**SECONDARY SCHOOL IMPROVEMENT PROGRAMME (SSIP) HIGH FLYERS**



**GRADE 12**

 **SUBJECT: LIFE SCIENCES**

**ANSWER BOOKLET**

 **(Page 1 of 56)**

**Check your answers Set 1 (Master 40%)**

**Life Sciences Paper 1 – answers to the questions**

**Meiosis**

**Question 2**

2.1 Spermatogenesis🗸 (1)

2.2 Testis🗸 (1)

2.3 (a) 23🗸 (1)

 (b) 23🗸 (1)

2.4 - Crossing over🗸

 - Random assortment of chromosomes🗸 (any order) (2)

2.5 2🗸 (1)

2.6 Sperm cells🗸/spermatozoa/male gametes (1)

 **(8)**

**Question 3**

3.1 (a) Chromosome🗸 (1)

 (b) Spindle fibre🗸 (1)

 (c) Centromere🗸 (1)

3.2 Metaphase II🗸 (1)

3.3 Chromosomes lying independently🗸/singly at the equator🗸 (2)

**(6)**

**Question 4**

4.1 Prophase II🗸/Telophase I (1)

4.2 (a) D🗸- centriole🗸/(centrosome) (2)

 (b) B🗸- chromosome🗸 (2)

 (c) E🗸- centromere🗸 (2)

4.3 (a) 4🗸 (1)

 (b) 2🗸 (1)

 (9)

**Human reproduction**

**Question 2**

2.1 (a) Nucleus🗸 (1)

(b) Tail🗸 (1)

* 1. - C/ middle piece contains mitochondria🗸 that provides energy for movement🗸

- Has a tail🗸 for swimming🗸

 - Torpedo shape🗸 reducing friction🗸 Any (1 x 2) (2)

2.3 - No acrosome🗸 will be present in the sperm cell

- therefore no enzymes present🗸

 - Sperm cell will be unable to penetrate the ovum🗸

 - \*therefore no fertilisation will occur🗸 \***compulsory mark** + any other 2 (3)

 **(7)**

**Question 3**

3.1 (a) Jelly🗸 layer/zona pellucida (1)

(b) Cell membrane🗸/plasma-lemma/plasma membrane (1)

1. Cytoplasm🗸/cytosol (1)
2. Nucleus🗸 (1)

3.2 (a) G🗸 - Middle piece🗸/neck

**OR**

 C🗸 - Cytoplasm🗸 (2)

1. E🗸 - Acrosome🗸 (2)

 (c) D🗸 - Nucleus🗸 (2)

**Responding to the environment (Humans)**

**Question 2**

2.1 (a) Medulla oblongata🗸 (1)

 (b) Corpus callosum🗸 (1)

 (c) Cerebellum🗸 (1)

2.2

* 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)

 **(6)**

**Question 3**

3.1 A – Ciliary🗸muscle/(body)

 B – Iris🗸

 E – Choroid🗸 (3)

3.2 (a) F🗸 (1)

 (b) D🗸 (1)

 (c) C🗸 (1)

 (d) A🗸 (1)

 **(7)**

**Question 4**

4.1 A - Pinna✓

 D - Semi-circular canal✓ (2)

4.2 (a) B✓ (1)

 (b) G✓ (1)

 (c) F✓ (1)

 (d) C✓ (1)

(e)E✓ (1)

**(7)**

**Question 5**

* 1. Motor🗸/multi-polar /efferent (1)
	2. - Transmits impulse away from the cell body🗸

 - Transmits impulse to effector🗸 Any 1 (1)

**(2)**

**Human endocrine system and Homeostasis in Humans**

**Question 2**

2.1 The process by which the human body is able to maintain a constant🗸internal environment🗸 (2)

2.2 (a) Kidney🗸 (1)

 (b) Adrenal🗸 gland (1)

(c) Aldosterone🗸 (1)

2.3 - 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 (2)

 **(7)**

**Question 3**

When thyroxin levels decrease

* The pituitary gland is stimulated✓
* to produce more TSH✓
* High TSH levels stimulate the thyroid gland✓
* to secrete more thyroxin✓
* The thyroxin levels thus increase back to normal✓ (5)

**Responding to the environment (Plants)**

**Question 2**

* Auxins✓
* are sensitive to light✓
* Light stimulus from one side causes auxins to move to the shaded
* side✓/destroyed on the illuminated side
* Auxin concentration is higher on the shaded side🗸
* This promotes cell elongation✓ on shaded side of plant
* resulting in more growth✓ on this side
* Stem grows towards the light stimulus ✓
* This is called phototropism✓ (Any 4) (4)

**Human impact on the environment**

**Question 2**

2.1

- Food security refers to the access🗸

* of adequate🗸/safe/nutritious food
* to all people at all times🗸 (Any 2) (2)

2.2

* 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)

2.3

* Decreased need to buy food🗸
* Selling of excess produce to earn some money🗸 (2)

2.4

* Making people aware of the benefits of farming🗸
* Providing resources🗸/example
* Developing skills for farming🗸
* Providing incentives🗸 to encourage farming (Any 2) (2)

**(7)**

**Life Sciences Paper 2 – answers to the questions**

**DNA: Code of Life**

**Question 2**

2.1 (a) W – Nucleotide🗸 (1)

U – DNA🗸 (1)

(b) X – Phosphate🗸/phosphate ion (1)

 Y – Deoxyribose🗸sugar (1)

 (c) Z – Hydrogen🗸 bond (1)

 (d) V – Adenine🗸 (1)

2.2 Nucleus 🗸 (1)

2.3 Interphase 🗸 (1)

 **(8)**

**Question 4**

4.1 Translation🗸 (1)

4.2 X - tRNA🗸/ transfer RNA (1)

 Y - mRNA🗸/ messenger RNA (1)

4.3 Anticodon🗸 (1)

4.4 ATA🗸 (1)

4.5 Tyrosine🗸🗸 (2)

4.6

* **The process is transcription🗸\***
* 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🗸 (5)

**Genetics**

**Question 3**



**Question 4**

4.1 IA🗸, IB🗸, i🗸 (3)

4.2 2🗸 (1)

4.3

* Any individual inherits one allele🗸
* from each parent🗸 (2)

4.4

* Each child🗸
* has an equal🗸/25% chance of having
* any blood group🗸/ A, B, AB, or O. (3)

 **(9)**

**Evolution:**

**Question 1**

1.1. A group of organisms of the **same** species🗸

 that can interbreed to produce **fertile** offspring🗸 (2)

1.2

* Crossing over✓

Meiosis🗸

* Random arrangement✓of chromosomes
* Independent assortment ✓/random segregation / random assortment
* Mutations🗸
* Chance fertilization🗸/Random fertilization
* Random mating🗸

 (Any 4) (4)

1.3

(a) Speciation🗸 (1)

 (b)

* The **rocky island**🗸**\*** /**geographic barrier**
* separated the fish into two populations🗸
* with different environmental conditions🗸 on each side
* Each group underwent natural selection independently🗸
* and developed differently🗸
* Each group became genotypically🗸
* and phenotypically🗸 different
* which prevented them from interbreeding🗸 leading to the formation of a new species

 (6)

**Question 2**

2.1

* 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🗸

 Any 2 (2)

2.2

* 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🗸

 (Any 2 x 2) (4)

 **(6)**

**Question 3**

3.1 Phylogenetic tree✓ (1)

3.2

 (a) 2✓ (1)

 (b) 7✓ (1)

3.3

* *A*. *boisei* and *A.* *robustus* share a more recent✓
* common ancestor🗸 (2)

3.4 *Homo habilis*✓ (1)

3.5

Taung child✓

*A. africanus✓*

Mrs Ples✓

Karabo✓/*A. sediba*

Little foot✓ /*A. prometheus*

Any 2 (2)

