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Western Cape Government FOR YOU

CAPE WINELANDS EDUCATION DISTRICT

LIFE SCIENCES PAPER 1

Survival Kit

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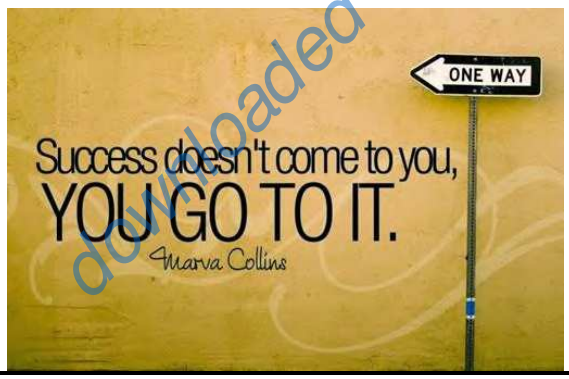
Grade 12 Learner

It is important **for YOU** to be successful in the NSC examination at the end of 2022, and to achieve this, it will take extra effort and work **from YOU**. We have taken time to prepare this kit to enable **YOU** to achieve this goal in Life Sciences.

This document has been prepared as **study material** for the Final Examinations for Grade 12 Life Sciences.
The materials have been arranged in such a way that studying can be undertaken topic-wise.
Within each topic, **core notes** have been included according to the 2021 Examination Guideline Document.
Questions were selected such that the core concepts and core skills are assessed and practiced.
The **action words** have been underlined in the questions, so that you can **follow the instructions** of the question.



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HUMAN REPRODUCTION – PAPER 1, 41 marks

It is important that you can **label and provide functions** of the different parts of the male and female reproductive systems.

MALE REPRODUCTIVE SYSTEM:

The figure below shows the different parts of the male reproductive system and their functions.

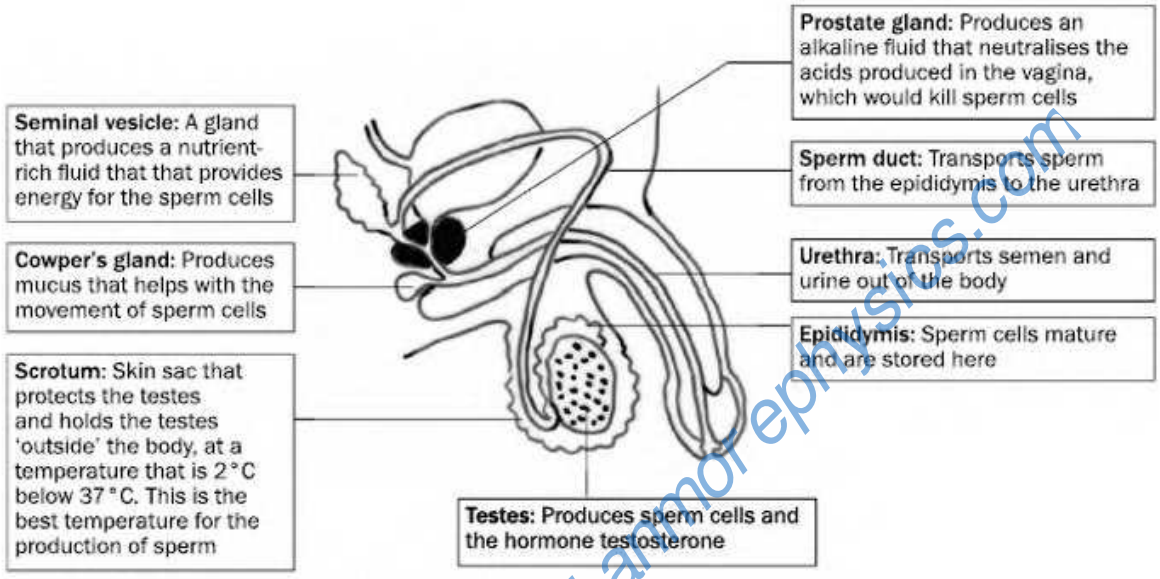

Figure 4.1 Structure of the male reproductive system

Functions of testosterone

The testes produce the hormone **testosterone**, which has the following functions:

1. Development of male secondary sexual characteristics, such as beard, pubic hair, deep voice and a muscular body.
2. Stimulates the maturation of sperm cells.

A possible question in the NSC exams:

Describe the process of **SPERMATOGENESIS –** (the formation of male gametes, sperm cells)

- Under the influence of **testosterone**
- **diploid cells** in the **seminiferous tubules** of the **testes** undergo **meiosis**
- to form **haploid sperm cells**

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It is very important that you can draw the structure of a sperm cell/ provide labels and functions of the parts

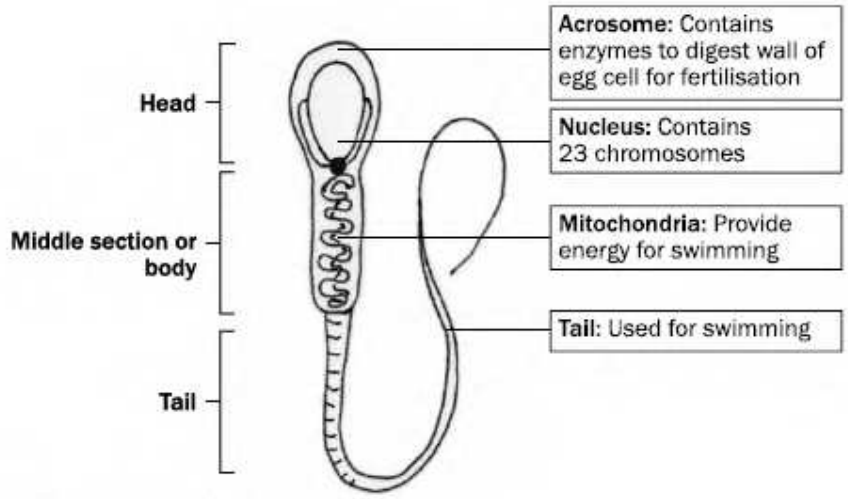


Figure 4.2 Structure of a sperm cell

Female reproductive system:

Know the parts and functions of the following parts:

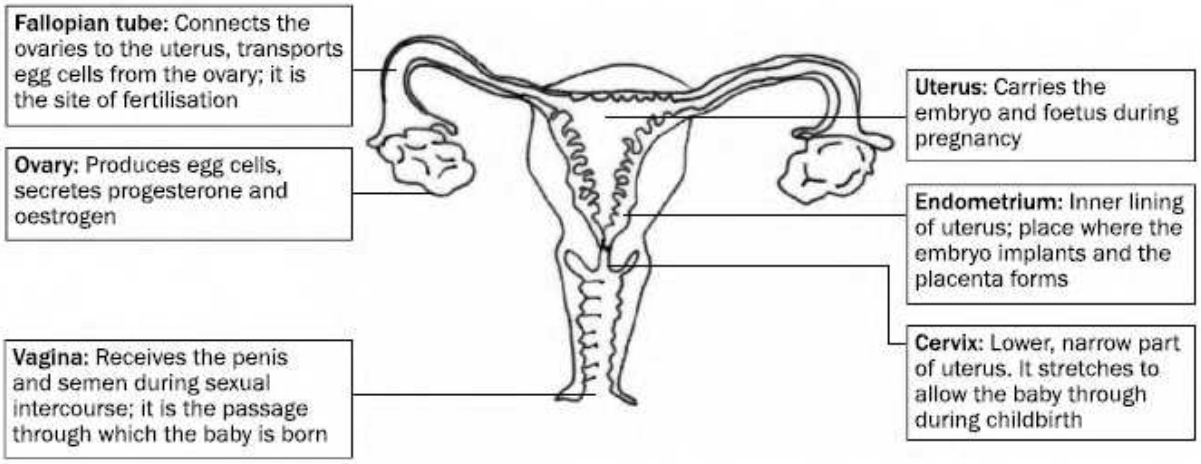
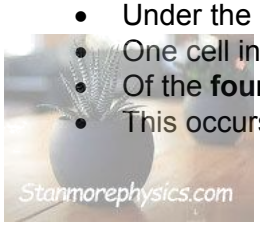


Figure 4.3 Structure of the female reproductive system

Be able to describe oogenesis as follows:

Oogenesis: the formation of female gametes - ovum

- **Diploid cells** in the ovary **undergo mitosis**
- To form numerous **follicles**
- At the onset of **puberty**
- Under the influence **of FSH**
- One cell inside a **follicle enlarges** and **undergoes meiosis**
- Of the **four cells produced**, only **ONE survives to form** a mature, **haploid ovum**
- This occurs in a monthly cycle



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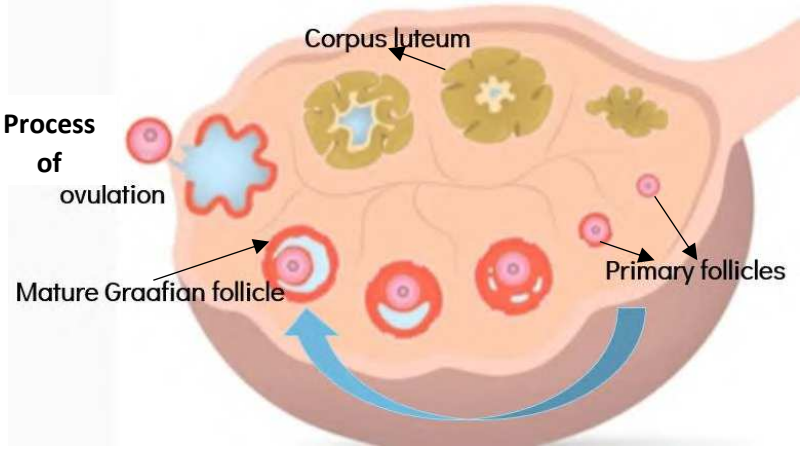
Be able to draw the structure of an ovum and provide labels *(jelly layer, haploid nucleus, cytoplasm)*

Structure of the ovum:

Cross section of the ovary indicating the development of the follicles



You must know the names and functions of the following hormones that play a role in the menstrual cycle:

Hormone	Gland/structure that secretes hormone	Function
FSH (**F**ollicle-**S**timulating-**H**ormone)	hypophysis/ pituitary gland	Stimulates the development of the primary follicle into a mature Graafian follicle
LH	hypophysis/ pituitary gland	Stimulates the release of the ovum (ovulation) Formation of the corpus luteum
oestrogen	Graafian follicle	Starts the thickening of the endometrium (lining of the uterus)
progesterone	Corpus luteum	Thickens the endometrium even further, preparation should fertilization occur

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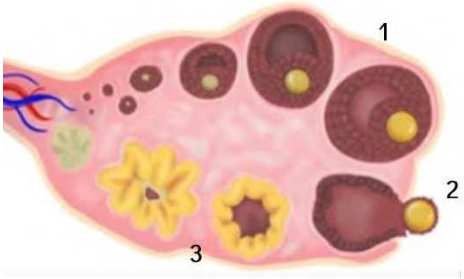
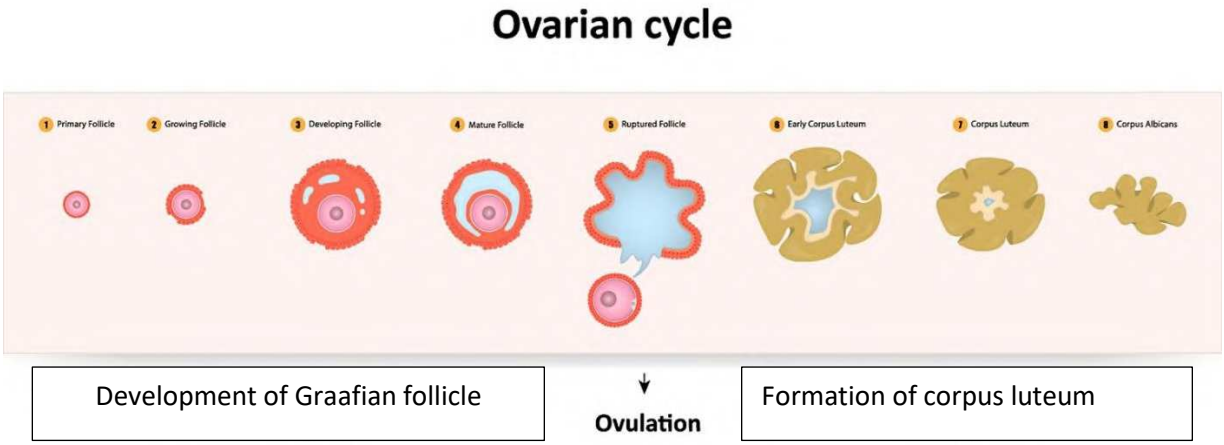
A. Events in the ovarian cycle:



1. Development of Graafian follicle
2. Ovulation
3. Formation of corpus luteum



B. Events in the uterine cycle:

- Changes that take place in the thickness of the endometrium
- Menstruation

Uterine cycle:

1. **Oestrogen** is responsible for the **thickening of the endometrium**
2. **Progesterone** thickens the endometrium **even more**

Menstruation:

- The blood vessel rich endometrium breaks down, and is bleeding occurs through the vagina.

