

LIFE SCIENCES
TUTORS' REVISION MATERIAL
LAST PUSH CLASSES
GRADE 12

PAPER I
PAPER II

TUTOR'S

LAST- PUSH-CLASSES

TUTORS' REVISION

MATERIAL

PAPER I

PAPER II

2024

Topic	Mark Allocation in Paper	Study Date	Content
PAPER 1:			
Reproduction in Vertebrates P1	8		Diversity of reproductive strategies: (External/Internal fertilization; Oviparity, ovoviviparity, viviparity; amniotic egg; precocial/altricial development; parental care)
Human Reproduction P1	41		Human reproduction: Male & female systems, puberty, gametogenesis, ovum and sperm cell, cycle ; menstrual cycle; fertilization; zygote, morula, blastocyst, embryo; implantation; chorion & chorionic villi; amnion, amniotic fluid, amniotic cavity; umbilical cord, placenta; 3 stages of birth process
Responding to environment (Humans) P1	54		Nervous System: Cerebrum, cerebellum, corpus callosum, medulla oblongata, spinal cord, peripheral system (cranial & spinal nerves) Autonomic system (sympathetic & parasympathetic: neuron, reflex arc & reflex action ; Alzheimer's disease, multiple sclerosis ; injuries to nervous system ; effect of drugs
			Receptors: Eye – structure & functions of parts; accommodation; pupil action; short- and long sightedness; astigmatism; cataracts Ear – structure and functions of parts; how does the ear hear; balancing function of ear
Endocrine and Homeostasis P1	34		Endocrine glands (location& hormones of Hypothalamus (ADH), Pituitary/hypophysis (GH, FSH, LH, TSH, prolactin), Thyroid (thyroxin) Pancreas/Islets of Langerhans (adrenalin, aldosterone), Ovaries (oestrogen & progesterone), Testis (testosterone) Plus functions of each hormone in brackets
			Examples of negative feedback : TSH & thyroxin, insulin & glucagon, diabetes
			Homeostasis (of glucose, carbon dioxide, water, salts) Thermo-regulation (through sweating, vasodilation, vasoconstriction)
Responding to environment (Plants) P1	13		Plant hormones (auxins, gibberellins, abscisic acid) Geotropism & phototropism Defensive mechanisms (chemicals, thorns)

Compiling a list of biological terms per topic for learners and regular informal tasks on biological terms might help in improving learner's comprehension of biological terms.

Informal activities in the form of word puzzle/fill in the missing words can assist in improving spelling and terminology.

e.g. Crosswords / matching columns

Learners must be taught in the language of the exam papers to familiarize them with description and comprehension of questions generally

1.1. BIOLOGICAL TERMS: PAPER 1

Give the correct biological term for the following descriptions.

Description	Biological term (MEMO)
1. The period of development of an embryo in the uterus between fertilisation and birth.	Gestation/ Pregnancy✓
2. Disease characterised by a lack of insulin production.	Diabetes mellitus✓
3. Tube that connects the pharynx and the middle ear.	Eustachian tube✓
4. A stage in the development of humans in which the embryo consists of a layer of cells surrounding a cavity.	Blastocyst✓
5.. The structure at the tip of a sperm cell containing enzymes and which makes contact with the egg cell during fertilisation.	Acrosome✓
6. The gland in the male reproductive system of humans that produces an alkaline fluid to counteract the acid environment of the vagina.	Prostate gland✓
7. The duct leading from the testis to the urethra in human males.	Vas deferens/sperm duct✓
8. The process by which the ovum is formed through meiosis in the ovary.	Oogenesis✓
9. The membranes which protect the central nervous system.	meninges✓
10. A plant growth hormone that stimulates seed germination.	Gibberellins✓
11. The nervous system which consists of cranial and spinal nerves.	Peripheral nervous system✓
12. A branch of the autonomic nervous system that decreases the heartbeat back to normal.	Parasympathetic nervous system✓
13. The outermost extra-embryonic membrane surrounding the embryo.	Chorion✓
14. The hormone that regulates the salt concentration in the human body.	Aldosterone✓
15. The blood vessel in the umbilical cord that carries blood rich in oxygen and nutrients.	Umbilical vein✓
16. The hormone inhibited by an increased level of thyroxine.	TSH✓
17. The structure in the ear that equalises the pressure on either side of the eardrum.	Eustachian tube✓
18. The watery fluid that supports the cornea and the front chamber of the eye.	Aqueous humor✓
19. The hormone produced by the Graafian follicle.	Oestrogen✓
20. The hormone responsible for the formation of the corpus luteum.	LH✓
21. The receptors in the ear that detect changes in the direction and speed of any movement of the body.	Cristae✓
22. The type of fertilisation associated with viviparous reproduction.	Internal fertilisation✓
23. The series of changes that take place in the shape of the lens and the eyeball in response to	Accommodation✓

the distance of an object from the eye.	
24. The part of the brain that controls the heart rate.	Medulla oblongata✓
25. The maintenance of a constant internal environment in the body within certain limits.	Homeostasis✓
26. The plant hormone that promotes seed dormancy.	Abscisic acid✓
27. A hormone that stimulates the maturation of sperm.	Testosterone✓
28. The type of development in birds in which the young is capable of moving around on its own soon after hatching.	Precocial development✓
29. A Disorder which results in the myelin sheath of the neurons being damaged.	Multiple sclerosis✓
30. A liquid between the cornea and the lens in the human eye.	Aqueous humor✓
31. A long, coiled tube in human males that lies at the top of the testes, which stores sperm.	Epididymis✓
32. A hormone that promotes the absorption of water in the kidneys.	ADH✓
33. A type of reproduction in humans where the foetus develops inside the uterus.	Vivipary✓
34. The movement of part of a plant in response to gravity.	Geotropism✓
35. The stage in humans when sexual maturity is reached in males and females.	Puberty✓
36. A change in the internal or external environment that will be detected by a receptor and converted into an impulse.	Stimulus✓
37. Small tubes placed in the tympanic membrane to drain liquid from the middle ear.	Grommets✓
38. Part of the human ear that directs sound waves into the auditory canal.	Pinna✓
39. A type of fertilisation in which the nucleus of a sperm fuses with the nucleus of an ovum outside the body of the female.	External fertilisation✓
40. The growth of part of a plant in response to light.	Phototropism✓
41. The condition of the blood vessels in the skin in humans when the environmental temperature is low.	vasoconstriction✓
42. The sensory receptors found in the semi-circular canals.	cristae✓
43. A layer inside the eye that absorbs light, thus reducing reflection.	Choroid✓
44. The part of the brain that receives nerve impulses from the semi-circular canals.	cerebellum✓
45. The part of the eye where a light stimulus is converted into a nerve impulse.	Retina✓
46. The part of the peripheral nervous system that controls involuntary actions.	Autonomic nervous system✓
47. A plant hormone that causes leaves to fall off trees in autumn.	Abscisic acid✓
48. The structure in the amniotic egg that stores wastes.	Allantois✓
49. The inner lining of the uterus where implantation of the embryo occurs.	Endometrium✓

50. Part of the female reproductive system where fertilisation occurs.	Fallopian tubes✓
51. The diploid cell formed by the process of fertilisation.	Zygote ✓
52. A fluid that protects the human embryo against injuries and large-scale temperature changes.	Amniotic fluid✓
53. A disorder of the nervous system that is characterised by the breakdown of the myelin sheath of neurons.	Multiple sclerosis ✓
54.. A hormone produced by the hypophysis that stimulates milk production in human females.	Prolactin✓
55. A blood vessel in the umbilical cord that transports nutrients to the foetus.	Umbilical vein✓
56. A part of the neuron that conducts impulses towards the cell body.	dendrites✓
57. A disease that results from the body's inability to produce insulin.	Diabetes mellitus✓
58. The part of the sperm cell that contains enzymes to digest the membrane of the ovum	acrosome✓
59. The hormone that prepares the human body for an emergency situation.	Adrenalin✓
60. A hormone that stimulates the maturation of sperm and puberty in males.	Testosterone✓
61. The tube in the male reproductive system that connects the epididymis with the urethra	Vas deferens✓
62. The hormone which regulates the salt balance in humans	Aldosterone✓
63. The hormone that stimulates the mammary glands to secrete milk	prolactin✓
64. The plant hormone that stimulates the germination of seeds.	Gibberellins✓

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

COLUMN I	COLUMN II
1.3.1 Type of development resulting in offspring that are capable of moving around soon after hatching	A Precocial B Altricial
1.3.2 Converts glucose to glycogen	A Glucagon B Adrenalin
1.3.4 Provides greater chances for the fusion of sperm and egg	A External fertilisation B Internal fertilisation
1.3.5 Characteristic of vivipary	A Placenta is formed B Live offspring is born

- 1.3 1.3.1 A only ✓✓
 1.3.2 None ✓✓
 1.3.3 Both A and B ✓✓
 1.3.4 B only ✓✓
 1.3.5 Both A and B ✓✓

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

- 1.3 1.3.1 B only ✓✓
 1.3.2 B only ✓✓
 1.3.3 A only ✓✓
 1.3.4 B only ✓✓
 1.3.5 None ✓✓
 1.3.6 A only ✓✓

(6 x 2)

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

- 1.3 1.3.1 Both A and B ✓✓
 1.3.2 B only ✓✓
 1.3.3 A only ✓✓
 1.3.4 B only ✓✓
 1.3.5 Both A and B ✓✓

(5 x 2)

COLUMN I		COLUMN II
1.3.1	Only cones are present	A: Blind spot B: Yellow spot
1.3.2	Occurs in the iris in bright light	A: Radial muscles contract B: Circular muscles relax
1.3.3	High concentration of auxins stimulate growth	A: Stem B: Root
1.3.4	A hollow ball of cells	A: Morula B: Blastocyst/Blastula

- 1.3 1.3.1 B only ✓✓
 1.3.2 None ✓✓
 1.3.3 A only ✓✓
 1.3.4 B only ✓✓

(4 x 2)

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

COLUMN I	COLUMN II
1.3.1 Female frogs lay eggs in water and the males spray sperm onto the eggs.	A: Vivipary B: Ovovivipary
1.3.2 The phase of meiosis when independent assortment occurs	A: Anaphase II B: Metaphase I
1.3.3 The type of development in vertebrates where the young are well developed and able to move at birth	A: Precocial development B: Altricial development

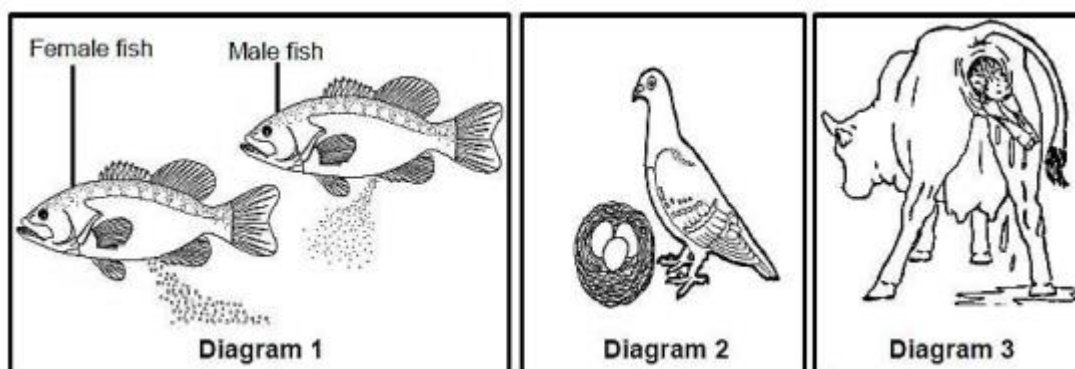
(3 x 2)

(6)

- 1.3 1.3.1 None✓✓
 1.3.2 A only✓✓/B only
 1.3.3 A only✓✓

DATA RESPONSE TYPE QUESTIONS: REPRODUCTION IN VERTEBRATES

2.1. The diagrams below represent organisms with different reproductive strategies



2.1.1 Which diagram(s) (1, 2 or 3) represent(s) organism(s):

- (a) Where external fertilisation takes place (1)
Diagram 1 ✓
- (b) Where extra-embryonic membranes develop to assist with the protection and nutrition of the embryo (2)
Diagram 2 ✓ and Diagram 3 ✓
- (c) Which) is/are oviparous (2)
Diagram 1 ✓ and Diagram 2 ✓

2.1.2. Name the type of egg produced by the organism represented in Diagram 2. (1)

Amniotic ✓egg

This question was the worst performing question. Learners struggle to understand the strategy of amplexus. "Amplexus is when the male climbs onto the back of the female and grasps her with his front legs".

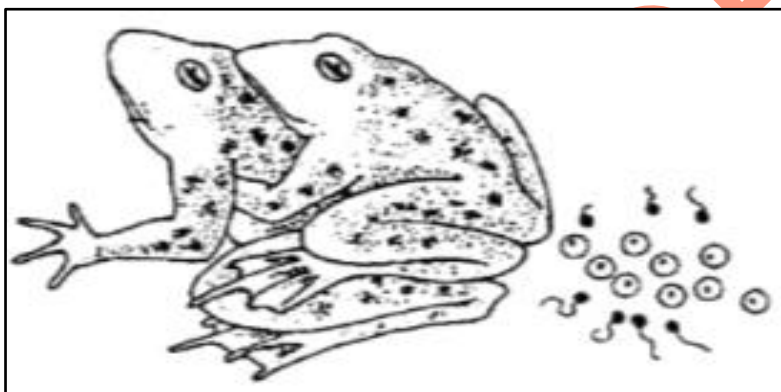
Adjustment was made to the memo due to the confusion of what amplexus was.

This question may be used as an example to encourage learners to think about a situation.

BUT

Do not teach amplexus as it won't be taught again.

2.2. The diagram below shows the type of fertilization in frogs.



2.2.1. State the type of fertilization in frogs above

(1)

External fertilization ✓

2.2.2. Are the frogs viviparous, ovoviviparous or oviparous.

(1)

Oviparous ✓

2.2.3. Give a reason for your answer in QUESTION 2.2.2.

(2)

- Lays eggs ✓

- Young develop in the egg outside the mother's body ✓

2.2.4. State ONE significance for this type of fertilization in frogs to occur in water (1)

- Prevents drying out of gametes ✓

- Allow sperms cells to swim towards eggs cells ✓

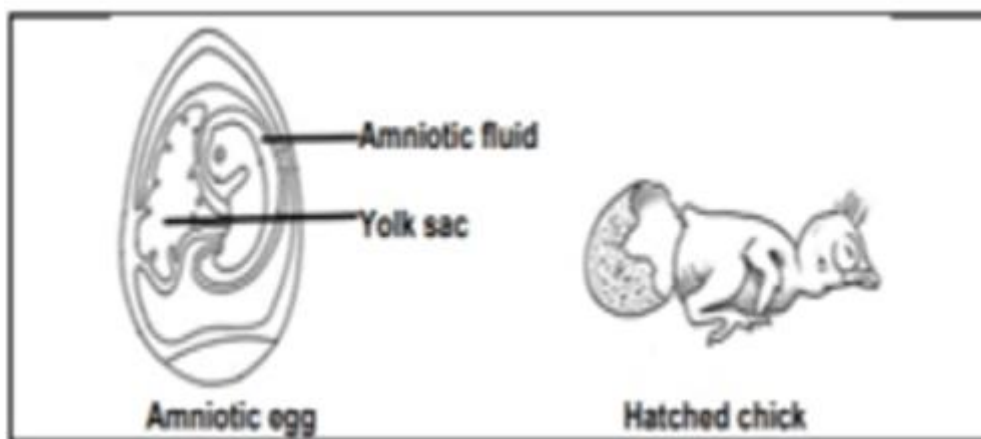
ANY ONE

Learners did not know Amniotic Egg.

Amniotic egg has shell and amniotic fluid that prevents embryo drying out on land. Learners don't understand difference between functions of parts of amniotic egg and why it is suitable for land.

Learners copying word for word from text and do not understand concept.

2.3. The diagram below shows the internal structure of amniotic egg after fertilization, as well as the chick that hatched from the egg.



2.3.1. Name the type of fertilization that has taken place

(1)

Internal fertilization ✓

2.3.2. State the type of reproductive strategy which is shown by the development of the embryo within the amniotic egg.

(1)

Oviparity/Ovipary ✓

2.3.3. Identify the type of development that the hatched chick shows

(1)

Altricial ✓

2.3.4. Give TWO functions of amniotic fluid.

(2)

- Protects the foetus against shock ✓ /mechanical injuries
- Keeps the foetus moist ✓ /Protects the foetus from drying out
- Protects the foetus from temperature changes ✓
- Allows the foetus to move freely ✓ /Supports the body of the foetus during development

Mark first TWO only

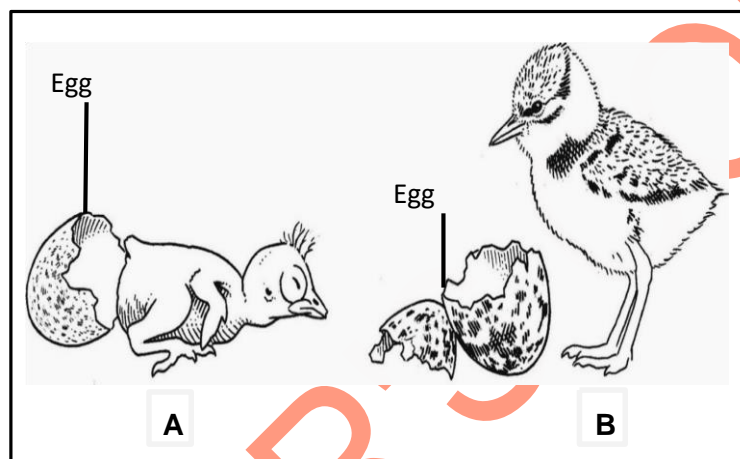
(Any 2)

2.3.5. Explain how the size of the yolk sac affects the development of the chick in the diagram (3)

The yolk sac was smaller✓

Therefore, (the chick) it received less nutrients✓ in the form of yolk
(The chick) it is less developed✓ /underdeveloped/eyes are closed/has only down feathers/has no feathers/cannot walk/shows altricial development

2.4. Answer the questions following the diagram.



2.4.1. State TWO visible features in hatchling A which indicate altricial development (2)

- The hatchling's eyes are closed✓
- The hatchling can't move✓
- The hatchling can't feed on its own✓
- The hatchling has no feathers/wings are not developed✓

2.4.2. The diagram represents ovipary.

(a) Name the type of egg produced by the organisms above (1)

- Amniotic egg✓

(b) Explain ONE possible advantage of vivipary when compared to ovipary (2)

- Foetus develops inside the uterus✓ for greater protection✓
- Food is supplied by the mother✓ and is therefore supplied for a longer period✓

(c) Explain why you would expect that the yolk content of the egg of hatchling

B was more than that of hatchling **A**. (2)

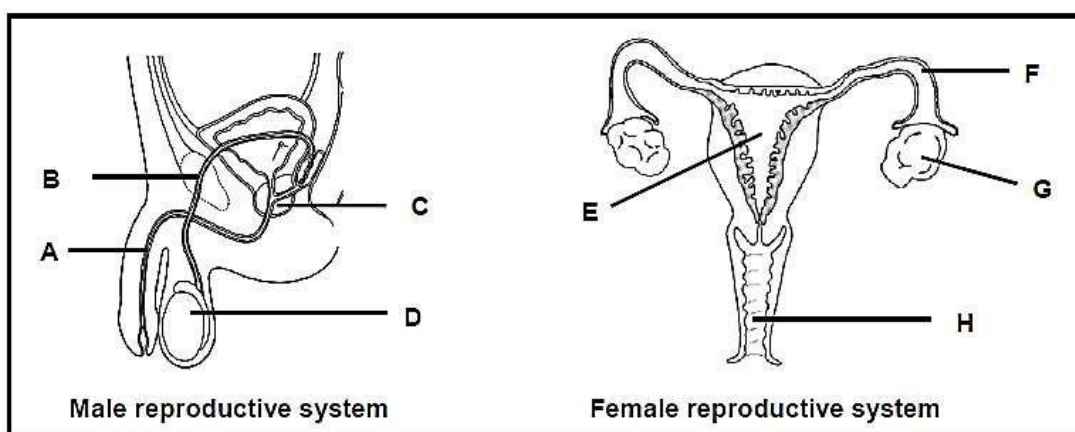
- More yolk allows for greater development of the protection of the chick✓
- so that it can be more independent after hatching✓

2.4.3. Describe the process of fertilisation . (3)

- The fusion of the haploid male gamete✓/sperm cell with the haploid
- female gamete✓/ovum to form a diploid zygote✓

HUMAN REPRODUCTION

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



3.1.1. Identify parts A, B, C, E, F and G respectively. (6)

- Urethra✓
- Vas deferens✓/sperm duct
- Prostate gland✓
- Uterus✓
- Fallopian tube✓/oviduct
- Ovary✓

3.1.2. State ONE function of each of the following:

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

- Protects the sperm cell against the acidic environment of the vagina✓
- Increases the motility of the sperm✓
- Provides nutrients✓

(b) Part E (1)

- Place for foetus to develop ✓
- Maintain pregnancy✓
- Assist in childbirth✓

- **Implantation✓ of blastula**
- **Protects the foetus✓/prevents infections(mucus plug forms by cervix)**
- **Passage for sperm cells✓ between vagina and fallopian tubes**

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

(a) Male reproductive system (1)
D✓

(b) Female reproductive system (1)
G✓

3.1.4. Name the type of gametogenesis that takes place in the:

(a) Male reproductive system (1)

Spermatogenesis ✓

(b) Female reproductive system (1)

Oogenesis✓

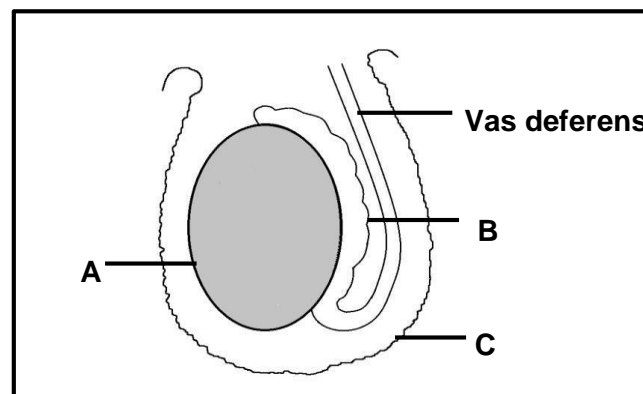
3.1.5. State TWO functions of part H. (2)

- **Serves as a birth canal ✓**
- **Allows for passage of blood✓/ endometrial lining/amniotic fluid/placenta**
- **Facilitates sexual intercourse ✓/receives semen**
- **Secretes acid which prevents infections✓**

3.1.5. Explain why it is necessary for part D to be 'outside' the body in males. (3)

- **To keep the testes at a temperature that is lower✓ than body temperature✓/optimum temperature for sperm production**
- **which is necessary for the production of healthy sperm✓/so that**
- **healthy sperms can survive**

3.2. The diagram below represents some parts of the male reproductive system



3.2.1. Identify parts numbered **A to C** (3)

- A. Testis**✓
B. Epididymis✓
C. Scrotum✓

3.2.2. Describe the process of spermatogenesis in part **A**. (4)

Under the influence of testosterone✓
diploid cells /germinal epithelium✓
in the seminiferous tubules of the testis✓
undergo meiosis✓
to form haploid sperm cells.✓ **any 4**

3.2.3. Test results show that a man has a low sperm count. Explain why a doctor would advise the man to wear Underwear that is not tight (3)

The testes will be away from the body✓
the temperature of the testes will therefore be lower✓ **than the body**
temperature/less pressure✓ **on the testes for successful sperm**
production✓

OR

Tight underwear will pull the testes close to the body✓
the temperature of the testes will be too high✓ **/ higher pressure on**
the testes✓
and sperm will not mature✓ **/sperm production is negatively**
affected.✓

Menstrual Cycle Hormones

FSH stimulates development of → Developing follicle produces → Oestrogen
 follicle to Graafian Follicle oestrogen
 *makes endometrium thicker & more vascular
 *inhibits pituitary to produce FSH
 *stimulate pituitary to produce LH →

→ LH stimulates ovulation
 stimulates the formation of the corpus luteum → corpus luteum produces progesterone →

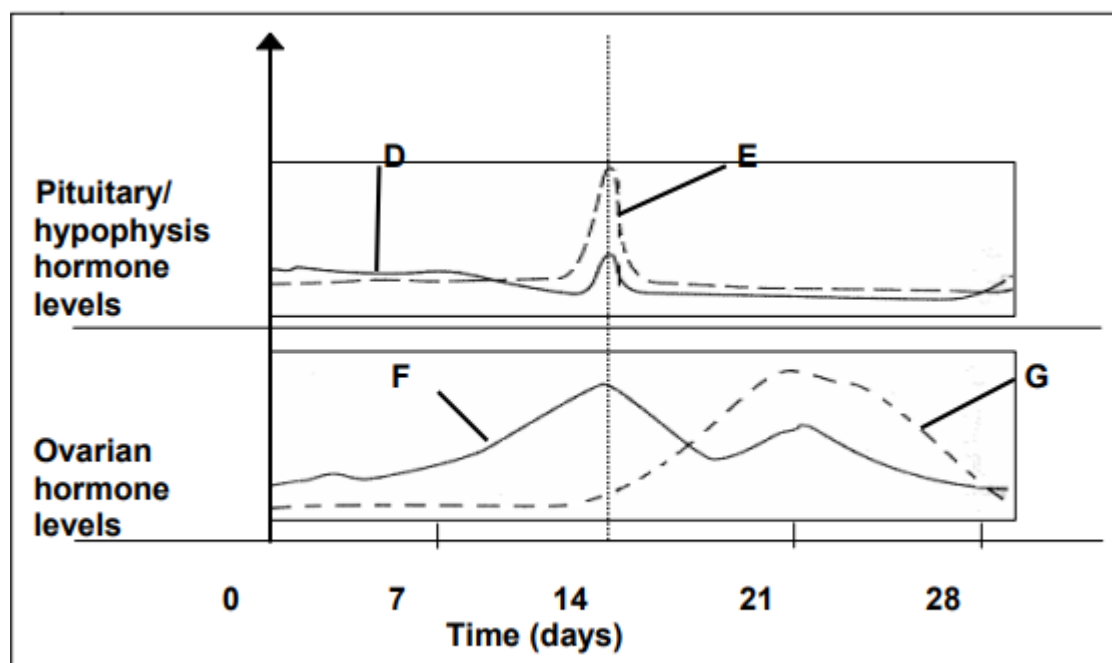
→ Progesterone *makes endometrium thicker & more vascular
 *inhibits pituitary to produce FSH
 *inhibits pituitary to produce LH

→ Fertilization takes place → corpus luteum continues to produce progesterone until the placenta is formed and takes over producing progesterone

→ No Fertilisation → Corpus Luteum disintegrates → No more progesterone produced → Pituitary no longer inhibited and starts to produce FSH



3.3. Study the graphs below, showing the levels of the hormones involved in the menstrual cycle in most women.



Hormonal regulation of the female reproductive cycle

3.1.1 Label hormone **E**. (1)

E – Luteinising hormone ✓ / LH

3.1.2 According to the graph, during which period of time is the level of hormone **F** lower than the level of hormone **G**? (1)

17 – 28 ✓ days

3.1.3 Name and explain the relationship that exist between the hormones labelled **D** and **G** in the menstrual cycle. (4)

Negative feedback mechanism ✓ Increased levels of hormone G ✓ / progesterone will inhibit ✓ hormone D ✓ / follicle stimulating hormone
When levels of hormone G ✓ / progesterone decreases ✓, then D / follicle stimulating hormone will be released from the pituitary gland ✓ and its level will increase ✓ (1 + any three)

3.1.4 Describe the changes that occur in the ovary during the 28-day cycle. (4)

Follicles are released ✓

Follicle in the ovary grows and matures into the Graafian follicle ✓

On approximately day 14 the ovum is released ✓ Process known as ovulation ✓

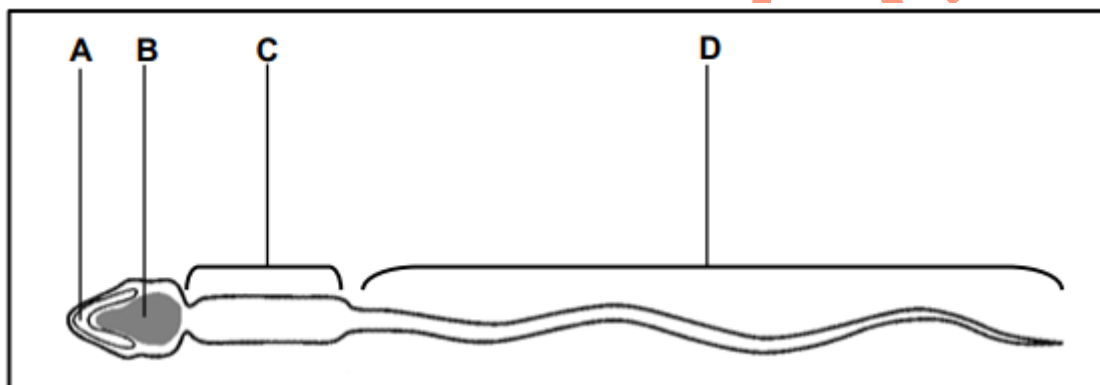
The remains of the Graafian follicle becomes the corpus Luteum ✓ that secretes progesterone (any four)

- 3.1.5 If fertilisation occurs on day 15, describe the changes that occur in the fertilised egg until the embryo attaches onto the endometrium. (3)

Corpus Luteum remains active✓ – continues to secrete progesterone.
The zygote divides by mitosis✓
To form a solid ball of cells called the morula✓
The morula becomes the blastocyst✓/blastula
The blastocyst/blastula develops into the embryo✓ which then attaches onto the endometrium (implantation) (any three)

Most candidates could not understand that the **oval shape** of a sperm allows it to move faster. Candidates must be familiar with shape of sperm and how this is an advantage to the sperm when swimming.

