



LIFE SCIENCES

TEACHER'S REVISION MATERIAL

LAST PUSH

GRADE 12

PAPER 1 & 2

LAST- PUSH

LEARNERS REVISION

MATERIAL

PAPER 1 & 2

2025

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, 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.

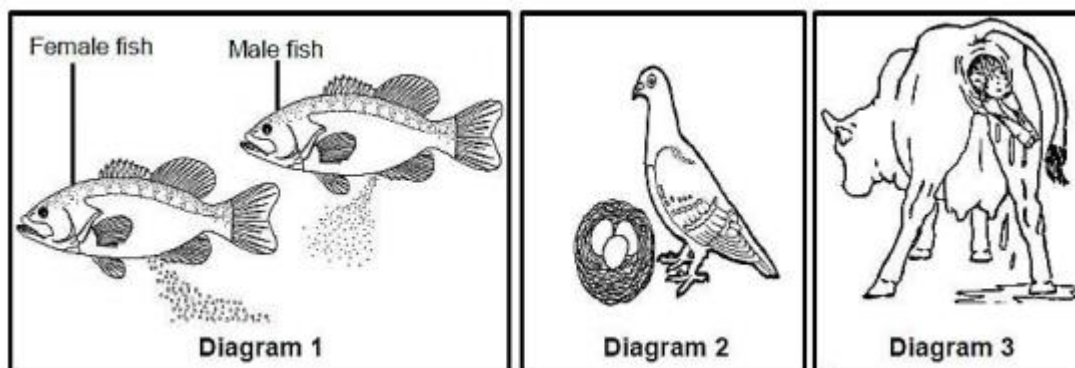
Informal activities in the form of word puzzle/fill in the missing words can assist in improving spelling and terminology.

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

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)

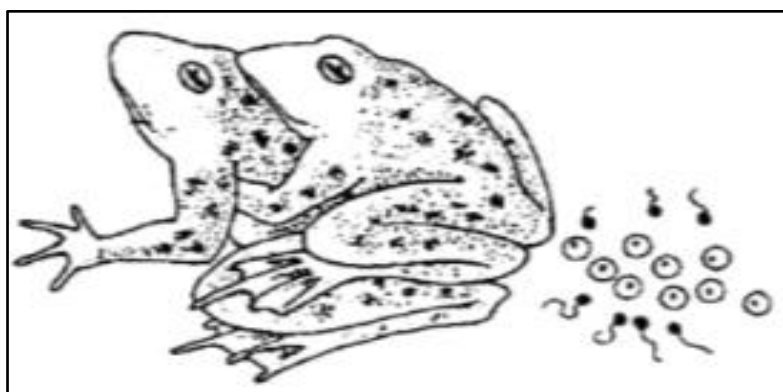
Diagram 1 ✓ and Diagram 2 ✓

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

Amniotic ✓ egg

(6)

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 ✓

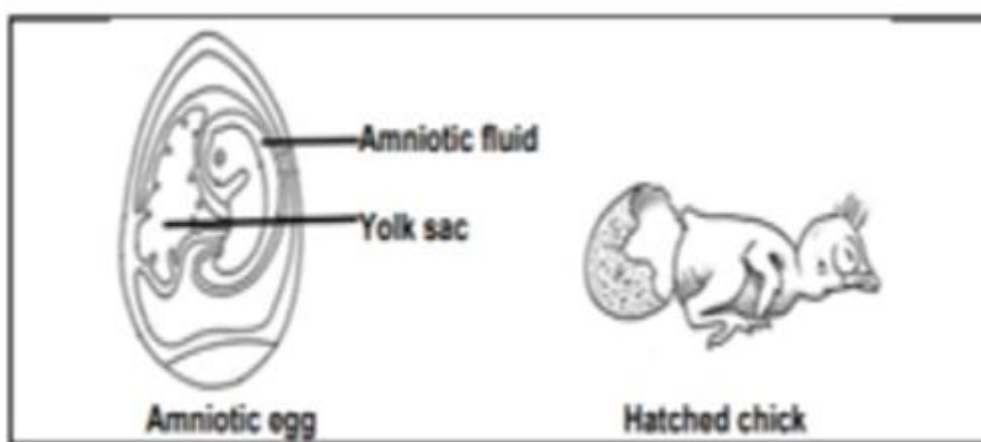
2.2.4. State ONE significance for this type of fertilization in frogs to occur in water (1)

- Prevents drying out of gametes ✓

- Allow sperms cells to swim towards eggs cells ✓

(5)

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)

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** ✓

Learners do not know Amniotic Egg.

Amniotic egg has shell and amniotic fluid that prevents embryo drying out on land.

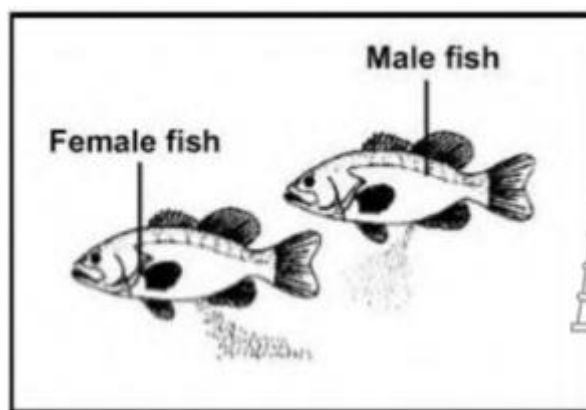
Learners must understand difference between functions of parts of amniotic egg and why it is suitable for land.

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 ✓**

(8)

2.4. The diagram below shows a certain species of fish mating.



2.4.1 Identify the type of fertilization displayed by the fish species. (1)

- **External fertilization ✓**

2.4.2 State TWO visible ways in which the chances of fertilisation in these fish are increased. (2)

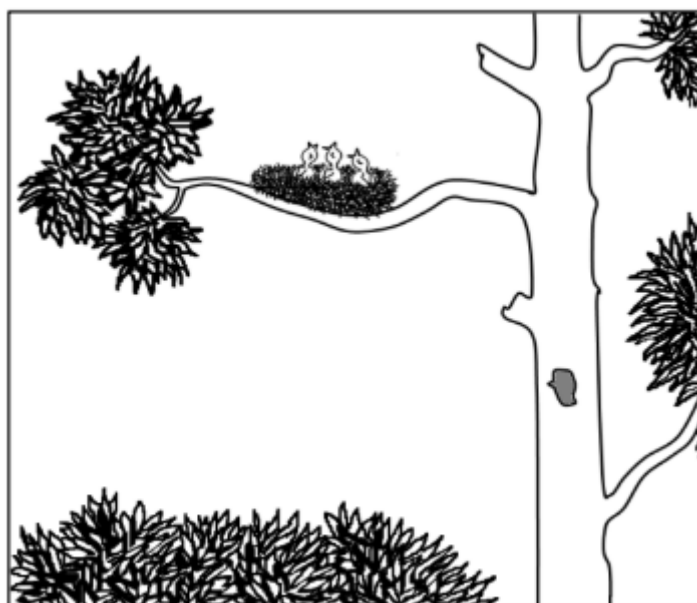
- **A large amount of sperm is released ✓**
- **A large amount of eggs is released ✓**
- **The male and female swim close to each other /the sperm is released close to the eggs ✓**

2.4.3 Give TWO reasons why there is no need for then eggs of these fish to be covered by a hard or leathery shell (2)

- **No danger of drying out ✓**

(5)

2.5. The diagram below shows a bird's nest in a high tree with some newly hatched birds.



2.5.1 State TWO observable reasons why this type of development can be regarded as altricial. (2)

- **Eyes are closed ✓/ blind**
- **No feathers ✓**
- **Cannot move ✓**

2.5.2 Explain ONE advantage of the nest being high in the tree for the altricial development in an ecosystem. (3)

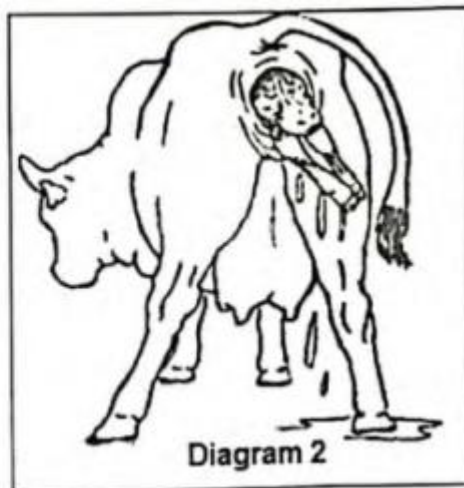
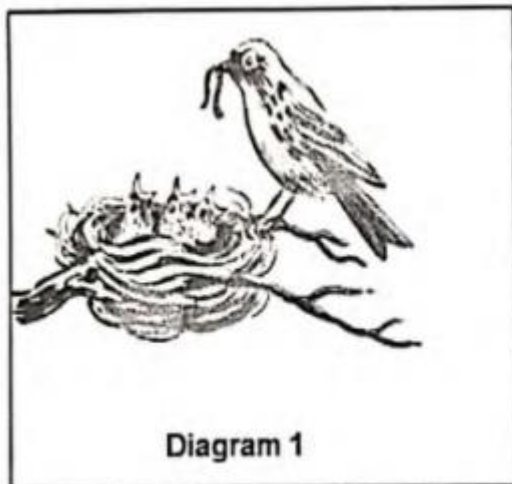
- **Not accessible to many predators ✓**
- **since they cannot run from them ✓**
- **Therefore, increasing the chances of survival ✓**

2.5.3 Explain the volume of the yolk in an amniotic egg of the bird that is precocial as compared to the same size of bird that is altricial. (3)

- **The yolk volume in precocial birds will be more ✓ than in altricial**
- **because it needs more nutrients ✓**
- **to be born fully developed ✓**

(8)

2.6. The diagram below shows different reproductive strategies in animals.



2.6.1. Identify the developmental strategy shown in:

(a) Diagram 1

(1)

- **Altricial development**✓

(b) Diagram 2

(1)

- **Precocial development**✓

2.6.2 State TWO characteristics of the young, born of organisms to your answer in QUESTION 2.6.1(b)

(2)

- **Eyes are open when they are born**✓
- **Their bodies are covered with fur** ✓
- **They are able to move about soon after birth**✓
- **They are able to feed themselves**✓
- **They are independent of their parents**✓

2.6.4 Explain the advantage of ovovivipary over ovipary as a reproductive strategy.

(4)

- **In ovovivipary the chances of producing offsprings are greater** ✓
- **Since in the eggs are protected within the mother**✓
the young ones are better developed to cope in the environment
- **In ovipary there is a smaller chances of survival.**✓
- **Since many eggs laid may be eaten by the predators**✓/**the young ones are not well developed.**

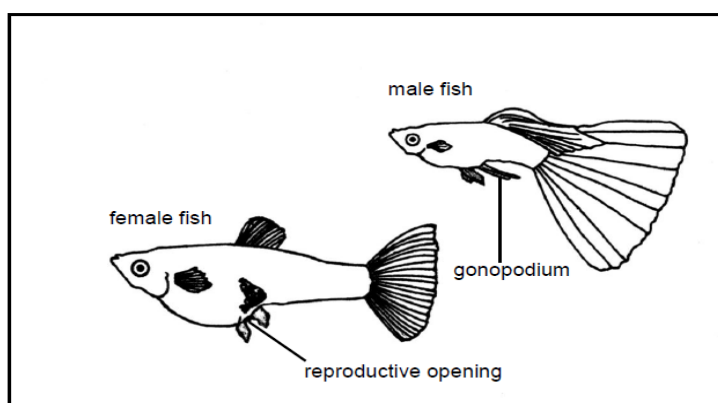
(8)

2.7. Read the extract below.

REPRODUCTION IN GUPPY FISH

Guppy fish have a very interesting method of breeding. During mating the male deposits packets of sperm inside the female's reproductive opening using an organ called the 'gonopodium'. This process takes place several times and the female stores some of the extra sperm.

The fertilised eggs remain in the female's body until they hatch and the young are born live. The gestation period is usually between 22 and 28 days.



2.7.1. Name the type of fertilisation in guppies. (1)

- **Internal fertilisation✓**

2.7.2. Explain TWO ways in which the type of fertilisation named in QUESTION 2.7.1 increases reproductive success. (4)

- **Sperm and ovum are brought into close contact inside the female ✓ body thereby increasing the chances of fertilisation✓**
- **Gametes inside the body ✓ therefore protected from the predators / environmental dangers✓/dehydration thereby increasing survival of gametes/chances of fertilization✓**

Note: Internal and external fertilization affect the survival of the gametes NOT the offspring only, as the offspring develops after fertilization has occurred

2.7.3. Why are guppies regarded as being ovoviviparous? (2)

- **The eggs hatch inside the female's body✓**
- **and the young are born live✓**

(7)

2.8. Read the extract below. (DBE/November 2021)

The bluefin tuna, the great white shark and the bottlenose dolphin are three aquatic species that are found in the Indian Ocean.

An adult bluefin tuna releases up to 540 000 000 eggs into the water annually, while the great white shark female produces 2 to 12 offspring through ovovivipary every two years. A bottlenose dolphin female, being a mammal, is viviparous and produces one offspring every two to three years.

2.8.1. Name the type of fertilisation that takes place in the bottlenose dolphin. (1)

- **Internal fertilisation✓**

2.8.2. Explain how TWO of the reproductive strategies of the great white shark increase its reproductive success. (4)

- **Internal fertilization✓**

increases the chances of fertilisation✓

- **Ovovivipary/ eggs retained inside the female's body✓**

- **where they are protected✓**

2.8.3. Explain ONE reason why the bluefin tuna releases a large number of eggs. (2)

- **To increase the chances of fertilisation/ the survival of the eggs/ number of offspring✓**

- **As eggs may be lost to predators/environmental factors✓
Since there is external fertilisation✓**

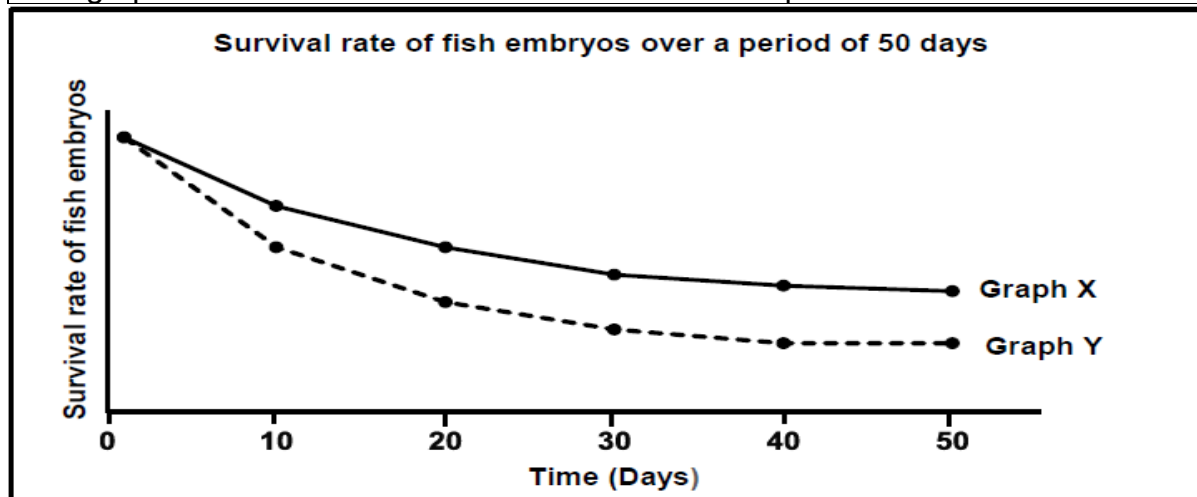
(7)

2.9. Read the extract below. (DBE/November 2022)

Anchovy is a type of fish found in the Pacific Ocean. During the breeding season, the females and males gather in large groups and release ova and semen into the water. Once fertilised, the eggs float in the water and embryonic development occurs until hatching.

The northern pike fish is found mainly in rivers. During the breeding season, the female releases thousands of ova and the male releases semen all around the female. The fertilised eggs attach to vegetation near the riverbed, where embryonic development occurs until hatching.

The graph below shows the survival rate of both fish species.



- 2.9.1. Name the type of fertilisation that takes place in both fish species. (1)
 - **External fertilization**✓
- 2.9.2. Explain why both fish species are oviparous. (2)
 - **Their embryos develop inside eggs that are**✓
 - **outside the body of the female**✓
- 2.9.3. Describe TWO ways in which the chances of fertilisation are increased in the northern pike fish. (2)
 - **The males release semen all around the female**✓
 - **A large number of gametes/ ova are produced**✓
- 2.9.4. Which graph (X or Y) represents the survival rate of the northern pike fish? (1)
 - **Graph X**✓
- 2.9.5. Explain your answer to QUESTION 2.9.4. (3)
 - **They will have a higher number of surviving**✓
 - **embryos /eggs/offspring**✓
 - **Because their fertilised eggs are attached to the vegetation**✓
 - **where they are protected from predators/washing away**✓

(9)

2.10. Frogs can survive in water and on land. Most frogs, however, need water for reproduction. During the breeding season, male and female frogs release millions of gametes into the water. (DBE/2023)

- 2.10.1. Name the type of fertilisation described above. (1)
 - **External fertilisation**✓
- 2.10.2. Explain why millions of gametes are released. (3)
 - **To increase the chances of fertilisation**✓
 - **since the gametes may be lost/not reach one another**✓
 - **due to predation /water currents**✓
- OR**
- **To produce more zygotes /offspring**✓
 - **since many will be lost**✓
 - **because they are preyed on/washed away/dry out**✓
- 2.10.3. State why the reproduction in frogs is an example of ovipary. (1)
 - **The embryos develop inside an egg, outside the female's body**✓

(5)

- 2.11. Describe how the developing embryo is protected and nourished in ovoviviparous organisms. (DBE/2022) (7)

Protection

- **The (amniotic) egg is retained inside the mother's body to protect the embryo from predators**✓
- **The allantois protects the embryo**✓
- **by removing waste products**✓
- **The embryo is protected from shocks/sudden changes in temperature/dehydration by the:**✓
 - **Chorion**✓
 - **Amnion**✓
 - **Amniotic fluid inside the amniotic membrane**✓
 - **Shell/outer covering**✓

- **Air pocket✓**
- Nourishment (N)**
 - **The embryo receives nutrients✓**
 - **from the egg yolk in the yolk sac✓**
 - **and from the albumen✓**

2.12. In some frog species, during mating, the male climbs onto the back of the female and grasps her with his front legs. During this time, the female will release about 6 000 ova, while the male releases sperm onto them. This mating behaviour is called amplexus. (DBE/November 2023)

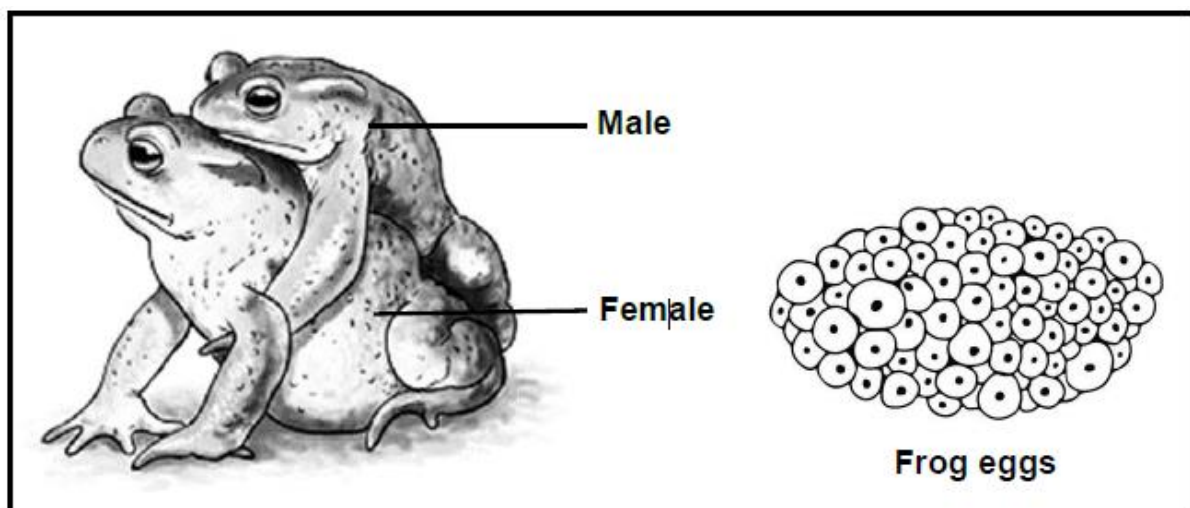
This question was the worst performing question. Learners struggle to understand the strategy of amplexus. "Amplexus is when the male climbs onto the back of the female and grasps her with his front legs".

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.



2.12.1. Name the type of fertilisation that occurs during reproduction in frogs. (1)

- **External fertilisation✓**

2.12.2. Explain why the fertilised eggs of these frogs do not survive on land. (2)

- **The eggs will dry out✓**
- **because they have no shells/are not amniotic eggs /have no amnion✓**

2.12.3. Explain how amplexus increases the chances of fertilisation in frogs. (2)

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

OR

- **Many/up to 6 000 ova are released✓**
- **since fertilisation is external✓**

2.12.4. From the information above, explain ONE other strategy that contributes to the reproductive success of the frog species. (2)

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

OR

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

(7)

2.13. The passage below describes the breeding habits of vultures. (DBE/November 2024)

Vultures are birds of prey that feed on the flesh of dead animals. A female vulture lays only one to two fertilised eggs, which are then protected by both parents during incubation. Incubation is the period from the time an egg is laid up to the time it hatches. Vultures have a short incubation period of 32 to 45 days. This short incubation period is typical of birds displaying altricial development. After hatching, the parents feed the young chicks as often as 20 times a day.

2.13.1. Give ONE reason from the passage why vultures:

(a) Are considered as oviparous

(1)

- **They lay eggs✓**

(1)

(b) Have a high survival rate even though few eggs are laid

- **The eggs are protected/incubated by the parents✓**
- **The young chicks are fed by the parents/display parental✓**

2.13.2. Fertilisation in vultures takes place internally.

State TWO advantages of internal fertilisation.

