TELEMATIC SCHOOLS PROJECT

2025 SUBJECT WORKBOOK
Grade 12

LIFE SCIENCES

A joint initiative between the Western Cape Education Department and Stellenbosch University.

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Education
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BROADCAST SESSIONS

GRADE 12

LIFE SCIENCES

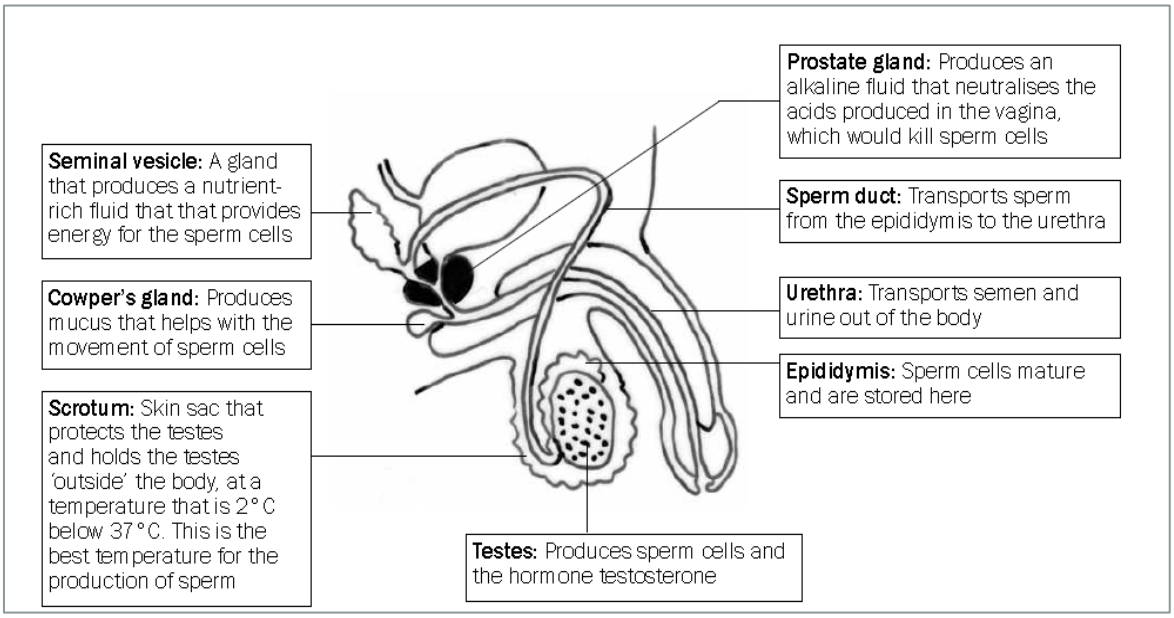
Session	Date	Time	Topic
1	**3/03/2025**	**16h00-17h00**	**Human reproduction**
2	28/05/2025	16h00-17h00	Nervous system
3	13/08/2025	16h00-17h00	Human evolution

SESSION 1 |HUMAN REPRODUCTION

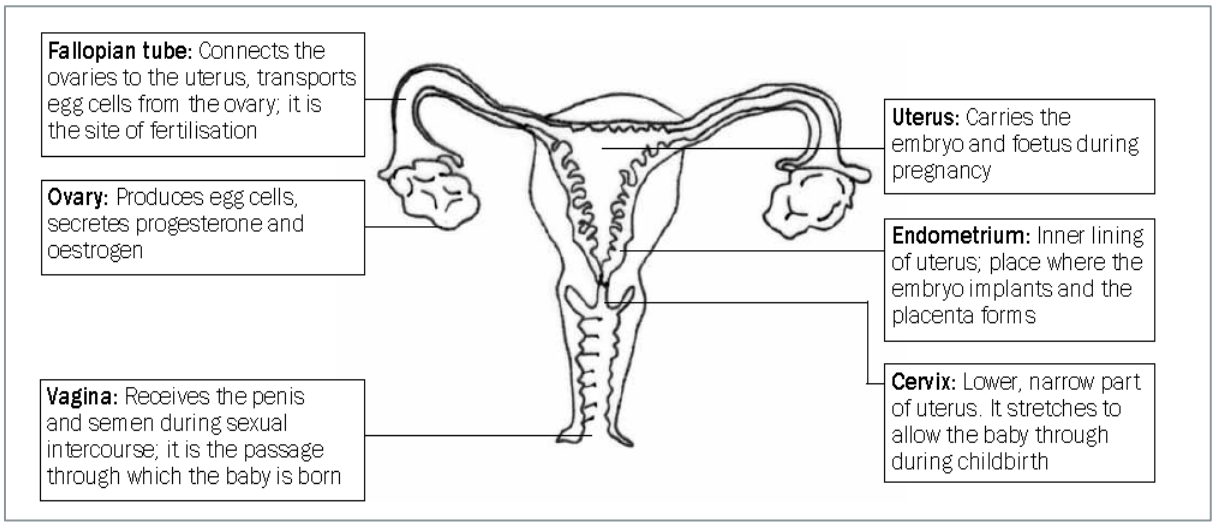
Structure of male and female reproductive systems

You should be able to *label and give* the functions of the different parts of the male and female reproductive systems.

Male reproductive system:



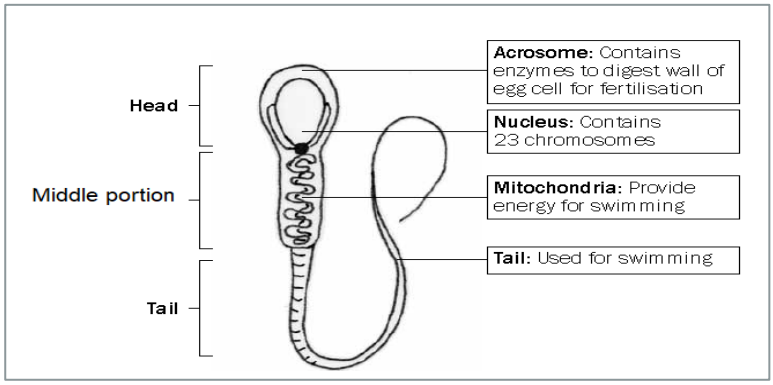
Female reproductive system:



SESSION 1 |HUMAN REPRODUCTION

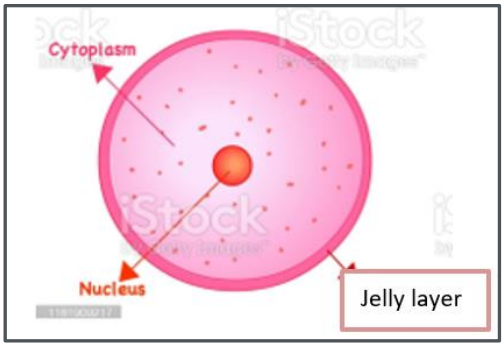
Structure of a sperm:

You should be able to draw the structure of a sperm cell and provide labels and functions of the parts (acrosome, head with haploid nucleus, middle portion/neck with mitochondria and a tail)



Structure of an ovum:

You should be able to draw the structure of an ovum and provide labels and functions of the parts (jelly layer, haploid nucleus, cytoplasm)



Gametogenesis:

- Gametogenesis is the formation of gametes by meiosis
- Male gametes formed by **spermatogenesis**
- Female gametes formed by **oogenesis**

***Describe* the process of spermatogenesis:**

- Diploid cells in the seminiferous tubules of the testes undergo meiosis
- under the influence of the hormone, **testosterone,**
- to form **haploid sperm cells**

***Describe* the process of oogenesis:**

- Diploid cells 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 **haploid ovum**.
- This occurs in a monthly cycle.