- 3.4. The diagram below represents a human sperm cell.



- 3.4.1. Identify parts: (1)
- (a) A **Acrosome ✓**
- (b) B **Nucleus ✓** (1)
- 3.4.2. Give the LETTER of the part that contains genetic material. (1)
- B ✓**
- 3.4.3. Give the LETTER and NAME of the part that would be damaged if the sperm cell is unable to: (2)
- (a) Penetrate the ovum **A ✓ - acrosome ✓**
- (b) Move because it lacks energy **C ✓ - middle piece ✓/ neck** (2)

3.4.5. In cats, a sperm cell has 19 chromosomes.

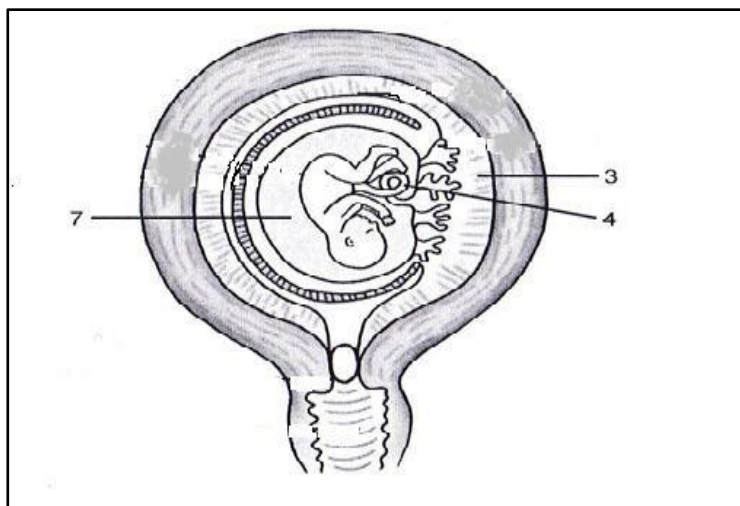
How many chromosomes will be found in the skin cell of a cat?

(1)

38 ✓

(8)

3.5. Study the diagram of a developing foetus and answer the questions that follow.



3.5.1. Identify the parts labelled 1 and 2

(2)

1 - Placenta ✓.

2 - Umbilical cord ✓.

3.5.2. State ONE function of the part labelled 3.

(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 shock, dehydration and temperature fluctuation ✓
 - Keeps foetus in a constant temperature ✓.
 - Acts as shock absorber ✓ (protecting the foetus).
- (any one)

3.5.3. In this diagram there is reference to a foetus. What is the difference between a foetus and an embryo?

(4)

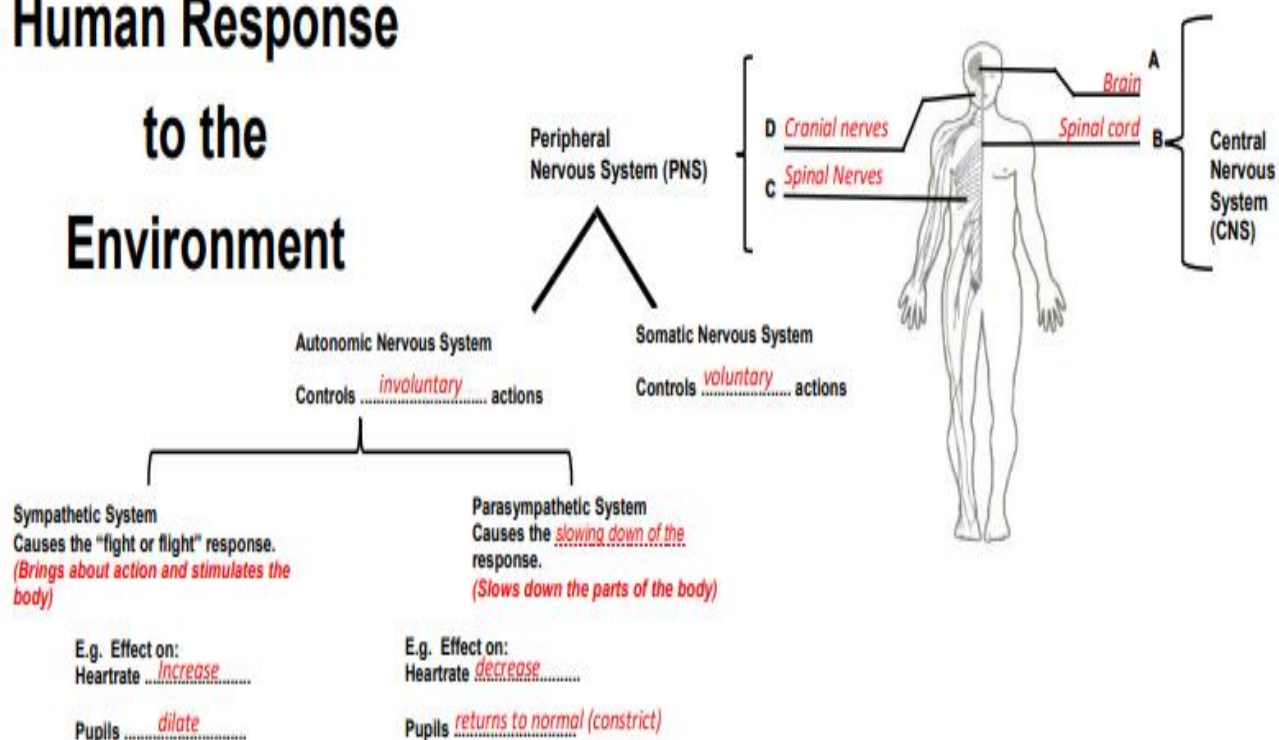
- Embryo refers to the first 8 weeks/ early stages ✓ of development of the
- zygote during which organs begin to develop ✓ through differentiation.
- Foetus refers to the development period from the 8th week ✓
- until birth, when all organs are already differentiated ✓.

3.5.4. Name any TWO systems in the baby's body that take over the functions of part 1 once the baby is born. (2)

- **Excretory system✓, respiratory system✓, digestive system✓,**
- **endocrine system✓** (any two)

TUTOR'S COPY

Human Response to the Environment



Provide the LABELS and FUNCTIONS of the parts of the brain.

Diseases of the Nervous System

1. Alzheimer's Disease

Definition: A disease of the brain that is characterised by memory loss and confusion.

Symptoms: Memory loss; Lack of judgement
Confusion; Disorientation

2. Multiple Sclerosis

Definition: A disorder of the nervous system that is characterised by the breakdown of the myelin sheath of neurons.

Symptoms: Vision loss; Speech difficulties; Muscle weakness; 'Pins and needles feeling'; Bladder and bowel problems; Pain; Fatigue

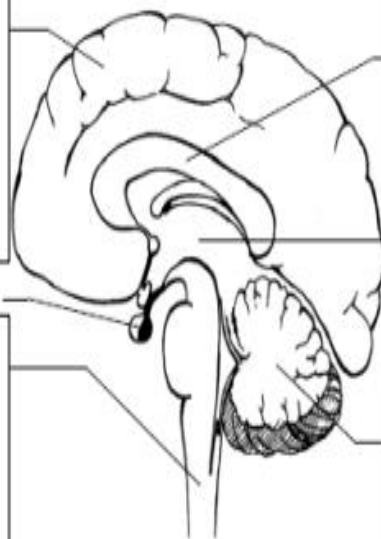
E Cerebrum

- Controls voluntary actions
- Receives and interprets sensations from sense organs
- Higher thought processes

D Medulla oblongata

- Transmits nerve impulses between the spinal cord and the brain
- Controls involuntary actions such as heartbeat and breathing

Pituitary gland



A Corpus callosum

- Connects the left and right hemispheres of the brain
- allowing communication between both hemispheres

B Hypothalamus

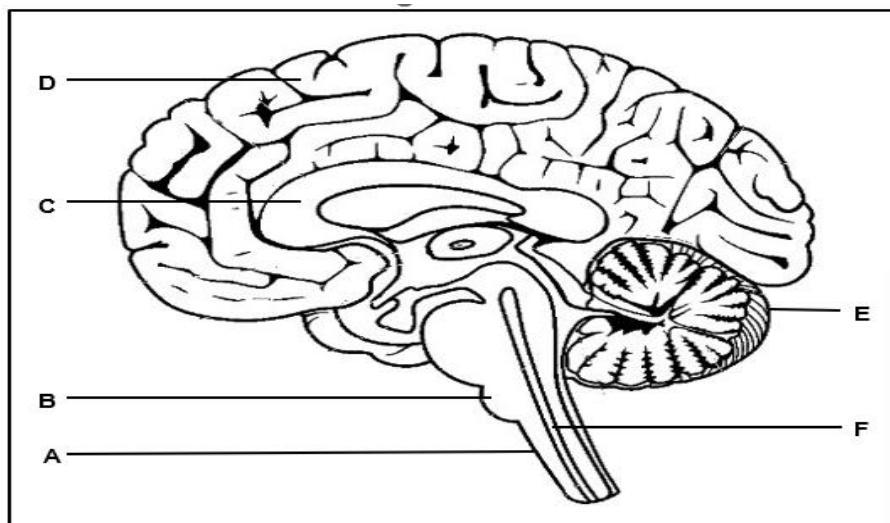
- Control centre for hunger, thirst, sleep, body temperature and emotion

C Cerebellum

- Coordinates all voluntary movements
- Controls muscle tension to maintain balance

RESPONDING TO THE ENVIRONMENT (HUMANS)

4. The diagram below shows the structure of a human brain.



4.1. Identify the parts labelled:

- (a) **B** (1)
B – Medulla oblongata ✓
- (b) **C** (1)
C – Corpus callosum ✓
- (c) **E** (1)
E – Cerebellum ✓

4.2. Give ONE function of the:

- a) Part labelled **A** (1)
 - **It conducts impulses between the brain and the receptors effectors ✓**
 - **Serves as a reflex centre for actions ✓ such as blinking, sneezing, coughing etc. (Any 1)**
- b) Fluid found in the part labelled **F** (1)
 - **Cerebro-spinal fluid in the central canal supplies nutrients and oxygen**
 - **for nerve cells ✓/ removes CO₂ and waste products from the nerve cells ✓**
 - **protects the brain and spinal cord against physical injury ✓ (Any 1)**

4.3. A haemorrhage (excessive bleeding due to rupture of blood vessels) at the part labelled **D** may cause permanent dysfunction.

(a) Explain the cause of damage to the part labelled **D**. (3)

- During a haemorrhage, the blood leaks out of the blood capillaries ✓
- and this disrupts the supply of oxygen and nutrients to the nerve cells ✓ / removal of CO₂ and metabolic waste causing them to die ✓
- causes excessive pressure

(b) State **THREE** possible consequences of the damage mentioned in **QUESTION 4.3** (a) to a patient. (3)

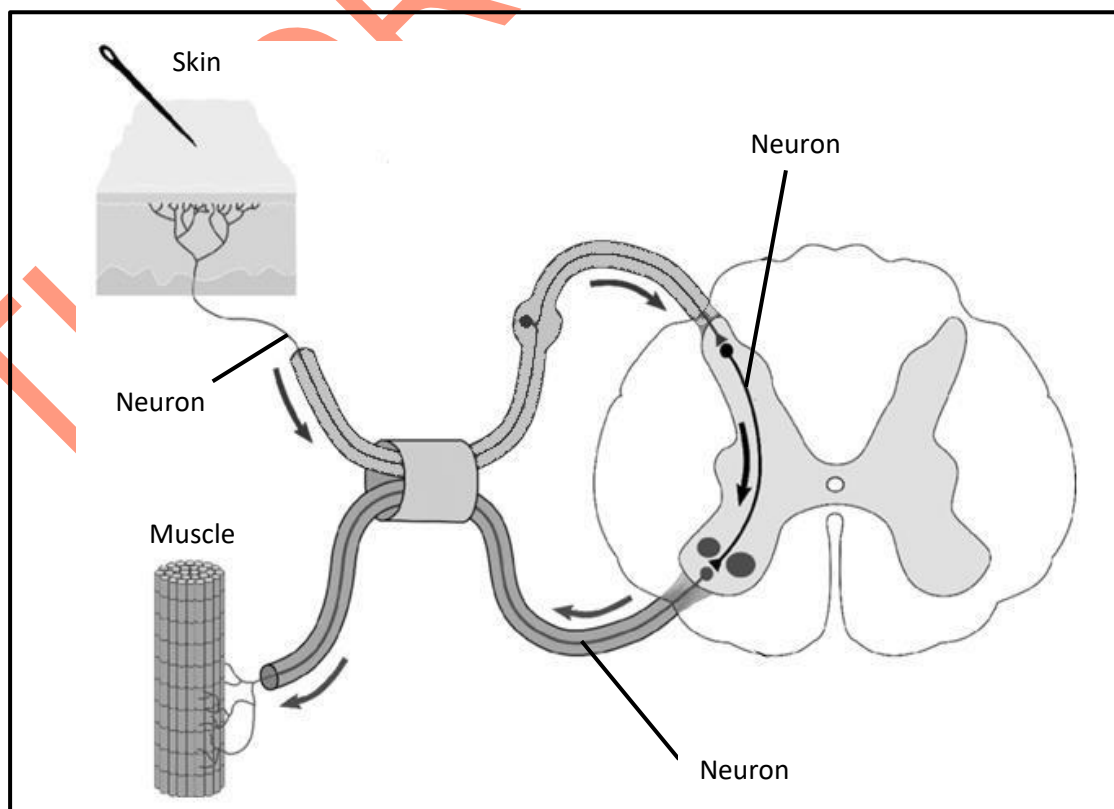
- Loss of sensation ✓ / consciousness / unable to process impulses from sense organs
- loss of higher intellectual abilities ✓ such as memory, judgement, reasoning. etc.
- unable to initiate voluntary muscular actions ✓

(Any 3)

Reflex Action

- Teachers need to teach learners to answer specific examples if given and to not just use the generic explanation.

5. The diagram below represents a portion of the central nervous system.



- 5.1. Name the type of reaction that is shown in the diagram. (1)

Reflex action ✓

- 5.2. State the significance of the reaction mentioned in QUESTION 5.1. (1)

It protects the body ✓ from further injury

- 5.3. How many synapses are shown in this diagram? (1)

Two/2 ✓

- 5.4. Use a flow diagram to give the correct sequence of neurons from the receptor to the effector. (2)

**Sensory neuron > interneuron > motor neuron > ✓✓
(TWO marks ONLY if all the neurons are mentioned and the sequence is correct)**

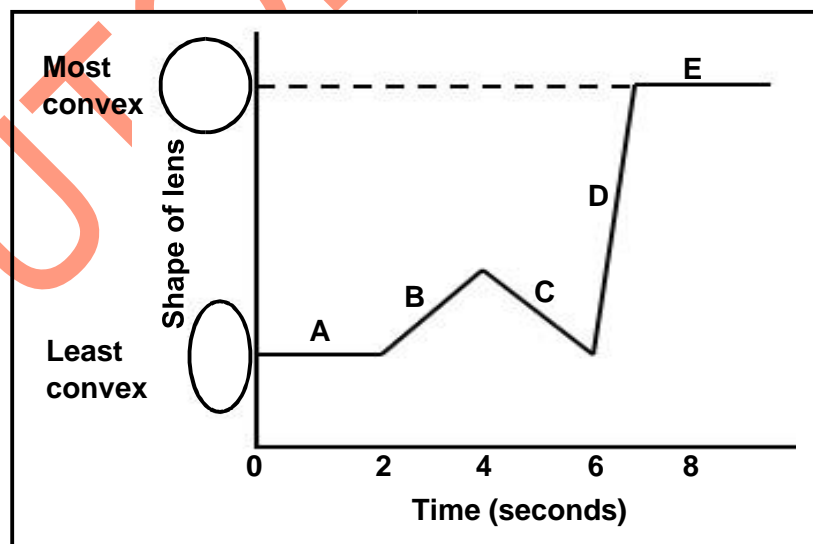
- 5.5. State TWO functions of the myelin sheath in neurons. (2)

**The transmission of impulses is accelerated ✓
It insulates the nerve fibres ✓ /one-way transmission of impulses**

- 5.6. Explain why no pain will be experienced if the spinal cord is damaged above the area shown in the diagram. (2)

**The impulse will not be transmitted to the cerebrum ✓ where the
Sensation of pain is interpreted ✓ /experienced**

- 5.7. During the time indicated, the participant was asked to look at an object which could be moved closer to or further away from the participant.



- 5.8. Name the process that changed the shape of the lens. (1)

Accommodation ✓

- 5.9. Give the LETTER on the graph that indicates the period of time during the investigation when the object was:
 (a) Closest to the participant (1)
E ✓
 (a) Moving towards the participant (1)
B ✓/D ✓ Any 1
- 5.10. Describe how a clear image of the object is maintained during period **C** on The graph. (4)
 - **The ciliary muscles relax ✓**
 - **Suspensory ligaments become taut ✓/stretched**
 - **and the lens becomes less convex ✓/flatter decreasing the refractive power of the lens ✓ maintaining a clear image.**
- 5.11. Read the following extract.

A Snellen chart helps to determine if a person meets the legal visual acuity (ability to see clearly) requirement for a valid driver's license (20/40). A person, standing 6 meters away from the chart, must cover one eye and he/she reads the letters of each row out loud. Starting from the top, the smallest row that can be accurately read, indicates the visual acuity in that specific eye.

Ratio of 20/20 is the smallest line that a person with normal acuity can read at 6 meters. When a person undergoes the visual acuity test special equipment is used to present the letters in different patterns, arrangements and sizes.

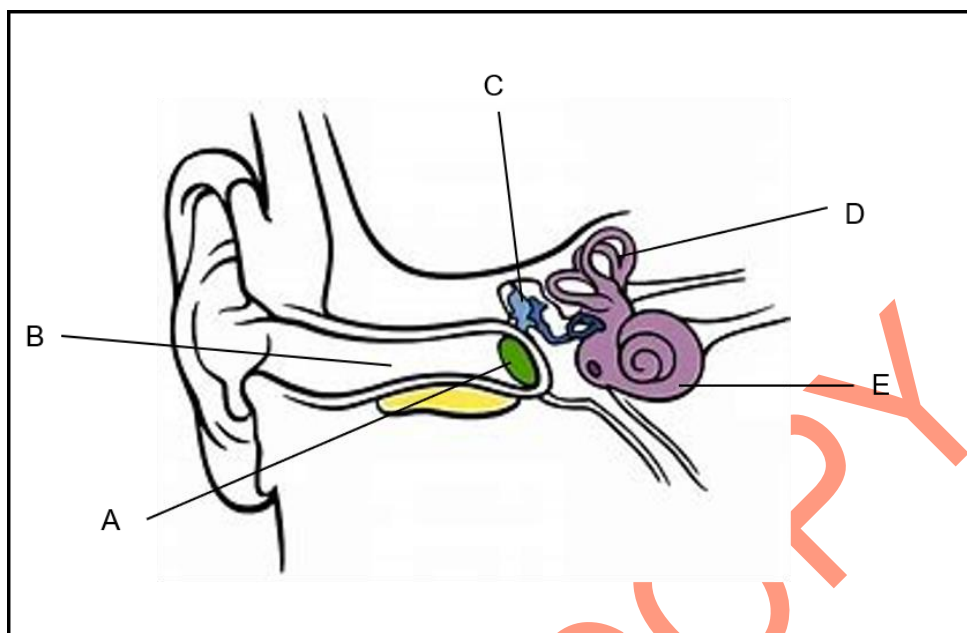
[Adapted from www.allaboutvision.com]

The diagram below represents a typical Snellen chart.

	Line number	Visual Acuity ratio
E	1	20/200
F P	2	20/100
T O Z	3	20/70
L P E D	4	20/50
P E C F D	5	20/40
E D F C Z P	6	20/30
F E L O P Z D	7	20/25
D E F P O T E C	8	20/20
L E F O D P C T	9	
F D P L T C E O	10	
P E Z O L C F T D	11	

- 5.13 During an eye test a person moves from 6 meters from the chart to 3 meters it.
- (a) Name the process that enables the eye of the person to focus on the letters on the chart.
Accommodation✓ (1)
- (b) Describe the process named in QUESTION 3.4.1 (a) for the person.
Ciliary muscles contract✓
The ciliary body moves closer to the lens✓
The suspensory ligaments slacken✓
The lens becomes more convex✓
More refraction of light✓
for a clear image to form on the retina✓ (Any 5) (5)
- 5.14 Explain ONE reason why the special equipment is used when testing eyesight for a driver's licence.
People cannot memorise the pattern/arrangement/sizes✓
therefore they need to rely on their eye sight✓ (2)
- 5.15 Binocular vision is also important to ensure safe driving.
- (a) What is binocular vision?
Images from both eyes✓ are able to perceive a three-dimensional image✓ (2)
- (b) Explain TWO reasons why binocular vision is important when driving a vehicle.
- It provides a wider field of vision✓ to improve the driver's driving ability✓ /reactions
- It creates a perception of depth✓ that will ensure the driver's ability to judge distance✓ (4)

5.16 The diagram below shows a section through the human ear.



5.17 Provide the LETTER ONLY of the part of the ear where the following will be inserted:

(a) A grommet (1)

A ✓

(b) A cochlear implant (1)

E ✓

5.18 Explain how the functioning of the ear would be affected if the bones at **C** were fused. (2)

- **Sound vibrations would not pass through to the inner ear ✓**
- **which means hearing would be affected ✓**

Learners confuse balance and hearing. They do not understand that the ear has TWO SEPARATE functions. Learners need to UNDERSTAND the functioning of the ear and not just learn to answer off by heart. Teachers must teach for understanding. Learners understand more about hearing instead of balance. Many of them lost a mark as they did not mention that Cristae are stimulated by change in direction/speed of head. Let us try this question with them.

5.19 A goalkeeper dives to save a ball being kicked towards the goal post. (6)

Provide an explanation on how his ears and nervous system control his balance while diving to save the ball.

- **As he dives:**
- **A change in direction and speed ✓ of the body**
- **stimulates the cristae ✓**
- **A change in the position of the head ✓**
- **stimulates the maculae ✓**
- **The stimuli are converted into impulses ✓**
- **which are transported along the auditory nerve ✓**
- **and interpreted by the cerebellum ✓**
- **which sends impulses to the muscles ✓ to restore balance and equilibrium**

Any 6

5.10. Describe the role of the ear in maintaining balance. (6)

- **Cristae ✓**
- **Are stimulated by changes in the speed/ direction of (movement) of the head ✓.**
- **Maculae. ✓**
- **Are stimulated by a change in the position of the head. ✓**
- **Go generate and impulse. ✓**
- **Which is transmitted by the auditory nerve. ✓**
- **To the cerebellum for interpretation ✓**

PLANT HORMONES

- Organic compounds
- Occur in low concentrations
- Act as chemical messengers

Functions of auxins

1. Promote cell division
2. Stimulate cell elongation
3. Stimulate the development of fruit
4. Control the **abscission** of leaves and fruit
(*high auxin concentrations inhibit the formation of the abscission layer in leaves and fruit*)
(*when auxin concentration decreases, an abscission layer is formed and the leaves/fruit drop off*)
5. Inhibit the growth of lateral branches – apical dominance
6. Stimulate the development of adventitious roots in stem cuttings
1. Cause **tropism** in stems and roots

Functions of Gibberellins

1. Stimulate cell elongation
2. Stimulate root growth
3. Promote flowering
4. Promote the growth of lateral buds
5. Stimulate the germination of seeds

Functions of Abscissic acid (ABA)

1. Causes dormancy of apical (terminal) buds and lateral buds in winter
2. Contributes to the dormancy of seeds by inhibiting germination
3. Promotes the abscission of leaves and fruit. ABA is produced in ripe fruit and induces fruit fall.
4. Causes the closing of stoma when the plant wilts. Its synthesis is stimulated by water deficiency (water stress)

TROPISMS

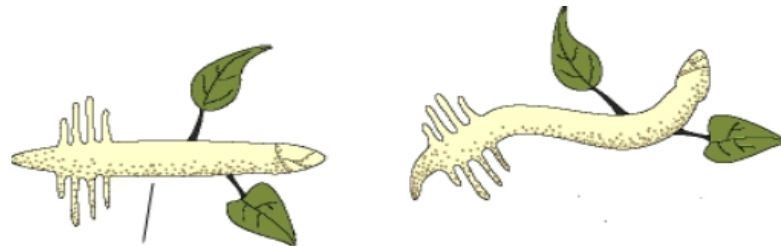
- ◇ Growth movement towards the stimulus is positive
- ◇ Growth movement away from the stimulus is negative
- ◇ It takes place as a result of the unequal distribution of auxins in the plant – some parts will grow faster than others

PLANT HORMONES AND WEED CONTROL

1. Some synthetic herbicides (weed killers) contain high concentrations of auxins that accelerate the metabolism of broad-leaved dicotyledonous weeds and therefore stimulate growth.
2. These weeds grow so fast that their water absorption and food production are insufficient.
3. The plants weaken and die.
4. Farmers can therefore successfully destroy dicotyledonous weeds growing among narrow-leaved monocotyledonous crops (such as wheat, corn and oats), because the narrow-leaved crops are not harmed by the herbicides.

