Basic Education

KwaZulu-Natal Department of Education
REPUBLIC OF SOUTH AFRICA

JUNE PRE-EXAMINATION 1

LIFE SCIENCES

JUNE 2023

NATIONAL SENIOR CERTIFICATE

MARKS: 160

TIME: 2hrs 40mins

N.B. This question paper consists of 15 pages.

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. Number the answers correctly according to the numbering system used in this question paper.
4. Present your answers according to the instructions of each question.
5. ALL drawings must be done in pencil and labelled in blue or black ink.
6. Draw diagrams, flow charts or tables only when asked to do so.
7. The diagrams in this question paper are NOT necessarily drawn to scale.
8. Do NOT use graph paper.
9. You must use a non-programmable calculator, protractor and a compass where necessary.
10. Write neatly and legibly.

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 1.1.12) in the ANSWER BOOK, for example 1.1.13. 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 When a cell divides by meiosis it results in …

A. four haploid gametes.
B. two diploid gametes.
C. four haploid somatic cells.
D. two haploid somatic cells.

1.1.3 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

1.1.4 Which one of the following occurs during meiosis?

A. A haploid cell gives rise to two haploid cells
B. A diploid cell gives rise to two haploid cells
C. A haploid cell gives rise to four haploid cells
D. A diploid cell gives rise to four haploid cells

1.1.5 A type of reproductive strategy in birds where hatchlings are helpless and unable to move and feed themselves?

A. Precocial development
B. Altricial development
C. Vivipary
D. Ovovivipary

1.1.6 Which ONE of the following involves the development of the young inside the uterus of the mother and where it receives nutrients through the placenta?

A. Ovipary
B. Vivipary
C. Ovovivipary
D. Amniotic egg

1.1.7 Where are sperm cells in humans temporarily stored?

A. Vas deferens
B. Epididymis
C. Urinary bladder
D. Prostate gland

1.1.8 A function of amniotic fluid is to …

A. serve as a micro-filter preventing germs from entering the foetus.
B. act as a shock absorber to protect the foetus.
C. keep the foetus at a temperature lower than body temperature.
D. serve as a medium for the sperm to swim in.

1.1.9 The genotype for an individual with blood group A is …

A. I^AI^A only.
B. I^AI^A or ii.
C. I^Ai only.
D. I^AI^A or I^Ai

1.1.10 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

1.1.11 Which ONE of the following hormones controls metabolic rate?

A.Testosterone
B.Thyroxin
C. Growth hormone
D. Insulin

1.1.12 Which ONE of the following will occur in the human body on a cold day?

A. Vasodilation in the skin
B. Increase in the activity of sweat glands
C. Decrease in evaporation of sweat from the surface of the skin
D. Increase in blood flow to the surface of the skin

(2 X 12 =24)

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 type of RNA containing anticodons

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

1.2.3 Undifferentiated animal cells that can form any type of tissue

1.2.4 Type of inheritance where none of the two alleles is dominant over the other and an intermediate phenotype is produced

1.2.5 The breeding of organisms by humans to achieve a desirable phenotype

1.2.6 The point of crossing over between two adjacent chromosomes

1.2.7 The organelle in a cell where translation occurs

1.2.8 A condition of the cell where there is only one set of chromosomes

1.2.9 A hormone that stimulates ovulation in humans

1.2.10 The part of the brain that connects the left and right hemispheres

1.2.11 The blood vessel that transports deoxygenated blood from the foetus towards the placenta

1.2.12 A small device that is inserted in the ear to drain fluids caused by a middle-ear infection

1.2.13 The branch of the autonomic nervous system that restores an increased heart rate back to normal

1.2.14 A structure in the eye that absorbs light to prevent internal reflection

1.2.15 The number, shape and arrangement of all the chromosomes in the nucleus of a somatic cell

1.2.16 The hormone that stimulates puberty in females

(1 X 16 = 16)

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 1.3.10) in the ANSWER BOOK.