(2)

- **It increases the chances of fertilisation/gametes are in close contact✓**
- **Gametes are protected from predation/desiccation/environmental factors✓**
- **Water is not needed✓**
- **Fewer gametes are needed ✓**

2.13.3. State TWO characteristics of chicks that display altricial development (2)

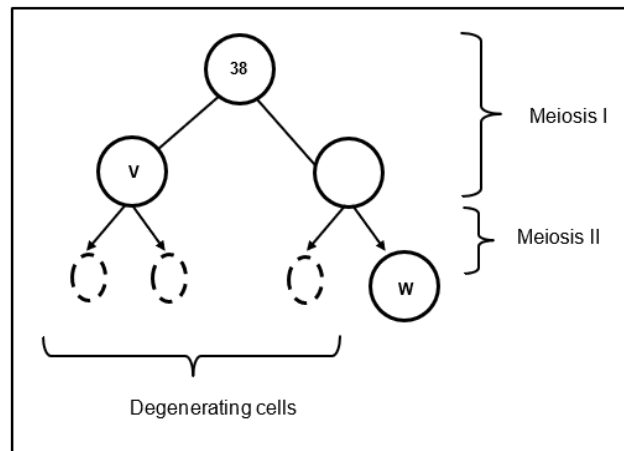
- **Eyes are closed when they hatch✓**
- **Bodies do not have (down) feathers✓**
- **Unable to move directly after hatching✓**
- **Dependent on parents for food/protection✓**

2.13.4. Explain why birds with altricial development would have short incubation periods. (2)

- **The chicks are not fully developed when hatched since✓**
- **the eggs have less yolk/ there is a high degree of parental care✓**

HUMAN REPRODUCTION

3.1. The diagram represents different stages during oogenesis in a female leopard that has a diploid chromosome number of 38



3.1.1. Where in the female body does oogenesis take place? (1)

Ovary✓

Give the number of:

(a) Chromosomes in cell **V** (1)

19 ✓

(b) Autosomes in cell **W** (1)

18 ✓

3.1.2. Name TWO processes that take place during Meiosis I that lead to genetic variation in the cells that are formed. (2)

- **Crossing over✓**

- **The random arrangement of chromosomes at the equator of the cell✓**

3.1.3. Explain ONE more reason why meiosis is very important. (1)

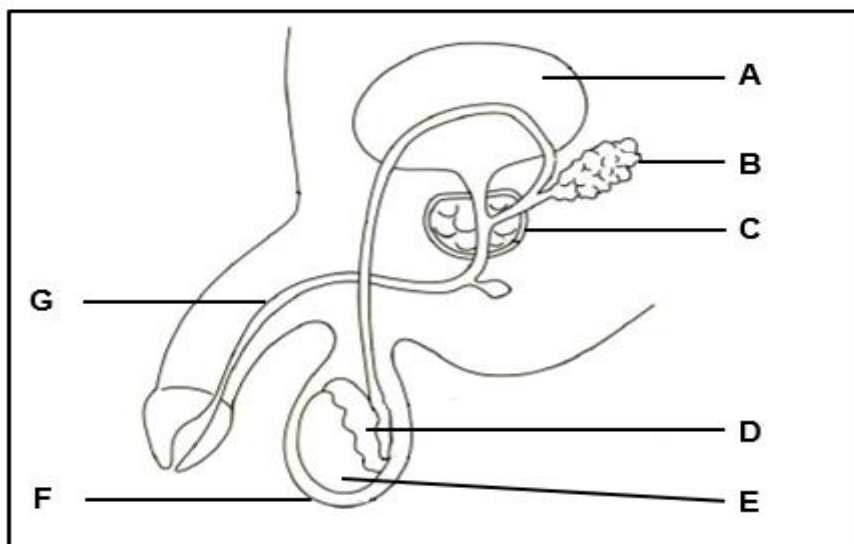
- **The chromosome number is halved✓/haploid gametes are produced**

- **to ensure a diploid chromosome number after fertilisation✓/to maintain a constant chromosome number in each generation**

(7)

Learners only need to know general functions of accessory glands not individual functions of glands.

3.2. The diagram below represents the male reproductive system.



3.2.1. Identify:

(a) B (1)

- **Seminal vesicle**✓

(b) G (1)

- **Urethra**✓

3.2.2 Give the LETTER and NAME of the part:

(a) Where sperm are kept to mature (2)

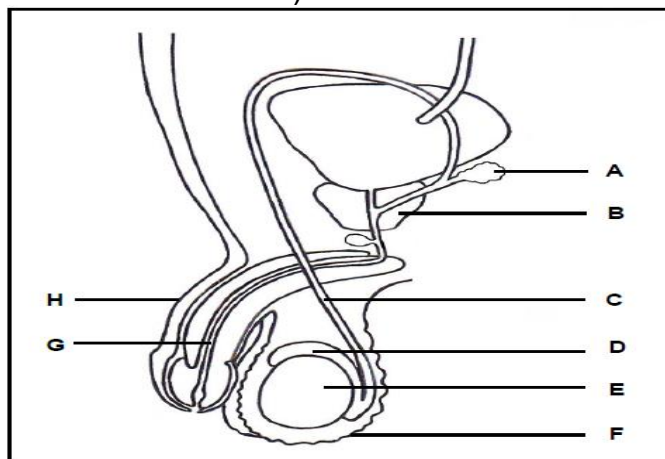
- **D**✓ - **Epididymis**✓

(b) That controls the temperature at which sperm is produced (2)

- **F**✓ - **Scrotum**✓

(6)

3.3 The diagram below shows the parts of the male reproductive system. (DBE/November 2021)



3.3.1 Identify part:

(a) **C** (1)

- **Vas deferens**✓/sperm duct

(b) **F** (1)

- **Scrotum**✓

(c) **H** (1)

- **Penis✓**

3.3.2 Give the LETTER and NAME of the part that:

(a) Stores sperm temporarily (1)

- **D Epididymis✓**

(b) Transports both semen and urine (1)

- **G Urethra✓**

(c) Produces testosterone (1)

- **E Testis✓**

3.3.3 Give the LETTERS of TWO parts that contribute to the formation of semen. (2)

- **A✓**

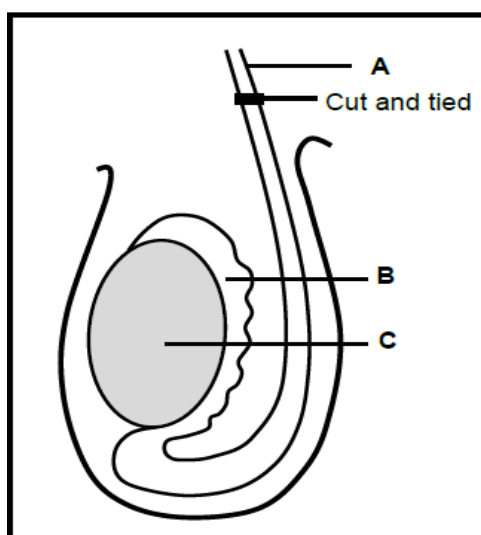
- **B✓**

- **E✓**

Any

(8)

3.4 The diagram below shows part of the male reproductive system.
(DBE/2022)



3.4.1 Identify part A. (1)

- **Vas deferens✓**

3.4.2 State ONE function of part B. (1)

- **Sperm storage✓**

- **Sperm maturation✓**

Any

3.4.3 During a vasectomy, part A is cut and tied as shown in the diagram. Explain the composition of the semen after a vasectomy. (3)

- **Semen will still be released during copulation✓**

- **The semen will not contain sperm because ✓**

- **they are not transported✓**

- **but will contain all other secretions of the accessory glands/ examples thereof✓**

- **the vasectomy occurred before the accessory glands ✓**

Any

3.4.4 In some rare cases, males are born with part C located inside the body because it failed to descend into the scrotum. Explain how this condition may affect male fertility. (3)

- The temperature of the testes inside the body will be too high✓
- No/abnormal sperm will be produced✓
- The man will be infertile/not able to reproduce ✓

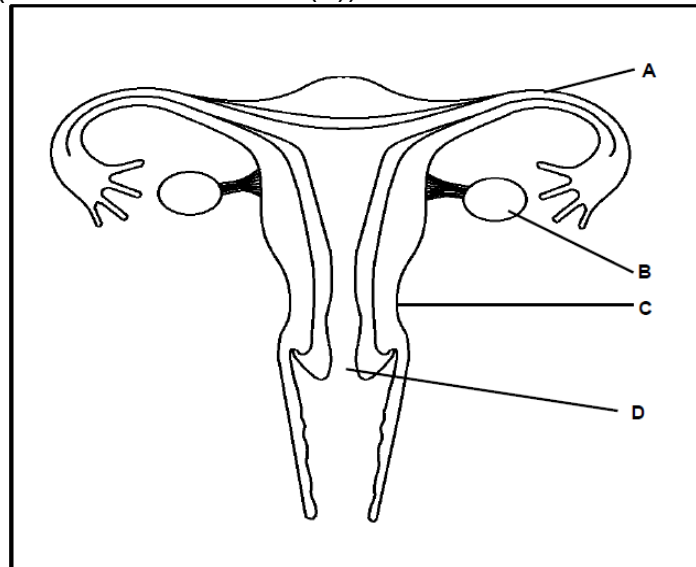
3.4.5 Describe the process of spermatogenesis (4)

- Under the influence of testosterone ✓
- diploid cells/germinal epithelial cells ✓
- in the seminiferous tubules/testes ✓
- undergo meiosis✓
- to form haploid sperm cells✓

Any

(12)

3.5 The structure below represents a part of the female reproductive system. (DBE/November 2020(2))



3.5.1 Identify part D. (1)

- Cervix✓

3.5.2 State ONE function of part A. (1)

- The site of fertilisation✓
- The site of zygote division ✓
- The transfer of the ovum/embryo to the uterus✓

Any

3.5.3 Describe the process of oogenesis as it occurs in part B. (4)

- Diploid cells in the ovary undergo mitosis ✓
- to form numerous follicles✓
- Under the influence of FSH ✓
- one cell undergoes meiosis ✓
- to form a (haploid) ovum✓

Any

3.5.4 State ONE way in which structure C is suited for its function during pregnancy (1)

- It is a hollow organ✓
- It has a muscular wall✓
- It has a blood-rich lining/endometrium ✓

Any

3.5.5 A person undergoes a surgical operation to remove part B on both sides. (3)

Explain why this person will not menstruate

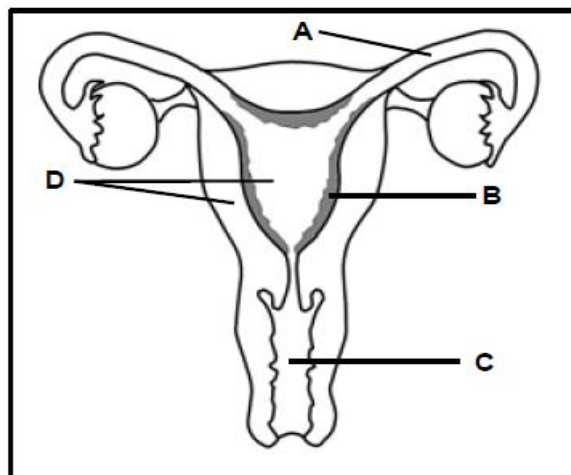
- No follicle will develop✓
- No oestrogen produced✓

- and no progesterone produced ✓
- Therefore, the endometrium will not develop to be shed during menstruation ✓

Any

(10)

3.6 The diagram below represents the female reproductive system.
(DBE/2023)



3.6.1 Identify part B. (1)

- **Endometrium**✓

3.6.2 Name the process that takes place in part A that leads to zygote formation (1)

- **Fertilisation**✓

3.6.3 Describe the process named in QUESTION 3.6.2 (1)

- **The (nucleus of the) sperm fuses with (the nucleus of) the ovum**✓

3.6.4 Describe the development of the zygote until implantation occurs. (4)

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

Any

3.6.5 Explain TWO ways in which part D is structurally suited for gestation. (4)

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

Any

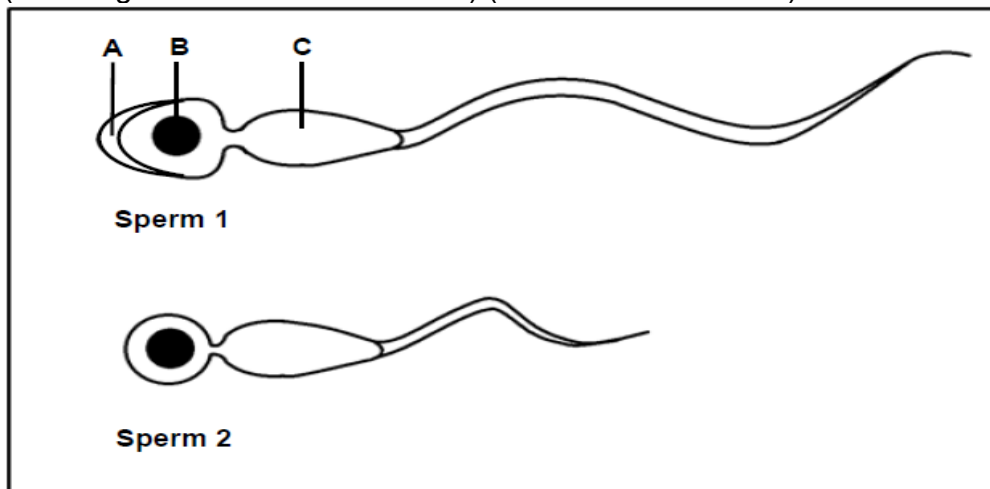
3.6.6 Describe how the secretion of the prostate gland provides protection for the sperm from the conditions in part C. (2)

- **The secretion is alkaline which** ✓
- **neutralises the acidic conditions of the vagina** ✓
- **It provides enzymes which give given mobility to sperms**✓
- **It contains nutrients to supply the sperm with energy**✓

Any

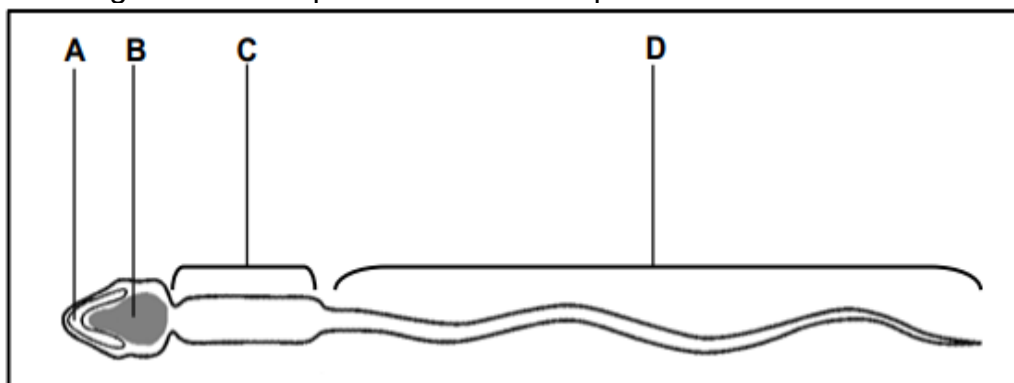
(13)

- 3.7 The diagrams below show the structure of a normal and an abnormal sperm. (The diagrams are drawn to scale.) (DBE/November 2022)



- 3.7.1 Identify part A. (1)
 - **Acrosome** ✓
- 3.7.2 Describe the role of structure B during fertilisation. (1)
 - **Fuses with the nucleus of the ovum** ✓
 - **Carries genetic material** ✓
- 3.7.3 Explain the role of the organelles found in large numbers in part C. (2)
 - **Produce energy/ site for cellular respiration** ✓
 - **which is needed for movement of the sperm** ✓
- 3.7.4 Explain TWO reasons why sperm 1 is structurally better suited for fertilisation than sperm 2. (4)
 - **The oval/torpedo-shaped head** ✓
 - **will facilitate faster movement** ✓
 - **The presence of an acrosome/part A** ✓
 - **enables the sperm to penetrate the ovum** ✓
 - **A longer tail** ✓
 - **ensures faster movement** ✓
- Any**
(8)

- 3.8 The diagram below represents a human sperm cell.



- 3.8.1 Identify parts:
 (a) A (1)

- **Acrosome** ✓

(b) B

- **Nucleus** ✓

(1)

3.8.2 Give the LETTER of the part that contains genetic material.

(1)

- **B** ✓

3.8.3 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)

3.8.4 In cats, a sperm cell has 19 chromosomes.

(1)

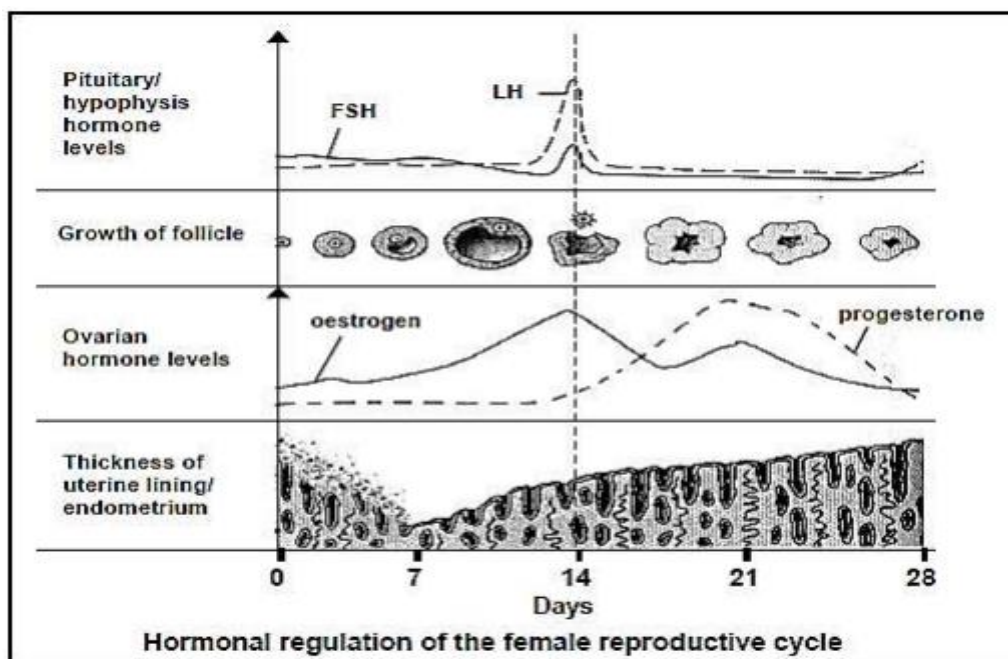
3.4.5. How many chromosomes will be found in the skin cell of a cat?

- **38** ✓

(8)

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.

3.9 Study the graph below of a menstrual cycle and the influence of the different hormones on it.



3.9.1 On which day does ovulation take place?

(1)

- **Day 14** ✓ / **15**

3.9.2 Between which days does menstruation take place?

(1)

- **Day 0-6** ✓ / **day 0-7**

3.9.3 On which day does ovulation take place?

(1)

- **Day 14** ✓ / **15**

3.9.4 Between which days does menstruation take place?

(1)

- **Day 0-6** ✓ / **day 0-7**

- 3.9.5 State ONE function of FSH during the menstrual cycle. (1)
 - **Stimulates follicle✓/ovum development in the ovary/secretion of oestrogen**
- 3.9.6 State two functions of LH. (2)
 - **stimulates the bursting of the Graafian follicle to release the ovum✓/stimulates ovulation**
 - **stimulates the conversion of the Graafian follicle into the corpus luteum ✓**
- 3.9.7 Describe the functional relationship between progesterone and FSH. (2)
 - **An increase in progesterone level✓ inhibits the release of FSH ✓**
- OR**
- **FSH stimulates the development of the ovum✓ and progesterone**
 - **prepares for implantation ✓when this ovum is fertilised Any**
- 3.9.8 Did fertilisation take place within the 28-day cycle illustrated in the graph? (1)
 - **No✓**
- 3.9.9 Give TWO reasons for your answer to QUESTION 3.9.8 (1)
 - **Corpus luteum has degenerated ✓**
 - **Progesterone level has decreased✓**
 - **FSH level starts to rise ✓**
 - **LH level decreases✓**

Any

(11)

- 3.10 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. (DBE/November 2020(2))

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

The procedure was as follows:

- 308 healthy, male volunteers were selected.
- A sperm count for each volunteer was done initially.
- Each volunteer was given 500 mg of TU monthly over a period of 12 months.
- During the period of the 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.

- 3.10.1 Identify the dependent variable in the investigation. (1)
 - **Male fertility✓**
- 3.10.2 State how the dependent variable in QUESTION 3.10.1 was measured. (1)

- **Measuring the sperm count✓**
- 3.10.3 Name TWO other factors that should be considered when selecting volunteers. (2)
- **Age✓**
 - **Diet✓**
 - **Exercise✓**
 - **Activity level✓**
 - **Lifestyle✓**
 - **Occupation✓**
- 3.10.4 Explain how TU reduces fertility. (2)
- **TU inhibits the secretion of testosterone✓**
 - **spermatogenesis cannot take place✓/no sperm will be produced**
- 3.10.5 Explain why wearing tight-fitting trousers will decrease male fertility (2)
- **The higher temperature/pressure on the testes✓due to the tight underwear**
 - **could decrease the sperm count✓/sperm production/lead to the production of abnormal sperm**
- 3.10.6 Suggest ONE reason for doing the sperm count for an additional 12 months 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**
- 3.10.7 The contraceptive options that are currently available for men are limited to condoms and vasectomy. Vasectomy involves the cutting and tying of both the vas deferens. (2)
- Explain how a vasectomy prevents pregnancy.
- **No sperm will be transported✓**
 - **from the epididymis to the urethra✓**
 - **Semen without sperm will be released✓**

(11)

- 3.11 Read the extract below. (DBE/November 2021)

Endometriosis is a medical condition that occurs when the endometrium develops in or on other structures such as the Fallopian tubes, ovaries or pelvis. It is caused by higher than normal levels of oestrogen. Females with this condition will most likely experience mild to severe menstrual pains. This condition can sometimes lead to infertility.

Doctors may prescribe a contraceptive pill as treatment to reduce the development of the endometrium. The pill contains progesterone.

- 3.11.1 Name the structure where the endometrium normally develops. (1)
- **Uterus✓**
- 3.11.2 Explain why endometriosis in the Fallopian tubes may lead to infertility. (3)
- **The thickened layer may cause an obstruction✓/blockage**
 - **which may prevent the passage of gametes✓**
 - **preventing fertilisation✓ from taking place**

OR

- The thickened layer may cause an obstruction✓/blockage
- which may prevent the embryo from reaching the uterus✓/implantation could occur in the Fallopian tube
- which may lead to the death of the embryo✓/rupturing of the fallopian tube/miscarriage

3.11.3 Use the negative feedback mechanism to explain why the pills containing progesterone are successful in treating endometriosis. (4)

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

(7)

3.12 The FSH test is sometimes used to determine the cause of infertility in females. The levels of FSH usually indicate the number of follicles in the ovaries. If the number of follicles are low or depleted, the pituitary gland will secrete more FSH. (DBE/2022)

An investigation was conducted to compare the average FSH levels in 4 different age groups.

The procedure was done as follows:

- 1 000 females were asked to participate (250 in each of the four age groups).
- The females were all healthy and not using any hormone-based contraceptives.
- Their blood FSH levels were measured on day 3 of the menstrual cycle for 5 cycles.
- The average FSH levels in their blood were calculated per age group.

The results are shown in the table below.