ROLE OF AUXINS IN GEOTROPISM

- Auxins are produced at the tip of the root from where they move upwards evenly.
- Auxins are produced at the tip of the stem from where they move downwards evenly.
- The even distribution of auxins brings about equal growth on all sides of the root & stem.
- Therefore, the root grows straight downwards and stem upwards



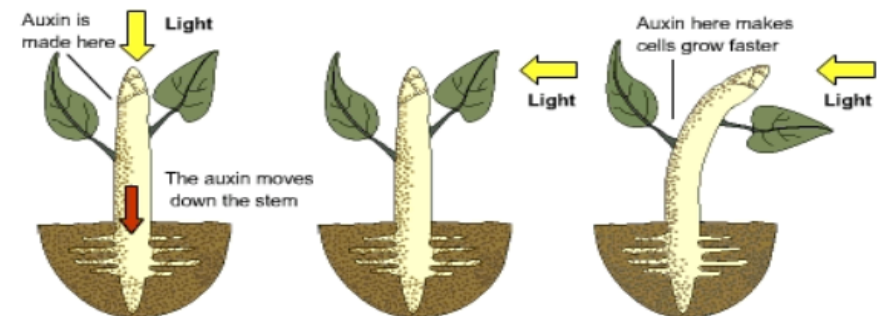
If a plant is laid on its side, auxin gathers in the lower half of the stem and root

When a **PLANT** is placed horizontally:

- In the **ROOT** the auxins accumulate on the lower side because of gravity.
- A high concentration of auxins on the lower side of root inhibits growth.
- This uneven distribution of auxins causes uneven growth of the root with the upper side growing faster and the root bends/grows downwards = *positively geotropic*
- In the **STEM** the auxins also accumulate on the lower side because of gravity.
- A high concentration of auxins on the lower side of the stem stimulates growth.
- This uneven distribution of auxins causes uneven growth of the stem with the lower side growing faster and the stem bends/grows upwards = *negatively geotropic*

ROLE OF AUXINS IN PHOTOTROPISM

- Auxins are produced at the tip of the stem from where they move downwards evenly.
- The even distribution of auxins brings about equal growth on all sides of the stem.
- Therefore, the stem grows straight upwards.



Auxin diffuses down the shoot stimulating growth.

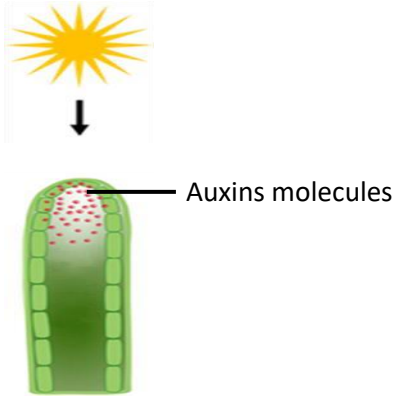
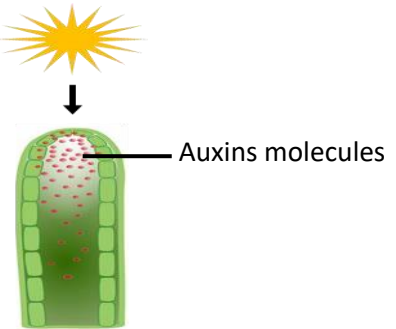
If one side of the shoot is in the light, auxin diffuses away from the light.

The side of the shoot in the shade has more auxin, so grows faster, causing the shoot to bend towards the light.

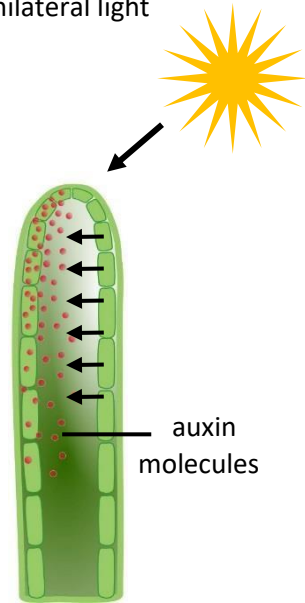
When stems are exposed to unilateral light (light from one side) the:

- brightly-lit side has a shortage of auxins because the auxins are destroyed by the light or because they move to the darker side.
- A high concentration of auxins in stems promotes growth.
- Thus an uneven distribution of auxins causes uneven growth of the stem with the darker side growing faster.
- The stem bends/grows towards the light i.e. stems are *positively*

Auxin (IAA)	Gibberellins	Absciscic acid (ABA)
Stimulate: <ul style="list-style-type: none"> • Cell division • Cell elongation (growth in stem length) (• The development of fruit • The abscission of leaves and fruit • The development of adventitious root in stem cuttings • Tropic movement in stem and roots • apical dominance it suppress the growth of the lateral buds. 	Stimulate: <ul style="list-style-type: none"> • Stem elongation • Root growth • The germination of seeds • Promotes flowering 	<ul style="list-style-type: none"> • Accelerate abscission in leaves and fruit. ABA is produced in ripe fruit and induced fruit fall. • ABA stimulates the closing of stomata in most plant species. Its synthesis is stimulated by water deficiency (water stress) Absciscic acid; • Causes dormancy in apical and lateral buds in winter. • Controls seed dormancy by inhibiting germination • Causes the closing of stomata when the plant wilts

Direction of light stimulus	Effect of light on auxins	Observations
<p>Shoot A – with sunlight directly overhead</p>  <p>Auxins molecules</p> <p>Figure 1A</p>	<ul style="list-style-type: none"> • Auxins produced at the tip of the stem / shoot • Auxins move downwards evenly • This distribution brings about equal growth on all sides of the stem 	<p>The stem / shoot A grows straight upward towards the light</p>  <p>Auxins molecules</p> <p>Figure 1B</p>

Shoot B – when the stem is exposed to unilateral light



auxin
molecules

Figure 1C

The auxin concentration will be high on the shaded side because light destroys auxins or auxins move away from the light

More growth occurs on the dark side because auxins stimulate growth on the dark side

The stem / shoot B bends towards the light

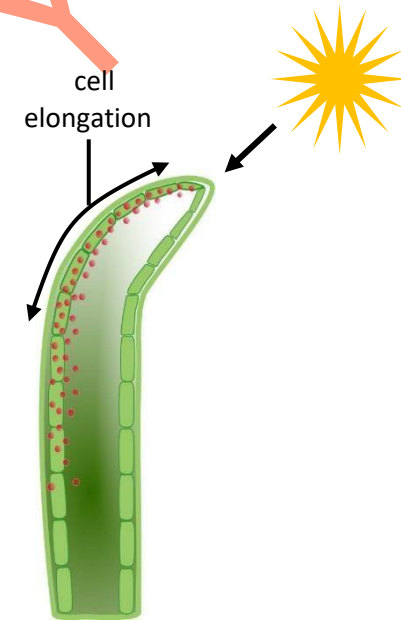


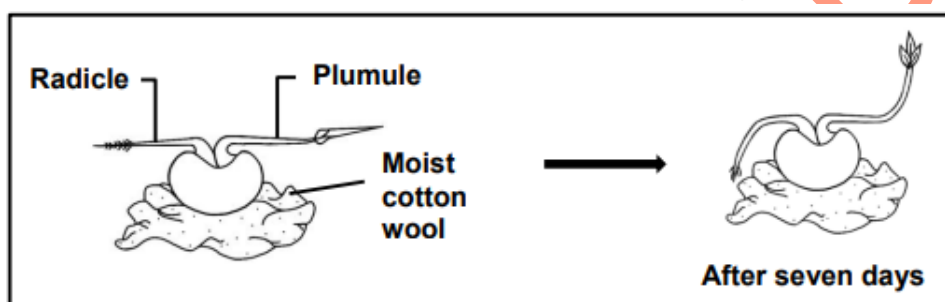
Figure 1D

RESPONDING TO ENVIRONMENT (PLANTS)

Candidates struggled in giving the correct answer, auxins. **Plant Hormones are not given enough teaching time because teachers rush from Endocrine System to Evolution as these are chapters that carry many marks in the exam.** Plant hormones is often tested as part of the Investigation question therefore more in depth knowledge is required.

6. An experiment was set up to investigate a plant response to a stimulus.
A seedling has a radicle (young root) and plumule (young stem)

This seedling was placed horizontally in a dark place and a growth response was observed after seven days, as shown in the diagram below.



- 6.1. Name the:

a) Growth response observed after seven days (1)

Geotropism/Gravitropism ✓

b) Plant hormone responsible for the growth response named in QUESTION 6.1.a (1)

Auxins ✓

- 6.2. Explain the growth response observed in the root of the seedling (5)

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 ✓

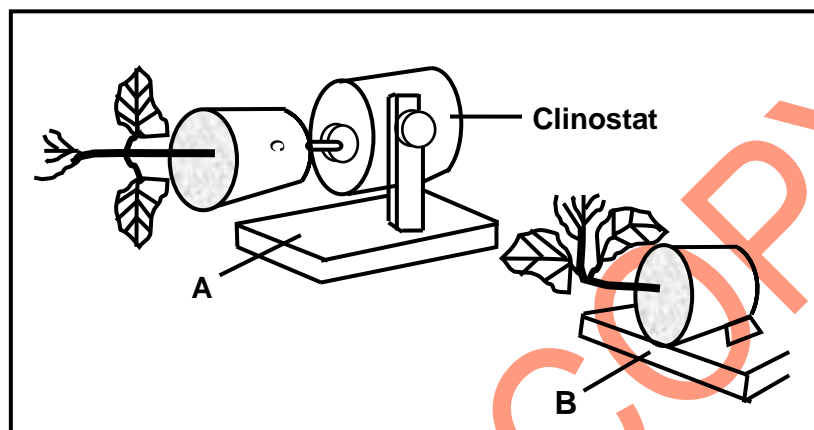
- 6.3. Explain how a control set-up will be different from the above set-up. (2)

The seedlings must be rotated constantly ✓

To remove the effect of gravity ✓

- 7.1. A group of Grade 12 learners set up the following apparatus in their classroom. Two plants were used. One was placed on a clinostat that rotated (Diagram A) and the other was placed in a stationary position (Diagram B). They left the apparatus in these positions inside a dark cupboard for two weeks before making the observations as indicated in the diagram below.

NOTE: A clinostat is an apparatus that is able to rotate.



- 7.1.1 What type of plant growth movement was observed? (1)

Geotropism ✓

- 7.1.2. Briefly explain the results observed in:

- (a) **A** (3)

- As the plant was constantly rotating, there was an equal distribution of auxins throughout
- the stem ✓
- therefore, there was no unequal growth of the stem ✓
- And the stem continued to grow straight ✓

- (b) **B** (4)

- As the plant was placed on its side, auxins accumulated at the Lower side of the stem ✓
- because of the gravitational force ✓
- A high concentration of auxins on the lower side of the stem
- Stimulated the growth of the stem ✓
- Thus, unequal distribution of auxins caused unequal growth of The stem on the lower side ✓ /the stem grew more on the lower side
- causing the stem to bend/grow upwards ✓

Any 4)

- 7.1.3. State ONE reason why the apparatus was placed in a dark cupboard for the duration of the investigation. (1)

- To eliminate the effect of light ✓ on the growth movement of the stems / To prevent phototropism from influencing the results

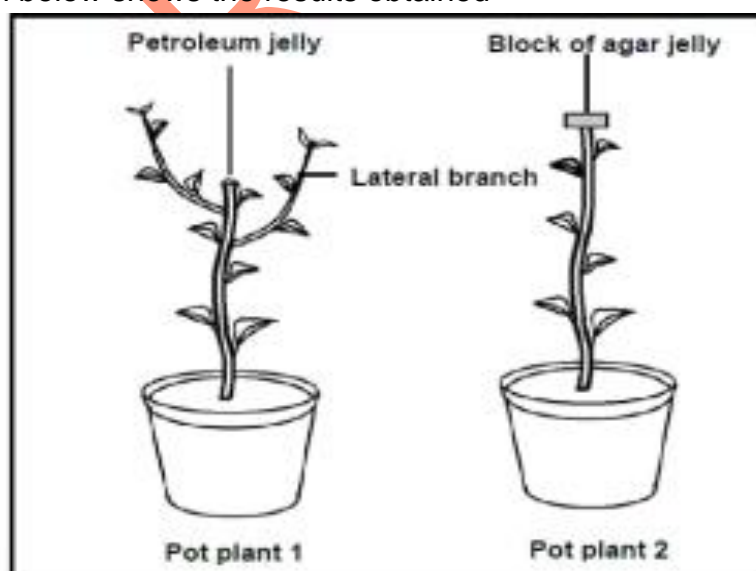
The investigation type of questions are basically challenging even for the strong candidates. Most rely on memory and are not able to explain a new concept or result. This is due to too much emphasis placed on learning for the examination rather than learning for understanding. This can be seen from learner's "workbooks" answers to questions that require application to new situations.

7.2. An investigation was done to determine the effect of a plant hormone on plant growth.

The procedure was as follows:

- Two pot plants (1 and 2) of the same species and age were used.
- The apical buds of both plants were cut at the same length along the stem.
- The cut surface of plant 1 was sealed with **petroleum jelly**.
- The cut apical of pot plant 2 was placed on a block of agar jelly for 2 hours.
- The block of agar jelly was then placed on the cut surface of plant 2.
- The plants were exposed to the same environmental conditions for 2 weeks.
- The growth of both plants was observed at the end of this period.

The diagram below shows the results obtained



7.2.1. State why the apical bud was placed on a block of agar jelly for 2

hours

(2)

- So that the plant hormone✓ / auxins from the apical tip
- could diffuse into the block of agar jelly✓

7.2.2. Describe the results obtained for plant 1. (2)

So that the plant hormone✓ / auxins from the apical tip
could diffuse into the block of agar jelly✓

7.2.3. Explain how fruit farmers can use the knowledge from the results in QUESTION 7.2.2. (2)

- The stem stopped growing upwards✓
- Lateral branches developed✓

7.2.4. Explain why the stem in pot plant 2 grew upwards (3)

- (Lateral) branches develop✓
- that can bear more fruit✓ / increased yield

OR

- Shorter trees✓ / development of lateral branches
- makes harvesting of fruit easier✓

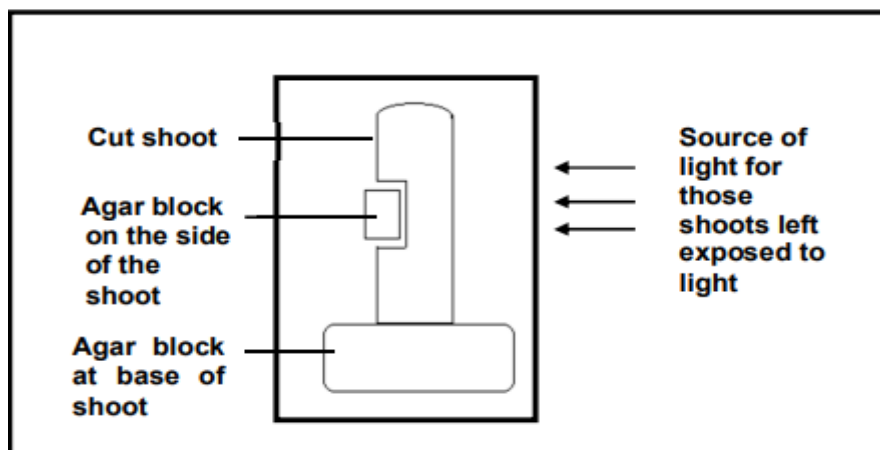
Any (1 x 2)

7.3. A group of Grade 12 learners investigated the effect of light on the amount of auxin distribution in shoots.

The diagram below shows how the investigation was carried out.

The following procedure was followed:

- 10 Shoots were removed from young plants, and each was placed on a block of agar.
- A second block of agar was placed on the side of each shoot where a portion of the tissue had been cut away.
- Half of the shoots were left in darkness and half were exposed to a light source from one side.
- The samples of the shoots treated in this way were left for several hours.
- The concentration of auxin collected in the two blocks of agar from each shoot was measured and the averages calculated



7.3.1. State the dependent variable for this investigation. (1)

Amount of auxin distributed ✓

7.3.2. Give a reason why some shoots were left in darkness, and some were exposed to a light source. (2)

- To act as a control ✓
- to validate the results ✓

7.3.3. State:

(a) **TWO** ways in which the reliability of the results could be ensured. (2)

- Repeat the investigation ✓
 - Use more than 10 shoots ✓ / a larger sample ✓
- (MARK FIRST TWO ONLY)**

(b) **THREE** ways in which the validity of the results could be ensured. (3)

- Using plants of the same age ✓
 - Using plants of the same species ✓
 - Treating plants in the same way ✓ / time
- (MARK FIRST THREE ONLY)**

7.4. An investigation was conducted to determine the effect of gravity on the direction of root growth in germinating seeds.

The procedure was as follows:

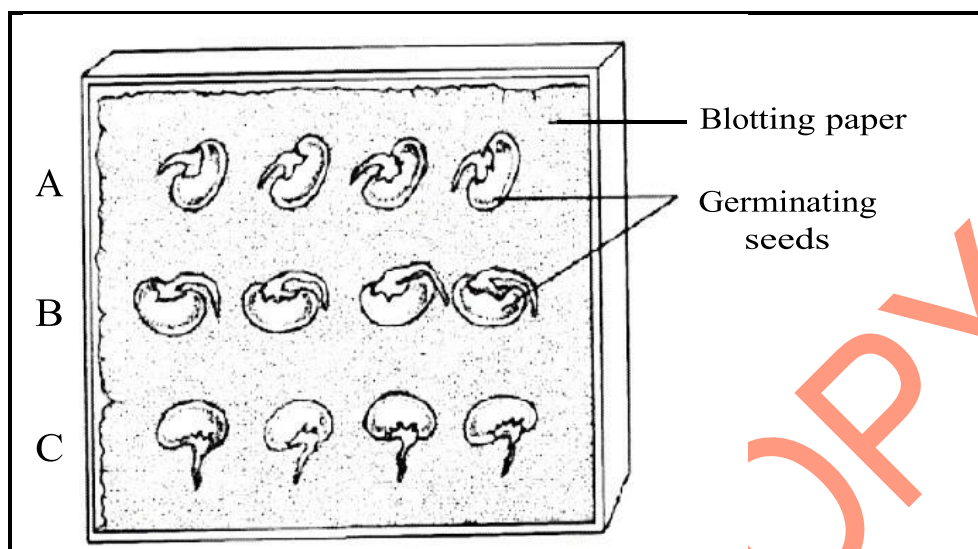
- A glass jar was lined with a layer of thick blotting paper
- 12 germinating bean seeds were placed between the glass jar and the blotting paper as follows:

A. 4 seedlings with their root tips pointing horizontal

B. 4 seedlings with their root tips pointing upwards

C. 4 seedlings with their root tips pointing downwards

- The glass jar received light from all directions
 - The growth response of the root tips was observed
- The diagram below shows the observation made after a week



7.4.1. In this investigation, identify the:

- Independent variable (1)
 - **Gravity** ✓
- Dependent variable (1)
 - **Direction of root growth** ✓

7.4.2. Mention TWO ways in which the validity of the investigation could have been improved. (2)

- **Use beans of the same species** ✓
- **Expose seeds to the same environmental conditions** ✓ / **light** ✓ / **temperature** ✓

(Mark first TWO only)

7.4.3. Give the name of the growth in response to gravity as observed in this investigation. (1)

- **Geotropism** ✓

7.4.4. Why did the investigator use 4 bean seeds for each group? (1)

- **To improve reliability** ✓ **of the results**

7.4.5. Explain the results of the investigation as observed in group A. (5)

- **Auxins** ✓
- **moved to the lower side of the root** ✓
- **because gravity attracts auxins** ✓
- **Therefore, there was high concentration on the lower side of the root** ✓
- **There will be a low concentration of auxins on the upper side of the root** ✓
- **More growth occurs on the upper side of the root** ✓
- **on the lower side the high concentration inhibits/slows down growth** ✓

- Uneven growth will result with the root bending downwards✓
towards gravity.

Any

(5)

TUTOR'S COPY

HUMAN ENDOCRINE SYSTEM: Chemical Coordination

Define:

Hormones: *Hormones are the body's chemical messengers. They are made up of proteins*

Endocrine gland: *(ductless gland) Releases hormones directly into the bloodstream*

Exocrine gland: *Gland that release discharges (juices) into ducts*

Hypothalamus gland secretes

ADH (Antidiuretic Hormone)

Function: *Controls the concentration of water in the blood*

Target organ: **Kidney**

Thyroid Gland. Releases **Thyroxin**

Functions:

- * Controls basic metabolic rate
- * Increases heart rate
- (Uses all energy from food - could lead to a person being underweight)*

gland secretes

Adrenalin

Functions: *Increases:*

- * Heartbeat and blood pressure
- * Conversion from glycogen to glucose
- * blood supply to the cardiac and skeletal muscles
- * rate and depth of breathing
- * diameter of pupils

Function: *Decreases* blood flow to the digestive system and the skin

Aldosterone

Target Organ: **Kidney**

Function:

- * Regulates **Salt** concentration in the blood *(regulates the salt balance)*

Pituitary gland (Hypophysis) secretes:

Complete the table below

HORMONE	FUNCTION
i) GH (growth hormone)	<i>Stimulates growth of the body</i>
ii) <i>Thyroid stimulating hormone (TSH)</i>	Stimulates the thyroid gland to secrete thyroxin
<i>Reproductive hormones</i>	
iii) FSH	<i>Stimulates follicle development</i>
iv) LH	Stimulates ovulation and development of the corpus luteum
v) Prolactin	<i>Stimulates milk production</i>

Pancreas : Islets of Langerhans secretes

Insulin

Functions:

- * When blood-glucose level is high
- * Converts glucose to glycogen, to decrease blood glucose levels

Glucagon ('released when the glucose is gone')

Functions:

- * When blood-glucose level is low
- * Converts glycogen to glucose, to increase blood glucose levels

Ovary

(Female gonad) secretes

Oestrogen

Functions:

- * Thickens the endometrium
- * Stimulates puberty in females

Progesterone

Functions:

- * Maintains pregnancy
- * Inhibits the release of FSH

Testes

(Male gonad) produces

Male hormone: **Testosterone**

Functions:

- * Stimulates secondary sexual characteristics in males
- * Stimulates the maturation of sperm cells
- * Stimulates puberty in males
- * Stimulates the male sexual organ

Reproductive Hormones

ENDOCRINE SYSTEM & HOMEOSTASIS

- Difference between an endocrine and an exocrine gland
- Definition of a hormone
- Location of each of the following glands, using a diagram, the hormones they secrete and function(s) of each hormone:
 - ☐ Hypothalamus (ADH)
 - ☐ Pituitary/Hypophysis (GH, TSH, FSH, LH, prolactin)
 - ☐ Thyroid glands (thyroxin)
 - ☐ Islets of Langerhans in the pancreas (insulin, glucagon)
 - ☐ Adrenal glands (adrenalin, aldosterone)
 - ☐ Ovary (oestrogen, progesterone)
 - ☐ Testis (testosterone)
- Homeostasis as the process of maintaining a constant, internal environment within narrow limits, despite changes that take place internally and externally.
- The conditions within cells depend on the conditions within the internal environment (the tissue fluid)
- Factors such as carbon dioxide, glucose, salt, water concentration, temperature and pH must be kept constant in the internal environment (tissue fluid)
- Negative feedback mechanism controlling each of the following in the body:
 - ☐ Thyroxin levels
 - ☐ Blood glucose levels
 - ☐ Blood carbon dioxide levels
 - ☐ Water balance (osmoregulation)
 - ☐ Salt
 - ☐ Disorders caused by an imbalance in levels of:
 - ☐ Thyroxin – Goitre
 - ☐ Blood glucose – Diabetes mellitus

NOTES

Endocrine	Exocrine
<ul style="list-style-type: none"> • Have no ducts/ are ductless. • Secrete hormones. • Pour their secretions directly into the bloodstream to reach target organs. 	<ul style="list-style-type: none"> • Have ducts. • Secrete enzymes or digestive juices. • Pour their secretion directly into ducts e.g. salivary duct of the salivary gland.

Homeostasis

The process maintaining a constant internal environment within narrow limits, despite changes that take place internally and externally.

Negative Feedback mechanism

Negative feedback mechanism is a type of regulation in biological systems in which the end product of a process leads to the reducing of the stimulus of that same process.