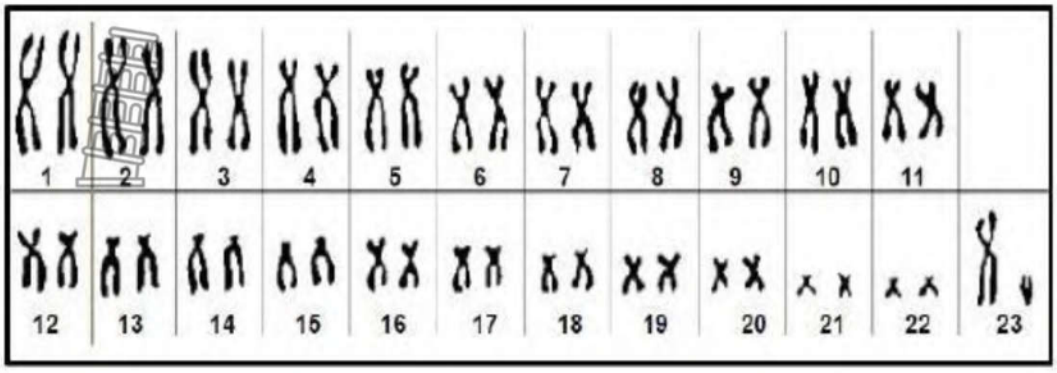
COLUMN I	COLUMN II
1.3.1 Condition affecting the cornea of the eye	A. Astigmatism B: Cataract
1.3.2 Hormones secreted by the pituitary gland	A:Prolactin B: Growth hormone
1.3.3 Location of DNA in a human	A: Mitochondrion B: Nucleus
1.3.4 First to discover the double helix structure of DNA	A: Mendel and Watson B: Watson and Crick
1.3.5 Contains the sugar ribose	A: DNA B: RNA
1.3.6 Chromosomes align at the equator	A: Metaphase I B: Metaphase II
1.3.7 The functional connection between two consecutive neurons	A: Receptor B: Synapse
1.3.8 Result of non-disjunction of chromosome pair 21 in humans	A: Gamete with 22 chromosomes B: Gamete with 24 chromosomes
1.3.9 The point of attachment of two overlapping chromatids	A: Locus B: Chiasma
1.3.10 Doubling of DNA	A: Prophase I B: Prophase II

(1 X 10 = 10)

TOTAL SECTION A: [50]

SECTION B
QUESTION 2

2.1 The diagram below shows a karyotype.



2.1.1 How many of the following are present in the karyotype:

(a) Chromosomes (1)

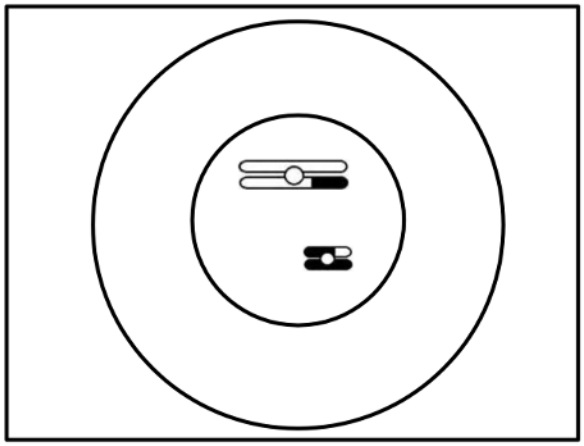
(b) Autosomes (1)

(c) Gonosomes (1)

2.1.2 How many chromosomes would be present in the gametes produced by this individual? (1)

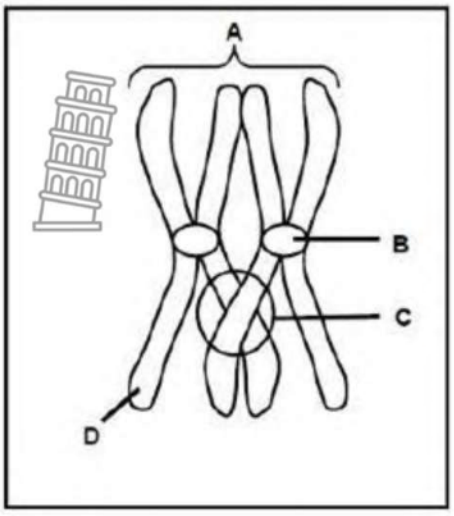
2.1.3 Is the karyotype above that of a male or a female? (1)
(5)

2.2 The diagram below represents one of the two cells that is formed during Telophase I of meiosis in an organism.



Draw a labelled diagram to show the cell during Anaphase II of meiosis. (5)
(5)

2.3 The diagram below represents a process that occurs during meiosis.



2.3.1 Identify parts

(i) **A** (1)

(ii) **B** (1)

(iii) **C** (1)

(iv) **D** (1)

