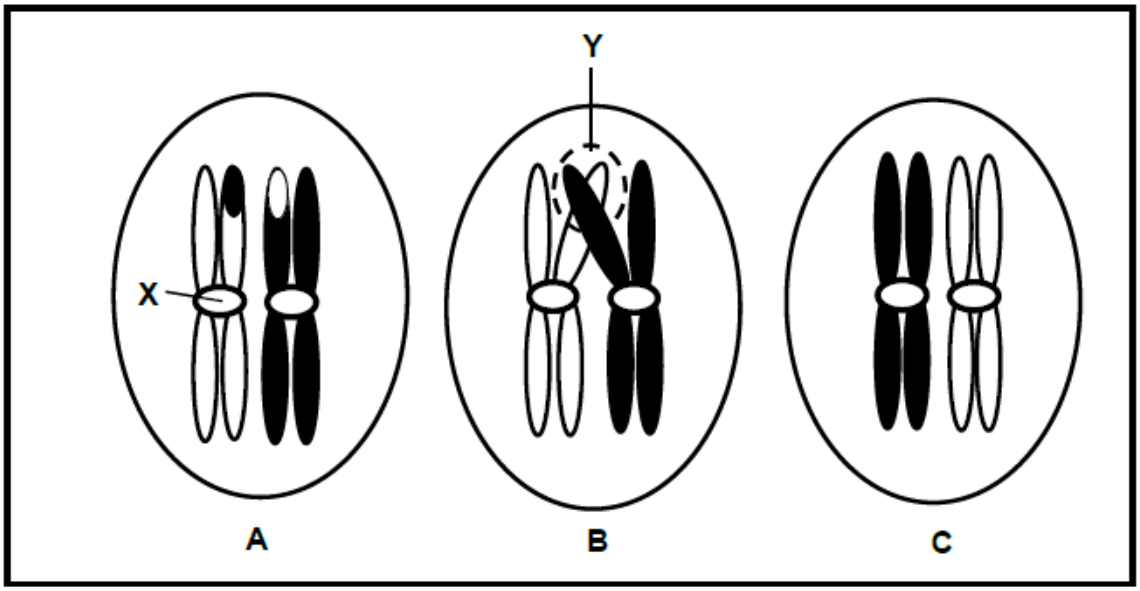
(a) Apes appear on Earth (1)

(b) Common ancestor evolve to form the Tarsiers and Lemurs (1)

1.4.2 Which TWO species share the most recent common ancestor? (2)

1.4.3 Which species is most closely related to the Lemur? (1)
(5)

1.5 The diagrams below represent a chromosome pair in a female human cell. The cells (**A**, **B** and **C**) show different events in a phase of meiosis, which are not necessarily in the correct sequence.



1.5.1 How many pairs of chromosomes occur in a normal human cell? (1)

1.5.2 Give labels for:

(a) Structure **X** (1)

(b) Area **Y** (1)

1.5.3 Name the organ in the human female where meiosis occurs. (1)

1.5.4 Name the:

(a) Process occurring in diagram **B** (1)

(b) Phase represented by the diagrams above (1)

(c) Type of cells that would result from meiosis of this cell (1)

1.5.5 Arrange the letters **A**, **B** and **C** to show the correct sequence of the events. (1)
(8)

1.6 Coat colour in mice is controlled by two alleles, black (**B**) and grey (**b**). Tail length is controlled by two alleles, long (**T**) and short (**t**).

The Punnett square below shows a part of the cross between two mice. Genotype **(i)** has been left out.

Parent 1

Parent 2	**Gametes**	**BT**	**Bt**	**bT**	**bt**
	Bt	BBTt	BBtt	BbTt	Bbtt
	Bt	BBTt	BBtt	BbTt	Bbtt
	Bt	BBTt	BBtt	**(i)**	Bbtt
	Bt	BBTt	BBtt	BbTt	Bbtt

1.6.1 Give the:

(a) Genotype of parent **1** (2)

(b) Phenotype of parent **2** (2)

(c) Genotype of offspring **(i)** (1)

1.6.2 What percentage of the offspring above is grey with short tails? (1)

1.6.3 State the genotypes of TWO gametes from the table above that will result in offspring that are heterozygous for both traits, if fertilisation occurs. (2)
(8)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 Read the passage below.

NEW HOMININ SPECIES DISCOVERED

On 13 September 2013 scientists discovered fossils in the Sterkfontein Caves in South Africa which appeared to belong to a previously unknown species of hominins.

The fossils were classified as a new species, *Homo naledi*. The physical characteristics of *H. naledi* are described as having traits similar to the genus *Australopithecus*, mixed with traits more characteristic of the genus *Homo*. It appeared that *H. naledi* represented a transitional fossil.

An analysis of *H. naledi*'s skeleton suggests that it stood upright and was bipedal. The structure of the pelvis is similar to the Australopithecines, but its legs, feet and ankles are more similar to the genus *Homo*.

Four skulls were discovered, each with approximately half the volume of modern human skulls. The *H. naledi* skulls are closer in cranial volume to the skull of *Australopithecus,* but the cranium structure is more similar to those found in the genus *Homo.*

The teeth are much smaller than those of *Australopithecus* and similar to the teeth of modern humans.

[Adapted from https://humanorigins.si.edu/evidence]

2.1.1 Define the term *transitional fossil*. (2)

2.1.2 Name a characteristic from the passage that *Homo naledi* shared with both *Australopithecus* and *Homo*. (1)

2.1.3 State ONE other characteristic from the passage that *Homo naledi* shared only with *Australopithecus.* (1)

2.1.4 Explain TWO characteristics of a skeleton which are adaptations for bipedalism. (4)

2.1.5 Give ONE possible reason why there was a change to smaller teeth in modern humans. (3)
(11)

2.2 Study the table below that shows the change in antibiotic resistance in three strains of bacteria (MRSA, VRE and FQRP) over a period of 20 years.

YEAR	ANTIBIOTIC RESISTANCE (%)		
	MRSA	VRE	FQRP
1981	2	0	0
1985	10	0	0
1989	15	2	0
1993	40	5	5
1997	40	20	10
2001	60	20	25

[Source: http://wallace.genetics.uga.edu/groups/evol]

2.2.1 Which bacterial strain was the:

(a) Most resistant to antibiotics over the years (1)

(b) Last to develop antibiotic resistance (1)

2.2.2 Calculate the percentage increase in antibiotic resistance in VRE from 1993 to 1997. (3)

2.2.3 Draw a line graph to show the development of antibiotic resistance in the bacterial strain MRSA. (6)
(11)

2.3 The diagram below represents nitrogen-base sequences of a part of a nucleic acid that codes for making insulin. Insulin is necessary for the uptake of sugar from the blood.

The sequences below are from two individuals and are read from left to right. Sequence **1** is from a normal person and sequence **2** is from a person who shows a mutation and cannot produce insulin.

TWO NITROGEN-BASE SEQUENCES OF A PART OF A NUCLEIC ACID									
Sequence 1	TAG	CCA	CAC	GTT	ACA	ACG	TGA	AGG	TAA
Sequence 2	TAT	CCA	CAC	GTT	ACA	ACG	TGA	AGG	TAA

[Source: www.biologyjunction.com]

2.3.1 Which nucleic acid is represented in both sequences? (1)

2.3.2 Where did the mutation in the second sequence occur? (1)

The table below shows the amino acids coded for by different DNA base triplets.

AMINO ACID	DNA BASE TRIPLET
Glycine	CCG
	CCT
	CCC
Valine	CAT
	CAC
Histidine	GTA
	GTG
Proline	GGA
	GGC
Isoleucine	TAA
	TAT

2.3.3 Give the:

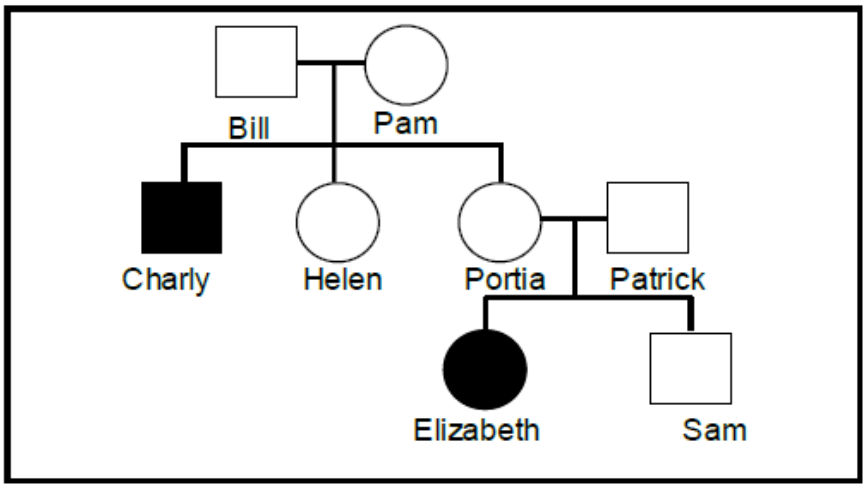
(a) Anticodon of the fourth base triplet on sequence **2** (2)

(b) Amino acid coded for by the first base triplet in sequence **2** (2)
(6)

2.4 Describe the process of *transcription in protein synthesis*. **(4)**

2.5 Tay-Sachs disease is caused by an autosomal recessive allele (**n**). Children with Tay-Sachs disease lose motor skills and mental functions. Over time, the children become blind, deaf, mentally retarded and paralysed. Tay-Sachs children die by the age of five.

The pedigree diagram below shows the inheritance of Tay-Sachs disease in a family.



[Source: www.tay-sachs.org]

2.5.1 Give:

(a) Charly's phenotype (2)

(b) Portia's genotype (2)

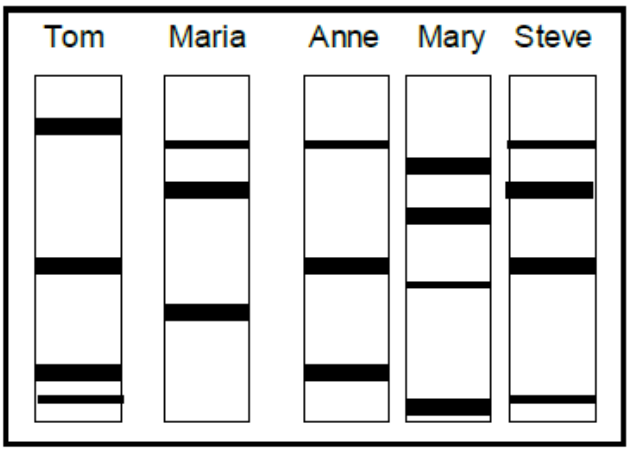
(c) Bill's genotype (2)

2.5.2 Explain why Patrick is normal, but a carrier of Tay-Sachs disease. (2)
(8)
[40]

QUESTION 3

3.1 Tom and Maria have three children. One of the three children was adopted. A DNA profile for each member of the family was prepared to determine if Tom is the father of all three children (Anne, Mary and Steve).

The DNA profiles are given below.



3.1.1 Which ONE of the children has been adopted? (2)

3.1.2 Explain your answer to QUESTION 3.1.1. (2)
(4)

3.2 Human blood groups are controlled by multiple alleles.

3.2.1 How many alleles control blood groups? (1)

3.2.2 Which TWO alleles are codominant in the inheritance of blood groups? (2)

3.2.3 A man is heterozygous for blood group A and marries a woman who has blood group O. Use a genetic cross to show the phenotypic ratio of their offspring. (7)
(10)

3.3 Haemophilia is a genetic disorder caused by a recessive allele on the X chromosome.

A haemophiliac female marries a normal male. Explain why all their sons will be haemophiliacs. **(4)**

3.4 Finches of the species *Geospiza fortis* are found on one of the Galápagos Islands. There was variation in the size of their beaks.

All the finches used to feed on small, soft seeds which were plentiful on the island. Then the island was affected by a severe drought which made food scarce.

Many of the plants on the island died. The small, soft seeds were all gone. Only hard, woody seeds remained.

Scientists conducted an investigation to determine the relationship between beak size and survival of the finches before and during the drought.

The table below shows the results of part of the investigation.

BEAK SIZE (mm)	TOTAL NUMBER OF FINCHES BEFORE THE DROUGHT	TOTAL NUMBER OF FINCHES DURING THE DROUGHT
7,3	2	0
7,8	12	2
8,3	30	4
8,8	48	4
9,3	45	6
9,8	40	8
10,3	25	10

[Adapted from *Excerpt Evolution*, Roberts et al.]

3.4.1 List FOUR steps that the scientists followed to obtain their results. (4)

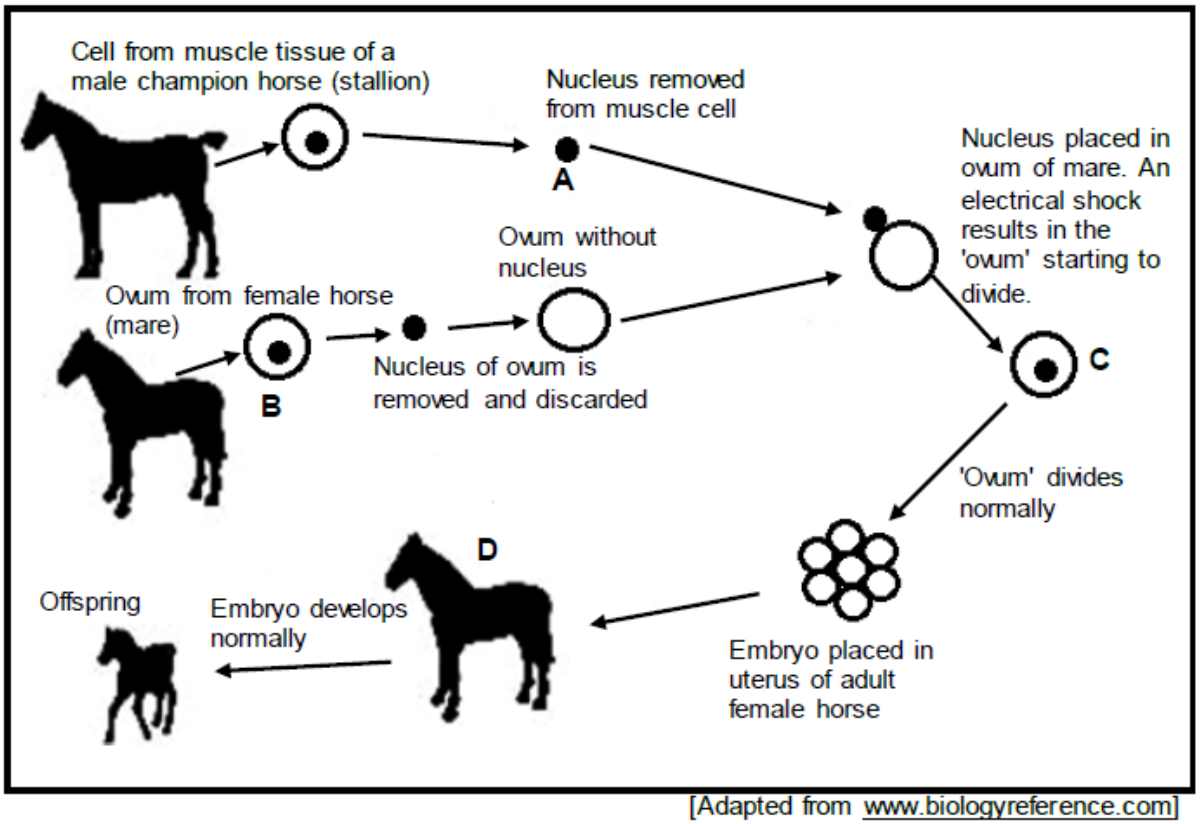
3.4.2 Name the independent variable of this investigation. (1)

3.4.3 Describe the relationship between the number of finches during the drought and beak size. (2)

3.4.4 Give a possible reason for the relationship in your answer to QUESTION 3.4.3. (3)

3.4.5 Predict which beak size(s) would be present in the population if the drought continued. (1)
(11)

3.5 The diagram below shows a genetic engineering process. A donor cell was taken from the muscle cell of a male champion horse (stallion) to create a new offspring.



[Adapted from www.biologyreference.com]

3.5.1 Name the:

(a) Genetic engineering process shown in the diagram above (1)

(b) Process that produced ovum **B** (1)

3.5.2 Why is the donor cell extracted from a champion horse? (2)

3.5.3 Explain why only the nucleus of the donor cell is used. (2)

3.5.4 A somatic cell in a horse contains 64 chromosomes.

How many chromosomes would there be in:

(a) Structure **A** (1)

(b) Ovum **B** (1)

(c) A muscle cell in organism **D** (1)

3.5.5 Explain why the 'ovum' labelled **C** cannot be considered a gamete. (2)

(11)

[40]

TOTAL SECTION B: 80

SECTION C

QUESTION 4

The anole lizard of the Caribbean Islands represents a group of about 150 closely related species, which evolved within the past 50 million years from a single species.

Use this example to describe how natural selection led to the process of speciation that gave rise to the 150 different species of lizards.

Content: (17)
Synthesis: (3)
(20)

NOTE: NO marks will be awarded for answers in the form of a table, flow charts or diagrams.

TOTAL SECTION C: 20
GRAND TOTAL: 150

LIFE SCIENCES P1

NOVEMBER 2017

SECTION A

QUESTION 1

1.1 Various options are provided as possible answers to the following questions. Choose the answer and write only the letter (A to D) next to the question number (1.1.1 to 1.1.10) in the ANSWER BOOK, for example 1.1.11 D.

1.1.1 The part of the brain that is responsible for higher thought processes is the …

A cerebellum.
B medulla oblongata.
C hypothalamus.
D cerebrum.

1.1.2 The central nervous system is made up of the …

A cranial and spinal nerves.
B brain and spinal cord.
C sympathetic and parasympathetic nerves.
D autonomic and peripheral nervous systems.

1.1.3 Which ONE of the following is the dark-coloured layer of the eye, which is rich in blood vessels?

A Conjunctiva
B Sclera
C Cornea
D Choroid

1.1.4 Which ONE of the following parts of the eye contains the photoreceptors?

A Retina
B Iris
C Sclera
D Vitreous humour

1.1.5 Which structures in the eye are responsible for the refraction of light?

A Pupil and iris
B Blind spot and yellow spot
C Cornea and lens
D Sclera and suspensory ligaments

1.1.6 Which ONE of the following occurs when you look up from reading a book on a clear, sunny day to focus on a mountain more than 100 metres away?

A Radial muscles of the iris contract.
B Pupil becomes dilated.
C Ciliary muscles relax.
D Lens becomes more convex.

1.1.7 Which ONE of the following pathways represents a reflex arc?

A Muscle → Spinal cord → Brain
B Effectors → Spinal cord → Receptor
C Receptor → Spinal cord → Brain
D Receptor → Spinal cord → Muscle

1.1.8 After exercising in a gymnasium people often go into a steam room to relax their muscles. The average temperature in a steam room is 41 °C and the humidity is between 80% and 100%.

Which ONE of the following explains why people are advised NOT to stay in a steam room for longer than 15 minutes?

A Increased sweating will cause overcooling.
B Sweat will not evaporate causing overheating.
C Vasoconstriction will lower sweat production.
D Heat receptors in the skin will be damaged.

1.1.9 A tumour in the hypothalamus of the brain of a patient caused a condition called diabetes insipidus. Below are some of the patient's symptoms:

- Dehydration
- Production of large quantities of dilute urine

Which ONE of the following is the most likely effect of the tumour?

A Increased secretion of TSH
B Decreased secretion of ADH
C Increased reabsorption of water in the kidneys
D Increased permeability of the collecting ducts in the kidney to water

1.1.10 Contraceptive pills which prevent pregnancy are likely to contain …

A high levels of FSH and progesterone.
B high levels of LH and oestrogen.
C high levels of only FSH.
D high levels of only progesterone. (10 x 2) **(20)**

1.2 Give the correct **biological term** for each of the following descriptions. Write only the term next to the question number (1.2.1 to 1.2.10) in the ANSWER BOOK.

1.2.1 A type of fertilisation in which the nucleus of a sperm fuses with the nucleus of an ovum outside the body of the female

1.2.2 The point where two chromatids overlap during prophase I

1.2.3 A hormone which regulates the salt balance in the human body

1.2.4 The maintenance of a constant internal environment in the human body within certain limits

1.2.5 A type of egg where the embryo develops inside a fluid-filled sac which is surrounded by a shell

1.2.6 A hormone that stimulates the development of the corpus luteum

1.2.7 A disorder of the eye caused by the curvature of the lens or cornea being uneven, resulting in distorted images

1.2.8 The structure that connects the left and right hemispheres of the brain, allowing communication between them

1.2.9 The nerve that carries impulses from the retina to the brain

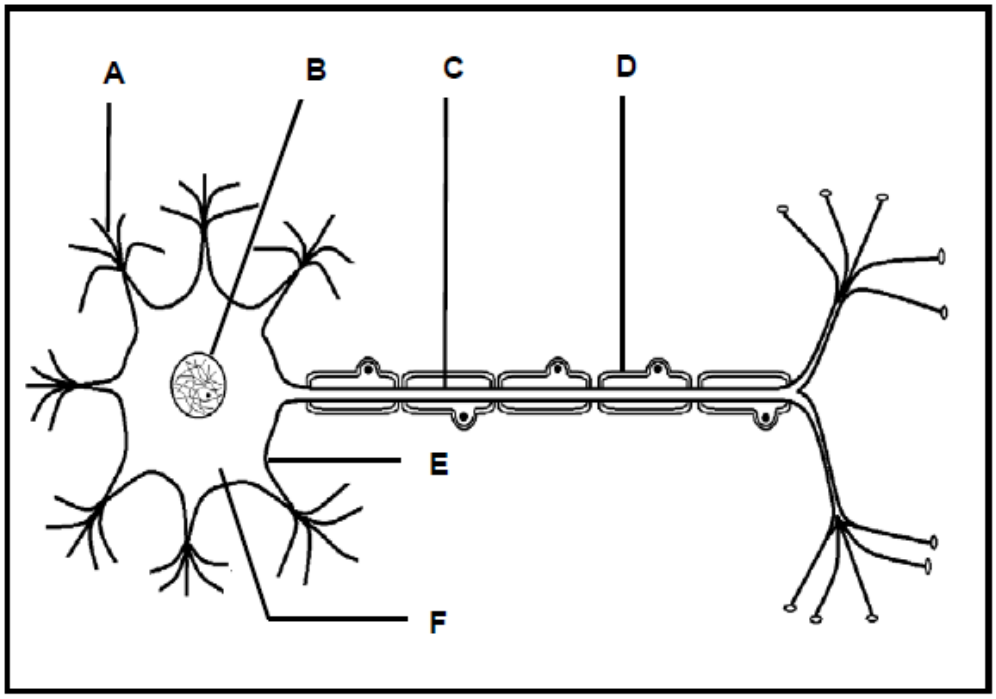
1.2.10 Collective name for the membranes that protect the brain and spinal cord (10 x 1) **(10)**

1.3 Indicate whether each of the descriptions in COLUMN I applies to **A ONLY**, **B ONLY**, **BOTH A AND B** or **NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B** or **none** next to the question number (1.3.1 to 1.3.3) in the ANSWER BOOK.

	COLUMN I	COLUMN II
1.3.1	Reduces greenhouse gases in the atmosphere	A: Landfill sites B: Deforestation
1.3.2	Reproductive strategy in birds where hatchlings are helpless and unable to move and feed themselves	A: Precocial B: Altricial
1.3.3	Type of reproduction in vertebrates where the foetus is attached to and develops inside the uterus	A: Vivipary B: Ovovivipary

(3 x 2) **(6)**

1.4 The diagram below represents the structure of a neuron.



1.4.1 Name the type of neuron in the diagram above. (1)

1.4.2 Identify part:

(a) **B** (1)

(b) **F** (1)

(c) **A** (1)

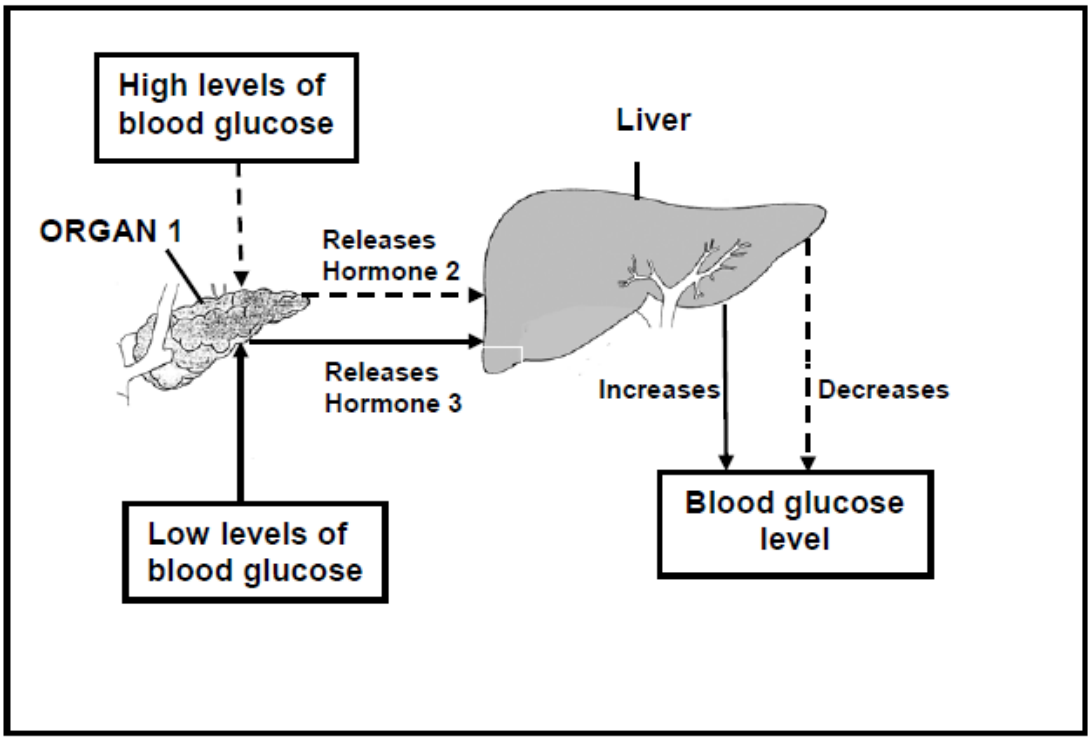
1.4.3 Give the LETTER and NAME of the part that:

(a) Transmits impulses away from the cell body (2)

(b) Insulates and speeds up the transmission of impulses (2)

1.4.4 Name the condition caused by the progressive degradation of part **D**. (1)
(9)

1.5 Study the flow diagram below.



Identify:

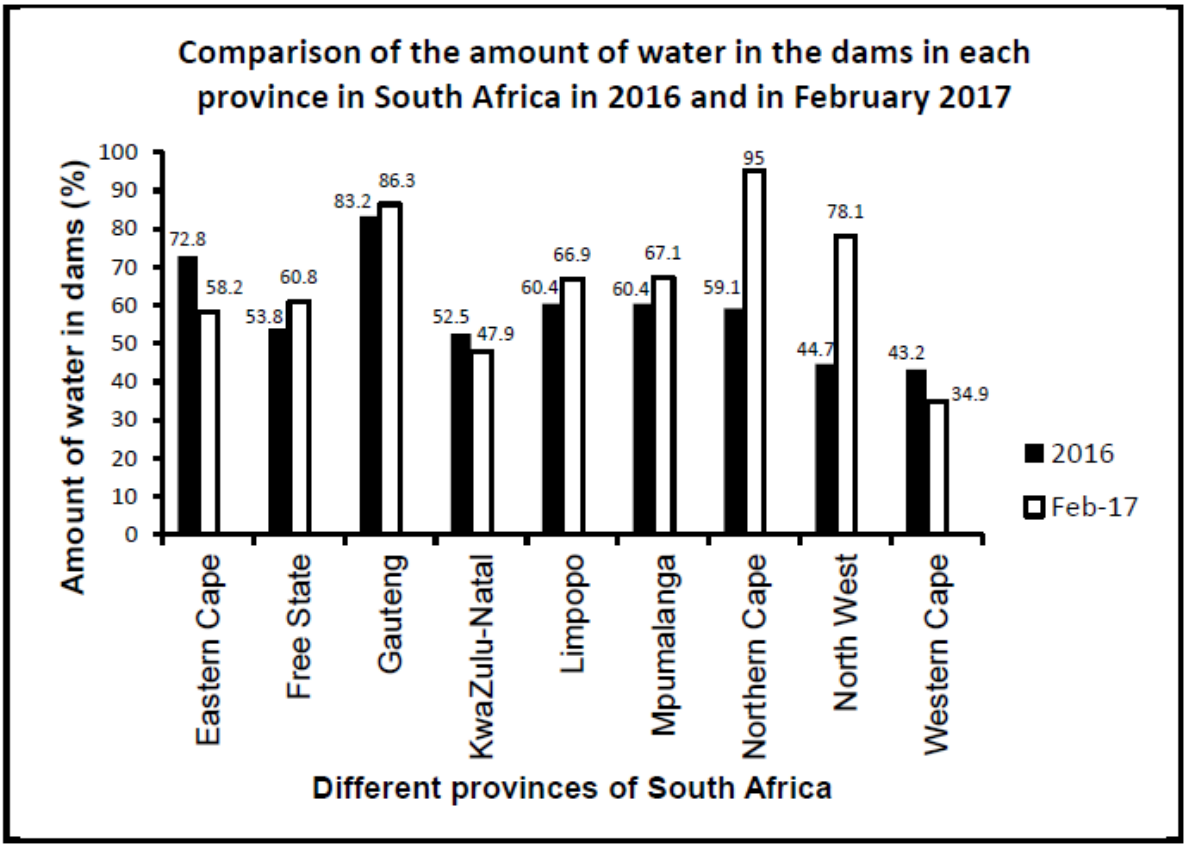
1.5.1	Organ **1**	(1)
1.5.2	Hormone **2**	(1)
1.5.3	Hormone **3**	(1)
1.5.4	The disorder caused when organ **1** fails to release sufficient amounts of hormone **2**	(1)
1.5.5	The mechanism that controls the levels of glucose in the body	(1) **(5)**

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 The graph below indicates the amount of water in the dams in each province shown as a percentage of the capacity of the dams. The information shows the amount of water in 2016 and at the end of February 2017.



