



**Western Cape
Government**

Education

Directorate: Curriculum FET

TELEMATIC SCHOOLS PROJECT 2021

Life Sciences Grade 12

FOREWORD

Life Sciences is the scientific study of living things from molecular level to their interactions with one another and their environments. To be successful in the subject you need to understand the processes of scientific inquiry, problem-solving, critical thinking and applying your knowledge. To assist you in developing these skills in preparation for your examinations, the telematics platform will allow you an opportunity to interact with expert teachers in a stimulating and fully interactive virtual learning space.

This Life Sciences Telematics resource provides you with:

- Key summaries including diagrams of some of the content areas which were identified as challenging as well as content that will prepare you for the trial and final NSC examination.
- Sample questions and answers that will assist you in answering different types of questions.

Life Sciences learners are expected to bring the following to each session:

- A Life Sciences textbook
- Notebook, pen and pencil
- Non-programmable calculator, protractor and compass for possible calculations, drawing of graphs and diagrams.

Date	Time	Topic
22 April 2021	16h00 – 17H00	Human evolution
20 May 2021	16h00 – 17H00	Human reproduction
05 August 2021	16h00 – 17H00	Nervous system



HUMAN EVOLUTION

Evidence of common ancestors for living hominids, including humans

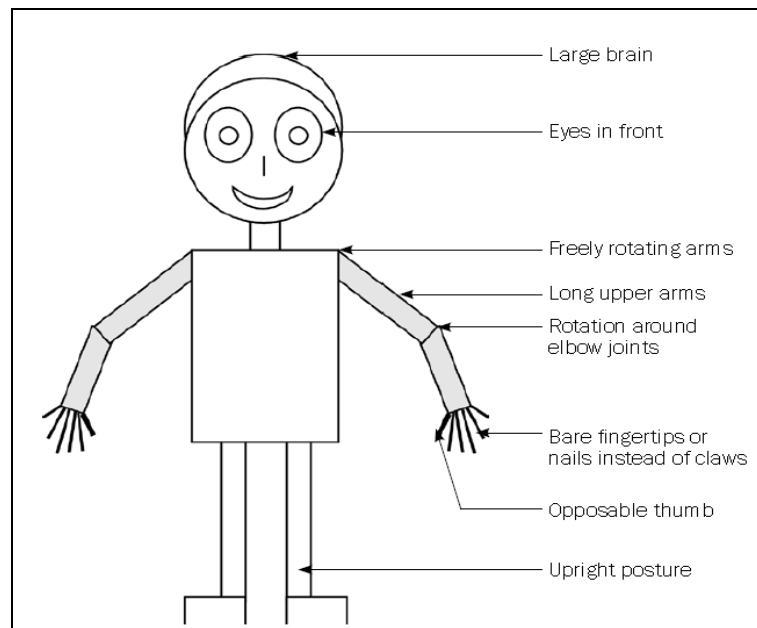
Phylogenetic trees:

Make sure that you can Interpret **phylogenetic trees** to show the place of the family **Hominidae** in the animal kingdom. Refer to questions on phylogenetic trees in past examination papers.

Remember the following:

- A **phylogenetic tree** is a diagrammatic representation of possible evolutionary relationships amongst species
- Humans belong to the **family Hominidae**.

Characteristics that humans share with African apes:



- Olfactory brain centres reduced
- Eyes in front/ Binocular vision / stereoscopic vision
- Freely rotating arms
- Rotation around the wrists
- Rotation around the elbow joints
- Bare fingertips/nails instead of claws
- Opposable thumbs
- Bipedal/ upright posture/foramen magnum in a more forward position
- Long upper arms
- Large brain/ skull compared to their body mass
- Five digits/fingers/toes per limb/pentadactyl limb

Differences between humans and African apes:

Feature	Humans	African apes
Foramen magnum	Foramen magnum in a more forward position	Foramen magnum in a more backward position
Cranium	Larger cranium size	Smaller cranium size
Spine	More curved/S-shaped	Less curved/C-shaped
Teeth	Smaller teeth/canines	Larger teeth/canines
Jaws	Less protruding jaws/non-prognathous	More protruding jaws/prognathous
Palate shape	Small and semi-circular	Long and rectangular
Cranial ridges	No cranial ridges	Cranial ridges across the top of the cranium
Brow ridges	Brow ridges less pronounced	Brow ridges pronounced

Out of Africa hypothesis:

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

Evidence for the 'Out of Africa' hypothesis:**Fossil evidence:**

- Fossils of *Ardipithecus* were found ONLY in Africa/Rift Valley/Ethiopia/South Africa
- Fossils of *Australopithecus* were found ONLY in Africa/Rift Valley/Ethiopia/South Africa
- The fossils of *Homo habilis* were ONLY found in Africa
- The OLDEST fossils of *Homo erectus* were found in Africa
- The OLDEST fossils of *Homo sapiens* were found in Africa

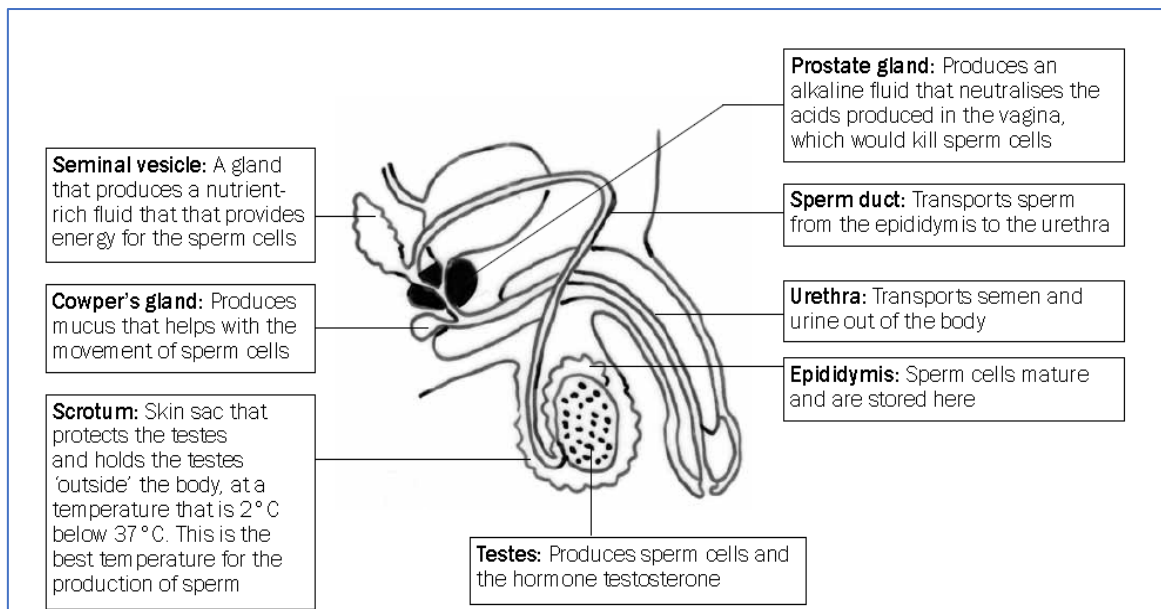
Genetic evidence:

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

HUMAN REPRODUCTION:

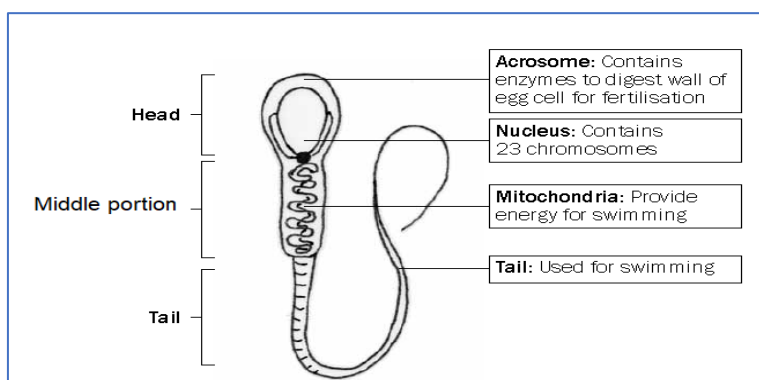
Structure of male and female reproductive systems

Structure of male reproductive system

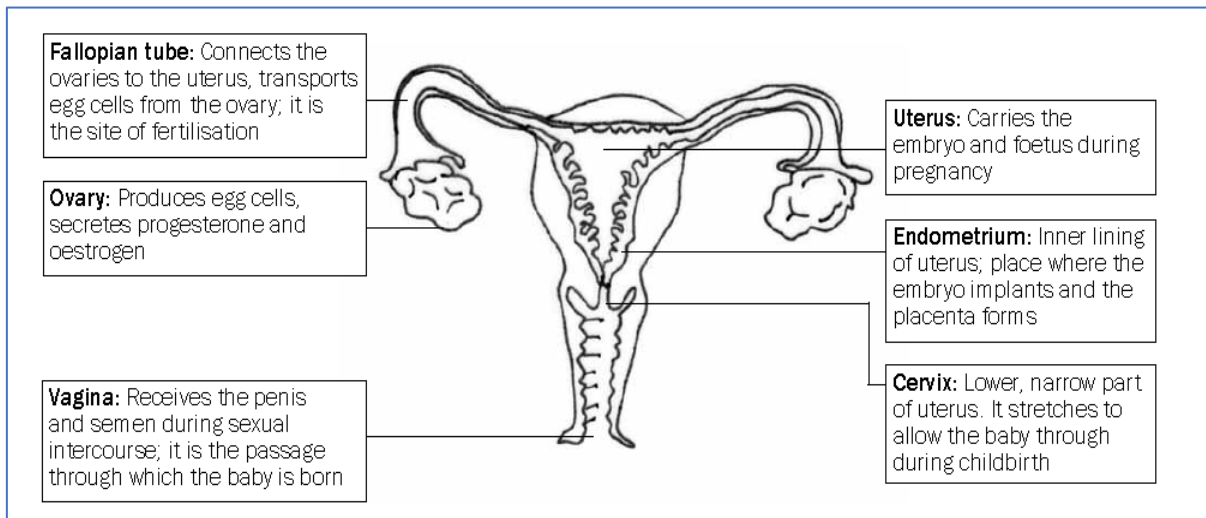


Structure of a sperm cell:

Note: The following labels are required according to the National Examination Guideline document: **acrosome, head, haploid nucleus, middle portion/piece, mitochondrion, tail.**

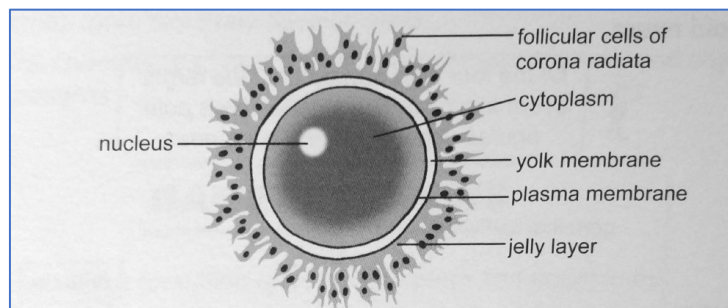


Structure of female reproductive system:



Structure of an ovum:

Note: The following labels are required according to the National Examination Guideline document: **jelly layer, haploid nucleus, cytoplasm.**



Puberty:

- Puberty is the stage when secondary sexual characteristics develop in males and females.

Gametogenesis:

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

Spermatogenesis:

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

Oogenesis:

- Diploid cells in the ovary undergo mitosis.
- under the influence of the hormone, **FSH**.
- to form numerous follicles.
- One cell inside a follicle enlarges and undergoes meiosis.
- Of the four cells that are produced, only one survives to form a mature, haploid **ovum**.

The menstrual cycle (ovarian and uterine cycles) and how it is influenced by 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 the 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 continues to function until the 12th week of pregnancy.

Fertilisation and development of zygote to blastocyst:

- Fertilisation takes place in the Fallopian tube.
- The ovum (containing 23 chromosomes) and sperm cell (containing 23 chromosomes) fuse to form a **zygote** (containing 46 chromosomes).
- The zygote divides by mitosis as it moves down the Fallopian tube and it forms a ball of cells called the **morula**
- The morula further divides to form a hollow ball of cells called the **blastula/blastocyst**.

Implantation, gestation and the role of the placenta:

- The blastocyst embeds itself into the endometrial/uterus lining. This process is called **implantation**.
- The outer wall of the blastocyst, called the **chorion** develops **chorionic villi** (finger-like projections that develop from the outer extra-embryonic membrane) which embeds into the uterine wall.
- The cells of the embryo continue to divide and differentiate to form the different organs and limbs of the foetus.
- The foetus is enclosed in a sac called the **amnion** which is filled with **amniotic fluid**.
- The **amniotic fluid** allows for the free movement of the foetus, protects the foetus against temperature fluctuations, protects the foetus against dehydration and protects the foetus against mechanical injury/acts as shock absorber.
- The chorionic villi and the endometrium form the **placenta** where the blood of both the foetus and the mother run close to each other.
- The placenta allows for the diffusion of nutrients and oxygen from the mother to the foetus, allows for the diffusion of carbon dioxide and waste products from the foetus to the mother, serves as a micro- filter and prevents the entry of pathogenic substances into the blood of the foetus and secretes progesterone which maintains pregnancy.
- The foetus is connected to the placenta by an **umbilical cord** which consists of two arteries and one vein.
- The **umbilical vein** carries oxygenated blood rich in nutrients from the placenta to the foetus.
- The **umbilical arteries** carry deoxygenated blood and waste products from the foetus to the placenta.
- The period of development of the foetus in the uterus is called **gestation**.