AGE GROUP	AVERAGE FSH LEVELS
20–32	7,0
33–35	7,8
36–40	8,0
41–50	8,5

3.12.1 State TWO factors, regarding the females, that should have been kept constant during the investigation. (2)

- Must have regular menstrual cycles✓
- They must not become pregnant✓
- Diet ✓

3.12.2 State TWO ways in which the reliability of the results was ensured. (2)

- 250 females per group were used✓/1000 females participated
- Measurement was done for 5 cycles✓

3.12.3 State ONE conclusion that can be drawn from the results. (2)

- Older groups of women have a higher (average) FSH level than the younger groups✓✓

OR

- Younger groups of women have a lower (average) FSH level than the older groups✓✓

3.12.4 Explain why the oestrogen levels may remain low in the blood of the females in the 41- 50 age group. (3)

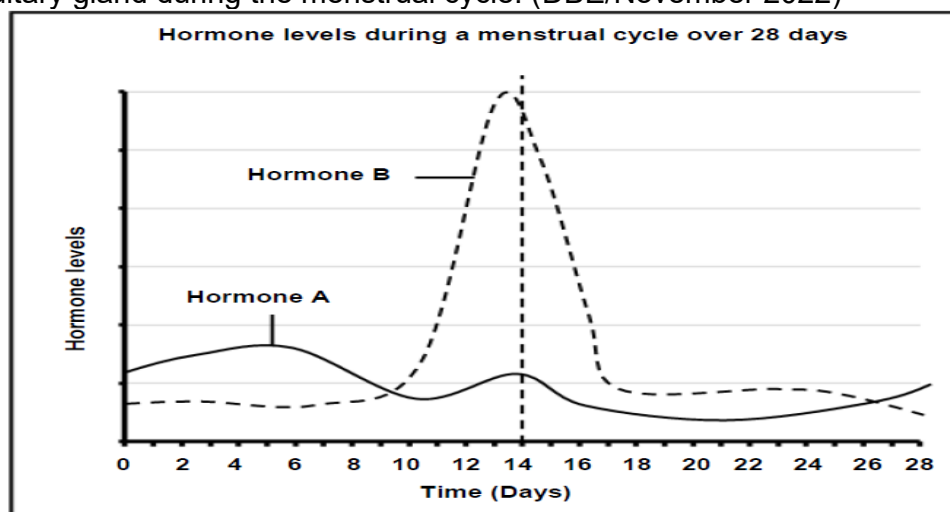
- The Graafian/developing follicles secretes oestrogen✓✓
- but since the number of follicles are low✓/depleted
- less/no oestrogen will be secreted✓

3.12.4 Explain why females that were using progesterone-based pills were excluded from the investigation. (3)

- high concentration of progesterone✓
- inhibits the pituitary gland✓/results in reduced FSH secretion
- This will decrease the validity of the investigation✓

(12)

3.13 The graph below shows the levels of two hormones that are secreted by the pituitary gland during the menstrual cycle. (DBE/November 2022)



3.13.1 State TWO functions of hormone B. (2)

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

3.13.2 Explain why a female who is struggling to get pregnant: (3)

(a) May be given pills containing hormone A as a treatment

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

(b) Will have her levels of hormone B constantly monitored (2)

- A peak in hormone B✓/LH
- will indicate that ovulation is about to happen✓
- therefore, an ovum will be available for fertilisation✓

3.13.3 Explain how the levels of hormone A on days 0 to 5 will differ in a pregnant female. (3)

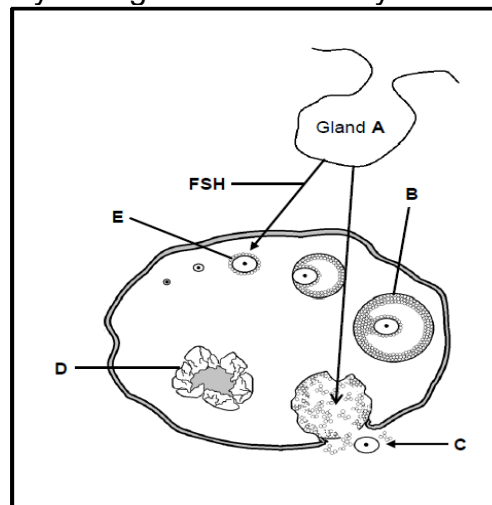
- The levels will remain low✓ because
- the high progesterone levels✓ during pregnancy
- will inhibit the secretion of FSH✓ /hormone A
-

3.13.4 Describe the secretion of the ovarian hormones and their role in the menstrual cycle. (5)

- **The Graafian follicle✓**
- **secretes oestrogen✓**
- **causing the endometrium to become thicker✓/more glandular or vascular**
- **The corpus luteum✓**
- **secretes progesterone✓**
- **which (further) increases the thickness of the endometrium✓**
- **High levels of progesterone inhibit FSH secretion✓**

(15)

3.14 The diagram below represents an endocrine gland **A** and the events that take place in the ovary during the menstrual cycle in humans. (DBE/2019)



3.14.1 Identify:

- (a) Gland A (1)
- **Pituitary✓gland/hypophysis**
- (b) Structure B (1)
- **Graafian follicle✓**
- (c) Process C (1)
- **Ovulation✓**
- (d) Structure D (1)
- **Corpus luteum✓**

3.14.2 State the effect on the oestrogen levels in the blood if gland **A** stops secreting FSH. (1)

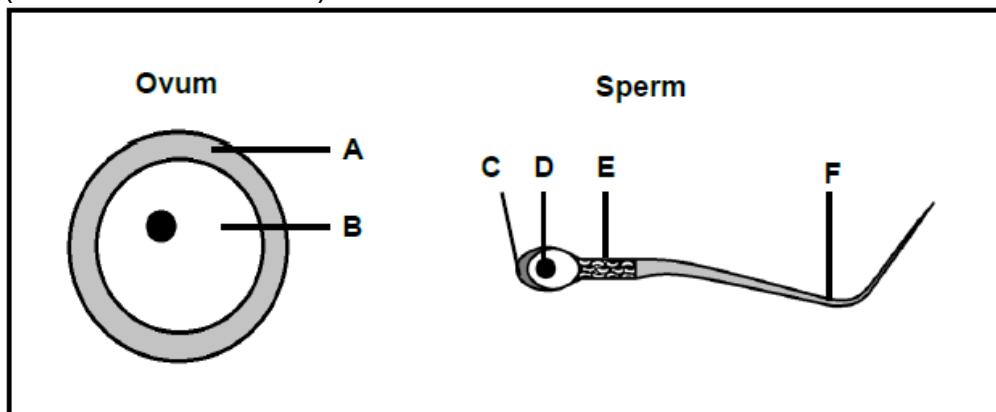
- **Remains low✓/decreases**

3.14.3 State ONE function of LH. (1)

- **Stimulates ovulation✓**
- **Stimulates the development of the corpus luteum✓**

(6)

- 3.15 The diagrams below represent the structures of an ovum and a sperm.
(DBE/November 2019)



- 3.15.1 Identify part:

(a) **A**

(1)

- **Jelly layer✓/Zona pellucida**

(b) **B**

(1)

- **Cytoplasm✓/cytosol**

(c) **C**

(1)

- **Acrosome✓**

- 3.15.2 Name the process involving meiosis that leads to the formation of an ovum.

(1)

- **Oogenesis✓**

- 3.15.3 Write down only the LETTER of the part of the sperm that enters the ovum.

(1)

- **D✓**

- 3.15.4 Write down only the LETTERS of TWO parts that enable the sperm to move towards the ovum.

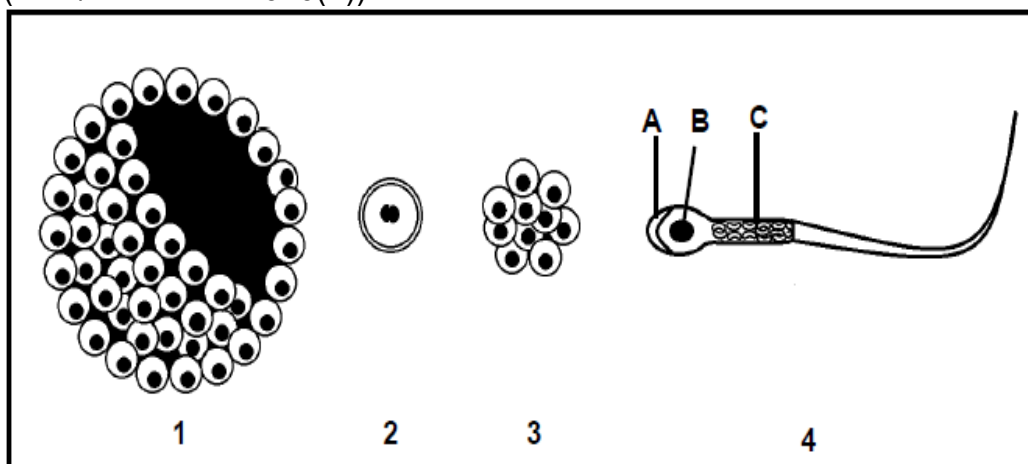
(2)

- **E✓**

- **F✓**

(7)

- 3.16 The diagrams below show structures formed during human reproduction.
(DBE/November 2020(2))



- 3.16.1 Identify part A.

(1)

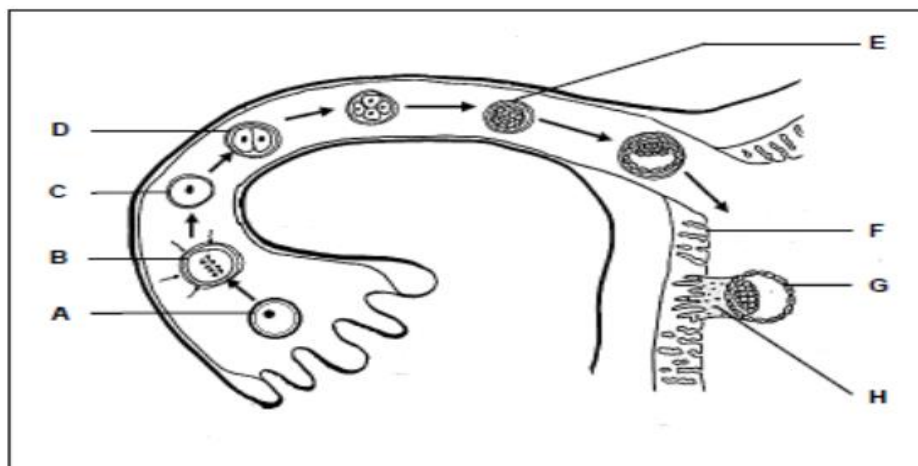
- **Acrosome✓**

- 3.16.2 Name the organelle found in large numbers in part **C**. (1)
 - **Mitochondria**✓
- 3.16.3 Give the NUMBER (1, 2, 3 or 4) only of the diagram that represents the following: (1)
 (a) Morula
 - **3**✓
 (b) Structure that will implant in the uterus (1)
 - **1**✓
 (c) Blastula/Blastocyst (1)
 - **1**✓
- 3.16.4 Give the LETTER and NAME of the part that will enter the ovum during fertilisation. (2)
 - **B**✓ - **Nucleus**✓
- 3.16.5 Name the type of cell division that occurred to produce the structure in diagram 3. (1)
 - **Mitosis**✓

(8)

- 3.17 Study the diagram below of the sequence of events that takes place from the fertilisation of the ovum to the development of the embryo in a part of the human female reproductive system.

The arrows indicate the direction of development of one ovum after fertilisation.



- 3.17.1 Identify: (1)
 (a) Structure C (1)
 - **Zygote**✓
 (b) The stage of embryo development at E (1)
 - **Morula**✓
 (c) The structure that develops from a combination of parts F and H (1)
 - **Placenta**✓
- 3.17.2 Name the process that takes place: (1)
 (a) At B (1)
 - **Fertilisation**✓
 (b) When G attaches to part F (1)
 - **Implantation**✓

3.17.3 Give the chromosome number of.

(a) The cells at D

- **46/23 pairs✓**

(1)

(b) Cell A

- **23✓**

(1)

(7)

3.18 Read the extract and study the diagram below. (DBE/2019)

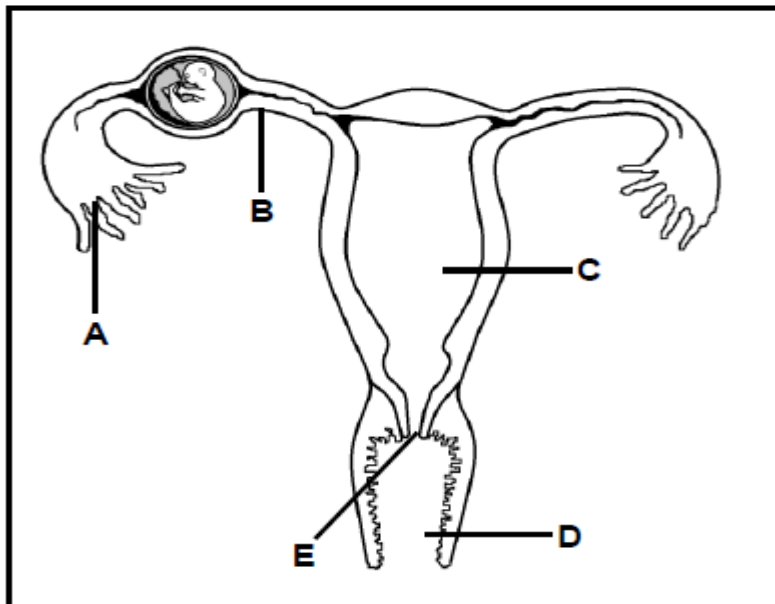
ECTOPIC PREGNANCIES

An ectopic pregnancy is a problem in which the embryo attaches outside the uterus. In most cases the embryo implants in the Fallopian tubes but implantation can also occur on the ovaries, in the cervix or in the abdominal cavity. An ectopic pregnancy cannot proceed normally. The embryo usually cannot survive.

Ectopic pregnancies are caused by one or more of the following:

- An infection or inflammation of the Fallopian tubes
- The development of scar tissue from a previous infection or a surgical procedure in the Fallopian tubes
- Previous surgery in the pelvic area

In most cases, the Fallopian tube where the ectopic pregnancy occurs, has to be removed surgically to save the woman's life.



3.18.1 Give only the LETTERS of the TWO parts in the diagram where implantation of the embryo may occur during an ectopic pregnancy. (2)

- **A✓**
- **B✓**
- **E✓**

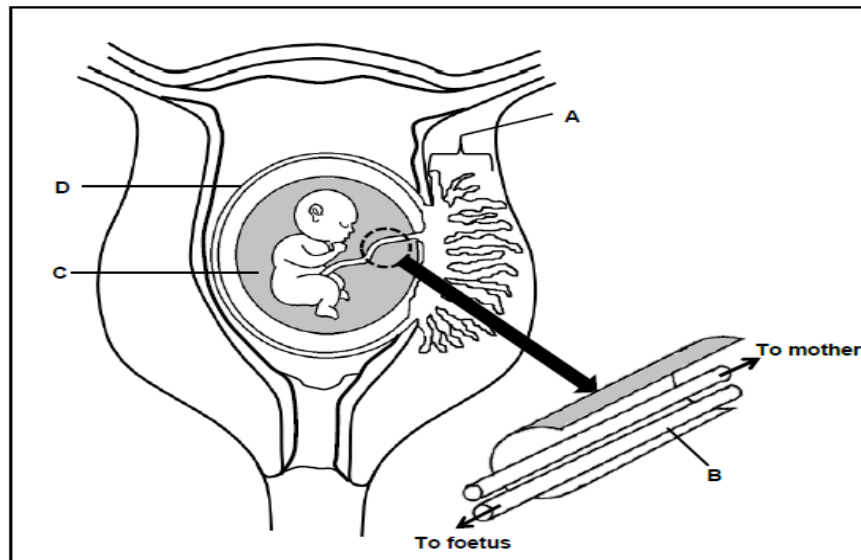
3.18.2 Explain why women who have had surgery on their Fallopian tubes have a greater risk of experiencing an ectopic pregnancy. (3)

- **The scar tissue✓**

Any

- **may partially block the Fallopian tube✓**
 - **preventing the embryo from reaching the uterus✓/resulting in implantation in the Fallopian tube**
- 3.18.3 Explain why a woman who had her Fallopian tube removed after an ectopic pregnancy occurred, may still be able to fall pregnant. (2)
- **The other Fallopian tube is still present✓/not blocked**
 - **Fertilisation may still take place in this Fallopian tube✓/the developing embryo can move along this Fallopian tube**
- OR**
- **During invitro fertilisation✓ (IVF)**
 - **the resulting embryo is inserted into the uterus✓**
- OR**
- **The ovum can be placed after the blockage✓**
 - **allowing fertilisation✓**
- 3.18.4 Give TWO reasons why the embryo may not be able to survive during an ectopic pregnancy inside the Fallopian tube. (2)
- **Insufficient space✓**
 - **Poor/no placental development✓**
 - **Decreased blood supply✓**
 - **Insufficient nutrients✓/oxygen**
- (9)**
- 3.19.1. Why is the injection of progesterone a good treatment to prevent premature delivery? (2)
- **Progesterone maintains/thickens the endometrium✓**
 - **and therefore, maintains the pregnancy✓**
- 3.19.2 Identify the: (1)
- (a) Independent variable (1)
- **Progesterone treatment✓**
- (b) Dependent variable (1)
- **Development of gestational diabetes✓**
- 3.19.3 Describe how the investigators determined whether any of the participants in Group **A** had developed gestational diabetes mellitus. (2)
- **Glucose levels were taken✓ daily**
 - **When the glucose level of a pregnant woman remains high continuously✓it indicates the development of gestational diabetes**
- 3.19.4 State TWO factors that were kept constant when the progesterone was administered in Group **A**. (2)
- **(Same) dosage✓/250 mg of progesterone**
 - **(Same) period of time for injection✓/injections given between weeks 16 and 20**
 - **(Same) frequency of injections✓/ weekly injections**
- 3.19.5 Group **B** was the control.
- Explain the importance of group **B** in this investigation (2)
- **Group B did not receive progesterone✓**
 - **If gestational diabetes develops in group A it would be due to the progesterone treatment✓**

3.20 The diagram below shows a developing human foetus.
(DBE/November 2021)



3.20.1 Identify part D. (1)

- **Chorion✓**

3.20.2 State TWO functions of the fluid in part C. (2)

- **Acts as a shock absorber✓**
- **It prevents desiccation✓/dehydration**
- **It helps to keep the temperature within a narrow range✓**
- **It facilitates free movement✓ of the foetus**

3.20.3 Describe the development of the zygote until implantation occurs. (4)

- **The zygote divides by mitosis✓**
- **to form a (solid) ball of cells✓**
- **called the morula✓**
- **which develops into a hollow ball of cells✓**
- **called the blastula✓/blastocyst**

Any

3.20.4 State TWO ways in which part A functions in protecting the developing foetus. (2)

- **Acts as a micro-filter✓/protect against pathogens**
- **Removal of harmful metabolic waste✓**
- **Produces antibodies✓**
- **Maintains the endometrium✓**

Any

3.20.5 Identify blood vessel B. (1)

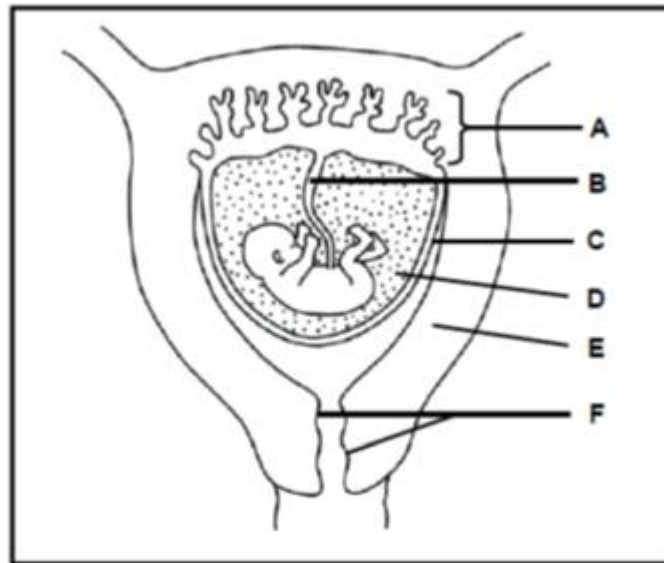
- **Umbilical vein✓**

3.20.6 Describe how the nutrition of a human foetus differs from that of oviparous organisms. (3)

- **In humans the developing foetus receives nutrients from the mother's✓ blood**
- **via the placenta✓/umbilical vein**
- **In oviparous organisms the developing embryo receives nutrients from the yolk✓/albumen**

(13)

3.21 Study the diagram below.



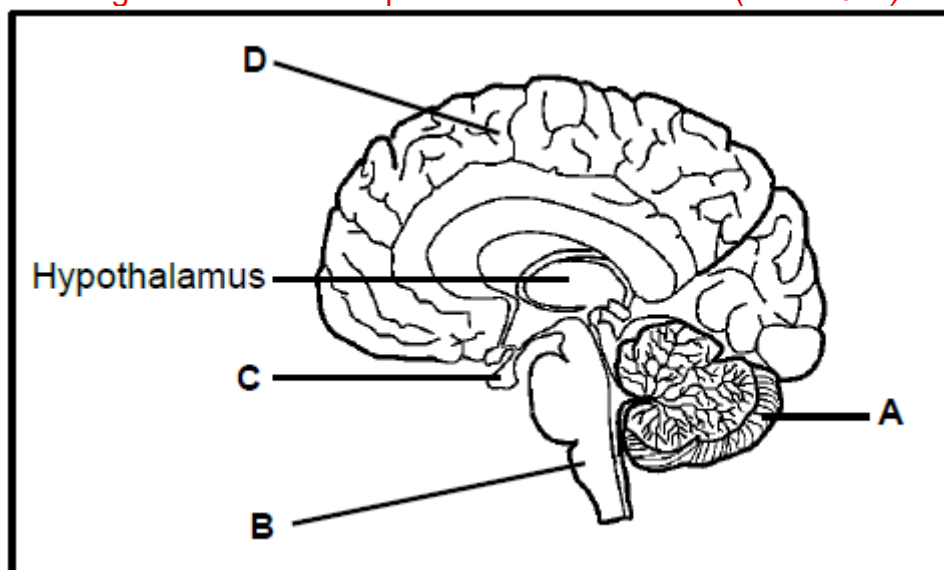
Match the structures (A to F) with the descriptions (3.22.1 to 3.22.5) below, for example 3.22.6 G. A letter may be used more than once, or not at all.

- 3.21.1 Where gaseous exchange occurs between the mother and the foetus (1)
- **A✓**
- 3.21.2 Removes excretory products from the foetus (1)
- **A✓**
- 3.21.3 Contains strong muscles which will push the foetus out during birth (1)
- **E✓**
- 3.21.4 Clamped and cut after the baby is born (1)
- **B✓**
- 3.21.5 Acts as a shock absorber for the developing foetus (1)
- **D✓**
- 3.21.6 Explain why the levels of progesterone remain high after day 20 in a pregnant female. (5)
(2)
- **the corpus luteum does not degenerate x and continues to produce progesterone x the**
- **placenta develops which secretes progesterone**

Learners must not write function of progesterone but rather what is causing progesterone levels to increase.