2.1.1 Which province had the **most** water in their dams in February 2017? (1)

2.1.2 Which province had the **greatest decrease** in the amount of water from 2016 to February 2017? (1)

2.1.3 The amount of water in the dams of North West increased by 33,4% from 2016 to February 2017. Calculate the percentage increase this represents in comparison to the amount of water in 2016. (3)

2.1.4 Which TWO provinces had the **lowest** amount of water in their dams in February 2017? (2)

2.1.5 Explain TWO possible strategies, other than water restrictions, that the provincial governments of the provinces named in QUESTION 2.1.4 could implement to reduce the water shortages. (4)

2.1.6 Explain TWO ways in which the building of dams could have a negative effect on the environment. (4)

(15)

2.2 Read the extract below.

INVASION OF *SPODOPTERA FRUGIPERDA* (ARMY WORM) THREATENS FOOD SECURITY IN SOUTH AFRICA

A crop-destroying caterpillar species (commonly known as the army worm) endemic to North and South America is spreading rapidly in Africa, including South Africa and is raising concerns about food security.

Different opinions exist on how the army worm reached Africa. The eggs may have arrived in maize imports or high altitude winds may have helped the moths to cross the Atlantic Ocean.

Specific pesticides have been identified to help combat the army worm.

2.2.1 Define *food security*. (2)

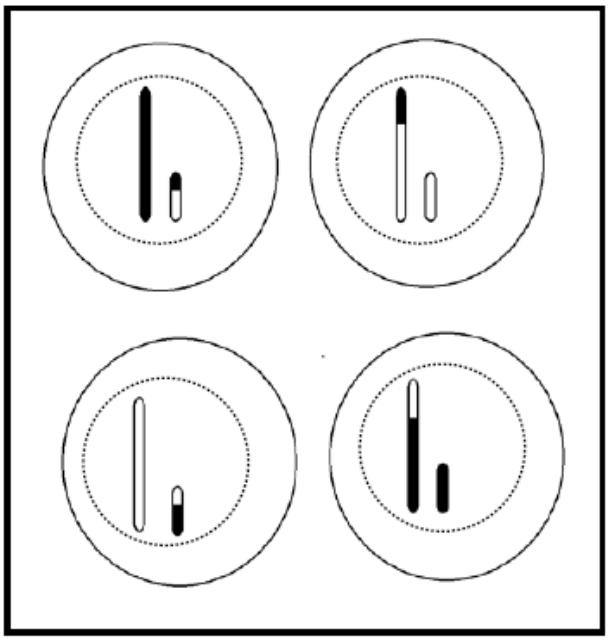
2.2.2 Give ONE phrase in the extract which implies that the army worm is an alien species on the African continent. (1)

2.2.3 According to the passage, state TWO ways in which the army worm could have been introduced into Africa. (2)

2.2.4 Refer to the passage and name the type of control (mechanical, biological or chemical) used currently to fight the spreading of the army worm. (1)

2.2.5 Explain ONE way in which the army worm could have a negative influence on the economy of South Africa. (2)
(8)

2.3 Study the diagram of a phase during meiosis below.



2.3.1 Identify the phase in the diagram above. (1)

2.3.2 Give TWO visible reasons for your answer to QUESTION 2.3.1. (2)

2.3.3 How many chromosomes:

(a) Are present in EACH cell in the diagram (1)

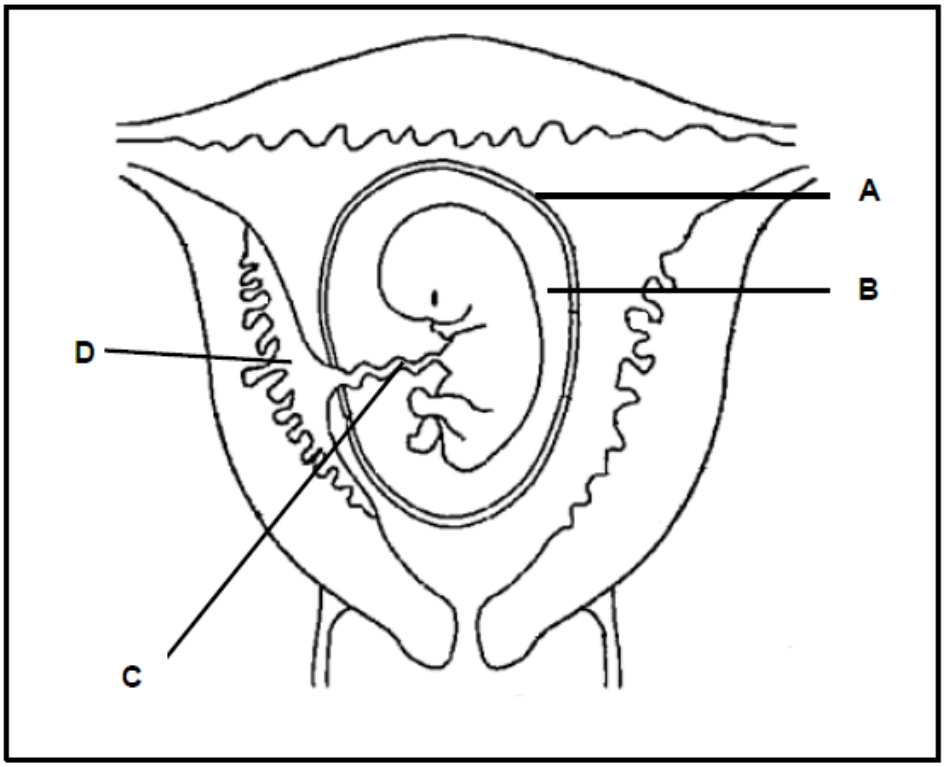
(b) Were present in the original cell at the start of meiosis (1)

2.3.4 The cells in the diagram are NOT identical.

(a) Name TWO processes during meiosis that lead to the cells being different from one another. (2)

(b) Explain the significance to a species of the cells being different from one another. (3)
(10)

2.4 The diagram below represents a developing foetus in a human body.



2.4.1 Identify:

(a) **A** (1)

(b) **C** (1)

2.4.2 State TWO functions of the fluid in part **B**. (2)

2.4.3 Name ONE system in the baby's body that takes over the function of part **D** once the baby is born. (1)

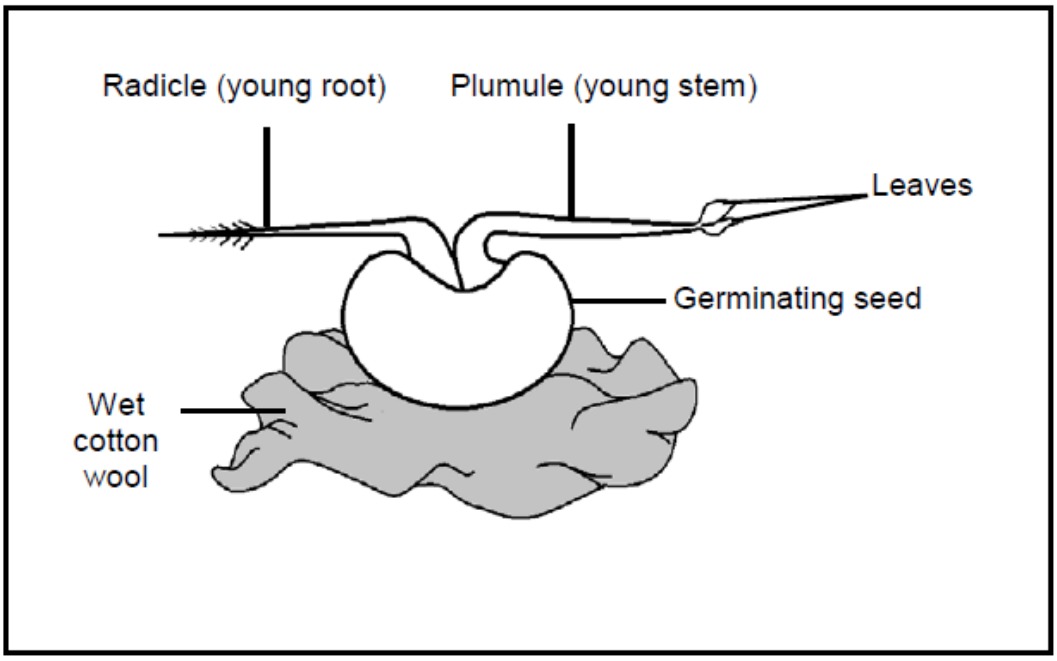
2.4.4 Explain ONE negative impact on foetal development if part **D** is reduced significantly. (2)

(7)

[40]

QUESTION 3

3.1 The diagram below represents a germinating seed. Assume that the radicle and plumule were exposed to uniform light from all directions.



3.1.1 Define *tropism*. (2)

3.1.2 Draw a labelled diagram to show the position of the radicle and plumule in the seedling one week later. (4)
(6)

3.2 Auxins influence the growth of stems and roots.

3.2.1 State where auxins are produced in a plant. (1)

3.2.2 Describe the effect of auxins on a plant stem that is exposed to unilateral light. (4)
(5)

3.3 An investigation was conducted to determine the effect of different amounts of thyroxin on metabolic rate.

The procedure was as follows:

- Nine healthy adult male rats were used.
- They were divided into three groups of three rats each: **A**, **B** and **C**.
- All three groups were kept in the same environment in three separate cages.
- Each group received the same amount of water.
- Each group was given a different diet.
- Their initial mass was taken.
- Three weeks later the mass was taken again.
- Their oxygen consumption was also measured.

DIET **X**: Food containing all the essential nutrients
DIET **Y**: Food containing all the essential nutrients and an extract of thyroxin
DIET **Z**: Food containing all the essential nutrients and a chemical that inhibits the effect of thyroxin

The table below shows the results of the investigation.

GROUP	DIET	AVERAGE MASS OF RATS (g)		AVERAGE OXYGEN CONSUMPTION (mℓ/kg/min)
		INITIAL	AFTER THREE WEEKS	
A	X	319	321	4,0
B	?	320	309	10,0
C	?	318	340	2,7

NOTE: Group **A** was given DIET **X**.

3.3.1 Name the group(s) (**A**, **B** or **C**) in which the average mass of the rats increased. (2)

3.3.2 For this investigation state the:

(a) Independent variable (1)

(b) Dependent variable and how it was measured (2)

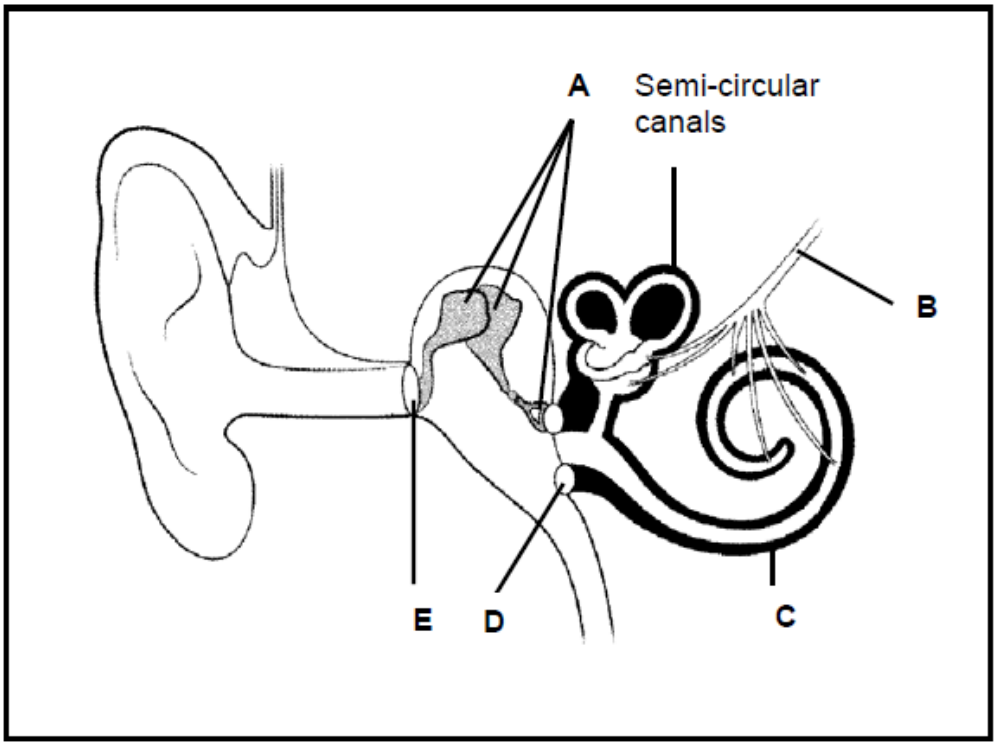
3.3.3 Arrange the diets (**X**, **Y** and **Z**) in order of increasing amounts of thyroxin that would be found in the rats after they were given these diets. (2)

3.3.4 Which group (**B** or **C**) was given diet **Y**? (1)

3.3.5 Refer to changes in mass and oxygen consumption of the rats in the table above. Explain your answer to QUESTION 3.3.4. (5)

3.3.6 State THREE ways in which the validity of this investigation could be increased. (3)
(16)

3.4 Study the diagram of the human ear below.



3.4.1 Identify:

(a) **B** (1)

(b) **D** (1)

3.4.2 Which part of the brain will receive impulses from part **C**? (1)

3.4.3 Describe the role of the semi-circular canals in maintaining balance. (5)

3.4.4 Describe how an increased production of mucus in the nose and throat may lead to the bursting of part **E**. (3)

3.4.5 Explain why fusion of the structures at **A** may lead to hearing loss. (2)
(13)
[40]

TOTAL SECTION B: 80

SECTION C

QUESTION 4

Sperm is produced, transported and then combined with secretions from the accessory glands to form semen. The semen is then transferred into the body of the female where it meets the ovum.

Describe all the processes referred to in the statement above and explain THREE structural adaptations of the sperm for fertilisation.

Content: (17)
Synthesis: (3)
(20)

NOTE: NO marks will be awarded for answers in the form of flow charts, tables or diagrams.

TOTAL SECTION C: 20
GRAND TOTAL: 150

SOLUTIONS

PRINCIPLES RELATED TO MARKING LIFE SCIENCES

1. **If more information than marks allocated is given**
   Stop marking when maximum marks is reached and put a wavy line and 'max' in the right-hand margin.

2. **If, for example, three reasons are required and five are given**
   Mark the first three irrespective of whether all or some are correct/incorrect.

3. **If whole process is given when only a part of it is required**
   Read all and credit the relevant part.

4. **If comparisons are asked for but descriptions are given**
   Accept if the differences/similarities are clear.

5. **If tabulation is required but paragraphs are given**
   Candidates will lose marks for not tabulating.

6. **If diagrams are given with annotations when descriptions are required**
   Candidates will lose marks.

7. **If flow charts are given instead of descriptions**
   Candidates will lose marks.

8. **If sequence is muddled and links do not make sense**
   Where sequence and links are correct, credit. Where sequence and links are incorrect, do not credit. If sequence and links become correct again, resume credit.

9. **Non-recognised abbreviations**
   Accept if first defined in answer. If not defined, do not credit the unrecognised abbreviation but credit the rest of the answer if correct.

10. **Wrong numbering**
    If answer fits into the correct sequence of questions but the wrong number is given, it is acceptable.

11. **If language used changes the intended meaning**
    Do not accept.

12. **Spelling errors**
    If recognisable, accept the answer, provided it does not mean something else in Life Sciences or if it is out of context.

13. **If common names are given in terminology**
    Accept, provided it was accepted at the national memo discussion meeting.

14. **If only the letter is asked for but only the name is given (and vice versa)**
    Do not credit.

15. **If units are not given in measurements**
Candidates will lose marks. Memorandum will allocate marks for units separately.

16. **Be sensitive to the sense of an answer, which may be stated in a different way.**

17. **Caption**
All illustrations (diagrams, graphs, tables, etc.) must have a caption.

18. **Code-switching of official languages (terms and concepts)**
A single word or two that appear(s) in any official language other than the learners' assessment language used to the greatest extent in his/her answers should be credited if it is correct. A marker that is proficient in the relevant official language should be consulted. This is applicable to all official languages.

19. **Changes to the memorandum**
No changes must be made to the memoranda without consulting the provincial internal moderator who in turn will consult with the national internal moderator (and the Umalusi moderators where necessary).

20. **Official memoranda**
Only memoranda bearing the signatures of the national internal moderator and the Umalusi moderators and distributed by the National Department of Basic Education via the provinces must be used.

LIFE SCIENCES P1

NOVEMBER 2014

MEMORANDUM

SECTION A

QUESTION 1

1.1	1.1.1	A✓✓		
	1.1.2	B✓✓		
	1.1.3	A✓✓		
	1.1.4	D✓✓		
	1.1.5	C✓✓		
	1.1.6	A✓✓		
	1.1.7	C✓✓		
	1.1.8	D✓✓		
	1.1.9	C✓✓		
	1.1.10	B✓✓	(10 x 2)	**(20)**
1.2	1.2.1	Meninges✓		
	1.2.2	Gibberellin✓		
	1.2.3	Peripheral ✓nervous system		
	1.2.4	Parasympathetic✓system		
	1.2.5	Chorion✓		
	1.2.6	Aldosterone✓		
	1.2.7	Umbilical vein✓		
	1.2.8	TSH✓ /thyroid stimulating hormone		
	1.2.9	Gestation✓		
	1.2.10	Acrosome✓		**(10)**
1.3	1.3.1	A only✓✓		
	1.3.2	B only✓✓		
	1.3.3	None✓✓		
	1.3.4	B only✓✓		
	1.3.5	Both A and B✓✓		
			(5 x 2)	**(10)**
1.4	1.4.1	A✓ - Iris✓		(2)
	1.4.2	C✓ - Choroid✓		(2)
	1.4.3	E✓ - Optic nerve✓		(2)
	1.4.4	D✓ - Fovea✓/yellow spot		(2)
	1.4.5	B✓ - Cornea✓		(2)
				(10)

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1	2.1.1	A - Urethra✓ B - Vas deferens✓/sperm duct F - Fallopian tube✓/oviduct		(3)
	2.1.2	(a) - Protects the sperm cell against the acidic environment of the vagina✓ - Increases the motility of the sperm✓ - Provides nutrients✓ **(Mark first ONE only)**	Any	(1)
		(b) - Place for foetus to develop ✓ - Maintain pregnancy✓ - Assist in childbirth✓ - Implantation✓ of blastula - Protects the foetus✓/prevents infections(mucus plug forms by cervix) - Passage for sperm cells✓between vagina and fallopian tubes **(Mark first ONE only)**	Any	(1)
	2.1.3	(a) D✓ (b) G✓		(1) (1)
	2.1.4	(a) Spermatogenesis✓ (b) Oogenesis✓		(1) (1)
	2.1.5	- Serves as a birth canal✓ - Allows for passage of blood/ endometrial lining/amniotic fluid/placenta - Facilitates sexual intercourse ✓/receives semen - Secretes acid which prevents infections✓ **(Mark first TWO only)**	Any	(2)
	2.1.6	- To keep the testes at a temperature that is lower than body temperature✓/optimum temperature for sperm production - which is necessary for the production of healthy sperm✓/so that healthy sperms can survive		(2) **(13)**
2.2	2.2.1	FSH✓ **OR** Oestrogen✓ **(Mark first ONE only)**	Any	(1)
	2.2.2	-The follicle✓develops✓ during this period stimulated by increased levels of FSH -The lining of the endometrium✓ thickens✓ during this period stimulated by increased levels of oestrogen **(Mark first ONE only)**	Any(1 x 2)	(2)

2.2.3
- Corpus luteum has not disintegrated✓
- it continues to secrete progesterone✓
- so the endometrial lining remains thickened✓ (3)

2.2.4
- The zygote✓
- undergoes mitosis✓
- until a ball of cells is formed✓
- called a morula✓
- The morula continues to divide and forms a mass of cells with a hollow cavity✓
- called a blastocyst✓
- the outer membrane of the blastocyst forms chorionic villi✓/ attachment villi
- which attaches it to the endometrium✓ Any (5)

2.2.5
(a) For family planning✓/ to know when they can get pregnant (1)

(b) LH✓/FSH/oestrogen
- There is a rise in levels✓ of LH/FSH/oestrogen
- around the time of ovulation✓ (3)
(15)

2.3 2.3.1
(a) A and B✓ (1)

(b) A and C✓ (1)

2.3.2
- To ensure that the results are attributed to gravity✓
- and not light✓/ to eliminate the effect of light (2)

2.3.3
B – No growth will be observed✓
C – Roots will grow **horizontally**✓/not change direction (2)

2.3.4
- Auxins will move to the lower side of the root✓/attracted by gravity
- and a high concentration will inhibit growth on the lower side of the roots✓
- while growth will occur faster on the upper side of the root✓
- causing the root to bend downwards✓ Any (3)

2.3.5
- Used same type of plant✓/pea only
- Seedlings were the same age✓/germination period was 7 days
- All groups were exposed to the same environment✓/light intensity/ placed in dark cupboard
- Same number of seedlings for each group✓
- Root tips were cut at the same length✓
- All seedlings placed in same position✓/horizontally
- Allowed same amount of time for the 3 groups✓
- Appropriate controls were set up✓ Any (3)

(Mark first THREE only) **(12)**
[40]

QUESTION 3

3.1	3.1.1	Number of kilograms of wheat per hectare✓/Yield	(1)
	3.1.2	To compare✓the yield obtained when using two types of fertiliser with the yield of the hectare with no fertiliser✓ **OR** It acts as a control✓- to ensure that the results obtained are due to the addition of fertilisers✓ and not any other factor Any(1x2)	(2)
	3.1.3	- She could have increased the sample size✓/number of plots/ number of plants for each type of fertiliser used - Repeated the investigation✓ **(Mark first ONE only)** Any	(1)
	3.1.4	- Depletes nutrients in the soil✓ - Leads to decrease in yield✓ - Increases pests✓ - Leads to soil erosion✓ - Decreases biodiversity✓ **(Mark first THREE only)** Any	(3)
	3.1.5	- The excessive use of fertilisers increases the nutrient content✓of the surrounding river /eutrophication occurs/ water becomes polluted - This causes an increase in algal growth✓ /algal bloom - The algae block out light✓ - reducing photosynthesis✓ - Plants and animals depending on them die✓ - increasing decomposition✓ - leading to a depletion of oxygen✓ - and reducing the biodiversity✓/reducing the number of animal and plant species in the river Any	(4) **(11)**
3.2	3.2.1	(a) - Carbon footprint is a measure of the total amount of greenhouse gas emissions✓/(example of greenhouse gas) - of an individual✓ /defined population/ company per year	(2)
		(b) - Food security refers to the availability and access✓ - to adequate, safe and nutritious food✓ to people at all times✓ Any	(2)
	3.2.2	- Energy used to produce and transport wasted food is lost✓ - The fossil fuels used in production and transport of wasted food✓ - and the decomposition of wasted food✓ - releases greenhouses gases ✓/examples of greenhouse gases - leading to the enhanced greenhouse effect✓ which eventually leads to global warming	(4)

	3.2.3	- Buy only what is needed in sufficient quantities✓ - Give to others what is not used instead of throwing away✓ - Educate about efficient farming methods✓ - Educate about ways to preserve food✓ - Improve storage facilities✓ - Improve the shelf-life of food✓ **(Mark first TWO only)**	Any	(2) **(10)**
3.3	3.3.1	Constricted✓		(1)
	3.3.2	- Less blood flows✓to the skin - so less heat is lost to the environment✓ by radiation - Less sweat is formed✓because less blood flows to the sweat glands - therefore less evaporation✓ of sweat - and hence less cooling✓ of the skin - Body heat is conserved✓	Any	(4)
	3.3.3	- Hypothalamus is stimulated✓ - sends message to the blood vessels of the skin to dilate✓/ vasodilation occurs - More blood flows✓to the surface of the skin - More heat is lost by radiation✓from the skin surface - More sweat is formed✓ because more blood flows to the sweat glands - and therefore more heat is lost by increased evaporation✓of sweat	Any	(4) **(9)**
3.4	3.4.1	- The blood glucagon levels increase✓/from 100 to 210 (picograms/ml) - from 0 to 20 min✓ - and become constant✓thereafter		(3)
	3.4.2	- during exercise more energy is needed✓ - therefore the rate of cellular respiration increased✓ - Increased cellular respiration requires more glucose✓ - hence more glucagon is secreted✓ - to stimulate the conversion of glycogen to glucose✓	Any	(3)
	3.4.3	Decrease✓		(1)
	3.4.4	- The lack of insulin✓/defective insulin - decreases the conversion✓ - of glucose to glycogen✓		(3) **(10)** **[40]**

SECTION C

QUESTION 4

As the ball moved towards the goalkeeper:

- Accommodation✓ took place
- Ciliary muscles contracted✓
- Suspensory ligaments became slack✓
- This reduced the tension on lens✓
- Lens became more convex✓/round
- Refractive power of the lens increased✓
- Image of the ball fell on the retina✓ Any (5)

Hearing
The shout of his team-mate was heard by the goal keeper as follows:

- The sound waves were directed by the pinna✓
- through the auditory canal✓
- to the tympanic membrane✓/eardrum
- causing it to vibrate✓
- The vibrations of the tympanic membrane were transferred to the ossicles✓ in the middle ear
- which eventually caused the oval window to vibrate✓
- This set up pressure waves in the cochlea✓
- This stimulated the Organ of Corti✓ in the cochlea
- to convert this stimulus into a nerve impulse✓
- which was then transmitted along the auditory nerve✓
- and interpreted in the cerebrum✓ Any (7)

Balance and equilibrium
As he dived:

- A change in the direction and speed✓of the body
- causes the movement of fluid in the semicircular canals✓
- which stimulates the cristae✓
- A change in the position of the head✓
- stimulated the maculae✓in the utriculus and sacculus
- The stimuli were converted into impulses✓
- which were transported along the auditory nerve✓
- and interpreted in the cerebellum✓
- which then sent impulses to the muscles✓
- to restore balance and equilibrium✓ Any (5)

Content (17)
Synthesis (3)