3.6

* The **oldest** fossils of *Homo*✓/*Homo habilis /Homo erectus*
* are found only in Africa ✓
* The **younger** fossils of *Homo*✓/*Homo erectus*
* were found in Africa and other parts of the world✓
* This implies that earliest *Homo* sp. evolved in Africa✓/*Homo erectus* migrated out Africa

 Any 3 (3)

 **(11)**

**Question 4**

4.1 A✓ and D✓ (2)

4.2

* The pelvis is wide✓/cup-shaped
* to support the weight✓ of an organism walking upright (2)

4.3

Diagram A

* The foramen magnum is located centrally✓/more forward position

below the skull

* so that the vertebral column arises from beneath the skull✓
* for bipedalism✓ Any 2 (2)

Diagram B

* The foramen magnum is located towards the back✓ of the skull
* so that the vertebral column arises from the back of the skull✓
* for quadrupedal locomotion✓ Any 2 (2)

 4.4

|  |  |
| --- | --- |
| **Diagram A** | **Diagram B** |
| Gently curved✓/C-shaped jaw | Rectangular✓/U-shaped jaw |
| Small jaws✓ | Large jaws✓ |
| Smaller canines✓ /(teeth)  | Larger canines✓/(teeth) |
| No diastema/Fewer spaces between the teeth✓ | Diastema present/Larger spaces between the teeth✓ |

 Table format 1 + Any 3 x 2 (7)

4.5

Freely rotating arm✓

Rotation around elbow joints✓

Rotation around the wrist✓

Bare fingertips/nails instead of claws✓

Long upper arms✓

Opposable thumbs✓

Five fingers✓

 Any 3 (3)

 **(18)**

**Question 5**

5.1 X - Foramen magnum✓

 Y - Canine✓ (2)

5.2

* 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)

5.3

1. B✓ (1)
2. A✓ (1)

5.4

* 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)

5.5

|  |  |
| --- | --- |
| Skull B | Skull C |
| Brow ridges pronounced🗸 | Brow ridges are not as pronounced🗸 |
| More protruding jaws🗸/larger jaws | Less protruding jaws🗸/smaller jaws |

 Table1 + (2 x 2) (5)

 **(15)**

**Question 6**

6.1

* Eyes in front/binocular vision✓
* Freely rotating arms✓
* Long upper arms✓
* Bare fingertips or nails✓
* Opposable thumb✓
* Upright posture ✓

(Any 5) (5)

6.2

1. More curved spine✓/S-shape in humans but less curved✓/

C-shaped in apes (2)

1. Short and wide✓ pelvis in humans but long and

narrow✓ pelvis in apes ✓ (2)

6.3

* Canines have changed from large✓
* to small✓.
* This is due to a change from eating raw✓ food
* to eating cooked✓food (4)

  **(13)**

**Question 7**

**HYPOTHESIS**

* **All modern humans✓/***Homo sapiens*
* **originated in Africa**✓
* and migrated to other parts✓ of the world

**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✓

**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

**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🗸 Content: (17)

 Synthesis: (3)

 **(20)**

|  |  |  |  |
| --- | --- | --- | --- |
| **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 |

**Check your answers Set 2**

**PAPER 1 MEMORANDUM**

**Question 1**

1.1

P🗸🗸

***Mark allocation of the graph***

|  |  |
| --- | --- |
| **Criteria** | **Mark Allocation** |
| Correct type of graph including the joining of points | 1 |
| Title of graph | 1 |
| Correct scale, label and unit for X-axis | 1 |
| Correct scale, label and unit for Y-axis | 1 |
| Drawing of the graph | 0: No points plotted correctly1: 1 to 5 points plotted correctly2: All 6 points plotted correctly |

 (6)

1.2 (a) Increased✓ (1)

(b) Decreased✓ (1)

 **(8)**

**Question 2**

2.1

***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 correctly1: 1 to 2 bars plotted correctly2: All 3 bars plotted correctly |

**Question 3**

3.1

**Calculations:**

Transport = 25/100 x 360° = 90°

Residential = 27/100 x 360° = 97,2°

Industrial = 15/100 x 360°= 54°

Commercial = 28/100 x 360° = 100,8°

Other = 5/100 x 360° = 18°

|  |  |
| --- | --- |
| **Mark allocation for the pie chart** | (7) |
| Correct type of graph | 1 |
| Title of graph(CO2 emission + Sector) | 1 |
| Calculations: | 1: 1-4 calculations correct2: All 5 calculations correct |
| Correct proportion for each labelled slice | 1: 1 to 2 slices correct2: 3 slices correct3: 4-5 slices correct |

**Question 2**

Remember you do not have to give all 3 answers because the question asked for ONE reason

4.1

* Food security refers to the access🗸
* of adequate🗸/safe/nutritious food
* to all people at all times🗸 (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)

4.3

* Decreased need to buy food🗸
* Selling of excess produce to earn some money🗸 (2)

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)

**Question 5**

5.1

* Poor infrastructure🗸
* Climate change🗸
* Wastage🗸
* Pollution of water sources🗸 (Any 2) (2)

5.2

- The need of water for irrigation will be reduced🗸 (1)

5.3

* Decreased production🗸
* will lead to loss of profit🗸 (2)

5.4

* More revenue for fixing poor infrastructure🗸/building dams
* Less water wastage🗸by individuals and companies (2)

 **(7)**

**Question 6**

6.1 Apical tips🗸/stem tips/root tips/bud (1)

6.2 Promotes cell elongation🗸 (1)

6.3

* Only kills part of a plant🗸/leaves and stems

leaving the chance of the roots to grow again🗸

* Poisonous🗸

can be harmful to other organisms🗸 (4)

6.4

* It could kill the beans as well🗸
* thus reducing the yield of the crop🗸 (2)

**Question 7**

7.1 Metaphase I🗸 (1)

7.2

- Crossing over has taken place🗸

* and genetic material was exchanged 🗸 (2)

7.3 Anaphase II🗸 (1)

7.4

* 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)

7.5 Testes🗸 (1)

**(8)**

**Question 8**

8.1

(a) ADH🗸/antidiuretic hormone (1)

(b) Hypothalamus🗸/Pituitary gland (1)

(c) Kidneys🗸 (1)

8.2

* 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🗸 (4)

 **(7)**

Question 9

- FSH🗸/follicle stimulating hormone

- is secreted by the pituitary gland🗸

- FSH stimulates the development of a primary follicle🗸

- into a Graafian follicle🗸

- As the follicle develops it secretes oestrogen🗸

- which causes the lining of the uterus🗸/endometrium

- to become thicker🗸/more vascular

- in preparation for a possible implantation of the embryo🗸/development of the foetus

- The pituitary gland🗸

- secretes LH🗸

- which causes the Graafian follicle to rupture and release the ovum🗸

- This is called ovulation🗸

- The empty follicle changes and becomes a corpus luteum🗸

- which begins to secretes progesterone🗸

- which causes further thickening🗸

- of the endometrium🗸

- High levels of progesterone🗸

- inhibits the secretion of FSH🗸

- which prevents development of a new follicle in the ovary🗸

- If there is no fertilisation, the corpus luteum degenerates🗸

- which leads to a drop in progesterone🗸

- The endometrium disintegrates and is shed during menstruation🗸

- If fertilisation occurs, the corpus luteum remains intact🗸

- which leads to the levels of progesterone remaining high🗸

- to maintain pregnancy🗸

Content: (17)

Synthesis (3) **(20)**

|  |  |  |
| --- | --- | --- |
| **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. |
| All information relevant to the events of the menstrual cycle only (no pregnancy) and the hormones FSH, LH, oestrogen and progesterone.  | All events of the menstrual cycle are in sequence. | All FOUR correct hormones mentioned with their functions. |
| 1 mark | 1 mark | 1 mark |

Question 10

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

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

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

|  |  |  |
| --- | --- | --- |
| **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 efficientlyThere 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 |

