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KWAZULU-NATAL PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

CURRICULUM GRADE 10-12
DIRECTORATENCS (CAPS)

LIFE SCIENCES

TEACHER SUPPORT DOCUMENT

GRADE 12

HIGH FLYERS PROGRAM

2026

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TOPIC: DNA CODE OF LIFE

ACTIVITY 1

1

1.1 A✓✓ (2)

1.2 C✓✓ (2)

(4)

ACTIVITY 2

2

2.1 (Gene) mutation ✓ (2)

2.2
- CTC on the DNA changed to CAC✓
- Codons (on the mRNA) changed✓/GAG changed to GUG
- Anticodons (on tRNA) changed✓/CUC replaced by CAC
- which resulted in a different amino acid✓/ Val (4)

2.3
- The cells will not receive enough oxygen✓
- resulting in reduced cellular respiration✓/ a person lacking energy/becoming tired/ anaemia (2)

(7)

ACTIVITY 3

3

3.1 (a) Nucleus✓/nucleoplasm (1)

(b) Ribosome✓/cytoplasm (1)

3.2 Transcription✓*
- The double helix DNA molecule 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✓/ A-U, G-C
- mRNA now has the coded message for protein synthesis✓

*1 compulsory mark + Any 5 (6)

(8)

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ACTIVITY 4

4

4.1
- A change in the sequence✓
- of nitrogenous bases✓/nucleotides in DNA (2)

4.2
- To check for the gene mutation✓
- and if it results in the high bone density✓ (2)

4.3 Produces high bone density✓ /reduces the risk of bone fractures (1)

4.4

$\frac{13}{20}$✓ x 100✓ = 65✓% **OR** $\frac{7}{20}$ x 100✓ = 35%

(100 – 35)✓ = 65✓%

(3)

(8)

ACTIVITY 5

5

5.1
- Either **male 1** or **male 2** could be the father✓ of the boy
- since both males have the I^B allele✓/ **male 1** I^AI^B and **male 2** I^BI^B or I^Bi
- The mother's blood group is O and must have the genotype ii✓ /homozygous recessive
- The boy would have inherited the recessive allele/i from the mother✓
- and he would have the genotype I^Bi ✓ (5)

5.2 Male 2✓ (1)

5.3
- Four/some bands of the boy's✓DNA profile
- match with those of the mother's✓ profile
- The remaining bands of the boy match with the bands of male **2**'s✓
- DNA profile/fewer bands match with male **1**'s DNA profile (3)

(9)

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ACTIVITY 6

6

6.1
- Codon GAC✓ (on the mRNA)
- changed to GAU✓
- Both these codons code for the same amino acid✓/Aspartic acid
- therefore there will be no effect✓ on the protein formed **(4)**

ACTIVITY 7

7

7.1 Translation✓*
- Each tRNA carries a specific amino acid✓
- When the anticodon on the tRNA✓/GUA
- matches the codon on the mRNA✓/CAU
- then tRNA brings the required amino acid to the ribosome✓
- Amino acids become attached to each other by peptide bonds✓
- to form the required protein✓

1* compulsory + Any 6 **(7)**

ACTIVITY 8

8

8.1 (a) CCU✓ (1)

(b) GTA✓✓ (2)

8.2
- A mutation occurred✓
- that changed the sequence of nitrogenous bases on DNA from
- GGG to GAA✓/when A replaced G
- mRNA codon changed from CCC to CUU✓/when U replaced C
- causing tRNA to bring amino acid✓

Any 3 (3)

(6)

ACTIVITY 9

9

9.1 DNA profiling✓ (1)

9.2 (Suspect)1✓ (1)

9.3 The DNA profile /bands of suspect 1 is /are identical to the DNA profile of the sample from the crime scene✓
(Mark first ONE only) (1)

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9.4 - Evidence could have been planted at the crime scene✓
- Suspect could have been at the crime scene before the crime was committed✓
- Human error might occur during the procedure✓
- Manipulation of results can occur✓
- Contamination of the DNA sample✓
- DNA sample too small✓
- Suspect may have an identical twin✓

(Mark first TWO only) (2)

9.5 - The DNA profiles of the child, mother and possible father are compared✓ since
- the child inherits 50% of their DNA from each parent✓
- All the DNA bands that are identical to the mother in the child's DNA profile are eliminated✓
- The remaining DNA bands are checked against the possible fathers'✓ for possible matches with the child✓ Any (4)

(9)

ACTIVITY 10

10

10.1 Gene✓ mutation (1)

10.2 (DNA) replication✓ (1)

10.3 CCA✓✓ (2)

10.4 - There will be a change in the (sequence of) amino acids✓/serine is replaced by glycine
- Resulting in the formation of a different protein✓ (2)

(6)

ACTIVITY 11

11

11.1 I^AI^A✓
I^Ai✓ (2)

11.2 - According to blood groups it is impossible for male 1 to be the father✓
- A child inherits one allele from each parent✓
- The child has the genotype I^AI^B✓/does not have the recessive allele/i
- Male 2 has the genotype ii✓and
- does not have the I^A or I^B allele to pass on to the child✓ and

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- can only have children that are I^A and I^B✓/blood groups A or B
  Any (5)

11.3 - To establish which bands of the child match with the bands of the mother✓
- To compare the remaining bands to the possible father✓
- Since the child inherits (50% of) DNA from each parent✓ Any (2)

11.4 (Male) 3✓ (1)

11.5 - Evidence in solving crimes✓
- Tracing missing persons✓
- Identification of genetic disorders✓
- Establishing family relations✓
- Matching tissues for organ transplants✓
- Identify dead persons/animals✓ Any (1)

(Mark first ONE only) **(11)**

ACTIVITY 12

12

12.1

(a) GUA✓ (1)

(b) CAT✓ (1)

12.2 - The sequence of bases on a DNA molecule changes✓
- from CCT to CGT✓ /second base in DNA triplet changed from C to G
- The codon GGA changed to GCA✓
- The tRNA molecule with the anticodon CCU✓
- is now replaced by a tRNA molecule with the anticodon CGU✓
- The sequence of amino acids changes✓ and
- a different protein is formed✓ (7)

(9)

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TOPIC: MEIOSIS

ACTIVITY 1

1

1.1 A ✓✓
1.2 D ✓✓
1.3 B ✓✓
1.4 D ✓✓
1.5 B ✓✓
1.6 C ✓✓ **(12)**

ACTIVITY 2

2

2.1 (a) Spindle fibre✓ (1)
(b) Nucleolus✓ (1)
(c) Ovum✓ (1)

2.2 Produces spindle fibres✓ (1)
(Mark first ONE only)

2.3 Metaphase I✓ (1)

2.4 – (Homologous) chromosomes align in pairs at the equator in Metaphase I✓ whereas chromosomes are lined up in a single row at the equator during mitosis✓
– Crossing over has taken place in meiosis I✓ whereas no crossing over takes place in mitosis✓ (2x2)
– **(Mark first ONE only)** (4)

2.5 – 4 chromosomes instead of 3✓/an extra chromosome
– at chromosome pair 22✓
– failed to separate✓/non-disjunction occurred (during Anaphase I) (3)
(12)

ACTIVITY 3

3

3.1 Cell membrane ✓ (1)

3.2 Produces spindle fibres✓ (1)
(Mark first ONE only)

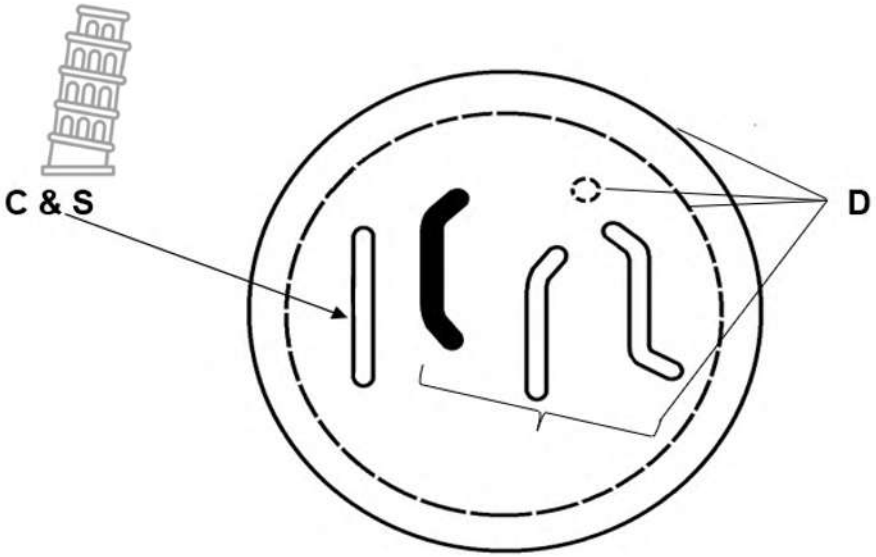
3.3 – Random arrangement of chromosomes✓ at the equator
– results in the formation of genetically different gametes✓
– This leads to increased genetic variation in a population✓
– which will cause some individuals to have favourable and some to have unfavourable characteristics✓

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– When environmental conditions change✓
– those with favourable characteristics will survive✓
– and those with unfavourable characteristics will die✓ (6)

3.4



Criteria for assessing the drawing

Criteria	Mark
Cell D copied correctly (D)	1
Missing chromosome drawn has a straight shape (C)	1
Missing chromosome is unshaded (S)	1

(3)
(11)

ACTIVITY 4

4

4.1 (a) Chromosomal✓mutation (1)
(b) Non-disjunction✓ (1)
(c) Mitosis✓ (1)

4.2 – The chromosome pair/chromatids failed to separate✓
– at position 21✓
– during anaphase✓ (I or II)
– resulting in one daughter cell having an extra chromosome✓/
– chromosomes
– Fusion of a gamete with 24 chromosomes✓
– and a normal gamete✓/gamete with 23 chromosomes
– results in a zygote-with 47 chromosomes✓/extra chromosome at position 21 Any (5)

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4.3
- In Trisomy 21 there is an extra chromosome/three copies of chromosome 21 in each somatic cell✓
- In Mosaic Down syndrome there is an extra chromosome only in some cells
- Trisomy 21 occurs during meiosis✓/before fertilisation
- Mosaic Down syndrome occurs during mitosis✓/after
- fertilisation (2 x 2)

(Mark first TWO only) (4)

(12)

ACTIVITY 5

5

5.1 Centromere✓ (1)

5.2 Gonosomes✓ (1)

5.3 There will be one X-chromosome and one Y-chromosome✓ (1)

5.4 (a) Crossing over✓ (1)
(b) Prophase I✓ (1)

5.5 Leads to (increased) genetic variation✓ (1)
(Mark first ONE only)

5.6
- They will appear as chromatids✓
- due to the splitting of the centromere✓/the chromosome separating

OR

- Each chromosome will have some genetic material of the other chromosome✓
- because of crossing over✓ (2)