ASSESSING THE PRESENTATION OF THE ESSAY

Relevance	Logical sequence	Comprehensive
All information provided is relevant to the topic	Ideas arranged in a logical/ cause-effect sequence	Answered all aspects required by the essay
Only information relating to accommodation, hearing and balance & equilibrium is included. (There is no irrelevant information)	Logical sequence of events in accommodation, hearing and balance & equilibrium.	Includes sufficient information on all 3 processes, i.e. accommodation(**min 3/5**), hearing(**min 4/7**) and balance & equilibrium(**min 3/5**)
1 mark	1 mark	1 mark

TOTAL SECTION C: 20
GRAND TOTAL: 150

LIFE SCIENCES P2

NOVEMBER 2014

MEMORANDUM

SECTION A

QUESTION 1

1.1	1.1.1	B✓✓		
	1.1.2	D✓✓		
	1.1.3	C✓✓		
	1.1.4	D✓✓		
	1.1.5	A✓✓		
	1.1.6	C✓✓		
	1.1.7	B✓✓		
	1.1.8	D✓✓		
	1.1.9	A✓✓		
	1.1.10	B✓✓	(10 x 2)	**(20)**
1.2	1.2.1	Recessive✓		
	1.2.2	Gene✓		
	1.2.3	Cloning✓		
	1.2.4	Genetic engineering✓		
	1.2.5	Artificial selection✓		
	1.2.6	Punctuated equilibrium✓		
	1.2.7	Anaphase I✓		
	1.2.8	Non-disjunction✓		
	1.2.9	Chromosome✓		
	1.2.10	Theory✓		**(10)**
1.3	1.3.1	Both A and B✓✓		
	1.3.2	A only✓✓		
	1.3.3	Both A and B✓✓		
	1.3.4	Both A and B✓✓		
	1.3.5	A only✓✓		
	1.3.6	A only✓✓	(6 x 2)	**(12)**
1.4	1.4.1	Two characteristics✓ are involved in the cross		(1)
	1.4.2	(a) ttnn✓		(1)
		(b) TN; Tn; tN; tn✓✓	1 – 3 correct ✓ all 4 correct ✓✓	(2)
	1.4.3	Taste-blind✓ and normal skin pigmentation✓		(2)
	1.4.4	TTNN✓✓		(2)
				(8)
			TOTAL SECTION A:	**50**

QUESTION 2

2.1. 2.1.1 Translation✓ (1)

2.1.2 X - tRNA✓/ transfer RNA
Y - mRNA✓/ messenger RNA (2)

2.1.3 Anticodon✓ (1)

2.1.4 ATA✓ (1)

2.1.5 Tyrosine✓✓ (2)

2.1.6 - **The process is transcription✓*** **(1)**

- The double stranded DNA molecule unwinds✓/unzips
- When the hydrogen bonds break✓
- One strand is used as a template✓
- to form mRNA ✓
- Using free nucleotides✓ from the nucleoplasm
- The mRNA is complementary to the DNA✓/ A-U, C-G
- This process is controlled by enzymes✓ Any (4)

indicates a compulsory mark 1 (5)
(12)

2.2 2.2.1 Lindiwe✓ and Bandile✓
(Mark first TWO only) (2)

2.2.2 They have DNA bands which correspond✓
with the banding patterns from both parents✓/ Zinhle and Ayanda (2)

2.2.3
- To investigate crimes✓/ resolve disputes
- To identify organisms from their remains✓
- To identify family relationships other than paternity✓, e.g. siblings or cousins
- To test for the presence of specific alleles✓/ genes that cause a genetic disorder
- To establish matching tissues for organ transplants✓

(Mark first TWO only) Any 2 (2)
(6)

2.3 2.3.1 *Homo habilis*✓ (1)

2.3.2 *Paranthropus robustus*✓,*Paranthropus boisei*✓,
Homo sapiens✓ *and Homo habilis*✓
(Mark first TWO only) Any 2 (2)

2.3.3 *Australopithecus afarensis*✓ (1)

2.3.4
- Olfactory brain centres reduced✓/ reduced sense of smell
- Eyes in front✓/ Binocular vision / stereoscopic vision
- Eyes with cones✓/ colour vision
- Freely rotating arms✓
- Elbow joints allowing rotation of forearm✓
- Flat nails instead of claws✓/ bare, sensitive finger tips
- Opposable thumbs✓
- Bipedal✓/ upright posture / foramen magnum in a more forward position
- Sexual dimorphism✓/ distinct differences between males and females
- Parts of the brain that process information from the hands and eyes are enlarged✓
- Longer upper arms✓
- Large brains✓ / skulls compared to their body mass
- Five digits per limb✓

(Mark first FIVE only) Any 5 (5)

2.3.5 1- 1,2 my✓/1 000 000 – 1 200 000 years (1)

(10)

2.4 2.4.1
- More✓/ fewer
- long-winged✓/ short-winged flies
- will survive✓/ die

OR

- Equal numbers✓
- of both types of flies✓
- will survive✓/ die (3)

2.4.2
- CO_2 to move out and O_2 to move in✓ / ventilation
- To allow respiration✓/ breathing
- So that flies do not die✓/ suffocate

(3)

2.4.3
- Repeat the investigation✓
- Increase the number of flies✓
- Using many flasks✓/ replications

(Mark first TWO only) Any 2 (2)

2.4.4
- Ensure that the flies do not come into contact with the sticky paper✓ when placing them in the flask so that their death will not be caused by the investigator✓
- Ensure sufficient food supply✓for the period of the investigation so that death of flies is not due to hunger✓
- The openings for airflow should be small✓ enough so that the flies cannot escape✓/ or others enter
- Maintain optimum environmental conditions✓ to allow the flies to survive✓/ behave normally

(Mark first TWO only) Any 2 x 2 (4)

(12)

[40]

QUESTION 3

3.1 3.1.1 2✓ (1)

3.1.2 **A and B** can interbreed and produce fertile offspring, making them **one species**✓

A does not mate with **C**, which makes C a **different species**✓/**B** cannot produce fertile offspring with **C**, which makes C a **different species** (2)

3.1.3
- ***Wind blew butterflies to next island**✓ **(1)**
- Thus separating them geographically✓
- As the separate islands had different environmental conditions ✓/ have different vegetation/different food for butterflies
- each group underwent natural selection independently✓
- and developed differently✓
- genotypically and phenotypically✓
- Gene flow/ reproduction between population A / B and C did not occur✓
- resulting in a new species✓ Any (4)

***Compulsory 1 mark** (5)
(8)

3.2 3.2.1
- Provided additional nutrients✓ all year round
- Provided Vitamin D✓
- Provided calcium✓

(Mark first ONE only) Any 1 (1)

3.2.2
- Primitive humans / *H. erectus* migrated out of Africa long before✓ the ability to digest milk evolved✓
- They did not have the mutation✓/ enzyme / gene / allele that would allow them to digest cow's milk✓

Any 1 x 2 (2)

3.2.3 Mutations on mitochondrial DNA✓ (1)

(4)

3.3 3.3.1 B✓ (1)

3.3.2 - The pelvis is shorter✓compared to its width✓

OR

- The pelvis is wider✓ compared to its height✓

(Mark first ONE only) (2)

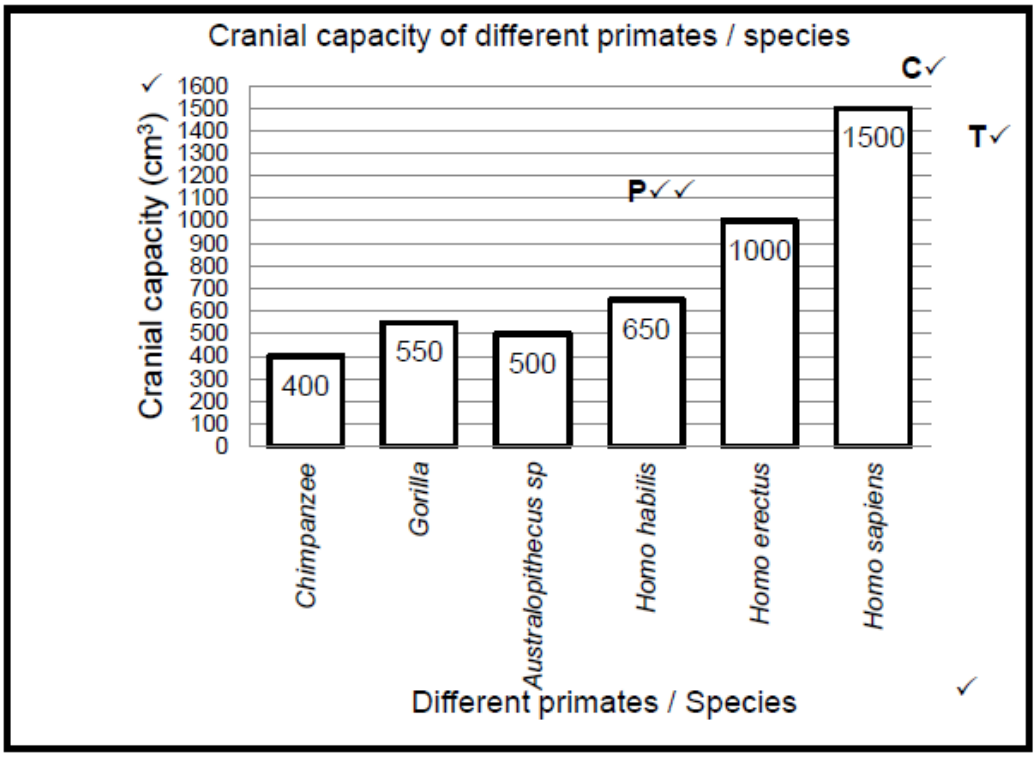
3.3.3
- Frees the arms✓ so that they could carry offspring✓/ tools / food / manipulate things
- Allows ability to see further✓ to spot danger✓/ food
- Exposes a large surface area✓ for thermoregulation✓
- Reduces the surface area exposed to the sun✓ so less heat is absorbed✓/ less heat lost/thermoregulation
- Expose the genitals✓to attract opposite sex✓
- Efficient locomotion✓allows to travel longer distances✓

(Mark first TWO only) Any 2 x 2 (4)
(7)

3.4 3.4.1
- Allows for a bigger brain✓
- Development of speech✓/ communication
- Higher intelligence✓
- Complex behaviour✓
- Quick processing of information✓
- Process large amounts of information✓

(Mark first TWO only) Any 2 (2)

3.4.2



Mark allocation of the graph

Criterion	Elaboration	Mark
Type of graph (T)	Bar graph drawn	1
Caption (C)	Includes both variables: 'different primates / species' and 'cranial capacity'	1
X-axis	Equal width of bars AND Correct label (different primates / species and names of species)	1
Y-axis	Appropriate scale AND Correct label and units for Y-axis (cm^3)	1
Drawing of bars (P)	1-5 bars plotted correctly – 1 mark All 6 bars plotted correctly – 2 marks	2

(6)

NOTE: If axes are transposed:
- Marks will be lost for labelling of 'X-axis 'and 'Y-axis' **(8)**

3.5 3.5.1 (a) Normal female✓ (1)

(b) X^HX^h✓✓ (2)

3.5.2
- Haemophilia is caused by a recessive allele✓
- Carried on the X chromosome✓
- Females have two X chromosomes✓/ Males only have one X chromosome
- Females must inherit two copies of the recessive allele✓/ females who inherit only one of the recessive allele are still normal

Any 3 (3)

3.5.3

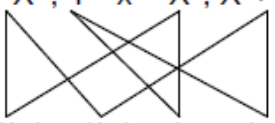
P_1/P_3 Phenotype Normal male x Haemophiliac female✓

Genotype X^HY x X^hX^h✓

Meiosis

G/gametes X^H, Y x X^h, X^h✓

Fertilisation



F_1/F_3 Genotype X^HX^h; X^HX^h; X^hY; X^hY✓

Phenotype 2 normal daughters : 2 haemophiliac sons✓

* **50%✓ chance of having a haemophiliac son**

P_1 and F_1✓

Meiosis and fertilisation✓

***1 compulsory** +any 6 (7)

OR

P_1/P_3 Phenotype Normal male x Haemophiliac female ✓

Genotype X^HY x X^hX^h✓

Meiosis

Fertilisation

Gametes	X^h	X^h
X^H	X^HX^h	X^HX^h
Y	X^hY	X^hY

1 mark for correct gametes
1 mark for correct genotypes

F_1/F_3 Phenotype 2 normal daughters : 2 haemophiliac sons✓

* **50%✓ chance of having a haemophiliac son**

P_1 and F_1✓

Meiosis and fertilisation✓ ***1 compulsory**+any 6 (7)

(13)

[40]

TOTAL SECTION B: 80

SECTION C

QUESTION 4

Meiosis

- Crossing over✓
- occurs during prophase I✓
- Homologous chromosomes / chromatids overlap✓
- at points called chiasma✓/ chiasmata
- Genetic material is exchanged✓
- resulting in new combinations of genetic material ✓ Max 3 (3)

- Random arrangement✓of chromosomes
- occurs during metaphase✓
- so that they separate in a random✓/ independent manner
- resulting in new combinations of genetic material✓

Max 3 (3)

Mutations

- A gene✓/ (point and frameshift) mutation occurs
- as a result of a change in sequence of nitrogen bases✓ in the DNA molecule

- A chromosome✓mutation occurs as a
- result of a change in the structure of a chromosome✓/ number of chromosomes during meiosis

- Mutations that occur in sex cells✓
- are passed on to the new generations✓
- creating new characteristics✓

Max 5 (5)

Role of variation in natural selection

- Organisms of a particular species shows a great deal of variation✓
- Some individuals may have characteristics that are favourable✓ / any example
- Others may have characteristics/any example that are unfavourable✓
- If there is competition/changing environmental conditions✓/ Selective pressure by the environment
- organisms with favourable characteristics survive✓
- and reproduce✓
- and pass this favourable characteristics to their offspring✓
- while organisms with unfavourable characteristics will die out✓
- Over time the whole population will have this favourable trait✓

Max 6 (6)
Content: **(17)**
Synthesis: **(3)**
(20)

ASSESSING THE PRESENTATION OF THE ESSAY

Criterion	Relevance (R)	Logical sequence (L)	Comprehensive (C)
Generally	All information provided is relevant to the topic	Ideas are arranged in a logical sequence for each process	All aspects required by the essay have been sufficiently addressed
In this essay	Only information relevant to the contribution of crossing over, random arrangement of chromosomes, mutation and natural selection is given	Information regarding crossing over, random arrangement of chromosomes, mutation and natural selection arranged in logical way within each aspect	At least **three** correct points included on **each** of the three aspects: meiosis, mutations and natural selection
Mark	1	1	1
	R	L	C

TOTAL SECTION C: 20
GRAND TOTAL: 150

LIFE SCIENCES P1

FEBRUARY/MARCH 2015

MEMORANDUM

SECTION A

QUESTION 1

1.1	1.1.1	B✓✓		
	1.1.2	C✓✓		
	1.1.3	C✓✓		
	1.1.4	B✓✓		
	1.1.5	B✓✓		
	1.1.6	C✓✓		
	1.1.7	C✓✓		
	1.1.8	D✓✓		
	1.1.9	B✓✓		
	1.1.10	C✓✓	(10 x 2)	**(20)**
1.2	1.2.1	Eustachian tube✓		
	1.2.2	Carbon footprint✓		
	1.2.3	Thermal✓pollution		
	1.2.4	Aqueous humour✓		
	1.2.5	Oestrogen✓		
	1.2.6	Luteinising hormone✓/LH		
	1.2.7	Cristae✓		
	1.2.8	TSH✓/Thyroid-stimulating hormone		
	1.2.9	Internal✓ fertilisation		
	1.2.10	Accommodation✓	(10 x 1)	**(10)**
1.3	1.3.1	B only✓✓		
	1.3.2	B only✓✓		
	1.3.3	A only✓✓		
	1.3.4	B only✓✓		
	1.3.5	None ✓✓		
	1.3.6	A only✓✓	(6 x 2)	**(12)**
1.4	1.4.1	Spermatogenesis✓		(1)
	1.4.2	Testis✓		(1)
	1.4.3	(a) 23✓		(1)
		(b) 23✓		(1)
	1.4.4	- Crossing over✓		
		- Random assortment of chromosomes✓	(any order)	
		(Mark first TWO only)		(2)
	1.4.5	2✓		(1)
	1.4.6	Sperm cells✓/spermatozoa/male gametes		(1)
				(8)
			TOTAL SECTION A:	**50**

SECTION B

QUESTION 2

2.1 2.1.1 (a) Epididymis✓ (1)
(b) Testis✓ (1)
(c) Vas deferens✓/sperm duct (1)

2.1.2 Stores sperm cells✓ (1)
(Mark first ONE only)

2.1.3 Sperm cells will not pass to urethra✓
to fertilise the egg✓
and hence he will not be able to have children✓ (3)

2.1.4 The HI virus may still be passed on✓during sexual intercourse
through the secretions of the accessory glands✓ (2)
(9)

2.2
- Sound waves are directed by the pinna✓
- through the auditory canal✓
- to the tympanic membrane✓/ eardrum
- causing it to vibrate✓
- The vibrations of the tympanic membrane are transferred to the ossicles✓ in the middle ear
- which eventually causes the oval window to vibrate✓
- This sets up pressure waves in the perilymph✓
- Pressure waves are then transferred to the endolymph✓ in the cochlea
- This stimulates the Organ of Corti✓
- in the cochlea✓
- to convert this stimulus into a nerve impulse✓
- ***which is then transported along the auditory nerve**✓
- ***to the cerebrum**✓
- ***where the sound is interpreted**✓

Any 4+3* (compulsory marks) **(7)**

2.3 2.3.1 A reflex action is a rapid✓, automatic response✓ to a stimulus. (2)

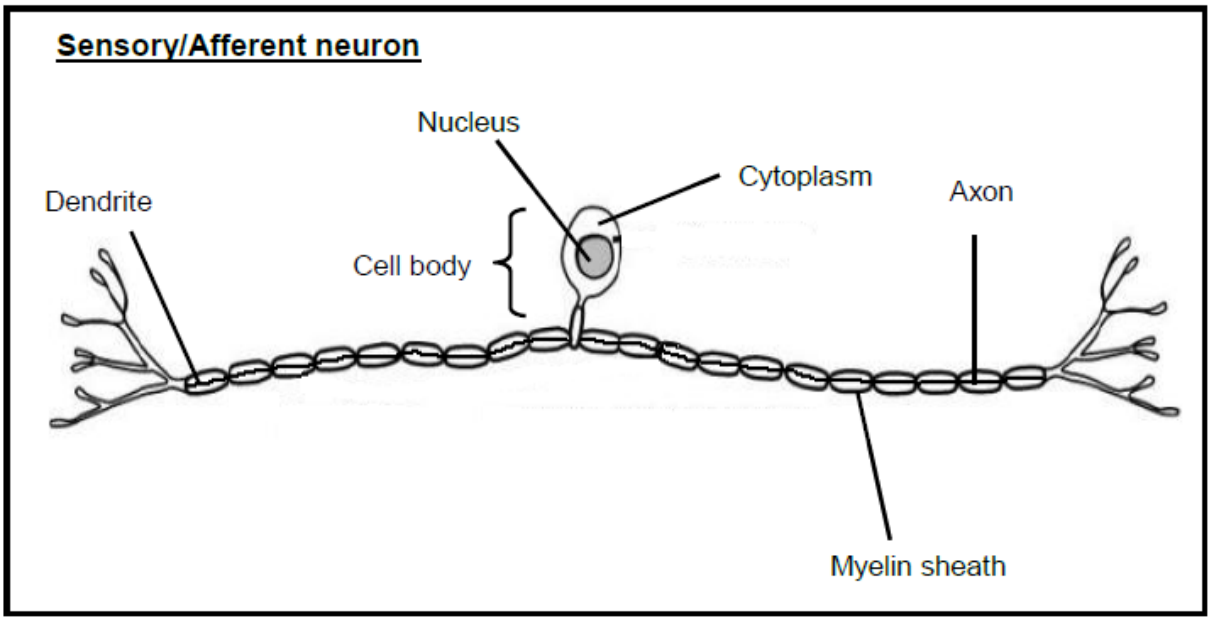
2.3.2 (a) Synapse✓ (1)
(b) Inter-neuron✓/connector neuron (1)

2.3.3 It ensures that the impulse moves in one direction only✓
It prevents continuous stimulation of the neurons✓
It ensures that the impulse is transmitted from the sensory neuron to the motor neuron✓ Any (1)

2.3.4 A ✓→ B ✓→ C (2)

2.3.5 - The person will be able to receive a stimulus✓
- but will not be able to respond to it✓ (2)

2.3.6



CRITERION	MARKS ALLOCATION
Caption	1 mark
Any 4 labels	4 marks

(5)
(14)

2.4	2.4.1	0.25✓ g/cm^3	(1)
	2.4.2	15✓ minutes	(1)
	2.4.3	- Blood glucose level of a person with diabetes mellitus is higher✓than that of a normal person at all times✓ - There is a greater increase in the blood glucose level of a person with diabetes mellitus after ingestion of glucose✓ compared to the normal person✓ - It takes longer for the blood glucose level to stabilise for the person with diabetes mellitus✓ compared to a normal person✓ Any (2x2) **(Mark first TWO only)**	(4)
	2.4.4	- Because the person with diabetes mellitus does not produce insulin✓/is insulin resistant - therefore blood glucose is not converted to glycogen✓	(2)
	2.4.5	- Glucagon✓ - Adrenalin✓ **(Mark first TWO only)**	(2) **(10)** **[40]**

QUESTION 3

3.1	3.1.1	The process by which the human body is able to maintain a constant✓internal environment✓		(2)
	3.1.2	(a) Kidney✓		(1)
		(b) Adrenal✓ gland		(1)
		(c) Aldosterone✓		(1)
	3.1.3	- Walls of renal tubules✓ - become more permeable✓ - allowing for a greater re-absorption of sodium ions✓ - from the filtrate✓/into the blood capillaries	Any	(2) **(7)**
3.2	3.2.1	Low number of species✓/low biodiversity		(1)
	3.2.2	- Addition of phosphates caused eutrophication✓ - which led to an increase in algal growth✓ / algal bloom - which depleted the oxygen in the water✓ - thus reducing its ability to support ✓a variety of life-forms	Any	(3)
	3.2.3	- The length of food chains will be reduced✓/complexity of food webs will be reduced - resulting in organisms feeding on the remaining species having - excess food✓ - leading to their overpopulation✓ - while organisms depending on the species that were lost will - have less✓/no food available - leading to their death✓/migration	Any	(4)
	3.2.4	- The use of living organisms✓ - to control the numbers✓ of other organisms		(2) **(10)**

3.3 3.3.1

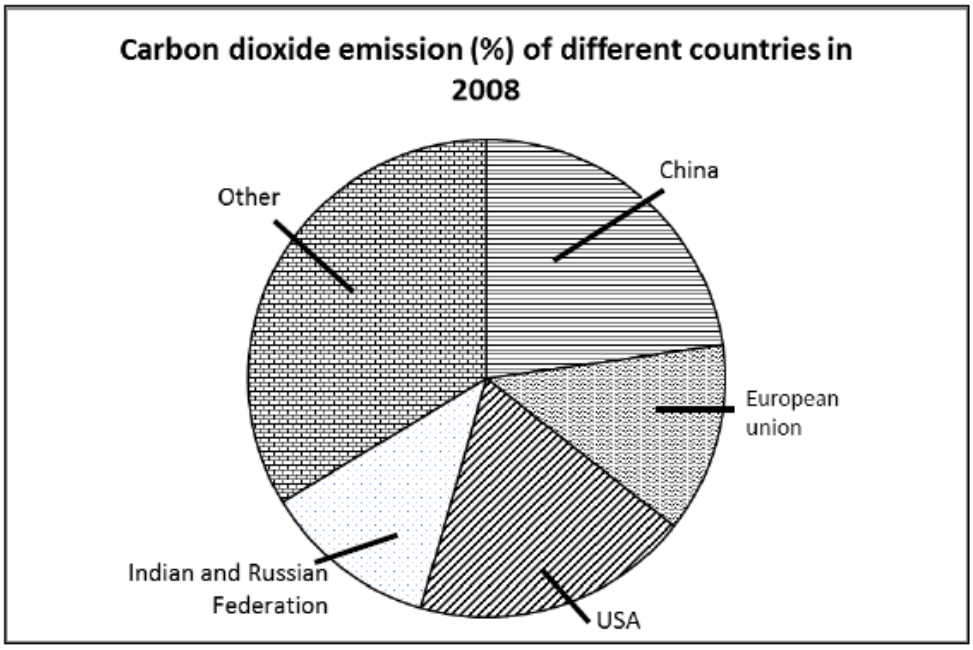
China: $23/100 \times 360^0 = 82.8^0$

European Union: $13/100 \times 360^0 = 46.8^0$

USA: $19/100 \times 360^0 = 68.4^0$

India and Russian Federation: $12/100 \times 360^0 = 43.2^0$

Other: $33/100 \times 360^0 = 118.8^0$



Correct type of graph	1 mark
Caption	1 mark
Correct calculations	1: 1–4 calculations correct 2: All 5 calculations correct
Correct proportion and labelling sectors	1: 1–3 sectors correct 2: 4–5 sectors correct

NOTE: If the wrong type of graph is drawn: marks will be awarded for 'caption only' (6)

3.3.2

- Leads to the enhanced 'greenhouse effect' ✓
- and thus global warming✓
- Global warming influences the weather patterns✓
- which can destroy habitats✓
- leading to a decrease in biodiversity✓ Any (3)

3.3.3
- It will be expensive✓ to change to machinery that produce less CO_2✓
- Too expensive✓ to purchase or develop systems that remove excess CO_2 from outlet gases✓
- This will reduce profit✓ that will lead to job losses✓/ have negative effect on the country's economy

(Mark first TWO only) Any (2x2) (4)
(13)

3.4 3.4.1 Treatment✓ of plant shoot (1)

3.4.2
- Same type of plant✓
- Placed in the same environment✓
- Same amount of time✓
- Tip removed at the same length✓
- Same concentration of auxins✓
- Same type of agar✓

(Mark first TWO only) Any (2)

3.4.3 (a)
- Shoot B would show upward growth✓
- Auxins in the agar gel diffused downwards✓ into the shoot
- leading to cell elongation✓ (3)

(b)
- No growth in shoot C✓
- Shoot tip contains NO auxins✓ (2)

3.4.4
- Repeat the investigation✓
- Use more than 1 plant per investigation✓/increase sample size

(Mark first TWO only) Any (2)
(10)
[40]

TOTAL SECTION B: 80

SECTION C

QUESTION 4

- The zygote divides by mitosis✓
- to form a ball of cells✓
- called the morula✓
- More mitotic divisions of the morula occurs to form a hollow ball of cells✓
- called a blastocyst✓

- The blastocyst attaches to the endometrial lining✓
- The outer wall of the blastocyst, called the chorion✓,
- develops projections called villi✓ which
- embeds/implants✓ into the uterine wall

- The cells of the embryo continues to divide✓
- and differentiate✓
- to form the different organs and limbs✓
- and is now called a foetus✓
- The foetus is enclosed in a sac called the amnion✓
- filled with amniotic fluid✓
- which protects the foetus against temperature fluctuations✓
- protects the foetus against dehydration✓
- and protects the foetus against mechanical injury✓/acts as a shock absorber

- The chorionic villi and the endometrium form the placenta✓
- where the blood of both the foetus and the mother✓
- run close to each other✓
- allowing for nutrients to diffuse✓ into the blood of the foetus
- The umbilical vein✓
- carries the absorbed nutrients from the mother to the foetus✓

Any (17)

Content: **(17)**
Synthesis: **(3)**

ASSESSING THE PRESENTATION OF THE ESSAY

RELEVANCE	LOGICAL SEQUENCE	COMPREHENSIVE
All information provided is relevant to the topic	Ideas arranged in a logical/ cause-effect sequence	Answered all aspects required by the essay
Only information relating to the development of the zygote to the foetus and its nutrition and protection is included (there is no irrelevant information)	Events that lead to the change from a zygote to a foetus are stated in the order in which they occur	ALL three aspects are included: 1. Development of zygote to foetus 2. Nutrition of the foetus 3. Protection of the foetus
1 mark	1 mark	1 mark