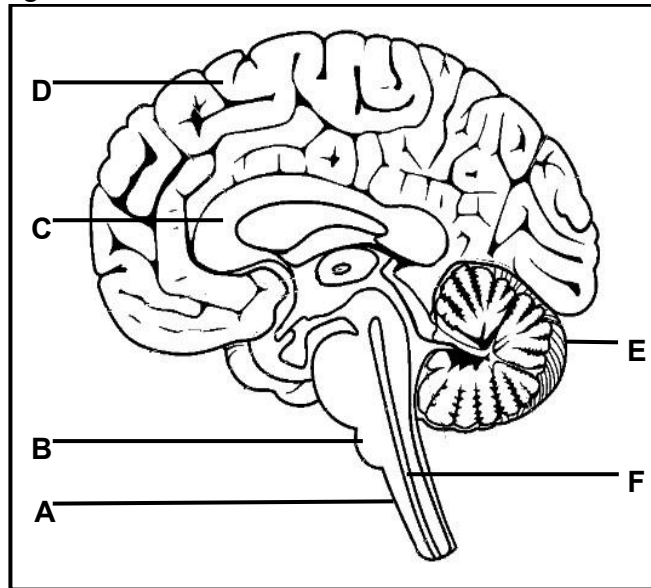
RESPONDING TO THE ENVIRONMENT (HUMANS)

4.1. The diagram below shows part of the human brain. (DBE/2022)



- 4.1.1 Identify part A. (1)
- 4.1.2 State TWO functions of part D. (2)
- 4.1.3 Name the hormone secreted by gland C that has an effect on: (1)
- (a) Long bones (1)
 - (b) Mammary glands in the breasts (1)
- 4.1.4 State ONE way in which the brain is protected. (1)
- 4.1.5 Describe the role of the hypothalamus in thermoregulation. (4)
- 4.1.6 Part B is involved in the homeostatic control of the carbon dioxide concentration in the blood. (1)
- (a) State the location of the receptors that are stimulated by an increase in the carbon dioxide concentration in the blood. (2)
 - (b) Name the TWO effectors that part B sends impulses to. (13)

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



4.2.1 Identify the parts labelled: (3)

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

4.2.2 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**
- (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**

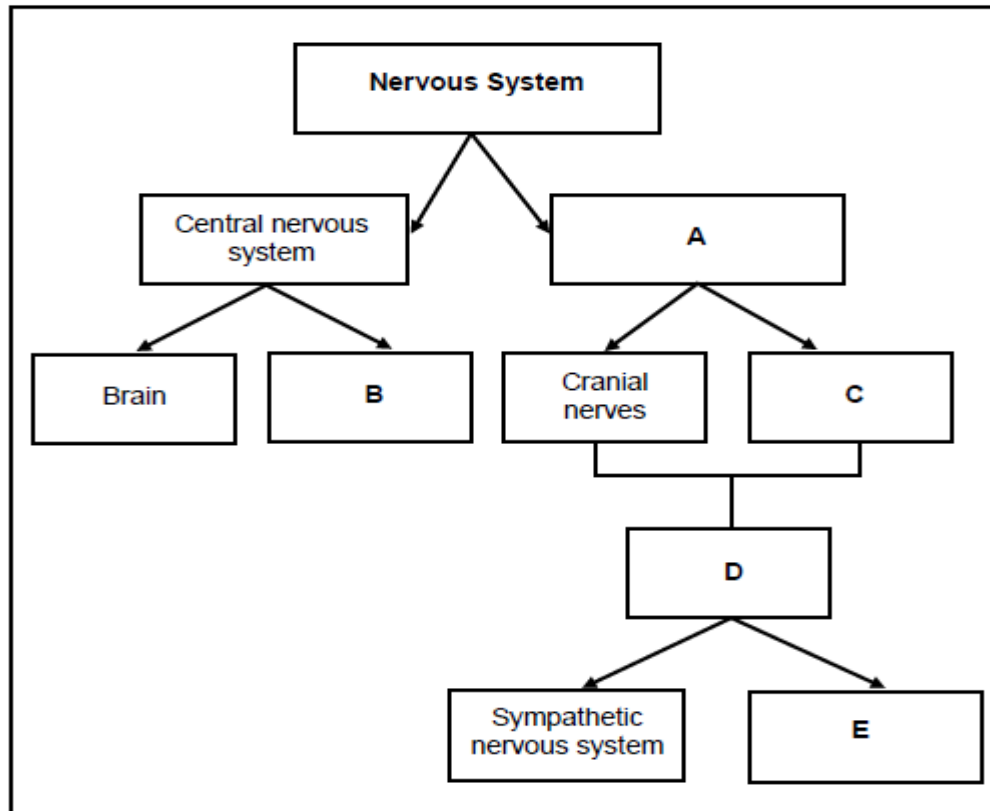
4.2.3 A haemorrhage (excessive bleeding due to rupture of blood vessels) at the part labelled **D** may cause permanent dysfunction. (2)

- (a) Explain the cause of damage to the part labelled **D**.
- **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 (Consequences)**
- (b) State THREE possible consequences of the damage mentioned in QUESTION 4.2.3 (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 ✓

(10)

4.3 The flow diagram below represents the components of the nervous system. (DBE/2023)



4.3.1 Identify the component of the nervous system represented by:

(a) **A**

- **Peripheral✓ nervous system**

(1)

(b) **D**

- **Autonomic nervous system✓**

(1)

4.3.2 Name the type of nerves found at C.

- **Spinal✓ nerves**

(1)

4.3.3 Give the LETTER and NAME of the component that slows down the heart rate when an emergency situation has passed.

- **E✓ - Parasympathetic nervous system✓**

(2)

4.3.4 Name the nerve cells that make up nervous tissue.

- **Neurons✓**

(1)

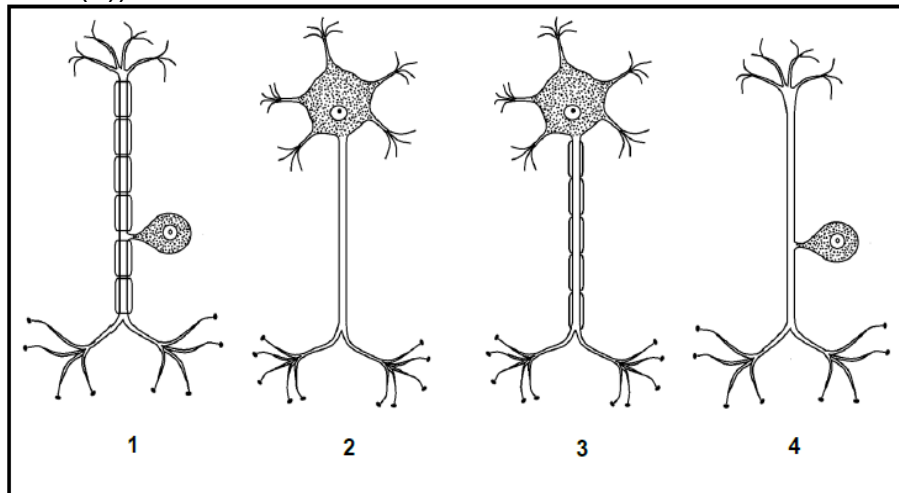
4.3.4 State TWO ways in which the brain is protected.

- **Meninges✓**
- **Cranium✓/bone tissue**
- **Cerebrospinal fluid✓**

(2)

(8)

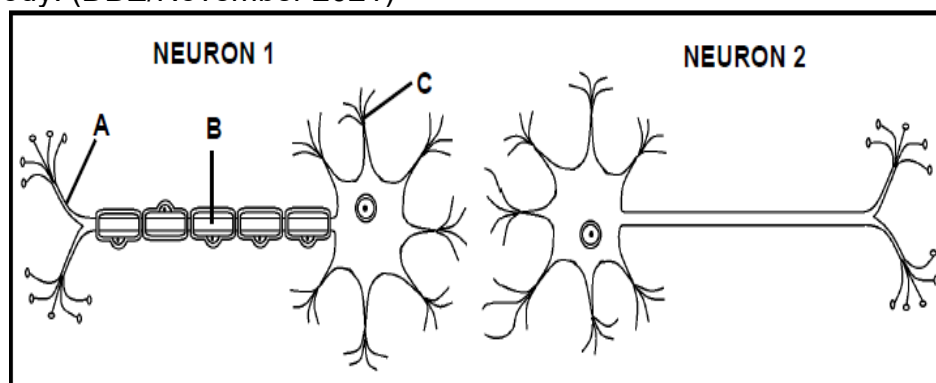
4.4 The diagrams below show different neurons (DBE/November 2020(2))



Give only the NUMBERS (1, 2, 3 or 4) of TWO neurons that:

- 4.4.1 Transport impulses from the receptor to the central nervous system (2)
 - **1✓ and 4✓**
- 4.4.2 Will have a faster transmission of impulses (2)
 - **1✓ and 3✓**
- 4.4.3 Are damaged if a person can feel the stimulus but is unable to react (2)
 - **2✓ and 3✓**
- (6)**

4.5 The diagram below represents a type of neuron found in the human body. (DBE/November 2021)



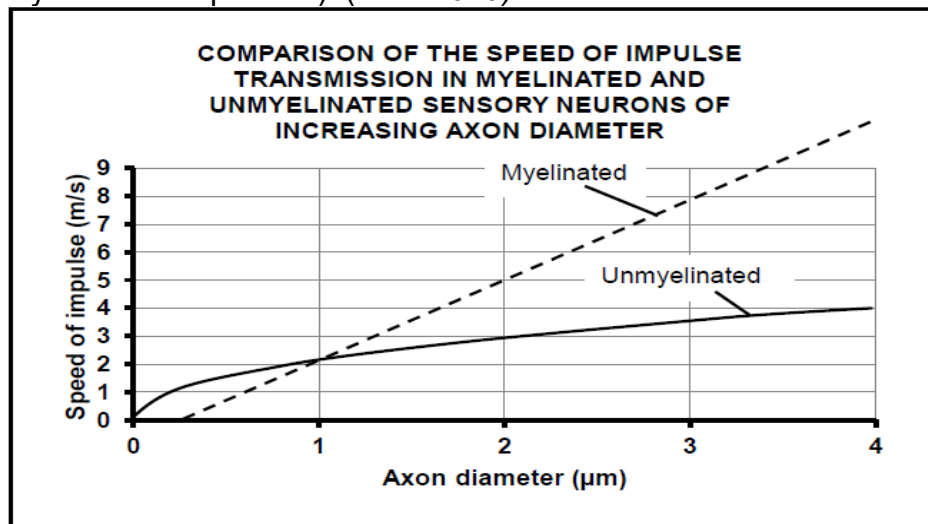
- 4.5.1 Identify the type of neuron shown. (1)
 - **Motor✓ / efferent neuron**
- 4.5.2 Using the LETTERS A, B and C only, give the correct sequence for the transmission of an impulse along neuron 1. (2)
 - **C → B → A✓✓**
- 4.5.3 Explain how the speed of transmission of impulses will differ for neuron 1 and neuron 2. (3)
 - **Impulses will be transmitted faster in neuron 1✓✓/ slower in neuron 2**
 - **because of the presence of a myelin sheath in neuron 1✓/ absence of a myelin sheath in neuron 2**

- 4.5.4 Explain why a person will feel the stimulus but will not be able to respond if only this type of neuron is damaged. (3)

- **Impulses from the receptor✓/sensory neuron**
- **will be transmitted to the central nervous system✓ but**
- **the impulse will not reach the effector✓**

(9)

- 4.6 The graph below shows the speed at which impulses are transmitted along sensory neuron axons of increasing diameter when the axons are myelinated (covered with myelin sheath) and unmyelinated (no myelin sheath present). (DBE/2019)



- 4.6.1 Describe the direction of the impulse within a neuron (2)

- **From the dendrite✓**
- **to the axon✓**

- 4.6.2 Give the diameter range (in µm) when the speed of the impulse is faster in unmyelinated axons than in myelinated axons. (2)

- **0 to 1✓✓ µm/ 0 to 0,9 µm**

- 4.6.3 Describe the relationship between axon diameter and the speed of the impulse in myelinated axons. (2)

- **As the axon diameter increases the speed of the impulse increases✓✓**

OR

- **As the axon diameter decreases the speed of the impulse decreases✓✓**

- 4.6.4 Use evidence from the graph to explain the effect of multiple sclerosis on a sufferer whose motor neuron axons are greater than 1 µm in diameter. (3)

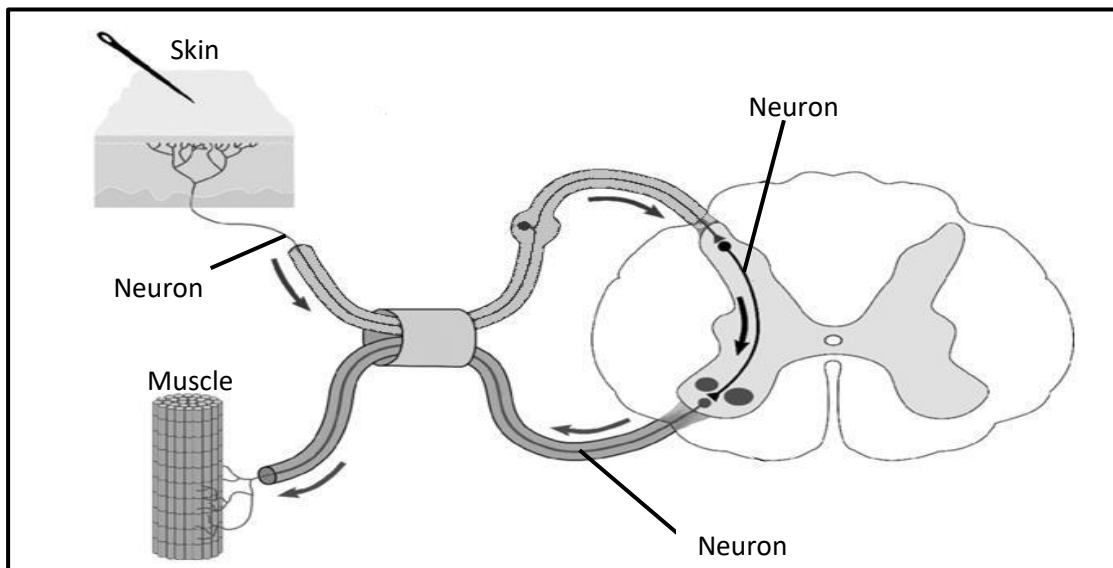
- **The speed of the impulse will decrease✓**
- **resulting in it taking longer for impulses to reach the effectors✓**
- **and the person will react more slowly✓**

(9)

Reflex Action

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

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



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

- **Reflex action ✓**

4.7.2 State the significance of the reaction mentioned in QUESTION 4.7.1 (1)

- **It protects the body ✓ from further injury**

4.7.3 How many synapses are shown in this diagram? (1)

- **Two/2**

4.7.4 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)

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

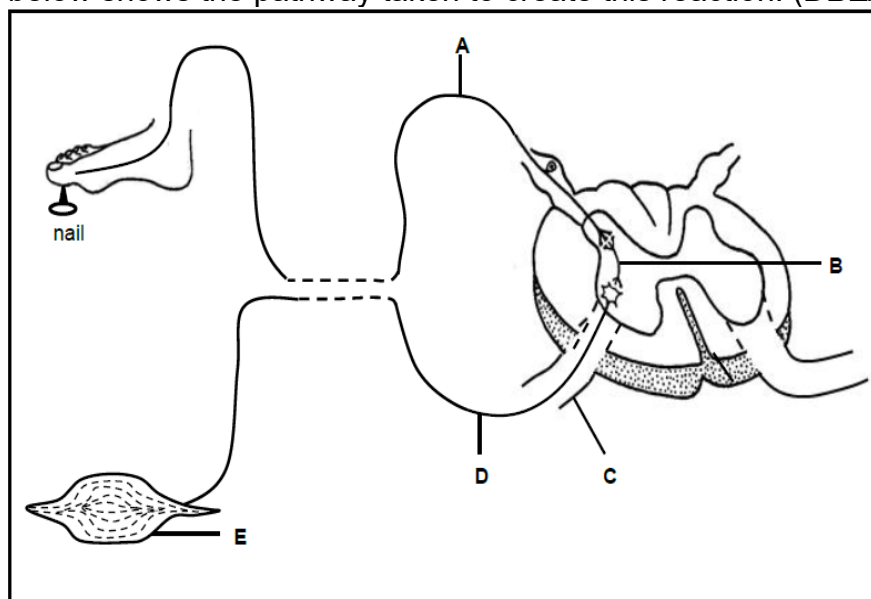
- **The transmission of impulses is accelerated ✓**
- **It insulates the nerve fibres ✓ /one-way transmission of impulses**

4.7.6 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**

(9)

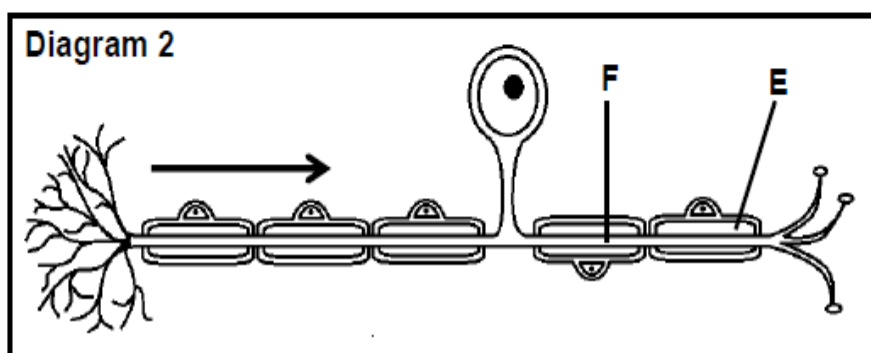
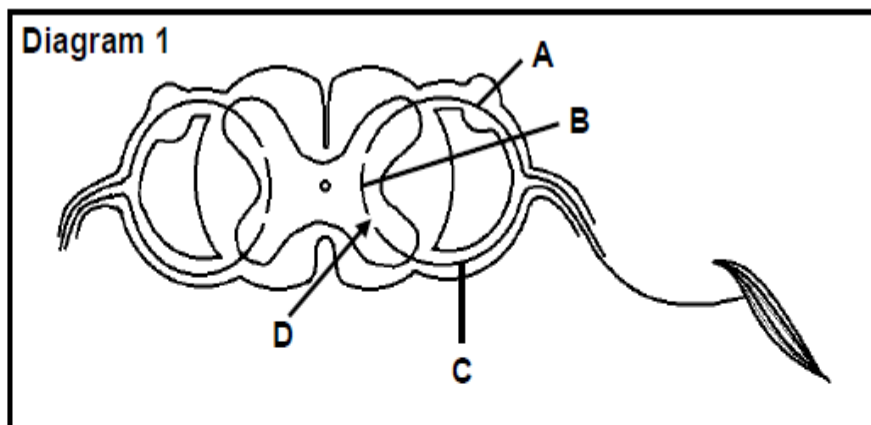
- 4.8 A boy steps on a nail and pulls his leg away suddenly. The diagram below shows the pathway taken to create this reaction. (DBE/2021)



- 4.8.1 Name the pathway represented by the diagram. (1)
 - **Reflex arc✓**
- 4.8.2 Give ONE advantage of this type of reaction. (1)
 - **To minimise injury✓**
- 4.8.3 Identify part: (1)
 (a) **B** (1)
 - **Interneuron✓/connector**
- (b) **C** (1)
 - **Ventral root✓**
- (c) **E** (1)
 - **Effector✓/muscle**
- 4.8.4 Give the LETTER and NAME of the neuron that transports impulses towards the spinal cord. (2)
 - **A✓ Sensory✓neuron**

(7)

- 4.9 Diagram 1 below represents part of a reflex arc and diagram 2 represents a neuron. (DBE/2022)

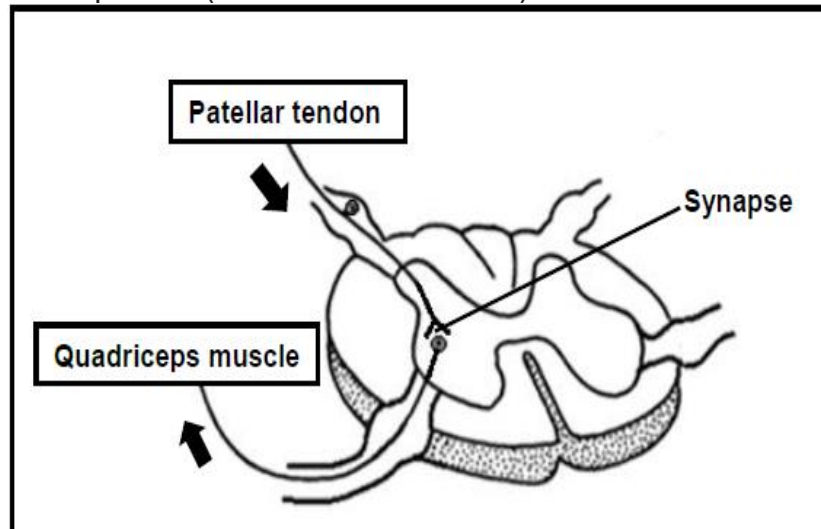


- 4.9.1 Identify:
- (a) Layer E (1)
 - **Myelin sheath✓**
 - (b) Structure F (1)
 - **Axon✓**
- 4.9.2 Which neuron (**A**, **B** or **C**):
- (a) Represents the type of neuron shown in diagram 2 (1)
 - **A✓**
 - (b) Is damaged when a person can feel the stimulus but cannot respond to it (1)
 - **C✓**
- 4.9.3 Give the LETTER and NAME of the part that ensures one-directional flow of the impulse. (2)
- **D✓ Synapse✓**

(6)

- 4.10 The efficiency and speed of the knee-jerk reaction is very important for balance and movement. The stimulation of the patellar tendon, just below the knee cap (patella), causes the contraction and relaxation of the quadriceps muscle in the upper leg.

The diagram below represents the reflex arc for the knee-jerk reaction containing only ONE synapse. The arrows indicate the transmission of nerve impulses. (DBE/November 2023)



- 4.10.1 What is a *reflex action*? (2)
- **A rapid involuntary/automatic response✓**
 - **to a stimulus✓**
- 4.10.2 State: (1)
- (a) ONE reason why a synapse is significant (1)
- **It ensures that the impulse is transmitted in one direction✓**
- (b) The importance of the knee-jerk reaction (1)
- **It is important for balance✓ /movement**
- 4.10.3 Describe the pathway of the impulse in this reflex arc to bring about the knee-jerk reaction. (5)
- **The impulse is transmitted from the receptors in the patellar tendon✓ through the**
 - **sensory neuron✓ and the**
 - **synapse✓ to the**
 - **motor neuron✓ and to the**
 - **quadriceps✓ muscle**
- (9)

4.11 Read the extract below.

Age and family history are the known risk factors for Alzheimer's disease. The most common symptom of Alzheimer's disease is a worsening ability to remember new information.

Regular exercise may help to reduce the risk of developing Alzheimer's disease because it can improve blood flow to the brain and help to maintain the volume of the hippocampus. The hippocampus is located deep inside the cerebrum and plays a major role in learning ability and orientation.

Scientists conducted an investigation to determine if regular exercise reduces the risk of Alzheimer's disease in humans.

They:

- Used 37 female participants between the ages of 65 and 75 in an exercise programme
- Used participants that did not show symptoms of Alzheimer's disease at the start of the investigation
- Conducted the investigation three times a week for three months

The results showed an improvement in higher-order thinking abilities and an increased blood flow to the cerebrum.