5.7
- The zygote will have XXY chromosomes✓/XXX chromosomes/an extra gonosome
- since the ovum with XX chromosomes✓
- fused with a sperm with a Y-chromosome✓/X-chromosome (3)

(11)

ACTIVITY 6

6

6.1 Anaphase II✓ (1)

6.2
- Chromosome pairs separate during Anaphase I✓/ chromosomes move to the pole
- A chromosome separates during Anaphase II✓/chromatids move to the poles **OR**
- Centromeres do not split during Anaphase I✓

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– Centromeres split during Anaphase II✓

(Mark first ONE only) Any (1 x 2) (2)

6.3 (a) Centriole✓/centrosome (1)

(b) Spindle fibre✓ (1)

6.4 – Attaches to the centromere✓

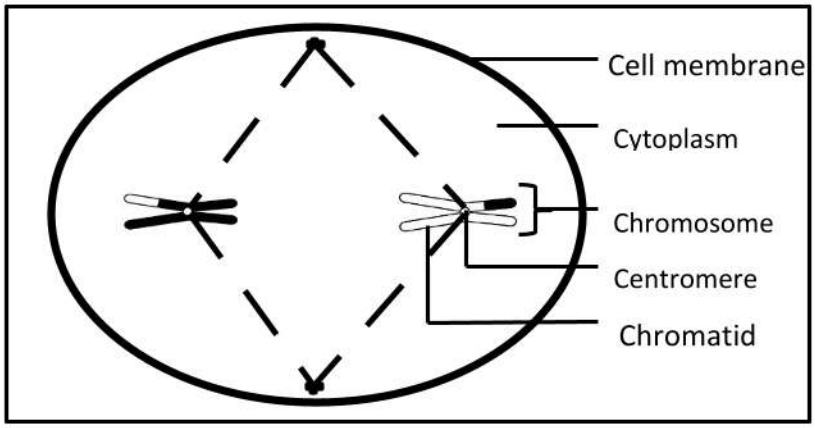
– to pull chromatids/chromosomes towards the (opposite) poles✓

- **OR**

– it contracts✓/shortens

– to pull chromatids/chromosomes towards the (opposite) poles✓ (2)

6.5 **Diagram showing metaphase II**



Guideline for assessing the drawing

Criteria		Marks
Position: chromosomes in a single row at the equator	(**P**)	1
Number: 2 unpaired chromosomes drawn	**(N)**	1
Shading of chromosomes [1 shaded chromosome with an unshaded tip 1 unshaded chromosome with a shaded tip]	**(S)**	1
Any **TWO** correct labels (except centriole & spindle fibre)	**(L)**	2

(5)

(12)

ACTIVITY 7

7

7.1 (a) Centriole✓/centrosome (1)

(b) Spindle fibre✓ (1)

7.2 Prophase I✓ (1)

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7.3 – Pairing of homologous chromosomes is visible✓/ bivalents are visible
– Development of spindle fibres✓
– Crossing over is taking place✓
– Centriole/ centrosome moved to opposite poles✓
– Disintegration of the nuclear membrane✓
Any 3 (3)
(Mark first THREE only)

7.4 – Parts of the homologous chromosomes overlap✓ and
– DNA/genetic material is exchanged✓
– at points called chiasmata✓/chiasma (3)

7.5 (a) Metaphase I✓ (1)

(b) – In Metaphase I/Meiosis I chromosomes are arranged in pairs at the equator✓
– In mitosis the chromosomes are arranged singly at the
– equator✓ (2)

7.6 – Four (daughter) cells will be formed✓of which
– two will each have five chromosomes✓ and
– The other two will each have three chromosomes✓ (3)
(15)

ACTIVITY 8

8

8.1 Body cells✓/cells in the body except the sex cells (1)

8.2 Autosomes✓ (1)

8.3 (a) – One chromosome comes from the sperm✓/father
– and the other comes from the ovum✓/mother (2)
(b) – Shape✓
– Size✓/length
– Position of genes✓/alleles
– Genes coding for same characteristic✓
– Location of centromere✓ Any 3
(Mark first THREE only) (3)

8.4 – Gonosomes are not identical✓/chromosomes at position 23 are not identical
– Individual 1 has XY gonosomes✓/is a male
– Individual 2 has XX gonosomes✓/is a female (3)
(10)

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TOPIC: REPRODUCTIVE STRATERGIES

ACTIVITY 1

1

1.1 - The egg has a high percentage (%) of yolk✓* therefore it
- contains more energy✓/nutrients
- The hatchling will be well developed✓ making it
- (more) independen✓ Compulsory mark✓* 1 + Any 2 (3)

1.2 - Eagle✓
- Vulture✓
- Pigeon✓ (3)

1.3 - The eggs have a lower percentage (%) of yolk✓ therefore
- the hatchlings will not be fully developed✓ (2)

(8)

ACTIVITY 2

2

2.1

(a) They lay eggs✓ (1)

(b) - The eggs are protected✓/incubated by the parents
- The young chicks are fed by the parents✓/display parental care Any (1)
(Mark first ONE only)

2.2 - It increases the chances of fertilisation✓/gametes are in close contact
- Gametes are protected from predation✓/desiccation/ environmental factors
- Water is not needed✓
- Fewer gametes are needed✓
(Mark first TWO only) (2)

(4)

ACTIVITY 3

3

3.1 - The eggs will dry out✓
- because they have no shells✓/are not amniotic eggs /have no amnion (2)

3.2 - The male and female bodies are in close contact✓
so that sperm can be released directly onto the ova✓
OR

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- Many/up to 6 000 ova are released✓
since fertilisation is external✓ Any (1 x 2) (2)

3.3 - Many/up to 6 000 ova are released✓
since fertilisation is external✓ /increasing the chance that some will be fertilised

OR

- The male and female bodies are in close contact✓
so that sperm can be released directly onto the ova✓ Any (1 x 2) (2)
(6)

ACTIVITY 4

4

4,1 External ✓ fertilisation (1)

4.2 The embryos develop inside an egg, outside the female's body✓ (1)

4.3 - To increase the chances of fertilisation✓
- since the gametes may be lost✓/not reach one another due to predation✓/water currents

OR

- To produce more zygotes✓offspring
- since many will be lost✓
- because they are preyed on✓/washed away/dry out (3)
(4)

ACTIVITY 5

5

5.1 Internal ✓ fertilisation (2)

5.2 -Sperm are deposited inside the female body ✓
thereby increasing the chances of fertilisation ✓
- Gametes/zygotes are inside the body✓
therefore protected from the predators✓/ environmental dangers
(Mark first TWO only) Any (2 x 2) (4)
(6)

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ACTIVITY 6

6

6.1 Internal ✓ fertilisation (1)

6.2 Internal fertilisation ✓
increases the chances of fertilisation ✓
Ovovivipary ✓/ eggs retained inside the female's body
where they are protected ✓
(Mark first TWO only) Any (2 x 2) (4)

6.3 To increase the chances of fertilisation✓/ the survival of the eggs/ number of offspring✓
- As eggs may be lost to predators✓/environmental factors etc.
- Since there is external fertilisation✓ Any 1 x 2 (2)
(7)

ACTIVITY 7

7

7.1 - Their embryos develop inside eggs✓ that are
- outside the body of the female✓✓ (2)

7.2 Graph X✓✓ (1)

7.3 - They will have a higher number of surviving embryos✓/eggs/offspring
- Because their fertilised eggs are attached to the vegetation✓
- where they are protected from predators✓/washing away (3)

(6)

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Topic: HUMAN REPRODUCTION

ACTIVITY 1

1

1.1 B ✓✓
1.2 D ✓✓
1.3 C ✓✓
1.4 D ✓✓
1.5 C ✓✓ **(12)**

ACTIVITY 2

2

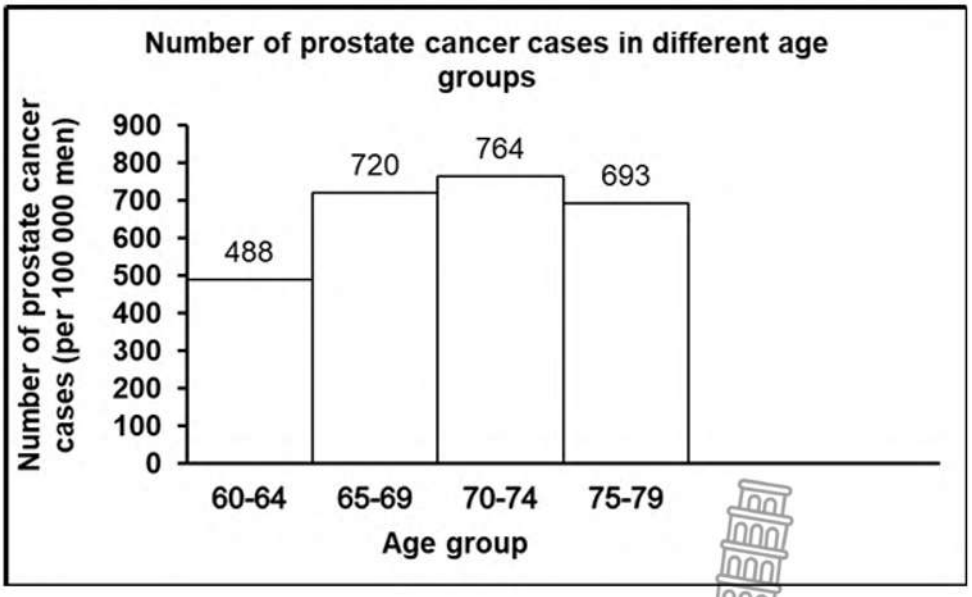
2.1 (a) Seminal vesicle ✓ (1)

(b) Testosterone ✓ (1)

2.2 - It is alkaline✓
to neutralise the acidic conditions of the vagina✓
- It contains mucus✓/provides medium
to facilitate the movement of the sperm✓
- It contains nutrients✓
to supply the sperm with energy✓ Any (1 x 2) (2)
(Mark first ONE only)

2.3 (a) (70 – 74) ✓ (1)

(b)



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Criteria for marking of the graph:

Criteria	Mark allocation
Histogram is drawn (**T**)	1
Caption of the graph includes both variables (**C**)	1
Correct labels on the X-axis and Y-axis with correct unit on the Y-axis (**L**)	1
Correct scale for Y-axis and bars of equal width with no spaces for X-axis **(S)**	1
Plotting (**P**) correctly done for: 1- 3 age groups All 4 required age groups **only**	 1 2

(6)

(11)

ACTIVITY 3

3

3.1 Endometrium ✓ (1)

3.2 Fertilisation✓ (1)

3.3 The (nucleus of the) sperm fuses with (the nucleus of) the ovum ✓ (1)

3.4
- Zygote divides by mitosis✓
- to form a (solid) ball of cells✓
- called the morula ✓
- which develops into a hollow ball of cells✓
- called the blastula✓/blastocyst Any (4)