Progesterone levels **will decrease** if fertilization does **NOT** occur, **menstruation will occur**.

If fertilization **DOES** occur, progesterone levels **will remain high,** endometrium will remain intact (**will not break down**) and **no menstruation** will occur.

Negative feedback between progesterone and FSH:

If **progesterone** levels **remain high,** the hormone **FSH will not be secreted** as no follicle will develop while the woman is pregnant.

If **progesterone** levels **decrease**, **FSH** will be **secreted,** and new follicles will develop.

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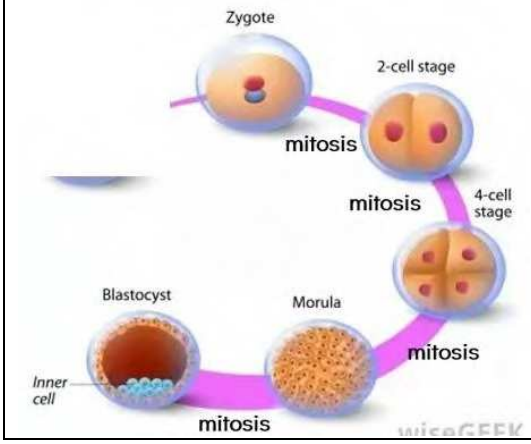
Process of fertilization:
The sperm cell(n) and the ovum(n) **fuse** to form a **fertilized egg cell**, a **zygote**(2n)

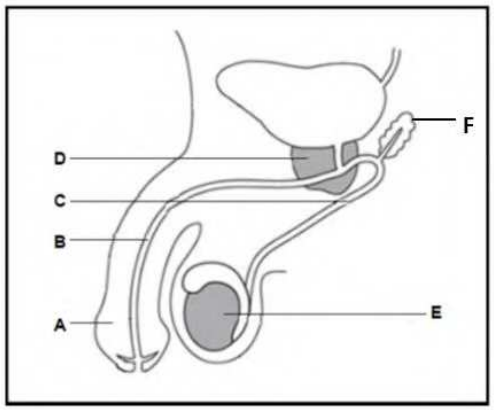
Also know: **Development of the zygote to embryo:**



- Zygote undergoes **mitosis**
- to form a **ball of cells**
- called a **morula**
- Which continues to divide by **mitosis** to
- form a **hollow balls of cells**
- called a **blastocyst**

QUESTIONS - HUMAN REPRODUCTION

1. The diagram below represents a part of the male reproductive system.



1.1 Give the **LETTER** and the **NAME** of the part that:
(a) Is used in copulation (2)
(b) Produces testosterone (2)

1.2 Give ONLY the **LETTERS** of the **TWO** parts in the diagram that:
(a) Contribute to the formation of semen (2)
(b) Provide a passage for the sperm cells (2)

Answer:

1.1 (a) **A ; penis** (2)
(b) E; testes (2)

2.2 (a) **D** (prostate) **; F** (seminal vesicle) (2)
(b) **C** (sperm duct/vas deferens); **B;** (urethra) (2)

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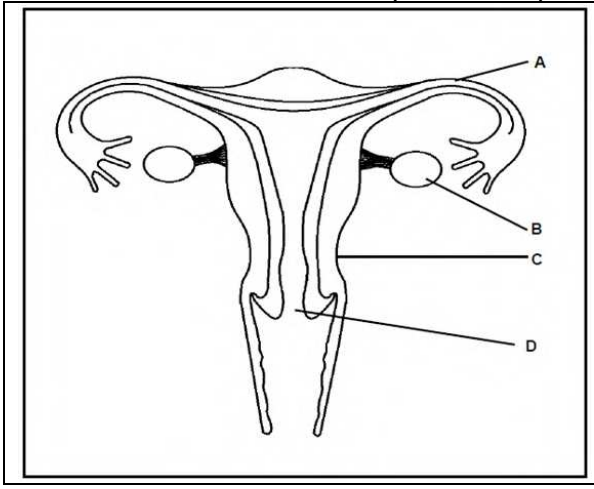
2. The structure below represents a part of the female reproductive system.



2.1 **Identify** part D. (1)
2.2 State **ONE function** of part A. (1)
2.3 **Describe** the **process of oogenesis** as it occurs in part B. (4)
2.4 **State** ONE way in which structure C is suited for its function during pregnancy. (1)
2.5 A person undergoes a surgical operation to **remove part B** on both sides. **Explain** why this person will not menstruate. (3)

Answer:

2.1 **cervix** (1)

2.2 **site of fertilization**
passage for egg cells (1)

2.3 **Diploid cells (2n)** in the ovary undergo **mitosis**
to form numerous **follicles.**
At the onset of **puberty**
and under the **influence of FSH**,
one cell inside a follicle enlarges and **undergoes meiosis**.
Of the four cells that are produced, **only one survives** to form a mature,
haploid (n)ovum.
This occurs in a monthly cycle. (3)

2.4 **Muscular – can enlarge to house and protect the developing foetus/**
contractions during childbirth (1)

2.5 The **ovaries** have been **removed**
No Graafian follicles can develop
No oestrogen will be secreted
endometrium will not thicken,
no thickening, no menstruation (3)

3.Draw a **labelled diagram** to show the structure of a **sperm cell** (4)
and an **ovum**. (4)

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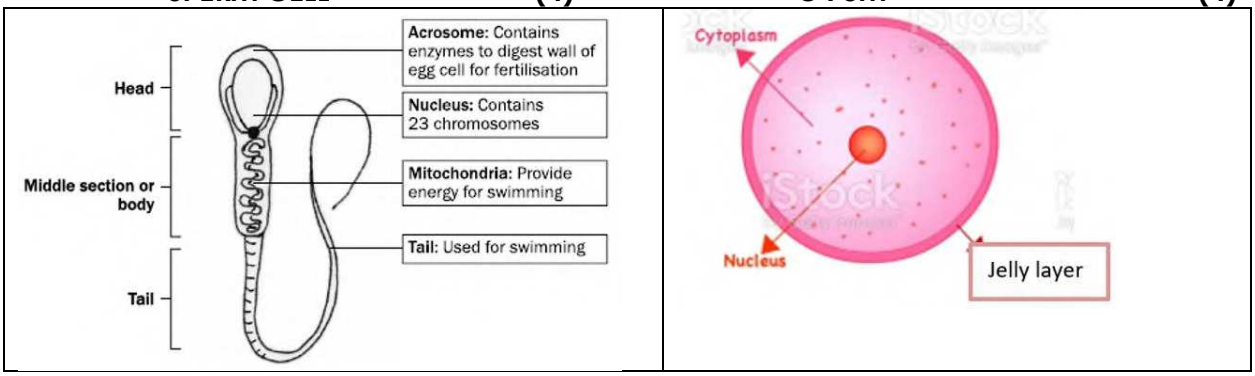
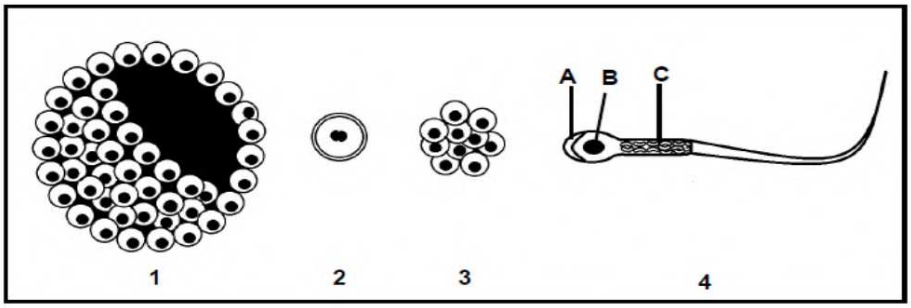
Answer:

Remember to always give the diagram a <u>heading</u>, you will be awarded a mark for it

SPERM CELL (4) **OVUM (4)**



4. The diagrams below show structures formed during human reproduction.



4.1 **Identify** part A. (1)
4.2 Name the organelle found in **large numbers** in part **C**. (1)
4.3 Give the **NUMBER** (1, 2, 3 or 4) only of the diagram that represents the following:
(a) Morula (1)
(b) Structure that will **implant** in the uterus (1)
(c) Blastula/Blastocyst (1)
4.4 Give the **LETTER and NAME** of the part that will enter the ovum during fertilisation. **(2)**
4.5 Name the **type of cell division** that occurred to produce the structure in diagram 3. (1)

Answer:

4.1 **acrosome** (1)
4.2 **mitochondria** (1)
4.3 (a) **3** (1)
(b) **1** (1)
(c) **1** (1)
4.4 **B – haploid nucleus** (2)
4.5 **mitosis** (1)

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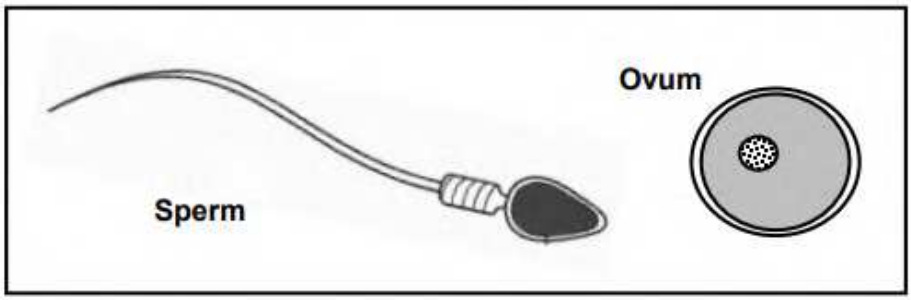
5. The diagram below shows a human sperm and ovum. The diagram is not drawn to scale.



5.1 **Tabulate** *ONE difference* between the structure of an ovum and a sperm cell. (3)

5.2 The head of the sperm contains a protein digesting enzyme. **Explain** the Importance of this enzyme during fertilisation. (2)

5.3 An active healthy sperm cell is able to swim about 4 mm per minute. If the distance from the cervix to the end of the Fallopian tube is 20 cm, how long will it take for the sperm cell to reach the ovum at the end of the Fallopian tube?
Show your working. (3)

5.4 Semen has a pH of 7.5. Sperm cells have a high mortality rate in acidic conditions. How does the male body ensure that the sperm cells are not killed by acidic urine as they travel through the urethra? (2)

5.1 **Answer:**

*If you are asked to **tabulate** an answer, always draw the table, **you will be awarded one mark for the table.***

Ovum	**Sperm cell**
No tail No mitochondria	Contains a tail for transport Mid-piece contains many mitochondria (3)

5.2 - **the digesting enzymes are responsible to break down the cell membrane of the ovum**
- **to allow the haploid nucleus of the sperm cell to enter the ovum** (2)

5.3 20 cm = 200 mm ✓

$$\frac{200 \text{ mm}}{4 \text{ mm}} \quad \checkmark$$

= 50 minutes ✓ (3)

5.4 **the prostate gland secretes an alkaline substance that neutralises the acidic environment of the urethra** (2)

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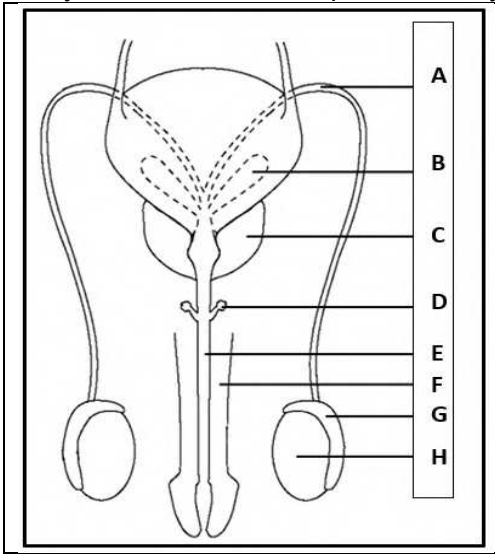
6. Study the human male reproductive system below and answer the questions.