HUMAN NERVOUS SYSTEM:

Organisms need to be able to detect and respond to stimuli to survive in a continuously changing environment.

There are two coordinating systems in humans:

- Nervous system and
- Endocrine system

The need for a nervous system in humans:

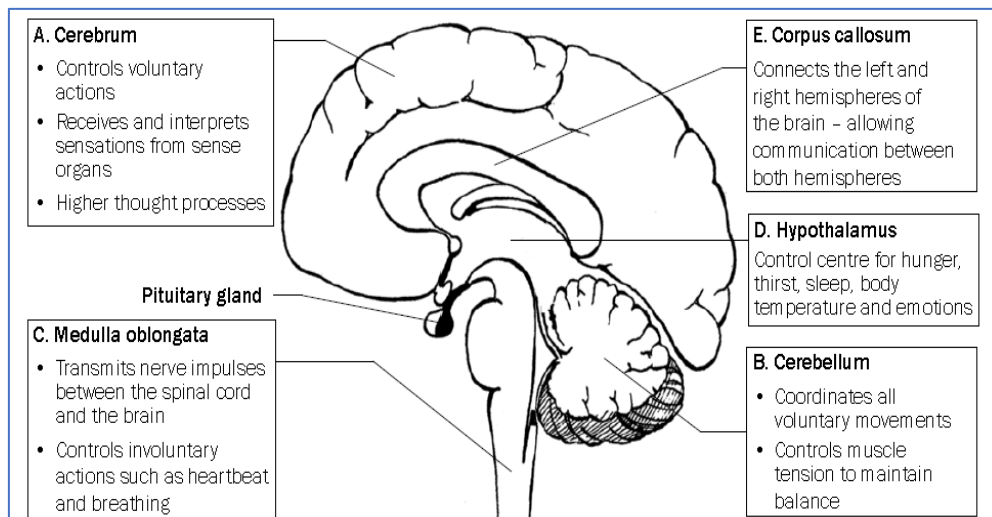
- The nervous system detects stimuli (changes in the environment) and allows for the body to react to these changes. Stimuli can be external and internal.
- The nervous system coordinates the various activities of the body e.g. walking, hearing etc.

The human nervous system:

- The human nervous system is subdivided into two main sections i.e.
 - **Central nervous system** – consisting of the brain and spinal cord
 - **Peripheral nervous system** – consisting of nerves that conduct impulses to and from the brain and spinal cord. It includes 12 pairs of cranial nerves and 31 pairs of spinal nerves.

The Central nervous system:

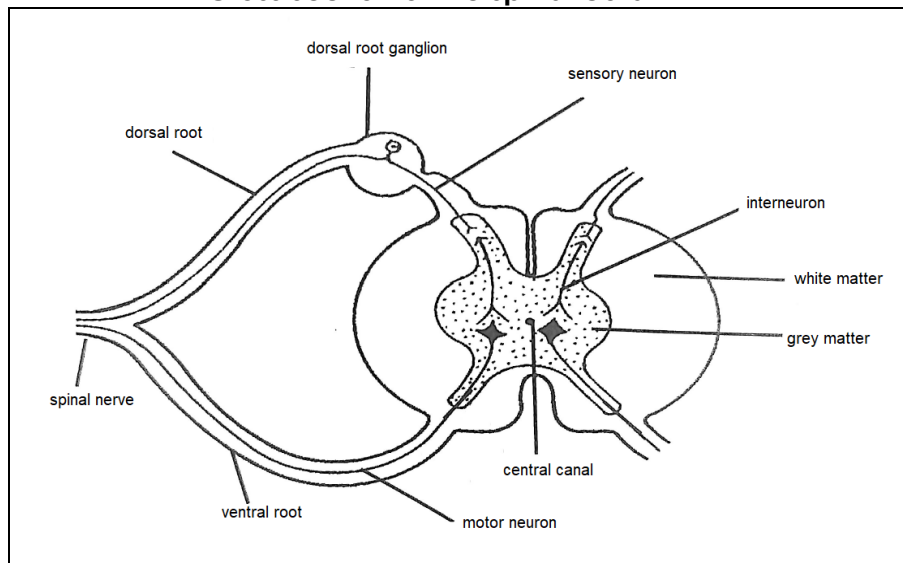
- The central nervous system consists of the **brain** and **spinal cord**.
- The brain is enclosed by the skull and the spinal cord by the vertebral column
- Both the brain and spinal cord are enclosed by the **meninges**.

The brain:**Diagram showing parts of the brain and their functions****The spinal cord:**

The spinal cord consists of:

- a central canal that is filled with cerebrospinal fluid
- grey matter and white matter

Cross section of the spinal cord



Spinal nerves arise from both sides of the spinal cord. Each spinal nerve has a **dorsal root** and a **ventral root**. The dorsal root consists of **sensory neurons** and the ventral root consists of **motor neurons**.

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.

The Peripheral nervous system:

- The peripheral nervous system includes all the nervous tissue situated outside the central nervous system i.e. **12 pairs of cranial nerves** and **31 pairs of spinal nerves**.
- It consists of sensory nerves and motor nerves.
- The motor nerves are subdivided into the **somatic nervous system** and the **autonomic nervous system**.
- The **somatic nervous system** conducts nerve impulses from the central nervous system to the voluntary muscles and controls voluntary actions e.g. running etc.
- The **autonomic nervous system** conducts nerve impulses from the central nervous system to the involuntary muscles and glands and controls involuntary actions e.g. sneezing, blinking of eyes etc.

Functions of the peripheral nervous system:

- Conduct impulses from the receptors to the central nervous system.
- Conduct impulses from the central nervous system to the effectors.

Location and functions of the autonomic nervous system (sympathetic and parasympathetic sections):

- The autonomic nervous system has two subdivisions i.e. the **sympathetic** and the **parasympathetic** divisions.
- The sympathetic division prepares the body for an emergency.
- The parasympathetic division allows the body to return to normal.