4.11.1 State ONE change in the nerve tissue of the brain that can cause Alzheimer's disease (1)

- **Degeneration✓/wasting away of nerve tissue**
- **Plaque/proteins formed around the nerve tissue✓**

4.11.2 From the extract, state: (1)

(a) ONE symptom of Alzheimer's disease (1)

- **Worsening ability to remember new information✓** (2)

(b) A genetic risk factor

- **Family history✓**

(c) TWO functions of the hippocampus

- **Learning ability✓**
- **Orientation✓**

4.11.3 Name TWO factors that were considered when selecting the participants for this investigation. (2)

They:

- **Were all females✓/considered gender**
- **Were between the ages of 65 and 75✓/considered age group/age**
- **Did not show symptoms of Alzheimer's disease✓**

4.11.4 State TWO ways in which the scientists improved the reliability of their results. (2)

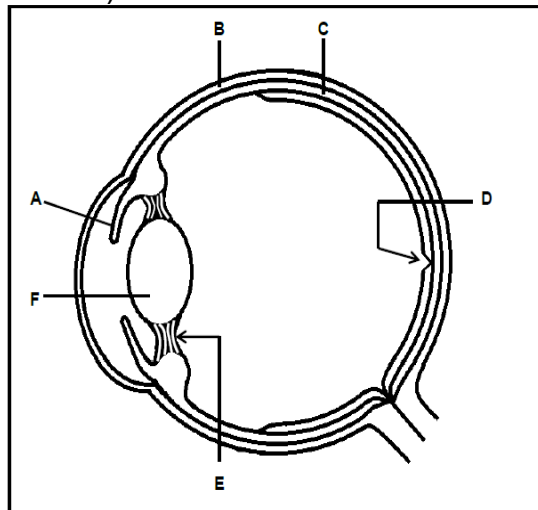
They:

- **Used 37 participants✓**

- 4.11.5 Explain why this investigation cannot be used to conclude that exercise reduces the risk of getting Alzheimer's disease. (2)
- Conducted the investigation three times a week✓
 - Conducted the investigation for three months✓
- Investigation did not establish the relationship between exercise and development of Alzheimer's disease✓
- since no changes in the nervous tissue were measured✓/ period was short
- OR
- There was no control group✓
 - to show that it is the exercise that improve blood flow✓/higher order-thinking abilities
- OR
- People who did not show symptoms of Alzheimer's disease were used✓
 - therefore, results do not show prevention of development of Alzheimer's disease✓
- 4.11.6 From the extract, explain why it is expected that regular exercise can reduce the risk of Alzheimer's disease. (3)
- Exercise can improve blood flow to the brain✓ and
 - it can maintain the volume of the hippocampus✓ which will
 - prevent a decrease in higher order thinking✓/cognitive abilities/learning abilities

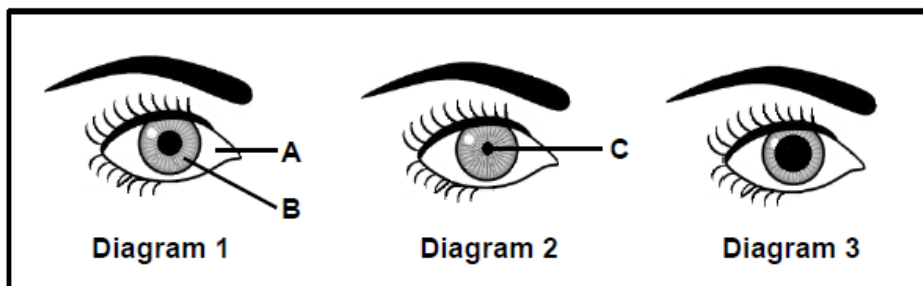
(14)

- 4.12 The diagram below represents the structure of the human eye.
(DBE/November 2021)

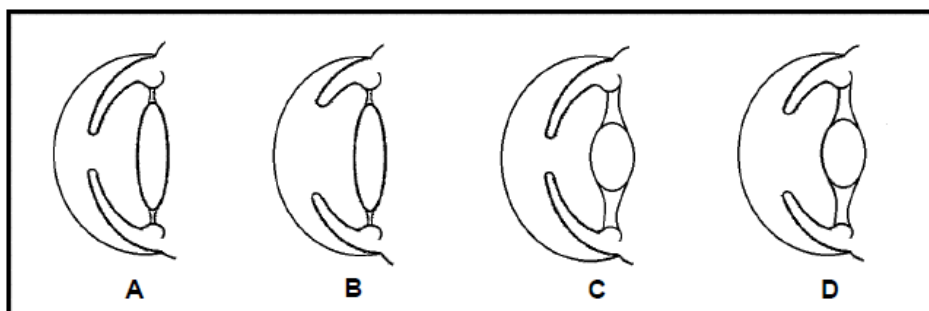


- 4.12.1 Identify part C. (1)
- **Choroid✓**
- 4.12.2 Give ONE function of part E. (1)
- **Holds the lens in position✓**
- **Connects the lens to the ciliary body✓**
- **Plays a role in accommodation✓**
- 4.12.3 State why the clearest image will form when light rays fall on part D (1)
- **(D/the yellow spot) has the highest concentration of cones✓**
- 4.12.4 Explain ONE way in which part B is structurally different from part F. (4)
- **Part B/sclera is opaque✓✓/does not allow light to pass through/ white**
- **part F/lens is transparent✓✓/allows light to pass into the eye**
- OR**
- **Part B/sclera is non-elastic✓✓/maintains the shape of the eye**
- **part F/lens is elastic✓✓/able to change its shape**
- 4.12.5 Describe how the muscles in part A function to increase the amount of light entering the eye. (3)
- **The circular muscles relax✓**
- **The radial muscles contract✓**
- **causing the pupil to dilate✓**
- 4.12.6 Describe how a blurred image forms if a person with normal vision wears spectacles with biconvex lenses while reading a book. (3)
- **The lenses in the spectacles will refract the light rays✓**
- **The lens of the eye also refracts✓ the light rays**
- **The light rays will therefore be focused in front of the retina✓**

- 4.13 The diagrams below show the condition of the eyes for different light intensities when viewing the same object. (DBE/November 2022)

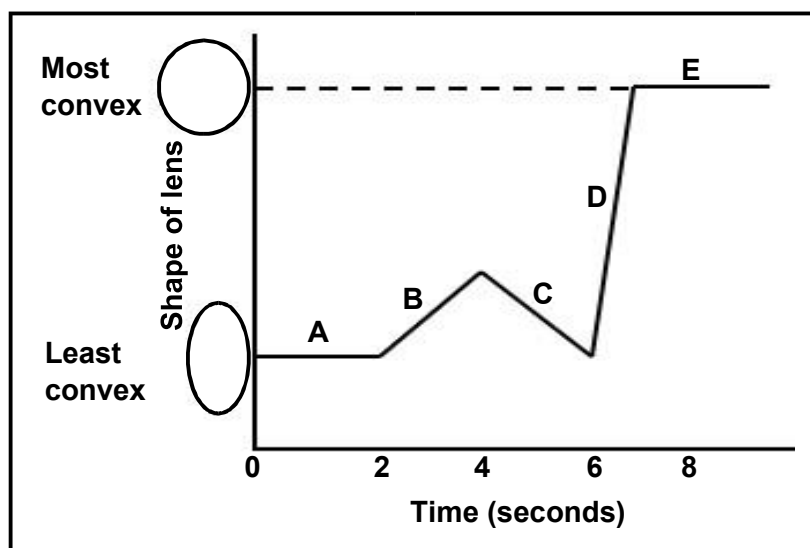


- 4.13.1 Give the LETTER and NAME of the part that:
- (a) Contains muscles (2)
 - **B✓ - Iris✓**
 - (b) Is made up of tough white fibrous tissue (2)
 - **A✓ - Sclera✓**
- 4.13.2 Which diagram (1, 2 or 3) represents the eye of a person:
- (a) In a very bright area (1)
 - **2✓**
 - (b) Where the rods are stimulated the most (1)
 - **3✓**
- 4.13.3 Which muscles are:
- (a) Contracted in diagram 2 (1)
 - **Circular✓ muscles**
 - (b) Relaxed in diagram 3 (1)
 - **Circular✓ muscles**
- (8)**
- 4.14 The diagrams below show part of the eye under different conditions. (DBE/2022)



- 4.14.1 Name the process that occurs when the:
- (a) Curvature of the lens changes to focus on a near or distant object (1)
 - **Accommodation✓**
 - (b) Pupil size changes to regulate the amount of light entering the eye (1)
 - **Pupillary mechanism✓ /Pupillary reflex**

- 4.14.2 Give the LETTERS of TWO diagrams (**A**, **B**, **C** or **D**) that represent the condition of the eye of a person:
- (a) In dim light (2)
- **B✓ and D✓**
- (b) Focusing on a distant object (2)
- **A✓ and B✓**
- 4.14.3 Give the LETTERS of TWO diagrams (**A**, **B**, **C** or **D**) that represent the eye of a person whose:
- (a) Ciliary muscles are contracted (2)
- **C✓ and D✓**
- (b) Radial muscles are relaxed (2)
- **A✓ and C✓**
- (10)**
- 4.15. 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.



- 4.15.1 Name the process that changed the shape of the lens. (1)
- **Accommodation ✓**
- 4.15.2 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 ✓**
- (b) Moving towards the participant (1)
- **B ✓/D** **Any**
- 4.15.3 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.**

(7)

4.16. 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	

4.16.1. During an eye test a person moves from 6 meters from the chart to 3 meters from it.

(a) Name the process that enables the eye of the person to focus on the letters on the chart. (1)

- **Accommodation✓**

(b) Describe the process named in QUESTION 14.16.1 (a) for the person. (5)

- **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)**

Explain ONE reason why the special equipment is used when testing eyesight for a driver's licence. (2)

4.16.2 - **People cannot memorise the pattern/arrangement/sizes✓**
 - **therefore they need to rely on their eye sight✓**

4.16.3 Binocular vision is also important to ensure safe driving.

(a) What is binocular vision? (2)

- **Images from both eyes✓ are able to perceive a three-dimensional image✓**

(b) Explain TWO reasons why binocular vision is important when driving a vehicle. (4)

- **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✓**

(14)

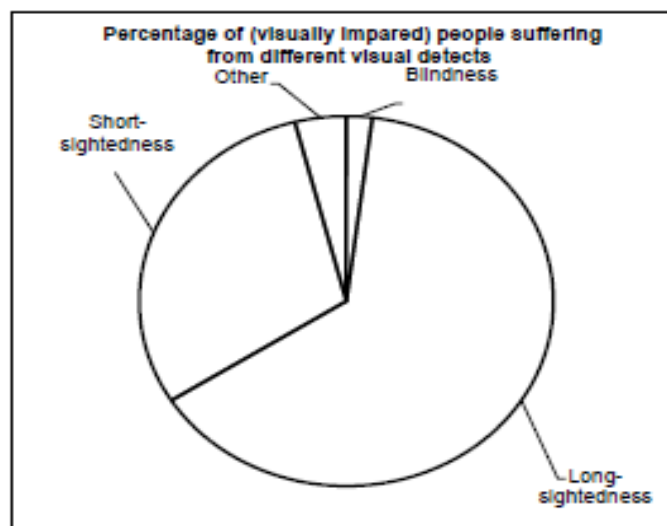
4.17 The table below indicates the percentage of visually impaired people in the world suffering from different visual defects. (DBE/November 2019)

VISUAL DEFECT	PEOPLE (%)
Blindness	2
Long-sightedness	64
Short-sightedness	30
Other	4

4.17.1 Which visual defect in the table is the most common among the world population? (1)

- **Long-sightedness✓**

- 4.17.2 In some cases where people are blind, the condition is caused by cataracts. (2)
- (a) Explain why people with cataracts may become blind. (2)
- The lens becomes opaque✓/milky/cloudy
 - and therefore does not allow the light to pass through✓
- (b) State ONE way in which cataracts can be treated. (1)
- Surgery✓
- 4.17.3 Explain why long-sighted people need to wear glasses with biconvex lenses as a corrective measure. (4)
- The lens is less convex✓/the eye ball is too short/cornea is flat
 - This causes the light rays to fall behind the retina✓
 - A biconvex lens increases the refractive power✓
 - Therefore light rays are focussed on the retina✓ to form a clear image
- 4.17.4 Name a visual defect that is characterised by an uneven cornea or lens. (1)
- Astigmatism✓
- 4.17.5 Draw a pie chart to represent the data in the table. (6)



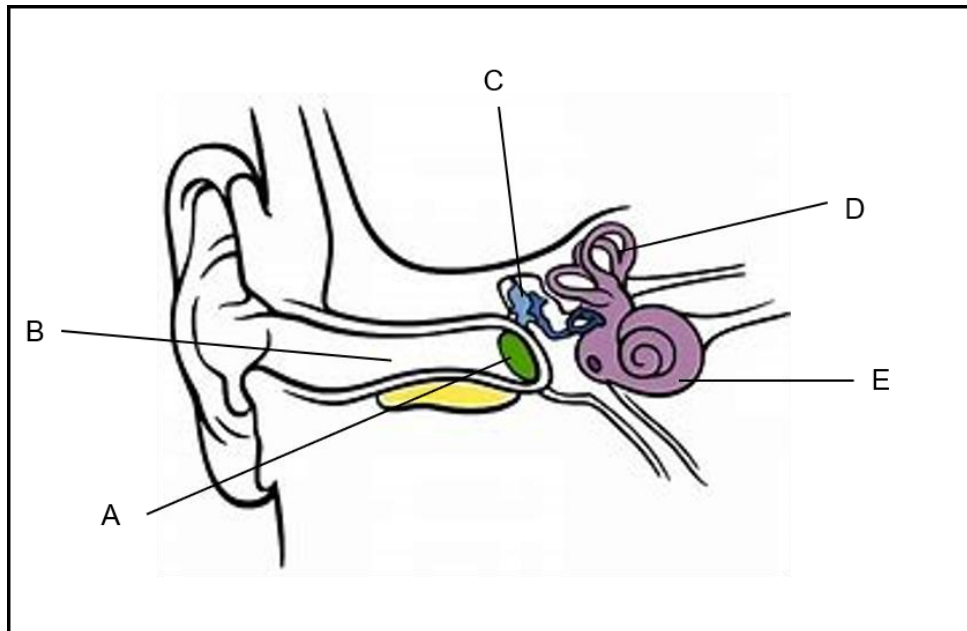
Calculations:

Blindness: $2/100 \times 360^\circ = 7,2^\circ$
 Short-sightedness: $30/100 \times 360^\circ = 108^\circ$
 Long-sightedness: $64/100 \times 360^\circ = 230,4^\circ$
 Other: $4/100 \times 360^\circ = 14,4^\circ$

Criteria for assessing the graph:

Pie chart drawn (T)	1
Title of the graph shows the relationship between the two variables (H)	1
Correct calculations to determine the proportions (C)	2: All 4 correct 1: 1-3 correct
Correct proportions for the labelled sectors (P) (To be checked using prepared transparency – see Annexure A – Page 12)	2: All 4 sectors correct 1: 1-2 sectors correct

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



- 4.18.1 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** ✓
- 4.18.2 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 functioning of ear and not just learner answer off by heart. Teach for understanding. They wrote about hearing instead of balance Many lost a mark as they did not say Cristae stimulates by change in direction/speed of head

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

(10)

- 4.18.4. Describe the role of the ear in maintaining balance.

(6)

Cristae

- are stimulated by a change in speed/direction of (movement) of the head✓

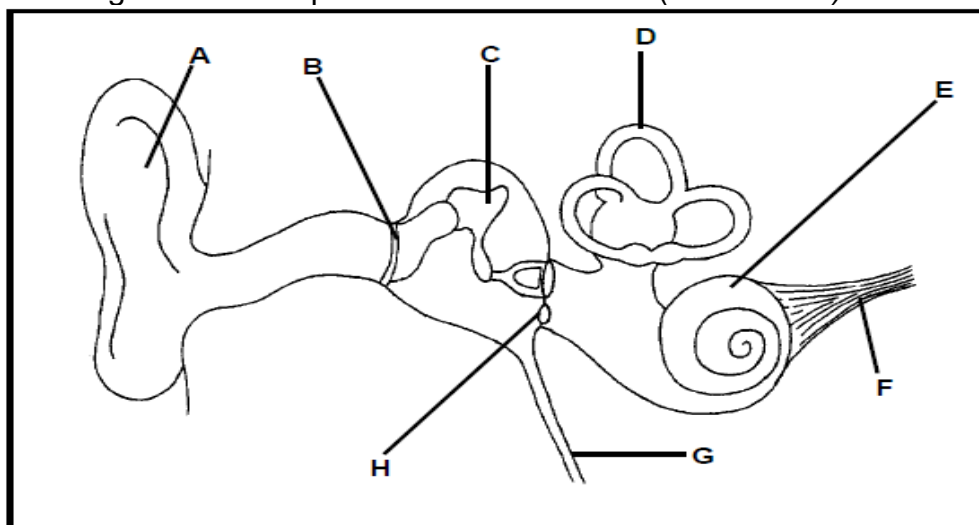
Maculae

- are stimulated by a change in the position of the head✓
- to generate an impulse✓
- which is transmitted by the auditory nerve✓
- to the cerebellum✓ for interpretation

- 4.19 TWO types of hearing loss occur in humans:

- **Conductive hearing loss** – occurs when sound vibrations cannot be conducted through the outer and middle ear
- **Sensorineural hearing loss** – occurs when sound waves in the inner ear are not converted into nerve impulses or when the impulses cannot be transmitted to the brain

The diagram below represents the human ear.(DBE/2019)



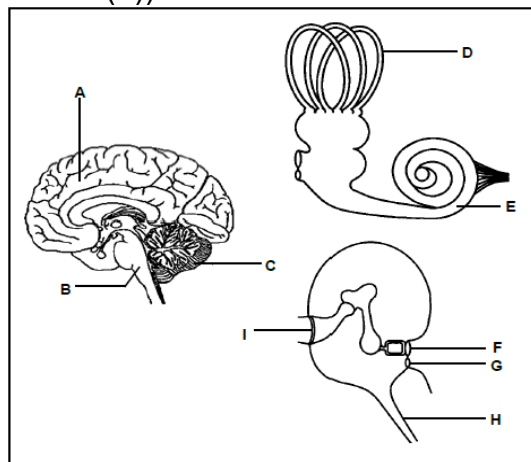
- 4.19.1 Give the LETTER and NAME of the part that:
- (a) Transmits impulses to the brain (1)
- **F✓ - Auditory nerve✓**
 - (b) Allows pressure to equalise between the outer ear and the middle ear (1)
- **G✓ - Eustachian tube✓**
- 4.19.2 Give only the LETTER of TWO structures in the diagram of the ear that, when damaged, would result in the following:
- (a) Conductive hearing loss (1)
- **B✓ and C✓**
 - (b) Sensorineural hearing loss (1)
- **E✓ and F✓**
- 4.19.3 Middle-ear infections are a common cause of hearing loss. (1)

State ONE way in which middle-ear infections are treated.

- **Grommets✓ will be inserted in the tympanic membrane**
 - **Antibiotics✓**
- 14.19.4 Name the part of the ear where ear wax is produced. (1)
- **Auditory canal✓**
- 4.19.5 Explain why hearing loss due to ear wax is usually temporary. (2)
- **The ear wax can be removed✓ from the auditory canal**
- **to allow sound to reach the tympanic membrane✓/which will allow the tympanic membrane to vibrate freely**

(12)

- 4.20 The diagrams below show different parts of the brain and the ear.
(DBE/November 2020(2))



- 4.20.1 Give the LETTER and NAME of the part of the ear that absorbs excess pressure waves from the inner ear. (2)
- **G✓ Round window✓**
- 4.20.2 Name the receptors found at part E. (1)
- **Hair cells✓/Organ of Corti**
- 4.20.3 Explain why damage to part B can lead to instant death. (2)
- **Part B controls vital processes✓/heartbeat/breathing**
- **These processes will stop✓ leading to death**

4.20.4 Describe how part **C** responds to impulses received from part **D**. (3)

- **The impulses will be interpreted✓**
- **and sent to the skeletal muscles✓**
- **to maintain balance✓**

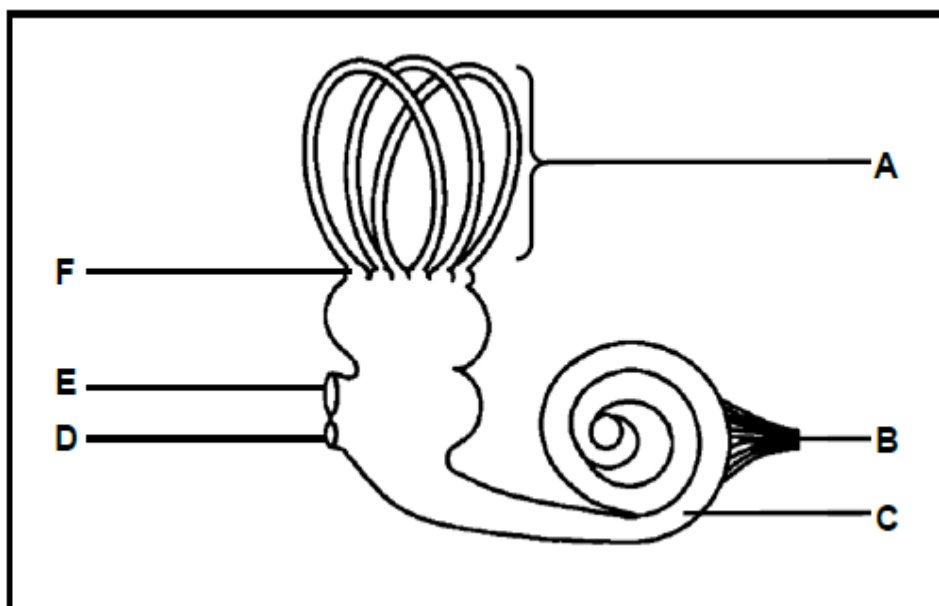
4.20.5 In older people, part **F** of the ear may harden.
Explain how this condition may lead to hearing loss. (4)

- **The oval window/Part F will not vibrate✓ freely**
- **Fewer/no vibrations will be carried to the cochlea✓/inner ear**
- **Fewer/no pressure waves will form✓ in the cochlea**
- **here will be less/no stimulation of the organ of Corti✓/hair cells**
- **Fewer/no impulses will be transmitted to the cerebrum✓leading to hearing loss**

Any

(12)

4.21 The diagram below represents a part of the human ear. (DBE/2021)



4.21.1 Identify part:
(a) **A** (1)

- **Semi-circular canals✓**

(b) **B** (1)

- **Auditory nerve✓**

4.21.2 Give the LETTER and NAME of the part that:
(a) Creates pressure waves in the fluid of the inner ear (2)

- **E✓ Oval window✓**

(b) Absorbs excess pressure waves in the inner ear to prevent the formation of an echo (2)

- **D✓ Round window✓**

4.21.3 Name the:
(a) Part of the brain that interprets impulses from part **F** (1)

- **Cerebellum✓**

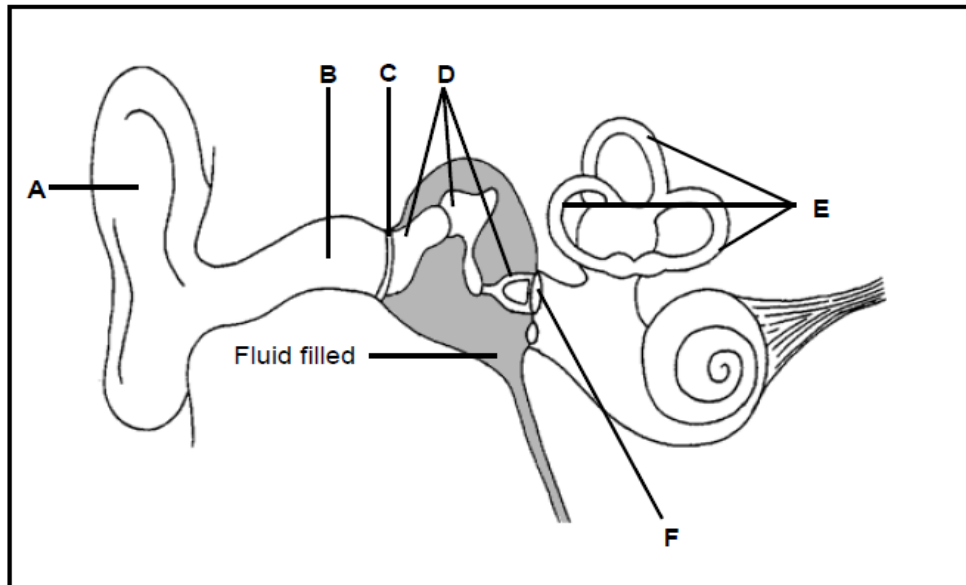
(b) Receptors found at C

- **Hair cells✓ /Organ of Corti**

(1)

(8)

4.22 The diagram below represents part of the human ear with a middle-ear infection. (DBE/2022)



4.22.1 Identify part:

(a) **B**

- **Auditory canal✓**

(1)

(1)

(b) **D**

- **Ossicles✓**

4.22.2 State ONE function of part A.

- **Collects the sound waves✓**
 - **Directs the sound waves towards the auditory canal✓**
- Any**

(1)

4.22.3 Explain how middle-ear infection could affect hearing.

- **Part D/the ossicles do not vibrate freely✓**
- **Fewer/no vibrations will be sent to the oval window✓/inner ear**
- **Fewer/no pressure waves will be set up in the cochlea✓**
- **The receptors/organ of Corti will be stimulated less✓/not stimulated**
- **The cerebrum is stimulated differently✓/not stimulated**
- **which leads to hearing loss✓**

(4)

Any

4.22.4 Describe the role of the Eustachian tube.

- **It equalises pressure✓**
- **on either side of the tympanic membrane✓**

(2)

4.22.5 Name the small device that is used in the treatment of middle-ear infection.

- **Grommet✓**

(1)

- 4.22.6 Write down the LETTER of the part where the small device, named in QUESTION 14.22.5, is inserted. (1)

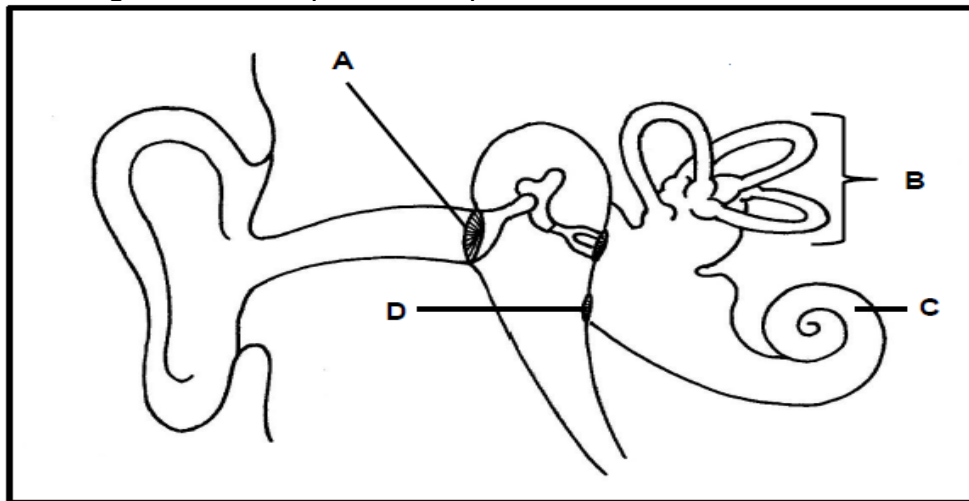
- **C✓**

- 4.22.7 Describe how part **E** is involved in maintaining balance when there is a change in the speed and direction of movement of the head. (4)

- **The cristae are stimulated✓**
- **to convert the stimuli to impulses✓**
- **The impulses are sent to the cerebellum✓**
- **where they are interpreted✓**
- **The cerebellum sends impulses to the skeletal muscles✓ to maintain balance**

(15)

- 14.23 The diagram below represents a part of the human ear.