OSMOREGULATION: ADRENAL GLAND(ALDOSTERONE) & PITUITARY GLAND(ADH)

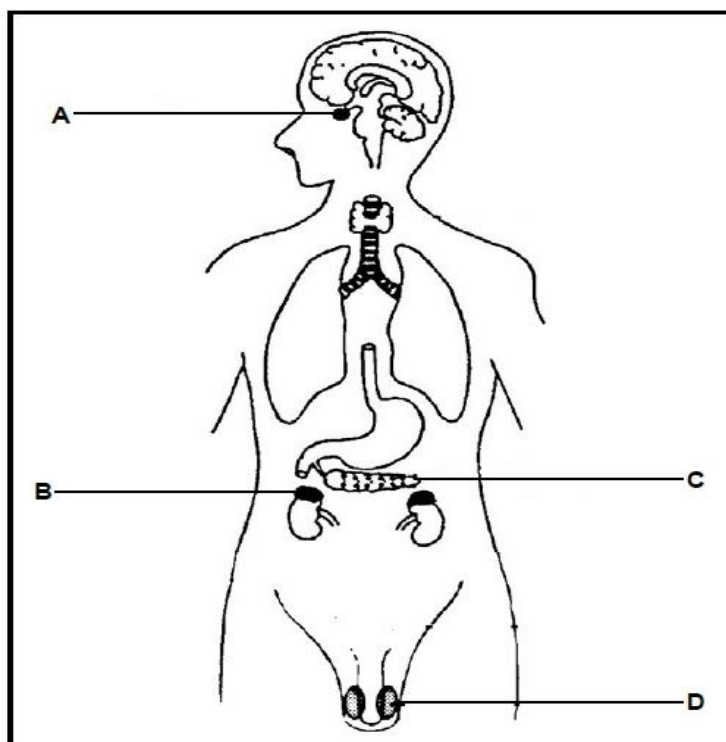
NOTES

- Both ADH and Aldosterone are responsible for OSMOREGULATION.
- ADH controls water concentration in the blood while Aldosterone controls the Sodium concentration in the blood. Both these have an effect on the concentration of the blood.
- When explaining the effect of ADH and Aldosterone it is important that you describe the comparative degree to which they are secreted, and they are affecting the body. These hormones are continually produced but the quantity changes as the conditions change)
When explaining how the secretion of, you need to use the key words **MORE, INCREASES and REABSORBED.**
e.g. MORE ADH is secreted which makes the renal tubules **MORE** permeable. **MORE** water is **REABSORBED.**
Water is **REABSORBED** into the blood not absorbed. It is important that reabsorbed is used as the water was in the blood vessels before it was filtered into the nephron during glomerular filtration. Therefore, the water will now be moving back into the blood. i.e. reabsorbed
- Remember that you are explaining the concentration of water and salt in the **BLOOD** not in the body.

What if a person eats salty chips on a hot day

- the blood will have a high salt content
- and therefore less/no aldosterone will be secreted
- resulting in less salt reabsorbed into the blood
- more salt secreted in the urine
- the blood will have less water than normal
- and therefore, more ADH will be secreted
- making the kidney tubules more permeable
- resulting in more water reabsorbed into the blood / less water lost in the urine

8. The diagram below represents parts of the endocrine system in human



8.1.1. Identify gland:

(a) A (1)

Hypothalamus/Pituitary gland✓

(b) B (1)

Adrenal gland ✓

8.1.2. Give the LETTER and the Name of the gland of the gland the secretes a hormone responsible for

(a) Starting puberty in males (2)

D✓ - Testis✓

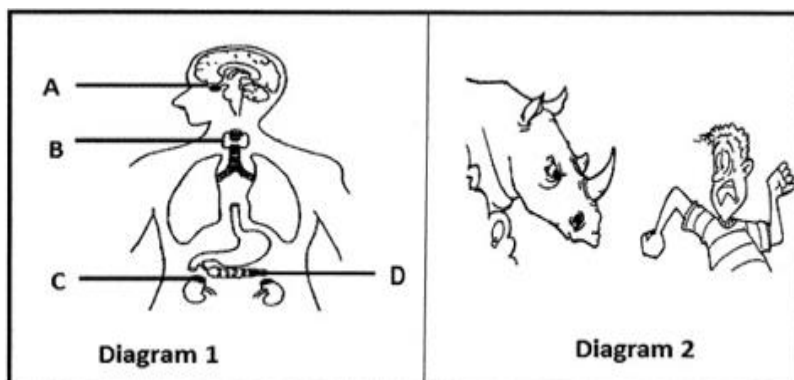
(b) Stimulates absorption of glucose by cells (2)

C✓ – Pancreas/Islets of Langerhans✓

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

A✓ – Hypophysis/pituitary gland✓

8.2. Study the diagram below and answer the questions that follow:



8.2.1. All four glands in Diagram 1 were stimulated in the person shown in the Diagram 2. Which gland, A or B was stimulated first? (1)

A✓

8.2.2. Write down only the letter of the gland that produces.... (1)

a) An iodine containing hormone, (1)

B✓

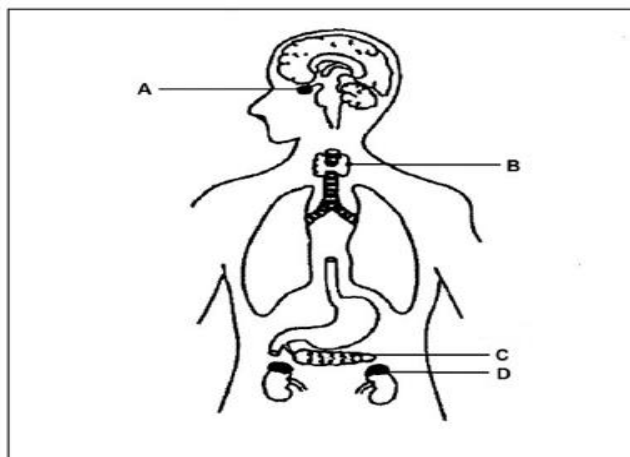
b) A hormone that controls the growth of long bones. (1)

A✓

c) A hormone that is involved in the re-absorption of some salt by the kidneys (1)

C✓

8.3. The diagram below indicates the position of some human endocrine glands. Study and answer the questions that follow.



8.3.1. Identify the parts labelled A, B and C (3)

A-Hypothalamus✓/Pituitary

B-Thyroid gland✓

C-Pancreas✓

8.3.2. Write down only the LETTER of the part that:

a) Requires iodine in order to function properly (1)

B✓

b) Regulates the release and functioning of other endocrine glands (1)

A✓

8.3.4. Describe the negative feedback mechanism in the interaction between parts A and B (4)

- The pituitary gland (A) secretes the hormone TSH ✓ which
- stimulates the thyroid gland (B) to secrete thyroxine. ✓
- an increase in thyroxine in the blood inhibits the pituitary (A)
- which secretes less TSH. ✓
- this causes the thyroid gland to secrete less thyroxine. ✓
- which in turn reduces the inhibitory effect on the pituitary gland ✓
- which will then increase the amount of TSH that it secretes. ✓

8.4. An oral glucose tolerance test is used to determine if a person is diabetic.

After a period of fasting (no food intake) the person drinks a glucose solution. The person's blood glucose levels are then measured at regular intervals.

If the person's blood glucose level is above 200mg/100ml two hours after drinking the glucose solution then the patient is diagnosed as being diabetic.

The results of a glucose tolerance test performed on three different patients (1, 2 and 3) are provided in the table below.

Time (minutes)	Blood glucose levels (mg/100ml)		
	Patient 1	Patient 2	Patient 3
0 (glucose solution is ingested)	85	130	100
30	125	215	210
60	100	250	180
90	85	260	170
120	80	240	160

8.4.1. Identify the dependent variable in the investigation. (2)

Blood glucose level ✓

8.4.2. Identify **TWO** factors that should be kept constant in this investigation. (2)

- Mass of the patients ✓
 - Age of patients ✓
 - Gender of patients ✓
 - Length of fasting ✓
 - Amount of glucose solution given to patients ✓
 - Person conducting the measurement ✓
 - Time of measurement for all patients ✓
 - Instrument used for measuring glucose level ✓
- (Any 2)
- (Mark first TWO only)**

8.4.3. Explain why patient **1** and **3** were **NOT** diagnosed as diabetic. (2)

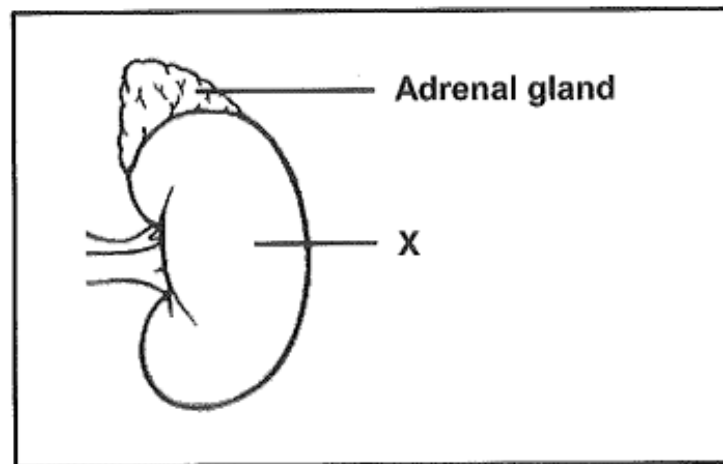
- **Their regular glucose level went below 200mg/100ml before 2 hours✓✓**

8.4.4. The normal blood glucose level in the blood is 90mg/100ml.

Explain how the blood glucose levels in the blood of patient **1** will be regulated over the next 30 minutes following the investigation (3)

- The pancreas will secrete more glucagon✓
- which will convert more glycogen into glucose✓
- causing the glucose level to increase✓ up to 90mg/100ml

8.5. The diagram below shows the location of the adrenal gland in the human. body.



8.5.1. Identify:

(a) Organ X (1)

Kidney✓

(b) The system to which the adrenal gland belongs (1)

Endocrine✓

8.5.2. State TWO characteristics of the type of glands that belongs to the system identified in Question 8.1.1 (b). (2)

- **it releases hormones✓**
- **directly into the blood✓ / it is ductless**

8.5.3. Describe the interaction between the adrenal gland and organ X in maintaining homeostasis when salt levels in the blood are low. (5)

- **Low salt levels are detected by receptor cells✓ in the kidney**
- **Adrenal glands are stimulates✓ to secrete**
- **more aldosterone✓**
- **which stimulates the renal tubules✓**
- **to be more permeable to salt✓**

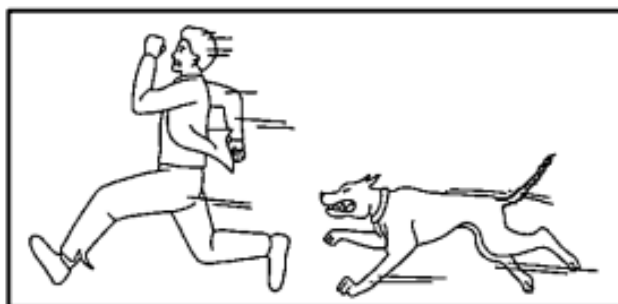
- This increases the reabsorption of salt✓ and
- the salt levels in the blood increases✓ / returns back to normal

8.5.4. Explain the effect that a secretion of the pituitary gland will have on organ X when a person experiences dehydration. (5)

- the secretion of ADH✓
- will increase✓
- which will increase the permeability✓
- of the renal tubules✓ in X
- so that more water is reabsorbed✓ from the filtrate

ADRENAL GLAND (ADRENALIN)

8.6. The diagram below represents a “fight or flight” reaction in humans.



8.6.1. Name the gland that is responsible for this reaction. (1)

Adrenal gland✓

8.6.2. State the location of the gland named in QUESTION 8.6.1. in the human body. (1)

On top of the kidneys✓

8.6.3. Explain the effect of adrenaline on the heart and the respiratory system during the situation shown in the diagram above. (5)

- it stimulates the breathing muscles✓
- and this increases 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✓

8.6.4. Describe the changes in the blood vessels that take place when adrenalin is secreted. (4)

- Dilates the blood vessels to muscles and brain✓
- to supply them with MORE blood carrying oxygen and glucose✓
- Constricts blood vessels to digestive system and skin✓
- so LESS blood is sent there and MORE blood is diverted to muscles and brain✓

8.6.5. Explain the changes in the muscles of the iris in response to adrenalin. (4)

- Radial muscles contract✓
- circular muscles relax✓
- pupil dilates✓
- to allow more light to enter the eye✓

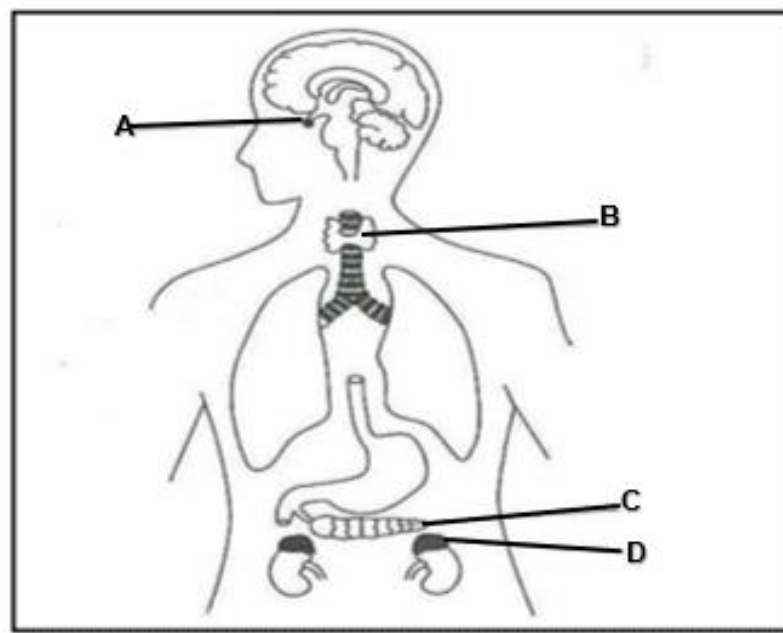
PITUITARY GLAND (GH, TSH) & THYROID GLAND (THYROXIN)

NOTES

- Remember all hormones secreted by Pituitary gland have acronyms
 - FSH → Follicle stimulating Hormone
 - LH → Luteinising hormone
 - GH → Growth Hormone
 - TSH → Thyroid stimulating hormone

TSH is continually produced in the body. The amount of TSH will vary according to the amount of thyroxin in the blood. Therefore, when describing the TSH-Thyroxin negative feedback mechanism always refer to **MORE** or **LESS** TSH being secreted.

8.7. The diagram below represents the human endocrine system.



8.7.1. Give TWO reasons why the glands in the diagram are considered to be endocrine. (2)

- it releases hormones✓
- directly into the blood✓ / it is ductless

8.7.2. Give the LETTER and NAME of the gland that produces Growth hormone. (1)

A✓ - pituitary✓ gland /hypophysis

8.7.3. Give ONE effect of the over secretion of Growth Hormone in children. (1)

Giantism✓

8.7.4. Name the type of interaction that occurs between gland A and B. (1)

Negative Feedback Mechanism✓

8.7.5. Explain how gland A and B will respond when the thyroxin levels in the blood are low. (5)

- low thyroxin levels will...
- stimulated the pituitary gland✓ / gland A to secrete
- more TSH✓
- High TSH stimulates the thyroid gland✓
- to secrete more thyroxin✓
- thyroxin levels will increase and return to normal✓

8.7.6. Explain how high thyroxin levels can lead to weight loss. (4)

- **an increase in thyroxin increases metabolic rate✓// cellular respiration**
- **more glucose is oxidised✓// used in respiration to release more energy**
- **less glucose is stored✓**
- **fat is broken down✓**
- **increasing weight loss✓**

8.7.7. Name the disorder that results when gland B becomes overstimulated and enlarged

(1)

Goitre✓

PANCREAS (INSULIN & GLUCAGON)

NOTES

- After a meal, the glucose levels in the blood increase. The glucose levels in a diabetic person will take longer to decrease after a meal. They will not increase higher.
- There are TWO types of diabetes mellitus.

Type 1 diabetes – pancreas no longer produces insulin and glucagon. Therefore, it cannot control blood sugar level.

Insulin injection before meals prevents glucose level going to high.

If glucose level drops a sweet can be eaten.

Type 2 – Body cells become resistant. The pancreas still make insulin, but the cells do not respond to it.

Insulin functions by opening channels in the cell membrane. This allows glucose to move from the blood into the cells. Therefore, lowering the blood glucose. If there is no insulin or cell are resistant to insulin, then the glucose cannot move into the cells and the blood glucose level remains high. The cells will also not have enough glucose for cellular respiration. This will mean that the person will not have energy and feels tired and weak.

- **Why are smaller meals/low GI foods better for a diabetic**

- A diabetic does not produce sufficient insulin
- when eating smaller meals/low GI foods less glucose enters into the blood
- less insulin needs to be produced
- to return blood glucose to normal

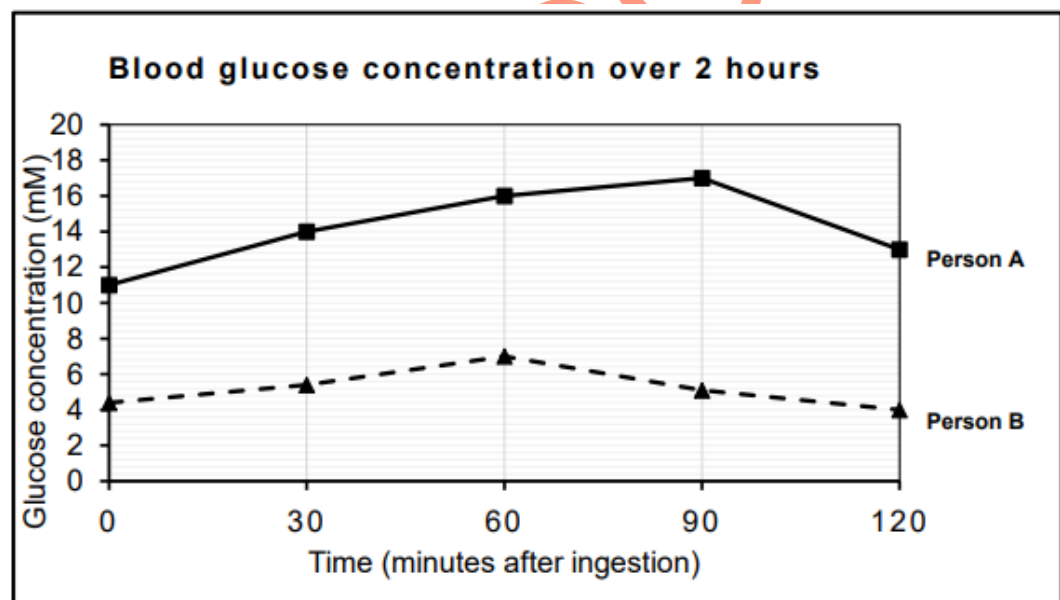
OR

- when eating larger meals/high GI foods
- more glucose enters the blood
- more insulin must be produced
- to return blood glucose to normal

➤ **Explain the blood glucose levels in a person who consumed a drink with high sugar levels**

- Blood glucose levels rise
- it stimulates the pancreas
- to secrete more insulin into the blood
- which causes the cells to uptake more glucose
- more glucose is converted into glycogen and stores in the liver and muscles
- and glucose levels return to normal

8.9. The graph below shows the blood glucose concentration of two people (**A** and **B**) over a period of 2 hours after they had consumed 100g of glucose drink.



8.9.1. Person A is not able to regulate his blood glucose level effectively.

(a) Name the disease that person **A** has.

(1)

Diabetes✓ mellitus

(b) Explain ONE possible reason why the blood glucose concentration remains high in person **A**.

(2)

No insulin available✓

To change glucose into glycogen✓

- 8.9.2. Calculate the difference between the blood glucose concentration of person A and person B 120 minutes after ingesting the glucose drink. Show all calculations. (2)

$$13 - 4 \checkmark = 9 \text{ mm}\checkmark$$

- 8.9.3. From the graph, describe TWO visible differences in the glucose concentration of person A and person B over the period of the investigation. (4)

Glucose concentration was higher in person A in the beginning than in person B✓✓

Glucose concentration increased more in person A than person B✓✓

Glucose concentration took longer to decrease in person A than person B✓✓

Any 2 x 2

- 8.9.4. Name TWO hormones that will have the opposite effect on the blood glucose concentration to that of insulin. (2)

Glucagon✓

Adrenalin✓

- 8.9.5. Explain the change in the graph between 60 and 90 minutes in person B. (6)

High glucose concentration✓ **in the blood**

Stimulates the pancreas✓

to produce insulin✓

Insulin stimulates the cells to increase the uptake of glucose from the blood✓

It also converts glucose into glycogen✓

Which is stored in the liver✓

Therefore reducing the glucose level in the blood✓

CARBON DIOXIDE REGULATION

NOTE

- Carbon dioxide levels in the blood **lower** the pH of the blood and this can have a negative effect on metabolic processes.
- CO₂ is one of the end products of cellular respiration.
- CO₂ dissolves in water forming carbonic acid.
- The more carbon dioxide there is in the blood, the more acidic the blood becomes. Changes in pH influence enzyme activity.
- The body will **ONLY LOWER** levels of carbon dioxide.

8.9.6. Explain how high carbon dioxide levels are regulated in the body. (5)

- receptor cells in the carotid artery in the neck/aorta are stimulated✓
- they send impulses to the medulla oblongata✓
- which sends impulses to the breathing muscles to contract more actively✓
- increasing the rate and depth of breathing✓
- An impulse is also sent to the heart muscle to beat faster✓
- more carbon dioxide is taken to the lungs to exhale✓
- carbon dioxide levels return to normal✓

PITUITARY (FSH, LH), OVARIES (OESTROGEN, PROGESTERONE) & TESTES (TESTOSTERONE)

NOTES

Some standard questions and responses on Reproductive hormones

If testosterone is not produced

- Secondary sexual characteristics in males won't develop
- Spermatogenesis will not occur

Increase in oestrogen

- causes the endometrium to become more vascular and thicker
- oestrogen also inhibits FSH so other follicles develop / only one follicle develops at a time

If there is no oestrogen secreted

- Secondary sexual characteristics won't develop in females
- The endometrium won't thicken and no implantation of embryo will occur
- FSH will not be inhibited and it will stimulate another ovarian follicle to develop

Increase in progesterone

→ progesterone contraceptive pills increase progesterone

- Inhibits FSH
- therefore, no more Graafian follicles will develop
- no ovulation will take place / no ova will be produced
- therefore, no ova will be fertilised preventing pregnancy

→ progesterone remains high in pregnancy as placenta secretes it

- causes the endometrium to become more vascular and thicker/ maintains endometrium
- so that embryo can implant
- Inhibits FSH
- therefore, no more follicles will develop
- no ovulation will take place / no ova will be produced
- therefore, no further ova will be fertilised and the endometrium will be maintained

for the duration of pregnancy

If too little progesterone is secreted

- the endometrium will not thicken enough
- causing the blastocyst not to implant
- the endometrium will not be maintained
- and this could lead to a miscarriage

What would happen if no LH was produced

- no ovulation therefore no fertilization

If FSH is not produced

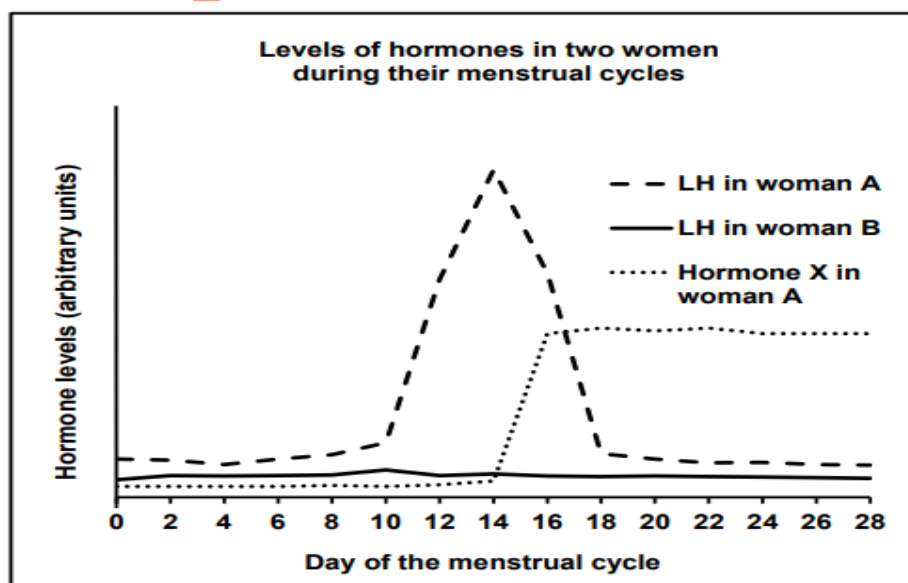
- no follicle will develop into Graafian follicle
- no ovum would develop/ no ovulation

If FSH concentration increased (in fertility treatment - FSH injections)

- It would stimulate more than one follicle to develop
- resulting in many Graafian follicles
- and numerous ova would be released
- meaning higher chance of fertilization
- resulting in multiple embryos (twins, triplets, quadruplets etc)

8.10.1. Sheehan's syndrome is a condition that results in females having very low levels of the luteinising hormone (LH).

The graph below shows the hormone levels of two different women during a 28-day menstrual cycle. Woman **A** has normal luteinising hormone (LH) levels while woman **B** suffers from Sheehan's syndrome.



8.10.2. State TWO functions of LH in the menstrual cycle. (2)

- stimulates ovulation✓
- stimulates the development of the corpus luteum✓

8.10.3. Besides LH, name ONE other hormone that is secreted by the pituitary gland during the menstrual cycle. (1)

Follicle stimulating hormone✓ /FSH

8.10.3. Give the name of hormone X. (1)

Progesterone✓

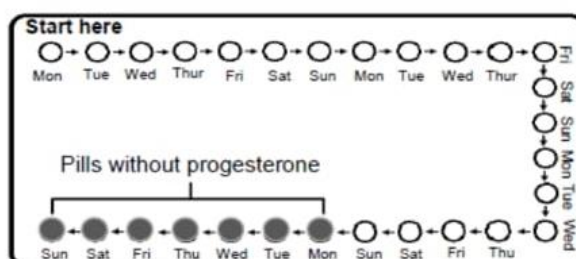
8.10.4. Use the information in the graph to explain how the level of hormone X will be different in woman B. (4)

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

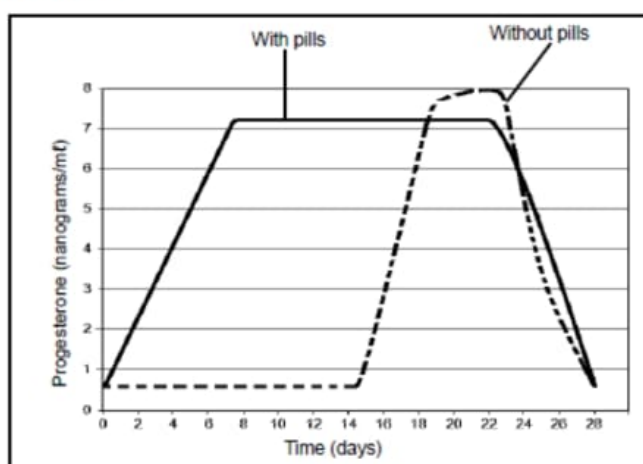
8.10.5. What evidence in the graph suggests that woman A is pregnant? (1)

Hormone X /progesterone levels remain high✓

8.11. Contraceptives are used to prevent pregnancy. Some females use pills that contain progesterone. In one packet there would be 28 pills, of which 21 contain different concentrations of progesterone according to the day in the cycle and the remaining 7 will contain no progesterone. A female has to take one pill daily at the same time in a given sequence, as shown below.