Examples of responses of the autonomic nervous system:

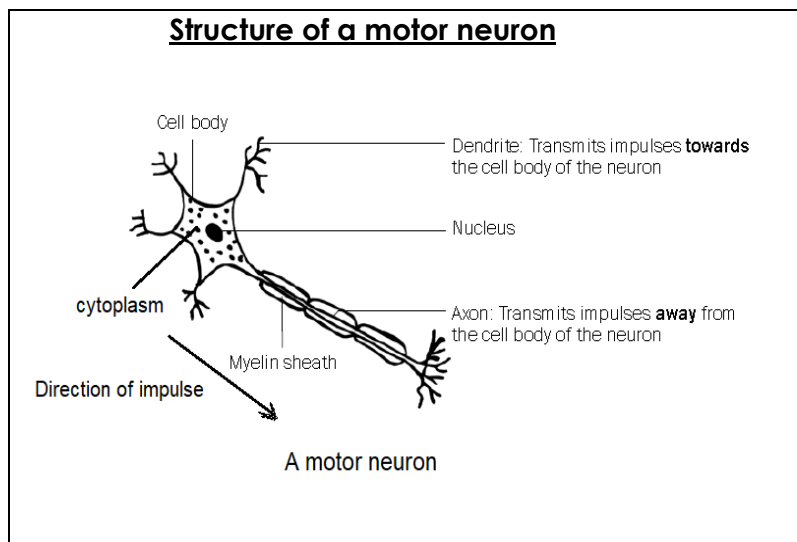
Sympathetic division	Parasympathetic division
Increases heart rate	Decreases heart rate
Dilates pupils	Constricts pupils
Increases blood pressure	Decreases blood pressure

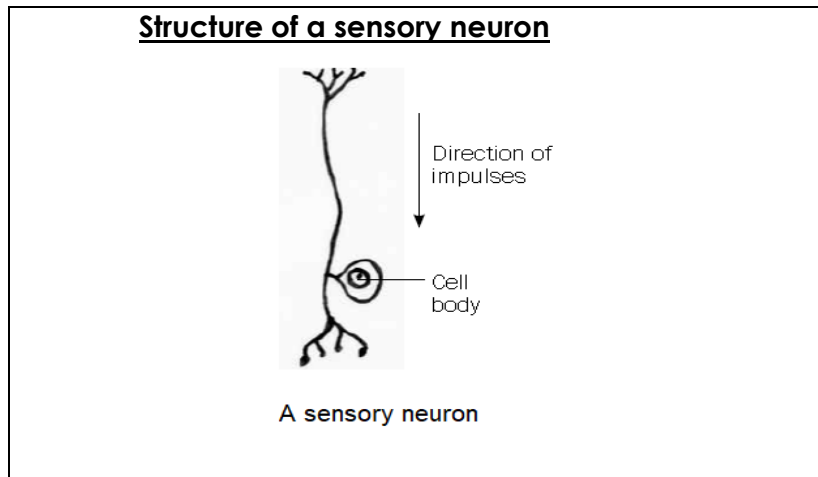
Structure and functioning of a nerve:

- Nervous tissue consists of millions of nerve cells called **neurons**.
- A neuron has a cell body consisting of cytoplasm and a nucleus.
- The cytoplasm contains granules, the **Nissl - granules**, which are rich in RNA and are involved in **protein synthesis**.
- Two types of outgrowths extend from the cell body i.e. **dendrites** and **axons**.
- **Dendrites** conduct nerve impulses **to** the cell body.
- **Axons** conduct nerve impulses **away** from the cell body.
- Most of the nerve tissue outside the central nervous system are enclosed by a **myelin sheath** which is formed by cells, called the Schwann cells. The myelin sheath insulates nerve fibres and accelerates the transmission of nerve impulses.

There are **three types of 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**: occur in the spinal cord and transmit impulses from the sensory neurons to the motor neurons.

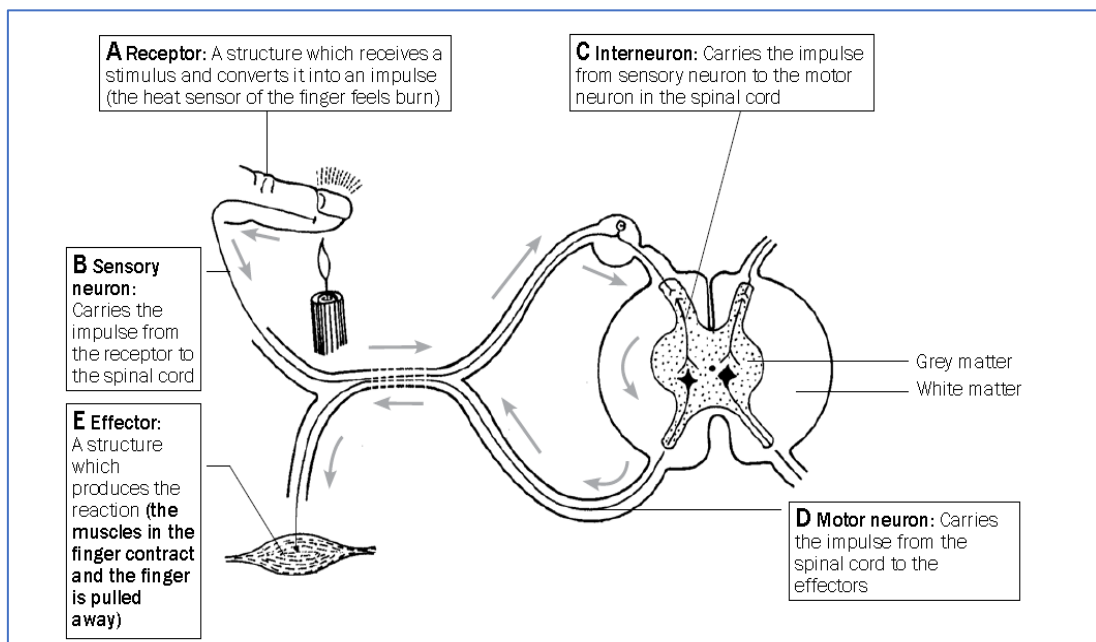




The simple reflex arc:

- **Reflex action:** a quick, automatic response to a stimulus and does not involve the brain. Protects the body from harm e.g. blinking of eyes, coughing etc.
- **Reflex arc:** the pathway along which nerve impulses are conducted from a receptor to an effector to bring about a reflex action.

Diagram of a simple reflex arc to show the different parts and functions of the parts



The path of a reflex arc:

Receptor (A) → Sensory neuron (B) → Interneuron (C) → Motor neuron (D) → Effector (E)

Significance of a reflex action:

- A reflex action is rapid to protect the body from injury

A synapse:

- A **synapse** is the functional connection between the axon of one neuron, and the dendrites of another neuron.

Significance of a synapse:

- Synapses ensure that impulses can only move in one direction.
- Impulses can be transmitted to more than one neuron at a synapse.
- A synapse determines which impulse will be transmitted to the next neuron.