**PAPER 2 MEMORANDUM**

**Question 1**

1.1

(a) DNA🗸 molecule (1)

(b) Amino acid🗸 (1)

1.2 Transcription🗸 (1)

1.3

* The sequence of nitrogen bases on molecule W/DNA will change🗸
* This would cause a corresponding change on the molecule X✓/mRNA
* The amino acid brought in by tRNA will be different✓
* A different protein will form✓ (4)

1.4

(a) UCU🗸 (1)

(b) Arginine🗸 ; Methionine🗸 ; Glycine🗸 (3)

 (Must be in the correct order)

 **(11)**

**Question 2**

2.1

* DNA contains coded information for protein synthesis🗸
* DNA carries hereditary information🗸 (Any 1) (1)

2.2 ACA 🗸 (1)

2.3 Threonine🗸; Cysteine🗸 (must be in correct order) (2)

2.4

- Both ATG and ATA🗸

- Code for the same amino acid/tyrosine🗸 (2)

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🗸 (5)

 **(11)**

**Question 3**

3.1 Lindiwe🗸 and Bandile🗸 (2)

3.2 They have DNA bands which correspond🗸

with the banding patterns from both parents🗸/ Zinhle and Ayanda (2)

3.3

* 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🗸

Any 2 (2)

 **(6)**

**Question 4**

4.1

 (a) White 🗸fur (1)

 (b) Black 🗸 fur (1)

4.2

 (a) 1🗸 and 3🗸 (2)

 (b) 1🗸 (1)

4.3



**Question 5**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| P2 | Phenotype | Grey male | x | White female🗸 |
|  | Genotype | Gg | x | gg🗸 |
| *Meiosis* |  |  |  |  |
|  | G/gametes | G, g | x |  g,g🗸 |
| *Fertilisation* |  |  |  |  |
| F2 | Genotype |  Gg; Gg; gg; gg 🗸 |
|  | Phenotype |  2 grey rabbits : 2 white rabbits 🗸 |
| Phenotypic ratio of offspring is \*1 : 1🗸  |
| P2 and F2🗸 |   |  |  |  |
| Meiosis and fertilisation🗸 |  |  |
|  | \*1 compulsory + any 6 |

**OR**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| P2 | Phenotype | Grey male | x | White female🗸 |
|  | Genotype | Gg | x | gg🗸 |
| *Meiosis* |  |

|  |  |  |
| --- | --- | --- |
| Gametes | G | g |
| g | Gg | gg |
| g | Gg | gg |

1 mark for correct gametes1 mark for correct genotypes |
|  |  |
| *Fertilisation* |  |
|  |  |
| F2 | Phenotype | 2 grey rabbits : 2 white rabbits 🗸 |
| Phenotypic ratio of offspring is \*1 : 1🗸 |
| P2 and F2🗸 |  |  |  |  |
| Meiosis and fertilisation🗸 |  |  |
|  | \*1 compulsory + any 6 |

 **(7)**

**Question 6**

6.1 2🗸 (1)

6.2 (a) XDXd🗸🗸 (2)

(b) XdXd🗸🗸 (2)

 **(5)**

Question 7

7.1 2✓ (1)

7.2

(a) Albino female✓ (1)

(b) Aa✓✓ (2)

7.3

(a) 50%✓ (1)

(b) 25%✓ (1)

 (6)

**Question 8**

8.1

* 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✓

 Any 2 (2)

8.2

* 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🗸

The table that follows indicates how a general account (based on recall) can be adapted to answer Question 8.2 above on natural selection. Remember for any question on natural selection in the examination you need to learn and know the general account and then apply it to the question asked.

 (5)

|  |  |
| --- | --- |
| **General Account on Natural Selection** | **Natural Selection in the Bongo/antelope** |
| There is variation amongst the offspring | There is variation amongst the Bongo population |
| Some have desirable characteristics and some do not | Some have horns that can be laid on their backs whilst others cannot lay their horns down on their backs |
| Sometimes there is a change in the environmental conditions which acts a selection pressure  | The antelope has to move through dense vegetation without becoming entangled to avoid being trapped and then caught by predators |
| Organisms with characteristics that make them less suited to the environment, die | Those with horns that cannot be laid on their backs become entangled and die |
| Organisms with characteristics which make them more suited to the environment, survive | Those with horns that can be laid on their backs do not become entangled and survive |

**Question 9**

9.1

* 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 (6)

The table that follows indicates how a general account (based on recall) can be adapted to answer Question 9.1 above on natural selection. Remember for any question on natural selection in the examination you need to learn and know the general account and then apply it to the question asked.

|  |  |
| --- | --- |
| **General Account on Natural Selection** | **Natural Selection in the Lizard Population** |
| There is variation amongst the offspring | There is variation amongst the lizard population |
| Some have favourable characteristics and some do not | Some are black and are better camouflaged/warm up faster to have energy to avoid predators, whilst others are red or brown and are NOT camouflaged/cannot warm up fast enough to have energy to run away from predators |
| Sometimes there is a change in the environmental conditions which acts a selection pressure  | Predation acts as the selection pressure. Survival depends on the colour of the lizards. |
| Organisms with characteristics that make them less suited to the environment, die | Red and brown lizards are caught by predators and die |
| Organisms with characteristics which make them more suited to the environment, survive | Black lizards survive |
| The organisms that survive, reproduce | The surviving black lizards will reproduce |
| They will pass on the favourable characteristic to their offspring | The allele for black colour will be passed on to the next generation |
| Over many generations, the proportion of individuals with the favourable characteristic, increases | Over many generations the proportion of lizards that are black, increases |

**Question 10**

Remember the only difference between the general account of speciation is the geographical barrier which would be stated in the examination question. The geographical barrier in this question is the **sea** or **separation due to continental drifting**.

10.1

* 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🗸 (6)

**Check your answers Set 3**

**PAPER 1 MEMO**

**MEIOSIS**

**Question 1**

1.1

(a) -Crossing over has taken place✓

* And genetic material was exchanged✓

 (b) Anaphase II ✓

(c) - The spindle fibres contract ✓

 - The centromeres split✓

 - and pull the daughter chromosomes/chromatids ✓

 - to the opposite poles of the cells✓

 - Cytokinesis begins✓

 (Any 3)

**Question 2**

2.1(a) Human somatic cells have 23 pairs****/46 chromosomes and this cell has only 2 pairs/4 chromosomes.

 (b) Rt  and RT 

 (c)

 



d) Crossing over✓

Genetic material exchanged between homologous chromosomes✓

Random✓/independent assortment of chromosomes arrange themselves

randomly/independently on either side of equator in metaphase 1✓

2.3. - Down syndrome✓

 - Two homologous chromosomes✓do not separate✓

 - Both chromosomes move to the same pole✓

 - This will result in a gamete with extra✓ chromosome

**Question 3**

Genetic variation is brought about in gametes through meiosis**** in two ways:

Crossing over****

* During Prophase****
* Homologous chromosomes**** /bivalents pair up
* Each chromosome has 2 chromatids****

 Chromatids of homologous pair crossover****

* Points at which crossing-over takes place are referred to as chiasmata****
* Genetic material chromatids****

 after the process of crossing-over , chromosomes have genes from its homologous partners****

* This means that each gamete formed will have a mixture of genes from maternal and paternal parents.****
* \*random arrangement of chromosomes at the equator****

 - During Metaphase I****

 - Each pair of homologous chromosomes****

 - \*may line up randomly on the equator of the spindle fiber****

 - \*Independently of what the other pairs are doing****/independent assortment

* During Metaphase II✓
* Each individual chromosome✓
* \*may line up either way✓/flipped on the equator of the spindle
* \*This means that gametes will have differing number/mix of maternal and
* paternal chromosomes✓/chromatids

 **(at least 1 of the \*compulsory and any 4 which could include compulsory points)**

**Formation of an ovum**

- During oogenesis✓

- diploid cells✓

 - in the ovary✓

 - undergo meiosis✓

 - to form a primary oocyte✓

 - consisting of haploid cells✓

 - One cell✓ develops into an ovum

|  |  |  |
| --- | --- | --- |
| **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 crossing over, random arrangement and development of an ovum.There is no irrelevant information | All the information regarding crossing over, random arrangement and development of an ovum is arranged in a logical manner. | At least the following marks should be obtained:* Crossing over (**5/7**)
* Random arrangement (**3/5**)
* Development of an ovum (**3/5**)
 |
| 1 mark | 1 mark | 1 mark |

**Reproduction in vertebrates**

**Question 1**

 - The female sea horse lays eggs externally,

 - the male fertilises the eggs externally🗸 in his pouch.