The graph below shows the difference in the progesterone levels during a menstrual cycle of a woman taking contraceptive pills and a woman not taking contraceptive pills



8.11.1. Name the organ that naturally produces progesterone in the female body. (1)

ovary✓

8.11.2. The oestrogen levels between day 8 and 22 will remain low in the woman who takes contraceptive pills. Explain why this is the case. (4)

- The high levels of progesterone✓ in the pill**
- will inhibit the pituitary gland secreting FSH✓**
- No follicle will develop✓ therefore**
- no oestrogen will be secreted✓**

8.11.3. Ovulation took place on day 14 in the woman not taking contraceptive pills. Explain the evidence in the graph that supports this conclusion. (2)

- The increase in the progesterone level✓**
- indicates that the corpus luteum has been formed✓**

8.11.4. Suggest ONE reason for including pills with no hormones in the contraceptive pill packet. (1)

- Women will stay in the habit of taking a pill everyday✓ / will not forget to take the progesterone containing pills**
- To allow menstruation to occur✓**

8.12. Male hormone contraceptive (birth control) pills have been in development for over 50 years. The pills contain a substance called TU, which inhibits the secretion of testosterone. There is, however, no product available on the market yet mainly due to many side effects associated with the product.

An investigation was done to determine how TU affects male fertility.

The procedure was as follows.

- 300 healthy, male volunteers were selected.
- A sperm count for each volunteer was done initially.
- Each volunteer was given 500mg of TU over a period of 12 months.
- During the period of investigation, the volunteers were asked to wear loose-fitting trousers and underwear made of the same light fabric.
- A sperm count was done weekly over a period of 24 months.
- The average sperm count was calculated per volunteer.

NOTE: Sperm count refers to the total number of healthy sperm per ml of semen and is an indication of male fertility.

8.12.1. Identify the dependant variable in the investigation. (1)

Male fertility✓

8.12.2. State how the dependant variable in Question 5.6.3.1 was measured. (1)

Measuring the sperm count✓

8.12.3. Name TWO other factors that should be considered when selecting volunteers. (2)

- Age✓
- Diet✓
- Exercise✓
- Activity level✓
- Lifestyle✓
- Occupation✓ etc.

8.12.4. Explain how TU reduces fertility. (2)

- TU inhibits the secretion of testosterone✓
- spermatogenesis cannot take place✓/ no sperm will be produced

8.12.5. Explain why wearing tight-fitting trousers will decrease male fertility. (2)

- The higher temperature / pressure of the testes✓ due to the tight underwear
- could decrease the sperm count✓ /sperm production / lead to the production of abdominal sperm

8.12.6. Suggest ONE reason for doing the sperm count for an additional 12 month after stopping the TU treatment. (1)

- To determine if TU is still effective after 12 months✓
- To see if the sperm count returns to normal✓ when the treatment Stops

8.12.7. The contraceptive options that are currently available for men are limited to condoms and vasectomy. Vasectomy involves the cutting and tying of both vas deferens.

Explain how a vasectomy prevents pregnancy. (2)

- no sperm will be transported✓
- from the epididymis to the urethra✓
- semen without sperm will be released✓

THERMOREGULATION

- Structure of the skin, using a diagram, with an emphasis on the parts involved in thermoregulation
- Role of the following in negative feedback mechanism for controlling temperature/thermoregulation:
 - ☐ Sweating
 - ☐ Vasodilation
 - ☐ Vasoconstriction

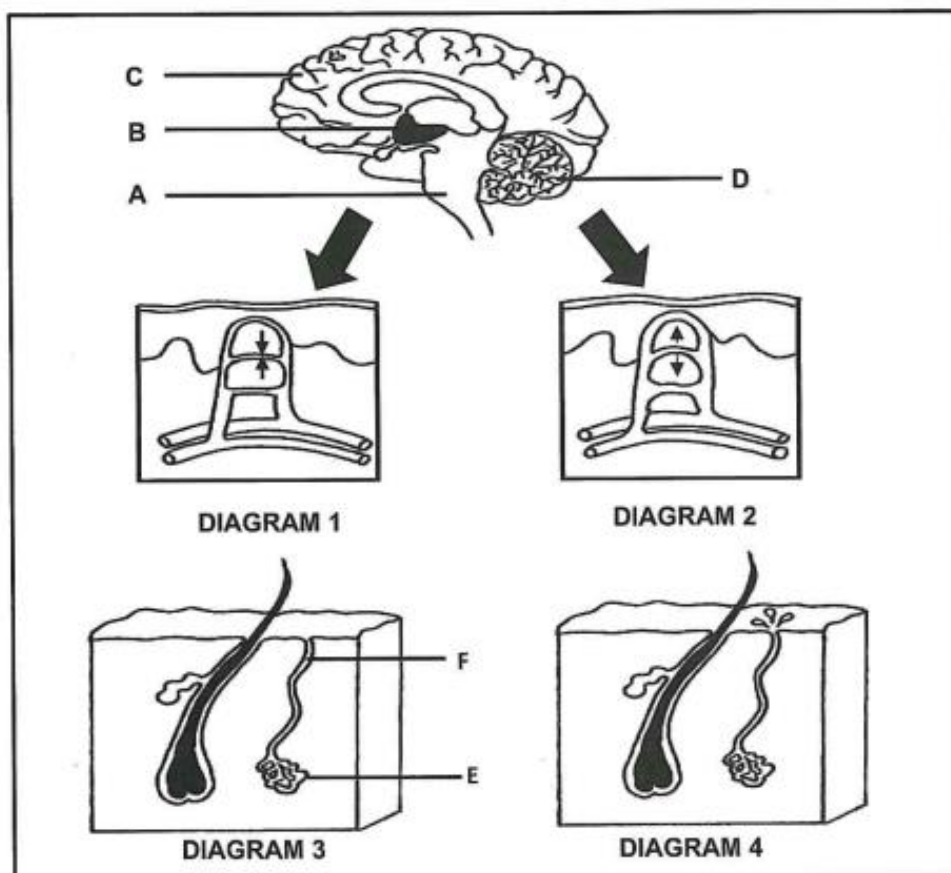
NOTES

Skin temperature may differ from core temperature in humans. The skin temperature is the temperature on the surface of the skin. Core temperature refers to the temperature within the body.

When exercising the core temperature will increase due to the increase in respiration in the body. However, skin temperature will decrease because heat is being lost on

the surface of the skin due to sweating.

8.13. The Diagrams below show parts of the homeostatic control process in humans.



8.13.1. Identify the homeostatic process represented by the diagrams above. (1)

Thermoregulation✓

8.13.2. Name the process that is represented in:

(a) DIAGRAM 1 (1)

Vasoconstriction✓

(b) DIAGRAM 2 (1)

Vasodilation✓

8.13.3. Give the LETTER and NAME of the part that:

(a) Controls homeostatic process represented in the diagrams (2)

B✓ - Hypothalamus✓

(b) Is less active on a cold day (2)

E✓ - Sweat gland✓

8.13.4. State the importance of the process taking place in DIAGRAM 4. (2)

- **The sweat evaporates✓ on the surface of the skin and**
- **cools down✓ the body**

8.13.5. Explain how part B play a role in causing the effect shown in DIAGRAM 2.(5)

- **When the temperature increases✓**
- **hypothalamus/ part B is stimulated✓**
- **and sends impulses to the blood vessels✓ of the skin**
- **blood vessels dilate✓ / vasodilation occurs**
- **more blood to flow to the surface✓**
- **so that more heat is lost✓**

Topic	Mark Allocation in Paper	Study Date	Content
PAPER 2:			
DNA: The code of Life P2	27		DNA: What it is, where it is found. Role of Watkins, Crick, Franklin & Wilkens in the discovery of DNA
			Structure & Functions of DNA. Replication of DNA; DNA profiling
			RNA: Types, location, structure. Transcription and translation in Protein synthesis
Meiosis P2 (ALSO IN P1)	12		Process of meiosis (purpose, importance, genetic variation) Importance of meiosis
			Consequences of abnormal meiosis. Similarities and differences between meiosis and mitosis
Genetics and inheritance P2	45		Genes, inheritance and variation, concepts of genetic crossings (alleles, genotype, phenotype, dominant, recessive, homozygous, heterozygous, complete/incomplete/co-dominance)
			Monohybrid crosses & Dihybrid crosses
			Sex chromosomes; Mutations
			Pedigrees; Genetic engineering (stem cell research, genetic modification, cloning) Paternity testing; mitochondrial DNA
Evolution by Natural selection P2	66		Evidence for evolution; Variation; Origins of ideas (Darwin, Lamarck, punctuated equilibrium), Artificial selection, Natural selection
			Speciation, reproductive isolation, evolution in present times
Human evolution P2			Evidence of common ancestors (Bipedalism, brain size, teeth, prognathism, palate, cranial ridges, brow ridges) Main fossil sites in SA
			Out of Africa hypothesis (Ardipithecus, Australopithecus & sites where they were found)

Compiling a list of biological terms per topic for learners and regular informal tasks on biological terms might help in improving learner's comprehension of biological terms.

Informal activities in the form of word puzzle/ fill in the missing words can assist in improving spelling and terminology.

e.g. Crosswords / matching columns

Learners must be taught in the language of the exam papers to familiarize them with description and comprehension of questions generally

BIOLOGICAL TERMS: PAPER 2

Give the correct biological term for the following descriptions.

DESCRIPTIONS	BIOLOGICAL TERM
1. An allele that does not influence the phenotype when found in the heterozygous condition.	Recessive allele ✓
2. The position of a gene on a chromosome.	Locus ✓
3. The physical and functional expression of a gene.	Phenotype ✓
4. Chromosomes that are not responsible for sex determination.	Autosomes ✓
5. The process of finding a desirable gene, isolating it and then moving it into the cells of another organism.	Genetic manipulation ✓
6. The two parts of a chromosome held together by a centromere.	Chromatids ✓
7. A section of a DNA molecule that codes for a specific characteristic.	Gene ✓
8. The production of genetically identical copy of an organism using biotechnology.	Cloning ✓
9. The deliberate breeding of organisms for desirable characteristics selected by humans.	Artificial selection ✓
10. The explanation that species experience long periods without physical change, followed by short periods of rapid physical change.	Punctuated equilibrium ✓
11. The phase of meiosis during which homologous chromosomes separate and start moving towards opposite poles.	Anaphase I ✓
12. The defect in cell division that leads to Down syndrome.	Non-disjunction ✓
13. The structure that is made up of two chromatids joined by a centromere.	Chromosome ✓
14. An explanation for something that has been observed in nature and which can be supported by facts, laws and tested hypotheses.	Theory ✓
15. Similar structures on different organisms that suggest they have a common ancestor.	Homologous structures ✓
16. The complete set of chromosomes in the cell of an organism.	Karyotype ✓
17. A bar code pattern formed from DNA.	DNA profile ✓
18. The bonds formed between amino acids.	Peptide bonds ✓
19. A representation of the number, shape and arrangement of all the chromosomes in the nucleus of a somatic cell.	Karyotype ✓
20. Openings in the nuclear membrane that allow mRNA to leave the nucleus.	Nuclear pore ✓

21. A tentative explanation of a phenomenon that can be tested.	Hypothesis ✓
22. The distribution of species in different parts of the world.	Biogeography ✓
23. Chromosomes that carry the same set of genes.	Homologous chromosomes ✓
24. Two or more alternative forms of a gene at the same locus.	Alleles ✓
25. The structure responsible for pulling chromosomes to the poles of an animal cell during cell division.	Centrioles ✓
26. A phase in the cell cycle that occurs before cell division.	Interphase ✓
27. A diagrammatic representation showing possible evolutionary relationships among different species.	Phylogenetic diagram ✓
28. The type of vision shared by apes and humans that allows for depth perception.	Stereoscopic/ binocular vision ✓
29. A genetic cross involving two characteristics.	Dihybrid cross ✓
30. A genetic disorder characterised by the absence of a blood-clotting factor.	Haemophilia ✓
31. The present –day distribution of organisms.	Biogeography ✓
32. A nucleic acid that carries amino acids to the ribosome for protein synthesis.	tRNA ✓
33. The natural shape of a DNA molecule.	Double helix ✓
34. A section of DNA that codes for a specific protein.	Gene ✓
35. Evolution with long periods of no change followed by short periods of rapid change.	Punctuated equilibrium
36. The sex chromosomes of an organism.	Gonosomes ✓
37. Descent with modification over time.	Evolution ✓
38. A group of organisms of the same species in a specific habitat.	Population ✓
39. The family to which humans belong.	Hominids ✓
40. A human disorder caused by a non-disjunction of chromosome pair 21.	Down Syndrome ✓
41. The stage of protein synthesis during which mRNA forms from DNA.	Transcription ✓
42. The type of variation in a population with no intermediate phenotypes.	Discontinuous variation ✓
43. The type of inheritance where the dominant allele masks the expression of the recessive allele in the heterozygous state.	Complete dominance ✓
45. The variety of life forms that exist on Earth.	Biodiversity ✓
46. The opening in the skull through which the spinal cord	Foramen magnum ✓

enters.	
47. A testable statement that can be rejected or accepted.	Hypothesis ✓
48. Total disappearance of a species from Earth.	Extinction ✓
49. A segment of a chromosome that codes for a particular characteristic.	Gene ✓
50. The ability to walk on two limbs.	Bipedalism ✓
51. The organelle in the cytoplasm which is the site of protein synthesis.	Ribosome ✓
52. The name of the bond that forms between amino acids in a protein molecule.	Peptide bonds ✓
53. The process by which a DNA molecule makes identical copies of itself.	Replication ✓
54. The name of the process when homologous chromosome pairs fail to separate during meiosis.	Non-disjunction ✓
55. The permanent disappearance of a species from earth.	Extinction ✓
56. A testable statement that may be rejected or accepted.	Hypothesis ✓
57. The type of nucleic acid that carries a specific amino acid.	tRNA ✓
58. The selection and breeding of organisms with desirable characteristics by humans.	Artificial selection ✓
59. An allele that is not shown/expressed in the phenotype when found in the heterozygous condition.	Recessive allele ✓
60. A sudden change in the sequence/order of nitrogenous bases of a nucleic acid.	Gene mutation ✓
61. Explanation of an observation that is supported by facts, models and laws.	Theory ✓
62. The breeding of organisms over many generations in order to achieve a desirable phenotype.	Artificial selection ✓
63. The type of sugar found in a RNA molecule.	Ribose ✓
64. Type of evolution involving long periods of time when species do not change and short periods of rapid change.	Punctuated equilibrium ✓
65. The hypothesis which supports migration of human ancestors from the point of origin.	Out of Africa Hypothesis ✓
66. The mineralised remains of organisms that have lived in the past.	Fossils ✓
67. The position of a gene on a chromosome.	Locus ✓
68. The genus of the fossil "Little Foot"	Australopithecus ✓

69. A diagram showing the inheritance of genetic disorders over many generations.	Pedigree diagram ✓
70. The bond that forms between amino acids.	Peptide bond ✓
71. The phase in the cell cycle during which DNA replication occurs.	Interphase ✓
72. The first <i>Homo</i> species to use tools	<i>Homo habilis</i> ✓
73. Undifferentiated cells that develop into any type of cell.	Stem cells ✓
74. A breeding process used for the domestication of plants and animals.	Artificial breeding ✓

- 1.1 Indicate whether each of the statements in COLUMN I applies to **A ONLY**, **B ONLY**, **BOTH A AND B** or **NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B** or **none** next to the question number (1.1.1 – 1.1.3) in the ANSWER BOOK.

	COLUMN I	COLUMN II
1.1.1	Used as evidence for the 'Out of Africa' hypothesis	A: Fossils B: Mitochondrial DNA
1.1.2	Inheritance of colour-blindness	A: Sex-linked inheritance B: Complete dominance
1.1.3	Results in genetic variation	A: Mitosis B: Cloning

- 1.1 1.1.1 **Both A and B ✓✓**
 1.1.2 **Both A and B ✓✓**
 1.1.3 **None ✓✓**

(3 x 2)

- 1.2 Indicate whether each of the statements in COLUMN I applies to **A ONLY**, **B ONLY**, **BOTH A AND B** or **NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B**, or **none** next to the question numbers (1.2.1 to 1.2.3) in the ANSWER BOOK.

	COLUMN I	COLUMN II
1.2.1	The genotype of blood group AB	A: $I^A i$ B: $I^B i$
1.2.2	The type of variation with a range of intermediate phenotypes	A: Continuous variation B: Discontinuous variation
1.2.3	Cytokinesis takes place	A: Telophase I B: Telophase II

(3 x 2)

1.2. 1.2.1 None ✓ ✓

1.1.2. A only ✓ ✓

1.2.3. Both A and B ✓ ✓

(3 x 2) (6)

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

COLUMN I		COLUMN II	
1.3.1	A long period of no change in a species that is interrupted by rapid changes to form a new species	A:	Punctuated equilibrium
		B:	Natural selection
1.3.2	A sex-linked disorder	A:	Albinism
		B:	Colour-blindness
1.3.3	The causes of variation in a population	A:	Random mating
		B:	Random arrangement of chromosomes
1.3.4	A place in the cell where DNA is found	A:	Nucleolus
		B:	Mitochondria

(4 x 2) (8)

1.3 1.3.1 A only ✓ ✓

1.3.2 B only ✓ ✓

1.3.3 Both A and B ✓ ✓

1.3.4 B only ✓ ✓

1.4 Indicate whether each of the descriptions in COLUMN I apply to **A ONLY**, **B ONLY**, **BOTH A AND B** or **NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B** or **none** next to the question number (1.4.1 – 1.4.3) in the ANSWER BOOK.

COLUMN I		COLUMN II	
1.4.1	Contains uracil	A:	DNA
		B:	RNA
1.4.2	Cause of Down syndrome	A:	Gene mutation
		B:	Extra copy of chromosome number 23
1.4.3	An allele for one gene could appear in the same gamete with any of the alleles of another gene	A:	Dihybrid cross
		B:	Mendel's law of independent assortment

(3 x 2) (6)

1.4

1.4.1. B only ✓✓

1.4.2. None ✓✓

1.4.3. Both A and B ✓✓

- 1.5 Indicate whether each of the statements in COLUMN I, applies to **A ONLY**, **B ONLY**, **BOTH A and B**, or **NONE** of the items in COLUMN II. Write **A only**, **B only**, **both A and B**, or **none** next to the question numbers (1.5.1–1.5.3) in the ANSWER BOOK.

COLUMN I	COLUMN II
1.5.1 Blood types	A: Incomplete dominance B: Multiple alleles
1.5.2 Heterozygous condition expresses both alleles in gene pair	A: Co-dominance B: Incomplete dominance
1.5.3 Complete set of chromosomes in one cell	A: Karyotype B: Genome

(3 x 2)

(6)

1.5. 1.5.1. B only ✓✓

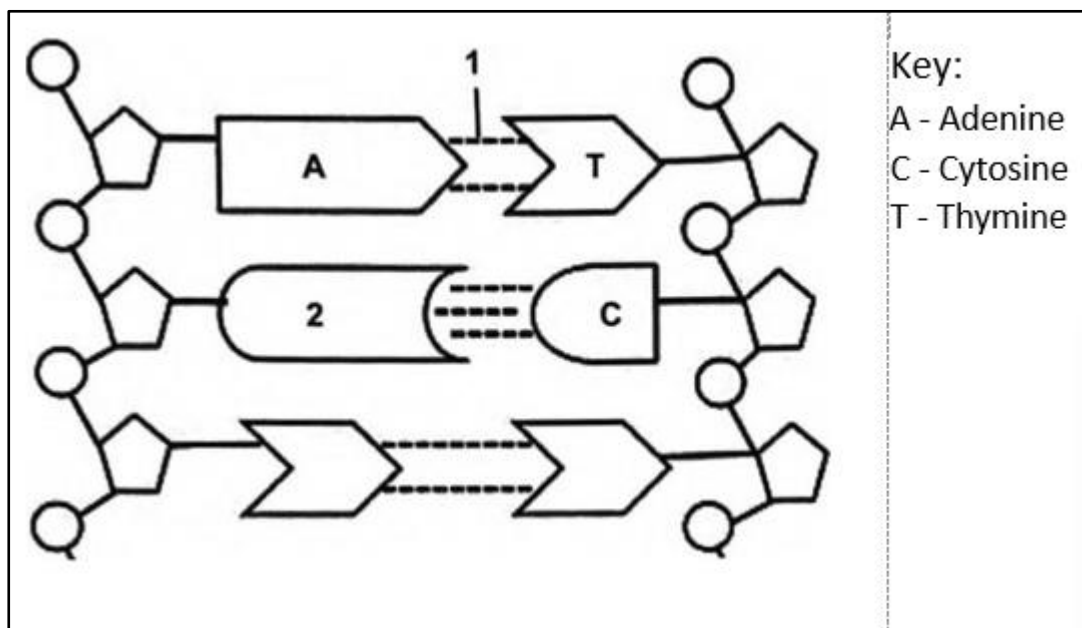
1.5.2. A only ✓✓

1.5.3. A only ✓✓

(3 x 2) (6)

1.6. DNA: Code of Life – 27 Marks

The diagram below represents a DNA molecule.



1.6.1. Identify:

a) Bond 1 (1)

Hydrogen✓ bond

b) Nitrogenous base 2 (1)

Guanine✓

1.6.2. Give TWO reasons for identifying this molecule above as DNA. (2)

- **Has thymine✓**
- **Double stranded✓**
- **Nitrogenous bases are bonded✓ Any 2 (Mark the first TWO only)**

1.6.3. Name the phase of the cell cycle during which this molecule makes a copy of itself. (1)

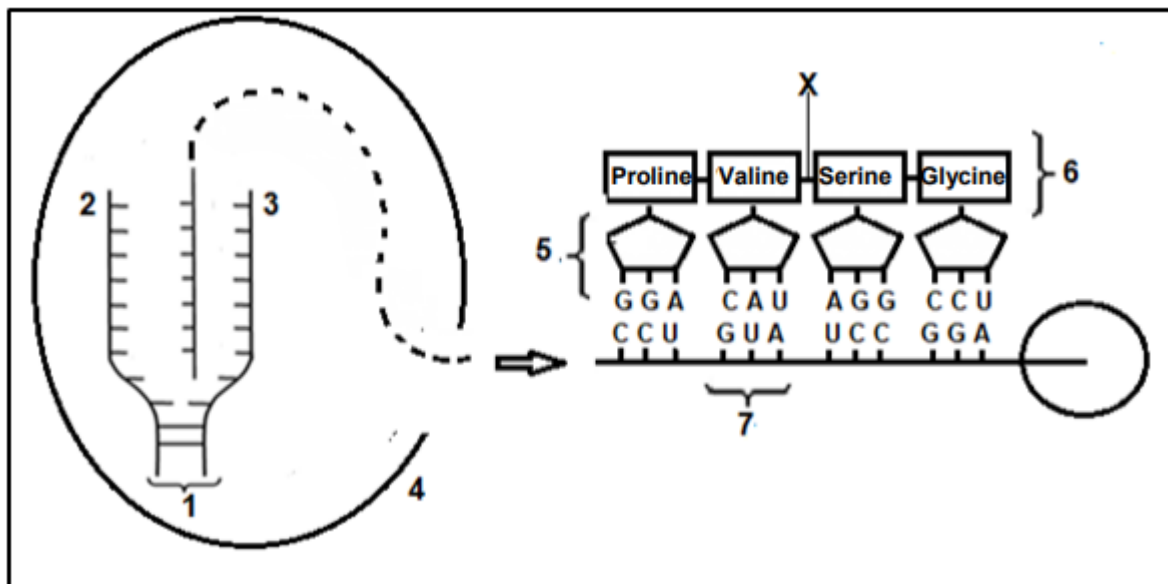
Interphase✓

1.6.3. Describe the structure of RNA molecule. (3)

- **RNA is a single-stranded✓ molecule**
- **Made up of nucleotides✓**
- **Each nucleotide has a ribose sugar✓**
- **a phosphate✓**
- **and a nitrogenous base✓**
- **the phosphate group is attached to the ribose sugar✓ and**
- **the nitrogenous base is attached to ribose sugar✓**

- Bases on RNA are arranged in triplets✓
- Nitrogenous bases are - Adenine, Guanine, Cytosine and Uracil✓
- Three types of RNA's are m-RNA, t-RNA and r-RNA✓ Any (6)

1.6.4. The diagram below represents two stages of protein synthesis.



1.6.4.1. Provide labels for:

(a) The bond at X (1)

Peptide✓ bond

(b) Organelle 4 (1)

Nucleus✓

(c) Molecule 1 (1)

DNA✓

(d) Molecule 5 (1)

tRNA✓

1.6.4.2. Does strand 2 or strand 3 serve as the template for the process that is taking place? (1)

Strand 2✓

1.6.4.3. Write down the DNA base triplet that corresponds to the codon numbered 7. (1)

CAT ✓

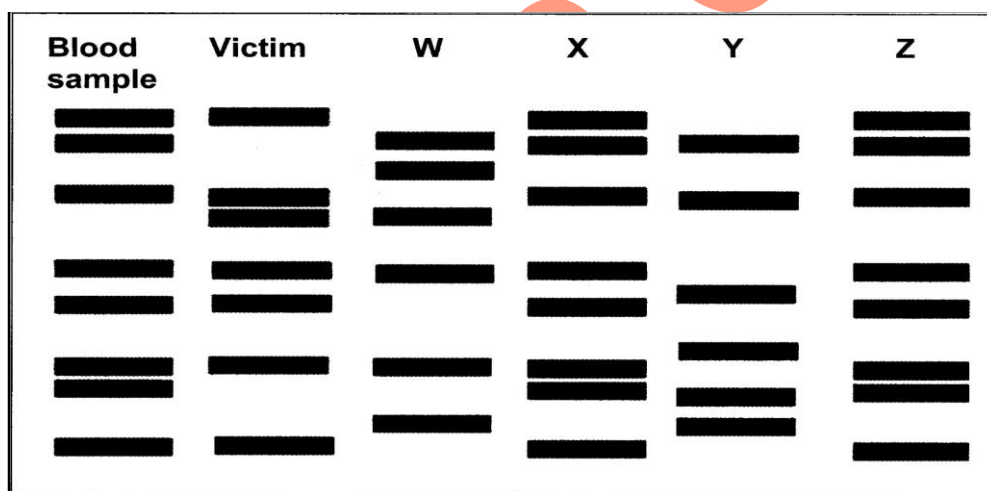
1.6.4.4. The table below shows two differences between a DNA molecule and an RNA molecule.

	DNA	RNA
Type of sugar	(a)	(b)
Number of strands	(c)	(d)

Write down the letters (a – d) in your ANSWER BOOK and list the differences.

- (a) **deoxyribose ✓**
 (b) **ribose ✓**
 (c) **two ✓**
 (d) **one ✓**

1.6.5. Study the diagram below which shows the DNA profile of blood sample found in the crime scene, victim and suspect W, X, Y and Z.