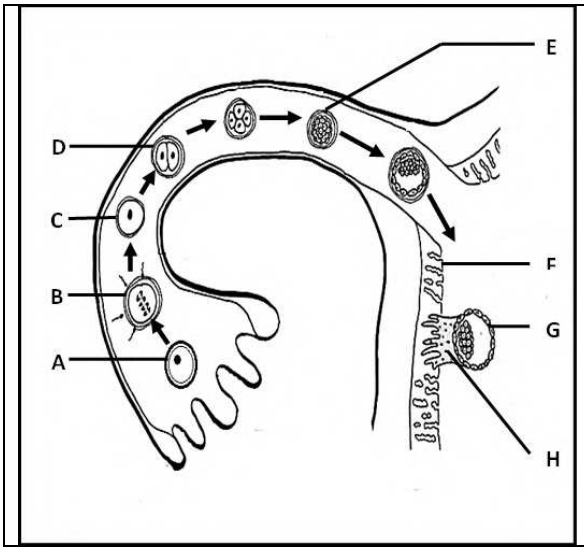


6.1 Identify part:
(a) **B**
(b) **H** (2)
6.2 What is the **function** of **E**? (2)
6.3 **Discuss** TWO **structural adaptations** of the sperm cells to reach the ovum in the Fallopian tube of the female. (4)
6.4 Test results show that a man has a **low sperm count.** The doctor advises the man that when he is working on his laptop (computer), which **radiates heat**, that he should not put the laptop on his lap.
Why do you think this could have an influence on fertility? (3)

Answer:

6.1 **(a) B seminal vesicle** (1)
(b) H testes (1)
6.2 **transport semen with sperm cells / transport urine** (2)
6.3 **Tail – to swim**
Mitochondria (in mid-piece) – for *energy* to swim (4)
6.4 **Optimal sperm production occurs at 2-3 ^{0} lower than body temperature**
The warm laptop will increase the temperature of the testes
and sperm production will decrease/not be optimal
decrease in fertility (3)

7. 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.



7.1 **Identify:**
(a) Structure C
(b) The stage of embryo development at E
(c) The structure that develops from a combination of parts F and H (3)
7.2 Name the ***process*** that takes place:
(a) At **B**
(b) When **G** attaches to part **F** (2)
7.3 Give the chromosome number of:
(a) The cells at **D**
(b) Cell **A** (2)

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Answer:

7.1 (a) **zygote (fertilized egg cell)**
(b) **morula (ball of cells)**
(c) **placenta** **(3)**

7.2 (a) **fertilization**
(b) **implantation** **(2)**

7.3 (a) **46**
(b) **23** **(2)**

RESPONDING TO THE ENVIRONMENT (HUMANS)
PAPER 1, 54 marks

Human Nervous System

The importance/need for a nervous system in humans:

- To respond to internal and external **change**
- Co-ordinate the various activities of the body

Know the difference between a stimulus and an impulse:

STIMULUS – any **change** in the environment (eg. a loud noise, a flashing light)

IMPULSE – a **message** carried/transmitted by nerves

Central Nervous System

Consists of **Brain** and **Spinal Cord**

Know the following parts and functions of the brain:

1.Brain:

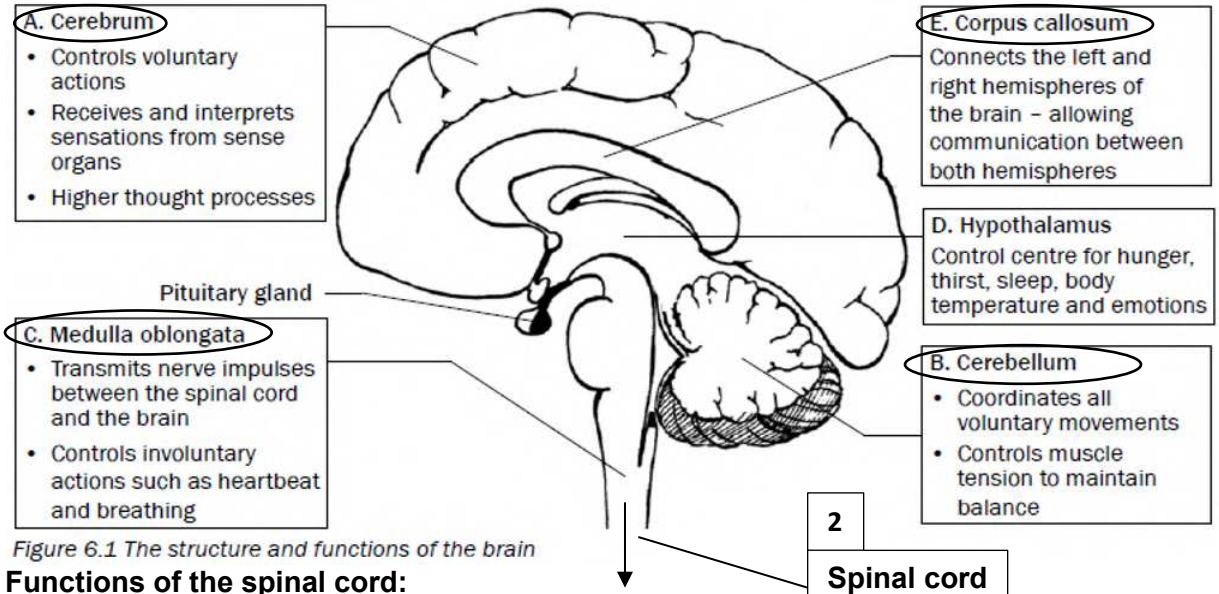

Figure 6.1 The structure and functions of the brain

Functions of the spinal cord:

·Provides a pathway for nerve impulses to and from the brain
·The spinal cord serves as a centre for reflex actions

PROTECTION OF THE Central Nervous System

The brain is enclosed by the **skull** and the spinal cord by the vertebral column
Both the brain and spinal cord are enclosed by the 3 membranes, called the **meninges**

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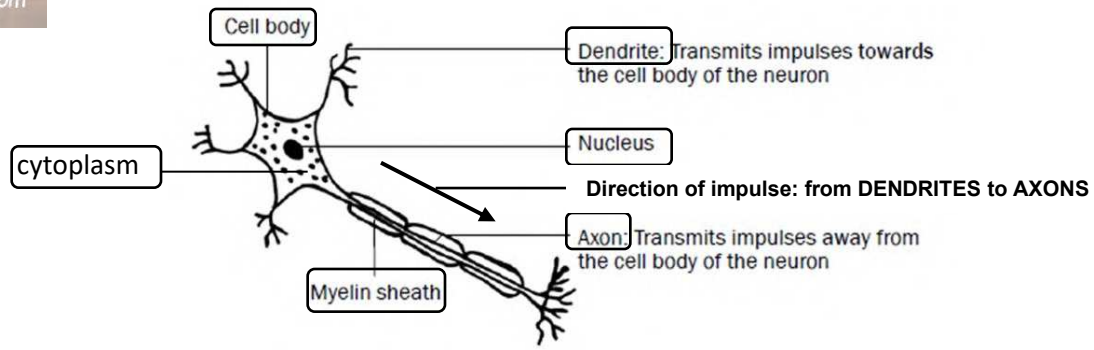
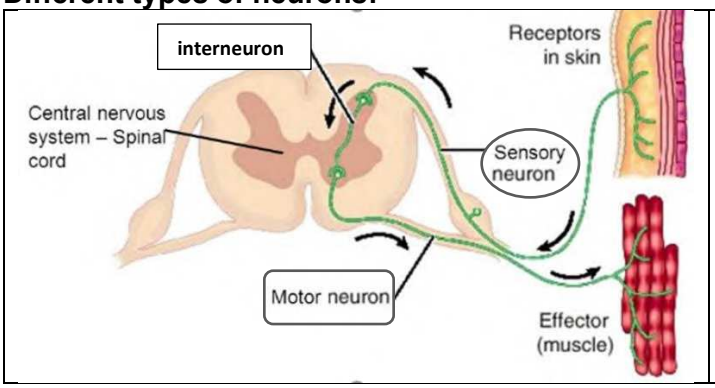
Our **nerves are made up** of millions of small **neurons**

You must be able to **draw and label** a simple of a neuron, using the following labels: nucleus, cell body, cytoplasm, myelin sheath, axons and dendrites

Heading - A motor neuron:



Different types of neurons:



Sensory neurons – transmit impulses from the **RECEPTORS** to the **Central Nervous System**

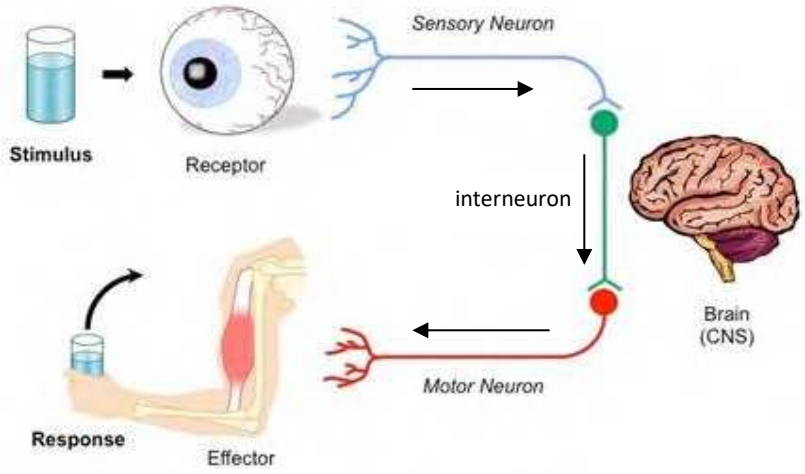
Interneurons – link **sensory neurons** to **motor neurons**

Motor neurons – transmit impulses from **the Central Nervous System** to the **effectors**

Know the difference between **a receptor** and **an effector:**

•**RECEPTOR**: special cells that become **aware of the STIMULUS** (the change) and **convert it into an IMPULSE** (message carried by nerves)

•**EFFECTOR**: an organ or cell that acts in **response to a stimulus** (REACTS)
Eg. **muscles or glands**



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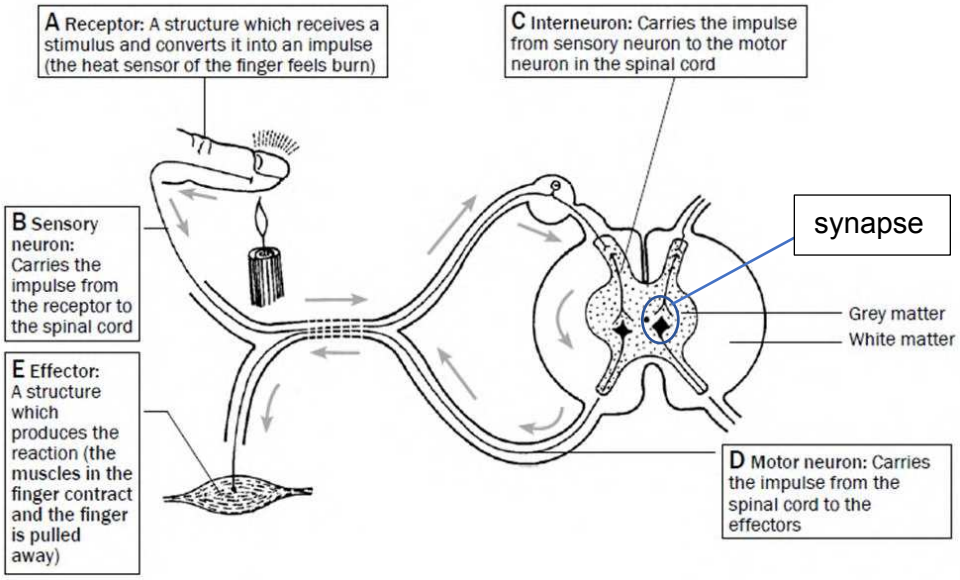
Know the difference between: A Reflex Action and a *Reflex Arc*.

•**Reflex action** – a *quick, automatic* movement/action by an effector, in response to a stimulus received by a receptor (eg. quickly pulling your hand away from a hot stove)

•***Reflex arc*** – *pathway* along which nerve impulses are carried from a receptor to an effector to bring about a reflex action.

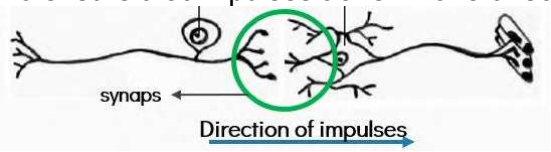
Structure and labels of a Reflex Arc:



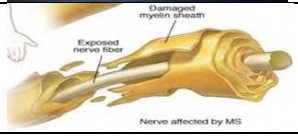
Reflex arc: pathway is from- 1 receptor → 2 sensory neuron → 3 interneuron → 4 motor neuron → 5 effector

The significance (importance) of a reflex action:
Reflex actions **protect** the body from dangerous situations, **protects** us from serious injury

The significance (importance) of a synapse:
To ensure that impulses travel in one direction only (from dendrites to axons)



Causes and symptoms of disorders:

•Alzheimers		Degeneration of brain cells that destroys memory and thinking skills
•Multiple sclerosis		**Myelin sheath** of neurons/nerve cells are **damaged,** making it difficult for impulses to be transmitted**, impulses slower**

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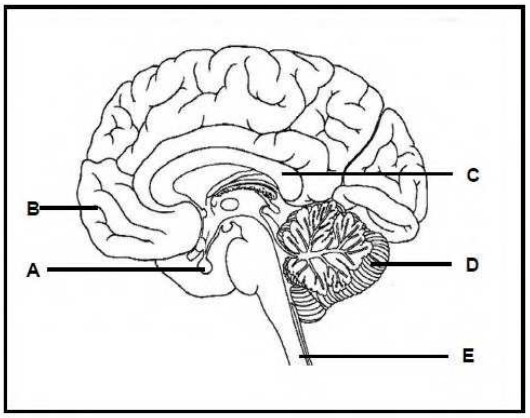
1.1 The diagram below represents a human brain.