2.3.2 Give the function of part labelled **B**. (1)

2.3.3 Name:

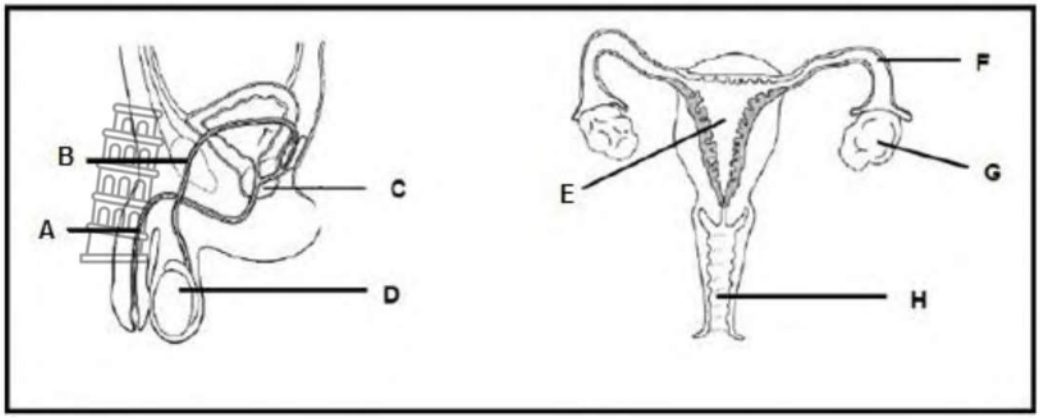
(a) The process occurring at **C** (1)

(b) The phase in meiosis during which the process **C** occurs (1)

2.3.4 State ONE reason why process **C** is important. (1)

(8)

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



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

2.4.2 State **ONE** function of each of the following:

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

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

(c) Part **F** (1)

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

(a) Male reproductive system (1)

(b) Female reproductive system (1)

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

(a) Male reproductive system (1)

(b) Female reproductive system (1)

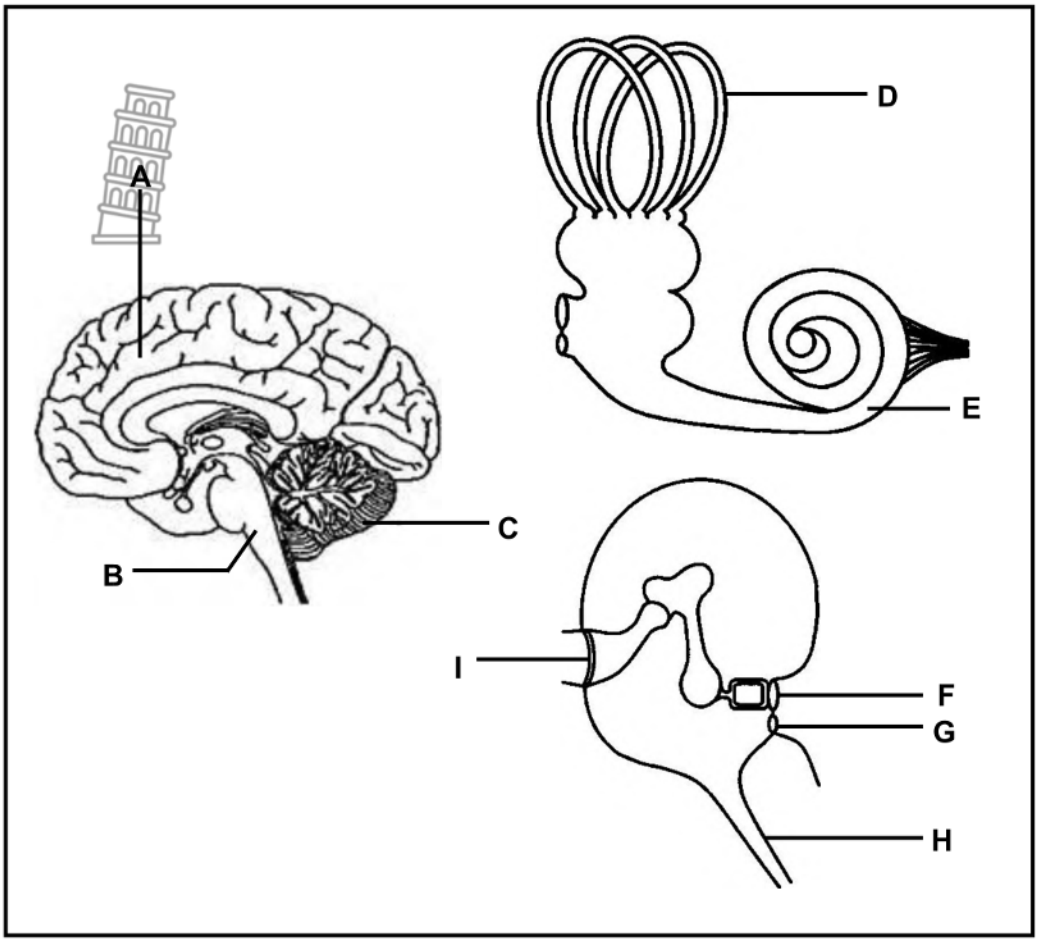
2.4.5 State **TWO** functions of part **H**. (2)
(12)