SESSION 1 |HUMAN REPRODUCTION

Describe **the menstrual cycle (ovarian and uterine cycles) and how it is influenced by different hormones (note the structures and names and functions of different hormones)**

- The menstrual cycle is a series of events that occur in the female body to prepare it for possible pregnancy.
- The pituitary gland/hypophysis secretes **FSH** which stimulates the development of a primary follicle into a **Graafian follicle** in the ovary
- The **Graafian follicle** secretes **oestrogen** which stimulates the thickening of the lining of the uterus/endometrium
- Around day 13/14 pituitary gland/hypophysis secretes **LH which** cause **ovulation** to occur
- The remains of the Graafian follicle develop into the **corpus luteum** which secretes the hormone, **progesterone** which continues to stimulate the thickening of the uterus
- High levels of progesterone inhibit the production of FSH so that the ovaries are no longer stimulated to produce another follicle (**negative feedback mechanism**).
- If fertilisation does not occur, the corpus luteum degenerates and stops producing progesterone
- The pituitary gland/hypophysis is no longer inhibited in its production of FSH and a new follicle develops
- The thick endometrium is no longer maintained, and it degenerates and is shed together with blood and **menstruation** takes place
- If fertilisation does occur the corpus luteum continuous to function until the 12th week of pregnancy.

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 (Follicle-Stimulating-Hormone)	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	Ovary (Graafian follicle)	Starts the thickening of the endometrium (lining of the uterus)
Progesterone	Ovary (Corpus luteum)	Thickens the endometrium even further, preparation should fertilisation occur

Process of fertilisation:

- The sperm cell(haploid) fuses with the ovum(haploid) to form a **fertilised egg cell**, a **zygote**(diploid)

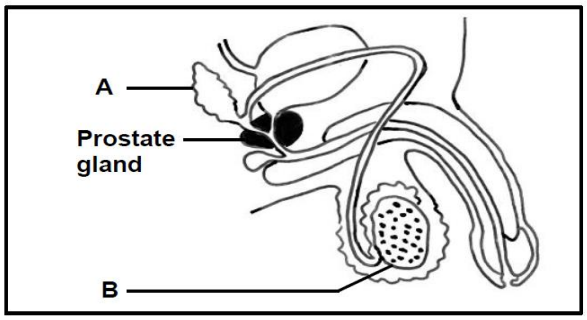
Describe **the development of a zygote until implantation occurs:**

- **Zygote** divides by mitosis to form a ball of cells called the **morula**
- The morula further divides to form a hollow ball of cells called the **blastula.**

SESSION 1 |HUMAN REPRODUCTION

QUESTION 1

1.1 The diagram below represents the male reproductive system.



1.1.1. Name

(a) Part **A** (1)

(b) The hormone secreted by **B** (1)

1.1.2 Explain ONE function of the fluid secreted by the prostate gland during reproduction. (2)

Answers:

1.1.1 (a) Seminal vesicle ✓ (1)

(b) Testosterone ✓ (1)

1.1.2 It is alkaline ✓ to neutralise the acidic conditions of the vagina ✓

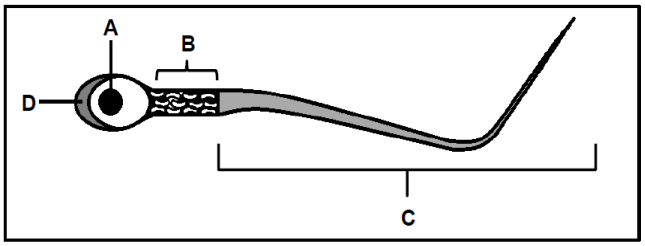
It contains mucus ✓ /provides medium to facilitates the movement of the sperm ✓

It contains nutrients ✓to supply the sperm with energy ✓

Any 1 x 2 (2)

QUESTION 2

2.1 The diagram below shows the structure of a sperm cell.



2.1.1 Name the organelles found in large numbers in Part **B** (1)

2.1.2 Explain the role of part **D** during fertilisation (2)

2.1.3 Describe the functional relationship between the organelles in part **B** and structure **C** during reproduction. (2)

Answers:

2.1.1 Mitochondria ✓ (1)

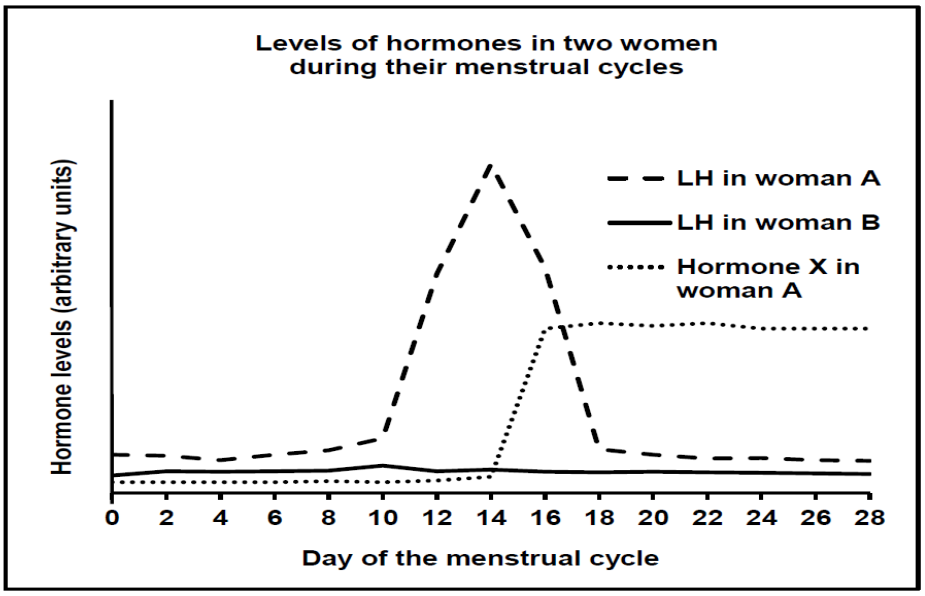
2.1.2 It contains enzymes ✓that digest the outer membrane of the ovum✓ (2)