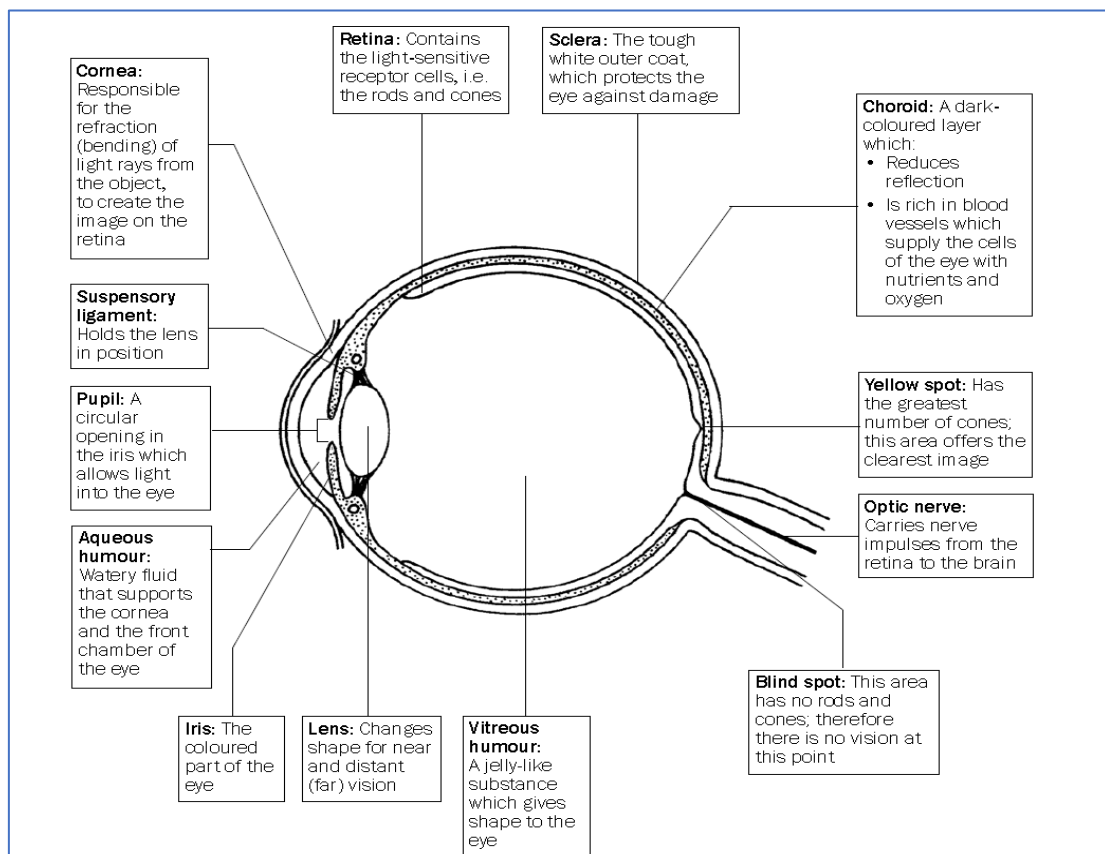
Disorders of the Central Nervous System:

You need to know the **causes** and **symptoms** of the following disorders i.e. **Alzheimer's disease** and **multiple sclerosis**.

- **Alzheimer's disease** – occurs when healthy neurons become less and less efficient. Symptoms include memory loss and confusion.
- **Multiple sclerosis** – occurs when the body's own immune system destroys the myelin sheaths of neurons. (Remember the myelin sheath insulates the nerve fibres and accelerates the transmission of nerve impulses). Symptoms include loss of muscle control and coordination in all parts of the body.

The Human Eye:**Structure and functions of different parts of the eye**

Diagram of the human eye showing the different parts and their functions

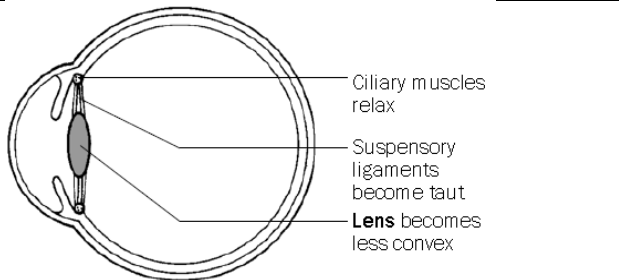
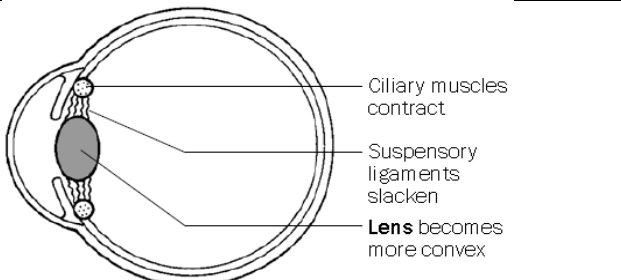


Binocular vision and its importance:

- The left and right eye each forms its own image of an observed object.
- The brain combines the two images to form a single three-dimensional image of the object
- Binocular vision provides a wider field of vision and creates a perception of depth.
- The ability to see in 3D is known as stereoscopic vision.

Accommodation:

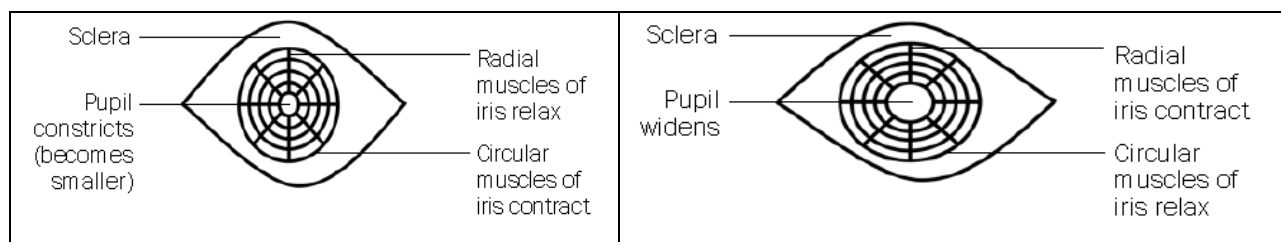
- Accommodation is the series of changes that take place in the shape of the lens and the eyeball in response to the distance of an object from the eye.

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
 <p>Ciliary muscles relax Suspensory ligaments become taut Lens becomes less convex</p>	 <p>Ciliary muscles contract Suspensory ligaments slacken Lens becomes more convex</p>

Pupillary mechanism:

- The pupillary mechanism is a reflex action
- The size of the pupil controls the amount of light that enters the eye

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



Visual defects:

Visual defect	Nature of the defect	Corrective measures
Short-sightedness – near objects can be seen clearly	<ul style="list-style-type: none"> • Inability of the lens to become more flat/eyeball is longer than normal • Lens bends the light rays too much • Focal point of distant objects lies in front of the retina • Causing the image to be blurred 	Wearing glasses with biconcave lenses
Long-sightedness – distant objects can be seen clearly	<ul style="list-style-type: none"> • Inability of the lens to become more convex/eyeball is shorter than normal • Lens does not bend light rays enough • Focal point of nearby objects lies behind the retina • Causing the image to be blurred 	Wearing glasses with biconvex lenses
Astigmatism	<ul style="list-style-type: none"> • The curvature of the lens or cornea is uneven, resulting in distorted images 	Glasses with lenses shaped to correct the distortion, contact lenses, laser surgery
Cataracts	<ul style="list-style-type: none"> • Lens becomes cloudy and opaque • Light cannot reach the retina and causes blurred vision 	Eye surgery to replace lens with a synthetic lens