2.5 Describe the process of fertilisation. (5)

2.6 Describe the process of oogenesis as it occurs in part **G** (5)
(10)

QUESTION 3

3.1 The diagrams below show different parts of the brain and the ear.



3.1.1 Identify part

(i) **A** (1)

(ii) **B** (1)

(iii) **H** (1)

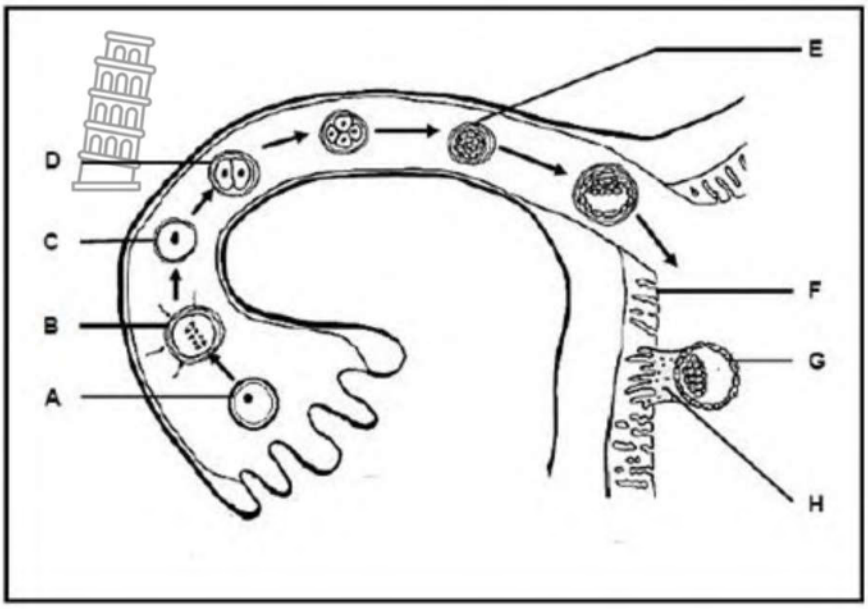
3.1.2 Give the **LETTER** and **NAME** of the part of the ear that absorbs excess pressure waves from the inner ear. (2)

3.1.3 Name the receptors found at part **E** (1)

3.1.4 Describe the process of hearing .(6)

(12)

3.2 Study the diagram below of the sequence of events that takes place from the fertilization of the ovum to the development of the embryo in a part of the human female reproductive system



3.2.1 Identify:

(a) Structure **C** (1)

(b) The stage of embryo development at **E.** (1)

(c) The structure that develops from a combination of parts **F** and **H** (1)

3.2.2 Name the process that takes place:

(a) At **B** (1)

(b) When **G** attaches to part **F** (1)

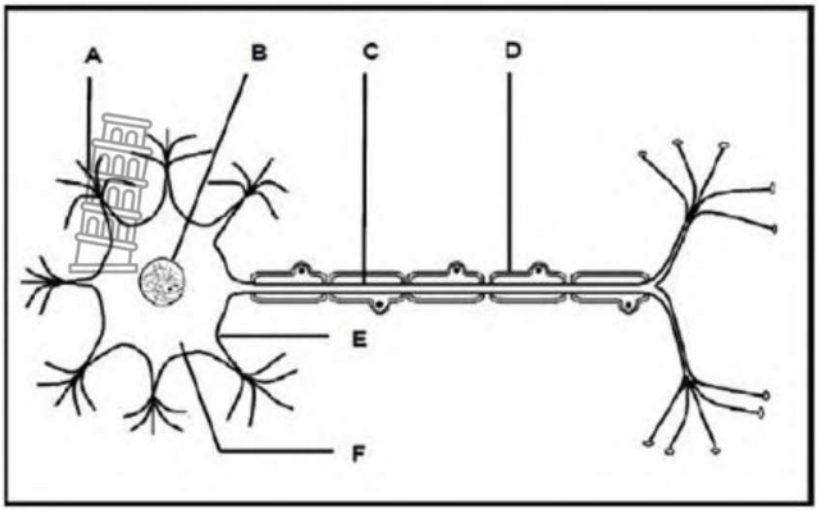
3.2.3 Give the chromosome number of:

(a) The cells at **D** (1)

(b) Cell **A** (1)

(7)

3.3 The diagram below represents the structure of a neuron.



3.3.1 Name the type of neuron in the diagram above. (1)

3.2.2 Identify parts:

(a) **B** (1)

(b) **F** (1)

(c) **A** (1)

3.2.3 Give the **LETTER** and **NAME** of the part that:

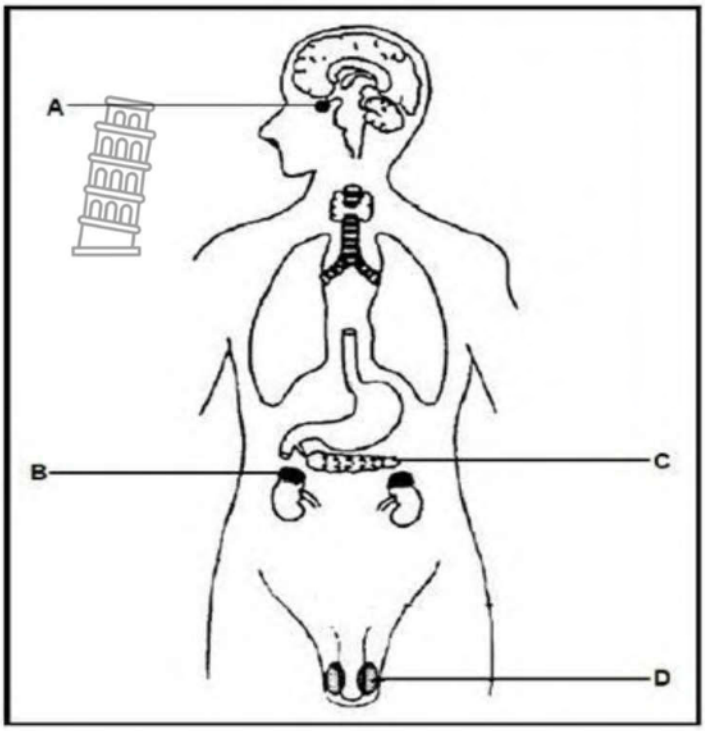
(a) Transmits impulses away from the cell body (2)

(b) Insulates and speeds up the transmission of impulses (2)

3.2.4 Name the condition caused by the progressive degradation of part **D** (1)

3.3 Describe the reflex action that occurs when a person touches a hot pot. (6)
(15)

3.4 The diagram below represents parts of the endocrine system in humans.



3.4.1 Identify gland:

(a) **A** (1)

(b) **B** (1)

3.4.2 Give the **LETTER** and **NAME** of the gland that secrete a hormone responsible for:

(a) Starting puberty in males (2)

(b) Stimulating absorption of glucose by cells (2)

(c) Making the kidney tubules permeable to water (2)

(8)

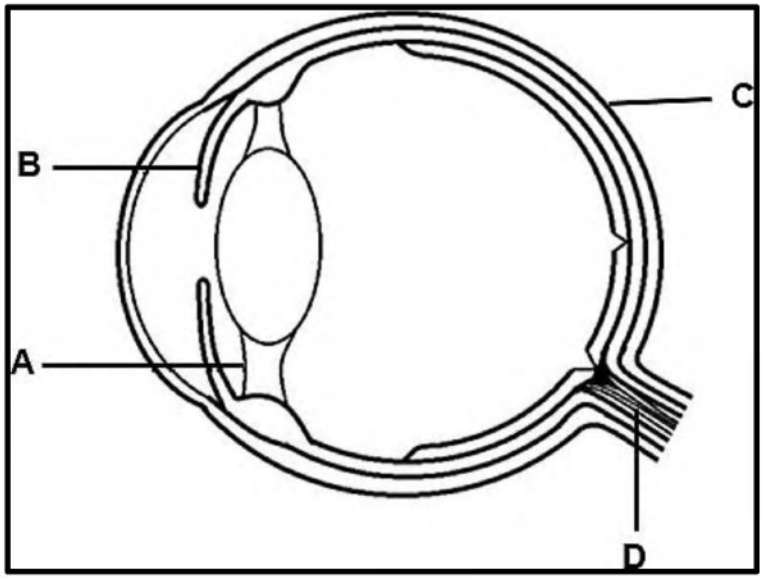
3.5 Read the extract below and answer the questions that follow.