1.6.5.1. Explain what the conclusion about the DNA profile of suspects X and Z.

could be

(2)

- The DNA profiles are identical ✓
- since the bars of the two DNA profiles match ✓

1.6.5.2. Give ONE reason why DNA profiling is preferred in solving crimes.

(3)

- DNA of each individual is unique ✓
- It leads to greater convictions ✓ (Any) (1)

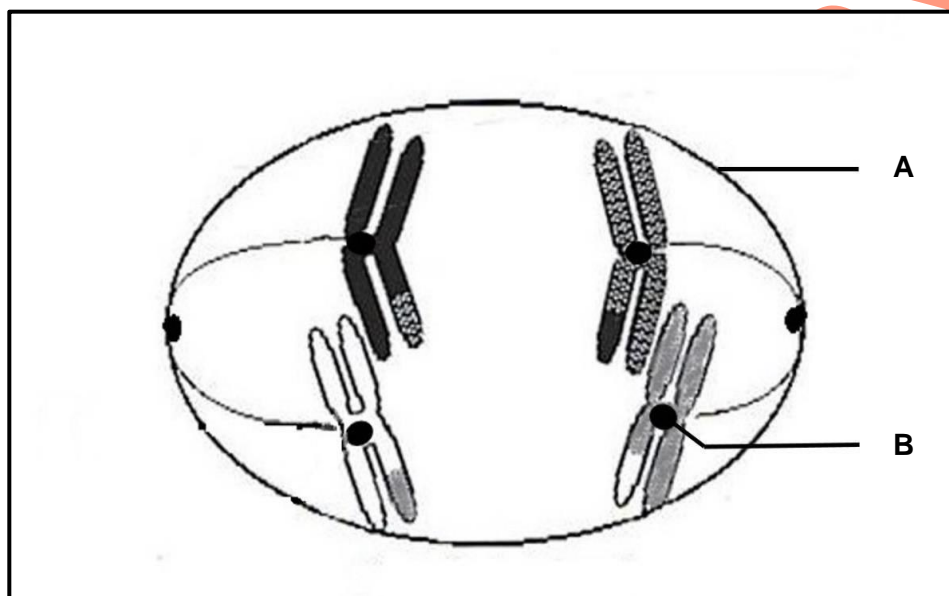
1.6.5.3. Name THREE benefits of DNA profiling other than for solving crimes. (7)

- Paternity testing ✓
- Identify relatives"individuals ✓
- Find inherited disorders ✓
- Develop cures for inherited disorders ✓

Any (3)

MEIOSIS -21 MARKS

The diagram below represents a phase of meiosis.



7.1.1. Identify the phase represented in the diagram. (1)

Anaphase 1 ✓

7.1.2. Give TWO visible reasons for your answer to QUESTION 7.1.1. (2)

- Whole chromosomes ✓ are pulled away
- from the equator towards the poles ✓

(Mark first TWO only)

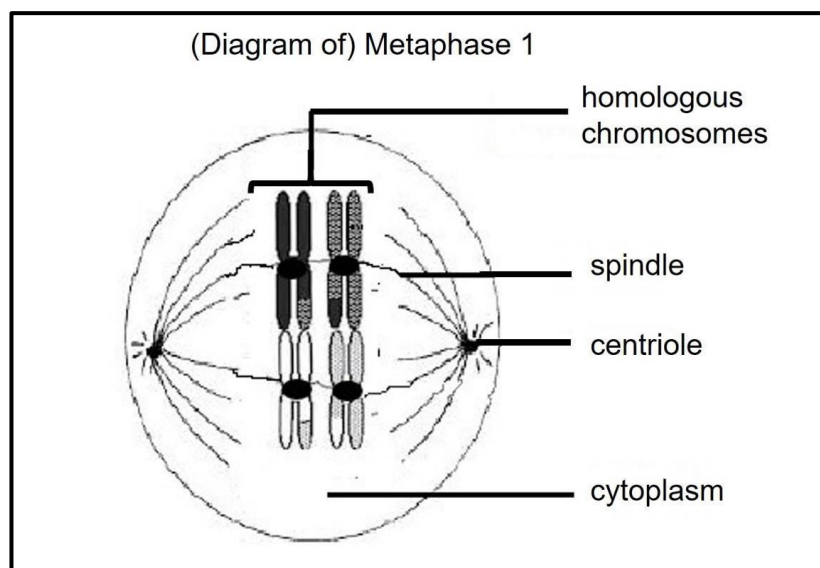
7.1.2. Identify the part labelled:

- a) **A Cell membrane ✓ /plasmalemma**
- b) **B Centromere ✓**

7.1.3. State the number of chromosomes that would be present in each daughter cell at the end of meiosis 2 of this cell. (1)

2 ✓

7.1.4. Draw a labelled diagram of the phase before the one mentioned in QUESTION 7.1.1. (5)



Criteria to assess the diagram

Correct caption	(C)	1
Diagram drawn correctly showing homologous pairs at the equator	(D)	1
Any THREE correct labels	(L)	3

7.1.5. Give TWO sources of genetic variation other than meiosis. (2)

- random fertilization ✓ of gametes
- random mating ✓
- mutations ✓
- (Mark first TWO only.)

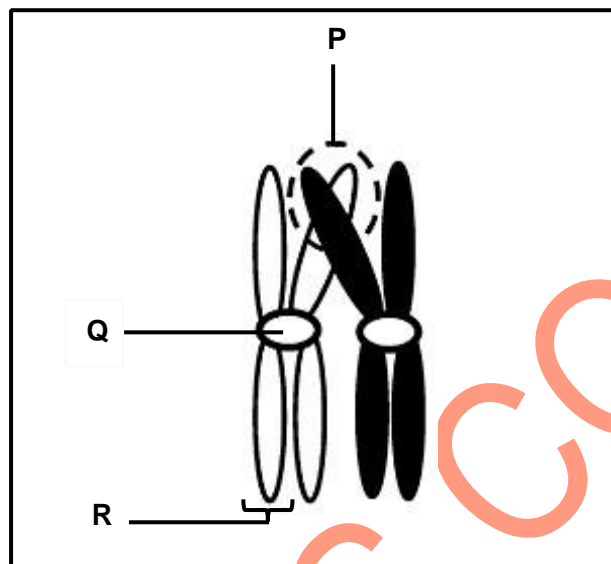
Any 2

7.1.6. Describe how a sperm cell formed through non-disjunction of chromosome pair 21 leads to Down syndrome. (3)

- When a gamete/sperm cell with 24 chromosomes ✓/an extra chromosome/of pair 21 ✓
- fertilises a normal ovum ✓/gamete/ovum with 23 chromosomes

- the zygote will have three chromosomes at position 21 ✓/47 chromosomes, leading to Down Syndrome

7.2. The diagram below represents a chromosome pair undergoing a process during meiosis.



7.2.1. Name the:

- (a) Organ in the human male where meiosis occurs (1)

Testis ✓

- (b) Process represented in the diagram (1)

Crossing over ✓

7.2.2. Label:

- (a) Area **P** (1)

Chiasma ✓

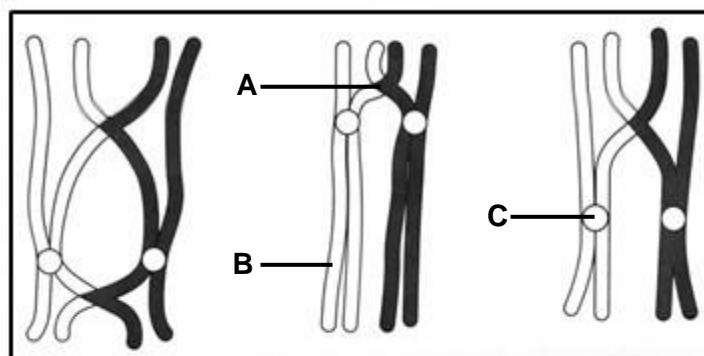
- (b) Structure **Q** (1)

Centromere ✓

- (c) Structure **R** (1)

Chromatid ✓

- 7.3. The diagram below represents ALL the chromosomes in a cell that is undergoing normal cell division.



7.3.1. Name the:

- (a) Type of cell division that is occurring in the cell in the diagram (1)

Meiosis ✓ /Meiosis I

- (b) Phase of cell division during which the chromosomes behave as

Prophase I ✓

shown in the diagram (1)

7.3.2. Where in the human female body would the type of cell division named in

QUESTION 7.3.1. (a) take place? (1)

Ovary ✓

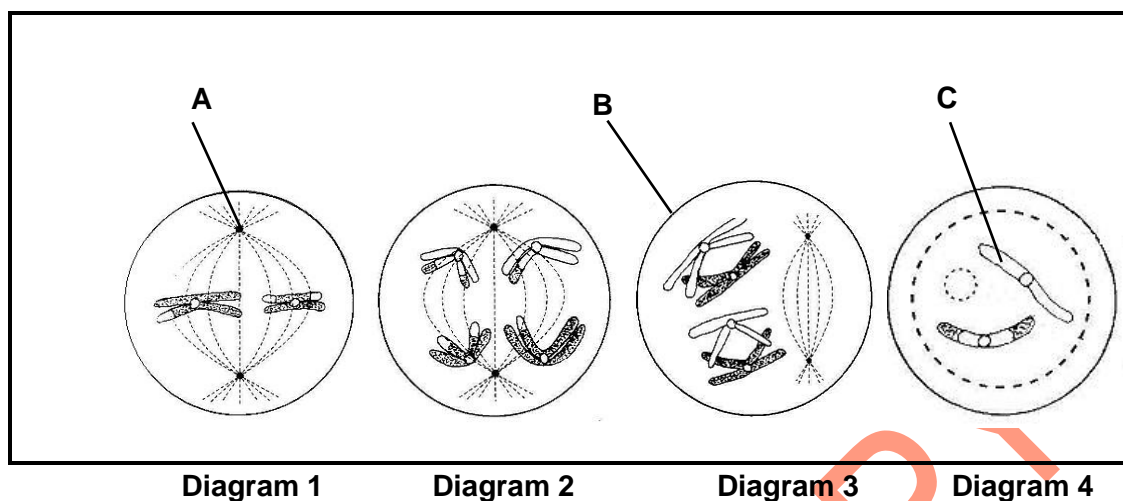
7.3.3. Give the LETTER and NAME of the structure that attaches to the spindle fibres. (2)

C ✓ - centromere ✓

7.3.4. How many chromosomes will be found in each daughter cell at the end of this cell division? (1)

3 ✓ /Three

7.4. The diagrams below show different phases of meiosis.



7.4.1. Name the parts labelled **A** to **C**. (3)

- A. Centriole ✓ /Centrosome**
- B. Cell membrane ✓ /plasmalemma/plasma membrane**
- C. Unreplicated/Single stranded chromosome ✓**

7.4.2. What is the process called through which ova are produced? (1)

Oogenesis ✓

7.4.3. Which diagram (1, 2, 3 or 4) indicates the process in meiosis which leads to genetically varied ovums? (1)

Diagram 3 ✓

7.4.4. Name and describe the process identified in QUESTION 7.4.3. (4)

- **Crossing-over ✓ ***
- **Adjacent chromatids ✓**
- **of homologous chromosomes cross ✓**
- **at a point called the chiasma ✓**
- **There is an exchange of DNA segments ✓ /genetic material**

(1 Compulsory* + Any 3) (4)

7.4.5. If the phases shown in the diagrams above represented meiosis in humans, what would the chromosome number be in ...

(a) Diagram 1? (1)

23 ✓ /twenty-three

(b) Diagram 2? (1)

46 ✓ /forty-six

8. GENETICS AND INHERITANCE

- 8.1. Grade 12 learners were studying the inheritance of characteristics in fruit flies. They observed two characteristics of the fruit flies, namely eye colour and wing type. The learners wanted to investigate the number of fruit flies that had the dominant and recessive phenotype for each characteristic in a population of 3 000 flies.

The phenotypes and the alleles coding for them are shown in the table below.

Characteristic	Phenotype	
	Dominant	Recessive
Eye colour	Red eyes (R)	White eyes (r)
Wing type	Normal wings (N)	Vestigial wings (n)

To conduct their investigation, they:

- Randomly collected 200 fruit flies from the population
- Recorded the number of fruit flies that had each phenotype

Their results are shown in the table below:

Characteristic	Phenotype	Number of fruit flies
Eye colour	Red	125
	White	75
Wing type	Normal	47
	Vestigial	153

- 8.1.1. State the type of inheritance that is represented for both characteristics. (1)

Complete dominance ✓

- 8.1.2 Identify the:

- (a) Independent variable (1)

Phenotype ✓

- (b) Dependent variable (1)

Number of (fruit) flies ✓

8.1.3. Describe THREE planning steps for this investigation. (3)

- They needed to:
- Find a source of fruit flies ✓
- Research how to keep fruit flies alive for the investigation ✓
- Decide on the sample size ✓ to be used
- Decide on what method ✓ to use when gathering results
- Design a data capture tool ✓ /table

(Mark first THREE only.)

Any 3

8.1.4. Give TWO ways in which the Grade 12 learners could increase the reliability of the investigation. (2)

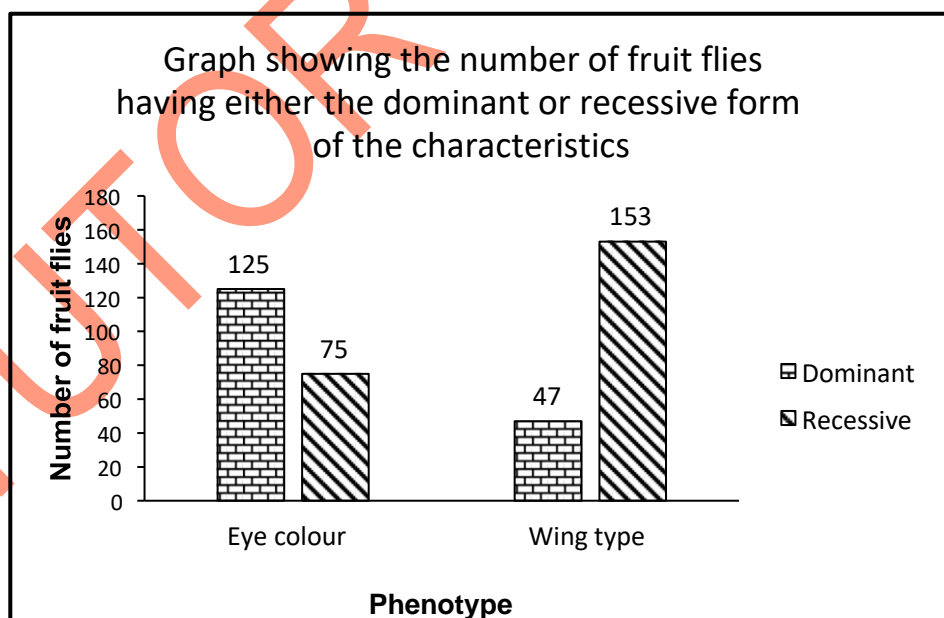
- Repeat ✓ the investigation
- Use a larger sample size ✓ /more fruit flies

8.1.5. State a conclusion based on the results. (2)

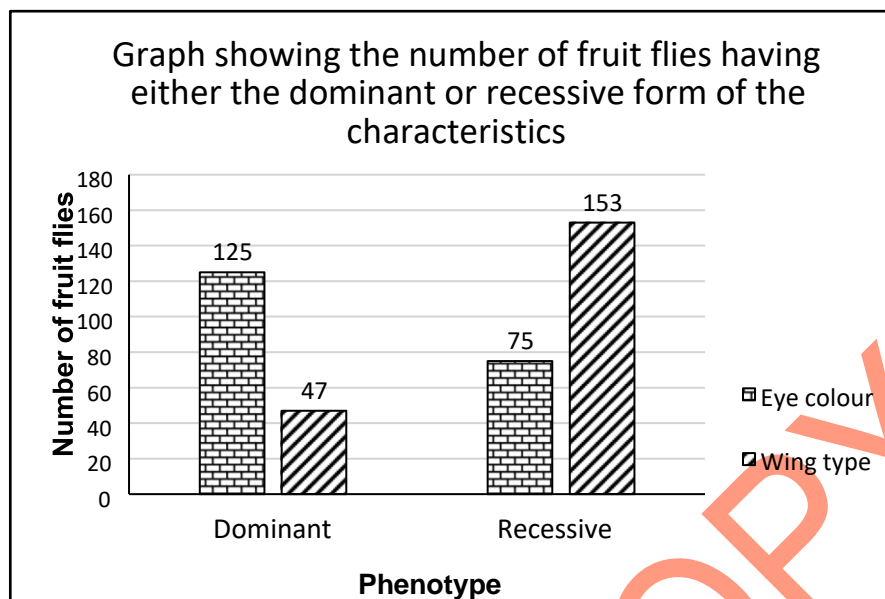
- More fruit flies have the dominant phenotype for eye colour ✓ /red eyes, than the recessive phenotype/white eyes. ✓
- Whereas more fruit flies have the recessive phenotype for wing type/ vestigial wings, than the dominant phenotype/normal wings. ✓

(Mark first TWO only.)

8.1.6. Draw a bar graph to represent the results of the investigation. (6)



OR



Guideline for assessing the graph:

Bar graph drawn	(T)	1
Title of the graph includes both variables	(C)	1
Correct label for X-axis Correct label for Y-axis	(L)	1
Equal width and interval of bars Correct scale for Y-axis	(S)	1
Drawing of bars:	(D)	1: 1 to 3 bars correctly drawn 2: All 4 bars correctly drawn

8.2. Some horses have straight hair and others have curly hair. A scientist wanted to clone a straight-haired male horse to meet the demand for horses with straight hair.

The scientist used the following procedure:

- The nucleus of a somatic cell was taken from a straight-haired male horse (horse **S**).
- An unfertilised ovum was removed from a curly-haired female horse (horse **T**).
- The nucleus from the somatic cell of horse **S** was placed into the ovum taken from horse **T**.

- This ovum was then placed into the uterus of a female surrogate horse (horse **R**).

8.2.1. Explain why a somatic cell and NOT a sperm cell from horse **S** would provide the nucleus for the procedure. (3)

- **The nucleus of the somatic cell is diploid ✓ / has a full set of chromosomes/has**
- **all the genetic material whereas**
- **the nucleus of the sperm cell is haploid ✓ /contains half the set of chromosomes/ has half the genetic material**
- **The somatic cell carries the desired characteristic ✓ /straight hair**

ANY (3)

8.2.2. Before inserting the nucleus from the somatic cell of horse **S**, the nucleus from the ovum of horse **T** was removed. Explain the significance of this procedure. (2)

To ensure that:

- **The DNA (of the ovum)/characteristic of curly hair is removed ✓**
- **Only the desired DNA is present in the clone ✓**
- **Correct number of chromosomes is present in the clone ✓**

Any (2)

8.2.4. To which of the three horses (**S**, **T** or **R**) will the cloned offspring be genetically identical? (1)

(Horse) S ✓

8.2.5. State TWO benefits of cloning. (2)

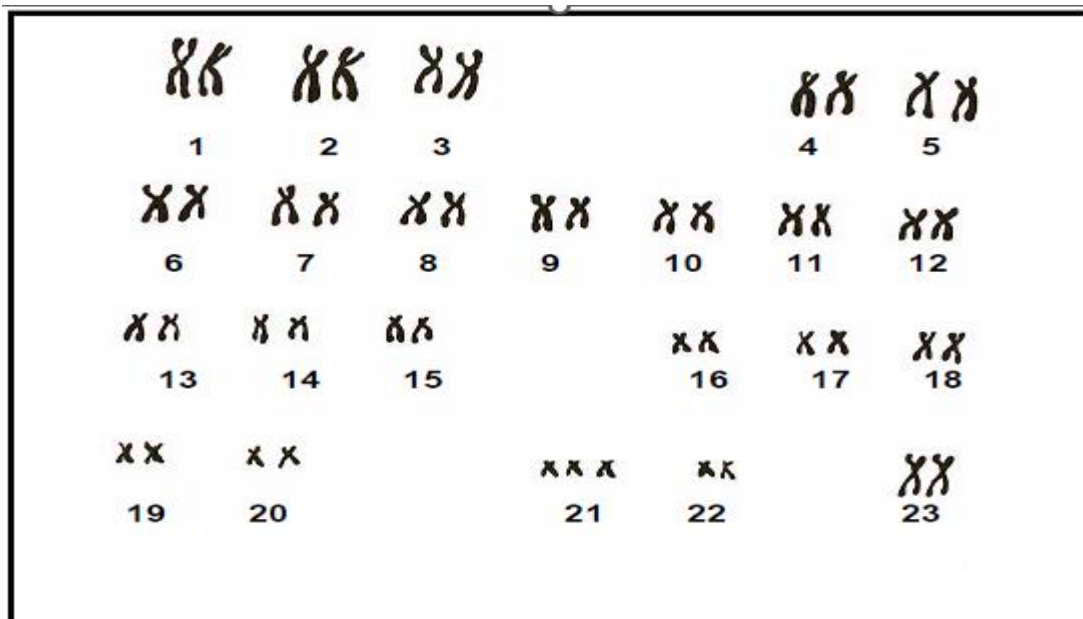
To produce organisms with desired traits ✓ e.g. he health, pearance, nutritious, yield, shelf life etc.

Conservation of threatened species ✓

To create tissue/organs for transplant ✓

Any (2)

8.3. The diagram shows a karyotype of an individual with a disorder.



8.3.1. Is this karyotype that of a male or a female? (1)

Female✓

8.3.2 Give a reason for your answer to QUESTION 8.3.1. (1)

The two gonosomes /pair 23 are similar✓/pair 23 is XX/same size

8.3.3. How many autosomes are present in this karyotype? (1)

45

8.3.4. Name the genetic disorder that the individual with this karyotype has. (1)

Down syndrome✓/Trisomy 21 ✓

Explain how this disorder occurs during gamete formation (6)

8.3.5 (10)

During Anaphase✓ I/II

homologous chromosomes✓

at chromosome pair 21✓

fail to separate/non-disjunction takes place✓

An abnormal gamete forms with 24 chromosomes/extra chromosomes at pair 21✓

If the abnormal gamete fuses with a normal gamete✓

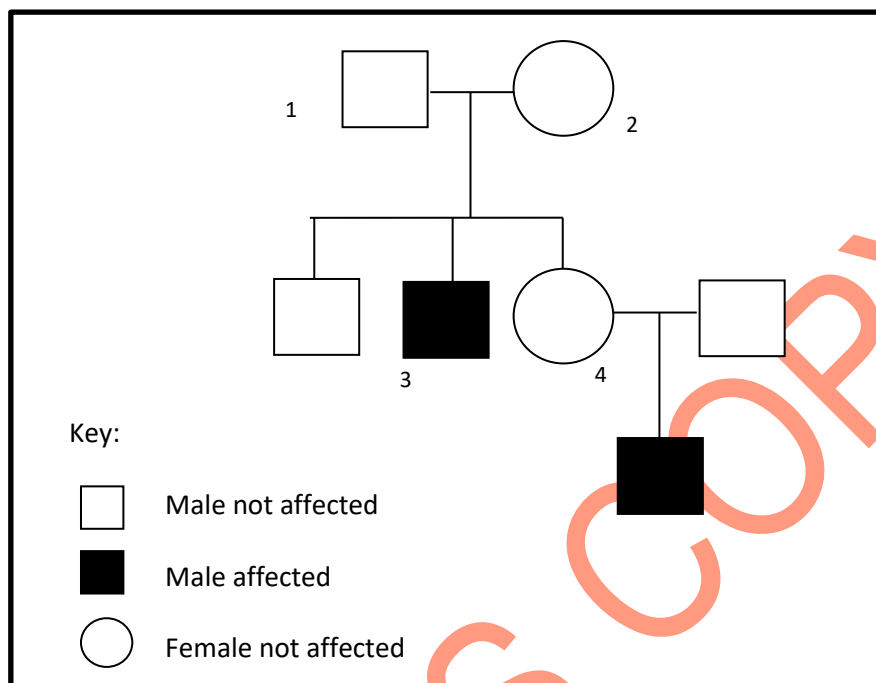
/with 23 chromosomes

the new cell has a chromosome number of 47✓ and Down syndrome comes about

Any 6

- 8.4. In humans the gene responsible for the clotting of blood is carried on the X chromosome. This disorder is sex linked and caused by a recessive allele.

The pedigree diagram below shows the occurrence of the gene responsible for the clotting of blood in a certain family.



- 8.4.1. Give the disorder where blood fails to clot properly. (1)
Haemophilia✓
- 8.4.2. Give the: (1)
 (a) Phenotype of individual 3
Male with haemophilia✓/affected male
 (b) Genotype of individual 2 (2)
XHXh ✓✓
- 8.4.3. Explain how individual 3 inherited this disorder from his mother and not from his father. (4)
Individual 3 is a male and his genotype is XhY✓
The Y chromosome is inherited from the father✓
The Y chromosome does not carry an allele✓
The Xh chromosome is inherited from the mother which is heterozygous/XHXh ✓

8.4.4. Use a genetic cross to show the probability of individual **4** having a daughter with this disorder.

P₁ Phenotype Unaffected female x Unaffected male ✓

Genotype $X^H X^h$ x $X^H Y$ ✓

Meiosis

G/gametes X^H, X^h x X^H, Y ✓

Fertilization



F₁ Genotype $X^H X^H$ $X^H Y$ $X^H X^h$ $X^h Y$ ✓

0% * Compulsory mark

P₁ and **F₁** ✓

Meiosis and fertilization ✓

*Compulsory 1 + Any 5

P₁ Phenotype Unaffected female x Unaffected male✓

Genotype $X^{H^+}X^{h^-}$ x $X^{H^+}Y$ ✓

Meiosis

Fertilisation

Gametes	X^{H^+}	x^{h^-}
X^{H^+}	$X^{H^+}X^{H^+}$	$X^{H^+}x^{h^-}$
Y	$X^{H^+}Y$	$x^{h^-}Y$
1 mark for correct gametes ✓ 1 mark for correct genotypes✓		

F₁

Genotype $X^{H^+}X^{H^+}$ $X^{H^+}Y$ $X^{H^+}x^{h^-}$ $x^{h^-}Y$ ✓

0% *Compulsory mark

P₁ and

F₁✓

Meiosis and fertilization✓ *Compulsory 1 + Any 5

(6)
100%



8.5. In holly trees, red fruit (**R**) is dominant over white fruit (**r**) and spiny leaves (**L**) are dominant over smooth leaves (**l**). The Punnett square below shows the possible results of a cross between two individual plants. The genotype at **X** is not given.

GAMETES	RL	RI	rL	rl
RL	X	RRLI	RrLL	RrLI
RI	RRLI	RRII	RrLI	RrII
rL	RrLL	RrLI	rrLL	rrLI
rl	RrLI	RrII	rrLI	rrII

8.5.1. Give the:

(a) Genotype of X (1)

RRLL✓

(b) Phenotype of the parents (2)

Red fruit✓ and spiny leaves✓

8.5.2. In a population of 128 plants, how many plants with red fruit and smooth leaves are expected from the Punnett square above?