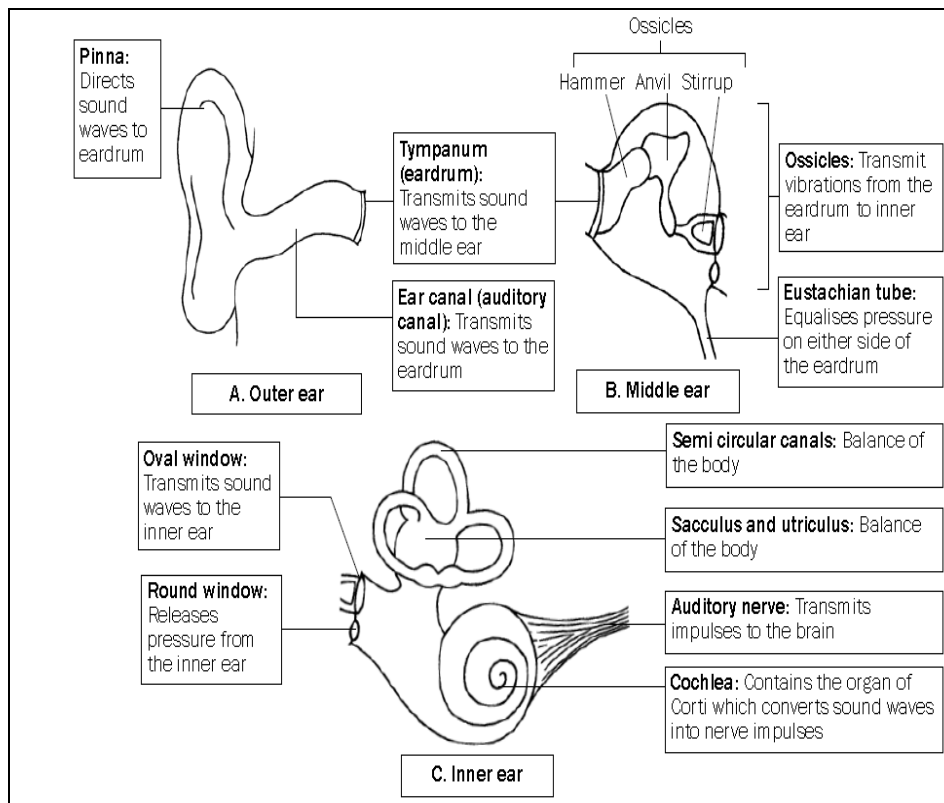
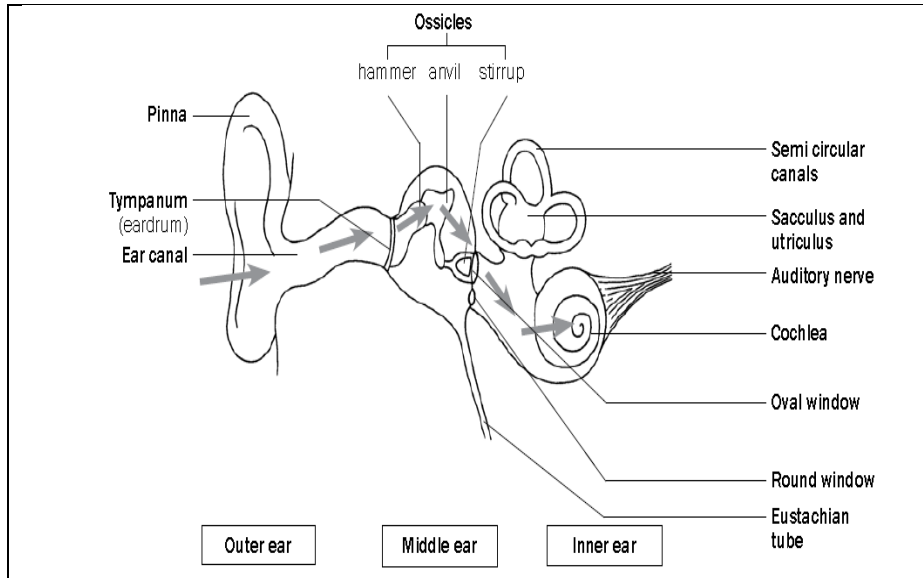
The Human Ear:

Structure and functions of different parts of the ear:

The human ear consists of three parts:

- Outer ear
- Middle ear
- Inner ear

Diagrams of the human ear showing the different parts and their functions



Functioning of the human ear:

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 waves
- into an **impulse**.
- The impulse travels along the auditory nerve to the **cerebrum** where it is interpreted.

Balance:

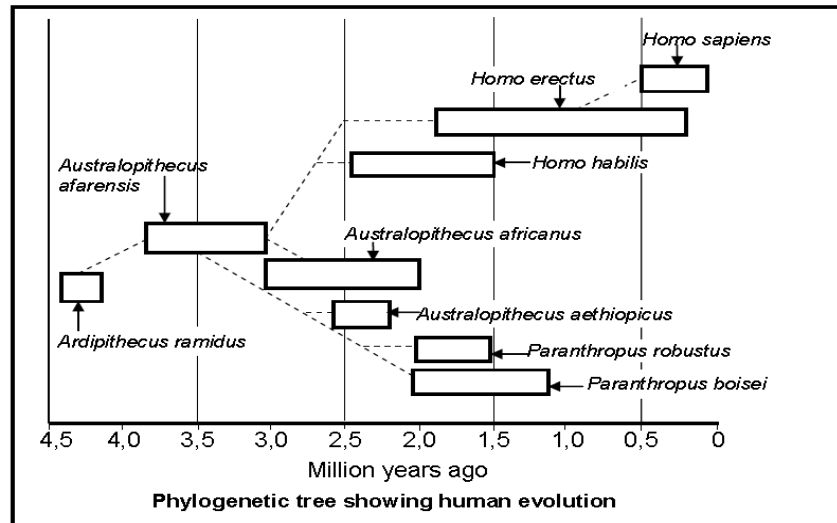
- The **maculae** in the **utricle and saccule** are stimulated by **changes in the position of the head**.
- The **crisae** in the **semi-circular canals** are stimulated by **changes in the direction and speed of movement**.
- When stimulated, the cristae and maculae convert the **stimuli** into nerve **impulses**.
- The nerve impulses are transmitted through the **auditory nerve** to the **cerebellum** where they are interpreted.
- The cerebellum then sends impulses via the motor neurons to the **skeletal muscles** to restore balance.