TOTAL SECTION C: 20
GRAND TOTAL: 150

LIFE SCIENCES P2

FEBRUARY/MARCH 2015

MEMORANDUM

SECTION A

QUESTION 1

1.1	1.1.1	D✓✓		
	1.1.2	B✓✓		
	1.1.3	B✓✓		
	1.1.4	D✓✓		
	1.1.5	A✓✓		
	1.1.6	C✓✓		
	1.1.7	B✓✓		
	1.1.8	A✓✓		
	1.1.9	A✓✓		
	1.1.10	D✓✓	(10 x 2)	**(20)**
1.2	1.2.1	Homologous✓		
	1.2.2	Genome✓		
	1.2.3	DNA profile✓/fingerprint		
	1.2.4	Albinism✓		
	1.2.5	Peptide✓ bonds		
	1.2.6	Karyotype ✓/Karyogram		
	1.2.7	Nuclear pores✓		
	1.2.8	Clone✓		
	1.2.9	Hypothesis✓		
	1.2.10	Biogeography✓	(10 x 1)	**(10)**
1.3	1.3.1	Both A and B ✓✓/Both/A and B		
	1.3.2	Both A and B ✓✓/Both/A and B		
	1.3.3	A only✓✓		
	1.3.4	B only✓✓		
	1.3.5	Both A and B ✓✓/Both/A and B		
	1.3.6	None✓✓	(6 x 2)	**(12)**
1.4	1.4.1	(a) W – Nucleotide✓ U – DNA✓		(2)
		(b) X – Phosphate✓/phosphate ion Y – Deoxyribose✓sugar		(2)
		(c) Z – Hydrogen✓ bond		(1)
		(d) V – Adenine✓		(1)
	1.4.2	Nucleus ✓		(1)
	1.4.3	Interphase ✓		(1) **(8)**
			TOTAL SECTION A:	**50**

SECTION B

QUESTION 2

2.1 2.1.1 2✓ (1)

2.1.2 (a) X^DX^d✓✓ (2)
(b) X^dX^d✓✓ (2)

2.1.3 Since the allele is found only on the X-chromosome✓
A male only has one allele✓
that is either dominant✓ (normal)
or recessive✓ (colour-blind)
and therefore will always be colour blind✓ (if recessive allele inherited) (Any 4) (4)

2.1.4 100%✓✓ (2)
(11)

2.2 2.2.1
- Andrew has short fingers while Susan has normal fingers✓
- Andrew has straight hair while Susan has curly hair✓ (2)

2.2.2 Bh✓, bh✓ (2)
(4)

2.3 2.3.1 (a) I^BI^B✓ of I^Bi✓ (2)
(b) ii✓ (1)

2.3.2
- The baby inherited one allele for type O blood/i from each parent✓ since
- her genotype is ii✓
- Mr Phonela does not have an allele for O blood/i✓ (3)

2.3.3 Blood type can be used to exclude a particular man✓ as the parent but it cannot confirm that a particular man is the father✓
Since a large portion of the population have the same blood type✓ (Any 2) (2)

2.3.4
- Normal females have two X✓ chromosomes
- Normal males have one X and one Y✓
- The female always provides X in the egg✓
- If an egg cell is fertilized by an X bearing sperm✓ a female/girl✓is formed
- If an egg is fertilized by a Y bearing sperm✓
- a male/boy✓ is formed (Any 5)

OR

Gametes		male gamete✓	
		X	Y
female gamete✓	X	XX✓	XY✓

2 XX : 2 XY
Female ✓ Male✓ (Any 5) (5)
(13)

2.4 2.4.1
- To prevent the flowers in Population 1✓ from self-pollination✓

OR

- To ensure cross-pollination✓ between the flowers of Population 1 and Population 2✓ (2)

2.4.2
- The seeds produced did not germinate✓ (1)

2.4.3
- Type of soil✓
- Amount of water✓
- Temperature✓
- pH✓
- Exposure to sunlight✓
- Depth of sowing in soil✓

(Mark first TWO only) (Any 2) (2)

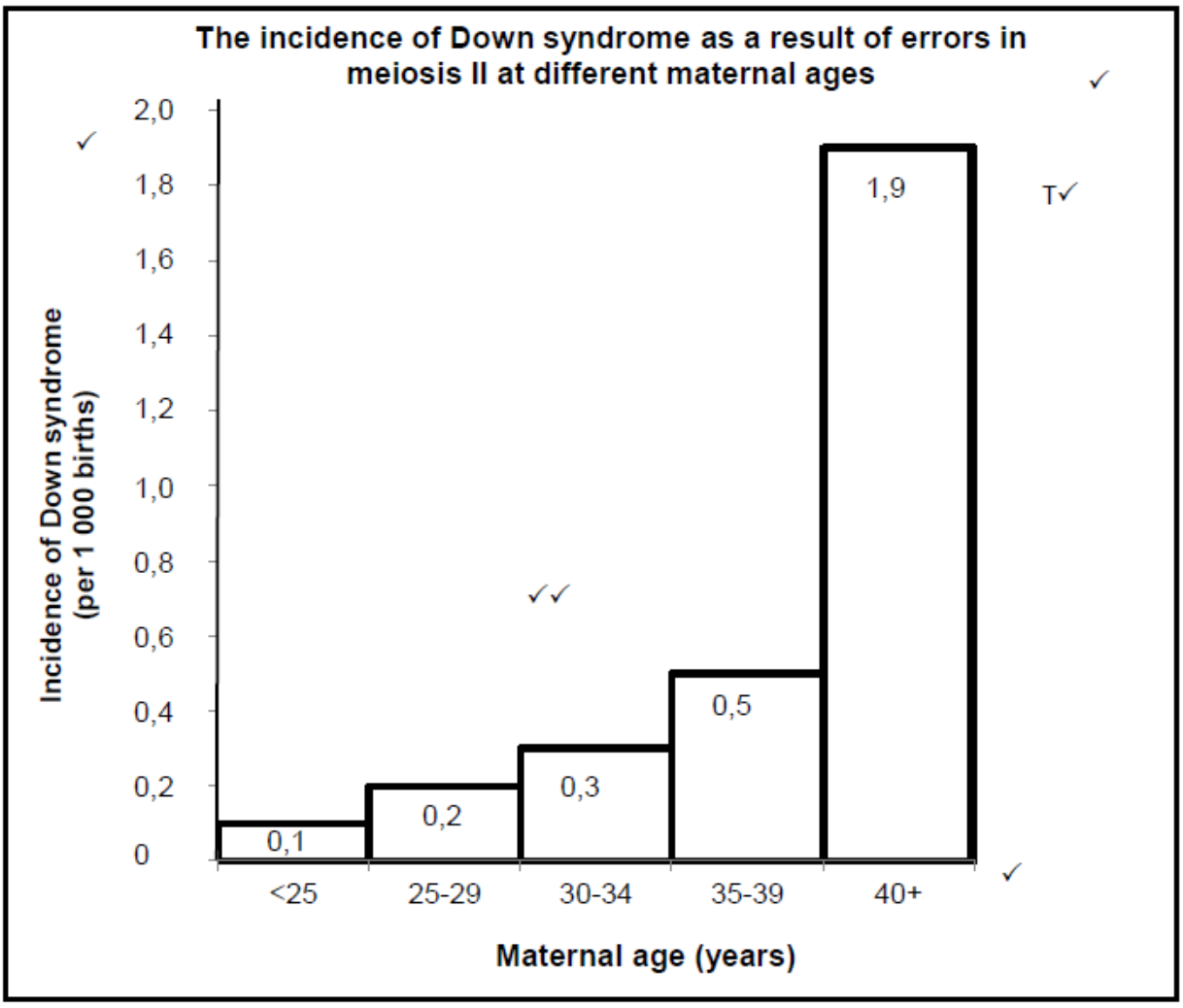
2.4.4 Repeat the investigation✓
Increase the sample size ✓/number of seeds/number of plots/ number of plants
(Mark first ONE only) (Any 1) (1)
(6)

2.5
- A population of a particular species may split into two populations✓
- because of a geographic barrier✓
- There will be no gene flow between the two separated populations✓
- Due to the difference in environmental conditions✓
- Natural selection✓will occur independently
- Making them genotypically✓ and
- Phenotypically✓different over a period of time.
- Even if the two populations mixed at a later stage, they will not be able to interbreed again✓ resulting in a new species (Any 6) **(6)**

[40]

QUESTION 3

3.1 3.1.1



Criterion	Elaboration	Mark
Type of graph	Histogram is drawn of Meiosis II	1
Caption	Including both variables: 'Incidence of Down syndrome and Maternal age'	1
X-axis	Correct label and units for X-axis: Maternal Age (years); Equal width of bars	1
Y-axis	Correct label, unit and scale for Y-axis: Incidence of Down syndrome (per 1 000 births)	1
Plotting of the bars	1 – 4 bars plotted correctly – 1 mark 5 bars correctly plotted – 2 marks	2

(6)

NOTE:
If axes are transposed:
- Marks will be lost for labelling of 'X-axis' and 'Y-axis'.

	3.1.2	Non-disjunction✓	(1)
	3.1.3	Meiosis I✓	(1)
	3.1.4	Number of Down syndrome babies = $\frac{1,9}{7,8}$✓ x 44✓ = 10,71✓/11 babies	(3) **(11)**
3.2	3.2.1	- DNA carries hereditary information✓ - DNA contains coded information for protein synthesis✓ (Mark first ONE only) (Any 1)	(1)
	3.2.2	ACA ✓	(1)
	3.2.3	Threonine✓; Cysteine✓ (must be in correct order)	(2)
	3.2.4	- Both ATG and ATA✓ - Code for the same amino acid/tyrosine✓	(2)
	3.2.5	- The anticodon on the tRNA matches the codon on the mRNA✓ - tRNA brings the required amino acid✓ - to the ribosome✓ - amino-acids are joined by peptide bonds✓ - to form the required protein✓ (Any 5)	(5) **(11)**

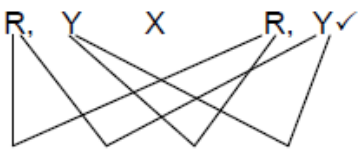
3.3 3.3.1

P_1 phenotype red-yellow X red-yellow✓
genotype RY X RY✓

Meiosis

G/gametes R, Y X R, Y✓

Fertilisation



F_1 genotype RR, RY, RY, YY✓

phenotype red apples / red-yellow apples / yellow apples✓

P_1 and F_1✓
Meiosis and fertilisation✓ (Any 6)

OR

P_1 phenotype red-yellow X red-yellow✓
genotype RY X RY✓

Meiosis

Fertilisation

Gametes	R	Y
R	RR	RY
Y	RY	YY

1 mark for correct gametes
1 mark for correct genotypes

F_1 genotype RR, RY, RY, YY✓

phenotype red apples / red-yellow apples / yellow apples✓

P_1 and F_1✓
Meiosis and fertilisation✓ (Any 6) (6)

3.3.2 50%✓/half (1)

3.3.3 A tree with red apples✓ should be crossed with a tree that produces yellow apples✓ (2)

(9)

3.4	3.4.1	*A. anamensis*✓ *and A. afarensis*✓ (Mark first TWO only)	(2)
	3.4.2	(4,5mya – 3mya)✓ = 1,5✓mya✓	(3)
	3.4.3	The cranium increased in size✓ so it could accommodate a larger brain✓	(2)
	3.4.4	Smaller teeth✓/canines in *Homo* species, can chew food that was cooked✓/made soft using fire OR Larger teeth/canines are not necessary ✓ because the food is softer ✓ because of cooking with fire.	(2) **(9)** **[40]**
		TOTAL SECTION B:	**80**

SECTION C

QUESTION 4

4.1 Evolution according to Lamarck

Lamarck explained evolution using the following two 'laws':

The law of use and disuse: ✓
- As an organism uses a structure or organ more regularly✓, it becomes better developed or enlarged in that organism✓.
- If an organism does not use a structure or organ frequently✓, it becomes less developed or reduced in size and may disappear altogether in that organism✓

The inheritance of acquired characteristics: ✓
- Characteristics developed during the life of an individual✓
- (Acquired characteristics) can be passed on to their offspring. ✓ (Max 5) (5)

Evolution according to Darwin

- Organisms produce a large number of offspring✓
- There is a great deal of variation✓ amongst the offspring
- Some have favourable characteristics✓
- and some do not✓
- When there is a change in the environmental conditions✓/or
- there is competition
- Then organisms with characteristics which are more favourable survive✓
- Whilst organisms with less favourable characteristics die✓
- This is called natural selection✓
- The organisms that survive reproduce✓
- And thus pass on the favourable characteristics to their offspring✓
- The next generation will therefore have a higher proportion of individuals with the favourable characteristics✓ (Max 8) (8)

Darwin's ideas about gradualism compared to Punctuated Equilibrium

- Darwin believed that evolution takes place through an
- accumulation of small✓
- gradual changes that occur over a long period of time✓
- supported by transitional forms in fossil record✓
- Punctuated equilibrium suggested that evolution sometimes involves long periods of time where species do not change✓/very little change occurs
- This alternates with short periods of time where rapid changes occur✓
- New species are formed in a short period of time✓/relative to the long period of no/little change
- supported by the absence of transitional forms✓ (Max 4) (4)

Content: **(17)**
Synthesis: **(3)**

ASSESSING THE PRESENTATION OF THE ESSAY

Criterion	Relevance (R)	Logical sequence (L)	Comprehensive (C)
Generally	All information provided is relevant to the topic	Ideas are arranged in a logical/cause-effect sequence	All aspects required by the essay have been sufficiently addressed
In this essay	There is no irrelevant information. Only information relating to the theories of Lamarck and/or Darwin and/or Punctuated Equilibrium is/are given.	The information provided for each of the theories of Lamarck and/or Darwin and/or Punctuated Equilibrium is/are arranged logically.	At least three points included on **each** of the 3 theories: Lamarck, Darwin and Punctuated Equilibrium
Mark	1	1	1
	R	L	C

TOTAL SECTION C: 20
GRAND TOTAL: 150

LIFE SCIENCES P1

NOVEMBER 2015

MEMORANDUM

SECTION A

QUESTION 1

1.1	1.1.1	A✓✓		
	1.1.2	C✓✓		
	1.1.3	C✓✓		
	1.1.4	A✓✓		
	1.1.5	C✓✓		
	1.1.6	C✓✓		
	1.1.7	C✓✓		
	1.1.8	D✓✓		
	1.1.9	B✓✓		
	1.1.10	C✓✓	(10 x 2)	**(20)**
1.2	1.2.1	Medulla oblongata✓		
	1.2.2	Homeostasis✓		
	1.2.3	Abscisic acid✓/ABA		
	1.2.4	Meninges✓		
	1.2.5	Aldosterone✓		
	1.2.6	Ozone✓/O_3		
	1.2.7	Testosterone✓/FSH/LH		**(7)**
1.3	1.3.1	Both A and B✓✓		
	1.3.2	B only✓✓		
	1.3.3	A only✓✓		
	1.3.4	B only✓✓		
	1.3.5	Both A and B✓✓	(5 x 2)	**(10)**
1.4	1.4.1	(a) A✓ - ciliary muscle✓		(2)
		(b) C✓ - iris✓		(2)
		(c) D✓ - cornea✓		(2)
	1.4.2	Accommodation✓		(1)
	1.4.3	Diagram 2✓		(1) **(8)**
1.5	1.5.1	Phototropism✓		(1)
	1.5.2	Light✓/Sunlight/Radiant energy		(1)
	1.5.3	Auxins✓/ IAA/ Indole acetic acid		(1)
	1.5.4	Inhibit ✓		(1)
	1.5.5	Apical dominance✓		(1) **(5)**

TOTAL SECTION A: 50

SECTION B

QUESTION 2

2.1 2.1.1 (a) Eustachian tube✓ (1)

(b) Round window✓ (1)

(c) Cochlea✓ (1)

2.1.2
- Air will not be taken in✓/released
- to equalise pressure✓
- on both sides of the tympanic membrane✓
- Tympanic membrane/ ossicles may not vibrate freely✓
- This may lead to the tympanic membrane bursting✓and
- therefore could lead to hearing loss✓/deafness/ pain (Any 4) (4)

2.1.3 Changes in the direction and speed of movement:

- Causes the endolymph to move✓ in part D/semi-circular canals
- The cristae✓
- found in the ampulla ✓are stimulated
- and converts the stimulus into an impulse✓
- which is transmitted via the auditory nerve✓/ vestibular nerve
- to the cerebellum✓
- from which impulses are transmitted via motor neurons✓
- to the skeletal muscles✓/effector to restore balance of the body

(Any 5) (5)
(12)

2.2 2.2.1 (a) Chromosome✓ (1)

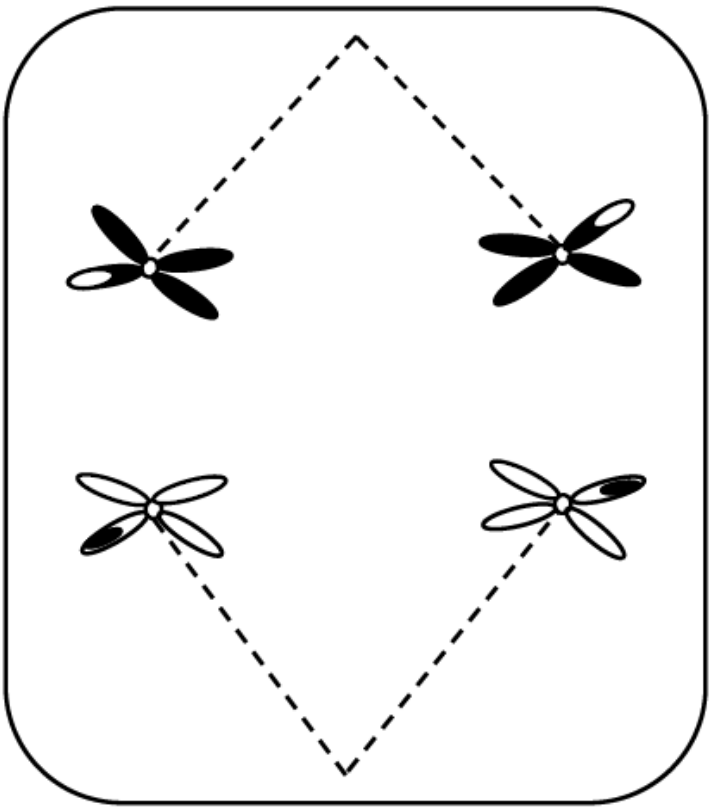
(b) Spindle fibre✓ (1)

(c) Centromere✓ (1)

2.2.2 Metaphase II✓ (1)

2.2.3
- Chromosomes lying independently✓/singly
- at the equator✓ (2)

2.2.4



Mark allocation:

C - Shows **4** chromosomes✓✓ (not chromatids)
S - Shows separation✓ of genetic material
D - Correct variation shown in the chromosomes✓(shading on the chromosomes must be complementary)
(Use the letters for marking process) (4)
(10)

2.3 2.3.1
- Seek permission✓/ethical clearance
- Deciding on the sample size✓
- Deciding on the equipment for measuring✓
- Deciding on the age-group of the participants✓
- Deciding on using women with regular menstrual cycles✓
- Deciding on how to record the results✓
- Decide on the duration✓
- Learning how to use the equipment✓ (Any 2) (2)

(MARK FIRST TWO ONLY)

2.3.2 (a)
- The follicles decreased in size✓
- as ovulation had taken place✓
- The resulting corpus luteum became smaller✓
- because fertilisation did not take place✓ (Any 3) (3)

(b)
- The production of FSH✓
- will be inhibited✓
- which will stop/inhibit the development/growth of a follicle✓
- therefore the follicle size will remain the same✓ (Any 3) (3)

(8)

2.4 2.4.1 (a) Medulla oblongata✓ (1)

(b) Corpus callosum✓ (1)

(c) Cerebellum✓ (1)

2.4.2
- Controls all voluntary activities✓/example
- It contains centres that receives and interprets all the sensations✓/example
- It is the seat of higher mental functions✓/example
- Influences emotional behaviour/ example (Any 3) (3)

(MARK FIRST THREE ONLY) **(6)**

2.5
- Every organ and gland is controlled by two sets of nerves✓/double innervations
- that act antagonistically✓
- to control involuntary events✓/brings about homeostasis
- Sympathetic✓nerves
- generally stimulates a response✓/example
- Parasympathetic✓nerves
- generally inhibits a response✓/example (Any 4) **(4)**

[40]

QUESTION 3

3.1
- Receptor cells✓
- in the carotid artery✓/aorta are stimulated
- to send impulses to the medulla oblongata✓ in the brain
- which then **stimulates the heart**✓
- to beat faster✓
- and the breathing muscles ✓/example
- to contract more actively✓
- This increases the rate/ depth of breathing✓
- More CO_2 is taken to and exhaled from the lungs✓returning the CO_2 level in the blood to normal (Any 6) **(6)**

3.2 3.2.1 Comparison of the blood glucose level of two people✓ over 5 hours✓/before and after ingesting glucose (2)

3.2.2 (145 – 125)✓
(Accept numbers in range 144 -146 for the first value and 124 -126 for the second value)

= 20✓ mg/100 cm^3 (2)
(Accept answer according to the values given by learner)

3.2.3 Accept any answer from 1,7 to 1,9✓ hours /102 – 114minutes/ 1h42min – 1h54min (1)

3.2.4 (a) Thabiso✓ (1)

(b)
- His glucose level is higher than the normal range✓
- It takes longer for his glucose level to come down to its original level✓ (Any 1) (1)

(MARK FIRST ONE ONLY)

3.2.5
- When his glucose level is high✓/ 99/98mg/100cm^3
- insulin✓is secreted into the blood
- to convert excess glucose into glycogen ✓ in the liver
- and to stimulate the cells to absorb more glucose✓
- thus decreasing the blood glucose level✓ (Any 4) (4)

(11)

3.3 3.3.1 Poaching✓ (1)

3.3.2
- Deforestation✓
- Urbanisation✓
- Mining ✓
- Agriculture✓
- Veld fires✓
- Building✓
- Pollution✓
- Introduction of alien species✓ (Any 1) (1)

(MARK FIRST ONE ONLY)

3.3.3
- Increasing human population✓
- Increasing unemployment✓/poverty
- Increased prices of bush-meat✓/greed
- Increased demand✓
- Poor protection of wildlife✓ (Any 2) (2)

(MARK FIRST TWO ONLY)

3.3.4
- Disturbs the ecosystem✓
- because food chains are affected✓
- leading to the extinction of some species✓ in the ecosystem
- and will eventually lead to loss of biodiversity✓ (Any 3) (3)

3.3.5
- Very old animals have passed the reproductive stage in their lives✓/old animals are at the end of lifespan
- therefore may not significantly influence the size of the population✓
- Weak animals have a short lifespan✓
- and will not contribute to the survival of the population✓
- Killing old and weak animals may prevent a population from exceeding carrying capacity✓
- Genes causing weakness will be removed from the gene pool✓

(Any 3) (3)
(10)

3.4 3.4.1
- Food security refers to the access✓
- of adequate✓/safe/nutritious food
- to all people at all times✓ (Any 2) (2)

3.4.2
- Price is added to cover the cost of transportation✓ over long distances
- No competition✓ between dealers in rural areas
- Decrease demand✓ for goods in rural areas (Any 1) (1)

(MARK FIRST ONE ONLY)

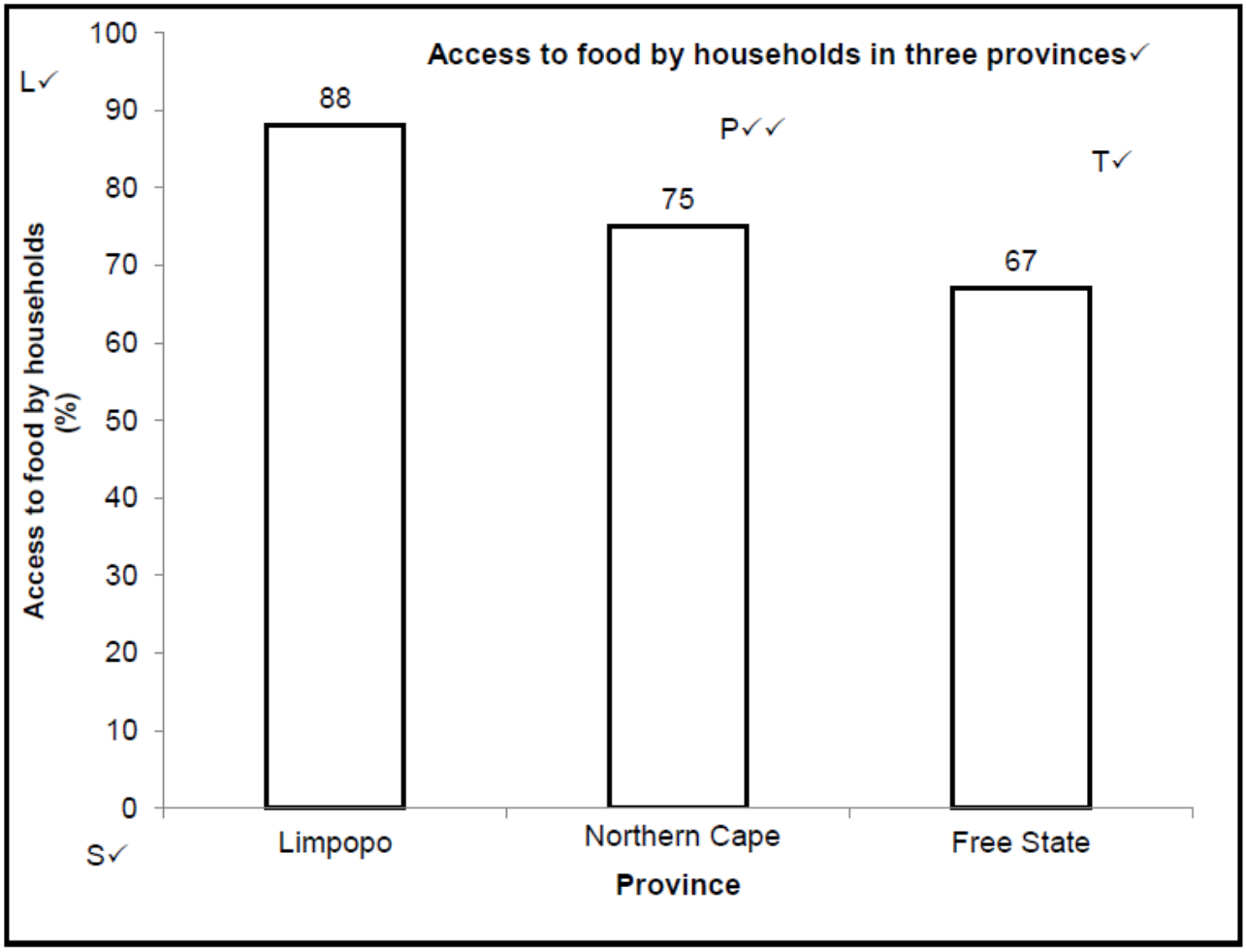
3.4.3
- Decreased need to buy food✓
- Selling of excess produce to earn some money✓ (2)

(MARK FIRST TWO ONLY)

3.4.4
- Making people aware of the benefits of farming✓
- Providing resources✓/example
- Developing skills for farming✓
- Providing incentives✓ to encourage farming (Any 2) (2)

(MARK FIRST TWO ONLY)

3.4.5



Mark allocation of the graph

Criteria	Mark Allocation
Bar graph drawn (T)	1
Title of graph	1
Correct scale for X-axis (equal width and spacing of the bars) and Y-axis (S)	1
Correct label and unit for X-axis and Y-axis (L)	1
Plotting of the bars (P)	0: No bars plotted correctly 1: 1 to 2 bars plotted correctly 2: All 3 bars plotted correctly

NOTE:
If a line graph is drawn – marks will be **awarded** for the 'title and label for X and Y axes' only
If a histogram is drawn – marks will be **lost** for the 'type of graph and correct scale' only

(6)
(13)
[40]