3.5
- It is muscular✓ to protect the foetus from mechanical injury✓/to allow for parturition/birth
- It is flexible✓/can expand to accommodate the growing foetus✓
- It is hollow✓ to accommodate the growing foetus✓
- The thickened endometrium✓allows for implantation✓ /survival of the embryo

(Mark first TWO only) Any (2 x 2) (4)

3.6
- The secretion is alkaline✓ which
- neutralises the acidic conditions✓ of the vagina (2)

(13)

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ACTIVITY 4

4

4.1 -Stimulates ovulation (2)
- Stimulates the development of the corpus luteum✓
(Mark first TWO only)

4.2 - Follicle stimulating hormone✓/FSH (1)
(Mark first ONE only)

4.4 - The (progesterone) levels will remain low✓
- The LH levels are low ✓therefore
- ovulation will not take place✓ and
- no corpus luteum will develop✓ (4)

4.5 Hormone X /progesterone levels remain high✓ (1)
(8)

ACTIVITY 5

5

5.1 Uterus✓ (1)

5.2 - The thickened layer may cause an obstruction✓/blockage
- which may prevent the passage of gametes✓
- preventing fertilisation✓ from taking place
OR
- The thickened layer may cause an obstruction✓/blockage
- which may prevent the embryo from reaching the uterus✓/ implantation could occur in the Fallopian tube
- which may lead to the death of the embryo✓/rupturing of the fallopian tube/miscarriage (3)

5.3 - A high concentration of progesterone✓
- inhibits the pituitary gland from secreting FSH✓
- Without FSH a follicle will not develop in the ovary✓
- Therefore, oestrogen will not be secreted✓ (4)
(8)

ACTIVITY 6

6

6.1 - Stimulates ovulation✓ (2)
- Stimulates the development of the corpus luteum✓
(Mark the first TWO only)

6.2 (a) - FSH/a high concentration of hormone A✓
- will stimulate follicles to develop✓
- Therefore, ova will be produced✓ increasing the chances to fall pregnant (3)

(b) - A peak in hormone B✓/LH

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- will indicate that ovulation is about to happen✓
- therefore, an ovum will be available for fertilisation✓
  Any 2 (2)

6.3 - The levels will remain low✓ because
- the high progesterone levels✓ during pregnancy
- will inhibit the secretion of FSH✓ /hormone A (3)

(10)

ACTIVITY 7

7

7.1 (a) - (Graafian) follicle✓ and (2)
- Corpus luteum✓
(Mark first TWO only)

(b) - (Intense) pain✓
- Internal bleeding ✓ (2)
(Mark first TWO only)

7.2 (a) FSH✓ (1)

(b) Oestrogen ✓
OR
LH✓
OR (1)
FSH✓

7.4 -The Graafian follicle keeps on producing oestrogen✓ /fails to rupture
OR
-The increased secretion of oestrogen stimulates the secretion of LH✓
OR
-Excess production of FSH can cause the failure to ovulate✓ /
Graafian follicle to rupture (1)

7.5 - The corpus luteum does not degenerate✓ and
- keeps on secreting progesterone ✓
- This will inhibit the pituitary gland✓
- from secreting FSH ✓
- Therefore no follicle will develop ✓and
- no ovulation✓ will take place Any (5)

(12)

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ACTIVITY 8

8

8.1 (a) Zygote✓ (1)

8.2 - Cell A is haploid✓ /has 23 chromosomes /contains the genetic material of the female
- Cell B is diploid✓ / has 46 chromosomes /contains the genetic material of both parents
- Cell A is not fertilised✓ /Cell B is fertilised

OR

- Cell A is haploid✓ /has 23 chromosomes
- Cell B is diploid✓/has 46 chromosomes
- Cell A contains the genetic material from the female✓ / Cell B contains the genetic material of both parents✓ (3)

8.3 Amniotic✓ fluid (1)

8.4 - Allows for free movement✓ of the foetus
- Protects the foetus against mechanical injury✓ /acts as a shock absorber
- Prevents dehydration✓ of the foetus
- Prevents temperature changes Any (3)

(Mark first THREE only)

(8)

ACTIVITY 9

9

9.1 (a) - It has a rich blood supply✓/is vascular
-It is glandular✓
-It is thick✓ Any (2)

(Mark first TWO only)

(b) - Sperm cells are present in the fallopian tube✓/proximity of the ovum
- Ovulation has taken place✓/an ovum has been released (2)

(Mark first TWO only)

9.2 -During oogenesis✓*
-diploid cells in the ovary undergo mitosis ✓
-to form numerous follicles ✓
-At the onset of puberty✓
-under the influence of FSH✓
-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 ✓

Compulsory mark✓ * (1) + Any 5 (6)

9.3 - Part A/the fallopian tube is unable to provide the space✓ and there is no

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- endometrium✓/blood supply
- to provide nutrients✓/oxygen **OR** remove waste products
- in order for the embryo to develop✓ Any (3)

(13)

ACTIVITY 10

10

10.1 20✓ (1)

10.2 FSH✓ (1)

10.3 - The progesterone level is decreasing✓/goes from 5 to 0,8 ng/ml therefore
- FSH secretion /the pituitary gland is no longer inhibited✓ (2)

10.4 280 – 70 ✓ x 100✓
= 300✓% (3)

10.5 - It remains high✓/will increase (1)

10.6 - The corpus luteum does not disintegrate✓
- and continues to secrete progesterone✓
OR
- The placenta develops✓
- which secretes progesterone✓ (2)

(10)

ACTIVITY 11

11

11.1 (a) - The corpus luteum degenerates✓ therefore
- the progesterone levels decrease✓
- The endometrium is no longer maintained□/menstruation occurs (3)

(b) - the Graafian follicle✓secretes
- oestrogen ✓ which increases endometrium thickness (2)

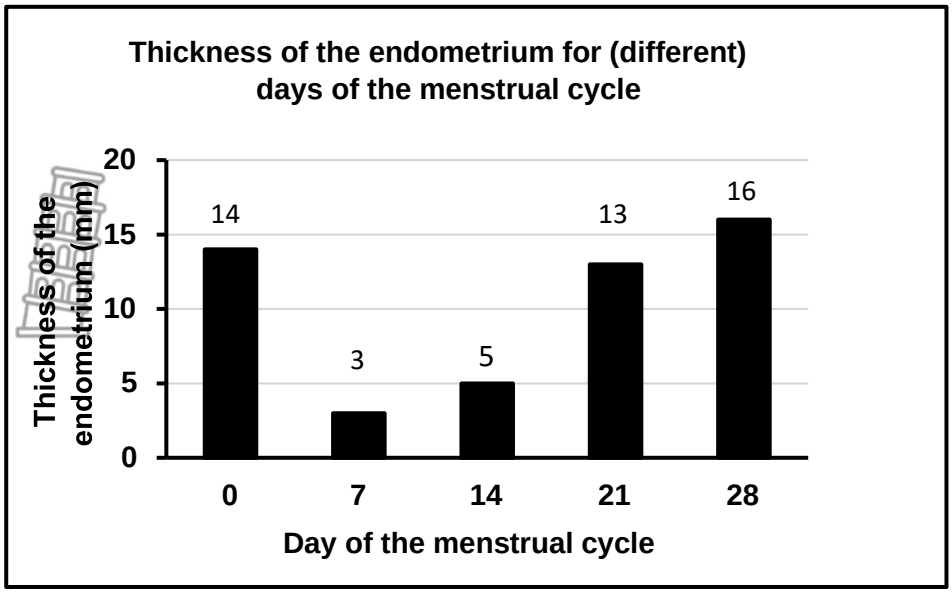
11.2 - It becomes more vascular✓and
- more glandular ✓ (2)

11.3 - It allows for implantation ✓of the embryo/the development of the placenta/increased blood supply for nutrition of the developing embryo (1)

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11.4



Criteria for marking the graph:

Criteria	Mark allocation
Type of graph: Bar graph is drawn (**T**)	1
Caption of the graph includes both variables (**C**)	1
Correct labels for X-axis and Y-axis and correct unit for Y-axis (**L**)	1
Equal space and width of bars for Xaxis and correct scale for Y-axis (**S**)	1
Plotting: (**P**) 1 - 4 co-ordinates are plotted correctly All 5 co-ordinates are plotted correctly	 1 2

If a histogram or line graph is drawn, marks will be lost for:
- Type of graph
- Scale

If axes are transposed:
- Can get all marks if labels are also swopped and bars are horizontal
- If labels are not corresponding, then:
  - Marks will be lost for labels and scale
  - Plotting can get credit if coordinates are correct for given labels

(6)

(14)

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ACTIVITY 12

12

12.1 (a) Age✓ (1)

(b) Fertility✓in men (1)

12.2 - They determined the:
- sperm count/✓number of normal sperm per mℓ of semen
- progressive motility✓/ability of sperm to swim effectively in a straight line
- sperm necrosis✓/immature or dead sperm per fresh semen sample

(Mark first THREE only) (3)

12.3 - The investigation was conducted from 1999 to 2017✓/over 18 years
- 1 294 men✓ were tested

(Mark first TWO only) (2)

12.4 - So that age will be the only independent variable✓
- since high temperature can affect fertility✓/sperm count /sperm motility/ sperm necrosis
- therefore, decreasing the validity ✓of the investigation (3)

(10)

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TOPIC: GENETICS AND INHERITANCE

ACTIVITY 1

1. 1.1 B ✓✓
1.2 A ✓✓
1.3 A ✓✓
1.4 B ✓✓
1.5 A ✓✓

(10)

ACTIVITY 2

2. 2.1
- An allele that is expressed in the phenotype ✓
- In the heterozygous condition ✓

OR

- An allele that masks the recessive allele/cannot be masked
- In the phenotype (2)

2.2 3 ✓/Three (1)

2.3 (a) Female with achondroplasia ✓/Female with Dwarfism (1)

(b) Aa ✓ (1)

(c) 3 ✓/Three (1)

2.4
- Both parents do not have achondroplasia ✓
- They have the genotype aa✓
- Since individual X inherits one allele from each parent ✓
- She must also have the genotype aa ✓
- And therefore, not have achondroplasia ✓/is not affected (5)

(11)

ACTIVITY 3

3 3.1 I^AI^A✓
I^Ai✓ (2)

3.2
- According to blood groups it is impossible for male 1 to be the father✓
- A child inherits one allele from each parent✓
- The child has the genotype I^AI^B✓/does not have the recessive allele/i
- Male 2 has the genotype ii✓and
- does not have the I^A or I^B allele to pass on to the child✓ and
- can only have children that are I^A and I^B✓/blood groups A or B

Any (5)

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3.3
- To establish which bands of the child match with the bands of the mother✓
- To compare the remaining bands to the possible father✓
- Since the child inherits (50% of) DNA from each parent✓ Any (2)

3.4 (Male) 3✓ (1)
(10)