2.1.3 Organelles in part **B** release energy✓ which enables movement✓ of part **C** (2)

QUESTION 3

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

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



3.1.1 State TWO functions of LH during the menstrual cycle. (2)

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

3.1.3 Give the name of hormone **X**. (1)

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

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

Answers:

3.1.1 Stimulates ovulation ✓, Stimulates the development of the corpus luteum ✓ (2)

3.1.2 FSH ✓ /Folicle stimulating hormone (1)

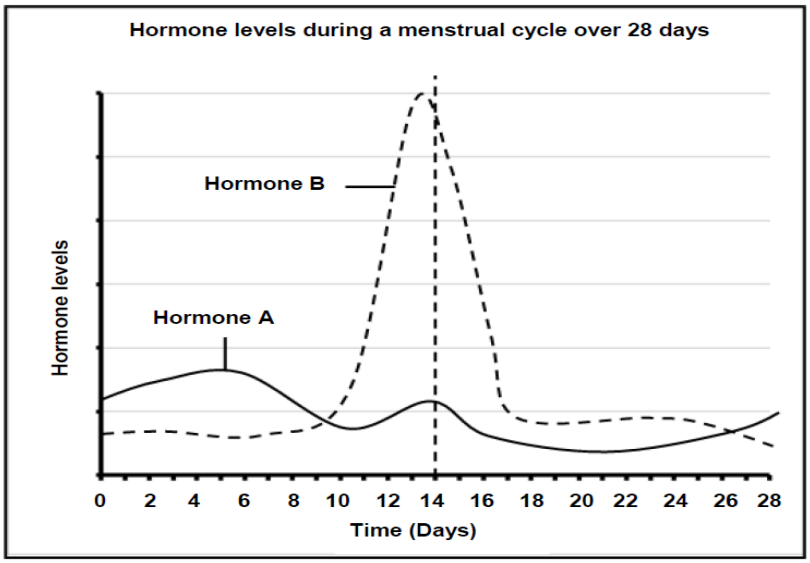
3.1.3 Progesterone ✓ (1)

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

3.1.5 Hormone X/progesterone levels remain high ✓ (1)

QUESTION 4

4.1 The graph below shows the levels of two hormones that are secreted by the pituitary gland during the menstrual cycle.



4.1.1 State TWO functions of hormone **B**. (2)

4.1.2 Explain why a female who is struggling to get pregnant:

(a)May be given pills containing hormone **A** as a treatment (3)

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

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

Answers:

4.1.1 Stimulates ovulation ✓, Stimulates the development of the corpus luteum ✓ (2)

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

(b) A peak in hormone B ✓ /LH will indicate that ovulation is about to happen ✓ therefore, an ovum will be available for fertilisation ✓ Any (2)

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

QUESTION 5

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

Answer:

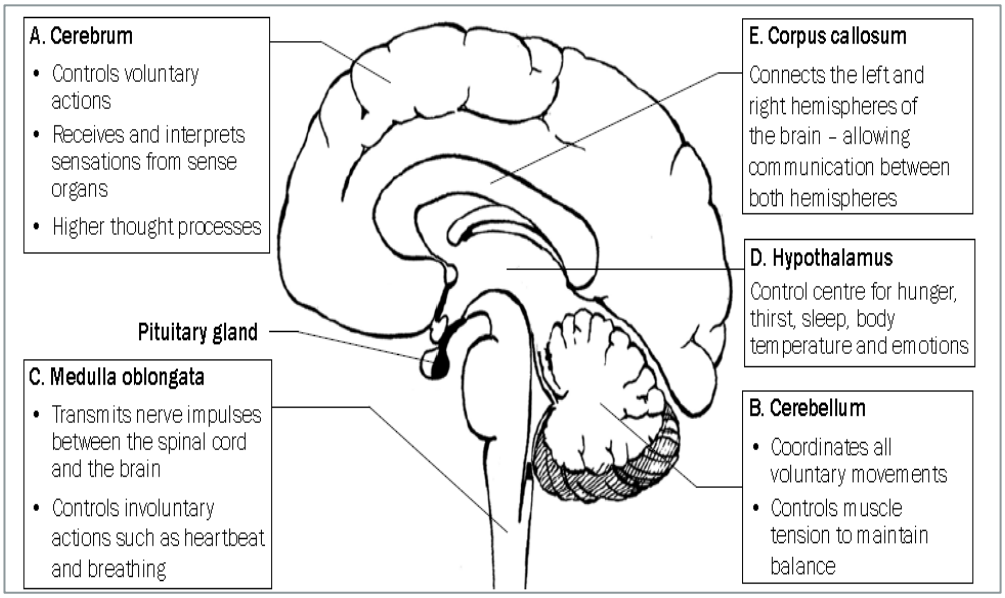
5.1 The Graafian follicle ✓ secretes oestrogen ✓ causing the endometrium to become thicker ✓ /more glandular or vascular. The corpus luteum ✓ secretes progesterone ✓ which (further) increases the thickness of the endometrium ✓. High levels of progesterone inhibit FSH secretion ✓

Any (5)

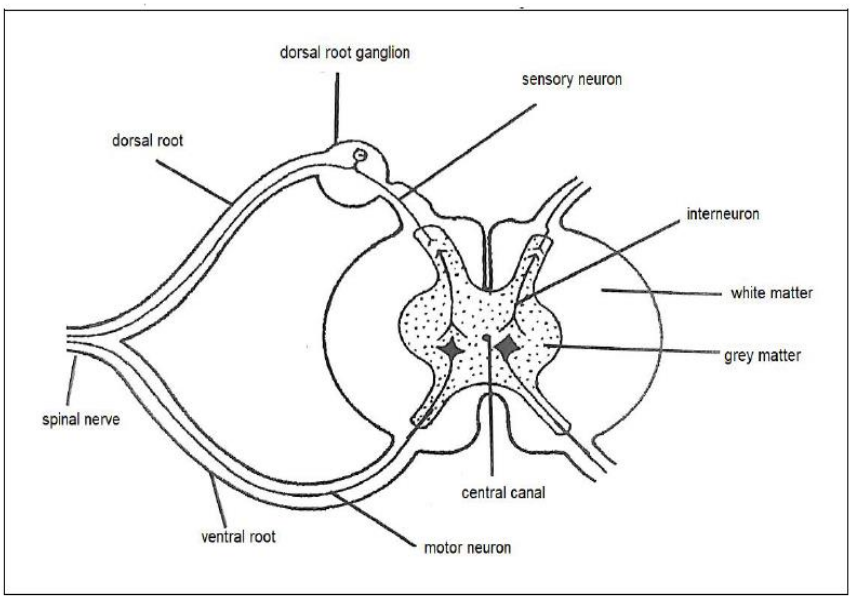
The Central nervous system:

- The central nervous system consists of the **brain** and **spinal cord**.
- The brain is enclosed by the cranium and the spinal cord by the vertebral column
- Both the brain and spinal cord are enclosed by the **meninges.**

You should be able to know the location and functions of parts of the brain:



You should be able to know the location and functions of the spinal cord:

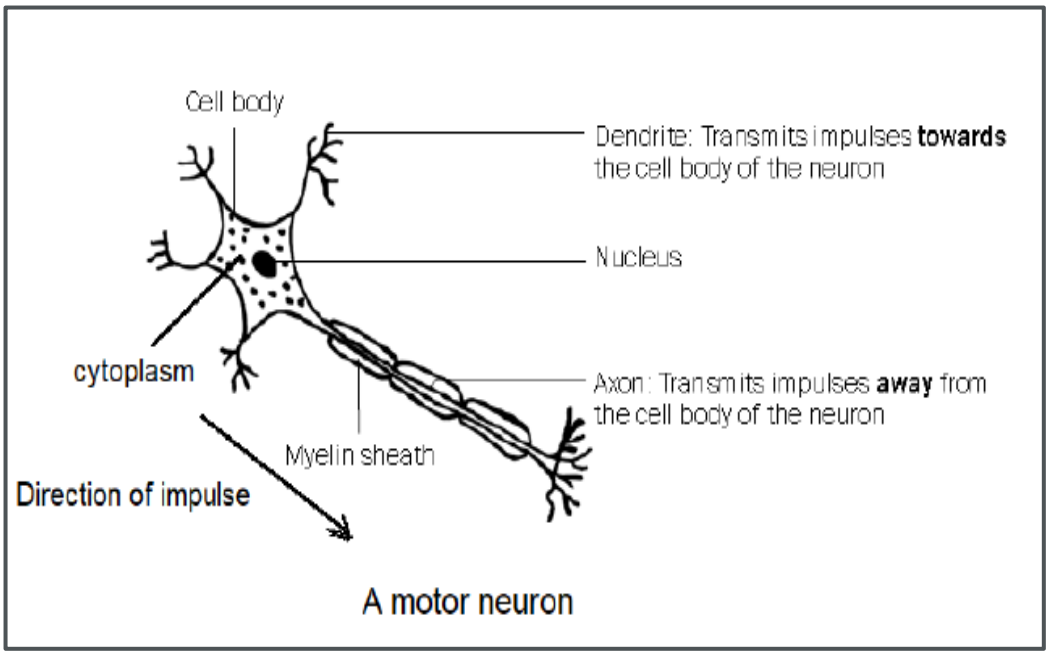


SESSION 2 | NERVOUS SYSTEM

Neurons:

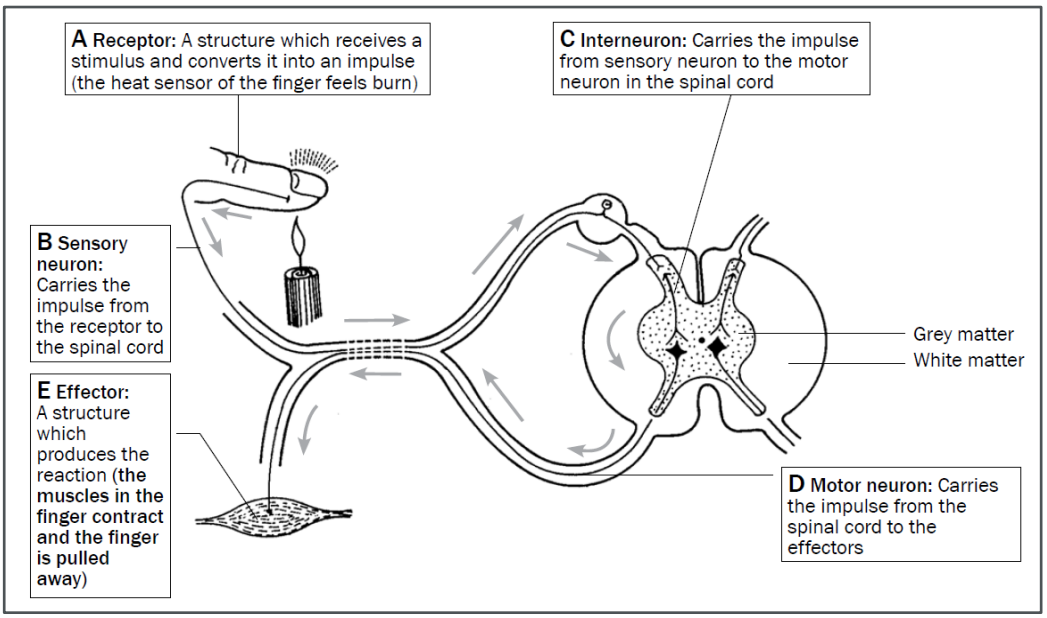
- **Sensory (afferent) neurons**: transmit impulses from the receptors to the spinal cord.
- **Motor (efferent) neurons**: transmit impulses from the spinal cord to the effector organs (muscles/glands).
- **Interneurons**: are found in the spinal cord and transmit impulses from the sensory neurons to the motor neurons.

Structure of a motor neuron:



A motor neuron

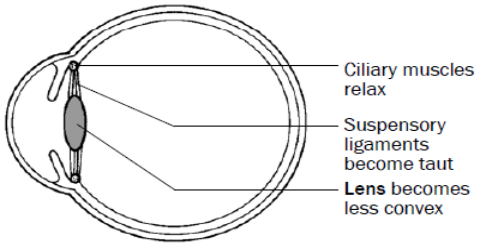
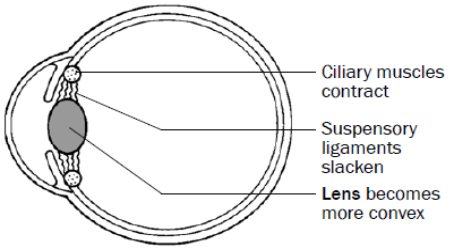
You should be able to know the structure of a reflex arc and functions of each part:



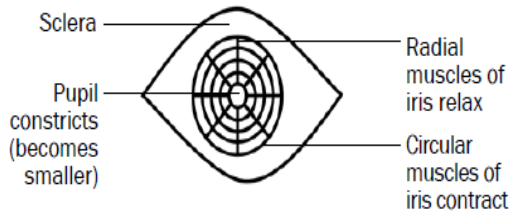
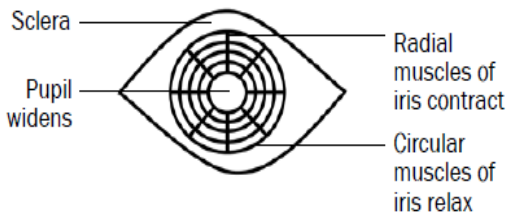
Human eye :

You should know the structure and functions of the parts of the human eye using a diagram.