TOTAL SECTION B: 80

SECTION C

QUESTION 4

Structural suitability of the sperm cell for internal fertilisation

- The front of the head of the sperm cell contains an acrosome✓/vesicle which carries enzymes to dissolve a path into the ovum✓
- Nucleus of the sperm✓ carries genetic material of the male✓/ haploid number of chromosomes
- The middle piece contains mitochondria✓ which release energy✓ so that sperms could swim
- The presence of a long tail✓ enables sperm cells to swim✓ towards the ovum
- The contents of the sperm cell such as the cytoplasm is reduced✓/condensed making the sperm light for efficient movement✓ (Any 3 x 2) (6)

Fertilisation

- In the Fallopian tubes✓
- one sperm cell makes contact with the ovum's membrane✓
- The nucleus of the sperm enters the ovum✓
- Then the ovum membrane becomes impenetrable✓to other sperms
- The nucleus of the sperm fuses✓
- with the nucleus of the ovum✓ } OR sperm fuses with an ovum✓
- to form a diploid✓ zygote
- This is called fertilisation✓ (Any 5) (5)

Events after fertilisation until implantation

- The zygote divides by mitosis✓many times
- to form an embryo✓
- It first consists of a ball of cells✓
- called the morula✓
- which then develops into a hollow ball of cells✓
- called the blastula✓/blastocyst
- It embeds itself into the uterus lining✓/endometrium
- using chorionic villi✓ (Any 6) (6)

Content: (17)
Synthesis: (3)
(20)

ASSESSING THE PRESENTATION OF THE ESSAY

Relevance	Logical sequence	Comprehensive
All information provided is relevant to the question	Ideas arranged in a logical/ cause-effect sequence	Answered all aspects required by the essay in sufficient detail
Only information regarding: - The structural suitability of the sperm cell - Events during fertilisation - Events after fertilisation until implantation No irrelevant information.	All structures are related to the respective functions of the sperm cell. The sequence of events in fertilisation and post fertilisation until implantation is in the correct order.	At least the following points should be included: - The structural suitability of the sperm cell **(4/6)** - Events during fertilisation **(3/5)** - Events after fertilisation until implantation **(4/6)**
1 mark	1 mark	1 mark

TOTAL SECTION C: 20
GRAND TOTAL: 150

LIFE SCIENCES P2

NOVEMBER 2015

MEMORANDUM 2015

SECTION A

QUESTION 1

1.1	1.1.1	C✓✓		
	1.1.2	D✓✓		
	1.1.3	B✓✓		
	1.1.4	C✓✓		
	1.1.5	A✓✓		
	1.1.6	A✓✓		
	1.1.7	B✓✓		
	1.1.8	D✓✓		
	1.1.9	B✓✓	(9 x 2)	**(18)**
1.2	1.2.1	Homologous✓/homologues/bivalent		
	1.2.2	Alleles✓/Multiple alleles		
	1.2.3	Spindle fibres✓/spindle threads/spindle apparatus		
	1.2.4	Interphase✓		
	1.2.5	Phylogenetic tree✓/cladogram		
	1.2.6	Binocular✓/stereoscopic		
	1.2.7	Dihybrid✓cross		
	1.2.8	Haemophilia✓		
	1.2.9	Biogeography✓	(9 x 1)	**(9)**
1.3	1.3.1	B only✓✓		
	1.3.2	Both A and B ✓✓		
	1.3.3	B only✓✓		
	1.3.4	A only✓✓	(4 x 2)	**(8)**
1.4	1.4.1	(a) B✓		(1)
		(b) B✓		(1)
		(c) A✓		(1)
		(d) A✓		(1)
	1.4.2	Mrs Ples✓ } *A. africanus* Taung Child✓ } Little Foot✓/ *A. prometheus* Karabo✓/ *A. sediba* **(*Mark first TWO only*)**	Any 2	(2)
	1.4.3	Site 4✓		(1)
	1.4.4	Mitochondrial DNA✓/mtDNA/genetic evidence/ Y-chromosome/cultural evidence **(*Mark first ONE only*)**		(1) **(8)**

1.5	1.5.1	(a) 3,1✓ mya✓ (Accept 3,05 to 3,15 mya)		(2)
		(b) *Homo sapiens*✓/*H. sapiens*		(1)
	1.5.2	(a) 500✓ cm^3 (Accept 495 to 505 cm^3)		(1)
		(b) 850✓ cm^3 (Accept 845 to 855 cm^3)		(1)
	1.5.3	Genetic evidence✓/mitochondrial DNA/mtDNA Cultural evidence✓/tool making Comparative anatomy✓ between living hominids **(*Mark first TWO only*)**	Any 2	(2) **(7)**
			TOTAL SECTION A:	**50**

QUESTION 2

2.1	2.1.1	- Conditions/example on the island probably remained the same✓ - so they experienced the same selection pressure✓ - species A was already suited to those conditions✓	Any 2	(2)
	2.1.2	- The original species was separated✓ into three/different populations - **by the sea✓*** - which acted as a geographical barrier✓ - There was no gene flow✓ between the populations - Each population was exposed to different environmental conditions✓ - Natural selection occurred independently✓ in each population - and the individuals of each population became different✓ from each other over time - genotypically✓/phenotypically - Even if the three populations were to mix again✓ - they would not be able to reproduce with each other✓/interbreed	1 *Compulsory mark + Any 5	(6) **(8)**
2.2	2.2.1	- The blood groups of the mother, possible father and the child must be compared✓. - If this shows that it is not possible that these parents can produce a child with his/her blood group✓ - then this man is not the father✓ - If this shows that it is possible that these parents can produce a child with his/her blood group✓ - then he may/may not be the father✓ - because other males have the same blood group✓	Any 5	(5)

2.2.2

P_1	Phenotype	Blood group B	x	Blood group B✓
	Genotype	I^BI	x	I^BI✓
Meiosis				
	G/gametes	I^B , i	x	I^B , i ✓
Fertilisation				
F_1	Genotype	I^BI^B; I^BI; I^Bi; ii ✓		
	Phenotype	3 blood group B : 1 blood group O ✓		

P_1 and F_1✓
Meiosis and fertilisation✓

Any 6

OR

P_1	Phenotype	Blood group B	x	Blood group B✓
	Genotype	I^BI	x	I^BI✓

Meiosis

Fertilisation

Gametes	I^B	i
I^B	I^BI^B	I^Bi
i	I^Bi	ii

1 mark for correct gametes
1 mark for correct genotypes

F_1	Phenotype	3 blood group B : 1 blood group O ✓	

P_1 and
F_1✓
Meiosis and fertilisation✓ (6)

Any 6 **(11)**

2.3 2.3.1 Prophase I✓ (1)

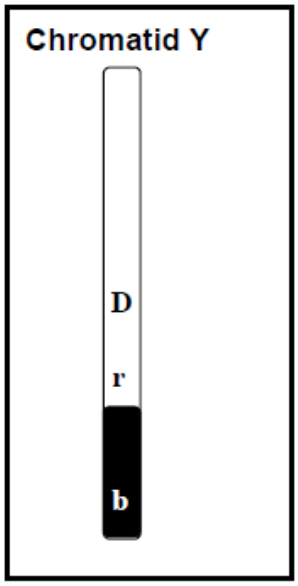
2.3.2
- Homologous chromosomes lie next to each other✓
- Chromatids overlap✓/touch
- at points called chiasmata✓
- and genetic information is exchanged✓/swapped

Any 3 (3)

2.3.3
- Crossing over introduces genetic variation✓ in gametes
- It may lead to new characteristics which are favourable✓
- or new characteristics which are unfavourable✓
- therefore affecting the chances of survival of the organism✓/ natural selection.

Any 2 (2)

2.3.4



ASSESSING THE DIAGRAM	
CRITERIA	**MARKS**
Chromatid Y represented (must be labelled if a whole chromosome is represented)	1
Alleles indicated correctly	1

(2)
(8)

2.4 2.4.1
- Coat is light brown✓ on the upper side
- Dark brown belly✓
- White stripes on the back and mane✓
- Black and white patches on the rest of the body✓
- The tip of the tail is black✓

(Mark first TWO only) Any 2 (2)

2.4.2
- There is variation✓ amongst the Bongo population
- Some have horns that can be laid on their backs✓
- while others do not have horns that can be laid on their backs✓
- The antelope must move through dense vegetation✓ without their horns getting entangled in the vegetation
- Those with horns that cannot be laid on their backs become entangled✓/ die
- Those with horns that can be laid on their backs do not become entangled and escape predators✓/survive
- Those with horns that can be laid back will reproduce✓
- and pass the gene for horns that can be laid on their backs to the next generation✓
- Over many years the proportion of animals that are able to lay their horns on their backs, increases✓

Any 5 (5)
(7)

2.5

2.5.1
- Characteristics that are desirable/beneficial to humans✓ are being selected
- The characteristics are chosen by humans✓/It is an artificial process
- It is not necessarily beneficial for the organism✓

(*Mark first TWO only*) Any 2 (2)

2.5.2
- The long-term effects on health are unknown✓ which could lead to health problems in the future✓
- The long-term effects on the environment are unknown✓ leading to environmental damage✓/loss of biodiversity/ damaging ecosystems/nature
- People are morally opposed✓ as humans are interfering with nature✓/playing God/interfering with the rights of every species
- Initially it is an expensive process✓ and many people/countries may not be able to afford it✓

(*Mark first TWO only*) (Any 2 x 2) (4)
(6)
[40]

QUESTION 3

3.1 3.1.1
- More mistakes are made✓/high rates of mutation
- when RNA is copied✓/than when DNA is copied (2)

3.1.2
- A mutation could allow the virus to be transmitted through the air✓
- This would allow the virus to be spread more easily✓ (2)

(4)

3.2 3.2.1

DNA	RNA
1. Double stranded✓ molecule	1. Single stranded✓ molecule
2. Has a helix✓ shape	2. Is a straight molecule✓
3. One of the nitrogen bases is thymine✓	3. The nitrogen base uracil✓ in place of thymine
4. Contains deoxyribose✓ sugars	4. Contains ribose✓ sugars
5. A longer ✓molecule	5. A shorter✓ molecule
6. Paired bases✓	6. Unpaired bases✓

(Mark first THREE only) (Any 3 x 2) table +1 (7)

3.2.2 Helps to:
- Solve crimes✓/criminal investigations
- Identify organisms from their tissues✓
- Identify family relationship✓
- Test for specific alleles that can cause a genetic disorder✓
- Establish matching tissues for organ transplants✓
- Used in research into variation in populations ✓

(Mark first TWO only) Any 2 (2)

3.2.3
- Samples containing DNA can be planted✓/person was framed
- Human error✓ during DNA profiling process
- Costly procedure✓
- Invasion of privacy✓

(Mark first TWO only) Any 2 (2)

(11)

3.3 3.3.1 (a) X^AY✓✓ (2)

(b) X^AX^a✓✓ (2)

3.3.2 $\left[\frac{3}{7} \times 100\right]$ ✓ = 42,86✓/42,9/43% (2)

3.3.3
- An affected female carries two/only recessive alleles✓/X^aX^a
- Sons/males inherit one X chromosome✓ from their mothers
- Sons/males need only one recessive allele to be affected✓
- And therefore must inherit X^a from their mother✓

Any 3 (3)

(9)

3.4 3.4.1
- The meat/egg chickens will grow faster/slower than the egg/meat chickens✓✓

OR

- There will be no difference in the rate of growth of the two types of chicken✓✓ (2)

3.4.2 The type✓/age of chicken. (1)

3.4.3 $\left[\frac{2500 - 500}{500} \times 100\right]$✓ = 400✓% (2)

3.4.4 Increase✓ the reliability✓ (2)

3.4.5
- The same person must weigh the chicks✓ to get accurate results
- The same scale✓ must be used to weigh the chicks
- The chicks must be weighed at the same time of day✓
- Same environmental conditions✓/example
- Same type of food✓
- The same amount of food✓
- The same feeding time✓
- Cages must be the same size✓
- Chickens must be female✓
- Age of the chickens✓
- Same number of chickens in each sample group✓
- ***(Mark first THREE only)*** Any 3 (3)

3.4.6 The chickens that underwent selective breeding for meat production grow faster than chickens bred for egg laying✓✓

OR

The chickens that underwent selective breeding for egg laying grow slower than chickens bred for meat production✓✓

OR

The weight of the chickens increases with age✓✓/time (2)

3.4.7
- Products produced more quickly✓
- Increased resistance to diseases✓
- Improved quality of (chicken) products✓
- Improved yield of (chicken) products✓ Any 2 (2)

3.4.8
- The chickens are larger✓/heavier so they cannot run away from predators✓
- The chickens are larger✓ and is more visible to predators✓
- Decreased variation✓ therefore more susceptible to diseases✓

(Mark first ONE only) Any 1 x 2 (2)

(16)

[40]

TOTAL SECTION B: 80

SECTION C

QUESTION 4

PROTEIN SYNTHESIS

Transcription✓ (T)

- Double stranded DNA unwinds ✓
- and unzips when✓
- the hydrogen bonds break✓
- and this is controlled by enzymes✓
- One strand is used as a template✓
- to form mRNA✓
- using free RNA nucleotides from the nucleoplasm✓
- The mRNA is complementary to the DNA✓
- mRNA now has the coded message for protein synthesis✓

Translation✓ (S)

- mRNA moves from the nucleus✓/to the ribosome
- Each tRNA carries an amino acid✓
- tRNA carries the amino acid to the ribosome✓
- When the anticodon on the tRNA✓
- matches the codon on the mRNA✓
- Amino acids become attached✓ in the sequence determined by the mRNA
- by peptide bonds✓
- to form the required protein✓ Max 13

EFFECTS OF A MUTATION (M)

- A gene mutation affects arrangement/type of the nitrogen bases✓/nucleotides
- This changes the code on the DNA ✓
- which changes the code on the RNA✓
- A different amino acid✓ may be coded for
- which causes a change in the amino acid sequence✓ in the protein
- leading to the formation of a different/alternate/no protein Max 4 (17)

Content: (3)
Synthesis: **(20)**

ASSESSING THE PRESENTATION OF THE ESSAY

Criterion	Relevance (R)	Logical sequence (L)	Comprehensive (C)
Generally	All information provided is relevant to the question	Ideas are arranged in a logical/cause-effect sequence	All aspects required by the essay have been sufficiently addressed
In this essay in Q4	Only information relevant to the description of protein synthesis and the effects of mutation on the process is given	The description of protein synthesis and the effects of mutation on the process given are logical and sequential	At least **5** correct points in the description of transcription and **5** correct points in the description of translation and **2** correct points on the effects of mutation
Mark	1	1	1

TOTAL SECTION C: 20
GRAND TOTAL: 150

LIFE SCIENCES P1

FEBRUARY/MARCH 2016

MEMORANDUM

SECTION A

QUESTION 1

1.1	1.1.1	C✓✓		
	1.1.2	D✓✓		
	1.1.3	C✓✓		
	1.1.4	B✓✓		
	1.1.5	B✓✓		
	1.1.6	C✓✓		
	1.1.7	A✓✓		
	1.1.8	D✓✓		
	1.1.9	B✓✓		
	1.1.10	A✓✓	(10 x 2)	**(20)**
1.2	1.2.1	Vivipary✓/Viviparous		
	1.2.2	Centrioles✓/Centrosome		
	1.2.3	Geotropism✓/Gravitropism		
	1.2.4	Carbon footprint✓		
	1.2.5	Puberty✓		
	1.2.6	Stimulus✓		
	1.2.7	Grommets✓		
	1.2.8	Pinna✓	(8 x 1)	**(8)**
1.3	1.3.1	B only✓✓		
	1.3.2	Both A and B✓✓		
	1.3.3	B only✓✓		
	1.3.4	None✓✓	(4 x 2)	**(8)**
1.4	1.4.1	(a) A✓ - penis✓		(2)
		(b) E✓ - testes✓		(2)
	1.4.2	(a) D✓ and E✓ **(Mark first TWO only)**		(2)
		(b) B✓ and C✓ **(Mark first TWO only)**		(2) **(8)**
1.5	1.5.1	(a) E✓		(1)
		(b) A✓		(1)
		(c) C✓		(1)
	1.5.2	F✓ - motor neuron✓		(2)
	1.5.3	D to E✓		(1) **(6)**
			TOTAL SECTION A:	**50**

SECTION B

QUESTION 2

2.1 2.1.1 (a) Round window✓ (1)

(b) Cochlea✓ (1)

2.1.2 Cristae✓ (1)

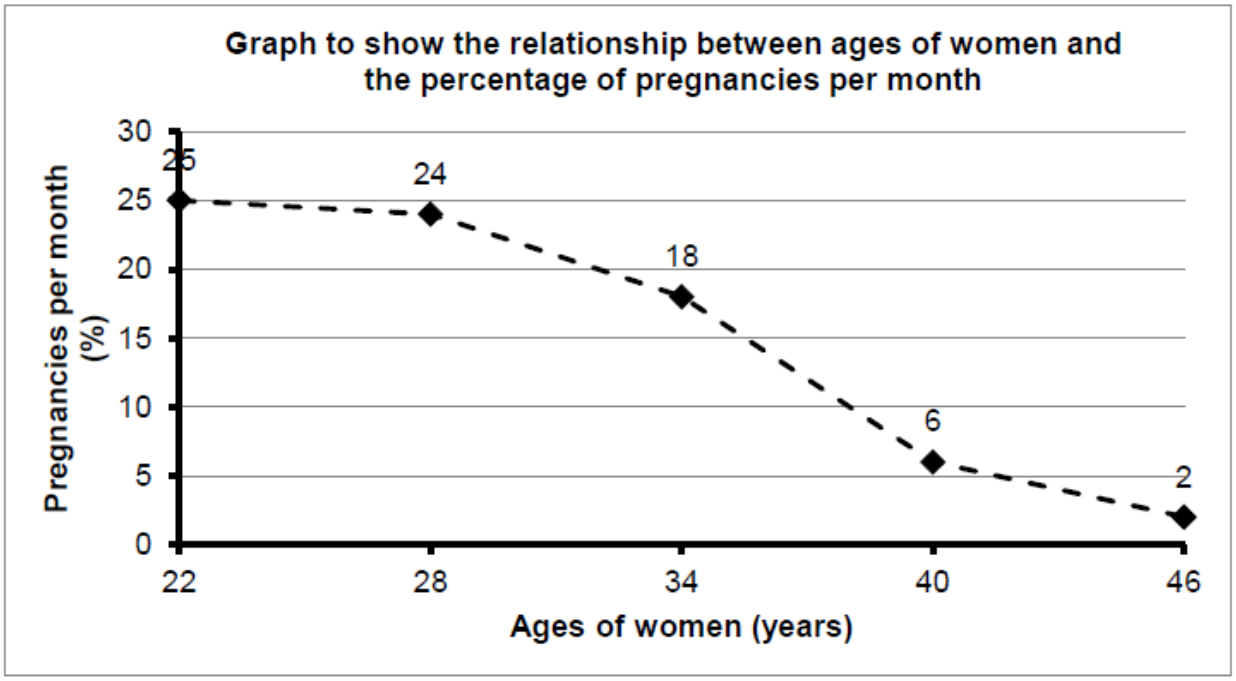
2.1.3 (a)
- Impulses from the cochlea cannot be transmitted to the brain✓
- and therefore hearing will not occur✓ (2)

2.1.4 (b)
- Part A will not be able to vibrate✓
- The round window will not absorb the sound waves✓ from the cochlea
- and hearing will be affected✓ (Any 2) (2)

(7)

2.2
- Mucus in the middle ear✓
- will lead to the blockage of the Eustachian tube✓
- which will not be able to equalise the pressure✓ in the middle ear
- resulting in pressure on the tympanic membrane✓
- that may cause the tympanic membrane to burst✓
- leading to hearing loss✓ (Any 4) **(4)**

2.3 2.3.1



Mark allocation of the graph

Criteria	Mark Allocation
Correct type of graph drawn for the pregnancies per month only	1
Title of graph including the two variables (Age of women and pregnancies per month)	1
Correct label and unit for X-axis and Y-axis	1
Correct scale for X-axis and Y-axis	1
Drawing of the graph	0: No points plotted correctly 1: 1 to 4 points plotted correctly 2: All 5 points plotted correctly

NOTE:
If axes are transposed: marks will be lost only for labelling of X-axis and Y-axis

(6)

2.3.2 The older the women, the higher the chances of having miscarriages✓✓

OR

The younger the women, the lower the chances of having miscarriages✓✓ (2)

2.3.3 50% x 12✓ = 6✓

OR

$\frac{50}{100}$ x 12✓ = 6✓

(2)
(10)

2.4.1	2.4.1	- As a result of the blocked Fallopian tube✓ - the sperm cannot reach the ovum✓ - therefore fertilisation cannot take place✓	(Any 2)	(2)
	2.4.2	(a) FSH✓/follicle stimulating hormone **(Mark first ONE only)**		(1)
		(b) Oestrogen✓ **(Mark first ONE only)**		(1)
	2.4.3	- A zygote✓ is formed - which divides by mitosis✓ - forming a ball of cells✓ - called the morula✓ - which further divides to form a hollow ball of cells✓	(Any 4)	(4)
	2.4.4	- Progesterone levels would fall✓ - The endometrium would no longer be maintained✓ - A miscarriage would occur✓		(3) **(11)**
2.5	2.5.1	Metaphase I✓		(1)
	2.5.2	- Crossing over has taken place✓ - and genetic material was exchanged ✓		(2)
	2.5.3	Anaphase II✓		(1)
	2.5.4	- The spindle fibres contract✓ - The centromeres split✓ - and pull the daughter chromosomes✓/chromatids - to the opposite poles of the cells✓ - Cytokinesis begins✓	(Any 3)	(3)
	2.5.5	Testes✓/seminiferous tubules **(Mark first ONE only)**		(1) **(8)** **[40]**

QUESTION 3

3.1 3.1.1 (a) ADH✓/antidiuretic hormone (1)

(b) Hypothalamus✓/Pituitary gland (1)

(c) Kidneys✓ (1)

3.1.2
- An increase in ADH causes the walls of the kidney tubules✓
- to become more permeable✓ to water
- More water is reabsorbed✓
- and the blood volume increases✓
- Less urine is produced✓
- and the urine is more concentrated✓ (Any 4) (4)

(7)

3.2 3.2.1 Pancreas✓ (1)

3.2.2

Insulin A	Insulin B
Glucose uptake peaks at a higher level✓/around 7 mg/kg/min	Glucose uptake peaks at lower level✓/around 1 mg/kg/min
All glucose uptake occurs in a short period of time✓/the first 5 hours	Glucose uptake is gradual✓/ sustained over a period of 24 hours
The initial uptake of glucose rises rapidly to a maximum within the first few hours✓	The initial uptake of glucose rises slowly to the maximum over 5 hours✓

TABULATION IS NOT REQUIRED (Any 2 x 2) (4)
(Mark first TWO only) **(5)**

3.3 3.3.1 (a) Amount of thyroxin✓ (1)

(b) Body weight✓ (1)

3.3.2
- Same number of rats in each group✓
- All rats were of the same species✓
- All groups were investigated for the same period of time✓
- All rats were the same gender✓
- All groups were weighed after the same interval✓ (Any 3) (3)

(Mark first THREE only)

3.3.3 Group A✓ (1)

3.3.4
- Low thyroxin levels✓
- will lead to low metabolic rate✓
- Therefore the energy from the diet is used very slowly✓
- and more organic compounds are stored✓ (Any 3) (3)

3.3.5 Group B✓ (1)

3.3.6
- These rats have high levels of thyroxin in their blood✓
- therefore pituitary gland will not be stimulated✓to secrete TSH (2)

(12)

3.4	3.4.1	- Poor infrastructure✓ - Climate change✓ - Wastage✓ - Pollution of water sources✓ **(Mark first TWO only)**	(Any 2)	(2)
	3.4.2	- The need of water for irrigation will be reduced✓		(1)
	3.4.3	- Decreased production✓ - will lead to loss of profit✓		(2)
	3.4.4	- More revenue for fixing poor infrastructure✓/building dams - Less water wastage✓by individuals and companies **(Mark first TWO only)**		(2) **(7)**
3.5	3.5.1	(a) - Invasive alien plants reduce food security✓ - since they grow rapidly and invade land✓ - that could be used to grow crops✓		(3)
		(b) - Invasive alien plants reduce water availability✓ - since they use more water✓		(2)
	3.5.2	(a) - The new organism may become a pest itself✓/it may feed on indigenous plants instead of the targeted alien plant - since no natural enemy for it was brought into the area✓		(2)
		(b) - Some parts that are left behind✓ - can regrow✓/will cost more money to remove them again		(2) **(9)** **[40]**
			TOTAL SECTION B:	**80**

SECTION C

QUESTION 4

Plant stems response to unilateral light

- Plant stems response to light is positively phototropic✓
- Auxins✓
- produced in the tip of the stem✓
- move away from unilateral light✓
- so that there is a high concentration of auxins on the darker side✓
- which stimulates growth✓/cell division/cell elongation
- The low concentration of auxins on the side exposed to light✓
- inhibits growth✓
- This uneven growth✓
- causes the stem to bend towards the light✓ Max 7

How humans receive and interpret light stimuli

- Light enters the eye ✓
- through the cornea✓
- which refracts the light✓
- It then passes through the aqueous humour✓
- and the pupil✓
- The size of the pupil is adjusted by the iris✓
- to regulate the amount of light that enters the eye✓
- The light then passes through the lens✓
- which also refracts the light✓
- It then passes through the vitreous humour✓
- and reaches the retina✓
- which has the photoreceptors✓/rods and cones which convert the light stimulus into a nerve impulse

Max 10 (10)
Content: (17)
Synthesis: (3)
(20)

ASSESSING THE PRESENTATION OF THE ESSAY

Relevance	Logical sequence	Comprehensive
All information provided is relevant to the question	Ideas arranged in a logical/ cause-effect sequence	Answered all aspects required by the essay in sufficient detail
All the information provided is relevant to plant stems' response to unilateral light and how humans receive and interpret light stimuli. No irrelevant information.	All the information regarding how plant stems respond to unilateral light and how humans receive and interpret light stimuli are arranged in a logical manner.	At least the following points should be included: - Plant response to unilateral light (**4/7**) - How humans receive and interpret light stimuli (**7/10**)
1 mark	1 mark	1 mark

TOTAL SECTION C: 20
GRAND TOTAL: 150

LIFE SCIENCES P2

FEBRUARY/MARCH 2016

MEMORANDUM

SECTION A

QUESTION 1

1.1	1.1.1	D✓✓		
	1.1.2	D✓✓		
	1.1.3	C✓✓		
	1.1.4	C✓✓		
	1.1.5	D✓✓		
	1.1.6	B✓✓		
	1.1.7	B✓✓		
	1.1.8	B✓✓		
	1.1.9	D✓✓		
	1.1.10	A✓✓	(10 x 2)	**(20)**
1.2	1.2.1	Complete dominance✓		
	1.2.2	Cloning✓		
	1.2.3	Population✓		
	1.2.4	Stereoscopic✓/Binocular		
	1.2.5	Hominidae✓/Hominids		
	1.2.6	Down syndrome✓/ trisomy 21		
	1.2.7	Transcription✓		
	1.2.8	Homologous✓		
	1.2.9	Locus✓		
	1.2.10	Discontinuous variation✓	(10 x 1)	**(10)**
1.3	1.3.1	Both A and B✓✓		
	1.3.2	Both A and B✓✓		
	1.3.3	B only✓✓	(3 x 2)	**(6)**
1.4	1.4.1	(a) Big✓ and green✓ fruit		(2)
		(b) BG, Bg, bG, bg✓✓		(2)
	1.4.2	0✓ %✓		(2)
				(6)
1.5	1.5.1	W Cell membrane ✓/ Plasmalemma		(1)
		X Homologous chromosomes✓/Bivalent		(1)
	1.5.2	(a) 4✓		(1)
		(b) 2 ✓		(1)
	1.5.3	D✓		(1)
	1.5.4	Y Holds the sister chromatids together✓		
		Z Pulls chromosomes/chromatids to the poles✓		(2)
	1.5.5	Telophase II✓		(1)
			TOTAL SECTION A:	**(8)**
				[50]

0

SECTION B

QUESTION 2

2.1 2.1.1 (11/100) ✓ x 2000✓ = 220✓ (3)

2.1.2
- Repeat✓the investigation
- Use a larger sample size✓/more dogs

(Mark first TWO only) Any 2 (2)

2.1.3 The breed of the dogs✓
(Mark first ONE only) (1)

2.1.4
- The disorders are inherited ✓
- and therefore does not change with age✓ (2)

2.1.5 Autosomal recessive inheritance causes most of the genetic disorders in dogs✓✓ (2)
(10)

2.2.