ACTIVITY 4

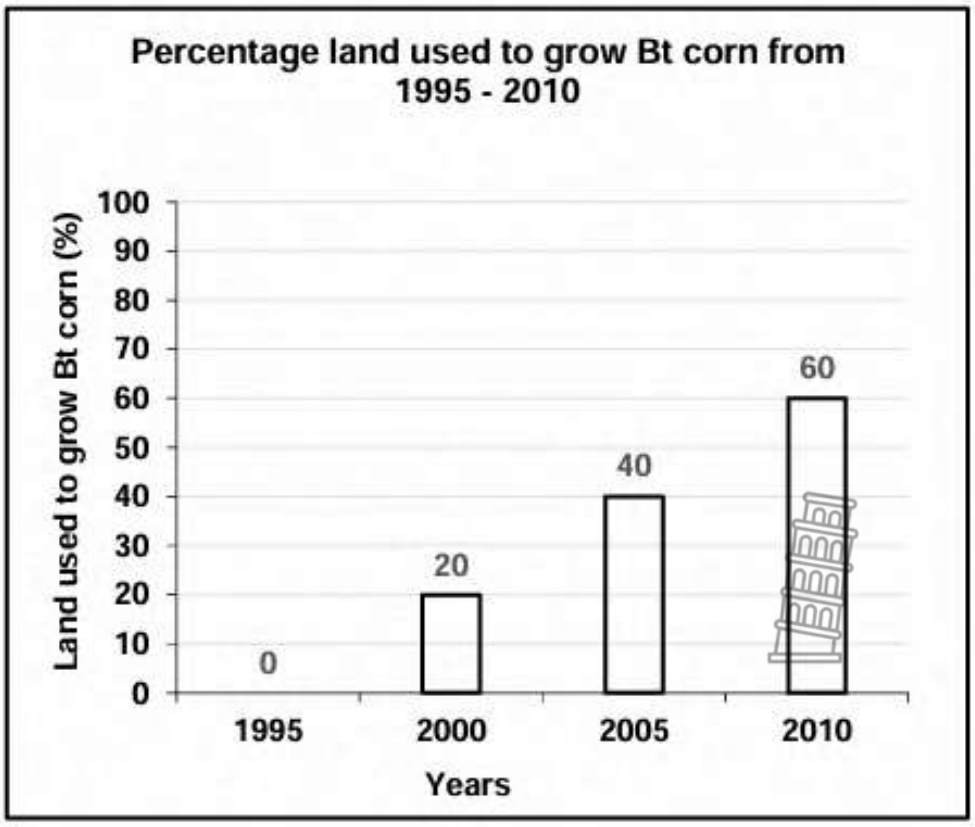
4. 4.1 - The gene for insect resistance is isolated from another species✓
- and inserted into the DNA of corn✓ where it is expressed (2)

4.2 As (the percentage of) land used to grow Bt corn increases the amount of insecticide used decreases✓✓ (2)

4.3
- Longer shelf-life✓
- Drought resistance✓
- More nutrients✓
- Frost-resistant✓
- Increased size✓
- Increased crop yield✓
- Herbicide-resistant✓
- No allergens✓
- Heat-tolerant✓
- Disease-resistant✓ Any (2)

(Mark first TWO only)

4.4



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Criteria for marking of the graph:

Criteria	Mark allocation
Bar graph is drawn (**T**)	1
Caption of the graph includes both variables (**C**)	1
Correct labels on the X-axis and Y-axis with correct unit on the Y-axis (**L**)	1
Correct scale for Y-axis and bars of equal width and spaces for X-axis **(S)**	1
Plotting (**P**) correctly done for: 1- 3 years All 4 required years	 1 2

If a histogram or line graph is drawn, marks will be lost for:

- Type of graph
- Scale

If axes are transposed:

- Can get all marks if labels are also swopped and bars are horizontal
- If labels are not corresponding, then:
  - Marks will be lost for labels and scale
  - Plotting can get credit if coordinates are correct for given labels

(6)
(12)

ACTIVITY 5

5

5.1

P_1	Phenotype	Woman without haemophilia	x	Man with haemophilia✓
	Genotype	X^HX^h	x	X^hY✓
Meiosis				
	G/gametes	X^H, X^h	x	X^h, Y✓
Fertilisation				
F_1	Genotype	X^HX^h, X^HY, X^hX^h, X^hY✓		
	Phenotype	1 daughter without haemophilia, 1 daughter with haemophilia, 1 son without haemophilia, 1 son with haemophilia✓		
		0%✓*chance of a daughter homozygous for normal blood clotting		

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P_1 and F_1✓
Meiosis and fertilisation✓

***1 compulsory mark** + any 6

OR

P_1	Phenotype	Woman without haemophilia	x	Man with haemophilia✓
	Genotype	X^HX^h	x	X^hY✓

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	Phenotype	1 daughter without haemophilia, 1 daughter with haemophilia, 1 son without haemophilia, 1 son with haemophilia✓
		0%✓* chance of a daughter homozygous for normal blood clotting

P_1 and F_1✓
Meiosis and fertilisation✓ (7)

***1 compulsory mark**+ any 6

(7)

ACTIVITY 6

6

6.1 To determine which blood group was the most common in their community✓✓ (2)

6.2 $\frac{15}{100}$ ✓ x 600✓ = 90✓ participants (3)

6.3 $I^A I^A$ ✓
I^A i✓ (2)

6.4 - Allele I^A / allele for blood group A is inherited from one parent✓and
- allele I^B/ the allele for blood group B from the other parent✓
- the alleles are co-dominant✓ /equally dominant and are

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- equally expressed in the phenotype✓ /the child will have the genotype I^AI^B Any (3)

(10)

ACTIVITY 7

7

7.1
- Either **male 1** or **male 2** could be the father✓ of the boy
- since both males have the I^B allele✓/ **male 1** I^AI^B and **male 2** I^BI^B or I^Bi
- The mother's blood group is O and must have the genotype ii✓/homozygous recessive
- The boy would have inherited the recessive allele/i from the mother✓
- and he would have the genotype I^Bi✓ (5)

7.2 Male 2✓ (1)

7.3
- Four/some bands of the boy's✓DNA profile
- match with those of the mother's✓ profile
- The remaining bands of the boy match with the bands of male **2**'s✓ DNA profile/fewer bands match with male **1**'s DNA profile (3)

(9)

ACTIVITY 8

8

8.1 (a) Tt✓ (1)

8.2
- J is a taster and therefore must have one dominant allele✓/T
- Individual K is tt✓
- Individual O is a non-taster✓/is homozygous recessive/tt
- She must have inherited a recessive allele/t from each parent✓
- Therefore, J must have one recessive allele✓/t

OR

- J is a taster and therefore must have one dominant allele✓/T
- If J is homozygous dominant✓/TT
- and K is homozygous recessive✓/tt
- then it is not possible to have child (O) who is homozygous recessive✓/ tt
- as she must have inherited a recessive allele/t from each parent✓ (4)

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Any

(5)

ACTIVITY 9

9

9.1

P_1 Phenotype Male x Female✓

Genotype ZZ x ZW✓

Meiosis

G/gametes Z Z x Z W ✓

Fertilisation



F_1 Genotype ZZ ZW ZZ ZW✓

Phenotype male female male female✓

50✓*% chance of a female

P_1 and F_1✓

Meiosis and fertilisation✓

***1 compulsory mark** + Any 5

OR

P_1 Phenotype Male x Female✓

Genotype ZZ x ZW✓

Meiosis

Fertilisation

Gametes	Z	Z
Z	ZZ	ZZ
W	ZW	ZW

1 mark for correct gametes
1 mark for correct genotypes

F_1 Phenotype male female male female✓

50✓*% chance of a female

P_1 and F_1✓

Meiosis and fertilisation✓

***1 compulsory mark** + Any 5

(6)

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9.2

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	female	:	male✓	

P_1 and F_1✓
Meiosis and fertilisation✓

OR

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	female: male✓	

P_1 and F_1✓
Meiosis and fertilisation✓ Any (6)

9.3
- In **birds**,
  - The sex chromosomes of **males** are <u>similar</u> ✓
  - The sex chromosomes of **females** are <u>dissimilar</u> ✓
  - The <u>shorter</u> sex chromosomes is found in the **female** ✓

- In **humans**,
  - The sex chromosomes of **females** are <u>similar</u> ✓
  - The sex chromosomes of **males** are <u>dissimilar</u> ✓
  - The <u>shorter</u> sex chromosomes is found in the **male** ✓

(Mark first TWO only) Any (2x2) (4)
(16)

ACTIVITY 10

10

10.1
- It is harmful✓ /prevents clotting of blood
- and leads to excessive bleeding✓ /internal bleeding/ swelling of joints/ bruising (2)

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10.2 $\left[\frac{25}{100} \times 25\,000\right]$ ✓ = 6250✓

OR

25% x 25000✓ / (0,25 x 25000) = 6250✓

OR

$\frac{25000}{4}$ ✓ = 6250✓ (2)

10.3
- Males have only one X-chromosome✓/XY
- If this chromosome carries the recessive allele the male will have haemophilia✓
- as there is no other allele that could mask the effect of the recessive allele✓ (3)

(7)

ACTIVITY 11

11

11.1 Autosomes✓ (1)

11.2 Female✓ (1)

11.3
- The gonosomes✓/chromosome pair 23
- are identical✓/XX

(Mark first ONE only) (2)

11.4 The factors/alleles that control a characteristic separate✓ (during meiosis) so that only one is present in each gamete✓ (2)

11.5
- A person with Down syndrome will have 3 chromosomes✓ at position number 21✓ (2)

(8)

ACTIVITY 12

12

12.1
- The grey fur colour is an intermediate phenotype✓/a blend of black and white
- This indicates that neither of the alleles is dominant✓ (2)

12.2

P_1	Phenotype	Grey	x	Black✓
	Genotype	BW	x	BB✓

Meiosis

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G/gametes B, W x B, B✓

Fertilisation

F_1 Genotype BB, BB, BW, BW✓*

Phenotype Black Grey✓*

P_1 and F_1✓

Meiosis and fertilisation✓

***2 compulsory marks** + any 4

OR

P_1 Phenotype Grey x Black✓

Genotype BW x BB✓

Meiosis

Fertilisation

Gametes	B	W
B	BB	BW
B	BB	BW

1 mark for correct gametes

1 mark for correct genotypes*

F_1 Phenotype Black Grey ✓*

P_1 and F_1✓

Meiosis and fertilisation✓ (6)

***2 compulsory marks** + any 4

(8)

ACTIVITY 13

13

13.1 Incomplete✓ dominance (1)

13.2 - Neither the allele of a cream-coloured coat and chestnut-coloured coat is dominant✓
- resulting in the intermediate phenotype which is the golden-coloured coat✓/palomino (2)

13.3 (a) Artificial selection✓/selective breeding (1)