 - baby seahorses develop and hatch from eggs in male body.🗸

 - In normal ovovivipary, internal fertilisation takes place🗸 in female body,

- the fertilised eggs develop inside mother🗸, hatch and are born alive.🗸 (5)

**Question 2**

 C (2)

**Question 3**

3.1 The eyes are still closed🗸

 The body is still naked, without a downy feather covering🗸 (2)

3.2 The embryo is directly connected to the mother🗸 as it receives nutrients through

the placenta🗸 which consists of embryonic and maternal tissues. (2)

3.3 The development time is longer🗸 in hatchling B, therefore more yolk will be

needed to supply nourishment to the developing embryo.🗸 (2)

 **(6)**

**Human reproduction**

**Question 1**

* 1. D (2)
	2. D (2)

**Question 2**

2.1 - High levels of LH✓

 - stimulates ovulation✓ (2)

2.2 - To monitor their fertile periods✓

 - to prevent pregnancy✓/to increase chances of falling pregnant (2)

2.3 - Oestrogen✓

 - levels rise✓ (2)

2.4 Between 16 and 18✓✓ (2)

2.5 - Progesterone only rises✓

 - after ovulation✓

 - this shows that the fertility period has already passed✓/when

 fertility is low (3)

 **(11)**

**Question 3**

3.1 A vasectomy will decrease/increase the testosterone level in GA rats. 🗸🗸

 **OR**

 A vasectomy will have no influence in the testosterone level in GA rats🗸🗸 (2)

3.2 The rats in Group 3 serves as the control group 🗸 (1)

3.3 (a) 5.35 – 2.26 = 3.09🗸/3.1 g 🗸 (2)

 (b) (68.2 - 0.35) 🗸 *for subtraction*

 68.2

 = 67.85 x 100 🗸 *for fraction and percentage*

 68.2

 = 99.5 🗸 % *for correct answer only* (3)

3.4 - The vasectomy caused a decrease in testosterone 🗸level

 - it also decreased the testosterone level of the other normal testis.🗸 (2)

3.5 - Repeat the experiment 🗸

 - Increase the sample size 🗸 / number of rats (2)

3.6 - When a vasectomy is done, the testosterone level will decrease 🗸

- which will affect the secondary male characteristics 🗸of the whole body/

 (muscle mass, growth of hair and beard etc.) (2)

 **(14)**

**Question 4**

4.1 B – Placenta✓ (1)

4.2 A – Umbilical cord✓ (1)

4.3

|  |  |
| --- | --- |
| **Vein** | **Artery** |
| Carries oxygenated blood/oxygen content is high✓ | Carries deoxygenated blood/oxygen content is low✓ |
| High nutrient content✓ | Low nutrient content✓ |
| CO2 content is low✓ | CO2 content is high✓ |
| Low amounts of nitrogenous waste✓ | High amounts of nitrogenous waste✓ |

(5)

**(7)**

**Question 5**

* 1. - Provides watery medium for the foetus to move freely🗸 and develop/ allows

 movement for growth and development🗸

* Prevents dehydration of the embryo🗸
* Protects the foetus against temperature fluctuation🗸/Keeps foetus at a constant temperature

 - Acts as shock absorber🗸 (3)

5.2 Allantois✓

 Yolk sac✓ (2)

5.3 Excretory system🗸, respiratory system🗸, digestive system🗸, endocrine system🗸

 ANY TWO (2)

**(7)**

**Question 6**

6.1 - High level of progesterone✓

 - inhibits hypophysis✓

 - from secreting FSH✓

 - therefore no primary follicle can develop✓ Any THREE (3)

6.2 Decreases✓ drastically (1)

6.3 - The placenta responsible for the secretion of progesterone during

 gestation✓

 - tears loose from the uterine wall✓ (2)

**(6)**

**Question 7**

7.1 - As a result of the blocked Fallopian tube✓

 - the sperm cannot reach the ovum✓

 - therefore fertilisation cannot take place✓ (Any 2) (2)

7.2 (a) FSH✓/follicle stimulating hormone (1)

 (Mark first ONE only)

 (b) Oestrogen (1)

 (Mark first ONE only)

7.3 - 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)

7.4 - Progesterone levels would fall✓

 - The endometrium would no longer be maintained✓

 - A miscarriage would occur✓ (3)

**(11)**

**Question 8**

8.1 - The endocrine disrupters/malfunctioning of endocrine glands

 - Life style/life style variations. Driving a vehicle for prolonged periods (Any 1) (1)

8.2 - Long distance drive extends the period sitting at a fixed position causing male

reproductive organ to remain tightly squeezed between the thighs for a considerable

period of time.✓

 - As the temperature rises✓ in the area, the scrotum is unable to pull the testis away

 from the body due to lack of spacing,

 - hence the testes remain in contact with the body and maintain a higher temperature

 causing a disruption of spermatogenesis.✓ (3)

8.3 The low sperm count reduces the chances of fertilisation✓ and may led to male

 infertility. ✓ (2)

8.4 - Use of tight underwear✓

 - Sitting in a hot tub for a long time as daily routine✓ (Any 1) (1)

**(7)**

**Question 9**

**Development of Graafian Follicle**

- The hypophysis✓/pituitary gland

- secretes FSH✓

- which stimulates the development of a primary follicle✓

- in one of the ovaries✓

- Only one follicle develops to full maturity in every cycle✓

- into a mature Graafian follicle✓

- Around day 14✓

- the Graafian follicle is fully developed✓

- The mature Graafian follicle moves to the surface of the ovary✓

- forming a slight swelling✓

- There is a sharp increase in the concentration of LH✓

- The wall of the ovary ruptures✓

- The ovum✓/haploid secondary oocyte is released

- which is known as ovulation✓

- After ovulation the remains of the Graafian follicle✓ develop

- into a mass of yellow cells✓ the corpus luteum (Any 9)

**Oogenesis**

- A diploid✓cell/2n

- in the ovary

- undergoes meiosis✓/meiosis I to

- form a primary oocyte

- reducing the number of chromosomes to haploid✓/n

- Only one cell develops into an ovum✓ (Any 4)

**Prevention of follicle development**

- Progesterone levels are high✓

- being secreted by the placenta✓

- It inhibits✓

- the secretion of FSH✓

- Therefore preventing the stimulation of development of primary follicle✓ (Any 4)

**ASSESSING THE PRESENTATION OF THE ESSAY**

|  |  |  |
| --- | --- | --- |
| **Criterion** | **Elaboration** | **Mark** |
| Relevance**(R)** | All information provided is relevant to the question | Only information with regard to development of the Graafian follicle until corpus luteum is formed, oogenesis and the prevention of follicle development during pregnancy. | 1 |
| Logical sequence**(L)** | Ideas are arranged in a logical/cause-effect sequence | The sequence of events in development of the Graafian follicle until corpus luteum is formed, oogenesis and the prevention of follicle development during pregnancy is correct. | 1 |
| Comprehensive**(C)** | Answered all aspects required by the essay in sufficient detail | Development of the Graafian follicle until corpus luteum is formed **(7/9)**oogenesis **(3/4)** andThe prevention of follicle development during pregnancy **(3/4)**. | 1 |

**(20)**

**Responding to the environment: Humans**

**The Nervous system**

**Question 1**

1.1 - The bigger/wider the diameter🗸

 - the faster🗸 the conduction of the impulse

1.2 - Unmyelinated: 3🗸 m/s

 - Myelinated: 8🗸 m/s

1.3 - Myelin sheath🗸

 - The increase in the conduction velocity is faster🗸 and

 higher🗸 with the Myelin sheath

**Question 2**

2.1(a) A

2.2 (a) D

2.2 (b) B

**Question 3**

3.1 Reflexes allow the rapid🗸/ involuntary responses to an external stimulus

 thus preventing /reducing damage🗸 to the body

3.2 The type of activity🗸performed

3.3 - Same age participants🗸

 - Same gender🗸

 - The reaction time was tested using the same method🗸

3.4 - Repeat the investigation🗸

 - Increase sample size

3.5 The hypothesis should be accepted🗸

* The results show that sending text message increases the time taken to react the most 🗸
* therefore if a people text while driving they react much more slowly🗸which could lead to an accident.