> The Comrades Marathon is an ultra-marathon of approximately 89 kilometres which is run annually in the KwaZulu-Natal province between the cities of Durban and Pietermaritzburg. It is the world's largest and oldest ultra-marathon race.

While running, an athlete's body temperature increases.

Describe the negative feedback mechanism that will restore the athlete's body temperature to normal. **(6)**

3.6 The diagram below shows the structure of the human eye.



3.6.1 Identify the parts labelled:

(a) A (1)

(b) B (1)

3.6.2 State ONE function of part **C**. (1)

3.6.3 Describe accommodation of the eye when a person focuses on an object that is moving away. (4)

(7)

3.7 Human blood groups are controlled by multiple alleles.

3.7.1 Name all the alleles that control blood groups (3)

3.7.2 How many of the alleles named in QUESTION 3.7.1 can any individual inherit (1)

3.7.3 A man has blood group A and his wife has blood group B.
Their first child has blood group AB and second child has blood group O.
What can one conclude about the blood groups of their future children? (3)

3.7.4 State Mendel's principle of segregation. (2)

3.7.5 Use a genetic cross to show how gender in human offspring is determined by the sex chromosomes of the parents. (6)

(15)

TOTAL SECTION B :110
GRAND TOTAL :160

Basic Education

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REPUBLIC OF SOUTH AFRICA

JUNE PRE-EXAMINATION 1 MEMORANDUM

LIFE SCIENCES

JUNE 2023

NATIONAL SENIOR CERTIFICATE

GRADE 12

MARKS: 160

N.B. This memorandum consists of 10 pages.

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.

SECTION A
QUESTION 1

1.1

1.1.1 B ✓✓

1.1.2 A ✓✓

1.1.3 A ✓✓

1.1.4 D✓✓

1.1.5 B✓✓

1.1.6 B✓✓

1.1.7 B✓✓

1.1.8 B✓✓

1.1.9 D✓✓

1.1.10 C✓✓

1.1.11 B✓✓

1.1.12 C✓✓ (2 x 12) (**24**)

1.2

1.2.1 tRNA ✓ /transfer RNA

1.2.2 Cloning✓

1.2.3 Stem cells✓

1.2.4 Incomplete dominance✓

1.2.5 Artificial selection✓ /selective breeding

1.2.6 Chiasma✓

1.2.7 Ribosome✓

1.2.8 Haploid✓

1.2.9 LH✓ / Leteinizing hormone

1.2.10 Corpus callosum✓

1.2.11 Umblical artery✓

1.2.12 Grommets✓

1.2.13 Parasympathetic✓ nervous system

1.2.14 Choroid✓

1.2.15 Karyotype✓

1.2.16 Oestrogen✓ (1 x 16) **(16)**

1.3

1.3.1 A only✓
1.3.2 Both A and B✓
1.3.3 Both A and B✓
1.3.4 B only✓
1.3.5 B only✓
1.3.6 Both A and B✓
1.3.7 B only✓
1.3.8 Both A and B ✓
1.3.9 B only✓
1.3.10 None✓

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

SECTION B
QUESTION 2

2.1
2.1.1 (a) 46✓ (1)

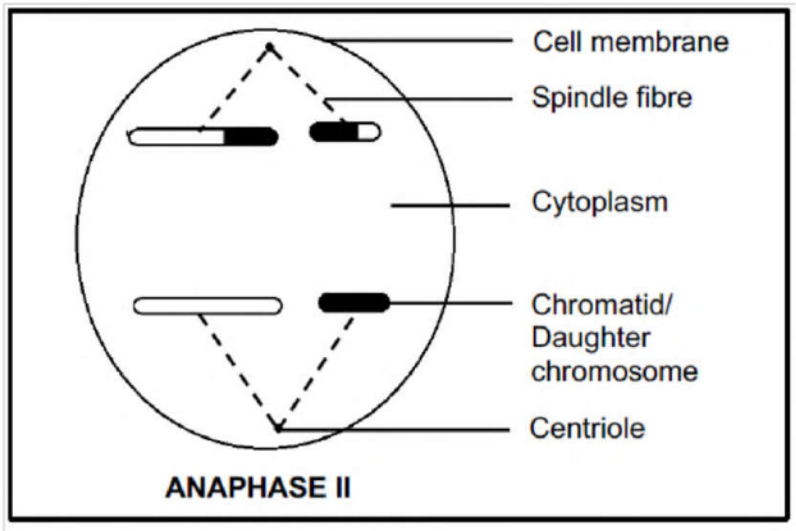
(b) 44✓ (1)