(b) - Chestnut (coloured) coat✓
- Cream (coloured) coat✓ **(Mark first TWO only)**

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(2)

13.4

P_1	Phenotype	Cream-coloured (coat)	x	Palomino✓/ golden coloured (coat)	
	Genotype	AA	x	AG✓	

Meiosis

	Gametes	A, A	x	A, G✓	

Fertilisation

F_1	Genotype	AA, AA,		AG, AG✓	
	Phenotype	Cream-coloured , palomino✓/golden-coloured			

1: 1 ✓* **(phenotypes must be correct)**

P_1 and F_1✓
Meiosis and fertilisation✓

***1 compulsory mark** + Any 5

OR

P_1	Phenotype	Cream-coloured	x	Palomino✓/ golden coloured	
	Genotype	AA	x	AG✓	

Meiosis

Fertilisation

Gametes	A	A
A	AA	AA
G	AG	AG

1 mark for correct gametes
1 mark for correct genotypes

F_1	Phenotype	Cream-coloured, palomino✓/ golden-coloured			

1: 1✓* **(phenotypes must be correct)**

P_1 and F_1✓
Meiosis and fertilisation✓

***1 compulsory mark** + Any 5

(6)

(12)

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TOPIC: RESPONDING TO THE ENVIRONMENT (HUMANS)

ACTIVITY 1

1

1.1 A ✓✓
1.2 C ✓✓
1.3 A ✓✓
1.4 B ✓✓
1.5 B ✓✓ **(10)**

ACTIVITY 2

2

2.1 (a) Performance training✓ (1)

(b) Hand-eye coordination✓ (1)

2.2 12✓ (1)

2.3 To measure hand-eye coordination✓ NOT improve (1)

2.4
- All participants were 11 years old✓
- Only girls✓/female participants were selected✓
- A rubber ball was used✓/same type of ball was used
- They stood at a distance of 2 m from the wall✓
- The ball-catch test was conducted for 30 s✓
- The girls participated in the same training programme✓/training was conducted for six weeks✓ /12 sessions

(Mark first THREE only) Any (3)

2.5
- More than 5 participants should be selected✓
- The ball-catch test should be repeated more than 3 times✓
- Increase the ball-catch test time to more than 30 seconds✓
- Repeat the investigation with another group✓

(Mark first ONE only) Any (1)

2.6 - The (average) number of ball catches increased✓
- due to performance training✓/ improved hand-eye coordination (2)

2.7 Performance training improves hand-eye coordination✓✓ (2)

(12)

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ACTIVITY 3

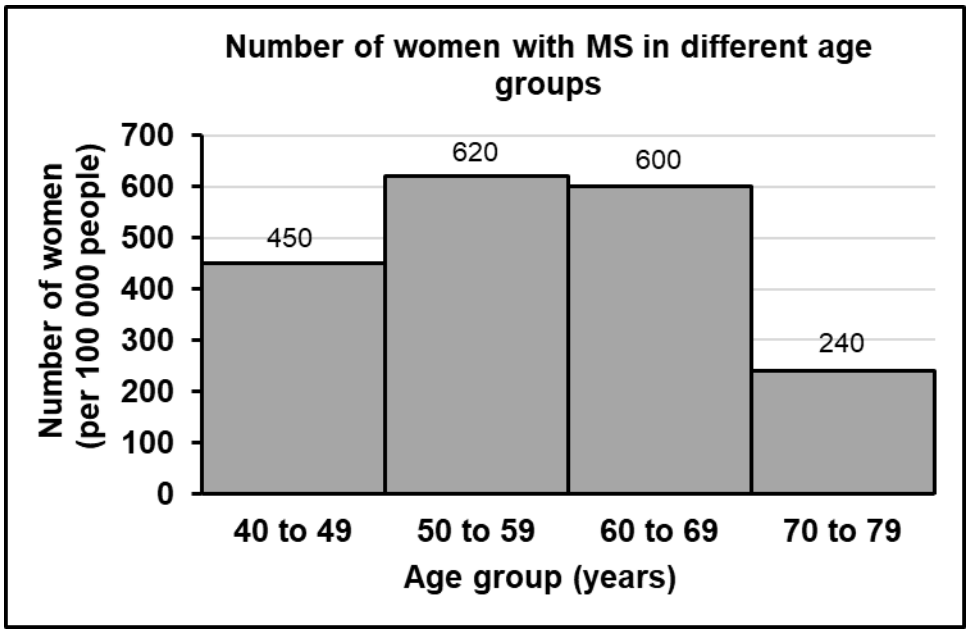
3

3.1 (a) Neurons✓ (1)

(b) Myelin sheath✓ (1)

3.2 The occurrence of MS is greater in men of higher age groups✓✓ (2)

3.3



Criteria for marking the graph:

Criteria	Mark allocation
Type of graph: Histogram is drawn (**T**)	1
Caption of the graph includes both variables (**C**)	1
Correct labels and units on X-axis and Y-axis (**L**)	1
Scale: (**S**) - Correct scale for Y-axis and - Same width of bars for X-axis	1
Plotting: (**P**) - 1 - 3 co-ordinates are plotted correctly - All 4 required co-ordinates are plotted correctly	1 2

If a bar or line graph is drawn, marks will be lost for: (6)

- Type of graph
- Scale

If axes are transposed:

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- Can get all marks, if labels are also swopped and bars are horizontal
- If labels are not corresponding, then:
  - Marks will be lost for labels and scale
  - Plotting can get credit if coordinates are correct for given labels

(10)

ACTIVITY 4

4

4.1 (a) Cornea✓ (1)

(b) Sclera✓ (1)

4.2 - It contains the photoreceptors✓ (2)
- which convert light stimuli into impulses✓

4.3 - The lens becomes less flexible✓/ is unable to change its shape
(Mark first ONE only) (1)

4.4 (a) - Light is not refracted enough✓/refracted too little
- The image is focussed behind the retina✓ (2)

(b) Convex✓ lenses (1)
(8)

ACTIVITY 5

5

5.1 (a) P✓ and T✓ (2)
(Mark first TWO only)

(b) S✓ and R✓ (2)
(Mark first TWO only)

5.2 Cochlea✓ (1)

5.3 - They convert the stimulus /pressure waves to an impulse✓and
- transfer it to the auditory nerve✓ (2)

5.4 - Ossicles will not vibrate freely✓ /fewer /no vibrations will be carried to the oval window
- There is decreased amplification✓ of sound

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- Fewer /no pressure waves will form in the cochlea✓
- Receptors in the cochlea will not be stimulated✓/stimulated less
- Less/no impulses will reach the cerebrum✓*

(4)

*1 Compulsory + Any 3

(11)

ACTIVITY 6

6

6.1 (a) Alcohol dose✓ (1)

(b) Reaction time✓ (1)

6.2
- Age✓ /30 years old
- Gender✓ /men
- Volunteers were tested over a period of 7 days✓
- Volunteers abstained from alcohol for 24 hours✓ prior to testing
- Volunteers had their reaction time measured 30 minutes after consuming the alcohol✓ /period from consumption to testing was the same

Any (2)

(Mark first TWO only)

6.3
- Use more than 2 volunteers✓ /increase the number of volunteers
- Repeat the investigation✓ / take multiple readings for the same dose

(2)

(Mark first TWO only)

6.4
- To ensure that there is no alcohol in the body✓ and
- that only the alcohol given on the day is tested for✓

(2)

6.5 (93 x 600)✓ = 55 800✓mg (2)

6.6 Higher doses of alcohol increase the reaction time✓✓ (2)

(12)

ACTIVITY 7

7

7.1 It ensures that nerve impulses are transmitted in one direction✓ (1)

7.2 (a)
- It is a rapid✓ /automatic reaction to a stimulus
- that protects the body ✓from damage

(2)

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(b)
- No impulse will be transmitted from the receptor✓
- to the spinal cord✓/interneuron and
- the effector will not be stimulated✓

(3)

7.3

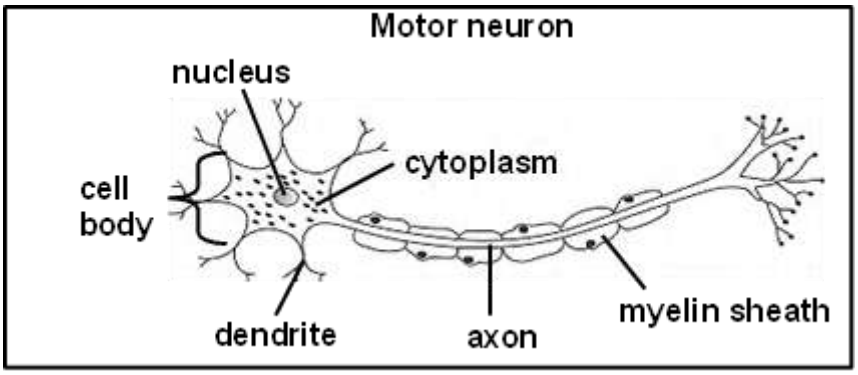


Diagram of a motor neuron	(D)	1
Correct caption		1
Any three correct labels		3

(5)
(11)

ACTIVITY 8

8

8.1
- The person will suffer from hearing loss✓*/be deaf because
- no/less vibrations will be transmitted to the oval window✓ and
- no/less pressure waves will form in the cochlea✓/inner ear
- Therefore, there will be less/no stimulation of the organ of Corti✓/ hair cells
- Less/no impulses will reach the cerebrum✓

Compulsory mark✓* + Any 3 **(4)**

ACTIVITY 9

9

9.1 Iris✓ (1)

9.2
- Helps to maintain the shape of the eye✓
- Plays a role in refraction of light✓
- Allows the transmission of light✓
- Prevents desiccation of✓ structures in the eye
- Holds the retina in position✓

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- Nourishment of✓ the eye
- Prevents mechanical injury in✓ the eye Any (2)

(Mark first TWO only)

9.3
- Area B contains (a high concentration of) photoreceptors/✓ cones
- Area C contains no photoreceptors/ ✓no rods & cones (2)

9.4 Astigmatism✓ (1)

9.5 (a)
- It is more convex✓
- so that light rays are refracted (bent) more✓
- to focus on the retina✓ /to form a clear image on the retina (3)

(b)
- Because the lens will become cloudy/✓opaque
- no/less light will enter the eye✓
- causing no sight /✓weak sight (3)

9.6
- The ciliary muscle contracts✓
- The ciliary body moves closer to the lens✓
- The suspensory ligaments slacken✓
- Tension on the lens decreases✓
- The lens becomes more convex/r✓ounded
- Light rays are refracted more✓
- To focus the light on the retina✓ Any (6)

(18)

ACTIVITY 10

10

10.1 Myelin sheath✓ (1)

10.2
- Axon is no longer insulated✓
- This causes the speed of transmission of nerve impulses to decrease✓
- which can lead to a delayed response✓ and
- therefore, loss of muscle control✓ Any (3)