Give the **LETTER and NAME** of the part of the brain responsible for:

1.1.1 Memorising a cell phone number (2)

1.1.2 Coordinating all voluntary movements (2)

1.1.3 Secretion of hormones (2)

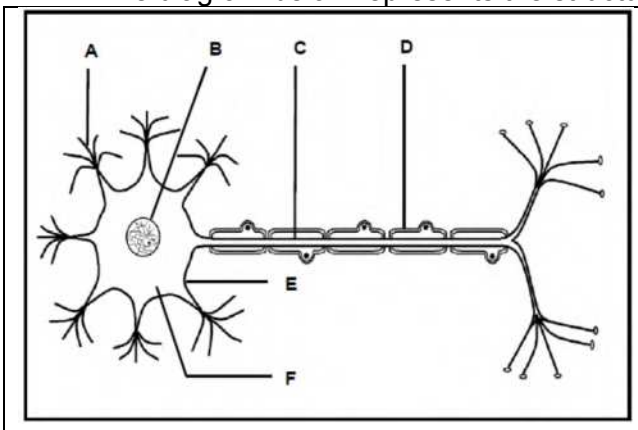
1.1.4 Connection of two hemispheres of part **B** (2)

1.1.5 The reflex action that occurs when stepping barefooted on a sharp object. (2)

Answer:

1.1.1 **B – Cerebrum**
1.1.2 **D – Cerebellum**
1.1.3 **A - Pituitary gland/ Hypophysis**
1.1.4 **C - Corpus callosum**
1.1.5 **E – Spinal cord**

1.1 The diagram below represents the structure of a neuron.



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

1.2.2 **Identify** part:
(a) B
(b) F
(c) A (3)

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

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

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

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

Answer:

1.2.1 **Motor neuron** (1)
1.2.2 (a) **B Nucleus /nuclear membrane** (1)
(b) **F Cytoplasm** (1)
(c) **A Dendrite** (1)
1.2.3 (a) **C- Axon** (2)
(b) **D- Myelin sheath** (2)
1.2.4 **Multiple sclerosis** (1)

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1.3 Study the diagram of a reflex arc below.

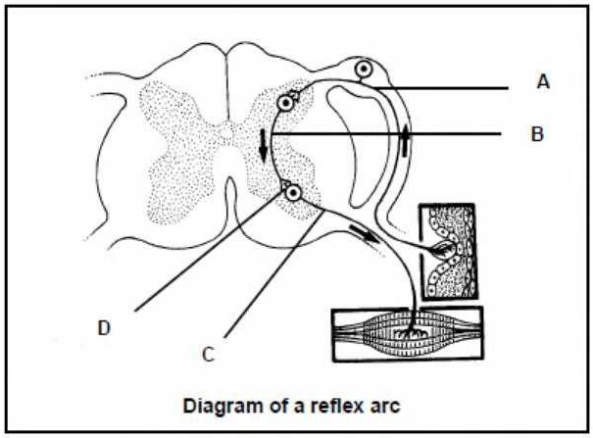
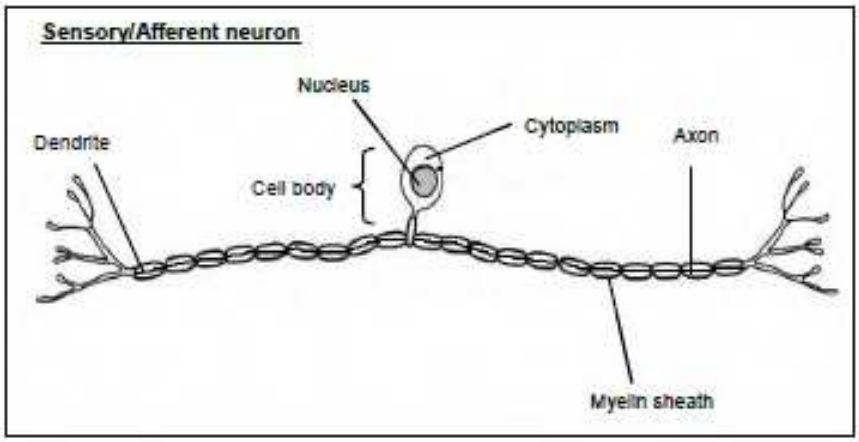


Diagram of a reflex arc

1.3.1 What is a reflex action? (2)
1.3.2 Label the following:
(a) the functional connection at **D** (1)
(b) neuron **B** (1)
1.3.3 State the significance of the functional connection at **D.** (1)
1.3.4 Write down, in the **correct order**, the **LETTERS ONLY** of the neurons involved from the time a stimulus is received until a response takes place. (2)
1.3.5 Explain the consequences for a reflex action if neuron **C** is damaged. (2)
1.3.6 Draw a labelled diagram to represent the structure of neuron **A** (5)

Answer:

1.3.1 A reflex action is a quick, automatic response to a stimulus (2)
1.3.2 (a) **Synapse** (1)
(b) **Interneuron** (1)
1.3.3 **It ensures that the impulse moves in one direction only**
It ensures that the impulse is transmitted from the sensory neuron to the motor neuron (1)
1.3.4 **A → B → C** (2)
1.3.5 **The person will be able to receive a stimulus but will not be able to respond to it** (2)
1.3.6



Heading: 1 mark
Correct type of neuron drawn: 1 mark
Any 3 correct labels: 3 marks (5)

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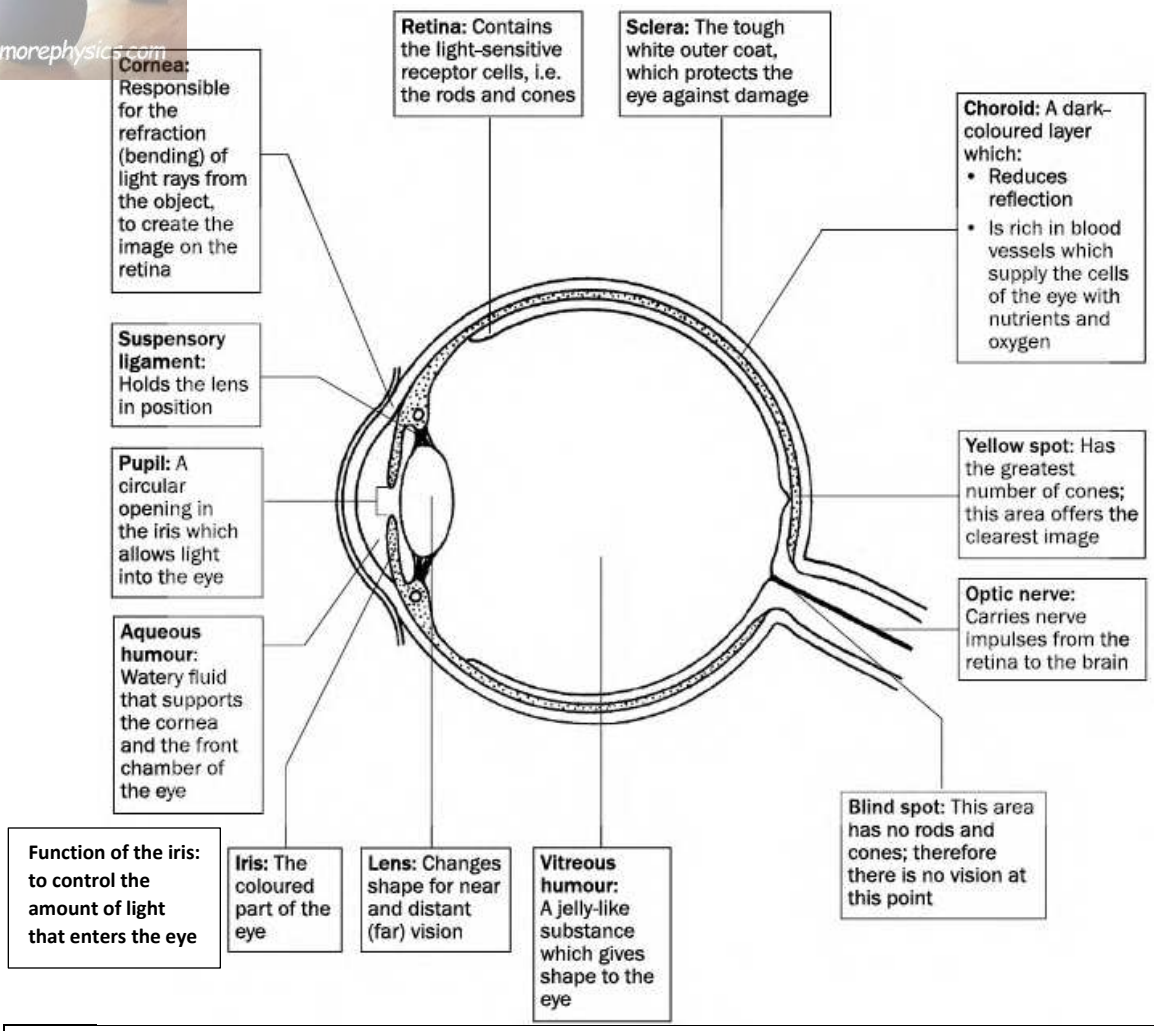
Human EYE:

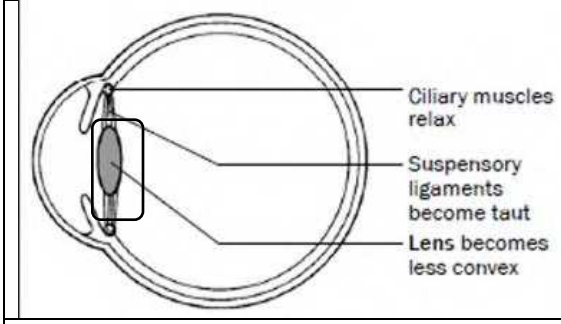
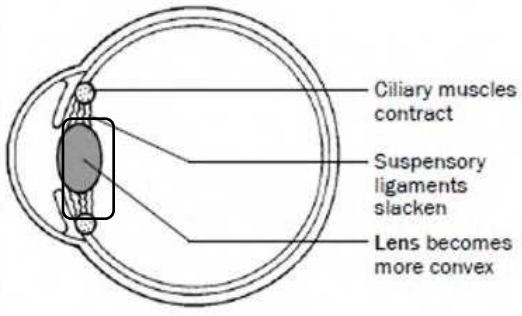
Know the **structure and functions** of the human eye, using a diagram



Know the difference between EYE ACCOMODATION and PUPILLARY MECHANISM

Eye Accomodation: is the adjustment/change of the **SHAPE OF THE LENS** to see clearly, whether objects are far away or close by.

Compare the **SHAPE OF THE LENS in these two diagrams below:*

DISTANT VISION (objects further than 6m)	NEAR VISION (objects closer than 6 m)
	
Shape of the lens is **flatter**	Shape of the lens is **rounder**

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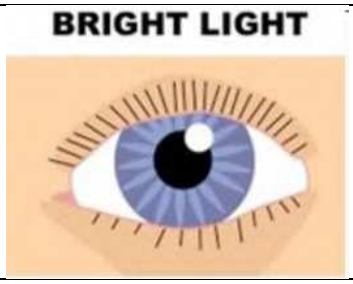
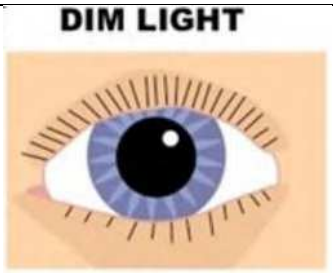
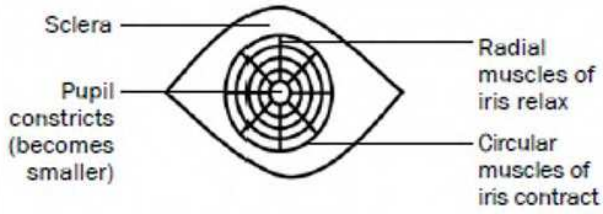
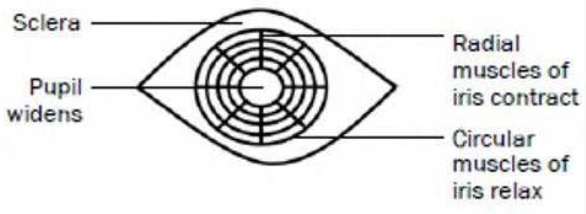
Be able to *describe* eye accomodation for *distant vision* and *near vision*:

Distant vision	Near vision
1. Ciliary muscles relax	1. Ciliary muscles contract
2. Suspensory ligaments tighten(become stiff/taut)	2. Suspensory ligaments slacken
3.Tension on the lens increases	3. Tension on the lens decreases
4. Lens becomes **flatter** (less convex)	4. Lens becomes **more rounded** (more convex)
5. Light rays are bent less	5. Light rays are bent more
6. Light rays are focuses onto the retina	6. Light rays are focused onto the retina

PUPILLARY MECHANISM: is dependant on the **AMOUNT OF LIGHT** that is available.