(c) 2✓ (1)

2.1.2. 23✓ (1)

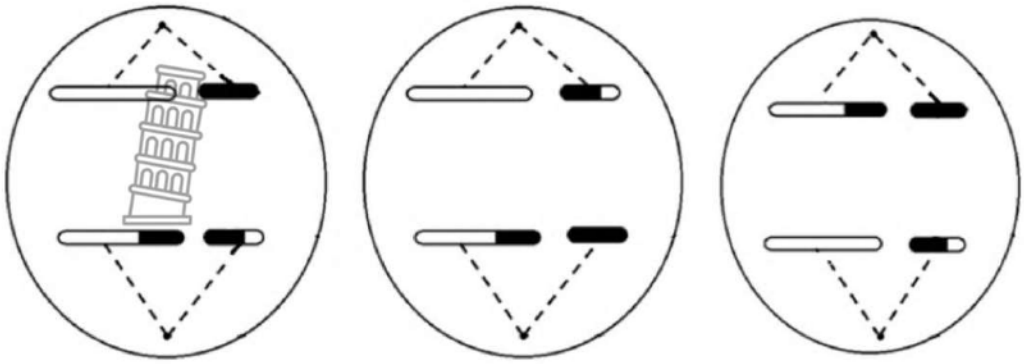
2.1.3 Male✓ (1)

2.2



OR

ANY ONE OF THE FOLLOWING ARRANGEMENTS INCLUDING CORRECT LABELS



MARK ALLOCATION FOR DIAGRAM

Correct phase drawn/chromatids separating **(P)**	1
Correct shading of chromatids **(S)**	1
Correct number and size of individual chromatids/daughter chromosomes (2 short and 2 long) **(N)**	1
Any TWO correct labels	2
TOTAL	**5**

(5)
(10)

2.3 2.3.1 (i) Homologous chromosomes✓/Bivalent (1)

(ii) Centromere✓ (1)

(iii) Chiasma✓ (1)

(iv) Chromatid✓ (1)

2.3.2 It holds the (two) chromatids✓ together (1)

2.3.3 (a) Crossing over✓ (1)

(b) Prophase 1✓

2.3.4 Introduces variation✓ (1)
(8)

2.4 2.4.1 A - Urethra✓ (1)

B - Vas deferens✓/sperm duct (1)

F - Fallopian tube✓/oviduct (1)

2.4.2 (a) Protects the sperm cell against the acidic environment of the vagina✓
-Increases the motility of the sperm✓
(**Mark first ONE only**) Any (1)

b) Place for foetus to develop✓
- Maintain pregnancy✓
- Assist in childbirth✓
- Protects the foetus✓/prevents infections
- Passage for sperm cells between vagina and fallopian tubes✓

(Mark first ONE only) Any (1)

(c) -Connects the ovaries to the uterus✓
-Transports egg cells from the ovary✓
-It is the site of fertilisation✓ **(Mark first ONE only)** Any (1)

2.4.3 (a) D✓ (1)

(b) G✓ (1)

2.4.4 -Spermatogenesis✓ (1)

-Oogenesis✓ (1)

2.4.5 -Receives the penis✓ during sexual intercourse (1)
-Serves as a birth canal✓ (1)

(12)

2.5 - 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 cannot be penetrated by other sperms✓
- The nucleus of the sperm fuses✓
-With the nucleus on the ovum✓
- To form a diploid zygote✓ Any 5 (5)

2.6 - Diploid cells in the ovary undergo mitosis✓
- to form numerous follicles✓
- At the onset of puberty✓
- and under the influence of FSH✓
- one cell inside a follicle enlarges✓ and
- Of the four cells that are produced, only one survives to form A haploid ovum✓ Any 5 (5)

(9)

QUESTION 3

3.1.