**Question 4**

4.1 0,038🗸 s 🗸

4.2 - As blood alcohol content increases🗸

 - the braking response time increases🗸

**OR**

 - The braking response time increases🗸

 - as the blood alcohol content increases🗸

4.3 - The motorist cannot judge the distance of an obstacle🗸

 - and will therefore not be able to stop in time to avoid the

 accident🗸

**OR**

 - Cannot judge boundaries of a lane🗸

 - and may therefore drive in the wrong lane🗸

4.4 - Acts as a control🗸/baseline assessment

 - so that the results can be attributed to the alcohol content in the

 blood and not any other factor🗸

**Question 5**

5.1 Myelin sheaths are fatty membranes🗸enclosing nerve fibres.

 It insulates nerve fibres🗸and accelerates the transmission of nerve impulse🗸

* 1. (a) - **D** is responsible for controlling the breathing rate✓
* thus the person will not be able to breathe✓

 **OR**

- **D** is responsible for controlling the heart rate/beat✓

- thus the heart would stop beating✓ (**Any 1 x 2)**

5.2(b) Receptors✓/pain receptors in his skin are stimulated and convert the stimulus into an impulse✓

 - The impulse is transmitted along a sensory neuron✓ to the spinal cord✓where it makes synaptic contact✓with an interneuron✓which makes synaptic contact with a motor neuron✓

 - The impulse then moves to the effector✓/muscles in the leg

 - Muscles will contract✓ and the leg is thus lifted away from the glass.

 **(Any 6)**

**Question 6**

6.1 Sensation would be felt but there would be no response

6.2  Helps to protect the bodyby reacting quickly

6.3 . Reflex arc- pathway of a nerve impulse✓ from receptor to effector✓

 Reflex action- automatic, ✓involuntary response to a stimulus✓



This difference is very important, remember this!

6.4 Structure of motor neuron



Criteria to mark diagram

|  |  |
| --- | --- |
| Caption  | 1 |
| Correct diagram | 1 |
| Any 3 correct labels | 3 |

**The Eye**

**Question 1**

1.1 6/12✓ / 6:12 (1)

1.2 - Validity/ People cannot learn the pattern✓/arrangement/sizes

 And therefore cheat on the test✓ (2)

1.3 - 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)

**Question 2**

 C🗸(2)

**Question 3**

3.1 (a) B🗸 (1)

 (b) A🗸 (1)

3.2 - Can change its shape🗸

 - to focus image onto the yellow spot🗸

 - irrespective of the distance from the eye🗸/

 For near distant vision🗸/for accommodation🗸 (mark first 3) (3)

 **(5)**

**Question 4**

* 1. Iris🗸/radial and circular muscles (1)

4.2 (20 – 30)🗸s (1)

4.3 - Radial muscles contract🗸

* Circular muscles relax🗸
* Pupil increases in diameter🗸/dilates (3)

4.4



Correct drawing of the front view of an eye🗸

Pupil = 6 mm🗸

Any 2 correct labels🗸🗸 (4)

**(9)**

**Question 5**

5.1 (a) Diameter of the pupil✓ (1)

 (b) Distance✓ between the eye and the bulb (1)

5.2 Between 7 and 8✓ (1)

5.3 4✓ (1)

5.4 - Diameter of pupil is the widest✓/6mm wide open

 - to allow the maximum amount of light✓ to enter the eye

 - to fall on the retina✓/yellow spot

 - enabling the woman to see during the lower light intensities✓ (Any 3) (3)

5.5 - To allow the eye/pupil to adjust✓

 - to the darkness of the room✓ and

 - to ensure validity✓ before the next reading is taken (Any 2) (2)

5.6 Repeat the investigation✓ Increase the sample size✓ (Any 1) (1)

 **(10)**

**The Ear**

**Question 1**

C (2)

**Question 2**

2.1 - Air will not be taken in✓/released

 - to equalise pressure✓

 - on both sides of the tympanic membrane✓

 - This may lead to the tympanic membrane bursting✓

 - and therefore could lead to hearing loss✓/deafness (4)

2.2 Changes in the direction and speed of movement:

 - Causes the endolymph in part D/semi-circular canals to move✓

 - The cristae✓ are stimulated

 - and converts the stimulus into an impulse✓

 - which is transmitted via the auditory nerve✓

 - to the cerebellum

 - from which impulses are transmitted via motor neurons✓

 - to the skeletal muscles✓/effector

 - to restore balance of the body✓ (5)

2.3 Sound vibrations✓ would not pass through to the inner ear✓ and hearing would

be affected. (2)

 **(11)**

**Question 3**

3.1 Both✓ (1)

3.2 4000✓Hz✓ (2)

3.3 - Earwax builds up in the auditory canal✓

 - and presses against the tympanic membrane✓

 - preventing it from vibrating freely✓/preventing the transmission of

 sound waves (3)

3.4 - The round window absorbs✓ sound waves from the inner ear

 - to prevent interference with subsequent waves✓/reduce pressure in

 cochlea (2)

 **(8)**

**Human endocrine system and Homeostasis**

**Question 1**

 - Excess carbon dioxide is formed✓

 - Mudulla oblongata is stimulated✓

 - it sends impulses to the heart✓

 - and the breathing muscles✓

 - Blood can be taken to the lungs at a faster rate✓

 - to eliminate the excess carbon dioxide formed✓

 - as a result of high respiratory rate✓

 - and to collect more oxygen✓ **(4)**

**Question 2**

2.1 As humans get older, there is a progressive decline in the secretion of growth

 hormone.✓✓ (2)

2.2 The amounts of growth hormone secreted between the ages of 13 and 19 is

 comparatively higher✓ than the amounts of hormone secreted during the rest of

the life of the person. (1)

2.3 (a) Gigantism✓ (1)

 (b) Dwarfism✓ (1)

2.4 - The rapid development of stronger muscles✓

 - Growth in size and mass of skeletal system✓ (1)

 **(6)**

**Question 3**

3.1 - Body temperature increases✓

 - Pulse rate increases✓

 **OR**

 Both increase✓✓ (2)

3.2 30✓ minutes (1)

3.3 **Vasoconstriction**

 - Less blood reaches the surface of the skin✓

 - and less heat is lost✓

 **OR**

* Less blood reaches the sweet glands✓
* And less heat is lost✓

**Increase in metabolism**

* Results in an increase in respiration✓
* Which generates more heat✓ (4)

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 (2)

 **(9)**

**Question 4**

4.1 Comparison of the blood glucose of two people✓ over 5 hours✓/before and after

 ingesting glucose (2)

4.2 (145 – 125) ✓

 = 20✓ mg/100cm3 (2)

4.3 (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✓ (1)

4.4 - When his glucose level is high✓

 - 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✓

 - below normal levels✓ (4)