P_1 Phenotype: Rough hair x Smooth hair✓
Genotype: Hh x hh✓

Meiosis

G/gametes: H h x h h✓

Fertilisation

F_1 Genotype: Hh Hh hh hh ✓

Phenotypic ratio: 1 rough hair : 1 smooth hair ✓

P_1 and F_1✓
Meiosis and fertilisation✓ Any 6

OR

P_1 Phenotype: Rough hair x Smooth hair✓
Genotype: Hh x hh✓

Meiosis

Fertilisation

Gametes	H	h
h	Hh	hh
h	Hh	hh

1 mark for correct gametes
1 mark for correct genotypes

F_1 Phenotypic ratio: 1 rough hair : 1 smooth hair ✓

P_1 and F_1✓
Meiosis and fertilisation✓ Any 6 **(6)**

2.3 2.3.1 (a) DNA✓ (1)

(b) Ribosome✓ (1)

2.3.2 (a) 2✓ (1)

(b) 5✓ (1)

(c) 7✓ (1)

2.3.3
- The mRNA attaches to the ribosome✓
- When each codon✓ of the mRNA
- matches with the anticodon ✓on the tRNA
- the tRNA brings the required amino acid to the ribosome✓
- When the different amino acids are brought in sequence✓
- adjacent amino acids are linked by peptide bonds✓
- to form the required protein✓/polypeptide Any 4 (4)

2.3.4 (a) CCT✓✓ (2)

(b) CCU✓✓ (2)

2.3.5

DNA	RNA
Has deoxyribose✓ sugar	Has ribose✓ sugar
Has nitrogen base thymine (T)✓/ A, C, G and T	Has nitrogen base uracil(U)✓/ A, C, G and U

(Mark first TWO only) (2 x 2) (4)

TABLE NOT REQUIRED

(17)

2.4.1 Embryos✓/Blastocysts
Umbilical cord✓/ Placenta
Bone marrow✓
(Mark first ONE only) Any 1 (1)

2.4.2
- Stem cells are undifferentiated ✓
- and have the potential to develop into any type of cell✓
- to replace the affected/defective cells✓causing the disorder (3)

2.4.3
- To produce ova✓ which could be used
- in cases where females do not have functional ovaries✓
- and are therefore infertile✓ and thereby
- allowing them to have children✓ Any 3 (3)

(7)

[40]

QUESTION 3

3.1 3.1.1

- The DNA molecule unwinds✓
- Hydrogen bonds between the two strands break✓/ the molecule unzips
- Each strand serves as a template✓
- Free nucleotides✓ attach to the individual strands
- with complementary nitrogen bases✓ pairing
- Two identical DNA molecules✓ are formed
- Process is controlled by enzymes✓ Any 5 (5)

3.1.2

- If the incorrect nitrogen base✓ attaches to the original strand/if a nitrogen base is added or deleted
- the sequence✓/order of the bases changes on the new DNA molecule
- resulting in a change in the gene structure✓ Any 2 (2)

(7)

3.2 3.2.1 'Out of Africa' hypothesis✓ (1)

3.2.2 Mitochondrial DNA✓/mtDNA (1)

3.2.3

- The mitochondrial DNA is only inherited from the mother✓
- Any mutation✓on this DNA
- can be traced✓ along the maternal line only (3)

3.2.4 Fossil evidence✓
Archaeological evidence✓ Any 1 (1)
(***Mark first ONE only)*** **(6)**

3.3

- A population of a species becomes separated✓ by a geographical barrier
- then the population splits into different populations✓
- There is no gene flow✓ between the populations
- Each population may be exposed to different environmental conditions✓
- Natural selection occurs independently✓ in each population
- The individuals of each population become different from each other✓ over time
- genotypically and phenotypically✓
- Even if the two populations were to mix again✓
- they would not be able to reproduce with each other✓and are thus different species Any 6 **(6)**

3.4.1 X - Foramen magnum✓ (1)
Y - Canine✓ (1)

3.4.2
- The foramen magnum is located in a more forward position✓below the skull
- showing that organism C is bipedal✓
- This allows for the vertebral column/spine to extend vertically✓from the base of the skull
- to balance the body weight in upright walking✓ Any 3 (3)

3.4.3 (a) B✓ (1)

(b) A✓ (1)

3.4.4
- There is an increase✓
- in the cranium size✓ from organism **B** to organism **C**
- This will allow it to house a larger brain✓/cerebrum which suggests greater intelligence (3)

3.4.5

Skull B	Skull C
Brow ridges pronounced✓	Brow ridges are not as pronounced✓
More protruding jaws✓/larger jaws	Less protruding jaws✓/ smaller jaws

(***Mark first TWO only)*** Table1 + (2 x 2) (5)
(15)

3.5 3.5.1
- Because they were normal they must each have one dominant allele✓
- and in order for their children to be affected each parent must have one recessive allele✓ (2)

3.5.2 NN✓ or Nn✓ (2)

3.5.3
- The father would have been affected✓ if it was sex-linked
- in order for the daughter to be affected✓ (2)

(6)
[40]

TOTAL SECTION B: 80

SECTION C

QUESTION 4

Lamarckism
- The ancestral elephant stretched its proboscis✓
- to get leaves✓ in trees/further from the body
- The more it used the proboscis✓,
- the longer it became✓
- The offspring then inherited the acquired longer proboscis ✓
- Over many generations the length of the proboscis increased✓
- until it became a trunk✓ as in the modern elephant Any 5 (5)

Darwinism
- There was a great deal of genetic variation✓ amongst the offspring
- Some had long proboscis✓
- and some had short proboscis✓
- There was a change in environmental conditions✓/competition amongst the animals for food
- They had to reach higher in the trees to get leaves✓
- The animals with shorter proboscis died✓
- Those individuals with the longer proboscis survived✓
- They then reproduced✓
- and passed on this characteristic to their offspring✓
- The next generation of animals had a greater proportion✓ of animals with longer proboscis Any 9 (9)

Artificial selection
- Humans✓ select the elephants with
- desirable characteristics✓/long trunk
- and mate them to produce offspring with longer trunks✓
- Those that are pure breeding✓ for long trunks
- are further selected to mate to produce offspring with further longer trunks✓ Any 3 (3)

Content: (17)
Synthesis: (3)
(20)

ASSESSING THE PRESENTATION OF THE ESSAY

Criterion	Relevance (R)	Logical sequence (L)	Comprehensive (C)
Generally	All information provided is relevant to the question	Ideas are arranged in a logical/cause-effect sequence	All aspects required by the essay have been sufficiently addressed
In this essay in Q4	Only information relevant to the explanations in terms of Lamarckism, Darwinism and artificial selection are provided	Explanations in terms of Lamarckism, Darwinism and artificial selection are provided in a logical and sequential manner.	At least **3** correct points for the explanation using Lamarckism, **6** correct points for the explanation using Darwinism and **2** correct points using artificial selection
Mark	1	1	1

TOTAL SECTION C: 20
GRAND TOTAL: 150

LIFE SCIENCES P1

NOVEMBER 2016

MEMORANDUM

SECTION A

QUESTION 1

1.1	1.1.1	B✓✓		
	1.1.2	B✓✓		
	1.1.3	C✓✓		
	1.1.4	D✓✓		
	1.1.5	B✓✓		
	1.1.6	C✓✓		
	1.1.7	C✓✓		
	1.1.8	B✓✓		
	1.1.9	B✓✓		
	1.1.10	B✓✓	(10 x 2)	**(20)**
1.2	1.2.1	Interphase✓		
	1.2.2	Autonomic✓ nervous system		
	1.2.3	Abscisic acid✓		
	1.2.4	Carbon footprint✓		
	1.2.5	Cytokinesis✓		
	1.2.6	Allantois✓		
	1.2.7	Endometrium✓		
	1.2.8	Fallopian tube✓/oviduct		**(8)**
1.3	1.3.1	None✓✓		(2)
	1.3.2	A only✓✓/B only		(2)
	1.3.3	A only✓✓		(2)
				(6)
1.4	1.4.1	(a) Centromere✓		(1)
		(b) Centriole✓		(1)
		(c) Chromatid✓/daughter chromosome		(1)
	1.4.2	4 → 2→ 1→ 3✓✓		(2)
	1.4.3	4✓		(1)
				(6)
1.5	1.5.1	(a) Jelly✓ layer/zona pellucida		(1)
		(b) Cell membrane✓/plasma-lemma/plasma membrane		(1)
		(c) Cytoplasm✓/cytosol		(1)
		(d) Nucleus✓		(1)
	1.5.2	(a) G✓ - Middle piece✓/neck **OR** C✓ - Cytoplasm✓		(2)
		(b) E✓ - Acrosome✓		(2)
		(c) D✓ - Nucleus✓		(2)
				(10)
			TOTAL SECTION A:	**50**

SECTION B

QUESTION 2

2.1	2.1.1	Seminal vesicles✓	(1)
	2.1.2	A✓ B✓ D✓ Any **(Mark first TWO only)**	(2)
	2.1.3	- Fertility is reduced✓ - because the temperature is always high✓ - This will lead to production of abnormal sperm✓/fewer sperm are formed/proteins in the cells that form the sperm will denature **OR** - Fertility is reduced✓ - because pressure is increased✓/reducing circulation of blood - This will lead to production of abnormal sperm✓/fewer sperm are formed	(3) **(6)**
2.2	2.2.1	Pituitary✓ gland/hypophysis	(1)
	2.2.2	- High levels of LH✓ - stimulates ovulation✓	(2)
	2.2.3	- To monitor their fertile periods✓ - to prevent pregnancy✓/to increase chances of falling pregnant	(2)
	2.2.4	- Oestrogen✓ - levels rise✓	(2)
	2.2.5	Between 16 and 18✓✓	(2)
	2.2.6	- Progesterone only rises✓ - after ovulation✓ - This shows that the fertility period has already passed✓/when fertility is low	(3) **(12)**

2.3 2.3.1
- Body temperature increases✓
- Pulse rate increases✓

OR

Both increase✓✓ (2)

2.3.2 30✓ minutes (1)

2.3.3 **Vasoconstriction**
- Less blood reaches the surface of the skin✓
- and less heat is lost✓

OR
- Less blood reaches the sweat glands✓
- and less heat is lost✓ Any 1 x 2

Increase in metabolism
- An increase in metabolism results in an increase in respiration✓
- which generates more heat✓ (4)

2.3.4
- Amount of energy drink✓
- Length of time when measurements were taken✓
- Amount of caffeine in the energy drink✓
- Type of energy drink✓
- The level of activity of all participants✓
- Gender✓/only men

(Mark first TWO only) Any (2)
(9)

2.4
- The pancreas✓/Islets of Langerhans is stimulated
- to secrete glucagon✓ into the blood
- which stimulates the liver✓/muscles
- to convert glycogen into glucose✓
- The glucose level in the blood now increases✓ and returns to normal Any **(4)**

2.5 2.5.1 (a)
- The shoot grows straight up✓
- The tip of the shoot does not receive any light✓
- The auxins remain evenly distributed in the tip✓
- All parts of the shoot are equally stimulated to grow✓ Any (3)

(b)
- The shoot bends towards the light✓/stimulus/shows positive phototropism
- because it is exposed to unilateral light✓
- The auxins in the tip move away from the lighted✓/to the darker side of the shoot/are destroyed on the lighted side
- The cells on the darker side are stimulated to grow✓/elongate
- Growth is inhibited in cells on the lighted side✓ Any (4)

2.5.2
- Since the apical bud was removed no auxins are produced✓ in the tip
- therefore no apical dominance✓/growth of the lateral buds/branches is not inhibited (2)

(9)
[40]

QUESTION 3

3.1.1 Motor✓/multi-polar /efferent (1)

3.1.2
- Transmits impulse away from the cell body✓
- Transmits impulse to effector✓

(Mark first ONE only) Any (1)

3.1.3
- Insulates✓ the neuron
- causing it to conduct impulse faster✓/prevent a short circuit (2)

3.1.4
- There will not be a response✓ to the particular stimulus
- Nerve impulse will not be carried to the effector✓/muscle/gland (2)

(6)

3.2 3.2.1 (a) Lens✓ (1)
(b) Choroid✓ (1)

3.2.2 Long-sightedness✓/hyperopia/hypermetropia (1)

3.2.3
- Cannot see nearby objects clearly✓
- causing the image to be blurred✓ (2)

3.2.4
- No image will be formed✓/cannot see the object
- No receptors✓ present
- Light will not be converted into an impulse✓ (3)

3.2.5
- Lens is elastic✓
  therefore can change shape✓/convexity/allow for accommodation
- Lens is transparent✓
  to allow light rays to pass through✓
- Lens is biconvex✓
  to refract light rays✓

(Mark first TWO only) (Any 2 x 2) (4)

(12)

3.3 3.3.1
- Poor taste✓
- Low quality✓ (2)

(Mark first TWO only)

3.3.2 (a)
- More fruit will be available✓/for longer periods/longer shelf life (2)
- Making it cheaper✓

(b)
- The farmer will sell more fruit✓/less fruit will go to waste from spoilage/ have better quality fruit/no need for refrigeration
- And therefore make a bigger profit✓ (2)

3.3.3
- droughts✓
- floods✓
- rising sea levels✓
- high temperature✓
- low temperatures✓
- desertification✓
- veldfires✓
- extreme wind✓
- (Any TWO different examples of extreme weather)

(Mark first TWO only) Any (2)
(8)

3.4 3.4.1
- It can reduce CO/carbon monoxide emissions✓ by 20% to 30%
- It can reduce greenhouse gas emissions✓ by 2% over regular petrol

(2)
(Mark first TWO only)

3.4.2 34,8 – 23,5✓ = 11,3✓ megajoules (2)

3.4.3
- Reduces the amount of crude oil✓ required to make petrol✓

OR
- Gasohol is produced from sugarcane✓/maize which is easily available✓ Any 1 x 2 (2)

3.4.4
- In cooler climates ethanol, will evaporate more slowly✓
- Less fuel is lost✓
- Less pollution is released into the atmosphere✓ (3)

3.4.5
- There will be less food available✓ for people to eat/reduces food security
- Maize and sugarcane will be in demand✓/prices will increase
- It is energy intensive to produce✓
- Gasohol is expensive (1)

(Mark first ONE only) **(10)**

3.5 Water quality

- Results in less oxygen✓/ more carbon dioxide /algal bloom/ eutrophication/ increase in bacteria/death and decomposition of organisms
- Decreasing the quality of the water✓

Biodiversity

- Organisms die✓
- therefore reducing biodiversity✓

(4)
[40]

SECTION C

QUESTION 4

Hearing

- Pinna traps/directs the sound waves✓
- into the ear canal✓/meatus
- This causes the tympanic membrane to vibrate✓
- The vibration is transmitted to the auditory ossicles✓
- The ossicles amplify the vibration✓
- and transmit it to the oval window✓
- The oval window vibrates✓
- creating waves✓
- in the fluid/endolymph of the cochlea✓
- which stimulates the Organ of Corti✓
- to convert the wave into an impulse✓
- The impulse travels along the auditory nerve✓
- to the cerebrum✓ where it is interpreted as the roar of the lion

Max 10

Role of Adrenalin

- More adrenalin is secreted✓
- Adrenalin increases muscle tone✓
- And causes the liver/muscles to convert glycogen into glucose✓
- The heart rate increases✓
- so that the muscles receive more glucose✓
- and oxygen✓
- needed for cellular respiration✓
- to provide the energy✓ for the muscles to contract efficiently
- The rate of breathing increases✓
- and the depth of breathing increases✓
- to exhale carbon dioxide from the muscles faster✓
- and inhale oxygen faster✓
- Constriction of blood vessels to the gut✓/skin
- and dilation of blood vessels to the vital organs✓/brain/muscles
- allowing more blood to be supplied to vital organs✓/brain/muscles

Max 7
Content: (17)
Synthesis: (3)
(20)

ASSESSING THE PRESENTATION OF THE ESSAY

Relevance	Logical sequence	Comprehensive
All information provided is relevant to the question	Ideas arranged in a logical/ cause-effect sequence	Answered all aspects required by the essay
All the information provided is relevant to hearing and how adrenalin ensures that muscles function efficiently There is no irrelevant information	All the information regarding hearing and how adrenalin ensures that muscles function efficiently is arranged in a logical manner	At least the following marks should be obtained for each of the following: - Hearing (**7/10**) - How adrenalin ensures that muscles function efficiently (**4/7**)
1 mark	1 mark	1 mark

TOTAL SECTION C: 20
GRAND TOTAL: 150

LIFE SCIENCES P2

NOVEMBER 2016

MEMORANDUM

SECTION A

QUESTION 1

1.1	1.1.1	D✓✓		
	1.1.2	C✓✓		
	1.1.3	C✓✓		
	1.1.4	C✓✓		
	1.1.5	C✓✓		
	1.1.6	No correct answer		
	1.1.7	B✓✓		
	1.1.8	D✓✓		
	1.1.9	A✓✓	(8 x 2)	**(16)**
1.2	1.2.1	Ribosome✓		
	1.2.2	Peptide✓		
	1.2.3	Replication✓		
	1.2.4	Non-disjunction✓		
	1.2.5	Extinction✓		
	1.2.6	Hypothesis✓		
	1.2.7	tRNA✓/transfer RNA	(7 x 1)	**(7)**
1.3	1.3.1	B only✓✓		
	1.3.2	B only✓✓		
	1.3.3	A only✓✓	(3 x 2)	**(6)**
1.4	1.4.1	(a) Adenine✓/A		(1)
		(b) Deoxyribose✓sugar		(1)
		(c) Hydrogen bond✓		(1)
	1.4.2	10✓		(1)
	1.4.3	- DNA has the nitrogen base thymine✓ whereas RNA has the nitrogen base uracil✓ **(Mark first ONE only)**		(2) **(6)**
1.5	1.5.1	(a) Homologous chromosomes✓/Bivalent		(1)
		(b) Centromere✓		(1)
		(c) Chromatid✓		(1)
	1.5.2	- It holds the (two) chromatids together✓ - Attaches the chromosome to the spindle fibres✓	Any	(1)
	1.5.3	(a) Crossing over✓		(1)
		(b) Prophase 1✓		(1)
	1.5.4	Introduces variation✓/different gametes		(1) **(7)**

1.6	1.6.1	(a) *Hyracotherium*✓	(1)
		(b) *Sinohippus*✓	(1)
	1.6.2	44✓mya✓ (44 – 44,5)	(2)
	1.6.3	55✓/50 /46 million years✓/my	(2)
			(6)
		TOTAL SECTION A:	**48**

QUESTION 2

2.1 2.1.1 (a) GgTt✓ (1)

(b) Yellow✓ leaves no thorns✓ (2)

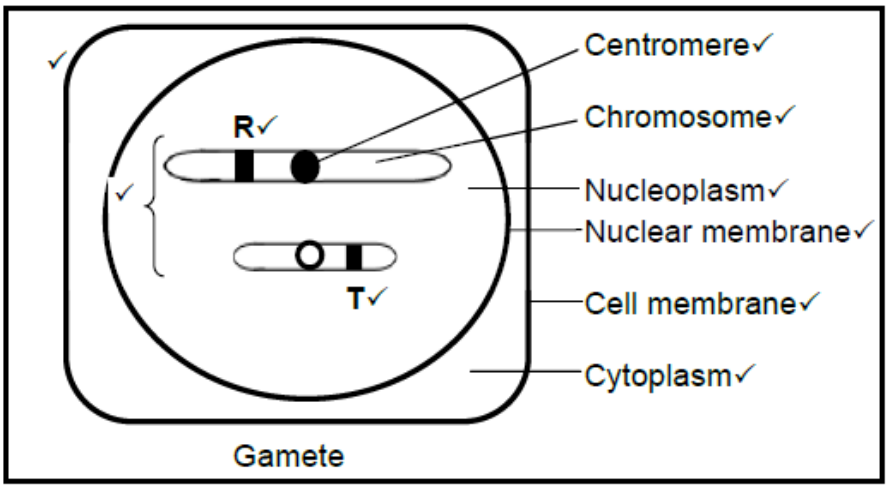
2.1.2 GGtt✓
Ggtt✓
ggTT✓
ggTt✓
(Mark first FOUR only) (4)
(7)

2.2 2.2.1 Human somatic cells have 23 pairs✓/46 chromosomes and this cell has only 2 pairs✓/4 chromosomes (2)

2.2.2 (a) 2✓ (1)

(b) 2✓ (1)

2.2.3



Criteria to mark diagram

Single cell is drawn	1
Only 2 unreplicated chromosomes in drawing	1
Short unreplicated chromosome indicating T	1
Long unreplicated chromosome indicating R	1
Any ONE correct label	1

(5)
(9)

2.3
- The pair of alleles✓on homologous chromosomes separate
- during meiosis✓/anaphase/ gamete formation, so that
- only one allele of each pair is present in the gamete✓/ offspring can acquire one allele from each parent **(3)**

2.4	2.4.1	(a) Suffers from Huntington's✓chorea	(1)
		(b) hh✓	(1)
	2.4.2	hh✓	(1)
	2.4.3	- Emma's genotype is Hh✓/heterozygous - The father's genotype has to be hh✓/homozygous recessive - a cross between only these two genotypes✓/(Hh and hh) will ensure that there is 50% chance of the child not inheriting the disease - The child inherits one recessive allele from each parent✓	(3) **(6)**
	2.5.1	Transcription✓	(1)
	2.5.2	Nucleus✓/nucleoplasm	(1)
	2.5.3	(a) GTC✓	(1)
		(b) UAC✓	(1)
	2.5.4	Valine✓✓	(2)
	2.5.5	- A mutation affects the nucleotide sequence✓/nitrogen base sequence/gene structure - Resulting in a changed mRNA✓/codon - A different amino acid✓ may be coded for - by tRNA✓/anticodon Any 3	(3) **(9)**

2.6 2.6.1

P_1	Phenotype	Pink	x	Pink✓	
	Genotype	RW	x	RW✓	
Meiosis					
	G/gametes	R, W	x	R, W ✓	
Fertilisation					
F_1	Genotype	RR;	RW; RW;	WW ✓	
	Phenotype	Red	Pink	White ✓	

P_1 and F_1✓
Meiosis and fertilisation✓

Any 6

OR

P_1	Phenotype	Pink	x	Pink ✓	
	Genotype	RW	x	RW ✓	

Meiosis

Fertilisation

Gametes	R	W
R	RR	RW
W	RW	WW

1 mark for correct gametes
1 mark for correct genotypes

F_1 Phenotype Red : Pink : White ✓

P_1 and
F_1✓
Meiosis and fertilisation✓

(6)

Any 6 **[40]**

QUESTION 3

3.1 3.1.1 With the discovery that the soil bacterium *Agrobacterium* could be used to transfer useful genes from unrelated species into plants✓ (1)

3.1.2
- Modified crops may become super-weeds✓/accidently breed with other plants to become super-weeds
- They are difficult/expensive to kill✓
- and could outcompete the original crop✓/other crops Any (2)

3.1.3
- Toxic proteins might be produced✓
- Antibiotic-resistance genes may be transferred to human gut bacteria✓

(Mark fist TWO only) (2)
(5)

3.2 3.2.1 (a) colour of lizard✓ (1)

(b) survival rate of the lizards✓ (1)

3.2.2
- It decreases survival✓/lizards may die/is harmful/is lethal to the red lizards as
- they will be seen✓ on the black rock by the predators

OR

- They could not escape predators✓/catch prey on cold days
- as red lizards did not warm up fast on cold days✓ Any 1 x 2 (2)

3.2.3
- To allow enough time for reproduction✓ and survival to be able to calculate the percentage to ensure reliability✓ of results

OR

- A change in population proportions will not be seen over a shorter time period✓ to ensure reliability✓ of results

Any 1 x 2 (2)

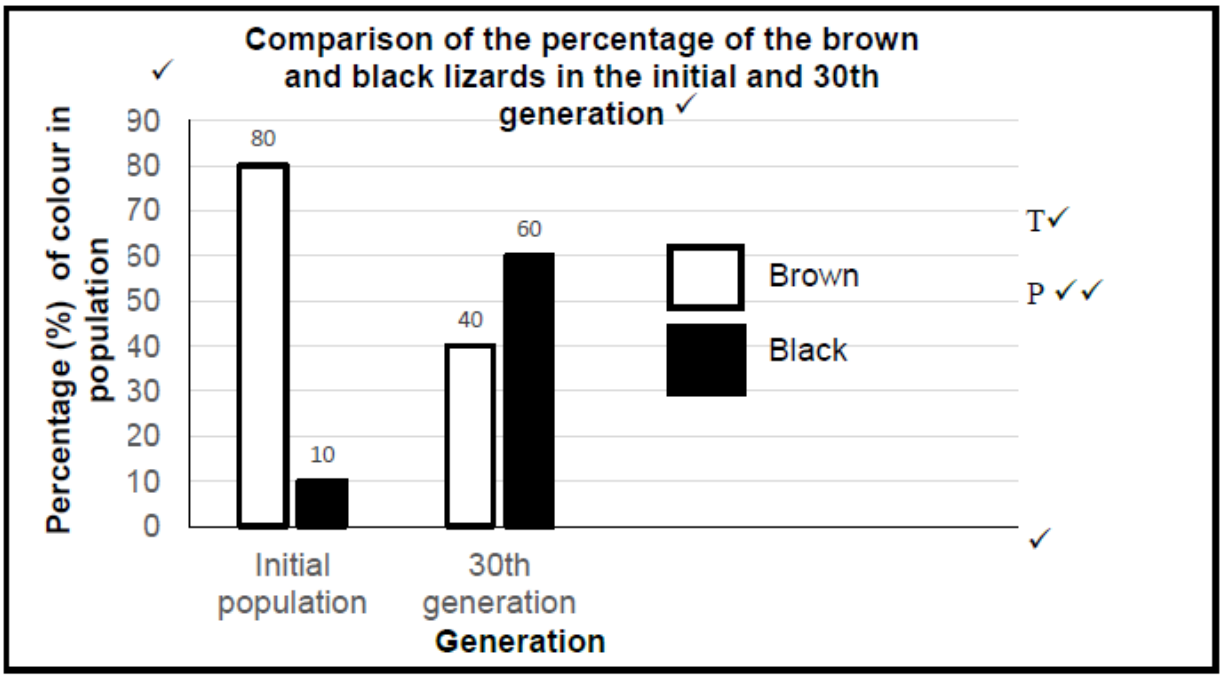
3.2.4
- Conduct the investigation in the same habitat✓/environment
- Use the same sampling technique✓
- Capture the same number of lizards in each sampled generation ✓
- Take each sample at the same time of day✓/weather conditions