(4)

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ACTIVITY 11

11

11.1 Cochlea✓ (1)

11.2 $\left[\frac{(130\,000 - 85\,000)\ ✓}{85\,000}\right]$ x 100✓= 52,94✓% (3)

11.3 - The impulse will not be transmitted to the cerebrum✓
- and will not be interpreted✓ (2)

(6)

ACTIVITY 12

12

12.1 Central nervous system✓ (1)

12.2 (a) B✓ - Cerebellum✓ (2)

(b) C✓ - Medulla oblongata✓ (2)

(c) A✓ - Cerebrum✓ (2)

12.3
- (The impulse) is transmitted by the sensory neuron✓
- via the dorsal root of the spinal nerve✓ to
- the interneuron✓ and to
- the motor neuron✓
- by synaptic✓ contact
- It is then transmitted via the ventral root (of the spinal nerve) ✓
- to the effector✓ which brings about the reflex action

Any (6)

(13)

ACTIVITY 13

13

13.1 (a) Pinna✓ (1)

(b) Ossicles✓ (1)

13.2 C✓ and D✓ (2)
(Mark first TWO only)

13.3
- Cristae are stimulated ✓and
- convert the stimulus to an impulse ✓which
- is sent via the auditory nerve✓

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- to the cerebellum f✓or interpretation
- Impulses are then sent to the skeletal muscles t✓o restore balance

(5)

13.4 (a)
- Fewer/no stimuli will be converted into impulses✓
- Fewer/no impulses will be sent to the cerebrum to✓ be interpreted

(2)

(b)
- The earplugs limit the sound waves in the auditory canal/✓
- reaching the tympanic membrane
- Fewer vibrations are formed in the middle ear✓
- Fewer pressure waves are formed in the cochlea✓

to prevent damage

(3)

(14)

ACTIVITY 14

14

14.1 (a) 5✓µm (1)

(b) 800✓µm (1)

14.2 (a) (The impulse speed) is faster in a myelinated neuron than in an unmyelinated neuron✓✓

OR

(The impulse speed) is slower in an unmyelinated neuron than in a myelinated neuron✓✓

(2)

(b) As the axon diameter increases, the impulse speed is faster ✓✓ (2)

(6)

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TOPIC: ENDOCRINE AND HOMEOSTASIS

ACTIVITY 1

1

1.1 C✓✓
1.2 C✓✓
1.3 D✓✓
1.4 D✓✓
1.5 A✓✓
1.6 C✓✓
1.7 A✓✓
1.8 C✓✓
1.9 C✓✓
1.10 C✓✓
1.11 C✓✓
1.12 B✓✓

12X2 (24)

ACTIVITY 2

2

2.1 (a) Aldosterone level ✓/ increased aldosterone level (1)

(b) Blood pressure ✓ (1)

2.2 - 1 688 volunteers were used✓
- The procedure was done 4 times for each individual ✓
(Mark first TWO only) (2)

2.3 - All factors should be kept constant ✓/there should be only one independent variable to ensure the validity of the investigation
- Dietary factors ✓/examples can also influence the blood pressure
(Mark first TWO only) (2 x 2) (4)

2.5 To compare the blood pressure before and after the administration of aldosterone✓✓ (2)

- The high aldosterone level ✓
- will increase the permeability of the renal tubules ✓ for salt
- More salt will be reabsorbed✓ (3)

(13)

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ACTIVITY 3

1

3.1 50✓°C (1)

3.2 As the temperature increases the average rate of blood-flow to the skin increases✓✓ (2)

3.3 $\left[\frac{11-4}{4}\right]$ ✓ X 100✓ = 175%✓ (3)

3.4 - As the temperature increases✓ from 20 °C to 45 °C
-vasodilation occurs✓/blood vessels dilate
-to increase the rate of blood flow✓ /more blood flows to the skin
-so that more heat✓/ sweat can be lost (4)

3.5 - Less blood flows to the skin✓ at low temperatures
-Less oxygen✓/nutrients reach the cells of the tissue and the cells may die

OR

-Less blood flows to the skin✓ at low temperatures
-More carbon dioxide✓/waste products accumulate in the cells of the tissue and the cells may die (2)

(12)

ACTIVITY 4

4

4.1 (a) 36,2✓˚C
(b) Day 16

4.2 - Body temperature increased above basal body temperature✓ / 36.2˚C
- (immediately) after day 16✓

4.3 - The corpus luteum is formed✓ after ovulation and
- it secretes progesterone✓

4.4 - Physical activity /increased cellular respiration changes body temperature✓

OR

- Low physical activity ✓/cellular respiration prevents a change in body temperature✓

(10)

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ACTIVITY 5

5

5.1 - It stimulates the breathing muscles✓
- and this increase the rate/depth of breathing✓ so that
- more oxygen is inhaled✓
- It stimulates the heart✓ muscle
- causing an increase in heart rate✓ /blood pressure so that
- oxygen and glucose are transported faster✓

Any **(5)**

ACTIVITY 6

6

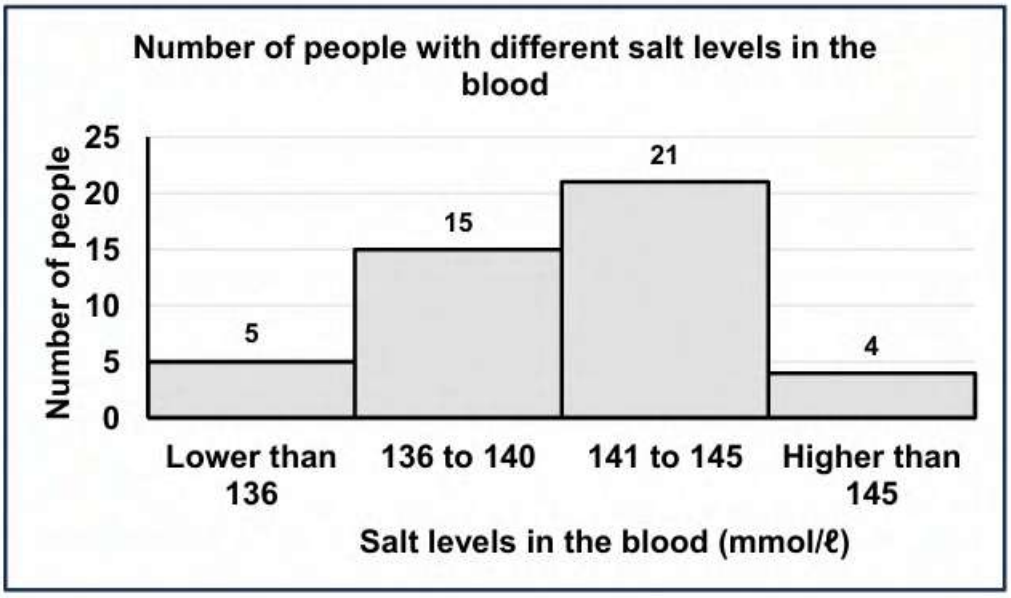
6.1 (a) 4✓ (1)

(b) 36✓ (1)

6.2 - Receptor cells detect the low salt level ✓
- The adrenal glands are stimulated ✓and
- more aldosterone is secreted ✓
- In the renal tubules✓
- the reabsorption of salt /sodium is increased ✓
- into the surrounding blood capillaries ✓
- Less salt is excreted ✓ (6)

Any

6.3



(6)

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Criteria for the assessing of the graph:

Criteria	Elaboration	Mark
Correct type of graph (**T**)	Histogram drawn	1
Caption of graph (**C**)	Both variables included	1
Axes labels (**L**)	X- and Y-axis correctly labelled and correct unit for X-axis	1
Scale for X- and Y-axes (**S**)	X-axis - equal width of bars with no spaces Y-axis – correct scale	1
Plotting (**P**)	1 to 3 coordinates plotted correctly All four coordinates plotted correctly	1 2

If a bar or line graph is drawn, marks will be lost for:

• Type of graph • Scale If axes are transposed:

• Can get all marks if labels are also swopped and bars are horizontal

•If labels are not corresponding with axes, then:

•Marks will be lost for labels and scale

•Plotting can get credit if coordinates are correct for given labels

(14)

ACTIVITY 7

7

7.1 Short stature✓ (1)

7.2 $\left[\frac{22,3}{100}\right]$✓ x 265✓ = 59,1✓ **OR** 22,3%✓ x 265✓ = 59,1✓ (3)

7.3 - High levels of TSH✓
- indicate low thyroxin levels✓ (2)

(10)

ACTIVITY 8

8

8.1 (a) Nervous✓ system (1)
(Mark first ONE only)

(b) Endocrine✓ system (1)
(Mark first ONE only)

8.2 (a)
- Osmoreceptors in the hypothalamus detect✓ low water levels
- The pituitary gland is stimulated✓ to
- release more ADH✓ which causes
- the renal tubules to become more permeable✓
- More water is reabsorbed✓ into the blood vessels of the kidney and
- less water is released in the urine✓

-Water levels return to normal✓/increase (4)

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(b) - To increase oxygen intake✓ which is needed for increased respiration✓/energy release
- To remove more carbon dioxide✓ which is a harmful waste product✓ (5)
(Mark first TWO only)

(10)

ACTIVITY 9

9

9.1 Adrenal ✓gland (1)

9.2 (a) Adrenalin✓ (1)

(b) Aldestorone✓ (1)

9.3 (a) -They will constrict✓ so that -more blood can flow to the heart✓ muscles/ brain/liver/ parts needed during emergency (2)

(b) -More glycogen will be converted to glucose✓in the liver -which is needed for energy✓/cellular respiration (2)

9.4 - The secretion of ADH✓
- will increase✓
- which will increase the permeability✓
- of the renal tubules in the kidney ✓
- so that more water is reabsorbed✓ from the filtrate (5)

9.5 - Low salt levels are detected by receptor cells✓ in the kidney
- Adrenal glands are stimulated✓ to secrete
- more aldosterone✓
- which stimulates the renal tubules✓
- to be more permeable to salt✓
- This increases the reabsorption of salt✓ and
- the salt level in the blood increase✓ /return back to normal (5)

(17)

ACTIVITY 10

10

10.1 (37,4 – 35,4) 37,4 ✓ x 100✓ = 5,35 ✓% (3)

10.2 - Skin temperature decreased✓ /lowers from 37,4 ºC to 35,4 ºC - because part Q dilated✓ /vasodilated
- causing more blood to flow to the (surface of the) skin✓ and
- part P became (more) active ✓/produced more sweat
- causing more heat to be lost✓ to the environment
- through evaporation✓ / radiation/ convection (6)

(9)

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ACTIVITY 11

11

11.1 (a) Negative feedback ✓mechanism (1)

(b) Thyroid✓ (1)

(c) Goitre✓ (1)

11.2 It regulates the metabolic rate ✓
- It affects the growth and functioning of the heart✓ /nervous system/
- It influences bone development✓ /muscle control
(Mark first ONE only) Any (1)