Hearing defects:

Hearing defect	Causes	Treatment
Middle ear infection	<ul style="list-style-type: none"> • Excess fluid in the middle ear caused by pathogens e.g. viral infection. The tympanic membrane bulges and this causes pain 	<ul style="list-style-type: none"> • Inserting of grommets • Antibiotics
Deafness	<ul style="list-style-type: none"> • Injury to parts of the ear, nerves or parts of the brain responsible for hearing • Accumulation and hardening of ear wax • Hardening of ear tissues such as ossicles 	<ul style="list-style-type: none"> • Hearing aids • Cochlear implants

HUMAN EVOLUTION (QUESTIONS)

1.1 The diagram below is a possible representation of human evolution.



[Adapted from *Biology: Understanding Life*, Sandra Alters, 1995]

- 1.1.1 What is this type of diagram called? (1)
- 1.1.2 According to the diagram, which organism, *Paranthropus boisei* or *Homo habilis*, appeared first on Earth? (1)
- 1.1.3 Name FOUR species whose existence on Earth overlapped with that of *Homo erectus*. (4)
- 1.1.4 Which organism was the direct ancestor of *Homo habilis*? (1)
- 1.1.5 List THREE characteristics that are shared by all the organisms in the above diagram. (3)
- 1.1.6 How long did *Australopithecus africanus* exist on Earth? (1)

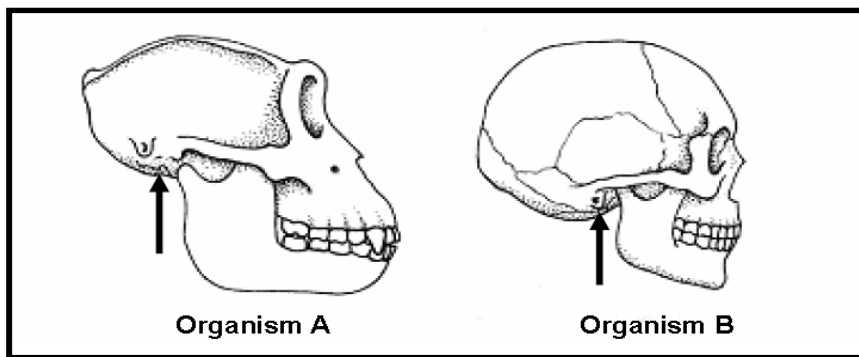
Answers:

- 1.1.1 Phylogenetic tree✓
- 1.1.2 *Homo habilis*✓
- 1.1.3 *Paranthropus robustus*✓, *Paranthropus boisei*✓, *Homo sapiens*✓, *Homo habilis*✓
- 1.1.4 *Australopithecus afarensis*✓
- 1.1.5 Olfactory brain centres reduced✓
 Eyes in front✓ / Binocular vision / stereoscopic vision
 Freely rotating arms✓
 Rotation around the wrists✓

- Rotation around the elbow joints✓
 - Bare fingertips/nails instead of claws✓
 - Opposable thumbs✓
 - Bipedal✓ / upright posture/foramen magnum in a more forward position
 - Long upper arms✓
 - Large brain/ skull compared to their body mass✓
 - Five digits per limb✓ /pentadactyl limb
- ANY 3

1.1.6 1 -1,2 my✓

1.2 The diagrams below represent the skulls of two organisms, a modern human and a gorilla. Each arrow indicates the position of the foramen magnum. Study the diagrams, which are drawn to scale, and answer the questions that follow.



- 1.2.1 Identify each of the organisms that are represented by **A** and **B**, respectively. (2)
- 1.2.2 Tabulate FOUR observable differences between the skulls of organisms **A** and **B**. (9)
- 1.2.3 Which organism is bipedal for most of its adult life? (1)
- 1.2.4 Explain TWO possible advantages of bipedalism for the organism referred to in QUESTION 1.2.3. (4)

Answers:

- 1.2.1 A- Gorilla✓
B – Human✓

1.2.2 Table 1 + (4x2)

Gorilla (A)	Modern human (B)
Larger teeth✓/canines	Smaller teeth✓/canines
Brow ridges pronounced✓	Brow ridges less pronounced✓
More protruding jaws✓/prognathous	Less protruding jaws✓/non-prognathous
Smaller cranium size✓	Larger cranium size✓
Poorly developed chin✓	Well-developed chin✓
Sloping face✓	Flat face✓

1.2.3 B✓

- 1.2.4 Allows total awareness✓ of the environment in sensing danger✓/looking for food
Enables hands to be free✓ to use implements✓/carry objects or offspring/throw/protect
Exposes a large surface area✓ for thermo-regulation✓/lose body heat to surroundings in hot conditions/reduce overheating therefore reduce need for water
Small surface area exposed to the sun✓, thus reducing over heating✓

1.3 Explain how each of the following skeletal structures have contributed to bipedalism in humans:

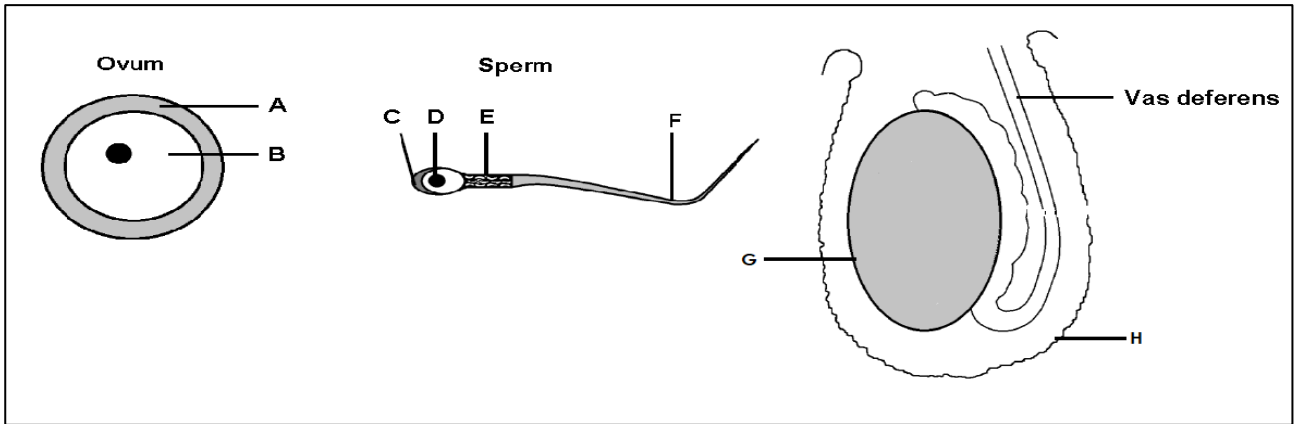
- (a) Pelvic girdle
(b) Spine

Answers:

- 1.3 (a) Pelvic girdle is short and wide✓/broad - to support the upper body✓
(b) Spine is more curved✓/S shaped - to absorb shock✓/allow flexible movement/support

HUMAN REPRODUCTION (QUESTIONS)