Accommodation:

Distant vision (objects further than 6m)	Near vision (objects closer than 6m)
Ciliary muscles relax	Ciliary muscles contract
Ciliary body moves further away from the lens	Ciliary body moves closer to the lens
Suspensory ligaments tighten (becomes taut)	Suspensory ligaments slacken
Tension on lens increases	Tension on lens decreases
Lens is less convex	Lens becomes more convex
Light rays are refracted less	Light rays are refracted more
Light rays are focused on the retina and image falls on the retina	Light rays are focused on the retina and image falls on the retina
	

Pupillary mechanism:

In bright light	In dim light
Radial muscles of the iris relax	Radial muscles of the iris contract
Circular muscles of the iris contract	Circular muscles of the iris relax
Pupil constricts (becomes smaller)	Pupil dilates (enlarges)
Less light enters the eye	More light enters the eye
	

Human ear :

You should know the structure and functions of the parts of the human ear using a diagram.

Hearing:

- The pinna traps and directs the sound waves into the external auditory canal/ear canal/meatus
- This causes the tympanic membrane to **vibrate**
- The **vibrations** are transmitted to the auditory ossicles
- The ossicles amplify the vibrations and transmit it to the oval window
- The oval window vibrates creating **pressure waves** in the fluid/endolymph of the cochlea
- This stimulates the organ of Corti to convert the wave into an **impulse**
- The impulse travels along the auditory nerve to the **cerebrum** where it is interpreted

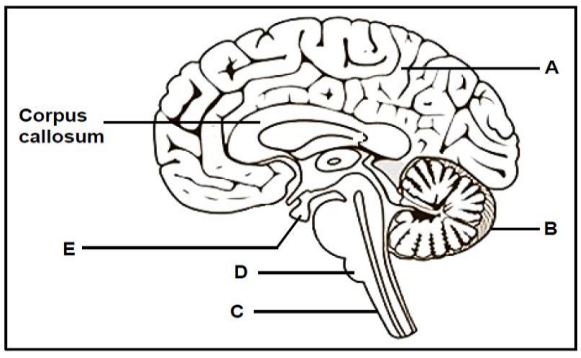
Balance:

The role of the ear in maintaining balance:

- **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**
- In both cases an **impulse** is generated which is transmitted by the **auditory nerve** to the **cerebellum** for interpretation

QUESTION 1:

1.1 The diagram below represents part of the central nervous system of a human.



1.1.1 Identify part **C.** (1)

1.1.2 Give the LETTER of the part that controls voluntary actions. (1)

1.1.3 Describe the location of the corpus callosum. (2)

1.1.4 A learner suffered a brain injury during a rugby match. He could still breathe properly but he experienced occasional loss of memory and balance. Explain why it is possible that the injury affected part **B**. (2)

Answers:

1.1.1 Spinal cord ✓ (1)

1.1.2 A ✓ (1)

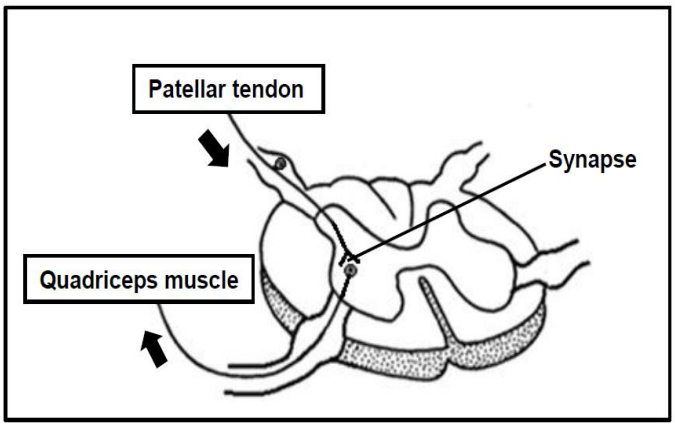
1.1.3 Between the two hemispheres of the cerebrum ✓ ✓ (2)

1.1.4 The learner (occasionally) lost balance ✓ due to no coordination of voluntary movements ✓ by part **B .** (2)

QUESTION 2

2.1 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.



2.1.1 What is a *reflex action*? (2)

2.1.2 State the importance of the knee-jerk reaction (1)

2.1.3 Describe the pathway of the impulse in this reflex arc to bring about the knee-jerk reaction. (5)

Answers:

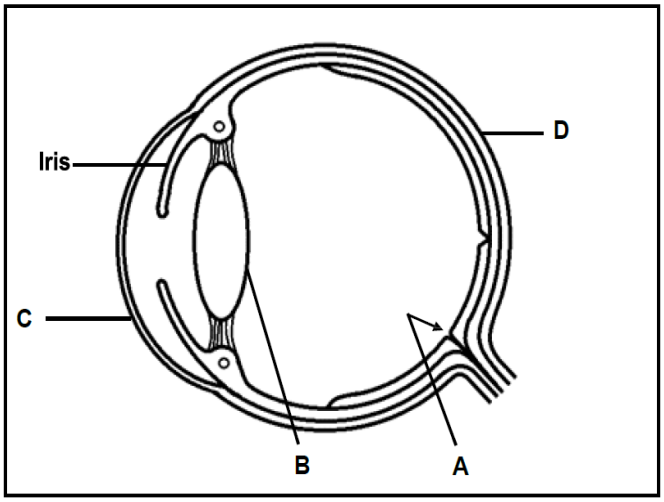
2.1.1 A rapid involuntary/automatic response ✓ to a stimulus ✓ (2)

2.1.2 It is important for balance ✓ /movement (1)

2.1.3 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 (5)

QUESTION 3:

3.1 The diagram below represents the structure of a human eye.



3.1.1 Identify part

(a) A (1)

(b) C (1)

(c) D (1)

3.1.2 Describe how the muscles in the iris enable a person to see in dim light. (4)

3.1.3 Explain how the shape of part **B** enables a person to read a book. (3)

Answers:

3.1.1 (a) Blind spot ✓ (1)

(b) Cornea ✓ (1)

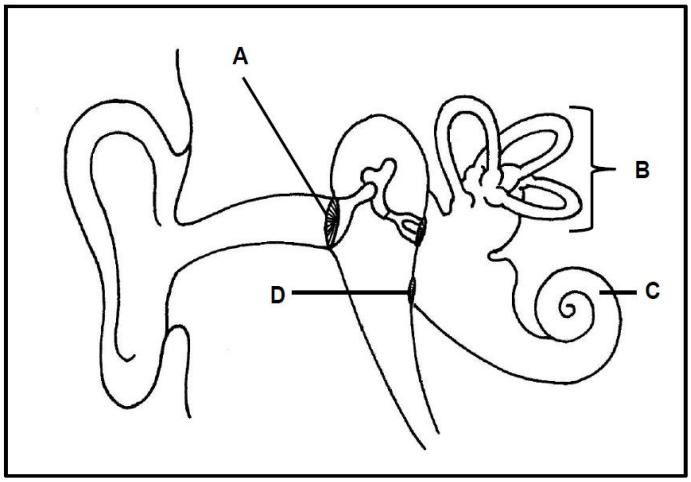
(c) Sclera ✓ (1)