11.3 -The thyroxin level is low✓
- The pituitary gland is stimulated ✓
- More TSH✓ is secreted
- which stimulates gland Y✓ /the thyroid gland
- to secrete more thyroxin ✓ Any (4)

11.4 - A lower metabolic rate✓
- causes decreased usage of nutrients✓ and
- excess nutrients/fat will be stored in the body✓
Any (2)
(10)

ACTIVITY 12

12

12.1 To ensure that the change in blood glucose levels was due to insulin only✓✓ (2)

12.2 - It stimulates the absorption of glucose✓ from the blood into the cells✓
- It stimulates the liver ✓/muscles to convert glucose to glycogen✓
- It causes increased cellular respiration✓ which utilises glucose✓
(Mark first TWO only) Any (2 x 2) (4)

12.3 Group Y✓ (1)

12.4 - At 0 mins, the blood glucose level for group Y was within the normal range✓/ the blood glucose level for group X was high

- At 90 minutes the blood glucose level for group Y returned to normal✓ /the blood glucose levels for group X remained high

- After the ingestion of glucose, the insulin level for group Y increased ✓/the insulin level for group X decreased (3)
(10)

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ACTIVITY 13

13

13.1 Islets of Langerhans (1)

13.2 (a) -Type 1 ✓
- No insulin will be produced✓
- The presence of GAD-antibodies indicates that pancreas cells are being destroyed✓ (3)

(b) Type 1✓
- A lower than normal **C**
-peptide level indicates that the insulin producing cells of the pancreas was destroyed✓
- therefore no insulin will be produced✓ (3)

13.3 - The insulin levels will remain high✓ because
- the blood glucose levels remain high✓
- the pancreas will continue secreting insulin✓ (3)

13.4 - The glucose cannot be absorbed into the cells ✓
- therefore it cannot be used in cellular respiration ✓/ to release energy (2)

(12)

ACTIVITY 14

14

14.1 - Water cannot be reabsorbed✓ /the water is in the urine since renal tubules are resistant to the effects of ADH
- Water levels are lower than normal in blood✓
- therefore, more ADH is secrete

(3)
(3)

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TOPIC: PLANT HORMONES

ACTIVITY 1

1

1.1 B✓✓
1.2 D✓✓
1.3 C✓✓
1.4 C✓✓
1.5 A✓✓
1.6 B✓✓

(5)

ACTIVITY 2

2.1
- Due to gravity✓
- there is a higher concentration of auxins on the lower side✓ of the root
- which inhibits growth✓
- Therefore, growth will occur mainly on the upper side ✓
- causing the root to bend/grow downwards✓ (5)

2.2
- The seedling must be rotated constantly✓
- To remove the effect of gravity✓ (2)

(7)

ACTIVITY 3

3

3.1 Stem growth✓ (1)

3.2
- To remove the source of auxins✓
- The tip produces auxins✓

Any 1 (1)

3.3 - To increase the reliability✓/validity of the results (1)

3.4 B✓ and C✓ (2)

3.5
- The presence of auxins✓ in the tip of the stem
- stimulate upward growth✓ and
- inhibit development of lateral branches✓ (3)

(8)

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ACTIVITY 4

4

4.1
- To prevent weeds from competing with crops✓
- for water✓ /nutrients/space/sunlight (2)

4.2
- They may kill other organisms✓
- They may accumulate in ecosystems✓
- They may disrupt ecosystems ✓

(Mark first ONE only) (1)

4.3
- The application of auxin-based herbicides is less labour intensive ✓/less time-consuming/less expensive than mechanical removal
- Auxin-based herbicides will kill the whole plant but with physical removal only part of the plant may be removed✓

(Mark first ONE only) (1)

4.4
- Auxin-based herbicides selectively kill broad leaved plants✓
- and the farmer will lose money ✓/the bean crop will fail (2)

(10)

ACTIVITY 5

5

5.1 November✓ (1)

5.2
- The concentration of abscisic acid increases ✓
- To stimulate the abscission✓ /falling of leaves
- To prepare the to prepare the tree for dormancy✓

(3)

5.3
- Less sunlight✓ / less water/ cold conditions therefore
- Decreased photosynthesis✓ / reduced transpiration/ lower energy demand/ low growth rate

Any (1 x 2) (Mark first ONE only) (2)

(6)

ACTIVITY 6

6

6.1 Phototropism✓ (1)

6.2 B✓ (1)

6.3
- All the seedlings grew straight up✓ /showed no phototropism
- because they were evenly exposed to light✓ /not exposed to unilateral light / equal distribution of auxins (2)

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6.4
- The seedlings/stems grew/bend to the left✓ /towards light
- because they were exposed to light from one side✓ /unilateral light
- Auxins diffuse to the right ✓ /dark side of the seedlings
- The high concentration of auxins on the right✓ /dark side
- stimulates cell elongation ✓ /cell division/growth on that side

(5)

(9)

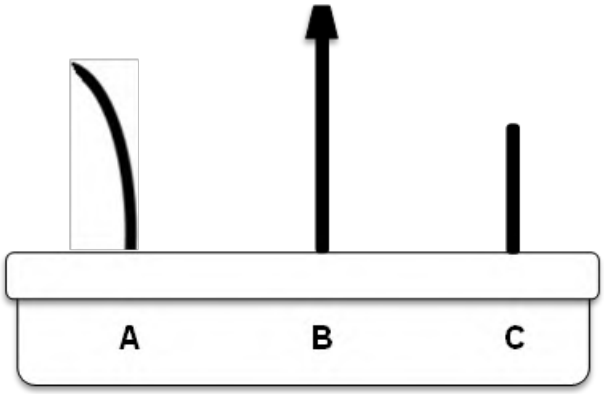
ACTIVITY 7

7

7.1 Phototropism✓

7.2 Auxins✓
- To remove the auxins✓ and
- prevent phototropism✓

7.3 **(Mark first TWO only)**



7.4

CRITERIA	MARK ALLOCATION
Stem **A** is bent towards the left✓	1
Stem **B** has grown straight upwards✓/ is taller than tip **C**	1
No growth in stem **C**✓/stem **C** is shorter than tip **A** and **B**	1

NOTE: Tray need not be drawn

(7)

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ACTIVITY 8

8

8.1 (a) (Presence of) auxins✓ (1)

(b) Species✓
- Light ✓
- Duration in the dark✓

(Mark first TWO only)

(2)

8.2 (a) - The plant/stem grows (straight) upwards✓ (1)

(b) - No upward growth will occur✓
- Lateral branches will develop✓

(Any One) (1)

8.3 Four plants in each group✓✓ (3)

8.4
- The auxins diffuse into the left side of the stem ✓
- The higher concentration of auxins✓ on the left side
- results in more cell elongation✓ /growth of cells on the left side
- - There is less growth on the right-hand side ✓and the stem will bend to the right-hand side

(4)
(11)

ACTIVITY 9

9

9.1
- Stimulate cell division✓ /mitosis
- Stimulate cell elongation✓

(2)

9.2 Gibberellins✓

(Mark first ONE only) (1)

9.3
- Increased plant growth ✓
- saves species that are facing extinction✓

(2)
(5)

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ACTIVITY 10

10

10.1 (a) (Presence/absence of) auxins✓ (1)

(b) Growth of lateral branches✓ (1)

10.2 - To ensure that the results are caused only by the presence of auxins ✓which - increases the validity✓ of the investigation (2)

10.3 - It acts as a control ✓ (3)
- to show that the results of Plant D✓
- are caused by the (presence of) auxins✓
- and not the agar jelly✓

Any 3

10.4 - The presence of auxins slows down the growth of lateral branches ✓✓ (2)

OR

- The absence of auxins stimulated the growth of lateral branches✓✓

(9)

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TOPIC: EVOLUTION

ACTIVITY 1

1

1.1 B✓✓
1.2 C✓✓
1.3 A✓✓
1.4 A✓✓
1.5 C✓✓
1.6 D✓✓
1.7 A✓✓
1.8 D✓✓
1.9 C✓✓
1.10 C✓✓
1.11 B✓✓
1.12 A✓✓
1.13 C✓✓

(26)

ACTIVITY 2

2

2.1
– The Bt producing gene is cut from the bacterial DNA✓ and
– inserted into maize DNA✓
– This recombinant DNA✓
– causes the maize plant to produce the Bt toxin✓ Any 3 (3)

2.2
– Fewer crops damaged✓
– leads to increased yield✓/more food for people/increased food security/healthier crops/more profit
– Reduced need for pesticides,✓
– farmers save money✓/less toxins to consumers/environment
(Mark first TWO only) (2 x 2) (4)

(7)

ACTIVITY 3

3

3.1 Artificial selection✓/selective breeding (1)

3.2
– They chose dogs with desirable traits✓
– and interbred✓ them to
– produce offspring with these traits✓ (3)

3.3
– Allow them to interbreed with each other✓
– and see whether they produce fertile offspring✓
OR
– Analysis of DNA✓
– to check for matching sequences✓ (2)

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3.4
– Rhodesian ridgeback✓
– is strong, athletic and fast✓
– is able to catch the prey✓ (2)

3.5
– Due to reduction in gene pool✓/variation
– they will not be able to hunt✓/find shelter/defend themselves
– as well as wolves are able to✓
– therefore unable to survive in the wild✓ Any 3 **(3)**

(11)

ACTIVITY 4

4 4.1 (a) (Presence or absence of) tall trees✓ (1)

(b) (Presence or absence of) wings on stone flies (1)

4.2 (a)
– Type of net/ apparatus used to catch the insects✓
– Season of collection✓/collection was done in summer
– Time of day for collection✓/collection was done in the morning
– Type of location for each category✓
– Number of locations for each category✓
– Labelling of samples was done according to the area of collection✓
Any
(Mark first TWO only) (2)

(b)
– Collected thousands of stoneflies✓
– Three (3) locations for each category✓
(Mark first TWO only) (2)

4.3
– All stoneflies had wings✓
– Due to strong winds✓ /since it was dangerous to fly in cleared areas
– They stopped using their wings✓/flying
– The wings became smaller✓/disappeared
– The acquired characteristic of no wings was passed on to the offspring✓
– All offspring in the next generation had no wings✓ Any (5)

(11)

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ACTIVITY 5

5 5.1 (a) Type of milk✓ (1)

(b) Height✓ of children (1)

5.2 Continuous✓ (variation) (1)

5.3
- Ensure the same additional diet✓
- Ensure similar daily activities✓
- Ensure similar living conditions✓
- Date✓ /time/ venue for measurement
- Decide on the sample size✓
- Ask for parental consent✓
- Train the research assistants✓
- Recruit parents that are willing to participate✓
- Decide on the target group✓
- Design the recording sheet✓
- Decide on the source of milk✓
- Select apparatus✓ /equipment/decide on method measurement
- Decide on duration✓ of investigation
- Choosing the type of milk✓
- Decide on the amount of milk✓ Any