- 4.23.1 Identify part C. (1)

- **Cochlea✓**

- 4.23.2 State ONE function of:
(a) Part D (1)

- **Absorbs excess pressure waves✓/releases pressure from the inner ear/ prevents an echo** (1)

- (b) The receptors found in part C

- **It converts stimuli/pressure waves into impulses✓**

- 4.23.3 Explain why a build-up of ear wax at part **A** may result in temporary hearing loss. (2)

- **Part A/tympanic membrane will not be able to vibrate✓/vibrate freely**
- **No/less vibrations will be carried to the middle ear✓/ossicles**

- 4.23.4 A grommet is a small device that allows the air to move into and out of the middle ear. This prevents pressure build-up in the middle ear.

Explain how the use of grommets in the treatment of middle-ear infections prevents hearing loss. (4)

- **Middle ear infections cause fluid build-up in the middle ear✓**
- **which can block the Eustachian tube✓**

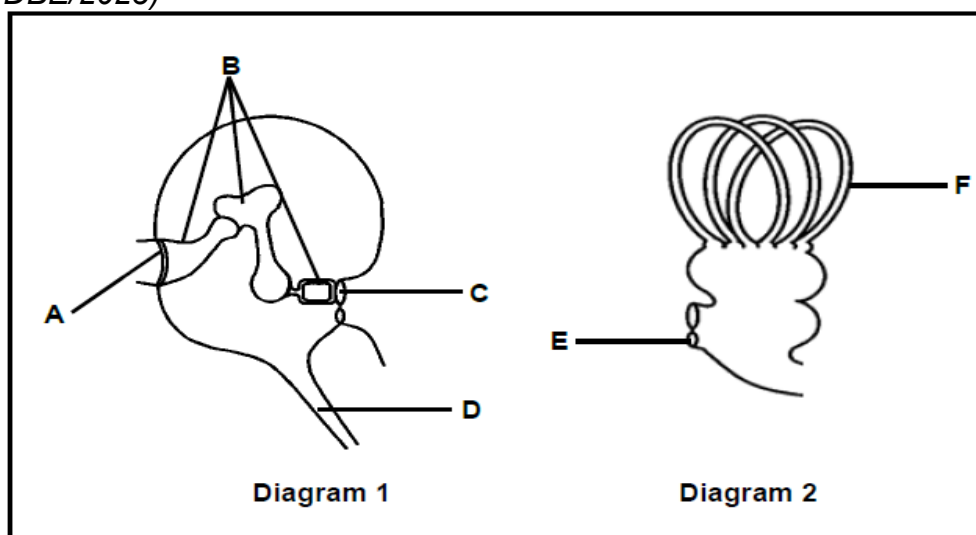
- The grommet will release the pressure✓ that will build up in the middle ear/ drain the fluid from the middle ear
- The pressure on either side of the tympanic membrane is equalised✓
- preventing the tympanic membrane from rupturing✓ and
- allowing the ossicles to vibrate freely✓

4.23.5 Describe how the receptors in part **B** are involved in maintaining balance when there are changes in the speed and direction of movement of the head. (4)

- The cristae are stimulated✓ and
- convert the stimuli into impulses✓
- The impulses are sent via the auditory nerve✓
- to the cerebellum✓
- which interprets the information✓ and
- sends impulses to the skeletal muscles✓ to restore balance

(13)

4.24 The diagrams below show parts of the middle and inner ear. (DBE/2023)



4.24.1 Identify part F. (1)

- Semi-circular canals✓

4.24.2 Give the collective term for bones B. (1)

- Ossicles✓

4.24.3 Give the LETTER and NAME of the structure that: (2)

(a) Equalises pressure between the outer and middle ear (2)

- D✓ - Eustachian tube✓

(b) Creates pressure waves in the inner ear

- C✓ - Oval window✓

4.24.4 Name the receptors that are stimulated by a change in the: (1)

(a) Position of the head

- Maculae✓

(b) Direction and speed of movement of the head (1)

- Cristae✓

(8)

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.**

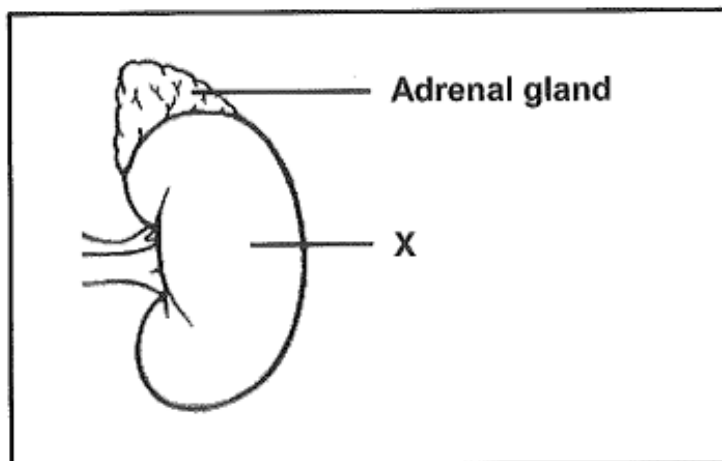
Water is **REABSORBED** into the blood not absorbed. It is important that reabsorbed is used as the water was in the blood vessels before it was filtered into the nephron during glomerular filtration. Therefore, the water will now be moving back into the blood. i.e. reabsorbed

- 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

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



5.1.1 Identify:

(a) Organ X

(1)

- **Kidney✓**

(b) The system to which the adrenal gland belongs

(1)

- **Endocrine✓**

5.1.2 State TWO characteristics of the type of glands that belongs to the system identified in Question 15.1.1 (b).

(2)

- **it releases hormones✓**

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

5.1.3 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**

5.1.4 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✓**

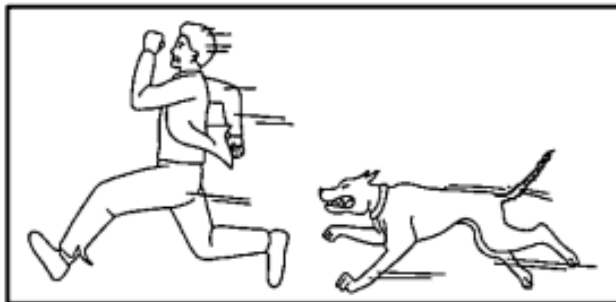
- **of the renal tubules✓ in X**

- **so that more water is reabsorbed✓ from the filtrate**

(14)

ADRENAL GLAND (ADRENALIN)

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



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

- **Adrenal gland✓**

5.2.2. State the location of the gland named in QUESTION 15.2.1 in the human body. (1)

- **On top of the kidneys✓**

5.2.3. 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✓**

5.2.4 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✓**

5.2.5 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✓**

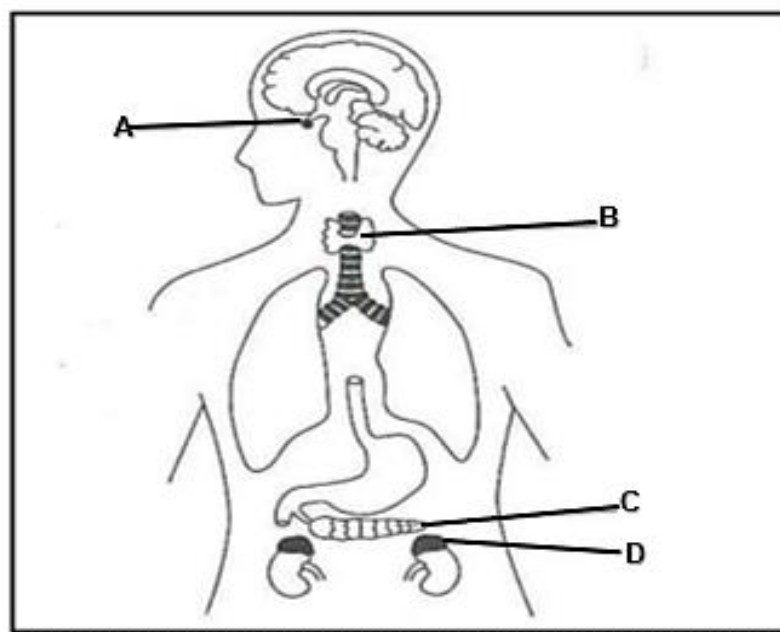
(15)

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.

5.3 The diagram below represents the human endocrine system.



5.3.1 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**

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

- **A✓ - pituitary✓ gland /hypophysis**

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

- **Giantism✓**

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

- **Negative Feedback Mechanism✓**

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

- **low thyroxin levels will stimulate 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✓**

5.3.6 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✓**

Any

5.3.7 Name the disorder that results when gland B becomes overstimulated and enlarged (1)

- **Goitre✓**

(14)

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.

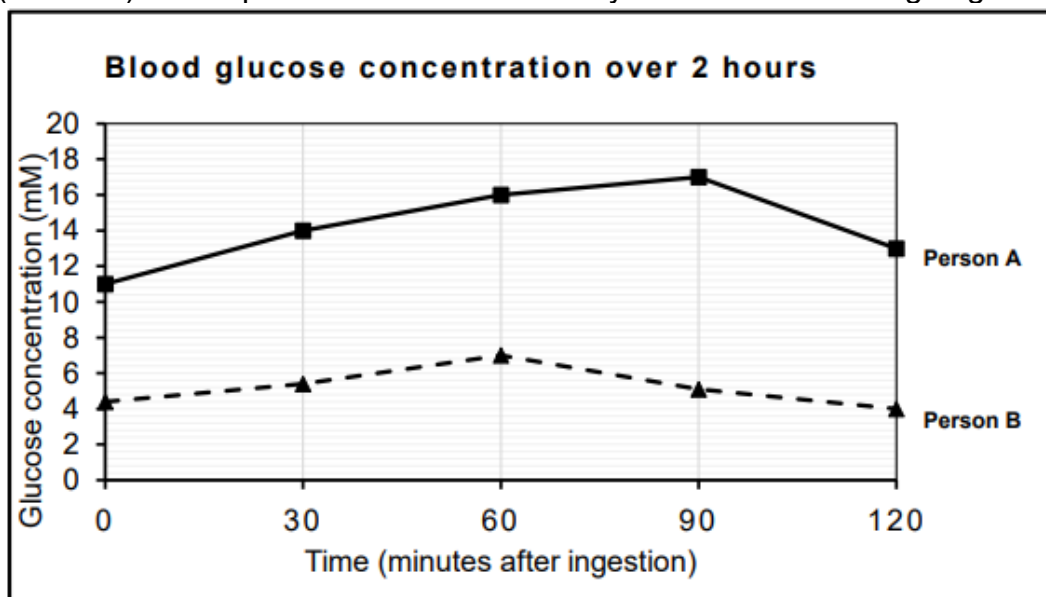
- **Why are smaller meals/low GI foods better for a diabetic**

- 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

5.4. 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.



5.4.1 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✓**

5.4.2 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 ✓ = 9 mM✓**

5.4.3 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

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

- **Glucagon✓**
- **Adrenalin✓**

5.4.5 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✓**
- Any

(17)

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.

5.4.6 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✓**

Any
(5)

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 no 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

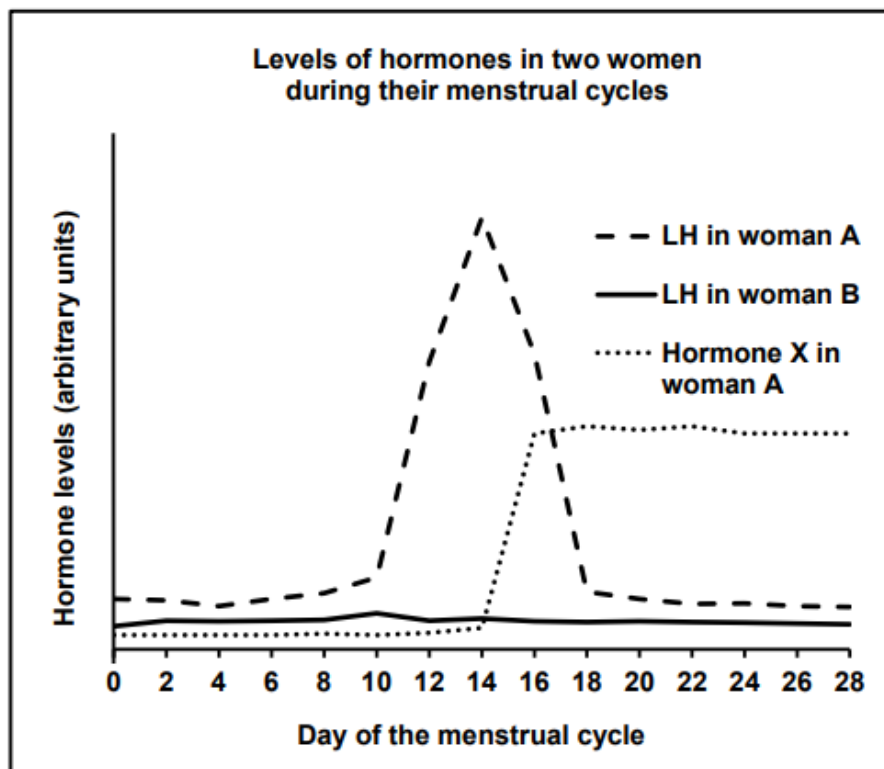
- no follicle will develop into Graafian follicle
- no ovum would develop/ no ovulation

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)

5.5 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.



5.5.1 State TWO functions of LH in the menstrual cycle.

(2)

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

5.5.2 Besides LH, name ONE other hormone that is secreted by the pituitary gland during the menstrual cycle.

(1)

- Follicle stimulating hormone✓ /FSH

5.5.3 Give the name of hormone X.

(1)

- Progesterone✓

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

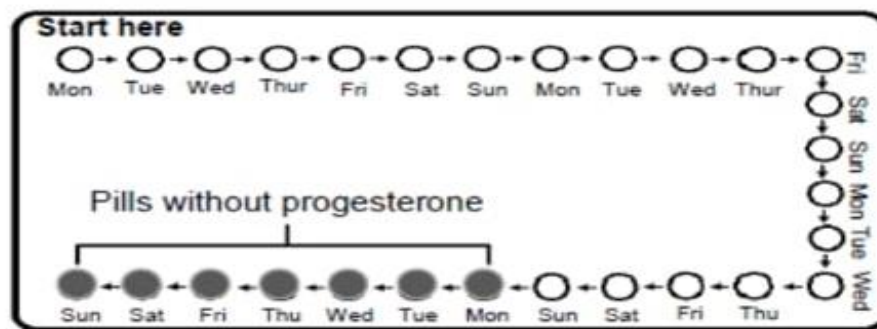
- **The (progesterone) levels will remain low✓**
- **The LH levels are low✓ therefore**
- **ovulation will not take place✓ and**
- **No corpus luteum will develop✓**

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

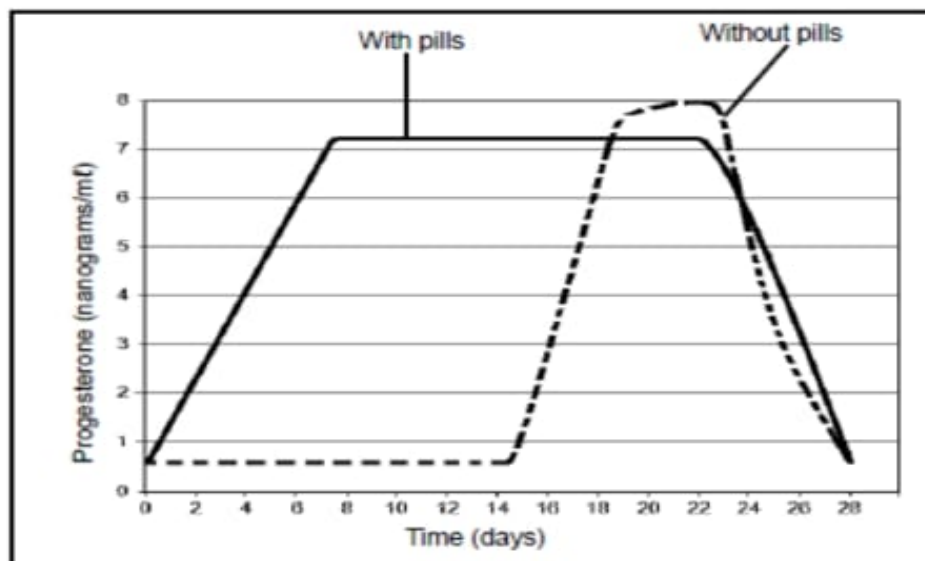
- **Hormone X /progesterone levels remain high✓**

(9)

5.6 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.



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

- **ovary✓**

5.6.2 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✓**

5.6.3 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✓**

5.6.4 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✓**

Any
(8)

5.7 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.

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

- **Male fertility✓**

5.7.2 State how the dependant variable in Question 15.7.1 was measured. (1)

- **Measuring the sperm count✓**

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

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

Any

- 5.7.4 Explain how TU reduces fertility. (2)
- **TU inhibits the secretion of testosterone✓ spermatogenesis cannot take place✓/ no sperm will be produced**
- 5.7.5. Explain why wearing tight-fitting trousers will decrease male fertility. (2)
- **could decrease the sperm count✓ /sperm production / lead to the**
 - **production of abdominal sperm✓**
- 5.7.6. 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**
- 5.7.7. 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✓**

(11)

THERMOREGULATION

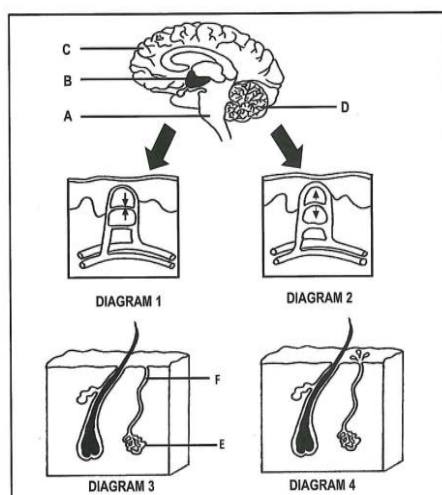
- Structure of the skin, using a diagram, with an emphasis on the parts involved in thermoregulation
- Role of the following in negative feedback mechanism for controlling temperature/thermoregulation:
 - ☐ Sweating
 - ☐ Vasodilation
 - ☐ Vasoconstriction

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.

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



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

- **Thermoregulation✓**

5.8.2 Name the process that is represented in:

(a) DIAGRAM 1 (1)

- **Vasoconstriction✓**

(b) DIAGRAM 2 (1)

- **Vasodilation✓**

5.8.3 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✓**

5.8.4 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**

5.8.5 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✓**

(14)

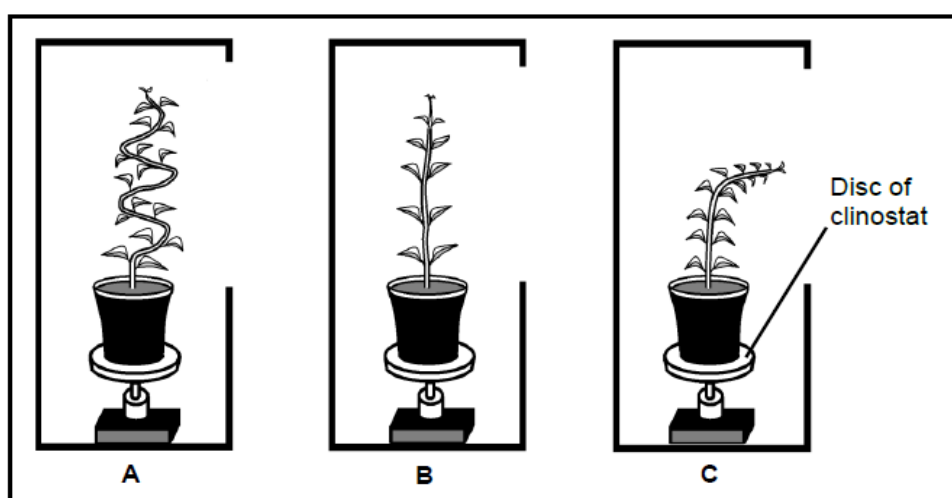
RESPONDING TO ENVIRONMENT (PLANTS)

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.

6.1 A clinostat is a device used to investigate plant growth responses. It has a disc that rotates very slowly when the clinostat is switched on. During an investigation on plant responses to light, the procedure below was followed: *DBE/2019*

- Three pot plants of the same species were used.
- Each pot plant was placed on one of three identical clinostats.
- Each set of apparatus, A, B and C, was placed in a box with a single opening.
- Each clinostat was treated in a different way over a period of five weeks.

The results of the investigation are represented in the diagrams below.