3.1.2 Radial muscles contract ✓ and circular muscles relax ✓. The pupil widens ✓ /dilates and more light enters the eye ✓ (4)

3.1.3 It is more convex ✓ so that light rays are refracted more ✓ to focus on the retina ✓. (3)

QUESTION 4

4.1 The diagram below represents a part of the human ear.



4.1.1 Identify part **C** (1)

4.1.2 State ONE function of part **D** (1)

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

4.1.4 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)

4.1.5 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)

Answers:

4.1.1 Cochlea ✓ (1)

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

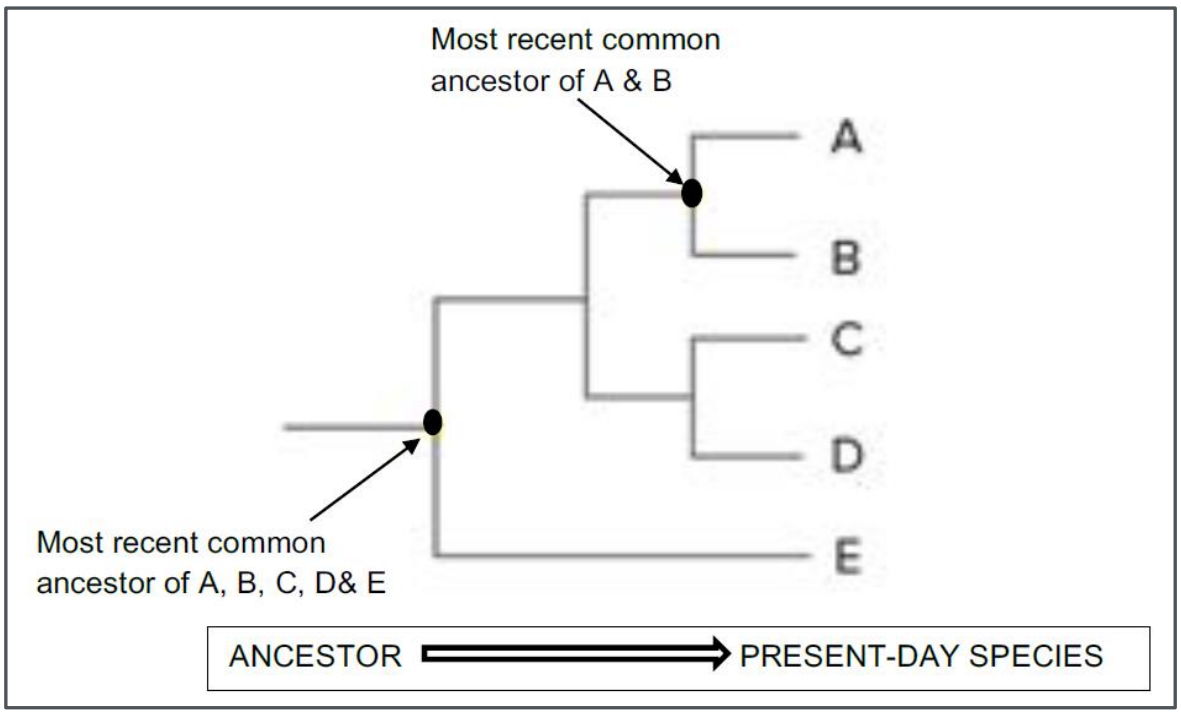
4.1.3 Part A/tympanic membrane will not be able to vibrate ✓ /vibrate freely. No/less vibrations will be carried to the middle ear ✓ /ossicles (2)

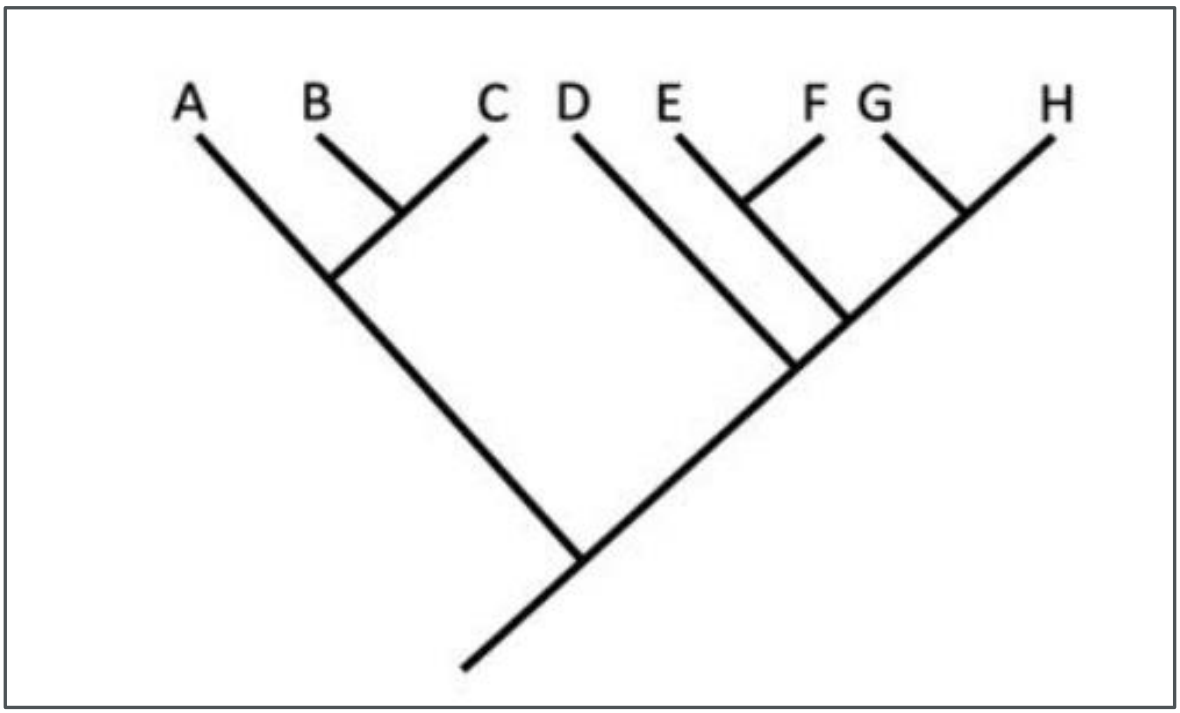
4.1.4 Middle ear infections cause fluid build-up in the middle ear ✓ which can block the Eustachian tube ✓. The grommet will release the pressure ✓ that will build up in the middle ear/ drain the fluid from the middle ear. The pressure on either side of the tympanic membrane is equalised ✓ preventing the tympanic membrane from rupturing ✓and allowing ossicles to vibrate freely (4)