BRIGHT LIGHT	DIM LIGHT
	
Pupil becomes SMALLER (constricts)	**Pupil** becomes **BIGGER (widens)**

Light is bright	Light is dim
1. Radial muscles of the iris relax	1. Radial muscles of the iris contract
2. Circular muscles of the iris contract	2. Circular muscles of the iris relax
3. Pupil constricts (gets smaller)	3. Pupil widens (gets bigger)
4. Less light enters the eye	4. More light enters the eye
 *Figure 6.10 The pupil in bright light*	 *Figure 6.11 The pupil in dim light*

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Visual defects:

Short sightedness

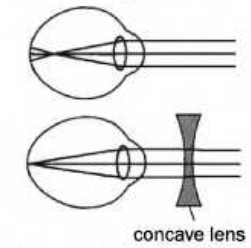


Figure 6.12 A

Long sightedness

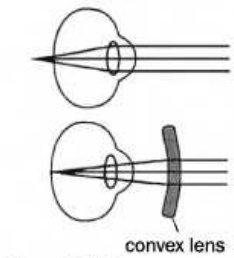
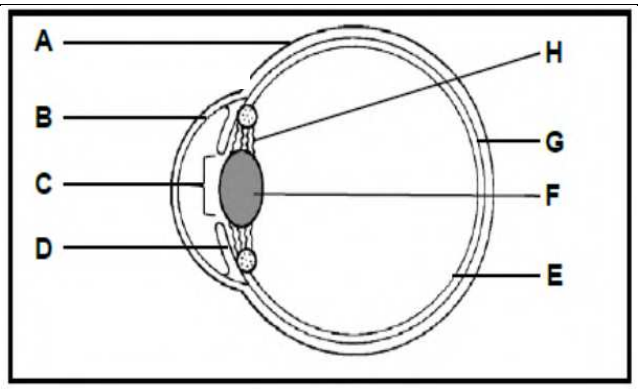


Figure 6.12 B

Visual defect	Nature of the defect	Corrective measures
Short-sightedness Near objects can be seen clearly (myopia)	• Inability of lens to become more flat/eyeball is longer than normal • Lens bends the light rays too much • As a result it falls in front of the retina • causing the image to be blurred • Cannot see distant objects clearly	Wearing glasses with converging (biconcave) lens Figure 6.12 A
Long-sightedness Objects far away can be seen clearly (hyperopia)	• Inability of lens to become more convex/eyeball is shorter than normal • Lens does not bend light rays enough • As a result it falls behind the retina • causing the image to be blurred • Cannot see near objects clearly	Wearing glasses with converging (biconvex) lens Figure 6.12 B
Astigmatism	• The curvature of the lens or cornea is uneven resulting in distorted images	Glasses with lenses shaped to correct the distortion
Cataracts	• Lens becomes cloudy and opaque	Surgery to replace the lens with a synthetic lens

Questions: The eye

1.1 The diagram below represents a section through a human eye.



1.1.1 **Identify**
(a) **A** (1)
(b) **B** (1)
(c) **C** (1)

1.1.2 Give the **LETTER and NAME** of the part that:
(a) Regulates the amount of light entering the eye (2)
(b) Contains a dark pigment that absorbs excess light in the eye (2)
(c) Contains receptors sensitive to light (2)
(d) Assists in the refraction of light rays (2)
(e) Changes shape for near and distant (far) vision (2)

Answer:

1.1.1 (a) **A**: **Sclera** (1)
(b) **B**: **Cornea** (1)
(c) **C: Pupil** (1)

1.1.2 (a) **D – iris**
(b) **G – choroid**

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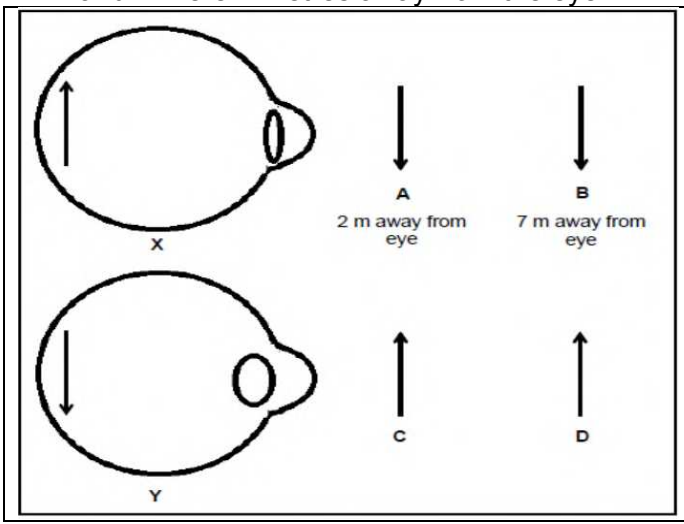
(c) **E – retina**
(d) **B – cornea**
(e) **F – lens** (10)

1.2 The diagram shows two eyes (X and Y) focused on objects (represented by arrows) at different distances from the eye. Objects A and C were 2 metres away from the eye. Objects B and D were 7 metres away from the eye.



1.2.1 Write down the **LETTER ONLY** of the object that:
(a) Eye **X** is focused on (1)
(b) Eye **Y** is focused on (1)

1.2.2 **Name** and **describe** the process that allows eye Y to form a clear image on the retina. (6)

1.2.3 **Describe** the process that allows to form a clear image on the retina when a Cape cobra is 9 meters from a person. (5)

Answer:

1.2.1 (**a) B**
(b) C

1.2.2 **Accommodation (* compulsory mark)**
Ciliary muscles contract
Suspensory ligaments slacken
Tension on lens decreases
Lens becomes more convex (more rounded)
Light rays are refracted (bent) more
Light rays are focused onto the retina **(6)**

1.2.3 **Ciliary muscles relax**
Suspensory ligaments tighten (become taut)
Tension on lens increases
Lens becomes less convex flatter
Light rays are refracted (bent) less
Light rays are focused onto the retina **(5)**

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1.3 The table below indicates the changes in diameter of the pupil of the human eye

Changes in pupil diameter over time:

Time in (s)	Diameter of pupil in (mm)
5	6 mm
10	6 mm
15	6 mm
20	6 mm
25	4 mm
30	2 mm
35	3 mm
40	3,5 mm
45	4 mm
50	4 mm
55	4 mm
60	4 mm

1.3.1 Which structure in the human eye is responsible for the changes indicated in the graph? (1)

1.3.2 During which period of time was the person moving from **dim light** to **bright light**? (1)

1.3.3 Describe the changes that took place in the eye that led to the diameter change indicated from 30 to 35 seconds. (3)

1.3.4 Draw a labelled diagram of the front view of the eye to illustrate pupillary mechanism when the light intensity is very high. (4)

(9)

Answer:

1.3.1 iris

1.3.2 (20 – 30) s

1.3.3 Radial muscles contract
Circular muscles relax
Pupil increases in diameter /dilates

1.3.4

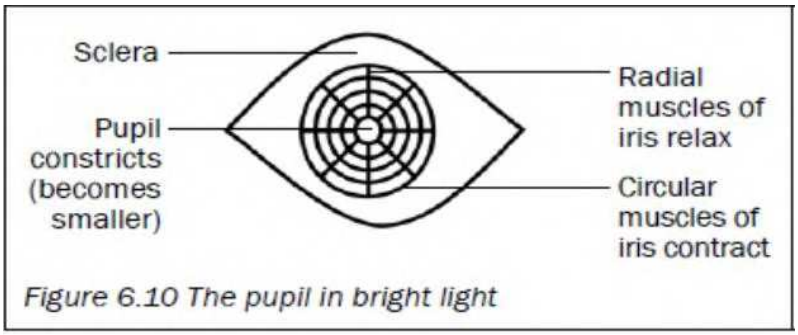

Figure 6.10 The pupil in bright light

Heading 1 mark
*Pupil constricted 1 mark
Any 2 correct labels

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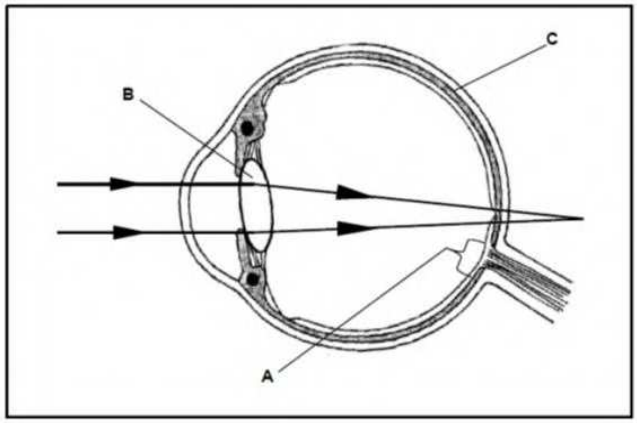
1.4 The diagram below illustrates how light refracted in the human eye leads to a visual defect.



1.4.1 **Identify** part:
(a) B
(b) C (2)

1.4.2 **Name** the visual defect that is illustrated in the diagram. (1)

1.4.3 **Describe** the consequences of the visual defect in your answer to QUESTION 1.4.2. (2)

1.4.4 **Explain** the consequences if the light rays were to fall on part **A**. (3)

1.4.5 Explain TWO ways in which the lens is structurally suited to perform its function. (4)

Answer:

1.4.1 (a) **B: Lens** (1)

(b) **C: Choroid** (1)

1.4.2 **Long-sightedness** (1)

1.4.3 **Cannot see nearby objects clearly**
causing the image to be blurred (2)

1.4.4 **No image will be formed /cannot see the object**
No receptors present
Light will not be converted into an impulse (3)

1.4.5 **Lens is <u>elastic</u>**
therefore can change shape /convexity/allow for accommodation

Lens is <u>transparent</u>
to allow light rays to pass through

Lens is <u>biconcave</u>
to refract/bend light rays **(any 2 x 2)** (4)