 **(10)**

**Responding to the environment: Plants**

**Question 1**

* 1.
* To allow for time for the auxins from the tip🗸
* to diffuse into the agar jelly 🗸 (2)
	1.
* 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🗸
* the uneven growth 🗸caused the stem to bend to the right Any (4)

1.3 - remove the agar jelly completely🗸 /use agar jelly

* that does not contain auxins
* and place a black box 🗸around the tip of the coleoptile (2)

1.4 (a) distribution of auxins 🗸 (1)

 (b) direction of growth 🗸 (1)

1.5 - repeat the investigation 🗸

* increase the number of coleoptiles used🗸/sample size🗸 (2)

1.6 - the uneven distribution of auxins on the side where the agar jelly was placed🗸

* caused the coleoptile stem to bend 🗸
* even though there was no exposure to light 🗸 (3)

 **(15)**

**Human Impact on the environment**

**Question 1**

1.1 Species of plants that have been introduced√ into an area/did not originally

 occur in that area 🗸 (1)

1.2 - Employing people to remove the vegetation🗸

 - Buying chemicals to kill the plants🗸

 - Providing equipment to cut down the plants🗸

 - Researching biological control species🗸

 - Alien vegetation may be widespread🗸

 - Alien vegetation may be growing in inaccessible areas🗸

 - A large amount of alien vegetation needs to be removed🗸

 **(Any 2)** (2)

1.3 - The biodiversity in the dam decreases🗸

 - Alien plants cover the surface of the water🗸

 - and block out the sunlight🗸

 - Less photosynthesis occurs🗸

 - and less oxygen is released into the water🗸

 - Other organisms die√/suffocate due to a lack of oxygen 🗸 **(Any 5)** (5)

1.4. - They deplete the topsoil of water🗸/nutrients

 - so that food crops do not grow well🗸

 - They invade land🗸

 - decreasing the space available to grow crops🗸 (4)

 **(12)**

**Question 2**

2.1 A site where (solid wastes) domestic and industrial wastes are buried. 🗸 (1)

2.2 R120 000 000 🗸/one hundred and twenty million rands (1)

2.3 Energy can be saved🗸by recycling because the raw materials used to manufacture

 certain waste materials such as glass do not have to be dug from the earth and melted

 together at very high temperatures.

 Reduces environmental pollution🗸because manufacturing of new products use large

 quantities of fossil fuels as a source of energy. (2)

2.4 Re-use shopping bags🗸/using an item for the same purpose more

2.5. Decomposition of organic 🗸/household waste🗸

 causes the release of greenhouse gases 🗸such as CO2 and methane🗸

 that trap more heat from the sun 🗸causing increased global warming

 cause enhanced greenhouse effect. 🗸 (Any 2 x 1)(2)

2.6

|  |
| --- |
| *Mark allocation of graph:*  |
| **Criteria**  | **Mark Allocation**  |
| Bar graph drawn (T)  | 1  |
| Title of graph (C) include both variables  | 1  |
| Correct scale for X-axis (equal width and spacing of the bars) and Y-axis (S)  | 1  |
| Correct labels 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 : 3 to 4 bars plotted correctly  |

**Question 3**

3.1. Number of kilograms of wheat per hectare/yield🗸 (1)

3.2. To compare🗸the yield obtained when ysing two types of fertiliser with the yield of the

 hectare with no fertiliser🗸

 **OR**

 It acts as a control🗸 to ensure that the results obtined are due to the addition of

 fertilisers🗸and not any other factor. **Any (1x2**) (2)

3.3. - She could have increased the sample size🗸/number of plots/ number of plants for

 each type of fertiliser used

 - Repeat the investigation 🗸 (**mark first one only)** (1)

3.4 - nutrients in the soil🗸

 - Leads to decrease in yield🗸

* Increases pests🗸
* Leads to soil erosion🗸
* Decreases biodiversity🗸 **Any 3** (3)

3.5.

* 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 decompostition🗸
* Leading to a depletion of oxygen🗸
* And reducing the biodiversity /reducing the number of animal and plant species in the river🗸 (4)

**(11)**

**PAPER 2**

**Meiosis**

**Refer to the questions and answers in Paper 1**

**DNA: Code of life**

**Question 1**

1.1 (a) uracil 🗸 (1)

 (b) ribose 🗸 (1)

1.2 10 🗸 (1)

1.3

|  |  |
| --- | --- |
| **DNA nucleotide** | **RNA nucleotide** |
| * Sugar part is deoxyribose 🗸
 | * Sugar part is ribose 🗸
 |
| * Nitrogen base part is thymine / A, C, G and T 🗸
 | * Nitrogen base part is uracil/ A, C, G and U 🗸
 |

 Any (1x2)

**Question 2**

2.1 (a) DNA replication 🗸 (1)

 (b) **X** – phosphate 🗸

 **Y** – deoxyribose 🗸 (2)

 (c) Hydrogen bond 🗸 (1)

 (d) Adenine 🗸 (1)

2.2 Interphase 🗸 (1)

2.3 - DNA replication 🗸 is taking place

 - the double helix DNA unwinds🗸

 - the double stranded DNA unzips 🗸

- due to the breaking of weak hydrogen bonds 🗸

- to form two separate strands 🗸

- free DNA nucleotides line up opposite each strand🗸

- in a complimentary way🗸/A – T and C – G

- bonds form between the two strands and they wind up once more 🗸

- two new molecules of DNA are formed identical to each other🗸 Any (6)

 **(12)**

**Question 3**

3.1 (a) Polypeptide chain 🗸 (1)

(b) Ribosome🗸 (1)

3.2 (a) 2 🗸 (1)

 (b) 5 🗸 (1)

(c) 7 🗸 (1)

Translation is process where the tRNA molecules read the code on the mRNA

and bring amino acids together in a particular sequence to form a required protein

3.3 - Translation 🗸

- The mRNA attaches to the ribosome🗸

 - each tRNA carries a specific amino acid🗸

- When each anti-codon🗸 of the tRNA

* matches with the codon 🗸on the mRNA
* 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 (5)

3.4 - tRNA has one free base triplet called an anti-codon 🗸

- which determines the specific amino acid it carries. 🗸

- This anti-codon matches a specific codon on mRNA 🗸

- and therefore the tRNA places an amino acid in a specific sequence🗸

 - depending on the code of the gene🗸 on the DNA Any (4)

3.5 CCT🗸 (1)

3.6 - A DNA molecule carries thousands of genes that code for different proteins 🗸

- Therefore the DNA is much larger than a protein 🗸

- When a protein is synthesised only one gene on the DNA 🗸

- is required to form mRNA 🗸

- for the for the required protein 🗸 to be synthesized (5)

3.7

|  |  |
| --- | --- |
| **DNA Nucleotide** | **RNA Nucleotide** |
| Sugar part consists of deoxyribose 🗸 | Sugar part consists of ribose 🗸 |
| Nitrogen bases are adenine, thymine, guanine and cytosine 🗸 | Nitrogen bases are adenine, uracil, guanine and cytosine 🗸 |

 (2x2) (4) **(25)**

**Question 4**

4.1 GUC 🗸 (1)

4.2 Valine 🗸 (1)

4.3 - During replication the base triplet CAG on the DNA occurs more than 36 times. 🗸

- this causes a change in the gene that forms m RNA. 🗸

- the mRNA code causes a change in the amino acid sequence 🗸

- and a different protein is formed called the ‘Huntington protein’ 🗸 (4)

 **(6)**

**Question 5**

5.1 DNA profiling 🗸 (1)

5.2 Male 3 🗸 (1)

5.3 - the bands of the child’s DNA is a combination of the DNA from each parent 🗸

 - Three bands are identical to that of the mother 🗸

 - The remaining three bands correspond with those of male 3 🗸 (3)

5.4 - To investigate crimes🗸 /resolve disputes

 - to identify organisms🗸 / missing persons 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 🗸 Any (2)