4.1.5 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 Any (4)

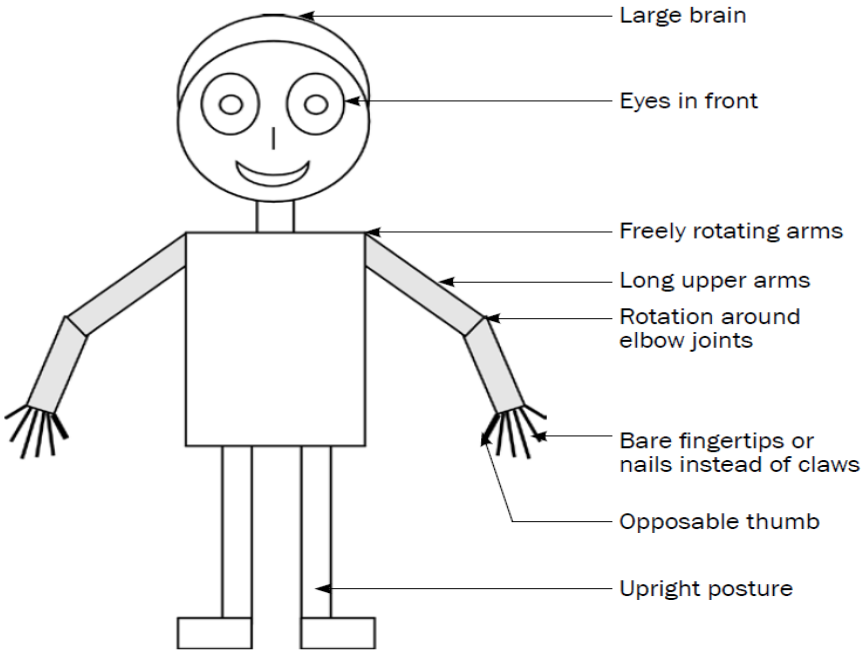
Phylogenetic tree to show the place of the family Hominidae in the animal kingdom:

A phylogenetic tree is a diagram representing possible evolutionary relationships between species.





Characteristics that humans share with African apes:



Differences between humans and African apes:

Feature	Humans	African apes
Foramen magnum	Foramen magnum in a forward position	Foramen magnum in a backward position
Cranium	Larger cranium size	Smaller cranium size
Spine	More curved/S-shaped	Less curved/C-shaped
Pelvic girdle	Short and wide pelvis	Long and narrow pelvis
Teeth	Smaller teeth/canines	Larger teeth/canines
Jaws	Non- prognathous	Prognathous
Palate shape	Gently curved/C-shaped	Rectangular/U-shaped
Cranial ridges	No cranial ridges	Cranial ridges across the top of the cranium
Brow ridges	Brow ridges less pronounced	Brow ridges pronounced

Lines of evidence that support the idea of common ancestors for living hominids, including humans

- Fossil evidence
- Genetic evidence – mitochondrial DNA
- Genetic evidence – tool-making

SESSION 3 |HUMAN EVOLUTION

The Out of Africa hypothesis:

- Modern humans originated in Africa and then migrated to other continents.

Evidence for the Out of Africa hypothesis:

Fossil evidence:

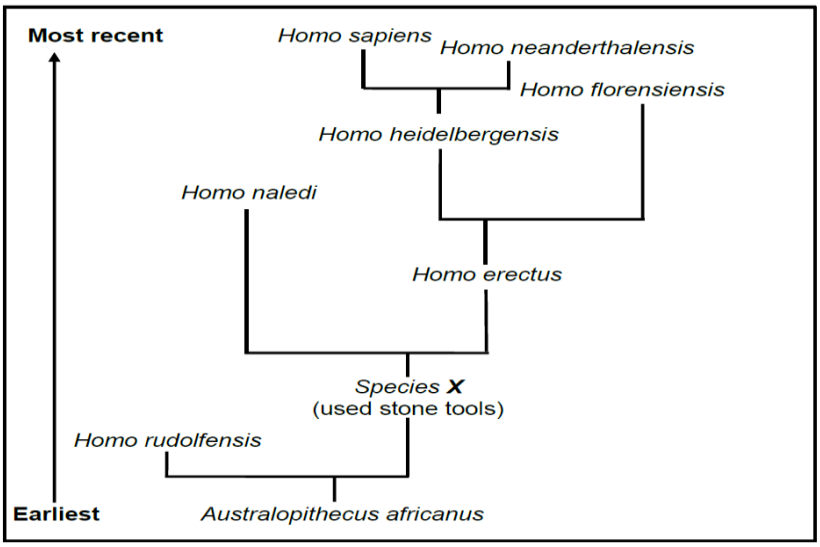
- Fossils of *Ardipithecus* were found in Africa ONLY
- Fossils of *Australopithecus* were found in Africa ONLY
- The fossils of *Homo habilis* were found in Africa ONLY
- The **OLDEST** fossils of *Homo erectus and Homo sapiens* were found in Africa while the younger fossils were found in other parts of the world

Genetic evidence:

- Mitochondrial DNA is inherited only from the maternal line.
- Analysis of mutations on this mitochondrial DNA shows that the oldest female ancestor was located in Africa and that all humans descended from her.

QUESTION 1:

1.1 The diagram below represents one model of the evolution of some hominids.



1.1.1 Identify the type of diagram shown. (1)

1.1.2 How many genera are represented by the diagram? (1)

1.1.3 Name the species:

(a) Represented by **X** on the diagram (1)
(b) That shares a common ancestor with *Homo erectus* (1)

1.1.4 Which species of the genus *Homo* is the only one in existence today? (1)

1.1.5 Name THREE forms of evidence that would have been used to support the information in the diagram. (3)

1.1.6 Explain how the fossils of *Australopithecus africanus*, *Species **X*** and *Homo erectus* are used to support the 'Out of Africa' hypothesis. (4)

Answers:

1.1.1 Phylogenetic tree ✓ (1)

1.1.2 2 ✓ /Two (1)

1.1.3 (a) *Homo habilis* ✓ (1)

(b) *Homo naledi* ✓ (1)

1.1.4 *Homo sapiens* ✓ (1)

1.1.5 Fossil ✓ evidence, Cultural ✓ evidence , Genetic ✓ evidence (3)

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

QUESTION 2:

2.1 Scientists find evidence for human evolution by comparing humans to other hominids. The upper limbs of humans and African apes show similar characteristics, whereas there are differences between the dentition (teeth) of the two.