Show ALL working. (3)

$$(3/16) \checkmark \times 128 \checkmark = 24 \checkmark$$

8.5.3. A farmer wanted to produce plants with only white fruit and spiny leaves.

Give the genotype of the plants that he should use in the cross. (2)

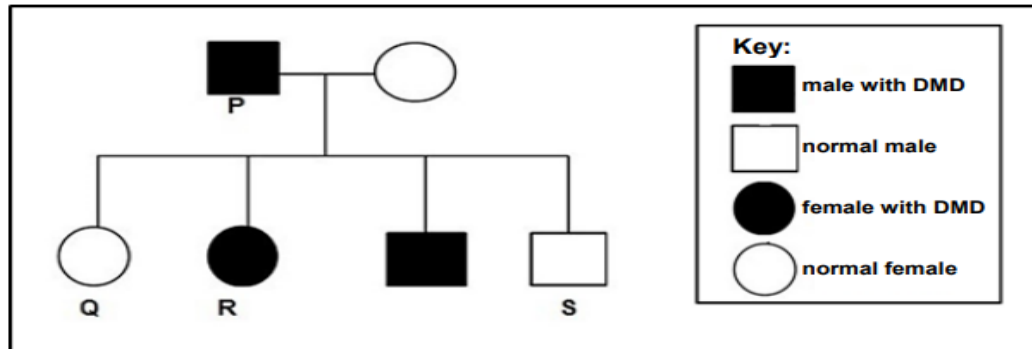
rrLL✓✓

OR

One parent is rrLL and the other parent is rrLI✓✓

- 8.6. Duchenne muscular dystrophy (DMD) is a neuromuscular disorder and is caused by a recessive allele X^d on the X-chromosome. The allele for normal neuromuscular functioning is X^D .

The inheritance of DMD in a family is shown in the diagram below.



- 8.6.1. How many generations are shown in this family? (1)

2✓/two

- 8.6.2. Give the phenotype for individual **P**. (2)

male ✓with Duchenne muscular dystrophy✓/DMD /affected

- 8.6.3. Give the genotype for individual **Q**. (1)

$X^D X^d$ ✓

- 8.6.4. Individual **S** marries a woman who is normal for neuromuscular functioning but carries the recessive allele. Use a genetic cross to show the percentage of offspring that will have DMD. (6)

P ₁	Phenotype	Normal male	x	Normal female✓	
	Genotype	X ^D Y	x	X ^D X ^d ✓	
Meiosis					
	gametes	X ^D	Y	x	
Fertilization					
F ₁	Genotype	X ^D X ^D	: X ^D X ^d	: X ^D Y	: X ^d Y✓
	Phenotype	3 normal/unaffected : 1 with Duchene muscular dystrophy✓/DMD/affected			
		There is a 25% chance✓* of offspring having Duchene muscular dystrophy /DMD			

P_1 and F_1 ✓

Meiosis and fertilization ✓

1 compulsory* + Any 5

OR

	Phenotype	Normal male	x	Normal female✓
	Genotype	$X^D Y$	x	$X^D X^d$ ✓
Meiosis				
Fertilization				
		1 mark for correct gametes✓		
		1 mark for correct genotypes✓		
F_1	Phenotype	3 normal/unaffected : 1 with Duchene muscular dystrophy✓/DMD/affected		
		There is a 25% chance✓* of offspring having Duchene muscular dystrophy /DMD		

P_1 and F_1 ✓

Meiosis and fertilization✓

1 compulsory* + Any 5

8.7. Read the passage below.

GENETIC MODIFICATION

Genetically modified (GM) foods are foods derived from organisms whose genetic material has been modified through the introduction of a gene from a different organism. The technology is often called biotechnology or recombinant DNA technology. Most existing genetically modified crops have been developed to improve yield through the introduction of resistance to plant diseases or of increased tolerance of herbicides. All GM foods should be assessed before being allowed on the market.

8.7.1. What is biotechnology? (2)

Manipulation of biological processes to satisfy human needs.✓✓

8.7.2. State ONE benefit of GM foods in the passage. (1)

Improve yield✓

Tolerance of herbicides✓

Any 1

Mark the first ONE only

8.7.3. Explain why GM foods should be assessed before being allowed in the market. (2)

They may have side-effects✓

which may be negative to human health✓ /may cause allergies

8.8. Bt-maize is a crop that is genetically modified to be insect resistant. An investigation was conducted to determine if plants with the Bt-gene are insect resistant.

The procedure was as follows:

- A total of 400 maize seeds was divided into two equal groups
- A field was divided into two equal plots (X and Y).
- On plot X, 200 seeds without the Bt-gene were grown.
- On plot Y, 200 seeds with the Bt-gene were grown.
- Both plots were exposed to the same environmental conditions suitable for growth of crops.
- 200 insects of the same type were introduced into both plots.
- The maize plants that were resistant to the insects started producing flowers after 5 weeks and all the maize plants with flowers were counted in both plots X and Y.
- The average grain yield in each plot was calculated and used as an indication of insect resistance.

The results are shown in the table below.

PLOT	THE AVERAGE PERCENTAGE OF GRAIN YIELD PER PLOT
x	19
	38

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

Insect resistance✓

8.8.2. Describe how the dependent variable in QUESTION 8.8.1 was determined. (1)

Counting the average grain yield in each plot✓

8.8.3. State TWO ways in which the validity of the investigation was ensured. (2)

Same number of maize seeds sown on each plot✓

Same size of plots✓

Same environmental conditions✓

Same type of insects were introduced✓/ same number of insects

Same period of growth before counting✓

Mark the first TWO only

8.8.4. Why was plot X included in this investigation? (3)

To serve as control✓

so that it can be compared with the other group✓

and show that the Bt gene is the only factor that affects the results✓/improves the validity of the investigation

8.8.5. State why 400 maize seeds were used in the investigation instead of 100 only. (1)

To increase the reliability✓ of the investigation

8.9. A farmer decided to have his best meat-producing bull cloned.

The following steps were used in the process:

- A muscle cell was taken from the bull and the nucleus was removed.
- An ovum was taken from a cow and the nucleus was removed and discarded.
- The nucleus from the muscle cell was placed in the empty ovum.
- The ovum was given an electric shock to stimulate normal cell division to produce an embryo.
- The embryo was placed in the uterus of a surrogate cow where it developed into the clone.

8.9.1. What is *cloning*? (1)

The production of (genetically) identical organisms✓

8.9.2. Explain why the nucleus of a muscle cell was used and not the nucleus of a sperm cell. (2)

A muscle cell contains all the genetic material✓ of the bull/ is

a sperm cell has only half of the genetic material✓/ is haploid

8.9.3. Explain why the nucleus of the ovum was removed. (2)

To remove the genetic material of the cow✓

so that only the genetic material from the (best meat producing)

bull is present✓

8.9.4. State ONE benefit of cloning. (1)

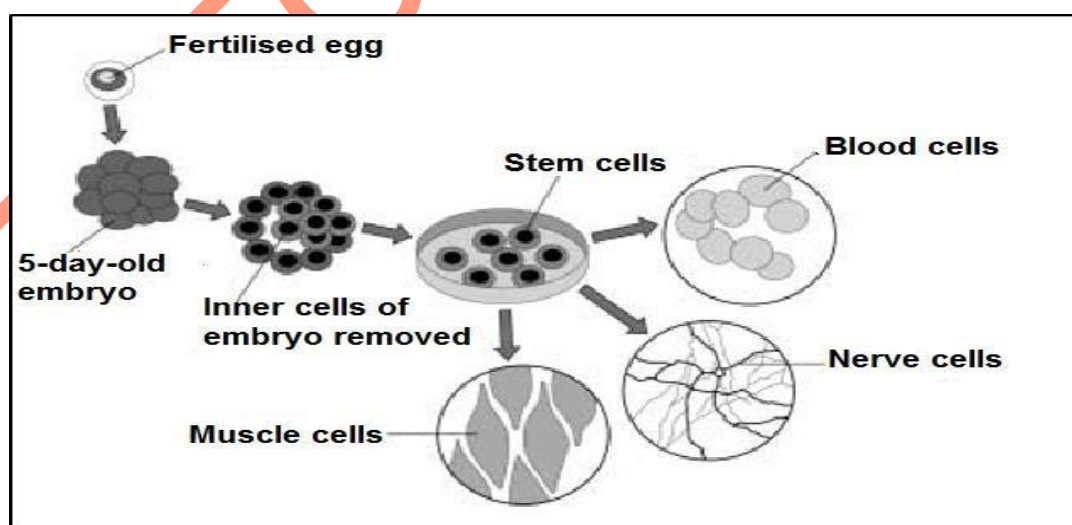
To produce organisms with desired traits✓ e.g. health;

appearance; nutritious; yield; shelf-life; etc

To create tissues/organs for transplant✓

(Mark first ONE only)

9. The diagram shows one way that stem cells can be produced from human embryos.



9.1. What are *stem cells*? (2)

Stem cell are undifferentiated cells ✓ that has the potential to form any tissue of organ ✓

9.2. Give TWO sources of stem cells other than human embryos. (2)

- Cord blood, umbilical cord blood ✓
- Bone marrow ✓
- Blood, peripheral blood stem cells ✓
- Menstrual blood ✓
- Skin ✓
- Teeth ✓
- Placental tissue ✓








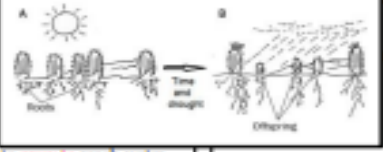
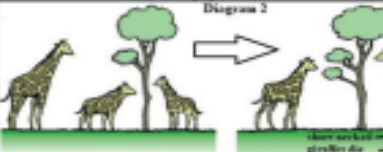
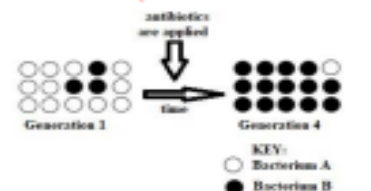
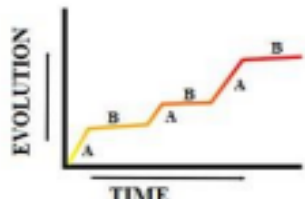
OR Adult stem cells ✓

(Any 2)

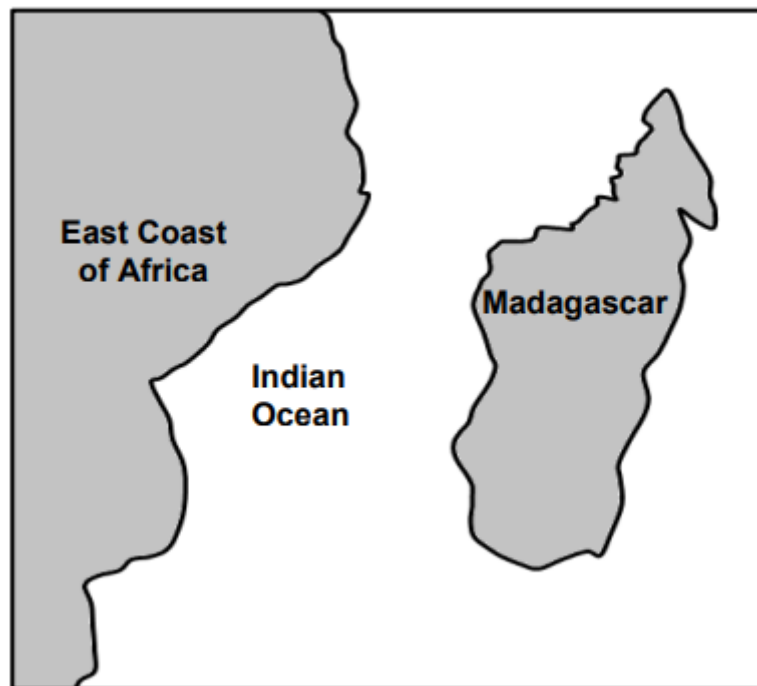
9.3. Give ONE medical condition that can be treated by using nerve cells grown from stem cells. (1)

Spinal cord injuries ✓ / neurodegenerative diseases ✓ (Parkinson's disease / Alzheimer's disease / Amyotrophic lateral sclerosis) (Any 1)

EVOLUTION: P2- 54 MARKS

<h3>CAUSES OF VARIATION</h3> <p>Name FOUR processes that cause variation and then fill in the missing words.</p> <ol style="list-style-type: none"> 1. Meiosis: because of 2. Fertilisation is random. 3. Random Mating. 4. Mutations. 	 <p>1.1 Crossing over process in prophase 1.</p>  <p>1.2 Random arrangement of chromosomes in metaphase 1 or metaphase 2.</p>	<h3>TYPES OF VARIATION</h3> <p>Name the 2 types of variation shown in each diagram</p>  <p>Continuous variation where there is a range of phenotypes eg eye shape</p>  <p>Discontinuous variation where there is no/a small range of phenotypes. eg hairline shape</p>	<h3>EVIDENCE FOR EVOLUTION</h3> <p>Name the 4 types of evidence that support evolution using the diagrams as clues.</p> <ol style="list-style-type: none"> 1. Genetics 2. Biogeography 3. Modification by descent (homologous structures) 4. Fossil record   
<h3>EVOLUTION THEORY 1: LAMARCKISM</h3> <p>LAW 1: 'Law' of use and disuse.</p> <p>Law of use: The more you use the structure/ organ/ body part, the bigger/ stronger/ more developed it is. eg. Long necks in Galapagos tortoises.</p> <p>Law of disuse: The less you use the structure/ organ/ body part, the smaller/ weaker/ less developed it is. eg. Snake legs.</p> <p>LAW 2: 'Law' of the inheritance of acquired characteristics</p> <p>The characteristic that developed during the lifetime of the parent is an acquired trait and will be passed on to the offspring as it is heritable.</p> <p>Why was Lamarck's theory rejected?</p> <ul style="list-style-type: none"> Acquired characteristics are not inherited / do not cause change to the DNA of an organism. (genes are inherited, not acquired traits) Lamarck's theory is deterministic / Organisms did not evolve because they want to. (Lamarck had no evidence) 	<h3>APPLYING THEORIES 1 and 2: Fill in the missing words below for the theories of Lamarckism and Darwinism (Natural Selection) for each of the two diagrams shown.</h3> <div style="display: flex;"> <div style="flex: 1;"> <h4>LAMARCKISM</h4> <p>Law of use. All cacti had roots that were the same length to start. The roots had to grow to reach water so roots were longer over time in all cacti.</p>  <p>Law of Use. All giraffes had the same length neck to start. They stretched to reach the high leaves and so acquired a long neck. This trait was and passed to offspring.</p>  </div> <div style="flex: 1;"> <h4>DARWINISM</h4> <p>Favourable root trait: long roots Unfavourable root trait: short roots Therefore cacti with long roots survive and reproduce. The offspring have long roots over time.</p> <p>Favourable neck length: long neck Unfavourable neck length: short neck. Long neck giraffes survive and reproduce passing the long neck on to their offspring.</p> </div> </div>	<h3>EVOLUTION THEORY 3: Evolution by the process of NATURAL SELECTION / DARWINISM.</h3> <p>Describe the theory of evolution by the process of natural selection.</p> <ul style="list-style-type: none"> Organisms produce a large number of offspring. There is a great deal of variation amongst the offspring, some have the favourable trait and some don't. When there is a change in the environmental conditions or if there is competition, the organisms with the unfavourable characteristics, which make them less suited, die. The organisms with characteristics which make them more suited, survive reproduce and pass on the allele for the favourable characteristic to their offspring. The next generation will have a higher proportion of individuals with the favourable characteristic. <p>Darwinism is also called Gradualism. Darwin called his theory Descent with modification.</p> <p>Today we call it: The theory of evolution by the process of natural selection.</p>	<h3>PRESENT DAY EVOLUTION: Tuberculosis (TB) → MDR-TB → XDR-TB</h3>  <p>KEY: ○ Bacterium A ● Bacterium B</p> <ol style="list-style-type: none"> Which process of evolution is represented in the diagrams above? Natural selection. The bacterium with the favourable characteristic is bacterium B, whereas the one with the unfavourable characteristic is bacterium A in the diagram. Explain your answer in question 2 using the theory of natural selection. <ul style="list-style-type: none"> In generation 1 there was variation amongst the bacteria, some had the favourable characteristic of antibiotic resistance (Bacterium B) and some did not (bacterium A). Antibiotics were applied and bacteria A had the unfavourable trait and died because the antibiotic killed them. Bacterium B had the favourable trait and resisted the antibiotic, so survived and reproduced passing on the favourable trait to their offspring. The next generation (number 4) has a higher proportion of individuals with the favourable trait of antibiotic resistance. The population gradually changed to be antibiotic
<h3>EVOLUTION THEORY 2: PUNCTUATED EQUILIBRIUM</h3> <p>Describe the theory of punctuated equilibrium.</p> <ul style="list-style-type: none"> Evolution involves long periods of time where species do not change or change gradually through natural selection (known as equilibrium). This alternates with (is punctuated by) short periods of time where rapid changes occur through natural selection During which new species may form in a short period of time. 	<h3>APPLYING THEORY 2: Study the graph below and then answer the questions.</h3>  <p>Use the graph to identify the phase at:</p> <ol style="list-style-type: none"> Punctuation phase (rapid change; short time). Equilibrium phase (little or no change; long time). <p>Circle the correct words from those that are underlined:</p> <ol style="list-style-type: none"> At A, the species undergoes <u>rapid</u>/ no or gradual change over a long/ <u>short</u> period of time. At B, the species undergoes <u>rapid</u>/ <u>no or gradual change</u> over a long/ <u>short</u> period of time 		

10. Pottos and lemurs are small mammals. Scientists believe that pottos and lemurs share a common ancestor that existed in Africa. Presently pottos only occur in Africa while lemurs are only found in Madagascar. Madagascar is an island off the East coast of Africa as shown in the diagram below.



- 10.1. Explain how continental drift could have affected the distribution of the common ancestor. (4)

**There was once one large continent✓ and
the common ancestor existed throughout this continent✓
When Madagascar separated✓
the common ancestor was found in both✓ regions**

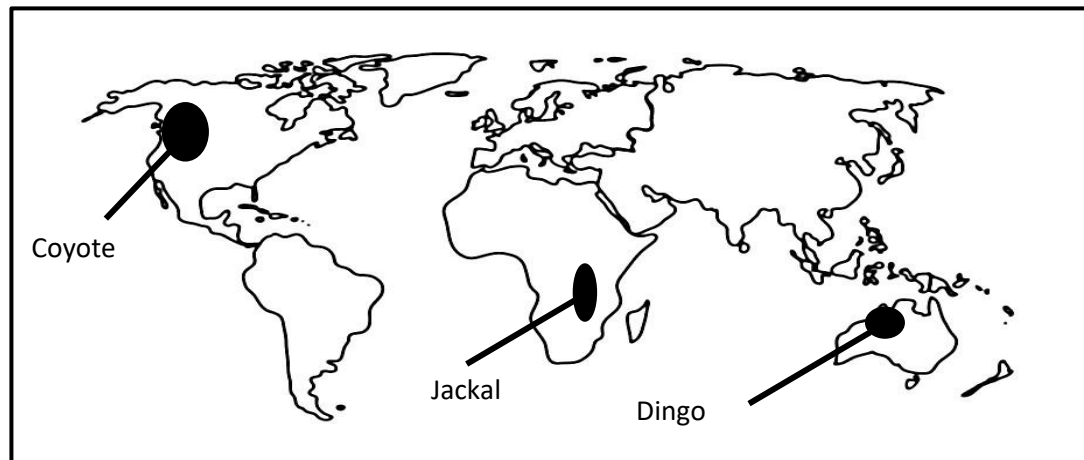
- 10.2. Describe the speciation of the pottos and lemurs to become different species(6)

The common ancestor became separated into two groups by the ocean✓*

**There was no gene flow between the two groups✓
Each group experienced different environmental conditions✓
and underwent natural selection independently✓
The individuals in each group became different✓
genotypically and phenotypically✓
to form the pottos and lemurs✓*
Eventually if the two groups are mixed again, they cannot
interbreed✓/produce fertile offspring.**

***2 Compulsory + Any 4**

11. The present-day distribution of three closely related species of the dog family, the coyote, jackal and dingo, is shown on the world map below.



- 11.1. What type of evidence for evolution is represented here? (1)

Biogeography✓

- 11.2. What is a *biological species*? (3)

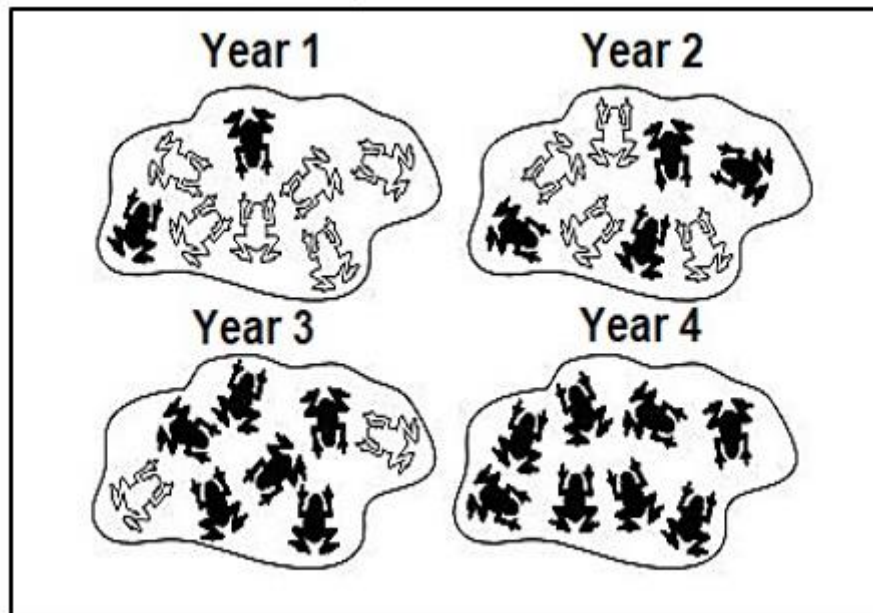
- **Similar organisms✓**
- **that can interbreed✓**
- **to produce fertile offspring✓**

- 11.3. Describe how these three species could have evolved from a common ancestor. (7)

- **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

- 11.4. A population of frogs live in a pond. The frogs may be darker or lighter in colour. A population of herons (long-legged water birds), who feed on the frogs, live in the same habitat. Over a period of time, the water in the pond became darker in colour. This caused the frog population to change over a period of 4 years as shown in the diagram below.



Use Darwin's theory of evolution to explain how the frog population changed over the period of 4 years.

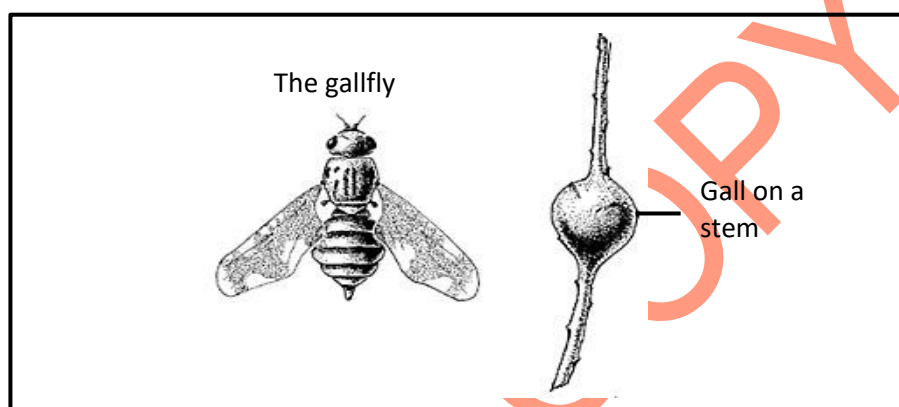
(6)

- **There was variation in the frog population. ✓**
- **Some of the frogs were light in colour and some of the frogs were dark in colour. ✓**
- **Those that were light in colour were not camouflaged/ were more visible and were eaten by the heron✓/did not survive.**
- **Those that were dark in colour, were camouflaged/were less visible and survived✓/ were not eaten by the heron.**
- **The frogs that survived, reproduced✓**
- **and passed on the allele for dark colour to their offspring, ✓**
- **leading to the population of dark coloured frogs✓after four years.**

12. Female gallflies lay eggs on the stems of plants. The eggs hatch to form larvae that secrete a substance into the plant tissue. The secretions cause the plant cells to grow and form ball-like structures, called galls, which are high in nutrients. Predatory birds feed on the larvae in the galls.

The size of the galls produced actually depends on genetic variation in the gallfly.

The diagram below shows the gallfly and a gall on a plant stem.



Scientists wanted to investigate whether the size of the galls had an effect on the percentage of gallfly larvae killed by predatory birds.

The table below shows the results of their investigation.