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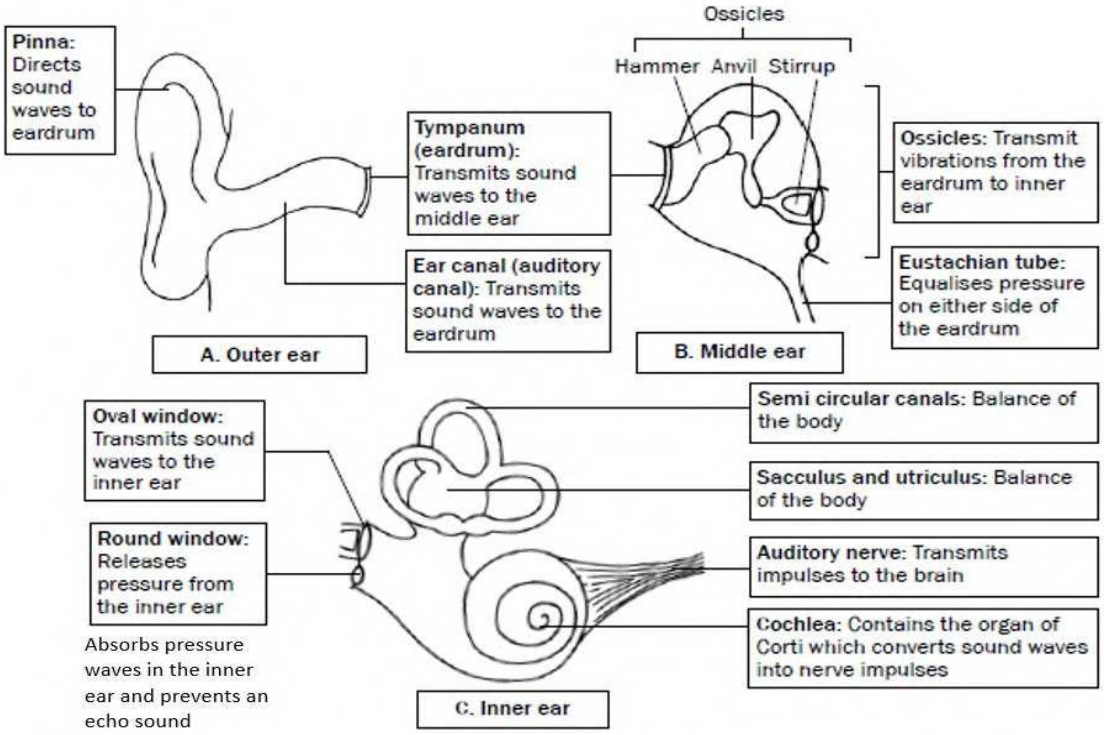
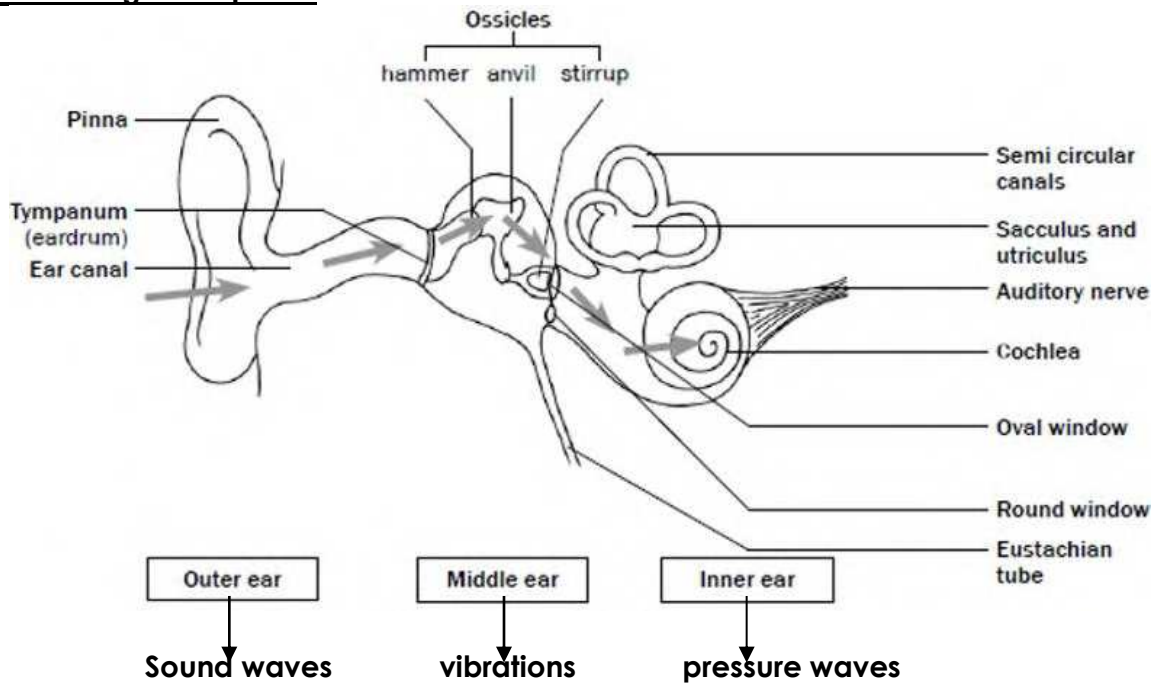
The HUMAN EAR

The EAR houses receptors that are sensitive for **hearing**, but also plays an important role in the maintenance of **balance** in our bodies

Know the parts and functions of the EAR



How hearing takes place:



Describe the pathway of sound waves until you hear:

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HEARING:

Sound waves are caught by the pinna
And **directed into** the external **auditory canal**
Sound waves hit against the **tympanum**(eardrum) and it starts to **vibrate**
Vibrations are carried by the **3 bony ossicles** to the **oval window**
Oval window also **vibrates**
The **vibrations of the oval window** cause the **fluid in the inner to move**, causing **pressure waves**
Pressure waves (movement of the fluid) in the inner ear **stimulates** the **receptors** *(hair cells in the Organ of Corti)* in the cochlea
Receptors become **aware** of the **stimulus** and **convert it into an impulse**
The impulse is transmitted by the **auditory nerve** to the **CEREBRUM,** where **hearing** is interpreted.

BALANCE:

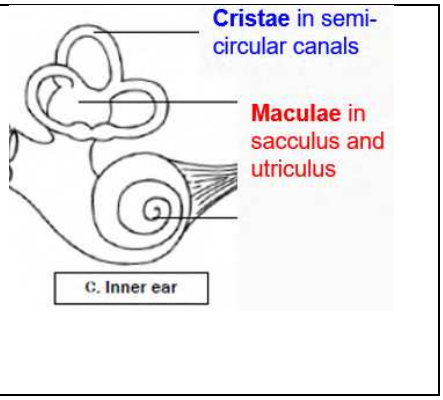
The human ear is responsible for balance in this way:

1. The cristae in the semicircular canals are stimulated by changes in the direction and speed of movement
2. The maculae in the sacculus and utriculus are stimulated by changes in the position of the head

When stimulated, the cristae and maculae convert the stimuli received into nerve impulses.

The nerve impulses are transported along the auditory nerve to the cerebellum to be interpreted.

The cerebellum then sends impulses to the muscles to restore balance.



Describe the functioning of the human ear in BALANCE:

A change in the **direction and speed** of the head	A change in the **position of the head**
which stimulates the **cristae** in the **semi-circular canals**	stimulated the **maculae** in the **utriculus and sacculus**
The stimuli were converted into impulses	The stimuli were converted into impulses
which were transported along the auditory nerve	which were transported along the auditory nerve
and interpreted in the cerebellum	and interpreted in the cerebellum
which then sent impulses to the muscles to restore the balance	which then sent impulses to the muscles to restore the balance

Hearing defect	Causes	Treatment
Middle ear infection	• Excess fluid in the middle ear caused by pathogen infection	• Inserting grommets • Antibiotics
Deafness	• Injury to parts of the ear, nerves or parts of brain responsible for hearing • Hardened wax • Hardening of ear tissues such as ossicles	• Hearing aids • Cochlear implants

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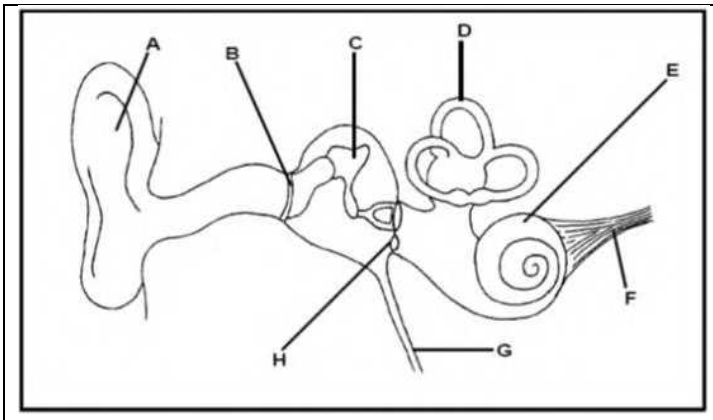
Questions: HUMAN EAR

1.1 The diagram below represents the human ear.



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

(a) Transmits impulses to the brain (2)

(b) Allows pressure to equalise between the outer ear and the middle ear (2)

(c) A pressure wave in a liquid (2)

(d) Releases pressure from the inner ear (2)

1.1.2 Give only the **LETTER of TWO structures** in the diagram of the ear that, when damaged, would result in the following:

(a) when sound vibrations cannot be conducted through the outer and middle ear (2)

(b) sound waves in the inner ear are not converted into nerve impulses (2)

1.1.3 Middle ear infection loorontsteking is a common cause for loss of hearing. **Name** ONE way which middle ear infection can be treated (1)

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Answer:

1.1.1

(a) F – auditory nerve

(b) G – eustachian tube

(c) E - cochlea

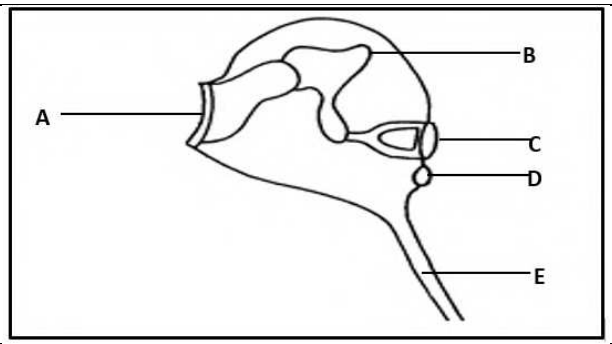
(d) H – round window

1.1.2 (a) B ; C

(b) E ; F

1.1.3 grommets or antibiotics

1.2 The diagram below represents the middle ear of humans.



1.2.1 **Identify** part:

(a) A (1)

(b) B (1)

(c) C (1)

1.2.2 **Explain** the result if part **E** is blocked. (4)

1.2.3 **Describe** how the parts of the middle ear, including the membranes, assist with amplifying sounds. (3)

1.2.4 Explain why fusion of the ossicles may lead to hearing loss. (2)

Answer:

1.2.1 (a) **A Tympanic membrane**

(b) B Incus /Anvil

(c) C Oval window

(d) **D Round window**

1.2.2 **Air will not be taken in /released**

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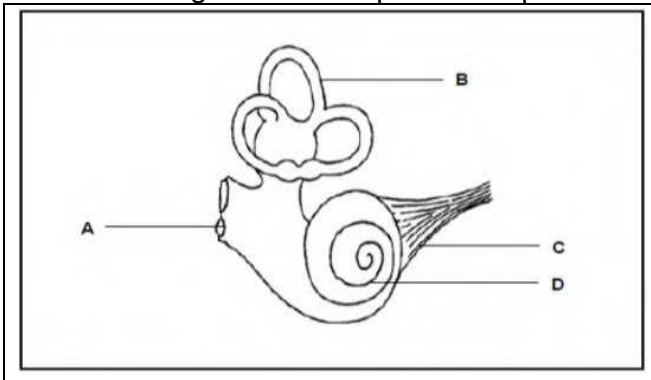
to equalise pressure
on both sides of the tympanic membrane
Tympanic membrane/ ossicles may not vibrate freely
This may lead to the tympanic membrane bursting and
therefore could lead to hearing loss /deafness/ pain (4)

1.2.3 **The sound vibrations are transmitted from the large tympanic membrane**
to the smaller oval window
through the ossicles
which are arranged from largest to smallest
This concentrates the vibrations, amplifying them (3)

1.2.4 The ossicles will not be able to vibrate
and hence no vibrations will be passed to the inner ear /cochlea will not be stimulated/no amplification (2)

1.3 The diagram below represents a part of a human ear.



1.3.1 **Identify** part:
(a) C
(b) D (2)

1.3.2 **Name** the receptors that are found in part **B.** (1)

1.3.3 **Describe** how part **B**, the semi-circular canals, plays a role in maintaining maintaining balance when the body changes speed and direction. (6)

1.3.4 Describe how balance and equilibrium is maintained by the ear when a person changes his/her position of the head. (6)

1.3.5 A goalkeeper in a soccer match prevented a goal from being scored when he dived to his right after the ball was kicked towards him.
Describe how he **maintained his balance** as he dived to save the ball. (6)

Answer:

1.3.1 **(a) C: Auditory nerve**
(b) D: Cochlea (1)

1.3.2 **Cristae** (1)

1.3.3 **A change in <u>speed/direction of movement</u>**
stimulates the cristae
The stimulus is converted to an impulse
The impulse is transmitted to the cerebellum
via the auditory nerve
The cerebellum sends impulses to the muscles to restore balance (6)

1.3.4 A change in the <u>position of the head</u>
stimulates the maculae
The stimulus is converted to an impulse
The impulse is transmitted to the cerebellum
via the auditory nerve
The cerebellum sends impulses to the muscles to restore balance (6)

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1.3.5 A change in the direction and speed of the body causes the movement of fluid in the semicircular canals which stimulates the cristae

A change in the position of the head stimulated the maculae
The stimuli were converted into impulses which were transported along the auditory nerve and interpreted in the cerebellum which then sent impulses to the muscles to restore balance and equilibrium

1.4 Describe how the different parts of the ear and brain **allow for hearing** to occur. **(7)**

The sound waves were directed by the pinna through the auditory canal to the tympanic membrane /eardrum causing it to vibrate
The vibrations of the tympanic membrane were transferred to the ossicles in the middle ear which eventually caused the oval window to vibrate
This set up pressure waves in the cochlea
This stimulated the Organ of Corti in the cochlea to convert this stimulus into a nerve impulse which was then transmitted along the auditory nerve and interpreted in the cerebrum