2.1.1 Why do scientists look for similarities between humans and African apes? (1)
2.1.2 Explain the importance of the positioning of the thumbs for humans and African apes. (2)
2.1.3 State ONE difference between the teeth of humans and African apes. (2)

Answers:

2.1.1 To show a possible common ancestor ✓

To identify trends in evolution ✓ Any (1)

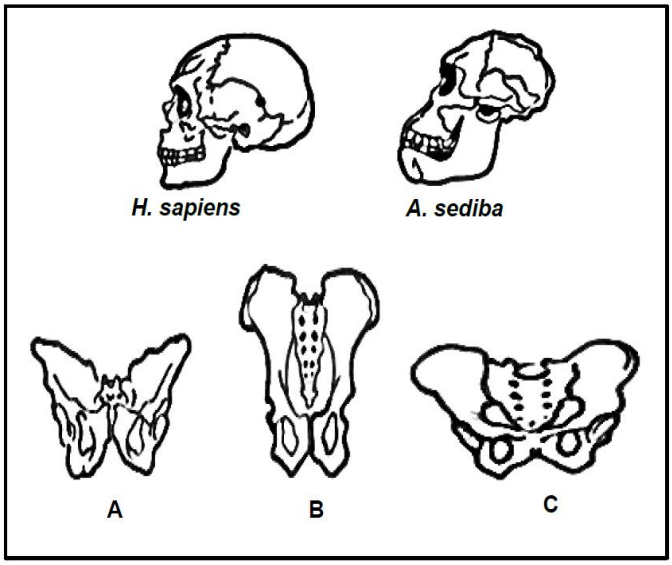
2.1.2 Both have opposable thumbs ✓ to allow for a power grip ✓ /precision grip (2)

2.1.3 Humans have small teeth ✓ /canines whereas African apes have large teeth ✓ /canines

There are no gaps ✓ /diastema between the teeth in humans whereas African apes have gaps/ diastema between the teeth Any 1 x 2 (2)

QUESTION 3:

3.1 The diagrams below show the skulls and pelvises of different hominids.



3.1.1 State the genus name of *A. sediba*. (1)
3.1.2 Describe the shape of the spine of *H. sapiens*. (1)
3.1.3 *A. sediba* is thought to be a transitional species. State what is meant by a *transitional species*. (2)
3.1.4 Give the LETTER of the pelvis that would be representative of *A. sediba.* (1)
3.1.5 Explain your answer to QUESTION 3.1.4. (2)
3.1.6 Explain the significance of the change in prognathism from *A. sediba* to *H. sapiens*. (5)

Answers:

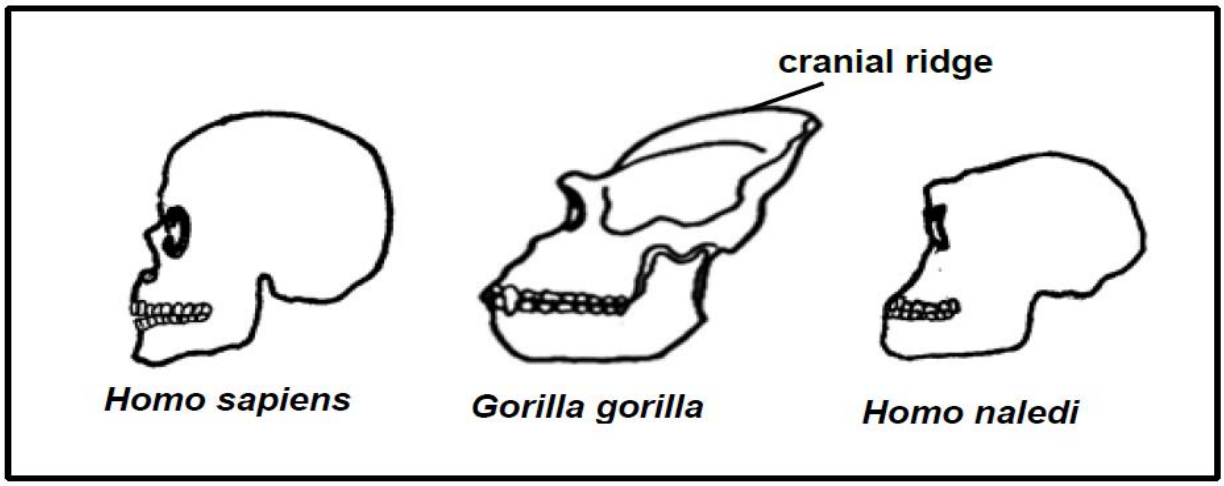
3.1.1 *Australopithecus* ✓ (1)
3.1.2 S ✓ -shaped spine (1)
3.1.3 An organism that has intermediate/common characteristics ✓between two genera ✓/species (2)

3.1.4 A ✓ (1)
3.1.5 **A** has a pelvis that is intermediate ✓ / transitional between **B** and **C** ✓ **OR A** has a shorter and wider pelvis than **B** ✓ but not as short and wide as **C** ✓ **OR A** has a longer and narrower pelvis than **C** ✓ but not as long and narrow as **B** ✓ (2)

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

QUESTION 4:

4.1. The diagrams below represent the skulls of hominids.



4.1.1 List FOUR similarities in relation to vision that are shared by these organisms. (4)

4.1.2 Name ONE species in the diagram that was most prognathous. (1)

4.1.3 Describe the TWO structures that caused the species named in QUESTION 4.1.2 to be most prognathous. (2)

4.1.4 *Homo naledi* was bipedal for most of its adult life. Explain how the structure of *Homo naledi* 's skull would have assisted in bipedalism. (3)

4.1.5 Describe the difference between *Homo sapiens* and *Gorrilla gorilla* in relation to the shape of the:

(a) Spine (2)

(b) Pelvis (2)

4.1.6 Explain why the *Gorrilla gorilla* species has a cranial ridge. (2)

Answers:

4.1.1 Eyes in front ✓, Binocular vision ✓, Stereoscopic vision ✓, Colour vision ✓ (4)

4.1.2 *Gorilla gorilla* ✓ (1)

4.1.3 Large canines ✓ /teeth, Large jaw ✓ (2)

4.1.4 More forward position of foramen magnum ✓ allows the spine to enter vertically ✓ beneath the skull to support the skull ✓ /upright walking (3)

4.1.5 (a) *Homo sapiens* has a S-shaped ✓ spine and *Gorilla gorilla* has a C-shaped ✓ spine (2)

(b) *Homo sapiens* has a short and wide ✓ and *Gorilla gorilla* has a long and narrow ✓pelvis (2)

4.1.6 For the attachment of strong muscles ✓ to assist in eating tough/hard food ✓ (2)

LINKS TO ONLINE RESOURCES

TOPICS	LINKS AND QR CODES
Human reproduction	https://bit.ly/3AgFxPD
Nervous system	https://bit.ly/3TScRn3
Human evolution	https://bit.ly/3TFd7Wd