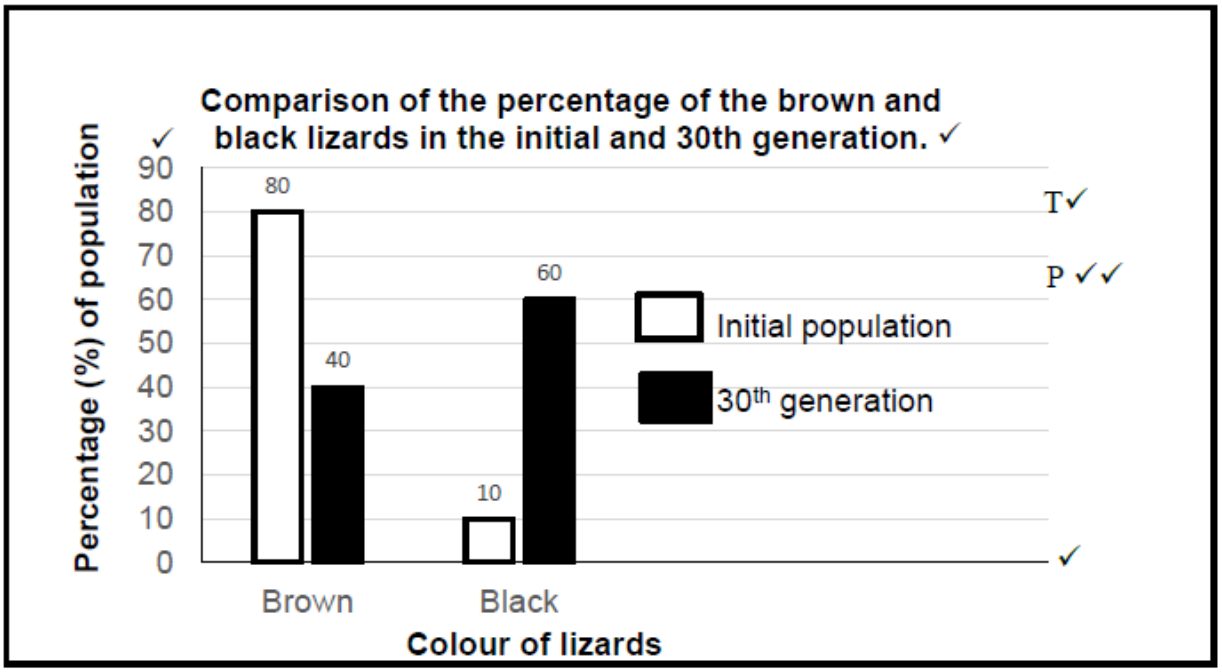
(*Mark first TWO only*) Any 2 (2)

3.2.5
- There is variation✓in colour amongst the lizards
- *__Red and brown__✓ lizards
- *__are not camouflaged✓/cannot warm up fast enough to have energy to run away__
- are killed by predators✓
- *__The black lizards__✓
- *__are better camouflaged✓/warm up faster to have energy to avoid predators__
- and survive✓/reproduce
- The allele for black colour is passed on to the next generation✓
- to produce more black lizards✓ in the next generation

Any 2+*__4 compulsory marks__ (6)

3.2.6





Guideline for the assessing the graph

Bar graph for the required data	1
Title of graph	1
Correct label and scale for X-axis	1
Correct label and scale for Y-axis	1
Drawing of bars	1: 1 to 3 bars plotted correctly 2: All 4 bars plotted correctly

(6)

NOTE:
If the wrong type of graph is drawn, marks will be lost for:

- 'Bar graph'
- 'Drawing of bars'

If two graphs are drawn mark the first ONE only

(20)

3.3
- The common ancestor✓/original camel population
- was separated✓ into different populations
- *by the sea✓/due to continental drift
- There was no gene flow✓ between the populations
- Each population was exposed to different environmental conditions✓/selection pressures
- Natural selection occurred independently✓ in each population
- The individuals of each population became different✓ from each other over time
- genotypically and phenotypically✓
- Even if the three populations were to mix again✓
- they would not be able to interbreed✓

Any 5+*1 compulsory mark **(6)**

3.4 3.4.1 I^A✓, I^B✓, i✓ (3)

3.4.2 2✓ (1)

3.4.3
- Any individual inherits one allele✓
- from each parent✓ (2)

3.4.4
- Each child✓
- has an equal✓/25% chance of having
- any blood group✓/ A, B, AB, or O. (3)

(9)
[40]

SECTION C

QUESTION 4

HYPOTHESIS

- **All modern humans**✓*/*Homo sapiens*
- **originated in Africa**✓*
- and migrated to other parts✓ of the world **2(*compulsory) +1 (3)**

FOSSIL EVIDENCE✓

- Fossils of *Ardipithecus* were found **ONLY** in Africa✓/Rift Valley/Ethiopia/South Africa
- Fossils of *Australopithecus* were found **ONLY** in Africa✓/Rift Valley/Ethiopia/South Africa
- The fossils of *Homo habilis* were **ONLY** found in Africa✓
- The **OLDEST** fossils of *Homo erectus* were found in Africa✓
- The **OLDEST** fossils of *Homo sapiens* were found in Africa✓ Max (4)

GENETIC EVIDENCE✓

- Mitochondrial DNA✓
- Is inherited only from the maternal line✓
- Analysis of mutations ✓ on this mitochondrial DNA
- shows that the oldest female ancestor were located in Africa✓
- and that all humans descended from her✓/mitochondrial Eve
- The Y chromosome shows the paternal line✓ Max (4)

CULTURAL EVIDENCE✓

- The **OLDEST**/most primitive artefacts (tools, cutlery, art etc.)
- were found in Africa✓ (2)

TOTAL FOR EVIDENCE (8)

BIPEDALISM

The fossils of all three genera indicate that:

- The foramen magnum✓
- is located in a more forward position✓
- The pelvis✓
- is wider and shorter✓
- The spine✓
- is S-shaped✓

(6)

Content (17)
Synthesis (3)
(20)

ASSESSING THE PRESENTATION OF THE ESSAY

Criterion	Relevance (R)	Logical sequence (L)	Comprehensive (C)
Generally	All information provided is relevant to the question.	Ideas are arranged in a logical sequence.	All aspects of the essay have been sufficiently addressed.
In this essay in Q4	Only information relevant to the 'Out of Africa' hypothesis and bipedal fossils of the three genera are described. No irrelevant information included.	The description of the evidence for the 'Out of Africa' hypothesis and the evidence of bipedalism is presented in a logical and sequential manner.	At least the following marks should be obtained: - **7/11** for the 'Out of Africa' hypothesis and the evidence - **4/6** on evidence for bipedalism.
Mark	1	1	1

TOTAL SECTION C: 20
GRAND TOTAL: 150

LIFE SCIENCES P1

FEBRUARY/MARCH 2017

MARKING GUIDELINE

SECTION A

QUESTION 1

1.1	1.1.1	C✓✓		
	1.1.2	C✓✓		
	1.1.3	C✓✓		
	1.1.4	B✓✓		
	1.1.5	B✓✓		
	1.1.6	C✓✓		
	1.1.7	C✓✓		
	1.1.8	A✓✓		
	1.1.9	D✓✓		
	1.1.10	D✓✓	(10 x 2)	**(20)**
1.2	1.2.1	Zygote✓		
	1.2.2	Amniotic✓fluid		
	1.2.3	Multiple sclerosis✓		
	1.2.4	Prolactin✓		
	1.2.5	Food security✓		
	1.2.6	Umbilical vein✓/Vein		
	1.2.7	Dendrite✓		
	1.2.8	Diabetes✓	(8 x 1)	**(8)**
1.3	1.3.1	None✓✓		(2)
	1.3.2	Both A and B✓✓		(2)
	1.3.3	B only✓✓		(2)
			(3 x 2)	**(6)**
1.4	1.4.1	(a) Centriole✓ (b) Chromosome✓(do not accept homologous chromosome/ chromatid) (c) Centromere✓		(3)
	1.4.2	Anaphase I✓		(1)
	1.4.3	Telophase I✓		(1)
	1.4.4	4✓		(1)
	1.4.5	Oogenesis✓		(1) **(7)**
1.5	1.5.1	(a) Sclera✓ (b) Cornea✓ (c) Pupil✓		(1) (1) (1)
	1.5.2	(a) D✓ – Iris✓ (b) G✓ – Choroid✓ (c) E✓ – Retina✓		(2) (2) (2) **(9)**
			TOTAL SECTION A:	**50**

SECTION B

QUESTION 2

2.1 2.1.1 Vagina✓/vaginal canal (birth canal not accepted since it is not always a birth canal) (1)

2.1.2
- Protects the developing foetus✓
- Contracts to push the baby out during labour✓
- Allows for implantation of embryo✓
- Contracts to push out blood/lining during menstruation✓

(MARK FIRST ONE ONLY) Any (1)

2.1.3 Oestrogen✓ (1)

2.1.4 It causes the initial thickening of the endometrium✓/endometrium become more vascular and glandular (1)

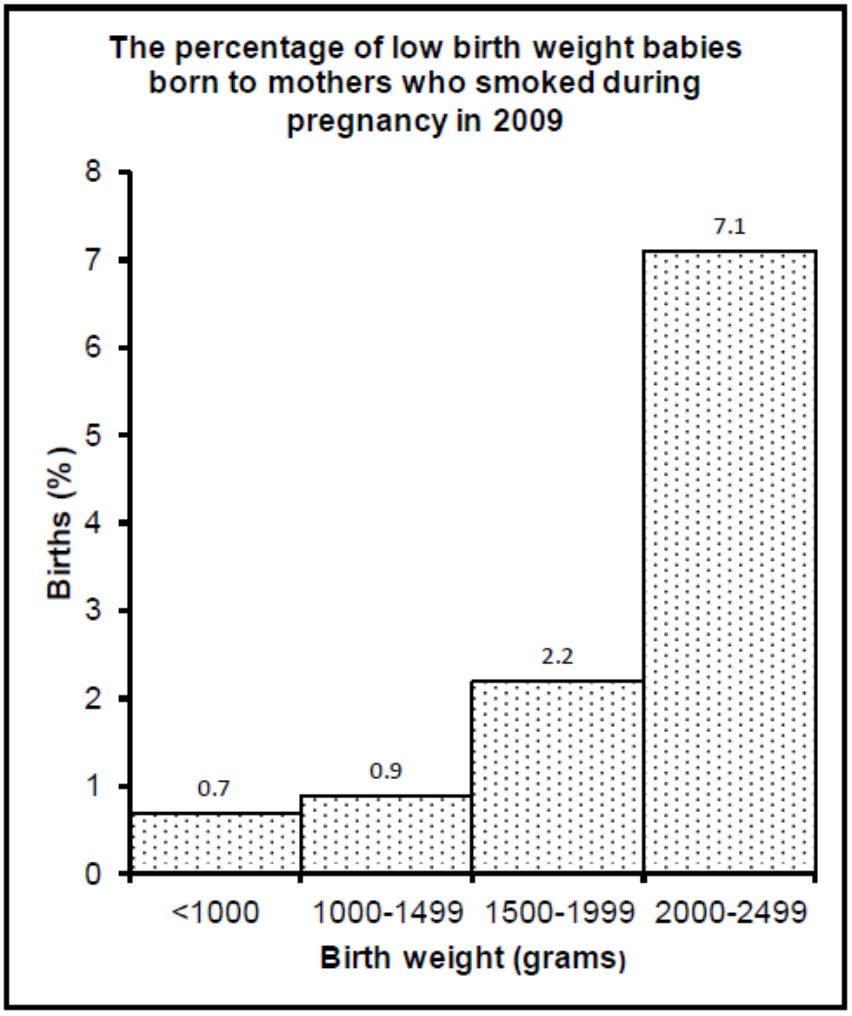
2.1.5
- Sperm✓
- cannot reach the ovum✓
- therefore fertilisation cannot take place✓

OR

- Ovum✓ cannot move into A/the Fallopian tube/oviduct
- cannot be reached by the sperm✓
- therefore fertilisation cannot take place✓ (3)

(7)

2.2 2.2.1



Mark allocation of the graph

Criteria	Mark Allocation
Histogram drawn (bars must be touching)	1
Title of graph (has both variables)	1
Correct label and unit for X-axis and Y-axis	1
Correct scale for Y-axis and X-axis and width of the bars	1
Drawing of the graph	1: 1 to 3 bars drawn correctly 2: All 4 bars drawn correctly

NOTE:
If the wrong type of graph is drawn: Marks will be lost for 'correct type of graph'
If axes are transposed: Marks will be lost only for labelling of X-axis and Y-axis

If learners draw both graphs on the same system of axes:
- Learners will lose the mark for the title
- If 8 bars are drawn, mark the first 4 bars only

If learners draw two graphs mark the first graph

(6)

2.2.2 Babies that weigh 2 500 g or more are considered to be of a normal/healthy birth weight✓ (1)

2.2.3 The total percentage of low birth weight babies born to mothers who smoked was higher than those born to mothers who did not smoke✓✓

OR

The total percentage of low birth weight babies born to mothers who did not smoke was lower than those born to mothers who smoked✓✓ (2)

2.2.4
- Chemicals dissolved in the mothers blood✓
- are able to move across the placenta✓/and through the umbilical cord into the babies blood
- by diffusion✓ Any (2)

(11)

2.3 2.3.1 Oviparous✓ (1)

2.3.2 Eggs are laid✓ in the nest (1)

2.3.3 (a) The graph will decrease more slowly✓at the beginning /not decrease as quickly at the beginning/more convex (1)

(b) The offspring are protected✓ by the parents for a longer period of time
Therefore more of them will survive✓ to become adults (2)

(5)

2.4 2.4.1
(a) Semi-circular canals✓ (1)
(b) Eustachian tube✓ (1)
(c) Oval window✓/fenestra ovalis (1)

2.4.2
- A/the tympanic membrane is larger✓/larger surface area
- than D/the oval window✓/smaller surface area
- Therefore the incoming sound waves are concentrated on to a smaller area✓
thus amplifying the sound (3)

2.4.3 Allows ossicles/tympanum to vibrate freely✓ (1)

(7)

2.5 2.5.1
- Loss of higher thought processes✓/memory/judgement/ problem solving/any example
- Loss of one or more of the senses✓/loss of smell/hearing/ any example
- Loss of voluntary actions✓/paralysis could occur

(MARK FIRST TWO ONLY) Any (2)

2.5.2
- The skull✓/cranium
- The meninges✓/name of ALL three i.e. pia mater, arachnoid and dura mater
- The cerebrospinal fluid✓

(MARK FIRST ONE ONLY) Any (1)

2.5.3
- CTE mainly affects the cerebrum✓
- Therefore the medulla oblongata✓ which controls breathing and heart rate
- is generally not damaged✓ Any (2)

(5)

2.6 2.6.1 Blood✓ (1)

2.6.2
- The pituitary gland/hypophysis is malfunctioning✓and secretes large amount of TSH✓
- Thyroid gland secretes less thyroxin✓and this will not have a negative feedback effect on the pituitary gland to secrete less TSH✓

(MARK FIRST TWO ONLY) (2 x 2) (4)

(5)

[40]

QUESTION 3

3.1 3.1.1
- To allow time for the auxins from the tip✓
- to diffuse into the agar jelly✓ (2)

3.1.2
- Auxins from the agar jelly✓
- diffused into the shoot/coleoptile on one side/the left side only✓
- The cells on this side were stimulated to grow✓/elongate
- The cells on the other side/right side did not receive auxins✓
- and grew more slowly✓
- This uneven growth✓ caused the stem to bend to the right

Any (4)

3.1.3
- Remove the agar jelly completely✓/use agar jelly/substance that does not contain auxins
- and place a black box✓ around the tip of the coleoptile (2)

(8)

3.2 3.2.1 6/12✓/6:12 (1)

3.2.2
- People cannot learn the pattern✓/arrangement/sizes and therefore cheat on the test✓ (2)

3.2.3
- The ciliary muscles contract✓
- and tension on the suspensory ligaments is released✓/ suspensory ligaments slacken
- The lens becomes more convex✓/bulges
- and its refractive power increases✓
- so that a clear image is formed on the retina✓ Any (4)

(7)

3.3 3.3.1
- **The transport of food over long distances**✓
- **The packaging and processing of food**✓

(MARK FIRST TWO ONLY) (2)

3.3.2
- Reduce prices✓
- Sell locally grown products✓
- Donate unsold food to charities✓
- Only buy quantities that they can sell✓
- Use large refrigerators✓/ storages

(MARK FIRST TWO ONLY) Any (2)

3.3.3 8/60 x 100✓ = 13,3✓/13,33/13 % (2)

3.3.4
- Crops will fail✓/farmers cannot plant crops therefore less food will be produced✓
- Decrease in supply of food✓/more food will have to be imported and this food will be more expensive✓ to purchase

(MARK FIRST TWO ONLY) (2 x 2) (4)

(10)

3.4 3.4.1 1650✓ (1)

3.4.2
- There was an increase in the human population✓ and a decrease in the parrot population✓ (2)

3.4.3
- Humans cut down the trees✓ which are the parrots habitat✓
- Humans probably killed the parrots✓ for food✓/sport/ as pests
- Humans introduces diseases✓ that kill the parrots✓
- Humans introduce other species✓ which use resources that the parrots would normally use✓

(MARK FIRST TWO ONLY) Any (2 x 2) (4)

3.4.4
- The organisms that feed on the parrots would probably migrate✓/die as they would no longer have any food✓
- They will have to find an alternative food source✓ and that will affect other food chains✓ Any (1 x 2) (2)

(9)

3.5
- Fertilisers are washed into water bodies when it rains✓/excessive irrigation
- and cause eutrophication✓
- The excess nutrients✓ in the fertilisers
- cause an algal bloom✓
- The algae block out the sunlight✓
- and the water plants cannot photosynthesise✓
- Less oxygen is released into the water✓
- plants die and bacteria cause decay✓
- This removes more oxygen from the water✓
- other organisms then also die✓
- due to the reduced water quality✓ Any **(6)**

[40]

SECTION C

QUESTION 4

Regulating water

- The water levels in her body are low✓/she is dehydrated
- Osmoreceptors✓
- in the hypothalamus✓ are stimulated by the low water levels and send impulses
- to the pituitary gland✓/hypophysis
- which is stimulated to secrete more ADH✓
- ADH increases the permeability✓
- of the tubules✓/collecting ducts and distal convoluted tubules
- in the kidneys✓
- More water is reabsorbed✓
- and passed to the surrounding blood vessels✓
- Less urine is produced✓
- and the urine is more concentrated✓
- in order to conserve water✓
- Aldosterone✓ is secreted by the adrenal glands
- to ensure more Na^+ ions✓ are reabsorbed by the distal convoluted tubules
- The increase in Na^+ ions in the blood✓
- causes more water to be reabsorbed✓ into the blood capillaries Max 12

Balance is achieved in the following way:

- The maculae✓
- in the utriculus and sacculus✓ and
- the cristae✓
- in the semi-circular canals✓ are stimulated
- They generate impulses✓
- which is transmitted through the auditory nerve✓
- to the cerebellum✓where they are interpreted
- Impulses are transmitted via the motor neuron✓
- to skeletal muscles✓ Max 5

Content: (17)
Synthesis: (3)
(20)

ASSESSING THE PRESENTATION OF THE ESSAY

Relevance	Logical sequence	Comprehensive
All information provided is relevant to the question.	Ideas arranged in a logical sequence.	Answered all aspects required by the essay.
All the information provided is relevant to regulating water and salts and maintaining balance. There is no irrelevant information.	All the information regarding regulating water and salts and maintaining balance is arranged in a logical manner.	At least the following marks should be obtained: -Regulating water (**8/12**) -Balance and equilibrium(**3/5**)
1 mark	1 mark	1 mark

TOTAL SECTION C: 20
GRAND TOTAL: 150

LIFE SCIENCES P2
FEBRUARY/MARCH 2017
MARKING GUIDELINE

SECTION A

QUESTION 1

1.1	1.1.1	B✓✓		
	1.1.2	C✓✓		
	1.1.3	B✓✓		
	1.1.4	D✓✓		
	1.1.5	C✓✓		
	1.1.6	B✓✓		
	1.1.7	A✓✓		
	1.1.8	D✓✓	(8 x 2)	**(16)**
1.2	1.2.1	(Gene) mutation✓		
	1.2.2	Theory✓		
	1.2.3	Artificial selection✓/Selective breeding		
	1.2.4	Ribose✓sugar		
	1.2.5	Punctuated equilibrium✓		
	1.2.6	Out of Africa✓hypothesis		
	1.2.7	Fossils✓	(7 x 1)	**(7)**
1.3	1.3.1	A only✓✓		
	1.3.2	Both A and B✓✓		
	1.3.3	B only✓✓	(3 x 2)	**(6)**
1.4	1.4.1	(a) 25✓ mya (accept 24 to 25)		(1)
		(b) 63✓ mya		(1)
	1.4.2	Old World monkeys✓ and apes✓ **(MARK FIRST TWO ONLY)**		(2)
	1.4.3	Lorises✓		(1) **(5)**
1.5	1.5.1	23✓		(1)
	1.5.2	(a) Centromere✓		(1)
		(b) Chiasma✓/chiasmata		(1)
	1.5.3	Ovary✓		(1)
	1.5.4	(a) Crossing over✓		(1)
		(b) Prophase I✓		(1)
		(c) ova✓/gametes/sex cells		(1)
	1.5.5	C→ B→ A✓(correct sequence)		(1) **(8)**

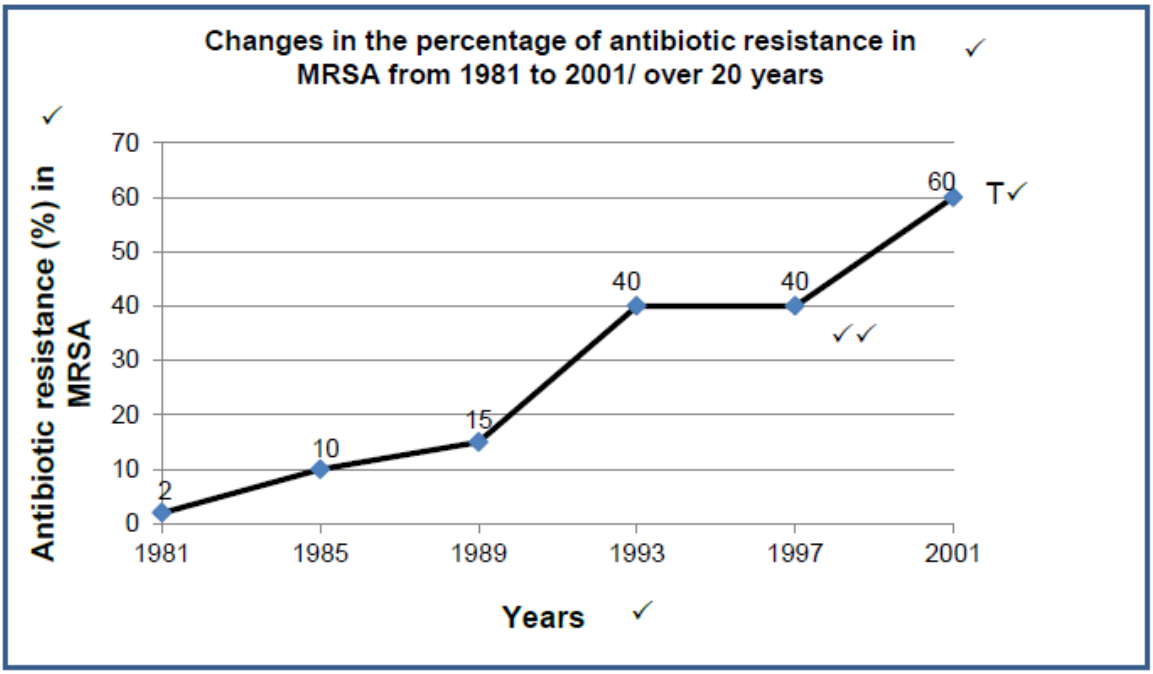
1.6	1.6.1	(a) BbTt✓✓	(2)
		(b) Black coat✓ short tail✓	(2)
		(c) BbTt✓	(1)
	1.6.2	0✓%	(1)
	1.6.3	Bt✓ bT✓ **(MARK FIRST TWO ONLY)**	(2) **(8)**
		TOTAL SECTION A:	**50**

SECTION B

QUESTION 2

2.1	2.1.1	A transitional fossil shows characteristics✓ of two✓/between genera/species	(2)
	2.1.2	Bipedalism✓/stood upright	(1)
	2.1.3	- Structure of the pelvis✓ - Cranial volume✓ **(MARK FIRST ONE ONLY)** Any 1	(1)
	2.1.4	- The foramen magnum is located more forward beneath the skull✓, so that - the vertebral column extends beneath✓ the skull. - The spine is S-shaped ✓to - support an upright posture✓ - The pelvis is shorter and wider✓ - to support the body above✓the pelvis **(MARK FIRST TWO ONLY)** Any (2 x 2)	(4)
	2.1.5	- There was a change in diet✓ - from tough✓/raw to - softer✓/cooked food	(3) **(11)**
2.2	2.2.1	(a) MRSA✓	(1)
		(b) FQRP✓	(1)
	2.2.2	$\frac{(20-5)✓}{5} \times \frac{100✓}{1}$ **OR** $\frac{(15)✓}{5} \times \frac{100✓}{1}$	
	.	= 300✓%	(3)

2.2.3



Mark allocation for the graph

Criteria	Mark Allocation
Correct type of graph (line graph)	1
Title of graph including both variables	1
Correct label and scale for X-axis	1
Correct label and scale for Y-axis	1
Plotting of points	1 – 1 to 5 points plotted correctly 2 – all 6 points plotted correctly

NOTE:
If the wrong type of graph is drawn, marks will be lost for:

- 'Correct type of graph'
- 'Plotting of points'

If the axes are transposed:
The learner will lose 2 marks for correct label and scale for x and y axes

If learners draw all 3 graphs on the same system of axes:

- Learners will lose the mark for the title
- Learners will lose 1 mark for correct label and scale for y axis
- If all three graphs drawn are labelled, mark the correct MRSA graph
- If all three graphs drawn are not labelled, marks for plotting will be lost

If learners draw three graphs separately mark the first graph

(6)
(11)

2.3 2.3.1 DNA✓ (1)

2.3.2 First triplet base✓/ TAT /TAG became TAT (1)

2.3.3 (a) GUU✓✓ (2)

(b) Isoleucine✓✓ (2)
(6)

2.4
- Double-stranded DNA unwinds✓
- and unzips✓
- when the hydrogen bonds break✓
- One strand is used as a template✓
- to form mRNA✓
- using free RNA nucleotides from the nucleoplasm✓
- the mRNA is complementary to the DNA✓
- The coded message for protein synthesis is thus copied onto mRNA✓ Any 4 **(4)**

2.5 2.5.1 (a) Male✓ with Tay Sachs disease✓/all 4 symptoms must be given blind, deaf, mentally retarded and paralysed/ lose motor skills and mental functions (2)

(b) Nn✓✓ (2)

(c) Nn✓✓ (2)

2.5.2
- Since Elizabeth has Tay-Sachs disease✓/nn she had to inherit one recessive allele from each of her parents✓/Portia and Patrick.
- Patrick's genotype is Nn✓/heterozygous which means he is a carrier but normal. (Any 2) (2)

(8)
[40]

QUESTION 3

3.1 3.1.1 Mary✓✓
(MARK FIRST ONE ONLY) (2)

3.1.2 There are no matching bands✓/bars/pattern/DNA profile with both parents✓ (2)
(4)

3.2 3.2.1 Three✓/3 (1)

3.2.2 I^A✓ and I^B✓ (2)
(MARK FIRST TWO ONLY)

3.2.3

P_1 Phenotype Blood group A x Blood group O✓
Genotype I^Ai x ii✓

Meiosis

G/gametes I^A, i x i, i✓

Fertilisation

F_1 Genotype I^Ai; I^Ai; ii; ii ✓

Phenotype 2 blood group A : 2 blood group O✓
Phenotypic ratio is **1 : 1***✓

P_1 and F_1✓
Meiosis and fertilisation✓

***1 compulsory mark** + Any 6

OR

P_1 Phenotype Blood group A x Blood group O✓
Genotype I^Ai x ii✓

Meiosis

Fertilisation

Gametes	I^A	i
i	I^Ai	ii
i	I^Ai	ii

1 mark for correct gametes
1 mark for correct genotypes

F_1 Phenotype 2 blood group A : 2 blood group O✓
Phenotypic ratio is **1 : 1***✓

P_1 and F_1✓
Meiosis and fertilisation✓ (7)
(10)

***1 compulsory mark** + Any 6

3.3
- An individual inherits one allele from each parent✓
- The Y chromosome was inherited from the father✓
- and the recessive allele/X^h was inherited from the mother✓
- since the mother has two recessive alleles✓/X^h X^h
- A son only needs to get one recessive allele to be haemophiliac✓since the
- Y-chromosome does not carry any allele to mask the haemophilia allele✓

Any 4 **(4)**

3.4 3.4.1
- Determine time/day to collect data✓
- Selected an area✓on the island
- randomly captured✓ a number of birds of the same species
- **measured their beaks✓**
- **before the drought✓**
- **and during the drought✓**
- recorded✓ the number of birds with each beak size