ENDOCRINE SYSTEM AND HOMEOSTASIS – PAPER 1, 34 marks

Know the difference between an **endocrine gland** and an **exocrine gland**	
Endocrine glands: ductless glands that **release their secretions (hormones) directly into the bloodstream.** *eg. Ovaries, adrenal glands, pancreas , hypophysis*	**Exocrine glands** – glands that release their **secretions through ducts to a body cavity or to the outside** eg. *salivary glands* that secrete saliva through ducts that open in the mouth cavity

Hormones are ***chemical messengers.***
Hormones can **stimulate** (increase the secretion of hormones, allow a reaction to occur) or **inhibit (slow down the secretion or stop the secretion**) for a reaction

Location of the following glands, the hormones they secrete:

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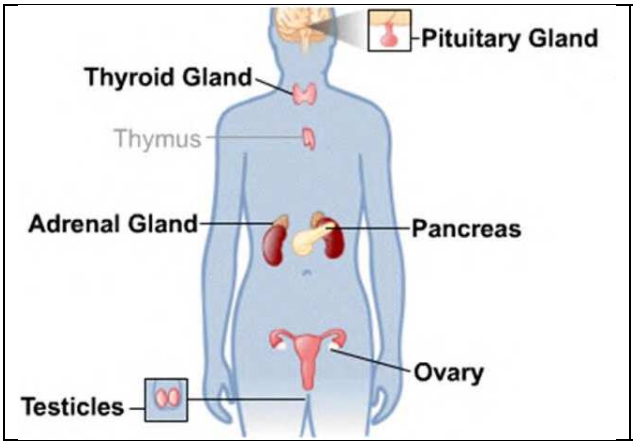	**Hypothalamus** – ADH (controls water concentration in blood) **Pituitary gland/hypophysis** – Growth hormone, TSH, FSH, LH and prolactin **Thyroid gland** – thyroxin **Pancreas** – insulin and glucagon **Adrenal gland** – adrenalin, aldosterone **Ovary** – oestrogen, progesterone **Testes** - testosterone

Homeostasis: the process of **maintaining a constant, internal environment**

Negative feedback mechanism: operate in the human body to **detect changes or imbalances** in the internal environment and **to restore the balance**

You should know and describe the **negative feedback mechanism involving:**

Thyroxin levels
Blood glucose levels (pancreas secreting insulin and glucagon)
Blood carbon dioxide levels
Water balance (osmoregulation)
Salt levels

Thyroxin and TSH – negative feedback

Imbalance could be:

Thyroxin levels are TOO HIGH:	***Thyroxin levels are TOO LOW:***
-Pituitary gland/hypophysis is stimulated -To **secrete LESS TSH** -Low TSH levels **stimulates the thyroid gland** -To secrete **LESS thyroxin** -**Thyroxin levels DECREASE** -Back to normal	*-**Pituitary gland/hypophysis** is stimulated* *-To **secrete MORE TSH*** *-High TSH levels **stimulates the thyroid gland*** *-To **secrete MORE thyroxin*** *-**Thyroxin levels INCREASE*** *-Back to normal*

Blood glucose levels

Glucose levels in the blood are TOO HIGH:	**Glucose levels in the blood are TOO LOW:**
Pancreas is stimulated To **secrete INSULIN** into the blood Insulin **stimulates the conversion of excess glucose to glycogen** which is stored **Glucose level** in the blood **decreases** Back to normal	***Pancreas** is stimulated* *To **secrete GLUCAGON** into the blood* *Glucagon **stimulates the conversion of glycogen** back to glucose* ***Glucose level** in the blood **INCREASES*** *Back to normal*

Have a careful look at these three terms: It is important that you do not confuse these terms with one another, and you have to spell them correctly or you will lose marks.

Glucose	Simplest sugar in the blood
Glycogen	Glucose is converted to glycogen and is stored in this form
Glucagon	The hormone that is secreted by the pancrea is blood sugar levels are too low

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The regulation of carbon dioxide levels in the internal environment

You only need to know how our body reacts when CO_2 levels are **too high:**

When the CO_2 level in the blood increases above normal levels:	
Step 1	CO_2 levels in the blood increase above normal levels
Step 2	Receptor cells in the carotid artery in the neck are stimulated
Step 3	To send impulses to the medulla oblongata in the brain
Step 4	Medulla oblongata stimulates breathing muscles (intercostal muscles and diaphragm) and heart
Step 5	Breathing muscles contract more actively – increases the rate and depth of breathing. The heart beats faster.
Step 6	More CO_2 is taken to and exhaled from the lungs
Step 7	The CO_2 level in the blood returns to normal

Regulation of water balance (osmoregulation):

When blood has <u>LESS water than normal</u>: **Hypothalamus is stimulated** **Send impulses to the pituitary gland** **To secrete MORE ADH** **ADH increases the permeability of the renal tubules** **MORE water is re-absorbed back into the blood** **Water level in blood returns to normal**	**When blood has <u>MORE water than normal</u>:** ***Hypothalamus is stimulated*** ***Send impulses to the pituitary gland*** ***To secrete LESS ADH*** ***ADH decreases the permeability of the renal tubules*** ***LESS water is re-absorbed back into the blood*** ***Water level in blood returns to normal***

The regulation of salt balance:

Salt levels <u>in the blood</u> <u>TOO HIGH:</u> **Adrenal gland is stimulated** **To stop secreting aldosterone/less aldosterone** **LESS salt is reabsorbed into the blood** **Salt level decreases** **Back to normal**	**Salt levels <u>in the blood TOO LOW</u>:** **Adrenal gland is stimulated** **To secrete MORE aldosterone** **MORE salt is reabsorbed into the blood** **Salt level increases** **Back to normal**

Disorders caused by imbalance in the levels of:

Imbalance of:	**Name of disorder**
Thyroxin	Goitre (low levels of iodine)
Blood glucose	Diabetes mellitus

Thermoregulation

The role of: sweating
vasodilation
vasoconstriction

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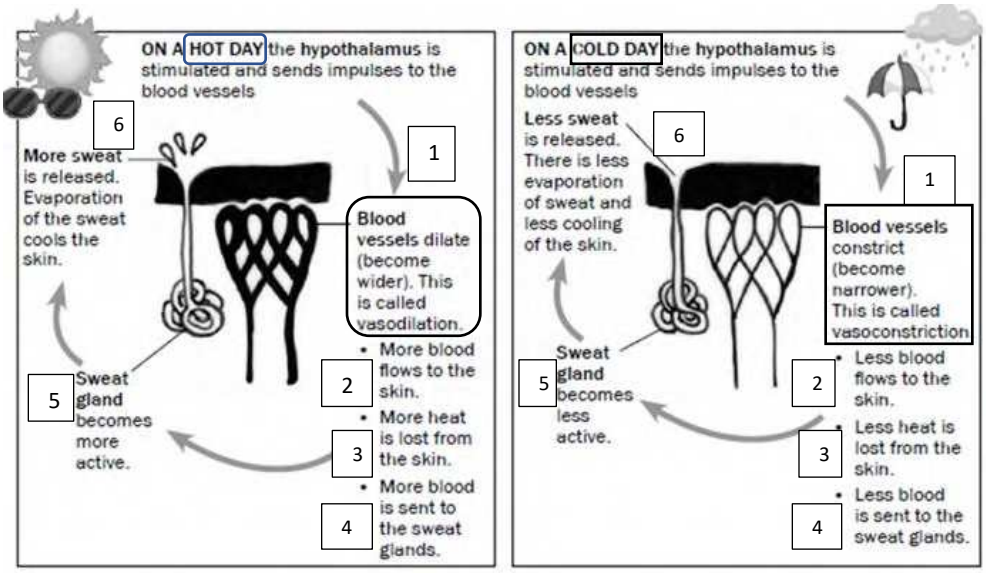
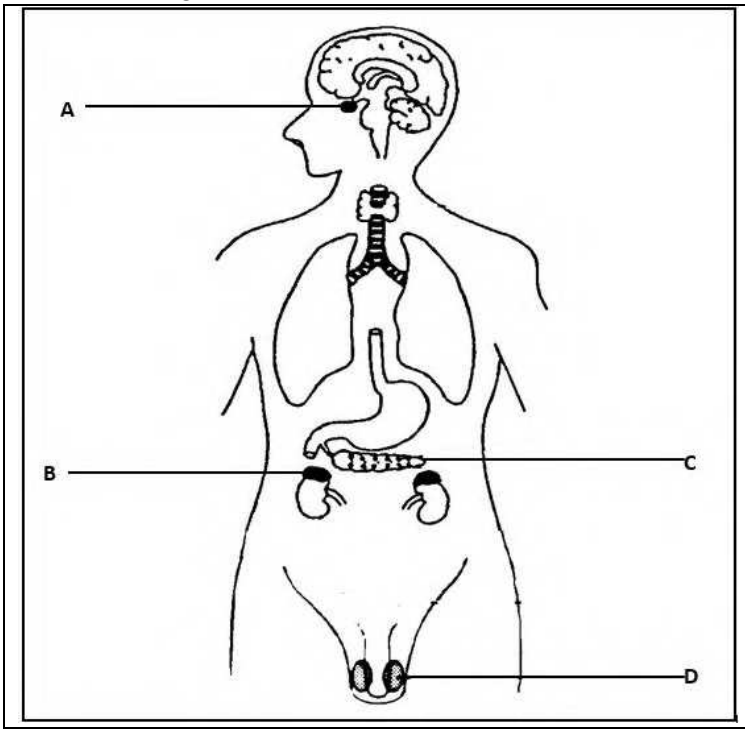


QUESTIONS: ENDOCRINE SYSTEM AND HOMEOSTASIS

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



1.1.1 Identify gland:
(a) **A**
(b) **B**
(c) **C** (3)

1.1.2 Give the LETTER and the NAME of the gland that secretes a hormoneresponsible for:
(a) Starting puberty in males
(b) Stimulating absorption of glucose by cells
(c) Making the kidney tubules permeable to water (6)

Answer:

1.1.1 (a) Hypophysis / Pituitary gland
(b) **Adrenal gland**
(c) **Pancreas**

1.1.2 (a) **D - Testis**
(b) **C - Pancreas**
(c) **A – Hypophysis / Pituitary gland** **(9)**

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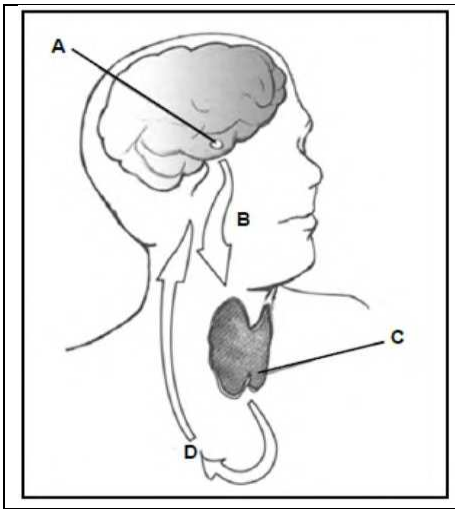
1.2 The diagram below represents the interaction between two important endocrine glands. The gland labelled **A** is found at the base of the brain, while the gland labelled **C** is present towards the front of the neck.



1.2.1 Give a **label** for gland **A** (1)
1.2.2 **Name** hormone **B**. (1)
1.2.3 **State** TWO functions of hormone **D.** (2)
1.2.4 **Describe** the negative feedback mechanism that operates when the level of hormone **D is higher than normal** in the blood. (5)
1.2.5 Describe the negative feedback mechanism that operates when the level of hormone **D** is **lower than normal** in the blood. (5)

Answer:

1.2.1 **A. Hypophysis / Pituitary gland** (1)
1.2.2 **B. TSH**
(1)
1.2.3 **Controls metabolism**
Influences heart rate (2)

1.2.4 **High levels of thyroxin are detected by the hypophysis**
which leads to a decrease
in the secretion of TSH
Activity of thyroid is slowed down /less thyroxin produced
Thyroxin level drops to normal (5)

1.2.5 **Low levels of thyroxin are detected by the hypophysis**
which leads to an increase
in the secretion of TSH
more thyroxin produced
Thyroxin level rises to normal (5)

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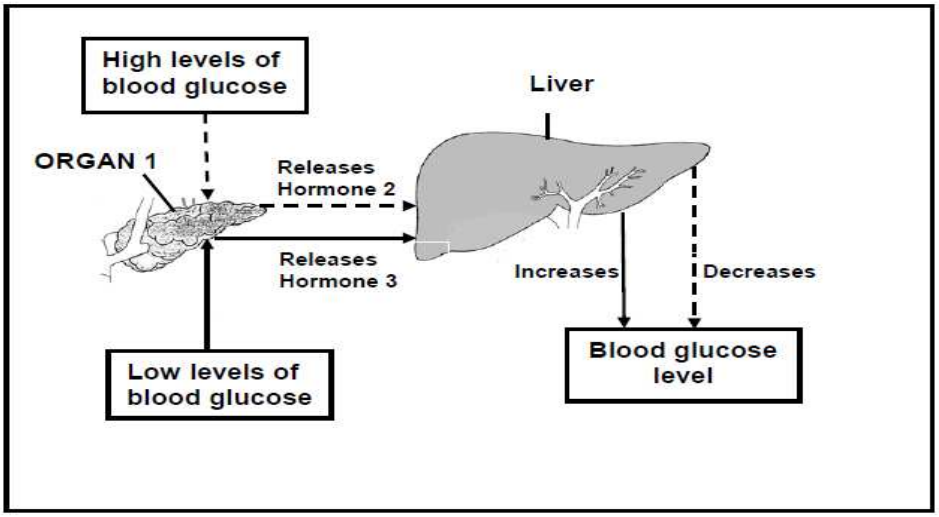
1.3 Study the flow diagram below.