(2)

(Mark first TWO only)

5.4 Only healthy children✓ chosen

Same:
- age✓
- race✓
- gender✓
- quantity of milk✓
- additional diet✓
- supplier of milk✓
- number of children in each group✓
- duration✓

(3)

Similar:
- daily activities✓
- living (environmental) conditions✓ Any

(Mark first THREE only)

5.5
- Genetic/hormonal influence was not considered✓
- Difficult to maintain the same conditions over a 7-year period✓
- Not measuring the baseline height✓ Any

(1)

(Mark first ONE only)

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5.6 – 2 073 children in each group✓ participated
– 4 146 children divided into two equal groups✓ participated (1)
– Investigation conducted over 7 years✓ Any

5.7 Cow milk consumption leads to better growth/increased height compared to soy milk✓✓
OR
Soy milk consumption by children leads to decreased height✓✓/ below average height (2)
OR
Cow-milk consumption by children leads to increased height✓✓/ above average height

(12)

ACTIVITY 6

6

6.1 – The farmer interbred✓
– mealie plants with a high protein content✓ (3)
– over 50/many generations✓

6.2 12,8✓ % (Accept 12,7 - 12,9%) (2)

6.3 $\frac{20✓}{14}$ = 1,43✓ times (2)

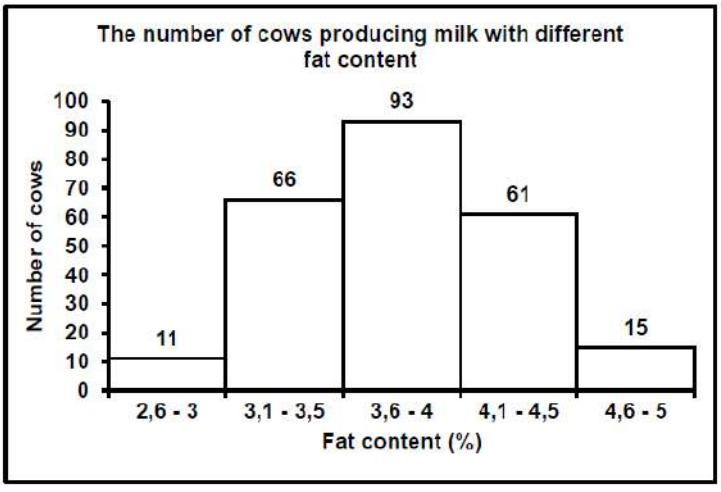
6.4 – Artificial selection: organisms with a desired characteristic are interbred✓
– Genetic engineering: genes coding for the desired characteristic are inserted into an organism✓ (2)

(6)

ACTIVITY 7

7

7.1



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Guideline for assessing the graph

CRITERIA	ELABORATION	MARK
Correct type of graph **(T)**	Histogram drawn	1
Caption of graph **(C)**	Both variables included	1
Axes labels **(L)**	X- and Y-axis correctly labelled with units	1
Scale for X- and Y-axis **(S)**	- Same width of bars for X-axis and - Correct scale for Y-axis	1
Plotting of bars **(P)**	1 to 4 bars plotted correctly All 5 bars plotted correctly	1 2

(6)

7.2 $\frac{11}{246}$ ✓ x 100✓ = 4,47✓% (Accept 4,5) (3)

7.3 Continuous✓ variation (1)

7.4 There is a range of intermediate phenotypes✓/the fat content % is a range (1)
(11)

ACTIVITY 8

8

8.1 – They measured the jaw size of lizards on both islands✓ and
– determined the average jaw size for each population✓
– They compared the difference✓ between the two (3)

8.2 – A larger jaw allows for better muscle attachment✓/more teeth /larger teeth Thereby increasing the bite force✓/ability
– to break downt✓ the fibrous plant material (3)

8.3 – They allowed the lizards of the two islands to mate✓
– and determined that they were able to interbreed✓ and
– give rise to fertile offspring✓ (2)

8.4 – Biodiversity remains the same✓/there is no effect
– because the number of species remains the same✓/a new species has not been formed

OR (2)
– Biodiversity decreases✓
– because some species of plants eaten on Island **B** could become extinct✓

8.5 – There is variation in the size of the lizards' jaws✓
– Some have small jaws and others have large jaws✓
– Due to the larger supply of (fibrous) plants✓/fewer insects

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– those with smaller jaws will be unable to feed✓
– and die✓
– The lizards with the larger jaws will have more food✓ (7)
– and survive✓
– to reproduce✓
– The allele for larger jaws will be passed on to the offspring✓
– The next generation will have a higher proportion of lizards with larger jaws✓

(17)

ACTIVITY 9

9.

9.1 *Ambulocetus*✓ (1)

9.2 It had flipper-like large feet and a tail✓✓
(Mark first ONE only) (2)

9.3 – They share characteristics✓/have intermediate characteristics
– of the ancestor/*Pakicetus* and the present-day species✓/ *Balaena*
OR (2)
– They have legs like *Pakicetus*✓ and
– flippers of the present day *Balaena*✓

9.4 –Ancestral species of whales all had legs✓/lived on land
–As more time was spent in the water✓in search of food
–the legs were used less✓ and disappeared (3)
–the acquired characteristic was passed on to the next generation✓ Any

(8)

ACTIVITY 10

10

10.1 – There was once one large continent✓ and
– the common ancestor existed throughout this continent✓
– When Madagascar separated✓ (4)
– the common ancestor was found in both✓regions

(10)

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ACTIVITY 11

11

11.1 Biogeography✓ (1)

11.2 – Similar organisms✓
– that can interbreed✓
– to produce fertile offspring ✓ (3)

11.3 – The original population /common ancestor once lived on a large continent✓
– and became separated by continental drift✓/oceans
– There was no gene flow amongst the three populations✓*****
– Each population experienced different environmental conditions✓
– and underwent natural selection independently✓
– The individuals in each population became different✓
– genotypically and phenotypically✓
– Even if the (three) populations are mixed again✓
– they would not be able to interbreed✓/produce fertile offspring
– forming the different species, the coyote, jackal and dingo ✓*****

2 compulsory***** + any 5 (7)

(11)

ACTIVITY 12

12

12.1 – Similar structures in different organisms✓
– modified to perform different functions✓
– indicate evolution from a common ancestor✓ (3)

12.2 (a) (Phalanges) with claws✓ **(Mark first ONE only)** (1)

(b) – moles have claws✓ / Apes have nails
– has 6 digits ✓
– no opposable thumbs ✓ Any (1)
– **(Mark first ONE only)**

(5)

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ACTIVITY 13

13

13.1 (a) X✓, Z✓ (in any order) (2)
(Mark first TWO only)

(b) C✓ (1)

13.2 – The pelvis is long✓
– and narrow✓ (2)

13.3 – The spine✓
– is S-shaped for the bipedal organism✓
– and C-shaped for the quadrupedal organism✓

OR
– The foramen magnum✓ (3)
– is in a more forward position in bipedal organisms✓
– and in a backward position in quadrupedal organisms✓
(Mark first ONE only)

(8)

ACTIVITY 14

14

14.1 – Modern humans originated in Africa✓ and
– then migrated to other continents✓ (2)

14.2 – Turkana boy, the older fossil of *Homo erectus*, was found in Kenya✓/Africa, while the younger fossil Java man was found in Java✓ / Asia
– Florisbad man, the older fossil of *Homo sapiens*, was founr in Forisbad✓ / South Africa, while the younger fossil Liujiang was found in Guanxi ✓ / Asia (4)

(6)

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ACTIVITY 15

15.1 3✓/Three (1)

15.2 609✓ mℓ (1)

15.3 $= \frac{1330-609}{609}$ ✓x 100✓
= 118,39✓% (3)

15.4 – The cranium remains✓/becomes fossilised
– The cranium houses the brain✓, therefore
– measuring the cranial capacity✓ gives brain volume (3)

15.5 – Brain volume increased✓
– leading to more intelligence✓ and
– the development of (complex) tools✓ (3)

(11)

ACTIVITY 16

16

16.1 Phylogenetic tree✓/cladogram (1)

16.2 2✓ (1)

16.3 (a) *Homo habilis*✓ (1)

(b) *(Homo) naledi*✓ (1)

16.4 *(Homo) sapiens*✓ (1)

16.5 – Fossil✓evidence
– Cultural✓ evidence
– Genetic✓ evidence Any
(Mark first TWO only) (2)

16.6 – *A* large cranial capacity✓ in *Homo sapiens*
– indicates a larger brain✓
– leading to greater intelligence✓

OR

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– A small cranial capacity✓in *Australopithecus africanus*
– indicates a smaller brain✓
– leading to lower intelligenc✓ (3)

16.7 – Fossils *of Australopithecus spp*. were found in Africa only✓and
– fossils of s*pecies **X**/Homo habilis* were found in Africa only✓
– The oldest fossils of *Homo erectus* were found in Africa✓ /the younger fossils were found elsewhere
– indicating that modern humans originated in Africa and migrated out of Africa✓ (4)

(14)

ACTIVITY 17

17

17.1 *Australopithecus*✓ (1)

17.2 – An organism that has intermediate/common characteristics✓ (2)
– between two genera✓/species

17.3 A✓ (1)

17.4 – **A** has a pelvis that is intermediate✓/ transitional between **B** and **C**✓
OR
– A has a shorter and wider pelvis than B✓ but not as short and wide as C✓ (2)
OR
– **A** has a longer and narrower pelvis than **C** ✓but not as long and narrow as B✓

17.5 – *sediba* was prognathous✓/ more prognathous while
– *H. sapiens* are non-prognathous✓/ less prognathous
– This is due to a smaller jaw✓
– with smaller teeth ✓and **(5)**
– reduced chewing muscles✓
– caused by a changed diet to eating soft/cooked food✓ Any

(11)

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ACTIVITY 18

18

18.1
– Eyes in front✓
– Binocular vision✓
– Stereoscopic vision✓
– Colour vision✓/ presence of cones Any (2)
(Mark first TWO only

18.2
– Smaller jaws in humans✓ and
– larger jaws in African apes✓
– Small teeth/canines in humans✓ and
– large teeth/canines in African apes✓
– C-shaped palate in humans✓ and
– a U-shaped palate in African apes✓
– Humans are non-prognathous✓ and
– African apes are prognathous✓
– Humans do not have diastema✓ and
– African apes have diastema✓
– There is a well-developed chin in humans✓ and
– an underdeveloped chin in African apes✓
(Mark first TWO only) Any (2 x 2) (4)

18.3
– The foramen magnum is in a more forward position✓
– to allow the vertebral column to attach below it✓
– The spine is S-shaped✓
– for better distribution of upper body weight✓/to absorb shock when walking upright/to allow flexibility
– The pelvis is short and wide✓
– to support the weight above the pelvis✓/upper body
(6)

(12)

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