 **(7)**

**Genetics and Heredity**

**Question 1**

1.1. A

1.2. D

1.3. B

1.4. C

1.5. C

1.6. A

1.7. C. 

**Question 2**

.P1 Phenotype: Blood group A x Blood group A 🗸

 Genotypes IA i x IA i🗸

 meiosis

 gametes IA , i x IA , i🗸

 🗸

|  |  |  |
| --- | --- | --- |
|  | IA | i |
| IA | IAIA | IAi |
| i | IAi | ii |

🗸 fusion/fertilisation

 F1 Genotype IAIA IAiIAiii 🗸

 Phenotype, blood group: A, A, A, **O** 🗸

 **OR**

 P1 Phenotype: Blood group A x Blood group A 🗸

 Genotypes IAi x IAi🗸

 meiosis

 gametes IA, i x IA, i🗸

 🗸

🗸 fusion/fertilisation

 F1 Genotype IAIA IAiIAiii 🗸

 Phenotype, blood group: A, A, A, **O** 🗸 **(7)**

**Question 3**

3.1. (11/100) 🗸x 2000 🗸= 220🗸 (3)

3.2. - Repeat🗸the investigation

 - Use a larger sample size🗸/more dogs/increase number of dogs

 **Any 2** (2)

3.3. The breed of the dogs🗸 (1)

3.4. - The disorders are inherited🗸

 - and therefore does not change with age🗸 (2)

3.5 Autosomal recessive inheritance causes most of the genetic disorders in dog🗸🗸 (2)

**Question 4**

4.1

P1 phenotype Red-yellow x red- yellow🗸

 Genotype RY x R Y🗸

 Meiosis

|  |  |  |
| --- | --- | --- |
|  | R | Y |
| R | RR | RY |
| Y | RY | YY |

 Gametes R, Y x R , Y 🗸 **OR**

 Fertilisation

 F1 Genotype RR ; RY RY ; YY 🗸

 Phenotype red red-yellow yellow🗸

P1 and F1🗸

Meiosis and fertilisation🗸 (any 6) (6)

4.2. 50%/half🗸 (1)

4.3. A tree with red apples🗸should be crossed with a tree with yellow apples🗸 (2)

**Question 5**

5.1 Incomplete dominance🗸 (1)

5.2 P1 phenotype Blue x yellow🗸

 Genotype BB x Y Y🗸

 Meiosis

|  |  |  |
| --- | --- | --- |
|  | Y | Y |
| B | BY | BY |
| B | BY | BY |

 Gametes B, B x Y , Y 🗸 **OR**

 Fertilisation

 F1  Genotype BY ; BY ; BY BY🗸

 Phenotype 100% green/ all green🗸

P1 and F1🗸 Meiosis and fertilisation🗸 (any 6)

**Question 6**

|  |  |
| --- | --- |
| 6. 1 | (a) Only seen in males / not in females 🗸(b) unaffected mother / parents yet they have a son that has colour-blindness🗸 |
| 6.2 | (a) 5 = XdY 🗸(b) 7 = XDXd 🗸 AND XDXD 🗸 (c) 8 = XDXd 🗸 |
| 6.3 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **P**1 | phenotype | Normal male | x | Normal female 🗸 |
|  | genotype |  XD Y | x | XD Xd 🗸 |
|  | *Meiosis* |
|  | **G**/gametes  | XD , Y  | x |  XD ; Xd 🗸 |
|  | *Fertilisation* |  |
| **F1**  | genotype | XD XD ; XD Xd ; XD Y ; Xd Y🗸 |
|  | phenotype | 2 normal females and 1 Normal male, 1 affected male🗸 \***25% or 1 in 4 🗸** |

Parents and offspring🗸/P1 and F1Meiosis and fertilisation🗸 Any 5 + 1\*(Compulsory)OR

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **P**1 | phenotype | Normal male | x | Normal female 🗸 |
|  | genotype |  XD Y | x | XD Xd 🗸 |
|  | *Meiosis* |
|  | **G**/gametes  | XD , Y  | x |  XD ; Xd 🗸 |
|  | *Fertilisation* |

|  |  |  |
| --- | --- | --- |
| Gametes | XD  | Y  |
| XD | XD XD  | XD Y  |
| Xd | XD Xd  | Xd Y |
|  🗸🗸 |

 |
| **F1**  | genotype | XD XD ; XD Xd ; XD Y ; Xd Y🗸 |
|  | phenotype | 2 normal females and 1 Normal male, 1 affected male🗸 \***25% or 1 in 4 🗸** |

Parents and offspring🗸/P1 and F1Meiosis and fertilisation🗸 Any 5 + 1\*(Compulsory) |

**Question 7**

|  |  |  |  |
| --- | --- | --- | --- |
| 7.17.27.37.47.5 | High yield🗸Short stem🗸 hT🗸HHtt 🗸, Hhtt🗸It is stronger🗸/to carry a bigger yield/withstand windy conditions without breaking The plant breeder must cross🗸 plants of variety A with plants of variety A🗸 |  | (2)(1)(2)(1)(2) |

**Question 8**

The genes of a specie which have drought resistant genes can be artificially selected 🗸 and

used for inbreeding 🗸 to obtain many organisms/population that do not need a lot of water (2)

**Question 9**

|  |  |  |
| --- | --- | --- |
| 9.1 | - Her father had brown tooth enamel.✓- Therefore his genotype must have been XbY✓.- She could only inherit the recessive allelleXb✓ from her father. - She had white teeth so she must have one dominant allele XB✓therefore  she must be heterozygous.  | (4) |
|  |  |  |
| 9.2 | **P1/P2**Phenotype Brown enamel🗸 x White enamel🗸 |  |
|  |  Genotype XbY x XBXb🗸 |  |
|  | Meiosis  |  |
|  |  G/gametes Xb, Y x XB ,Xb🗸 |  |
|  | Fertilisation |  |
|  | **F1/F2** Genotype XBY, XbY, XBXb, XbXb🗸 |  |
|  | Phenotype 1white enamel son, 1 son with brown enamel **1 white enamel daughter, 1 daughter with brown enamel✓**If you counted from the women’s father this will be the grandchildren and thus F2 but if you only looked at the man and woman the children will be F1 |  |
|  | P1 and F1🗸/P2 and F2Meiosis and fertilisation🗸1 Compulsory + any6 |  |

**Question 10**

10.1 a) Bbll✓ (1)

 b) white✓ with long hair✓ (2)

10.2 BBLL✓; BbLl✓ (2)

 **(5)**

**Question 11**

11.1. Eyebrows not connected ✓ (1)

11.2.

 - Parents A and B or C and D produce children with connected eyebrows✓

- and not connected eyebrows✓

- Only parents both carrying the dominant allele can

- produce offspring with both phenotypes✓

**OR**

- A and B or C and D have eyebrows that are not connected,produce a child

 with eyebrows which are connected✓

- then the allele for connected eyebrows was present in bothparents✓,

- but masked, so eyebrows that are connected is recessive. **Any two** (2)

11.3. Two ✓fertilised ova (1)

11.4 - One child is male and the other is female ✓ (1)

 - One child has eyebrows that are connected and the other-has eyebrows that

 are not connected. ✓ (2)

 **(6)**

**Question 12**

12.1.Suspect 2 ✓ (1)

12.2. 3 of his/her DNA bands match the evidence from the crime scene while none of the

 other suspects match. ✓ (1)

12.3

* Identification of relatives✓ e.g. paternity suits/tracing siblings separated at

birth/identifying unrecognisable bodies of dead people.