Identify:

1.3.1 Organ **1:** (1)
1.3.2 Hormone **2:** (1)
1.3.3 Hormone **3:** (1)
1.3.4 The disorder caused when organ **1** fails to release sufficient amounts of hormone **2** (1)
1.3.5 Describe how the blood glucose level in the human body is returned to normal when the glucose level **decreases to below normal.** (4)
1.3.6 Describe how the blood glucose level in the human body is returned to normal when the glucose level **increases to above normal.** (4)

Answer

1.3.1 Organ **1: Pancreas** (1)
1.3.2 Hormone **2: Insulin** (1)
1.3.3 Hormone **3: Glucagon** (1)

1.3.4 **Diabetes mellitus** (1)
1.3.5 **The pancreas /Islets of Langerhans is stimulated**
to secrete glucagon into the blood
which stimulates the liver / muscles
to convert glycogen into glucose
The glucose level in the blood now increases and returns to normal (4)
1.3.6 The pancreas /Islets of Langerhans is stimulated
to secrete insulin into the blood
which stimulates the liver / muscles
to convert glycose into glycogen
The glucose level in the blood now decreases and returns to normal (4)

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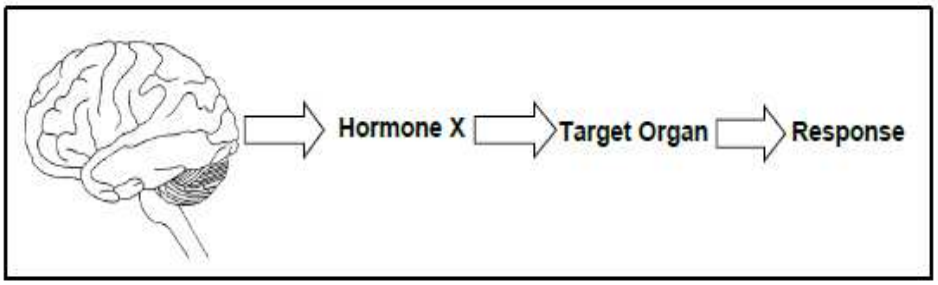
1.4 The diagram below represents one part of the negative feedback response that occurs when **a person is dehydrated.** The decrease in blood volume, as a result of **the excessive loss of water**, is detected by the brain.



1.4.1	Identify the	
	(a) Hormone **X**	(1)
	(a) Endocrine gland that secretes hormone **X**	(1)
	(c) Target organ	(1)
1.4.2	Describe the negative feedback response that occurs when a person is **dehydrated,** after it has been detected by the brain.	(4)
1.4.3	Describe what happens when the **blood has more water than normal**	(4)

Answer:

1.4.1 (a) **ADH**
(b) **Hypothalamus / Pituitary gland / Hypophysis**
(c) **Kidney**

1.4.2 **An increase in ADH causes the walls of the kidney tubule to become more permeable to water**
More water is reabsorbed and the blood volume increases
Less urine is produced and the urine is more concentrated

1.4.3 **A decrease in ADH causes the walls of the kidney tubule to become less permeable to water**
Less water is reabsorbed and the blood volume decreases
More urine is produced and the urine is less concentrated **(11)**

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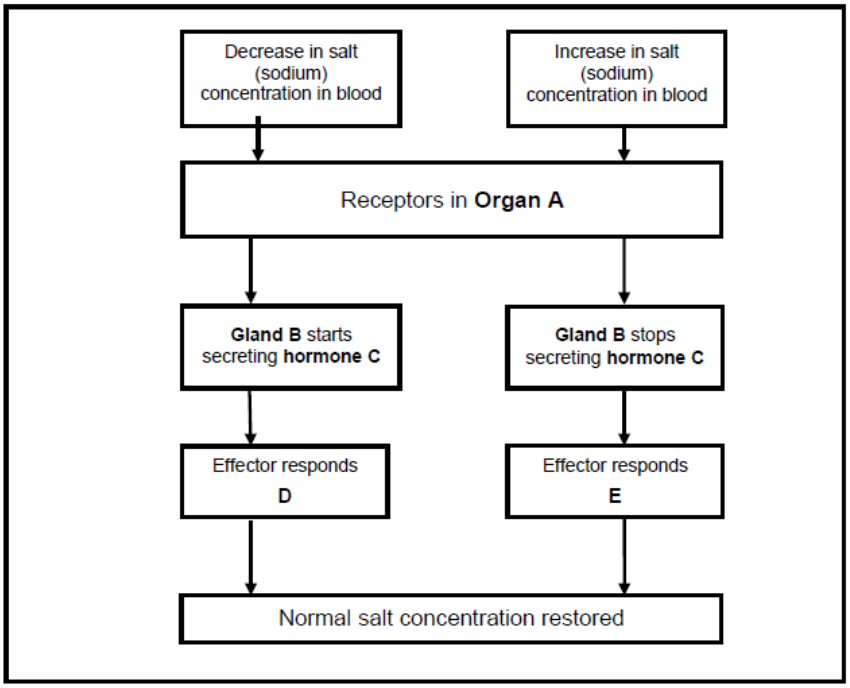
1.5 Study the flow diagram below of a **homeostatic mechanism** used to regulate the **concentration of salts** in the human body.



1.5.1 Define homeostasis. (2)

1.5.2 Give the name of the following:

(a) Organ **A** (1)

(b) Gland **B** (1)

(c) Hormone **C** (1)

1.5.3 Describe the response by the effector at **D.** (2)

Answer:

1.5.1 The process by which the human body maintains a constant internal environment

1.5.2 (a) **Kidney**

(b) **Adrenal gland**

(c) **Aldosterone**

1.5.3 **Walls of renal tubules**
become more permeable
allowing for a greater re-absorption of sodium ions
from the filtrate /into the blood capillaries **(7)**

1.6 Describe how the human body restores the carbon dioxide concentration the blood when it rises above normal levels. (6)

Receptor cells
in the carotid artery/aorta are stimulated
to send impulses to the medulla oblongata in the brain
which then stimulates the heart
to beat faster
and the breathing muscles /example
to contract more actively
This increases the rate/ depth of breathing
More CO2 is taken to and exhaled from the lungs returning the CO2 level in the blood to normal.

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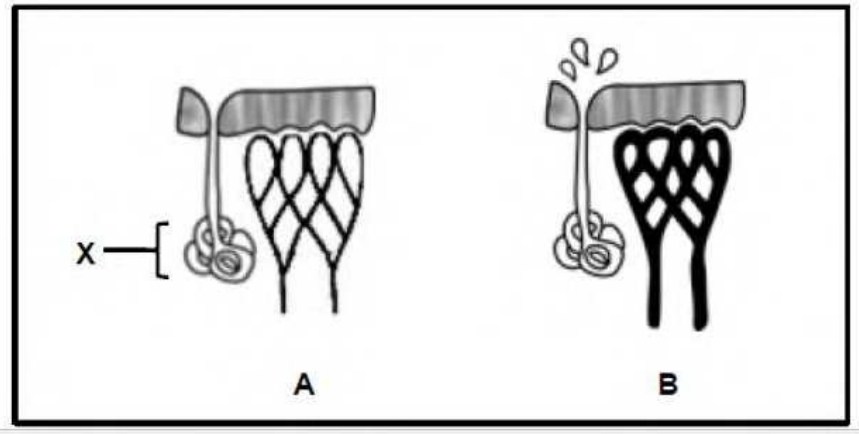
1.7 The diagram below represents the skin of a person under different environmental conditions.



1.7.1 **Identify** part X. (1)
1.7.2 Give the **LETTER** of the diagram which represents the skin on a **hot day**. (1)
1.7.3 Name **TWO visible reasons** for your answer QUESTION 1.7.2. (2)
1.7.4 Name the part of the brain that regulates temperature. (1)
1.7.5 Name ONE hormone which will have the same effect as seen in diagram A.

Answer:
1.7.1 **sweat glands**
1.7.2 **B**
1.7.3 **vasodilation (widening) of blood vessels**
Sweat glands are active
1.7.4 **hypothalamus**
1.7.5 **adrenaline**

Responding to the environment: Plants – Paper 1, 13 marks

GENERAL FUNCTIONS OF PLANT HORMONES

PLANT HORMONE	FUNCTIONS
AUXINS	Promotes growth - stimulates cell division and cell elongation Play a role in tropic movements
GIBBERELLINS	Responsible for the germination of seeds Stimulate the growth of side branches
ABSCISIC ACID	**Inhibits** cell division and growth in stems and roots **Inhibits** the germination of seeds (rest period in cold winter months) Promotes the abscission of leaves and fruit (leaves and fruits drop-off the tree)

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The role of AUXINS in phototropism and geotropism:

Role of auxins in phototropism	Role of auxins in geotropism
Produced at the tip of stem/shoot	Produced at the tip of roots
Auxins move downward evenly	Auxins move upwards evenly
This even distribution brings about equal growth on all sides of the stem	This even distribution brings about equal growth on all sides of the root
As a result the stem grows upward	As a result the root grows downward
When the stem is exposed to **unilateral light** (light from one side only)	When the root is placed **horizontally** (only one side exposed to gravity)
The auxin concentration will be high on the dark side – light destroys auxins	The auxin concentration will be high on the lower side of the root - gravity attracts auxins
More growth occurs on the dark side because auxins stimulate growth on the dark side	More growth occurs on the upper side of the root because auxins on the lower side inhibit growth
As a result the stem bends towards the light	As a result the root bends downwards

Phototropism: Growth of a plant stem towards light	**Geotropism:** Growth of a plant root downwards into the soil in response to gravity

Plants are eaten by herbivores and attacked by pathogenic organisms such as viruses, bacteria and fungi, causing them to become diseased. Plants protect themselves from these threats using chemicals and thorns.

Question:

1.1 A Grade 12 learner performed an investigation **to determine the effect of light on the growth of plant shoots.** The learner divided the plants that were used into three groups as follows:

Group **A** – The tip of the shoot was intact.
Group **B** – The tip of the shoot was removed.
Group **C** – The tip of the shoot was covered by a cap that does not allow light to pass through.

The diagram below shows each shoot at the start of the investigation and next to each, the same shoot at the end of the investigation.

The arrows indicate the direction of light in each investigation.

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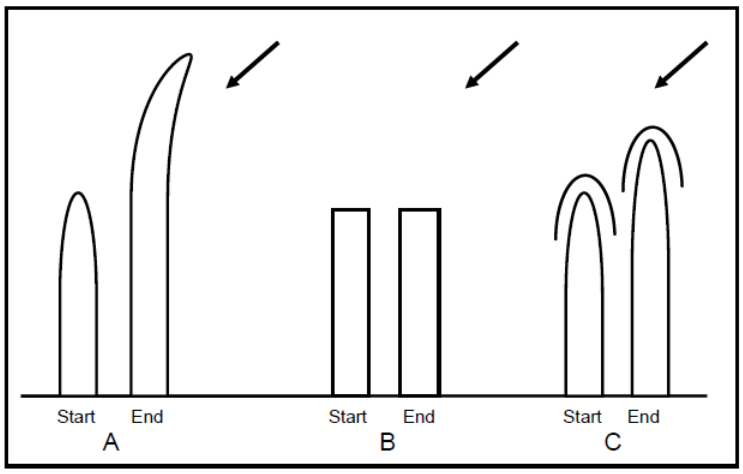

1.1.1 The influence of which plant hormone is being investigated? (1)

1.1.2 **Explain** the results observed in investigations **A** and **C**, as illustrated in the diagram above. (6)

1.1.3 Plants respond to gravity.
Explain why the root grows in different directions when a pot plant is placed horizontally on the ground, receiving light equally from all directions. (6)

Answer:

1.1.1 **Auxins**

1.1.2 **<u>In investigation A:</u>**
Light from the right
caused auxins to move to shaded side of the shoot
leading to increased cell elongation and division
There was therefore greater growth on the shaded side
thus bending the shoot in the direction of the source of light
<u>In investigation C</u>:
Light has no influence on the distribution of auxins
therefore the shoot grew upright

1.1.3 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