6.1.1 Name the plant growth response to light. (1)

- **Phototropism✓**

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

- **The same species✓ of plant was used in each set-up**
- **Identical clinostats✓ were used in each set-up**
- **The same period of time✓ /5 weeks was used for each set-up**
- **Each apparatus was placed in a box with a single opening✓**
- **The opening on each box was in the same position✓/was the same size/allowed the same amount of light to enter**

Any

6.1.3 Give ONE reason why the results of this investigation may be considered to be unreliable. (1)

- **The investigation was only done once✓/not repeated**
- **Only one plant was used in each set-up✓/the sample size was too small**

Any

6.1.4 In which apparatus (A, B or C) was the clinostat: (1)

- (a) Switched on and rotating slowly (1)

- **B✓**

(b) Switched off, but manually rotated through 180° once a week

- **A✓**

6.1.5 Explain the effect of the unilateral light on the distribution of auxins in the plant in apparatus C. (3)

- **The auxins moved away from the light✓ /were destroyed by the light**
- **so that the darker side had a high concentration of auxins✓**
- **and the lighted side had a low concentration of auxins✓**

(9)

6.2 Both plants and humans respond to gravity. (DBE/November 2019)

6.2.1 Explain why the root and the stem grow in different directions when a pot plant is placed horizontally on the ground, receiving light equally from all directions. (11)

Plant's response to gravity (P)

When a plant is placed horizontally:

- **auxins✓**
- **are attracted by gravity✓**

Root

- **There is a high concentration of auxins on the lower side of the root✓**
- **which inhibits growth/cell elongation/cell division on the lower side✓**
- **There is a low concentration of auxins on the upper side of the root✓**
- **which stimulates growth/cell elongation/cell division on the upper side✓**
- **The upper side of the root grows faster✓/Uneven growth occurs**
- **causing the root to grow/bend downwards✓**
- **The root grows towards gravity✓/The root is positively geotropic**

Stem

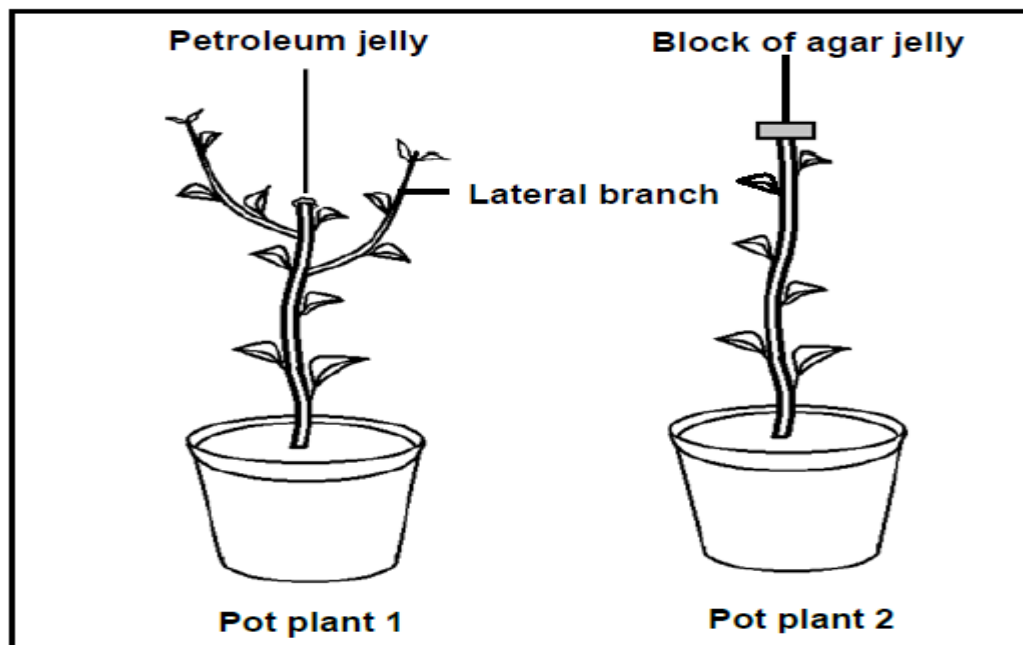
- **There is a high concentration of auxins on the lower side of the stem✓**
- **which stimulates growth/cell elongation/cell division on the lower side✓**
- **There is a low concentration of auxins on the upper side of the stem✓**
- **which inhibits growth/cell elongation/cell division on the upper side✓**
- **The lower side of the stem grows faster✓/Uneven growth occurs**
- **causing the stem to grow/bend upwards✓**
- **The stem grows away from gravity✓/The stem is negatively geotropic**

6.3 An investigation was done to determine the effect of a plant hormone on plant growth: (DBE/November 2020(2))

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 bud 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 diagrams below show the **results** obtained.



- 6.3.1 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✓
- 6.3.2 Describe the results obtained for plant 1. (2)
- The stem stopped growing upwards✓
 - Lateral branches developed✓
- 6.3.3 Explain how fruit farmers can use the knowledge from the results in QUESTION 16.3.2 to their benefit. (2)
- (Lateral) branches develop✓
 - that can bear more fruit✓ /increased yield
- OR
- Shorter trees✓ /development of lateral branches
 - makes harvesting of fruit easier✓

- 6.3.4 Explain why the stem in pot plant 2 grew upwards. (3)
- **Auxins✓ in the block of agar jelly**
 - **move downwards ✓ into the stem**
 - **causing (cell) elongation✓ /growth**
 - **resulting in upward growth of the stem**

(9)

- 6.4 Read the extract below. (DBE/2021

AUXINS CAN BE USED AS SELECTIVE HERBICIDES

Auxins stimulate plant growth, however, a high concentration of auxins may cause the plant to grow too fast. The plant is not able to sustain this rapid growth and as a result, it will die.

Farmers spray artificially manufactured auxins onto the surface of weeds to kill them. This type of herbicide (weed killer) is selective as it kills mainly the broad-leafed dicotyledonous plants without having any effect on narrow-leafed monocotyledonous plants, such as wheat, maize and grass.

Auxin-based herbicides are more environmentally friendly. Other herbicides may kill some organisms and the chemicals from these herbicides accumulate in the food chains, thus disturbing the ecosystems

- 6.4.1 State ONE way in which auxins cause growth in plants. (1)
- **They stimulate cell elongation✓ /cell division**
- 6.4.2 Explain why farmers would want to kill the weeds in their fields. (2)
- **To prevent weeds from competing with crops✓**
 - **- for water✓ /nutrients/space/sunlight**
- 6.4.3 According to the extract, state ONE disadvantage of using herbicides that are not auxin-based. (1)
- **They may kill other organisms✓**
 - **They may accumulate in ecosystems✓**
 - **They may disrupt ecosystems✓**
- 6.4.4 Give ONE reason for using auxin-based herbicides instead of physically removing the weeds. (2)
- **The application of auxin-based herbicides is less labour intensive✓ ✓ /less time-consuming/less expensive than mechanical removal**
 - **Auxin-based herbicides will kill the whole plant but with physical removal only part of the plant may be removed✓ ✓**
- 6.4.5 A farmer planted maize and beans (broad-leafed plants) in her field (2)
- Explain why the farmer should not use an auxin-based herbicide in her field.
- **Auxin-based herbicides selectively kill broad leaved plants✓**
 - **and the farmer will lose money✓ /the bean crop will fail**

Any

Any

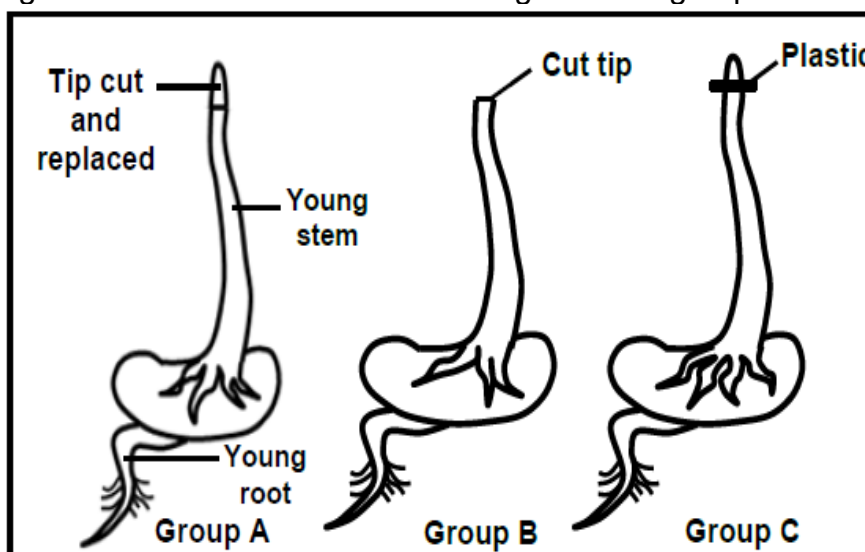
(8)

- 6.5 A group of learners conducted an investigation to determine the effect of auxins on the growth of stems in bean seedlings. (DBE/November 2021)

The procedure was as follows:

- 30 bean seeds were allowed to germinate for 5 days to produce seedlings.
- The seedlings were divided into 3 groups (**A**, **B** and **C**) of 10 seedlings each.
- The tips of all the seedlings were cut at the same length.
- In group **A**, the cut tip was placed back on top of the young stem.
- In group **B**, the tip was not placed back.
- In group **C**, a piece of plastic was placed on top of the cut surface and the tip was then placed on top of the plastic.
- The seedlings in all the groups were placed in a dark cupboard for a week.
- The growth of the stem was then observed.

The diagram below shows how the seedlings in each group were treated.



- 6.5.1 Identify the dependent variable in this investigation. (1)
 - **Stem growth✓**
- 6.5.2 Why did the learners cut the tips of the young stems? (1)
 - **To remove the source of auxins✓**
 - **The tip produces auxins✓**
- 6.5.3 Give ONE reason why 10 bean seedlings were used in each group. (1)
 - **To increase the reliability✓/validity of the results**
- 6.5.4 Write down the LETTER(S) (**A**, **B** or **C**) of the group(s) where there will be no upward growth of the stem. (2)
 - **B✓ and C✓**
- 6.5.5 Describe how auxins cause apical dominance. (3)
 - **The presence of auxins✓ in the tip of the stem**

Any

- **stimulate upward growth**✓
 - **and inhibit development of lateral branches**✓
- 6.5.6 Name the plant hormone: (1)
 (a) Other than auxins, that promotes the germination of seeds (1)
 (b) **Gibberellins**✓
 (c) That inhibits the germination of seeds
 - **Absciscic acid**✓
- 16.6 Describe the role of auxins in phototropism when a plant is exposed to unilateral light. (DBE/2022) (5)
- 16.7. Read the extract below. (DBE/November 2022)
- Auxins control different aspects of growth and development in plants. They are known to influence the growth of stems and they also stimulate the development of new roots on stem cuttings in plant propagation.

During plant propagation, a stem of a plant is cut and is then placed in water containing small quantities of artificial auxins. The auxins stimulate root development in the cuttings
- 6.7.1 Name TWO places in plants where auxins are produced. (2)
 - **(Apical) tip of the stem**✓ /**apical bud**
 - **(Apical) tip of the root**✓
- 6.7.2 State TWO ways in which auxins cause an increase in the length of stems. (2)
 - **Stimulate cell division**✓/**mitosis**
 - **Stimulate cell elongation**✓
- 6.7.3 Name ONE other plant hormone that causes an increase in the length of stems. (1)
 - **Gibberellins**✓
- 6.7.4 Explain how auxins can be used in plant propagation to the advantage of nature conservation. (2)
 - **Increased plant growth**✓
 - **saves species that are facing extinction**✓
- 6.8 Read the extract below. (DBE/2022) (7)
- Some plants contain chemical substances such as alkaloids and cyanogenic glycosides. Alkaloids are bitter-tasting compounds while cyanogenic glycosides are toxic substances.

Caffeine is an example of an alkaloid that occurs in plants like *Coffea arabica* (coffee), *Camelia sinensis* (tea) and *Theobroma cacao* (cocoa). Although harmless to humans, caffeine kills pathogenic fungi.

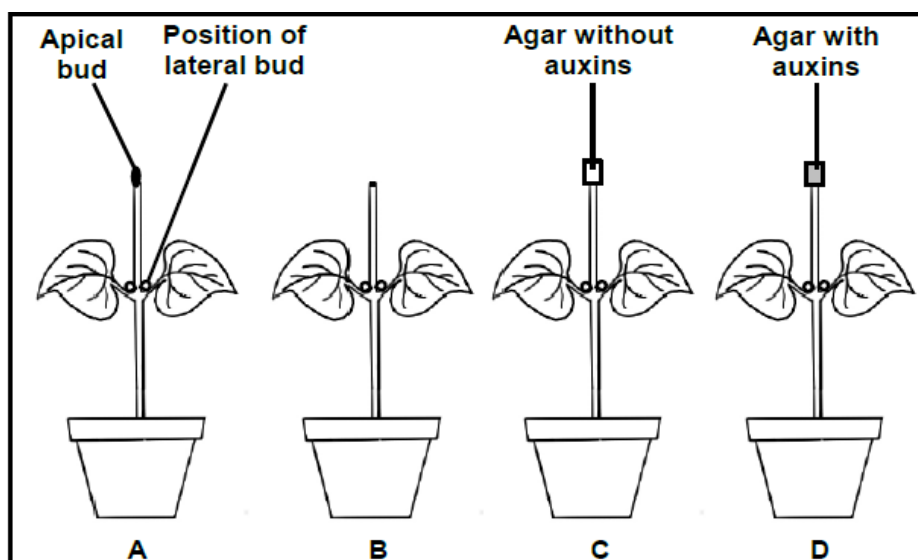
Nicotine is another example of an alkaloid that is found in tobacco plants.
- 6.8.1 Name TWO alkaloids that are found in plants. (2)
 - **Caffeine**✓

- Nicotine✓**
- 6.8.2 Explain TWO ways in which caffeine production acts as a defence mechanism in plants. (4)
- The bitter taste✓ will prevent herbivores✓ from feeding on them**
- The caffeine will kill pathogenic fungi✓ protecting the plants from disease✓/death
- 6.8.3 Name ONE other plant defence mechanism. (1)
- Thorns✓** (7)
- 6.9 Geotropism refers to the movement of a part of a plant in response to gravity. This tropism is controlled by auxins. (DBE/2023)
- 6.9.1 Describe the role of auxins in roots. (3)
- Auxins promote the development of roots✓**
- It brings about (general) root growth✓
- causing their downward✓ growth/positive
- 6.9.2 When a plant is placed horizontally, with light coming from all directions, the auxins will accumulate on the lower side of both the stem and the roots. (4)
- Explain the difference in the response of the stem and the roots after a few days.
- In the stem, the auxins stimulate growth✓ on the lower side**
- causing the stem to grow/bend upwards✓
- In the root, the auxins inhibit growth✓ on the lower side
- causing the root to grow/bend downwards✓ (7)
- 6.10 An investigation was done to determine the effect of auxins on the growth of lateral branches. (The elongation of lateral buds results in the growth of lateral branches.) (DBE/November 2023)

The procedure was as follows:

- Four potted plants (**A**, **B**, **C** and **D**) of the same species were used.
- Plant **A** was left untreated.
- The apical bud of plant **B** was removed.
- The apical bud of plant **C** was removed and replaced with agar jelly (a jelly-like substance through which other substances can diffuse).
- The apical bud of plant **D** was removed and replaced with agar jelly containing auxins.
- The plants were exposed to the same environmental conditions.
- The length of the lateral buds of each plant was measured at the beginning of the investigation and again after three weeks.

The diagram below shows the setup of the investigation at the beginning.



The results are shown in the table below.

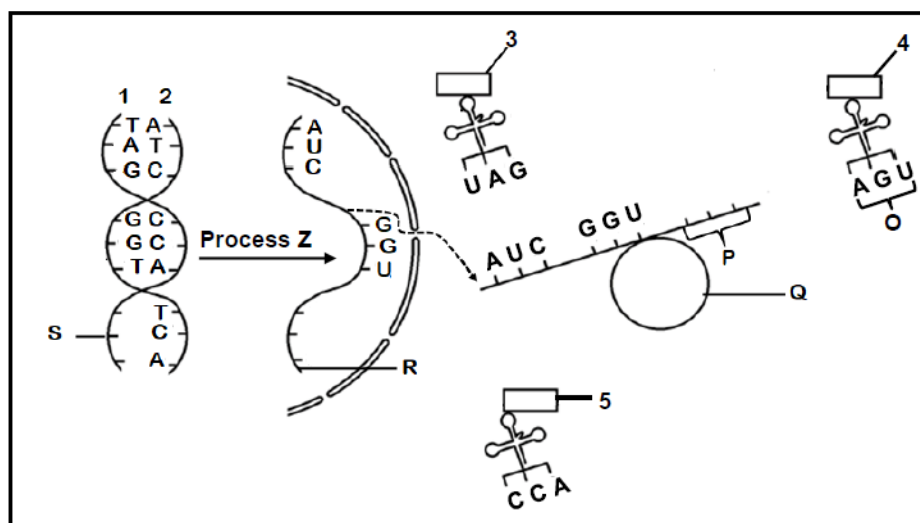
Plant	Length of the lateral buds (mm)	
	At the beginning	After three weeks
A	7,0	7,3
B	6,9	10,4
C	7,2	10,3
D	7,1	7,2

- 6.10.1 For this investigation, state the: (1)
- (a) Independent variable (1)
- **(Presence/absence of) auxins✓**
- (b) Dependent variable (1)
- **Growth of lateral branches✓**
- 6.10.2 Explain why all the plants were exposed to the same environmental conditions. (2)
- **To ensure that the results are caused only by the presence of auxins✓ which**
 - **increases the validity✓ of the investigation**
- 6.10.3 Explain why agar without auxins was used in plant C. (3)
- **It acts as a control✓**
 - **to show that the results of Plant D✓**
 - **are caused by the (presence of) auxins✓**
 - **and not the agar jelly✓**
- 6.10.4 State a conclusion for this investigation. **Any** (2)
- **The presence of auxins slows down the growth of lateral branches✓✓**
- OR**
- **The absence of auxins stimulated the growth of lateral branches✓✓**
- (9)**

PAPER 2

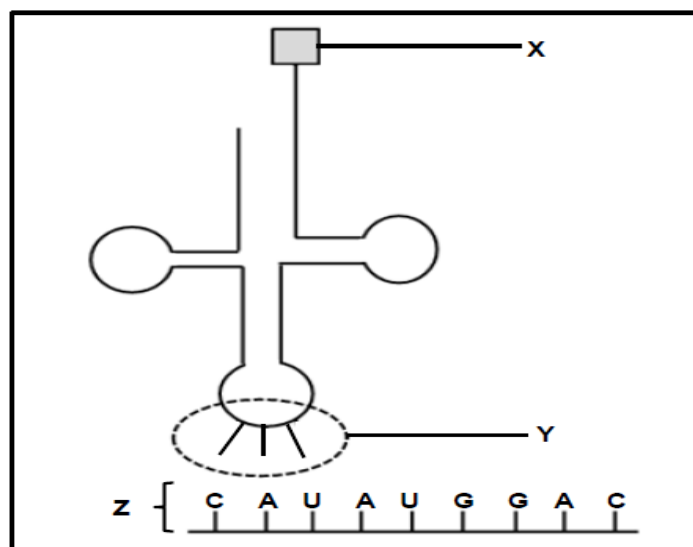
Topic	Mark Allocation in Paper	Study Date	Content
PAPER 2:			
DNA: The code of Life P2	27		DNA: What it is, where it is found. Role of Watkins, Crick, Franklin & Wilkens in the discovery of DNA
			Structure & Functions of DNA. Replication of DNA; DNA profiling
			RNA: Types , location, structure. Transcription 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

- 1.1 The diagram below is a schematic representation of protein synthesis. (DBE/November 2023)



- 1.1.1 Identify:
- (a) Process Z
Transcription✓ (1)
 - (b) Molecule R
mRNA✓/messenger RNA (1)
 - (c) Organelle Q
Ribosome✓ (1)
- 1.1.2 Give the collective name of nitrogenous bases O. (1)
Anticodon✓
- 1.1.3 Determine the sequence of the nitrogenous bases at area S. (1)

- 1.1.4 Which strand (1 or 2) was used as a template for the formation of molecule R? (1)
AGT✓
1✓
- 1.1.5 Which amino acid (3, 4 or 5) will be brought to area P? (1)
4✓
- 1.1.6 Name the type of sugar that forms part of the structure of molecule R. (1)
Ribose✓
- 1.2 The diagram below represents a process that occurs during protein synthesis. (May-June 2023) (8)



- 1.2.1 Identify molecule: (1)
 (a) X **Amino acid✓** (1)
 (b) Z **mRNA✓**
- 1.2.2 Give the nitrogenous base sequence of: (2)
 (a) The DNA base triplet complementary to the middle codon on molecule Z (1)
TAC✓✓
 (b) Y **GUA✓**
- 1.2.3 Name and describe the process shown in the diagram during the formation of a protein. (7)
Translation✓
 - Each tRNA carries a specific amino acid✓
 - When the anticodon on the tRNA✓/GUA
 - matches the codon on the mRNA✓/CAU
 - then tRNA brings the required amino acid to the ribosome✓
 - Amino acids become attached to each other by peptide bonds✓
 - to form the required protein✓
- 1.3 The table below shows the codons that code for some amino acids. (12)

(May-June 2023)

mRNA codon	Amino acid
AUG	methionine
CAU	histidine
CUA	leucine
GUA	valine
GAC	aspartic acid
GAG	glutamic acid
GAU	aspartic acid

A mutation caused a DNA base triplet to change from CTG to CTA.

1.3.1 Describe the effect of this mutation on the protein formed. (4)

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

1.3.2 Tabulate TWO differences between DNA and RNA nucleotides. (5)

DNA	RNA
Has deoxyribose✓ sugar	Has ribose✓ sugar
Has thymine✓/nitrogenous base T	Has uracil✓/nitrogenous base U

(Mark first TWO only)

Table 1 + (2 x 2)

1.3.3 Down syndrome is the result of an individual having an extra copy of chromosome 21.

Two genetic variations that can cause Down syndrome are:

Trisomy 21

All the somatic cells in an individual have three copies of chromosome 21 due to an abnormal process that occurs during gamete production.

Mosaic Down syndrome

The individual has only some cells with an extra copy of chromosome 21 which is caused by an abnormal process during cell division after fertilisation.

1.3.3.1 Name the:

(a) Type of mutation that leads to Trisomy 21 (1)

Chromosomal✓mutation

(b) Abnormal process during gamete production that leads to three copies of chromosome 21

Non-disjunction✓ (1)

(c) Type of cell division that occurs after fertilisation

Mitosis✓

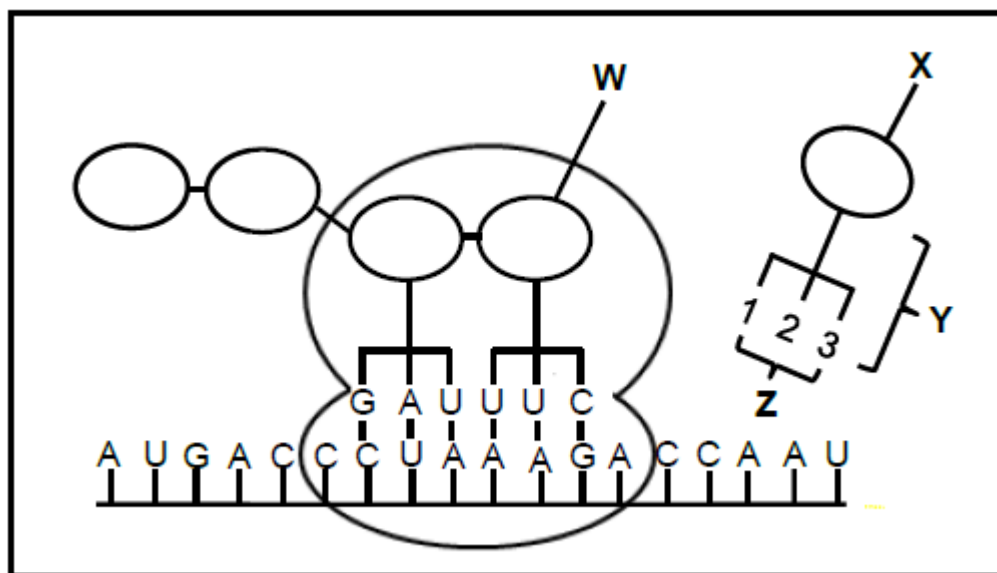
1.3.4 Describe how the process in QUESTION 1.3.3.1(b) leads to Trisomy 21. (1)

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

1.3.5 Describe TWO differences between *Trisomy 21* and *Mosaic Down syndrome*. (4)

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

1.4 The diagram below shows part of a process involved in the production of a protein. (DBE/November 2019) (12)



1.4.1 Identify:

(a) Molecule Y

- **tRNA✓/transfer RNA**

(b) The group of nitrogenous bases Z

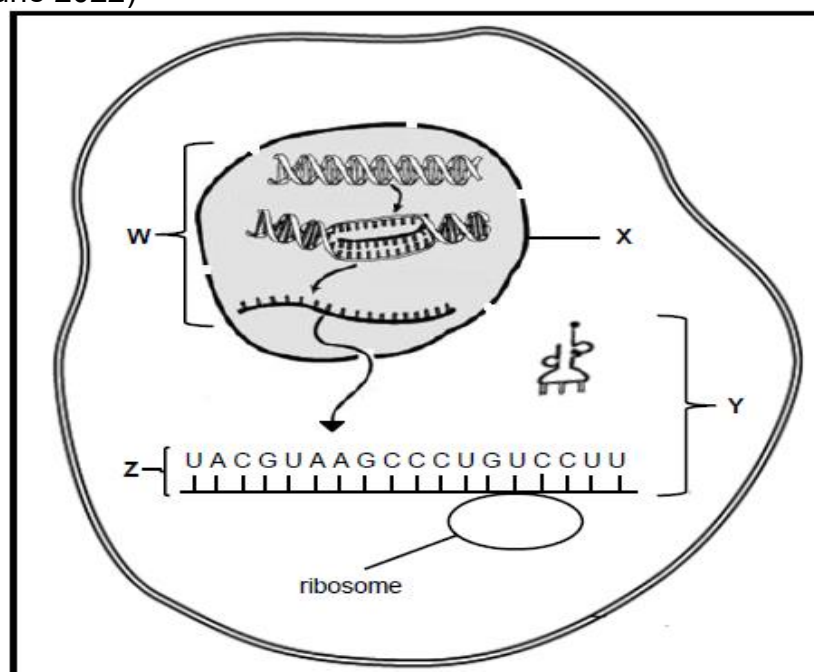
- **Anticodon✓**

1.4.2 If X is the next amino acid required after W, then identify:

- (a) Nitrogenous bases 1, 2 and 3 (2)
- **UGG✓✓ (in correct order)**
- (b) The DNA base triplet that codes for X (2)
- **TGG✓✓ (in correct order)**

- 1.4.3 Describe the process of transcription. (6)
- **The double helix DNA unwinds✓ and unzips✓/weak hydrogen bonds break**
 - **to form two separate strands✓**
 - **One strand is used as a template✓**
 - **to form mRNA✓**
 - **using free RNA nucleotides from the nucleoplasm✓**
 - **The mRNA is complementary to the DNA✓**
 - **The coded message for protein synthesis is thus copied onto mRNA✓**
- (12)

- 1.5 The diagram below represents the process of protein synthesis in a cell. (May-June 2022)



- 1.5.1 Name the process which occurs at: (1)
- (a) **W**
- **Transcription✓**
- (b) **Y**
- **Translation✓**
- 1.5.2 Identify: (1)
- (a) Organelle X (1)
- **Nucleus✓**
- (a) Molecule Z (1)
- **mRNA✓**
- 1.5.3 State TWO locations of DNA in a cell, other than in the nucleus. (2)
- **Chloroplasts✓**

- **Mitochondria**✓

(6)

- 1.6 The table below shows some tRNA anticodons with their corresponding amino acids. (May/June DBE/2022)

tRNA ANTICODON	AMINO ACID
CAG	Valine
GAA	Leucine
AUG	Tyrosine
GGA	Proline
UCG	Serine
CAU	Valine

- 1.6.1 Name the:

(a) DNA base triplet that codes for serine

(1)

- **TCG**✓

(b) First TWO amino acids coded for by molecule **Z** in the diagram (the molecule is read from left to right)

(2)

- **Tyrosine**✓

- **Valine**✓ (in this sequence)

- 1.6.2 What is the change in the sequence of nitrogenous bases in a DNA molecule called?