3.1.1 (i) Cerebrum✓ (1)

(ii) Medulla oblongata✓ (1)

(iii) Eustachian tube✓ (1)

3.1.2 G✓ Round window✓ (2)

3.1.3 Hair cells✓/Organ of Corti (1)

3.1.4 - The pinna of the ear traps sound waves✓

- The auditory canal directs the sound waves to the tympanic membrane✓

- The sound waves cause the tympanic membrane to vibrate✓

- The vibrations of the tympanic membrane cause the ossicles to vibrate✓

- The ossicles pass the vibrations to the oval window✓

- The vibration of the oval window cause pressure waves in the inner ear✓/perilymph/endolymph

- The pressure waves stimulate the organ of Corti✓

- The organ of Corti converts the stimuli to nerve impulses✓

- The auditory nerve transmits the impulses

- to the cerebrum for interpretation✓ Any 6 (6)

(12)

3.2

3.2.1 (a) Zygote✓ (1)

(b) Morula✓ (1)

(c) Placenta✓ (1)

3.2.2 (a) Fertilisation✓ (1)

(b) Implantation✓ (1)

3.2.3 (a) 46✓ /23 pairs (1)

(b) 23✓ (1)

(7)

3.3 3.3.1 Motor neuron✓ (1)

3.3.2 (a) Nucleus / nuclear membrane✓ (1)

(b) Cytoplasm✓ (1)

(c) Dendrite✓ (1)

3.3.3 (a) C✓ – Axon✓ (2)

(b) D✓ – Myelin sheath✓ (2)

3.2.4 Multiple Sclerosis✓ (1)

3.3 - The receptor/ finger receives the stimulus of the heat✓ / pain
- and converts it into an impulse✓
- The sensory neuron carries the impulse✓from the receptor
- to the interneuron✓connector neuron in the spinal cord
- The interneuron transmits the impulse to the motor neuron✓
- The motor neuron carries the impulse to the effector✓ / muscle
- to move the finger away✓ from the hot pot **Any 6** (6)

(15)

3.4 3.4.1 (a) Hypophysis✓ / Pituitary gland (1)

(b) Adrenal gland✓ (1)

3.4.2 (a) D✓ - Testis✓ (2)

(b) C✓ - Pancreas✓ (2)

(c) A✓ - Hypophysis✓ / Pituitary gland (2)

(8)

3.5 - The hypothalamus is stimulated✓
- and sends impulses to the blood vessels of the skin. ✓
- Blood vessels dilate✓ / blood vessels become wider/vasodilation occurs.
- More blood flows to the surface of the skin.
- More heat is lost, ✓
- through radiation✓ from the skin.
- More blood is sent to the sweat glands. ✓
- Sweat glands become more active. ✓ / More sweat is released.
- Evaporation of the sweat cools (the skin). Any 6 **(6)**

3.6 3.6.1 (a) Suspensory ligament✓ (1)

(b) Iris✓ (1)

3.6.2 Protects the eye✓ (1)

3.6.3 - Ciliary muscles relax✓ (1)

- Suspensory ligaments become taut✓
- Tension on the lens increases✓
- The lens becomes less convex✓/ flattened
- The refractive power of the lens is decreased✓ / light rays are bent less
- Light rays are focussed on the retina✓
- To form a clear image Any 4 (4)

(7)

3.7

3.7.1 I^A✓ , I^B✓ , i✓ (3)

3.7.2 2✓ (1)

3.7.3 - Any individual inherits one allele✓
- from each parent✓
- Each child has an equal✓ or 25% chance of having
- any blood group✓/ A, B, AB or O (4)

3.7.4 - 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)

3.7.5

P_1 Phenotype: Male x Female✓
Genotype: XY x XX✓

Meiosis

Fertilisation

Gametes	X	Y
X	XX	XY
X	XX	XY

1 mark for correct gametes
1 mark for correct genotypes

F_1 Phenotype: ***50% males**✓ / 50% females

P_1 and F_1✓
Meiosis and fertilisation✓

***Compulsory 1** + Any 5

OR

P_1 Phenotype: Male x Female✓
Genotype: XY x XX✓

Meiosis

G/gametes: X, Y x X, X✓

Fertilisation

F_1 Genotype: XX; XX; XY XY✓

Phenotype: ***50% males**✓ / 50% females

P_1 and F_1✓
Meiosis and fertilisation✓

(6)

***Compulsory 1** + Any 5

TOTAL MARKS: [160]