(MARK FIRST FOUR ONLY) Any 4 (4)

3.4.2 Number of finches before and during the drought✓/(beak size) (1)

3.4.3 During the drought there were more finches with larger beaks✓✓

OR

During the drought there were fewer finches with smaller beaks✓✓ (2)

3.4.4
- During the drought only hard woody seeds remained✓
- Finches with bigger beaks could crack open the seeds more easily✓
- had sufficient food✓
- and survived✓ and reproduced

OR

- During the drought, there were no small, soft seeds✓
- Finches with smaller beaks could not crack open the hard woody seeds✓
- and had no food✓
- did not survive✓to reproduce

Any 3 (3)

3.4.5 Range (9,8 – 10,3✓) mm/larger (1)

(11)

3.5	3.5.1	(a)	Cloning✓		(1)
		(b)	Oogenesis✓/gametogenesis/ meiosis		(1)
	3.5.2	-	The donor horse has the desired characteristics✓ - that need to be copied✓ - and be present in the offspring✓/next generation	Any 2	(2)
	3.5.3	-	The nucleus contains all the genetic information✓✓/ hereditary characteristics/chromosomes of the champion horse		(2)
	3.5.4	(a)	64✓		(1)
		(b)	32✓		(1)
		(c)	64✓		(1)
	3.5.5	-	A gamete is generally haploid✓ - This ovum is diploid✓ since - it has the nucleus of a somatic cell ✓	Any 2	(2) **(11)** **[40]**
				TOTAL SECTION B:	**80**

SECTION C

QUESTION 4

Natural selection and speciation

- The original species of anole lizards was separated✓S
- into different populations✓S
- by a geographical barrier✓S
- which is the sea✓S
- There was no gene flow✓S
- between the separated populations✓S
- Each population was exposed to different environmental conditions✓N on each island
- Because there is variation✓N amongst the lizards
- Natural selection occurred independently✓N in each population
- Some had favourable characteristics✓N to survive on a specific island
- while others did not✓N
- The ones that did not have the favourable characteristics died✓ N
- The ones with the favourable characteristic survived✓ N
- and reproduced✓ N
- to pass the gene for the favourable characteristics✓N
- to the next generation✓ N
- And over many generations the favourable characteristic becomes more frequent in the population✓ N
- each population became different from the other✓S over time
- genotypically ✓S
- and phenotypically✓S
- Even if the populations were to mix again✓S
- they would not be able to reproduce/interbreed with each other✓S Max 17

NOTE: ✓S = SPECIATION
✓N = NATURAL SELECTION

Content: (17)
Synthesis: (3)
(20)

ASSESSING THE PRESENTATION OF THE ESSAY

Criterion	Relevance (R)	Logical sequence (L)	Comprehensive (C)
Generally	All information provided is relevant to the topic.	Ideas arranged in a logical sequence.	Answered all aspects required by the essay.
In this essay (Q4)	Only information relevant to the description of natural selection and speciation is given.	The descriptions for natural selection and speciation are logical and sequential.	At least **6** correct points in the description of natural selection and **6** correct points on speciation are given.
Mark	1	1	1

TOTAL SECTION C: 20
GRAND TOTAL: 150

LIFE SCIENCES P1

NOVEMBER 2017

MARKING GUIDELINES

SECTION A

QUESTION 1

1.1	1.1.1	D✓✓		
	1.1.2	B✓✓		
	1.1.3	D✓✓		
	1.1.4	A✓✓		
	1.1.5	C✓✓		
	1.1.6	C✓✓		
	1.1.7	D✓✓		
	1.1.8	B✓✓		
	1.1.9	B✓✓		
	1.1.10	D✓✓	(10 x 2)	**(20)**
1.2	1.2.1	External✓fertilisation		
	1.2.2	Chiasma✓		
	1.2.3	Aldosterone✓		
	1.2.4	Homeostasis✓		
	1.2.5	Amniotic✓egg		
	1.2.6	Luteinising hormone✓/LH		
	1.2.7	Astigmatism✓		
	1.2.8	Corpus callosum✓		
	1.2.9	Optic✓nerve		
	1.2.10	Meninges✓		**(10)**
1.3	1.3.1	None✓✓		(2)
	1.3.2	B only✓✓		(2)
	1.3.3	A only✓✓		(2)
			(3 x 2)	**(6)**
1.4	1.4.1	Motor✓ neuron		(1)
	1.4.2	(a) Nucleus✓/nuclear membrane		(1)
		(b) Cytoplasm✓		(1)
		(c) Dendrite✓		(1)
	1.4.3	(a) C✓- Axon✓		(2)
		(b) D✓- Myelin sheath✓		(2)
	1.4.4	Multiple sclerosis✓		(1)
				(9)
1.5	1.5.1	Pancreas✓		(1)
	1.5.2	Insulin✓		(1)
	1.5.3	Glucagon✓		(1)
	1.5.4	Diabetes✓mellitus		(1)
	1.5.5	Negative feedback✓		(1)
				(5)
			TOTAL SECTION A:	**50**

SECTION B

QUESTION 2

2.1 2.1.1 Northern Cape✓ (1)

2.1.2 Eastern Cape✓ (1)

2.1.3 74,72 OR 74,7 OR 75✓✓✓% (3)

OR (if candidate does not have above answer)

$\frac{33,4/(78,1-44,7)✓}{44,7}$ x 100✓ Max (2)

2.1.4
- Western Cape✓ and
- Kwazulu-Natal✓ (2)

(MARK FIRST TWO ONLY)

2.1.5
- Research alternative methods✓/e.g.desalinate seawater/cloud seeding
  to supplement the normal water supplies✓
- Fix/maintain all waterworks✓/pipe systems
  to prevent water loss by leaking✓
- Locate aquifers✓/boreholes/underground water
  to provide additional water sources✓
- Penalise people who are using too much water✓
  to prevent them from wasting water✓
- Remove alien plants✓in the catchment area of the dam
  to ensure that more water reaches the dams✓
- Increase awareness✓
  to encourage wise water use✓
- Offer water tanks at a reduced price✓
  to create additional source of water✓
- Recycle grey water✓
  to provide additional water sources✓
- Build dams✓
  to store water✓ (Any 2 x 2) (4)

(MARK FIRST TWO ONLY)

2.1.6
- Habitats are destroyed✓ which will lead to a loss in biodiversity✓
- When flood gates are opened flooding may occur in the areas downstream from the dam✓ resulting in erosion✓/loss of top soil/loss of lives/loss of biodiversity
- The river downstream from the dam will receive less water✓ which may have a negative impact on aquatic ecosystems✓/lead to biodiversity loss
- Wall blocks fish migration✓ decreasing spawning✓/reproduction/survival
- Dam wall restricts movement of organisms✓ affecting food chains/webs✓ (Any 2 x 2) (4)

(MARK FIRST TWO ONLY) **(15)**

2.2 2.2.1
- Food security refers to the access by all people✓
- at all times✓
- to adequate✓/safe/nutritious food (Any 2) (2)

2.2.2
- 'endemic to North and South America'✓
- 'the armyworm reached Africa'✓
- 'Invasion of *Spodoptera*'✓ (Any 1) (1)

(MARK FIRST ONE ONLY)

2.2.3
- Maize imports✓
- High altitude wind streams✓

OR

- Eggs✓
- Moths✓

(MARK FIRST TWO ONLY) (2)

2.2.4 Chemical✓control (1)

2.2.5
- The armyworm may lead to crop failure✓/food shortages that will mean financial/job losses✓for farmers
- Food shortages✓/maize will have to be imported that will cause increase in food prices✓
- Using pesticides could adversely influence other crops✓ that will cause increase in food prices✓
- Using pesticides is expensive✓and will lead to increased food prices✓ (Any 1 x 2) (2)

(MARK FIRST ONE ONLY) **(8)**

2.3 2.3.1 Telophase II✓ (1)

2.3.2
- There are 4 cells✓
- Each cell contains only a single set of un-replicated✓/single stranded chromosomes (2)

(MARK FIRST TWO ONLY)

2.3.3 (a) Two/2✓ (1)

(b) Four✓/4/2 pairs (1)

2.3.4 (a)
- Crossing over✓
- Random arrangement✓of chromosomes on the equator (2)

(MARK FIRST TWO ONLY)

(b)
- The gametes that form will be genetically different✓
- leading to variation in the offspring✓/increasing the gene pool
- This increases a species chances of survival✓ (3)

(10)

2.4 2.4.1 (a) Chorion✓/Amnion (1)

(b) Umbilical cord✓ (1)

2.4.2
- Protects the foetus from shock✓/Acts as a shock absorber
- Protects the foetus from drying out✓
- Protects the foetus from temperature changes✓
- Allows free movement of the foetus✓ (Any 2) (2)

(MARK FIRST TWO ONLY)

2.4.3
- Gaseous exchange system✓
- Excretory system✓
- Digestive system✓ (Any 1) (1)

(MARK FIRST ONE ONLY)

2.4.4
- The foetus will receive less nutrients✓ and therefore have a lower birth mass✓/physical under-development/mental under-development

- The foetus will receive less oxygen✓ and therefore have a lower birth mass✓/physical under-development/mental under-development

- Waste will accumulate✓ and it will affect the functioning of the foetus✓ (A (2)

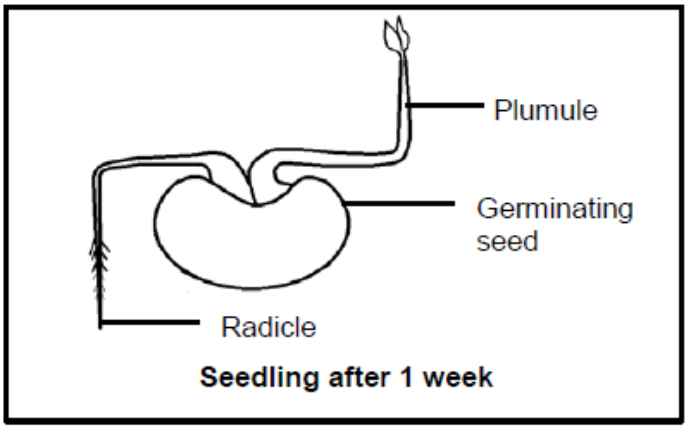
(MARK FIRST ONE ONLY) **(7)**

[40]

QUESTION 3

3.1 3.1.1 - The growth of a plant✓/part of a plant
- in response to a stimulus✓ (2)

3.1.2



Checklist for marking the diagram:

Caption	(1)
Correct drawing: Radicle growing downwards Plumule growing upwards	 (1) (1)
ONE correct label: Plumule/radicle/germinating seed	(1)
Total	**(4)**

(4)
(6)

3.2 3.2.1 Tip of the stem✓/tip of root/apical meristem/terminal bud/apical bud (1)

3.2.2 - The stem grows✓✓/bends
- towards the light✓✓ (4)
(5)

3.3 3.3.1 - Group A✓
- Group C✓ (2)

3.3.2 (a) Amount of Thyroxin✓ (1)

(b) Metabolic rate✓
By measuring the **change in mass✓/consumption of oxygen** (2)

3.3.3 Z, X, Y ✓✓ (2)

3.3.4 Group B✓ (1)

3.3.5
- The mass of the rats decreased✓/changed from 320 g to 309 g
- since body fat is used✓/ less fat is stored
- The oxygen consumption was the highest✓/(10ml/kg/min)
- indicating an increased rate of metabolism✓/respiration
- which is caused by the higher thyroxin concentration✓
- Diet Y is the only diet that contained thyroxin✓/ group B receives thyroxin through diet Y (Any 5) (5)

3.3.6
- The age of the rats must be the same✓
- All the rats must receive the same amount of food✓
- Food must be given at the same time✓
- The rats must be of the same species✓/genetically similar
- Use the same instrument to measure mass✓
- The same person must take the measurements✓
- Use identical cages✓ (Any 3) (3)

(MARK FIRST THREE ONLY) **(16)**

3.4 3.4.1 (a) Auditory nerve✓ (1)

(b) Round window✓/Fenestra rotunda (1)

3.4.2 Cerebrum✓ (1)

3.4.3
- The cristae✓in the semi-circular canals
- are stimulated by changes in speed and direction✓
- when the endolymph moves✓
- The cristae convert the stimuli to nerve impulses✓
- The nerve impulses are transported along the auditory nerve✓
- to the cerebellum✓to be interpreted
- Impulses sent to muscles✓ to restore balance (Any 5) (5)

3.4.4
- The mucus will block the opening of the Eustachian tube✓
- Air cannot enter or leave✓the middle ear
- to equalise pressure✓/causing imbalance in pressure

OR

- Mucus may move through the Eustachian tube✓
- causing pressure in the middle ear✓
- pushing on the tympanic membrane✓/part E (3)

3.4.5
- The ossicles/structures at A will not be able to vibrate✓
- and hence no vibrations will be passed to the inner ear✓/cochlea will not be stimulated/no amplification (2)

(13)
[40]

TOTAL SECTION B: 80

SECTION C

QUESTION 4

Spermatogenesis✓ (S)
- Takes place under the influence of testosterone✓
- in the seminiferous tubules✓/testis
- Diploid cells✓/germinal epithelium
- undergo meiosis✓
- to form haploid sperm cells✓ (Any 4) (4)

Formation and transport of semen (T)
- Sperm mature✓/are temporarily stored
- in the epididymis✓
- During ejaculation✓
- sperm move into the vas deferens✓
- As it passes the seminal vesicles✓,
- prostate gland✓ and
- Cowper's glands✓
- fluids are added that provide nutrition,✓
- promote the movement✓ of the sperm
- and neutralise the acids ✓ produced in the vagina
- The semen passes through the urethra✓
- of the penis✓
- into the vagina✓
- during copulation✓
- and swims up the Fallopian tube✓where it meets the ovum (Any 7) (7)

Structural suitability of the sperm cell for fertilisation (A)
- The acrosome✓
- contains enzymes to dissolve a path into the ovum✓

- Nucleus of the sperm✓
- carries genetic material of the male✓/haploid number of chromosomes

- Many mitochondria✓in the middle piece
- release energy✓ so that sperms could swim

- The presence of a tail✓
- enables sperm cells to swim✓ towards the ovum

- The contents of the sperm cell such as the cytoplasm is reduced✓/condensed
- making the sperm light for efficient movement✓

- Sperm is streamlined✓
- to allow for easier movement✓
  (MARK FIRST THREE ONLY) (Any 3 x 2) (6)

Content (17)
Synthesis (3)
(20)

ASSESSING THE PRESENTATION OF THE ESSAY

Relevance (R)	Logical sequence (L)	Comprehensive (C)
All information provided is relevant to the question	Ideas arranged in a logical/cause-effect sequence	Answered all aspects required by the essay in sufficient detail
All information relevant to - Spermatogenesis - Formation and transport of semen - Structural suitability of sperm. There is no irrelevant information	The information on - Spermatogenesis - Formation and transport of semen and - Structural suitability of sperm is in a logical sequence	The following must be included: - Spermatogenesis (2/4) - Formation and transport semen (5/7) - Structural suitability of sperm (4/6)
1 mark	1 mark	1 mark

TOTAL SECTION C: 20
GRAND TOTAL: 150

LIFE SCIENCES P2

NOVEMBER 2017

MARKING GUIDELINES

SECTION A

QUESTION 1

1.1	1.1.1	B✓✓		
	1.1.2	D✓✓		
	1.1.3	C✓✓		
	1.1.4	B✓✓		
	1.1.5	C✓✓		
	1.1.6	B✓✓		
	1.1.7	A✓✓		
	1.1.8	C✓✓		
	1.1.9	C✓✓		
	1.1.10	D✓✓	(10 x 2)	**(20)**
1.2	1.2.1	Uracil✓		
	1.2.2	Biotechnology✓/genetic engineering/genetic manipulation/genetic modification		
	1.2.3	Continuous✓variation		
	1.2.4	Bipedalism✓/bipedal		
	1.2.5	Deoxyribose✓		
	1.2.6	Haemophilia✓		
	1.2.7	Palaeontology✓		
	1.2.8	Biogeography✓		
	1.2.9	Hominidae✓	(9 x 1)	**(9)**
1.3	1.3.1	A only✓✓		
	1.3.2	A only✓✓		
	1.3.3	B only✓✓	(3 x 2)	**(6)**
1.4	1.4.1	(a) Genes✓/alleles		(1)
		(b) Monohybrid✓		(1)
	1.4.2	Ovary✓/gynaecium/pistil/ovule		(1)
	1.4.3	(a) 2✓/Two		(1)
		(b) 4✓/Four		(1)
	1.4.4	(a) Violet✓		(1)
		(b) Short✓		(1)
	1.4.5	2✓/Two		(1)
				(8)
1.5.1	1.5.1	Translation✓		(1)
	1.5.2	(a) Ribosome✓		(1)
		(b) mRNA✓/messenger RNA		(1)
		(c) Peptide✓		(1)
	1.5.3	(a) C✓		(1)
		(b) B✓		(1)
		(c) D✓		(1)
				(7)
			TOTAL SECTION A :	**[50]**

SECTION B

QUESTION 2

2.1 2.1.1 2✓ (1)

2.1.2 CUC✓ (1)

2.1.3 (a) TGG✓ (1)
(b) Aspartate✓ (1)

2.1.4 (a) - C was replaced by U✓ on the 4th codon✓/AGC
OR
- AGC✓/the 4th codon changed to AGU✓ (2)

(b) - It codes for the same amino acid✓/serine
- Therefore there will be no effect✓/same protein formed (2)

2.1.5
- The process is **transcription✓* Compulsory mark**
- The double helix DNA molecule unwinds✓
- When the hydrogen bonds break✓
- the DNA molecule unzips✓/2 DNA strands separate
- One strand is used as the template ✓to form mRNA
- using free RNA nucleotides✓from the nucleoplasm
- The mRNA is complementary to DNA✓/A-U, C-G
- This process is controlled by enzymes✓ 1* + Any 5 (6)

(14)

2.2 2.2.1 - A population is a group of organisms of the same species✓/that can interbreed to produce fertile offspring and
- occupy a given area at a certain time✓ (2)

2.2.2
- Crossing over✓
- Random arrangement✓ of chromosomes } **OR** meiosis✓
- Random fertilisation✓
- Random mating✓ Any 3 (3)

(Mark first THREE only)

2.2.3
- The squirrels with favourable characteristics✓ caused by the mutation
- survive✓/natural selection occurs
- since they are better suited✓ to the environmental conditions
- These characteristics are passed on to future generations✓

Any 3 (3)

2.2.4
- Since there are now two✓ species/a new species of squirrels
- the biodiversity has increased✓ (2)

2.2.5
- Allow them to interbreed✓/reproduce/mate
- They will not produce fertile offspring✓/check if they produce fertile offspring

OR

- Conduct DNA tests✓ of both species
- and compare them✓ (2)

(12)

2.3 2.3.1 (a) Colour blind male✓/male with Daltonism (1)

(b) X^DX^d✓ (1)

2.3.2 - Linda inherited one recessive allele/X^d from her father✓
- and one recessive allele/X^d from her mother✓ (2)

2.3.3 - Males only have one X-chromosome✓
- If this chromosome carries the recessive allele✓/X^d
- the male will be colour blind✓
- Females have 2 X-chromosomes✓
- They need to have two recessive alleles✓/X^d X^d to be affected
- A dominant allele on the other X-chromosome will mask the effect✓

Any 4 (4)

2.3.4

P_1 Phenotype Normal female x Normal male ✓
Genotype X^DX^d x X^DY ✓

Meiosis

G/gametes X^D, X^d x X^D,Y✓

Fertilisation

F_1 Genotype X^DX^D X^DY X^DX^d X^dY✓ *

Phenotype Normal females, Normal male, Colour blind male ✓ *

P_1 and F_1✓
Meiosis and fertilisation✓

OR

P_1 Phenotype Normal female X Normal male ✓
Genotype X^DX^d X X^DY ✓

Meiosis

Fertilisation

Gametes	X^D	Y
X^D	X^DX^D	X^DY
X^d	X^DX^d	X^dY

1 mark for correct gametes✓
1 mark for correct genotypes✓ *

F_1 Phenotype Normal females, Normal male, Colour blind male ✓ *

P_1 and F_1✓
Meiosis and fertilisation✓

(6)
***Compulsory** 2 + Any 4 **(14)**
[40]

QUESTION 3

3.1 3.1.1 - Genetic✓/mitochondrial DNA /Y chromosome
- Cultural✓ (2)
(Mark first TWO only)

3.1.2 *Ardipithecus ramidus*✓ (1)
(Mark first ONE only)

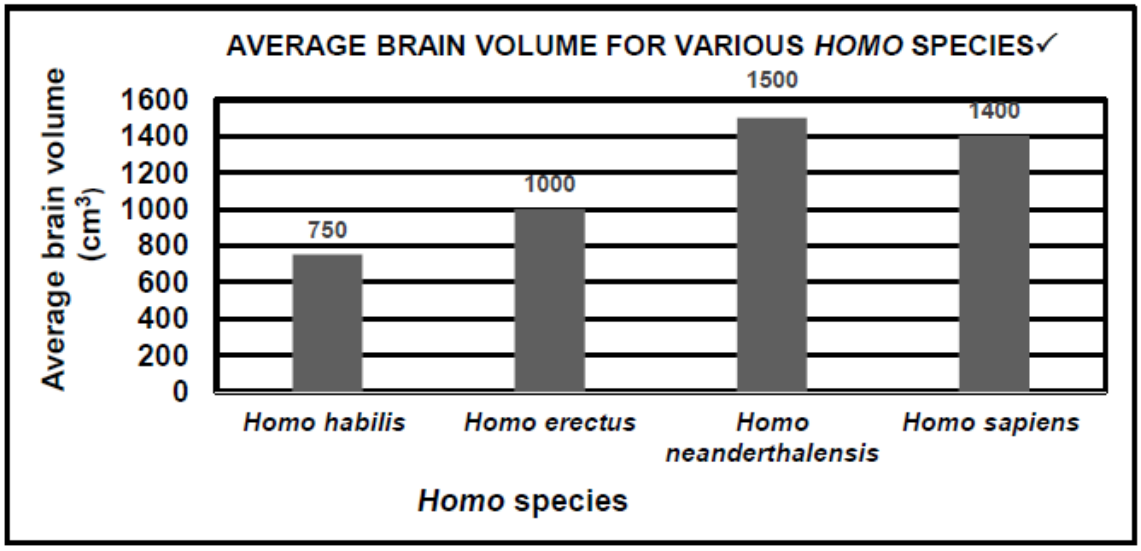
3.1.3 - They would measure the volume✓
- of the cranium✓of the fossil (2)

3.1.4 (1400 - 500)✓
= 900✓cm^3 (2)

3.1.5 (a) There is an overlap in their period of existence✓/they both existed between 2 and 1,6 mya (1)

(b) - It has the smallest brain volume✓
- It appeared first✓/is the oldest Any 1 (1)

3.1.6



✓

L✓
S✓
B✓✓

Guideline for assessing the graph:

Bar graph drawn	1
Title of graph includes both variables	1
Correct label for X-axis Correct label and unit for Y-axis (cm^3) (L)	1
Equal width and interval of bars Correct scale for Y axis (S)	1
Required bars drawn (B)	1 Only **REQUIRED** bars drawn
Drawing of bars (B)	1 All 4 **REQUIRED** bars drawn correctly

(6)
(15)

3.2 3.2.1
- Taste✓/sweetness
- Size✓/largest fruits (2)

3.2.2
- Humans✓/villagers
- select the fruits with desirable characteristics✓/sweetest and largest fruits
- and scatter✓/grow them/use them to form the next generation of offspring (3)

3.2.3
- Climate✓
- Temperature✓
- Water✓
- Soil✓
- Light✓
- Humidity✓
- Gases✓ Any 1 (1)

(Mark first ONE only)

3.2.4
- If trees are produced through marcotting there would be no variation within the plantation✓/trees would be genetically identical
- Any change in the environment/diseases/insects affecting one tree will probably destroy the whole plantation✓ /no other characteristics will be introduced

(Mark first ONE only) (2)

3.2.5
- No✓/ the fruits cannot be labelled as genetically modified (GM)
- because no gene transfer✓/introduction in the marcotting process took place (2)

3.2.6
- Production of medication/resources cheaply✓
- Control pests with specific genes inserted into a crop✓
- Using specific genes to increase crop yields✓/food security
- Introduction of genes to improve human health✓
- Selecting genes to increase shelf-life of plant products✓
- Improving the quality of the crop✓
- Allows a faster production time✓
- Developing resistance to drought✓
- Developing resistance to pests✓
- Developing resistance to herbicides✓
- Developing resistance to diseases✓ Any 2 (2)

(Mark first TWO only)

(12)

3.3 3.3.1 - Habitat✓/colour of sand
- Fur colour✓ (2)
(Mark first TWO only)

3.3.2 100✓ (1)

3.3.3 - They used a large sample size✓/200 models per habitat/ 200 models per fur colour/ 400 models in total
- Allowed enough time for predators to attack the models✓
- Placed mice randomly in each habitat✓ Any 2 (2)
(Mark first TWO only)

3.3.4 The darker coloured models were attacked less✓✓ than the lighter coloured models

OR

The lighter coloured models were attacked more✓✓ than the darker coloured models (2)

3.3.5 - More mice/78 models with dark fur colour were attacked✓ in the beach habitat
- as they were more visible✓/less camouflaged against the light coloured sand
- Fewer mice with light fur colour/26 models were attacked✓ in the beach habitat
- as they are less visible✓ /well camouflaged against the light coloured sand (4)

3.3.6 - The clay models are not able to escape✓ from predators
- and therefore they would be attacked more frequently✓

OR

- The owls will not recognise the models as prey✓and
- therefore will attack less frequently✓

OR

-If the models showed signs of an attack✓
-it doesn't give an indication of their survival ✓ (2)

(13)
[40]

TOTAL SECTION B: 80

SECTION C
QUESTION 4

STRUCTURE AND ARRANGEMENT OF CHROMOSOMES

- Each chromosome comprises two chromatids✓
- held together by a centromere✓
- There are 23 pairs✓/46 chromosomes in
- human somatic cells✓/body cells
- which are arranged into homologous pairs✓
  - that are similar in length✓
  - carry genes for the same characteristics✓
  - have alleles of a particular gene at the same loci✓and
  - have the same centromere position✓
- Each somatic cell has 22 pairs/44 autosomes✓and
- a pair/2 gonosomes✓/sex chromosomes/X and Y chromosomes
- Autosomes are arranged in pairs from largest to smallest✓ in a karyotype
- Males have XY chromosomes✓
- Females have XX chromosomes✓
- The X chromosome is larger than the Y chromosome✓ Max 8 (8)

BEHAVIOUR OF CHROMOSOMES IN MEIOSIS I

- During prophase✓ **I**
- chromosomes pair✓up/homologous pairs/bivalents form
- Crossing over✓/exchange of genetic material occurs
- between chromatids✓/adjacent chromosome pairs
- During metaphase✓ **I** of meiosis
- homologous chromosomes✓/chromosome pairs are arranged
- at the equator✓ of the cell
- in a random✓ way
- with the chromosome attached to the spindle fibre✓
- During anaphase✓ **I**
- chromosome pairs separate✓/chromosomes move to opposite poles
- During telophase✓ **I**
- the chromosomes reach the poles of the cell✓ Max 9 (9)

Content (17)
Synthesis (3)
(20)

ASSESSING THE PRESENTATION OF THE ESSAY

Criterion	Relevance (R)	Logical sequence (L)	Comprehensive (C)
Generally	All information provided is relevant to the question.	Ideas are arranged in a logical sequence.	All aspects of the essay have been sufficiently addressed.
In this essay in Q4	Only information relevant to structure and arrangement of human chromosomes and their behaviour in the different phases of meiosis **I** is given. No irrelevant information included.	The description of structure and arrangement of human chromosomes and their behaviour in the different phases of meiosis **I** is given in a logical and sequential manner.	At least the following marks should be obtained - **5/8** for the structure and arrangement of human chromosome - **6/9** for behaviour during meiosis **I**
Mark	1	1	1

TOTAL SECTION C: 20
GRAND TOTAL: 150