(1)

- **Gene mutation**✓

- 1.6.3 The codon CUU (last codon) on molecule **Z** changed to CCU. Explain the effect it would have on this particular protein molecule.

(3)

- **The anticodon will be GGA**✓/not GAA

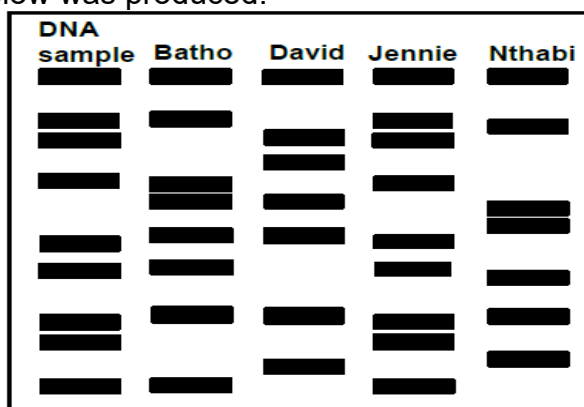
- **The last amino acid would be proline instead of leucine**✓

- **resulting in a different protein**✓/ no protein at all

(7)

- 1.8 Detectives were investigating a crime scene and found blood on a broken window. They suspected that the blood was that of the criminal. To identify the criminal, they analysed a DNA sample from the blood and compared it to that of four suspects. (DBE/November 2020(2))

The diagram below was produced:



- 1.8.1 Name the technique that was used to identify the criminal.

(1)

- **DNA profiling**✓

- 1.8.2 Who is the possible criminal?

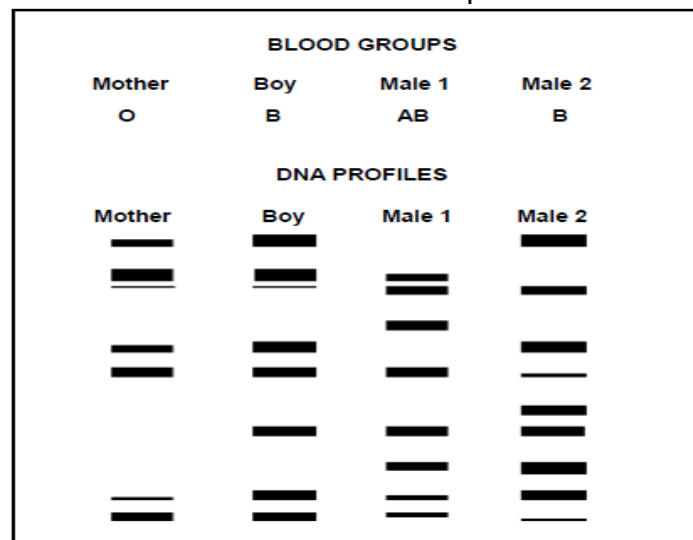
(1)

- 1.8.3 Explain your answer to QUESTION 1.8.2 (2)
- **Jennie✓**
 - **Jennie's DNA profile✓/ bands**
 - **matches the DNA profile/ bands of the sample✓from the crime scene**
- 1.8.4 State ONE other use of the technique identified in QUESTION 1.8.1 (1)
- **Proof of paternity✓**
 - **Tracing missing persons✓**
 - **Identification of genetic disorders✓**
 - **Establishing family relations✓**
 - **Matching tissues for organ transplants✓**
 - **Identifying dead persons✓/animals Any**

(Mark first ONE only)

- 1.9 A family wanted to identify the biological father of a boy. The mother of the boy is known. Blood groups and DNA profiles of the mother, the boy and two males were used to determine paternity. (DBE/2022)

The data below shows the results of the two procedures.



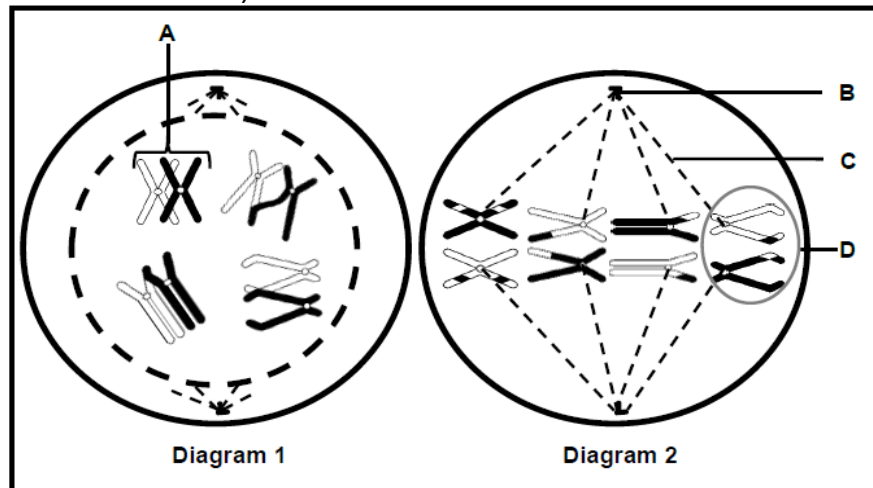
- 1.9.1 Explain why paternity of the boy could not be established using blood groups only. (5)
- **Either male 1 or male 2 could be the father✓ of the boy**
 - **since both males have the IB allele✓/ male 1 IAIB and male 2 IBIB or IBi**
 - **The mother's blood group is O and must have the genotype ii✓/homozygous recessive**
 - **The boy would have inherited the recessive allele/i from the mother✓**
 - **and he would have the genotype IBi✓**
- 1.9.2 Who is the biological father of the boy according to the DNA profiles? (1)
- **Male 2✓**
- 1.9.3 Explain your answer to QUESTION 1.9.2. (3)
- **Four/some bands of the boy's✓DNA profile**
 - **match with those of the mother's✓ profile**
 - **The remaining bands of the boy match with the bands of male 2's✓ DNA profile/fewer bands match with male 1's DNA profile**

(Mark first ONE only)

- 1.9.4 State ONE other use of DNA profiling. (1)
- **Tracing missing persons✓**
 - **Identification of genetic disorders✓**
 - **Establishing family relations✓**
 - **Matching tissues for organ transplants✓**
 - **Identifying dead persons✓/criminals/suspects Any**

(Mark first ONE only)

- 1.10 The diagrams below represent two stages of meiotic cell division. (DBE/November 2023)



- 1.10.1 Name structure: (1)
- (a) **B** (1)
- **Centriole✓/centrosome**
- (b) **C**
- **Spindle fibre✓**

- 1.10.2 Identify the phase represented in Diagram 1. (1)

- **Prophase I✓**

- 1.10.3 Give THREE reasons for your answer to QUESTION 2.1.2. (3)

- **Pairing of homologous chromosomes is visible✓/ bivalents are visible**
- **Development of spindle fibres✓**
- **Crossing over is taking place✓**
- **Centriole/ centrosome moved to opposite poles✓**
- **Disintegration of the nuclear membrane✓**

(Mark first THREE only)

- 1.10.4 Describe the process taking place at **A**. (3)

- **Parts of the homologous chromosomes overlap✓ and**
- **DNA/genetic material is exchanged✓**
- **at points called chiasmata✓/chiasma**

- 1.10.5 (a) Identify the phase represented in Diagram 2. (1)

- **Metaphase I✓**

- (b) Describe the difference in the events that take place in the phase mentioned in (a) and the same phase during mitosis. (2)

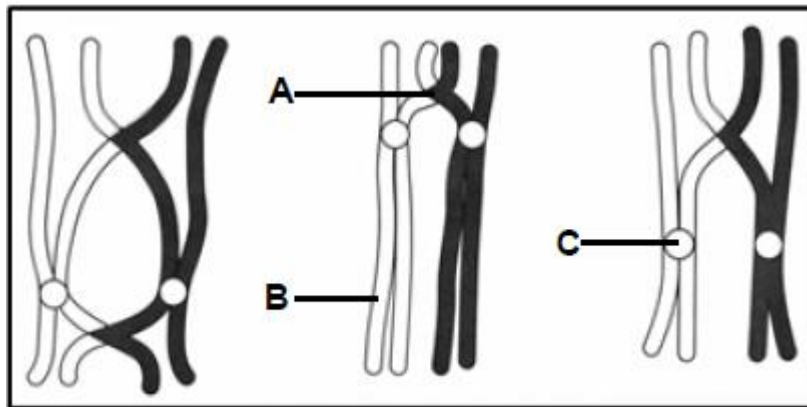
- In Metaphase I/Meiosis I chromosomes are arranged in pairs at the equator✓
- In mitosis the chromosomes are arranged singly at the equator✓

1.10.6 Describe the results at the end of meiosis if the chromosomes at **D** failed to separate. (3)

- Four (daughter) cells will be formed✓of which
- two will each have five chromosomes✓ and
- the other two will each have three chromosomes✓

(15)

1.11 The diagram below represents ALL the chromosomes in a cell that is undergoing normal cell division.(DBE/November 2020(2))



1.11.1 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 shown in the diagram (1)

- Prophase I✓

1.11.2 Where in the human female body would the type of cell division named in QUESTION 1.4.1(a) take place? (1)

- Ovary✓

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

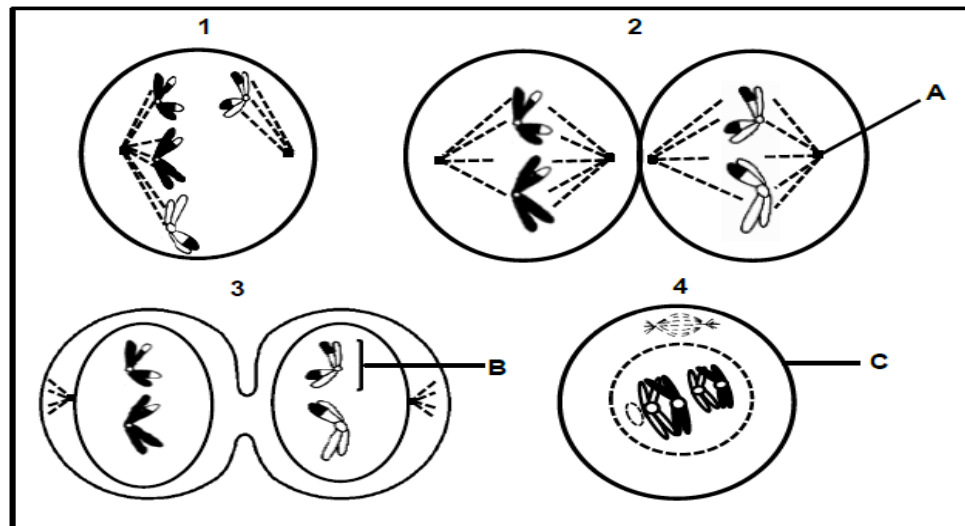
- C✓ - centromere✓

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

- 3✓/Three

(6)

1.12 The diagrams below represent different phases of meiosis. (DBE/November 2019)



1.12.1 Identify part:

(a) **A**

- **Centriole✓/centrosome**

(1)

(b) **B**

- **Chromosome✓**

(1)

(c) **C**

- **Cell membrane✓/plasma membrane/plasmalemma**

(1)

1.12.2 Give the NUMBER and NAME of the phase which shows the following:

(a) Random arrangement of chromosomes at the equator

- **2✓ - Metaphase II✓**

(2)

(b) Crossing over

- **4✓ - Prophase I✓**

(2)

(c) Non-disjunction

- **1✓ - Anaphase I✓**

(2)

1.12.3 How many chromosomes will be found in:

(a) The cells at the end of meiosis shown in the diagrams

- **2✓/ 3 and 1**

(1)

(b) A normal, human sperm

- **23✓**

(1)

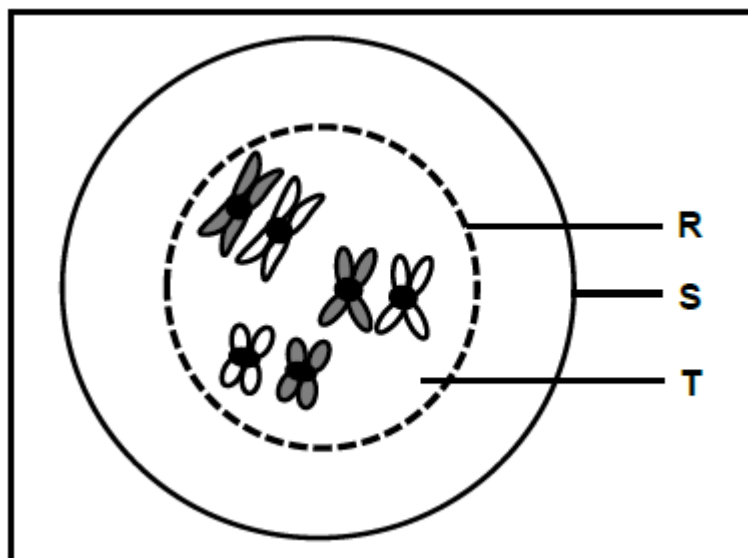
(c) The somatic cells of a normal mother who has a son with Down syndrome

- **46✓**

(1)

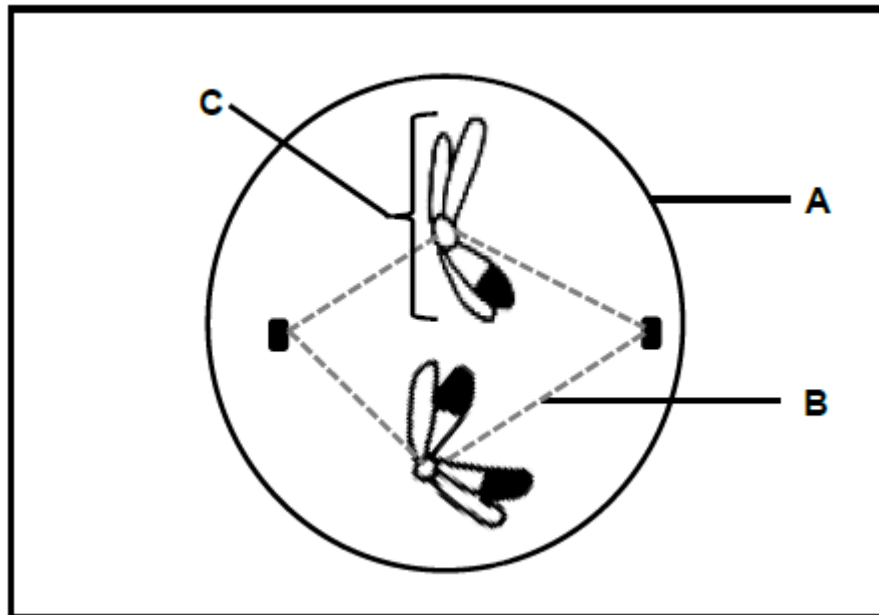
(12)

1.13 The diagram below represents a cell in an early stage of meiosis. (May-June 2023)



- 1.13.1 Give the:
- (a) Phase of meiosis represented (1)
- **Prophase I**✓
 - (b) Number of chromatids shown (1)
- **Twelve**✓/12
 - (c) Number of homologous chromosome pairs (1)
- **Three**✓3
- 1.13.2 Identify structure:
- (a) **R** (1)
- **Nuclear membrane**✓
 - (b) **S** (1)
- **Cell membrane**✓/plasmalemma/plasma membrane
 - (c) **T** (1)
- **Nucleoplasm**✓
- 1.13.3 Name TWO organs in an animal where meiosis occurs. (2)
- **Testes**✓
- **Ovaries**✓
- (Mark first TWO only)
- (8)**

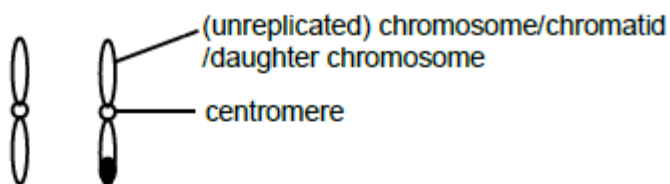
- 1.14 The diagram below represents one cell in a phase of meiosis. (May-June 2022)



- 1.14.1 Identify the phase of meiosis shown. (1)
 - **Metaphase II**✓
- 1.14.2 Give ONE observable reason for your answer to QUESTION 1.14.1 (2)
 - **Individual chromosomes line up at the equator**✓✓ **of the cell**
 (Mark first ONE only)
- 1.14.3 Identify structure: (1)
 (a) **A**
 - **Cell membrane**✓
 (b) **B** (1)
 - **Spindle fibre**✓
- 1.14.4 Describe the role of part **B** in the movement of chromosomes during meiosis. (2)
 - **It contracts**✓/shortens
 - **to pull the chromosomes**✓/ **daughter chromosomes/chromatids to opposite poles of the cell**
- 1.14.5 Draw a labelled diagram of structure **C** as it would appear in the final phase of this meiotic division. Show the correct shading. (4)

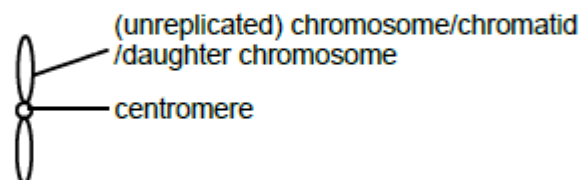


Structure C in the final phase of Meiosis/ Telophase II



OR

Structure C in the final phase of Meiosis/ Telophase II

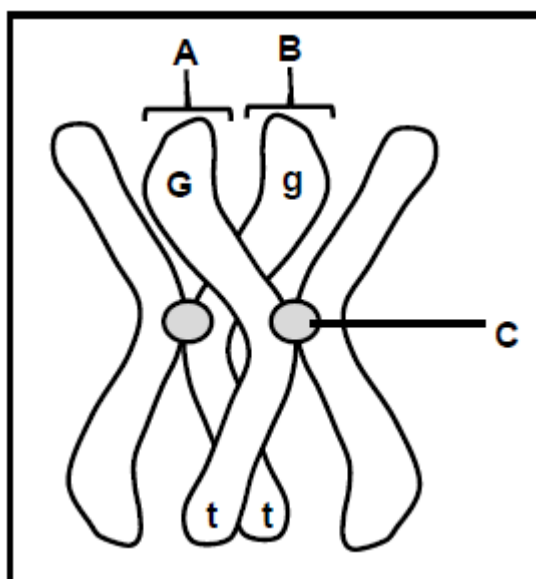


Guideline for assessing the drawing

CRITERIA	ELABORATION	MARK
Heading (H)	- Structure C in the final phase of meiosis/Telophase II	1
Correct drawing (D)	- Daughter chromosome/ unreplicated chromosome/ chromatid/s drawn from structure C only	1
Correct shading (S)	- One unshaded - One with a shaded tip } OR one unshaded	1
Labels (L)	- Any 1 correct label	1

(11)

- 1.15 The diagram below represents a pair of homologous chromosomes in a plant cell. The alleles for two characteristics, seed colour (**G** and **g**) and plant height (**T** and **t**), are indicated on the chromosomes.
(May-June 2021)



- 1.15.1 Give the term used to describe the position of an allele on a chromosome. (1)

- **Locus**✓

1.15.2 Identify parts A and C. (2)

- **A - chromatid**✓

- **C - centromere**✓

1.15.3 Name the process during which parts A and B exchange genetic material. (1)

- **Crossing over**✓

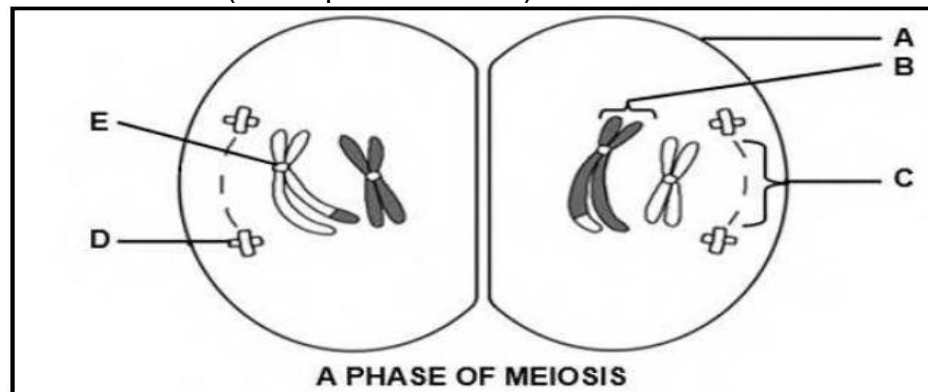
1.15.4 During which phase of meiosis does the process named in QUESTION (1)

1.15.3 take place?

- **Prophase I**✓

(5)

1.16 The diagram below shows the somatic cells of an organism in one of the phases of meiosis. (FS/September 2022)



1.16.1 Which phase of meiosis is represented in the diagram? (1)

- **Prophase II**✓

1.16.2 Give the LETTER and NAME of the part that:

(a) Carries the genetic information (2)

- **B ✓ - chromosome**✓

(b) Holds the chromatids together (2)

- **E ✓ - centromere**✓

1.16.3 State the number of chromosomes present in each of the cells of this organism.

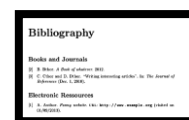
(a) At the beginning of meiosis (1)

- **4**✓ (1)

(b) In a gamete of this organism

- **2**✓

(7)



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 Past Exam Papers, 2019 – 2024.