Gall size (mm)	Gallfly larvae killed by predatory birds (%)
10	1
15	0
20	1
25	2
30	10

12.1. State the:

- (a) Independent variable (1)

Gall size ✓

- (b) Dependent variable (1)

Percentage of gallfly larvae killed ✓

12.2. Give ONE advantage of the gall to the gallfly larvae. (1)

Nutrition ✓ /food

Protection ✓

Space ✓

(Mark first ONE only)

12.3. State why the size of the galls produced is an example of continuous variation. (1)

There is a range of (intermediate) values ✓ in gall size

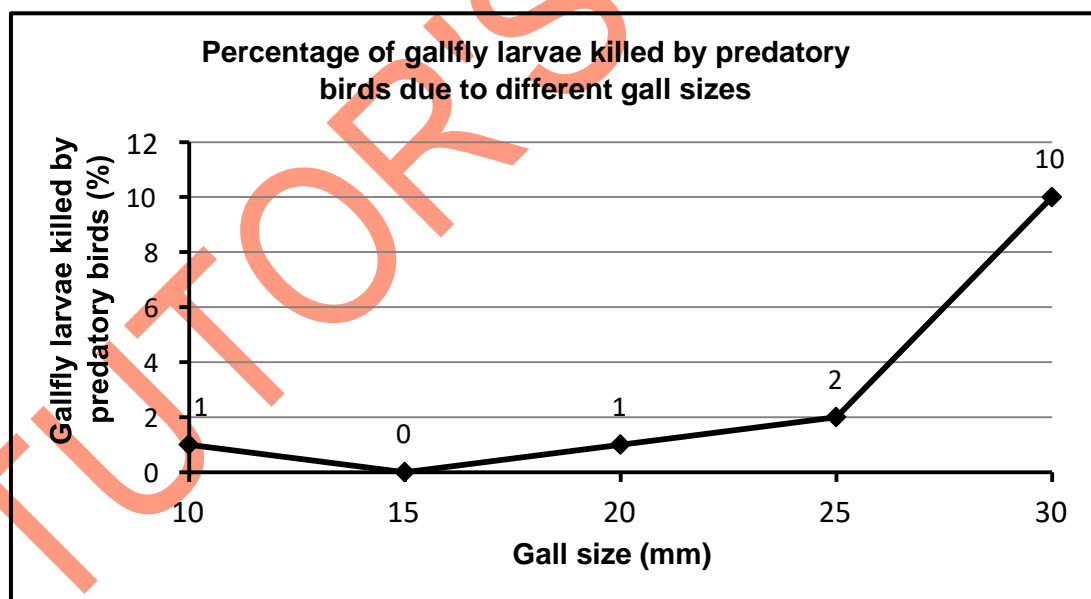
12.4. Explain how the percentage of gallfly larvae killed by predatory birds is influenced by the size of the gall. (3)

- **Larvae in 30mm galls are eaten more ✓**
- **since they are more visible ✓ to birds and**
- **contain more/larger larvae ✓**

OR

- **Larvae in galls that are 25mm and smaller are eaten less ✓**
- **since they are less visible ✓ to birds and**
- **contain fewer/smaller larvae ✓**

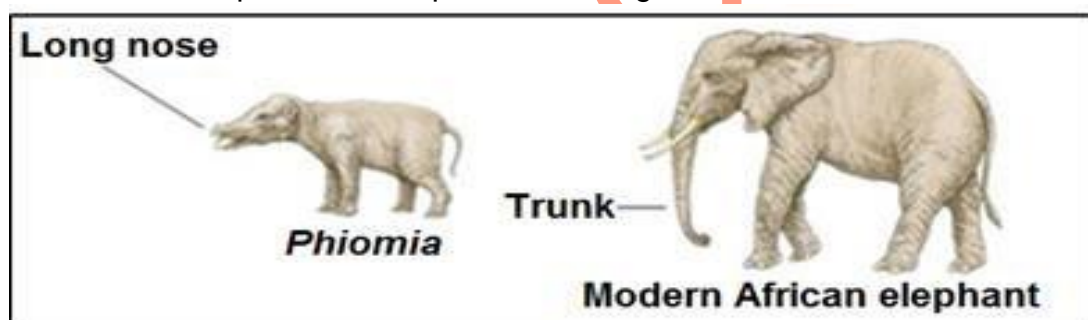
12.5. Draw a line graph to represent the information in the table. (6)



Guideline for the assessing of the graph

CRITERIA	ELABORATION	MARK
Correct type of graph (T)	Line graph drawn	1
Caption of graph (C)	Both variables included	1
Axes labels (L)	Correct labels and units on X- and Y-axes	1
Scale for X- and Y-axes (S)	Equal spacing between intervals for each axis	1
Plotting of points (P)	1 to 4 points plotted correctly	1
	All 5 points plotted correctly	2

13. The diagrams below show the *Phiomia*, an ancestor of the elephants and a modern African elephant. The *Phiomia* lived 35 million years ago. Both the *Phiomia* and modern African elephant reach up into trees to get leaves to eat.



- 13.1. Explain how Jean-Baptiste Lamarck would explain how the modern African elephant developed a long trunk.

(5)

- All elephants had short trunks / noses ✓
- They frequently stretched their trunk / nose to reach for leaves in the trees ✓
- As a result, their trunks became longer ✓
- The characteristic for long trunks acquired in this way was then passed on to the next generation ✓
- Eventually all elephants had long trunks ✓

13.2. Give TWO reasons why Lamarck's theory is no longer accepted today. (2)

- **Organisms evolved, not because they wanted to evolve but because changes**
- **took place randomly, in response to the environment ✓**
- **There is very little evidence to support Lamarck's idea that changes brought about by adaptation to the environment are inherited from parent to offspring ✓**

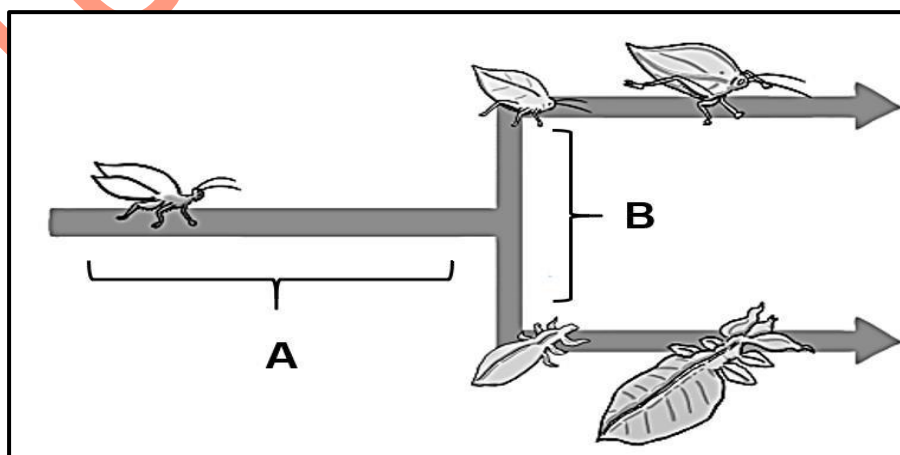
13.3. Give ONE similarity between Lamarck's theories and Darwin's theory of natural selection. (1)

- **Characteristics are passed from parents to offspring ✓**

14. Tabulate THREE differences between artificial selection and natural selection. (7)

Artificial selection	Natural selection
humans select a desired characteristic ✓ / humans represent the selective force	nature selects the desired characteristic ✓ / the environment or nature is the selective force
human needs are fulfilled ✓	the characteristic improves chances of survival ✓
humans select organisms to breed ✓	mating is random ✓
the characteristics of the population do not necessarily change ✓	the characteristics of the population change ✓
may involve more than one species ✓	occurs within a species ✓

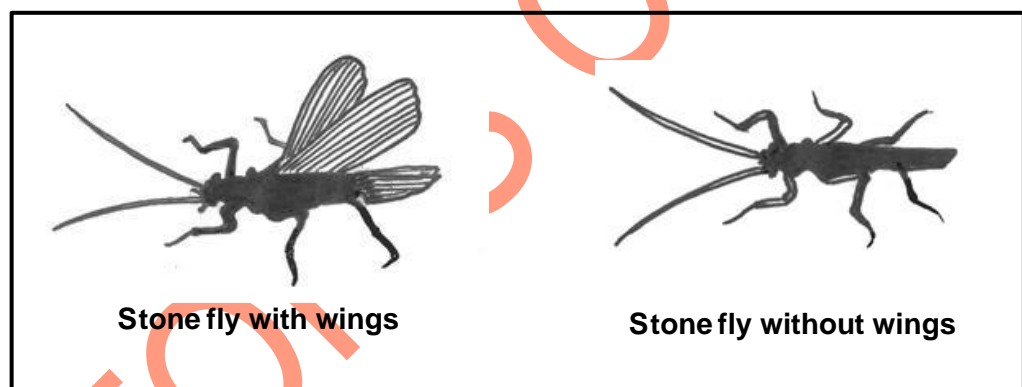
15. The phylogenetic tree below shows evolution by punctuated equilibrium in a species of insect.



- 15.1. Use the letters **A** and **B** to explain the theory of punctuated equilibrium. (4)
- **Evolution involves long periods of time where species do not change/or change gradually through natural selection as shown by A. ✓ ✓**
 - **These alternates with/are punctuated by short periods of time where rapid changes occur through natural selection as shown by B. ✓ ✓**
- 15.2. Insects on islands without trees are likely to be wingless because flying is dangerous for them in an area with strong winds.

A certain island was once covered with tall trees. Over the years, there has been deforestation in some areas of the island. On this island, insects called stoneflies, have undergone natural selection. Some have wings and some do not have wings, depending on the area where they are found.

The diagram below shows stoneflies with and without wings.



Scientists wanted to determine the relationship between the presence of tall trees and the wings on the stoneflies.

- They selected six locations, of which three had tall trees and three were without trees.
- Using a specialised net, they collected thousands of stoneflies in each location.
- The samples were labelled according to the area of collection.
- These samples were all collected in the morning during summer.
- The number of stoneflies with wings and without wings at each location was counted and recorded.

15.2.1. Identify the:

- (a) Independent variable (1)
(Presence or absence of) tall trees ✓
- (b) Dependent variable (1)
(Presence or absence of) wings on the stoneflies ✓

15.2.2. State TWO factors that were kept constant during the investigation (2)

- **Type of net ✓ / apparatus used to catch the insect"**
- **Season of collection ✓ /collection was done in summer**
- **Time of day for collection ✓**
- **Type of location for each category ✓**
- **Number of locations for each category ✓**
- **Labelling of samples was done according to the area of collection ✓**

ANY 2

15.2.3. State TWO ways in which the reliability of this investigation was ensured. (2)

- **Collected thousands of stoneflies ✓**
- **Three (3) locations for each category ✓**

15.2.4. Explain why it would be expected that more stoneflies will have no wings in the areas without trees. (4)

- **Flying is dangerous ✓ / in areas without trees**
- **However, stoneflies with no wings ✓ survived since they could not fly ✓**
- **Therefore, they reproduced ✓ ***
- **Passing the allele for no wings ✓ to the next generation****
- **All offspring in the next generation had no wings ✓ '**

15.2.5. Describe how Lamarck would have explained the evolution of stoneflies without wings in the areas without trees. (5)

- **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 was passed on to the next generation ✓**
- **All stoneflies had no wings ✓**

15.3. Read the passage below.

Datura flowers open in the evening and release a powerful fragrance which attracts hawk moths. The Datura produces a highly addictive nectar which ensures that the hawk moths stay longer inside the flower and only visit Datura flowers.

- 15.3.1. Explain TWO ways in which the Datura plants ensure that they are reproductively isolated. (4)

Datura flowers:

release a powerful fragrance ✓ that attracts hawk moths ✓
release a highly addictive nectar ✓ that ensures that the hawk
moths only visit it ✓ /stays longer in the flower
open in the evening ✓ / and this ensures visit by moth ✓
are adapted to a specific pollinator ✓
since they attract hawk moths ✓

Any (2 x 2)

- 15.3.2. State TWO other mechanisms that would ensure reproductive isolation in plants. (2)

Reproduction is at different times of the year ✓
Infertile offspring ✓
Prevention of fertilisation ✓

15.4. An ancestral squirrel population living in an area was separated when an earthquake caused a deep valley to form. The two populations were separated from each other and no longer lived in the same area. Over thousands of years, the divided squirrel populations became two different species.

15.5. Define the term *population*. (2)

- **A group of organisms of the same species ✓ found in the same habitat at the same time. ✓**

15.6. Describe the speciation of the squirrels. (6)

- **The ancestral population of squirrels became separated into two populations ✓**
- **by a a deep valley ✓ /geographical barrier.**
- **The two populations could not interbreed ✓ /there was no gene flow between the two.**
- **Natural selection occurred independently in each population ✓**
- **due to different environmental conditions on either side of the barrier ✓**
- **The two populations became genotypically and phenotypically ✓**
- **different ✓ from each other.**
- **Even if the geographical barrier is removed, the squirrels will not be able to interbreed ✓ /produce fertile offspring.**
- **Two separate species have formed**

Any 6

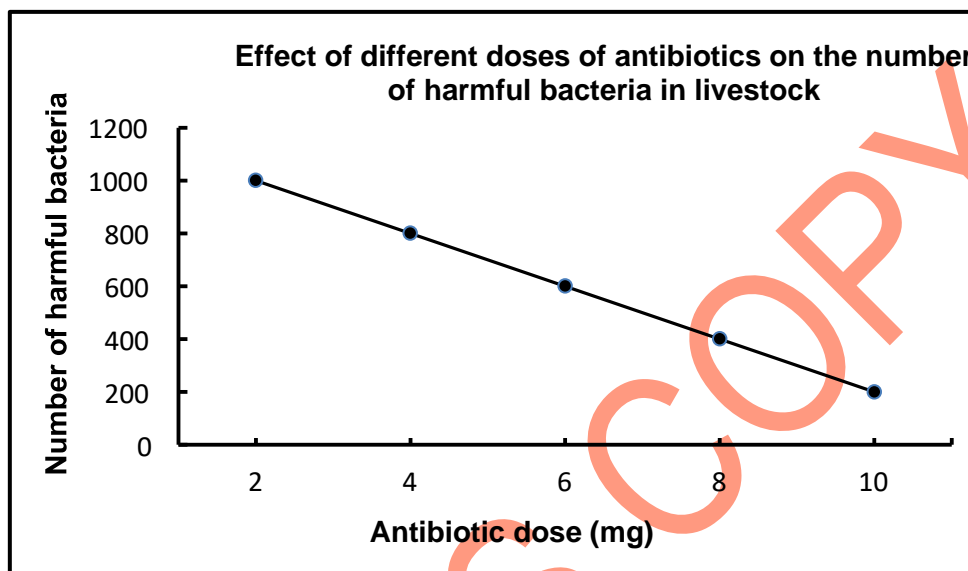
15.7. Name TWO reproductive isolating mechanisms that help to keep species separate. (2)

- **Breeding at different times of the year ✓**
- **Species-specific courtship behaviour ✓**
- **Plant adaptation to different pollinators ✓**
- **Infertile offspring ✓**
- **Prevention of fertilization ✓**

Any 2

16. Some farmers add low doses of antibiotics to the feed for cattle. The use of antibiotics in cattle feed could result in the evolution of antibiotic-resistant bacteria.

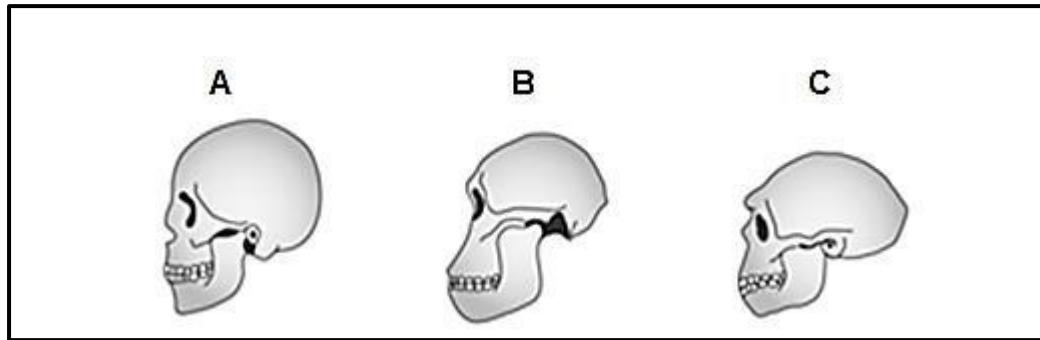
The graph below shows the effect of different doses of antibiotics on the number of harmful bacteria in the cattle.



- 16.1. Use evidence from the graph to explain why higher doses of antibiotics will benefit the farmer economically. (4)
- It decreases the number of harmful bacteria the most ✓
 - thereby preventing disease in cattle ✓ /resulting in less medical expenses
 - Decreasing mortality ✓ /maintaining the number of cattle to sell ✓ /breed /increase profit
- 16.2. Explain how the use of antibiotics in animal feed may result in the evolution of antibiotic resistant bacteria. (6)
- Natural selection ✓ occurs
 - There is variation ✓ /mutation in the population of bacteria
 - Some are resistant to antibiotics, some are non-resistant ✓
 - When antibiotic is added ✓ to the animal feed
 - The bacteria that are non-resistant are killed by the antibiotic ✓
 - Those that are resistant survive and reproduce ✓
 - The characteristic for resistance to antibiotics is passed on to the offspring ✓
 - The next generation will have a higher proportion of antibiotic resistant bacteria ✓

Any 6

17. The diagram below shows three skulls.



17.1. Arrange the skulls **A**, **B** and **C** from oldest to youngest (most recent). (2)

B C A ✓ ✓

17.2. Describe the significance of the difference in cranium size between skulls **A** and **C**. (3)

**The cranium of skull A is larger ✓
than the cranium of skull C ✓
indicating an increase in brain capacity ✓/intelligence**

OR

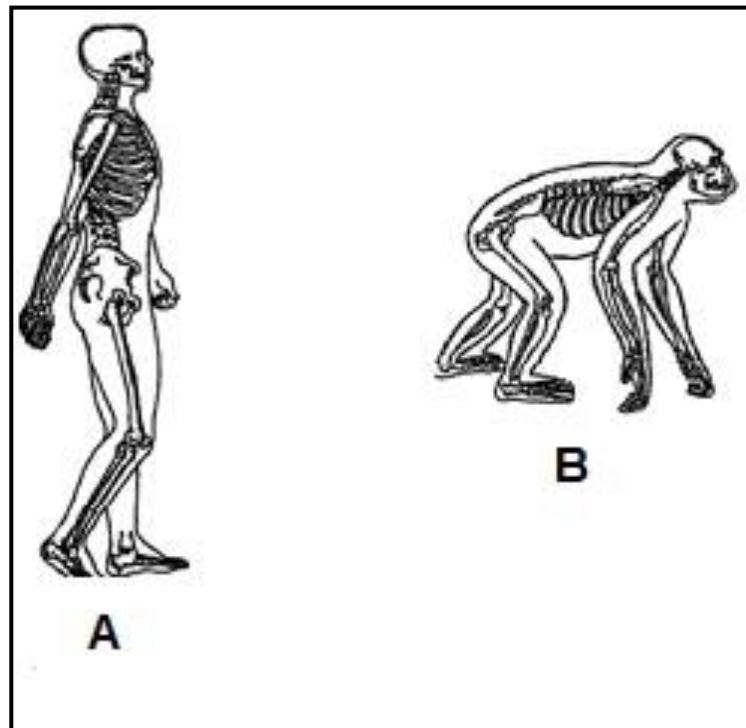
**The cranium of skull C is smaller ✓
than the cranium of skull A ✓
indicating a reduced brain capacity ✓ /intelligence**

17.3. Describe TWO visible differences in the structure of the jaw of skulls **A** and **B**. (6)

Skull A is less prognathous ✓ /less protruding jaw than skull B ✓

**Skull A has a well-defined chin ✓ whereas skull B does not ✓
Skull A has a smaller jaw ✓ whereas Skull B has a large jaw ✓
(Mark first TWO only.)**

18. The picture below shows the parts of the skeletal structures of two hominids.



18.1. Name the term used to describe the type of locomotion of species **B**. (1)

- **Quadrupedal ✓**

18.2. Explain how the position of the foramen magnum, the shape of the spine and the structure of the pelvis are suited for the type of locomotion in species **A**. (6)

- **The foramen magnum is in a forward position ✓**
- **To allow the spinal cord to enter vertically ✓**
- **The spine is more curved ✓ /S-shaped**
- **To absorb shock ✓ /allow flexible movement/for support**
- **The pelvis is short and wide ✓ /broad to support the upper body ✓ in an upright position**

18.3. Name TWO species that display the type of locomotion shown by species **A**. (2)

- ***Homo sapiens* ✓**
- ***Homo habilis* ✓**
- ***Homo erectus* ✓**
- ***Homo naledi* ✓**
- ***Australopithecus spp (afarensis, africanus, sediba)* ✓**

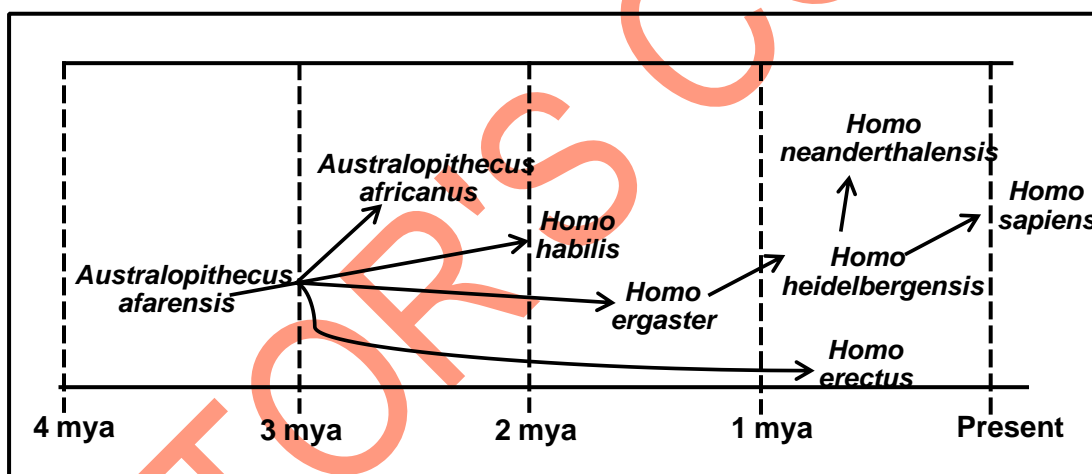
19. Describe the process of natural selection.

(7)

- **Organisms produce a large number of offspring ✓**
- **There is variation ✓ amongst the offspring**
- **Some have favourable characteristics and some do not ✓**
- **When there is a change in the environmental conditions ✓ / there is competition**
- **organisms with favourable characteristics, survive ✓**
- **whilst organisms with unfavourable characteristics, die ✓**
- **The organisms that survive, reproduce ✓**
- **and pass on the allele for the favourable characteristic to their offspring ✓**
- **The next generation will therefore have a higher proportion of individuals with the favourable characteristic ✓**

Any (7)

20. Fossil evidence for humans may be interpreted in different ways. One possible model of human evolution is shown below.



20.1. Name the family to which all the represented organisms belong.

(1)

Hominidae ✓

20.2. Describe how cultural evidence is used to support the theory of human evolution.

(2)

- **Evidence such as tools ✓ /weapons/ language/ artefacts**
- **is used to show advances ✓ in human development**

20.3. How long ago did the most recent common ancestor of *H. erectus* and *H. heidelbergensis* exist on earth?

(1)

- **mya ✓**

20.4. Explain a possible reason why *H. ergaster* was placed between *A. afarensis* and *H. heidelbergensis* on the model. (2)

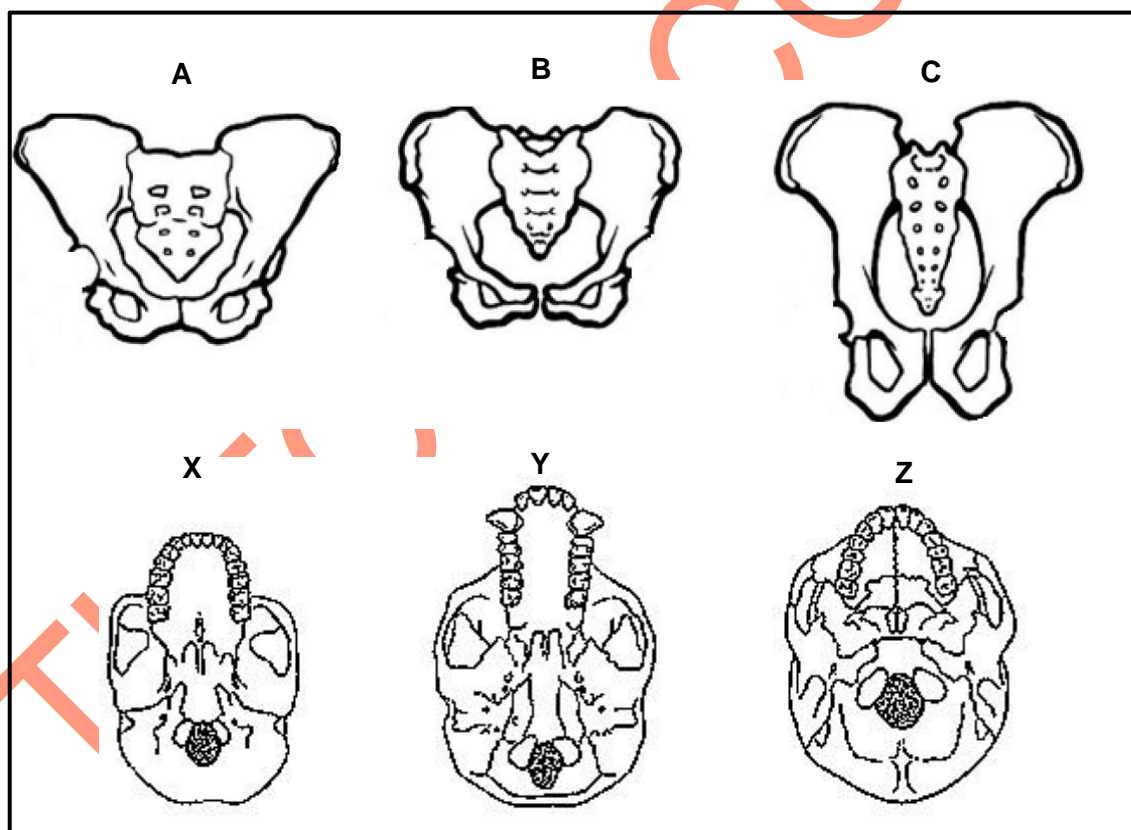
- ***H. ergaster* shows characteristics of both ✓ *A. afarensis* and *H. heidelbergensis***
- **therefore, it is a transitional ✓ species**

20.5. Explain how the fossils of organisms that existed from 4 mya to present time are used to support the 'Out of Africa' hypothesis. (3)

- **The fossils of *Australopithecus* were ONLY found in 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 ✓**
- **This suggests that (the ancestors of) *Homo sapiens* originated in Africa ✓ ***

***1 Compulsory + Any 2**

21. The diagram below represents the pelvic structure and the ventral view of the skulls of three organisms. The diagrams are drawn to scale.



21.1. Write down the LETTER(S) of the diagram(s) that represent the:

a) Skulls of bipedal organisms (2)
X ✓, Z ✓ (in any order)

b) Pelvic structure of a quadrupedal organism (1)
C ✓

21.2. Give a reason for your answer to QUESTION 21.1. (b). (2)

**The pelvis is long ✓
and narrow ✓**

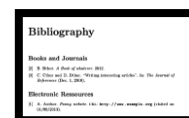
21.3. Describe ONE other structural difference between a *bipedal* and a *quadrupedal* organism. (3)

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

OR

- **The foramen magnum ✓**
- **is in a more forward position in bipedal organisms ✓**
- **and in a backward position in quadrupedal organisms ✓ (3)**

(Mark first ONE only)



BIBLIOGRAPHY

Department of Basic Education 2013-2021. The Curriculum Assessment and Policy Statement
National and Provincial question papers.

Department of Basic Education 2021. The Curriculum Assessment and Policy Statement examination guideline. Pretoria: Government Printing Works.

JSDT solutions-Experts in Educational Apps 2020 – 2024.

National Senior Certificate, 2016 – 2021 diagnostic reports. Pretoria: Government Printing Works.

<http://www.untamedscience.com/biology/plants/phototropism/>

Plant growth: Auxins and gibberellins: https://www.youtube.com/watch?v=EZ5tU45Ti_g

Plant hormones: <https://www.youtube.com/watch?v=HR9KHW-e0pY>

Phototropism time-lapse: <https://www.youtube.com/watch?v=G4Mo9-JAeok>

Geotropism: <https://www.youtube.com/watch?v=57IXUG0CHSQ>