* Test for alleles that can cause inherited genetic disorders. ✓
* To determine matching tissues for organ transplants✓
* Can be used in research into variation in populations✓

 (Any 1 x 1) (1)

12.4

* + DNA samples may be planted✓/ person can be framed with the use of false evidence.
	+ Human error✓ can lead to false results/ small amount of DNA is analysed therefore not necessarily unique to an individual/ done in private labs so testing standards may not be followed.
	+ Invasion of privacy✓ /revealing personal information. (2)

**(5)**

**Question 13**

(a) Smith's - Baby 3✓ (1)

(b) Jones' - Baby 2✓ (1)

 **(2)**

**Question 14**

Gene mutation involves the change in a single nitrogen base ✓of a DNA molecule✓

Chromosome aberration involves a change ✓in the structure or number of chromosomes ✓

**(4)**

**Question 15**

15.1. Since legalisation of abortions in 1997 the umber of live birhts of babies with genetic

 defect have increas/decreased✓✓

**OR**

 Legalising abortions had no effect on the number of babies with genetic diseases✓✓(2)

15.2. Identify hospitals and clinics from which you can collect data✓

 get permission from the hospitals/clinics/governmaent to collect the data✓

 Decide on the data and time to visit the hsopitals and clinics✓

 Design a table to record the results✓ (3)

15.3. Babies with genetic diseases✓ (1)

15.4. Repeat the investigation/ use a larger sample size✓ (1)

 **(7)**

**Question 16**

16.1.

- 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)

16.2.

- 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

**OR**

- Woman that have hormonal imbalances because of a dysfunctional ovarycould be

- cured by replacing it with a functional ovary

- which secretes the correct doses of hormones (3)

**(6)**

**Question 17**

17.1 a) Cloning✓ (1)

 b) Oogenesis✓/gametogenesis/meiosis (1)

17.2 - the donor horse has the desired characteristics✓

 - that need to be copied✓

 - and be present in the offspring√next generation Any 2 (2)

17.3 The nucleus contains all the genetic information ✓✓/

 Hereditary characteristics/chromosomes of the champion horse (2)

17.4. a) 64✓

 b) 32✓

 c) 64✓ (3)

17.5. - A gemete is generally haploid✓

 - this ovum is diploid✓since

 - it has the nucleus of a somatic cell✓ Any 2 (2)

**(11)**

**Evolution**

**Question 1**

1.1 (a) 25🗸mya (accept 24 to 25) (1)

 (b) 63🗸mya (1)

1.2 Old World monkeys🗸 and apes 🗸 (2)

1.3 Lorises 🗸 (1)

1.4 Apes 🗸 (1)

 **(6)**

**Question 2**

2.1 (a) MRSA 🗸 (1)

 (B) FQRP🗸 (1)

2.2 (20-5) 🗸 X 100🗸 **OR** (15)🗸 X 100🗸

 5 1 5 1

 = 300🗸 % (3)

2.3



 **Mark allocation for the graph**

|  |  |
| --- | --- |
| **Criteria**  | **Mark Allocation** |
| Correct type of graph (line graph) | 1 |
| Title of graph including both varaibles  | 1 |
| Correct label and scale for X-axis | 1 |
| Correct labeland 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’**
* **‘ ploting of points’**

**If the axes are transposed:**

**The learner will lose 2 marks for correct label and scale for X and Y axesIf 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**

 (6)

**(11)**

**Question 3**

* The baobab population has been separated into two groups✓
* **by a geographical barrier**✓
* **\*sea**/continental drift✓
* Environment al conditions on the continents may have be different✓
* Each population underwent natural selection independently✓
* and they become **genotypically** and **phenotypically**✓ different 🗸
* This prevented them from interbreeding✓ leading to the formation of new species.
* **\*e.g. of a geographical barrier is the compulsory mark**

 Any 5 + 1\*

 **(6)**

**(6)**

|  |  |  |
| --- | --- | --- |
| 4.14.2 | Change in diet (from insectivorous to vegetarian)✓,larger body✓ andthicker tail✓bigger bite force✓ **(Mark first THREE only)** They do not need to move quickly✓ to catch insects✓/plants are sedentary | (3)(2) |
| 4.3 | - There is variation in the head size amongst wall lizards in the population✓- some have large heads✓/bigger bite force and other - have smaller heads✓/smaller bite force- Insects became scarce on the island✓/competition occurred for food- lizards with smaller heads that fed on insects struggled to obtain food and died✓ of hunger- While those with the larger heads fed on plants/ vegetation, and had enough food to eat and survived✓- Those with larger heads reproduced✓- and passed on the favourable gene to the next generation✓- Resulting in an increase in number in the population✓  | (6) |
|  |  | **(11)** |

**Question 4**

**Question 5**

5.1 - Determined 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 Any (4)

5.2 Number of finches before and during the drought🗸/ (beak size) (1)

5.3 During the drought there were more finches with larger beaks 🗸🗸

**OR**

 During the drought therewere fewer finches with smaller beaks 🗸🗸 (2)

5.4 - During the drought only hard woody seeds remained🗸

 - Finches with bigger beaks could crack ipen the seeds more easily🗸

 - and had sufficient food🗸

 - therefore they 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🗸
* therfore they did not survive🗸 to reproduce Any (3)

5.5 accept a range of 9,8 to 10,3🗸 mm /larger (1)

 **(11)**

**Question 6**

6.1 - the mutation caused variation🗸 among the clover plants

 - some produced cyanide🗸/poison and

- others do not produce cyanide🗸/poison

- the non-cyanide producing plants survive the lower temperatures🗸

- whereas the cyanide producing plants are killed at lower temperatures🗸

- Therefore they do not reproduce 🗸and

- the allele for cyanide production is not passed onto the next generation🗸

- there are fewer cyanide producing clover plants 🗸 in the next generation

 Any **(6)**

**Question 7**

7.1. A transitional fossil shows characteristics🗸of two🗸 / between genera/species (2)

7.2. Bipedalism/ stood upright 🗸 (1)

7.3. - 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 short and wider🗸
* To support the body above🗸 the pelvis

 **Any (2x 2)** (4)

7.4. -there was a change in diet

 - from tough/🗸raw to

 -softer 🗸 /cooked food (3)

7.5. No/Less intelligent🗸. The skulls of *Homo naledi* is half of humans skulls size

 which indicates a smaller brain 🗸. (2)

**(12)**

**Question 8**

8.1 A🗸, E🗸, F🗸 (3)

8.2.In A the big toe is close to the other 4 smaller toes/faces forward

 In B the big toe is apart/opposable from the other 4 smaller toes/points outwards🗸

**OR** In A the heel bone is relatively larger and in B it is relatively smaller

**OR** In A the bones in the foot are straight and in B they are curved

**OR** In A phalanges are relatively shorter and in B they are relatively longer **Any one** (1)

8.3. Diagram C is adapted for tree climbing/qaudripedalism / whereas diagram F is adapted

 for bipedalism/upright walking🗸 (1)

8.4. The foramen magnum in diagram A is more forward / towards the centre than diagram

 B🗸 which indicates that diagram A is bipedal/ diagram B is qaudropedal. 🗸

 The pelvic girdle in Diagram E is flatter and more bowl shaped / diagram D is long and

 narrow🗸 is which indicates bipedalism in diagram E / that diagram D is quadropedal🗸

(4)

**(9)**

**Question 9**

* 1. 35 000✓ (1)
	2. *(*a) Homo habilis✓

 (b) Australopithecus africanus🗸 and Australopithecus afarensis🗸

 (c)Homo erectus🗸

 (d) Pelvis – wide and short✓ and bowl shape✓ holding the weight✓ of the body

 making upright walking possible✓ (4)

**(5)**

**Question 10**

There is a great deal of variation🗸among the mosquito offspring.

Some were resistant to DDT and others were not🗸

DDT was sprayed and only mosquitos that were resistant to DDT survived.

Those that were not resistant to DDT died🗸

The mosquitos that survived reproduce 🗸and passed on the favourable characteristics

to their offspring. 🗸

The next generation therefore have a bigger proportion🗸of individuals that are resistant to

DDT **(7)**