1.4 The diagrams below represent the structures of an ovum, a sperm and some parts of the male reproductive system.



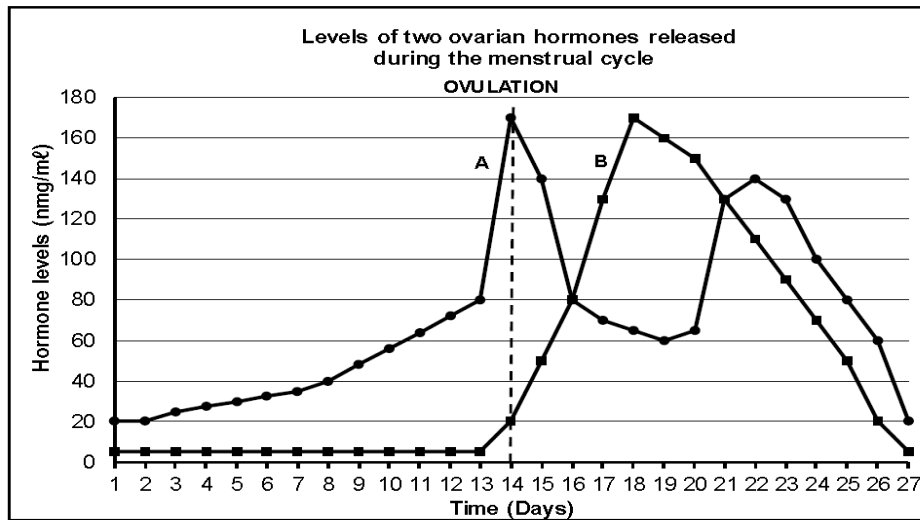
- 1.4.1 Identify parts **A, B, C, G** and **H** (4)
- 1.4.2 Describe the process of spermatogenesis in part **G**. (4)
- 1.4.3 Write down only the LETTER of the part of the sperm that enters the ovum. (1)
- 1.4.4 Write down only the LETTERS of the TWO parts that enable the sperm to move towards the ovum. (2)
- 1.4.5 Test results show that a man has a low sperm count. Explain why a doctor would advise the man to wear underwear that is not tight. (3)

Answers:

- 1.4.1 A - Jelly layer✓/Zona pellucida
 B – Cytoplasm✓
 C – Acrosome✓
 G – Testis
 H - Scrotum
- 1.4.2 Under the influence of testosterone✓ diploid cells✓ in the seminiferous tubules✓ of the testis undergo meiosis✓ to form haploid sperm✓
- 1.4.3 D✓
- 1.4.4 E✓ and F✓
- 1.4.5 Tight underwear will pull the testes closer to the body✓

The temperature of the testes will be too high✓ and sperm will not mature✓/sperm production is negatively affected

1.5 Study the graph below.



1.5.1 Identify hormones **A** and **B** (2)

1.5.2 What effect does an increase in hormone **A** have on the endometrium? (2)

1.5.3 Ovulation is indicated on the graph.

- (a) Define *ovulation* (2)
- (b) On which day did ovulation take place? (1)
- (c) Which hormone secreted by the pituitary gland stimulates ovulation? (1)

1.5.4 Explain why high levels of hormone **B** prevent the development of new follicles. (2)

1.5.4 Explain evidence in the graph that indicates that no fertilisation took place during the menstrual cycle shown above. (3)

Answers:

1.5.1 A – Oestrogen✓
B – Progesterone✓

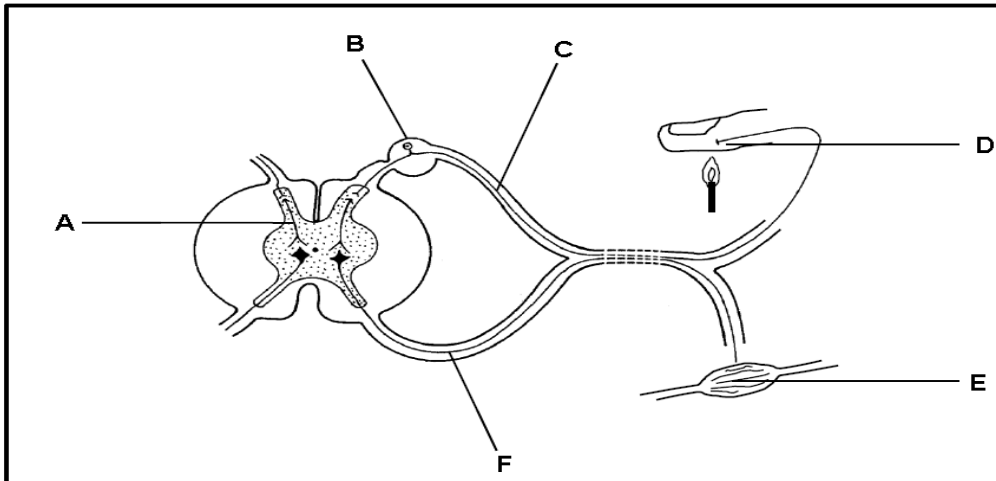
1.5.2 It increases✓
the thickness of the endometrium✓/the blood vessels in the endometrium/the amount of glandular tissue in the endometrium

1.5.3 (a) Release of an ovum✓ from a Graafian follicle✓
(b) Day 14✓
(c) LH✓

- 1.5.4 High levels of hormone B/progesterone will inhibit✓ the secretion of FSH✓
- 1.5.5 The progesterone✓ levels decreased✓ because the corpus luteum degenerated✓.

HUMAN NERVOUS SYSTEM (QUESTIONS)

1.6 The diagram below shows a reflex arc.

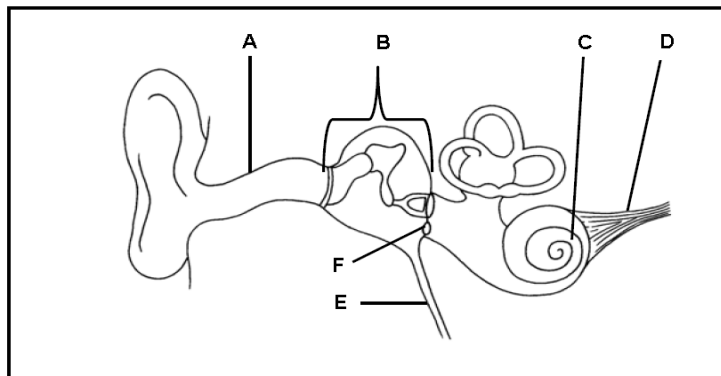


- 1.6.1 Give ONLY the LETTER of the part that represents the:
 - (a) Effector (1)
 - (b) Interneuron (1)
 - (c) Sensory neuron (1)
- 1.6.2 Give the LETTER and NAME of the neuron in the diagram that is probably damaged if a person is able to detect the stimulus, but cannot respond. (2)
- 1.6.3 State if the nerve impulse travels from **D** to **E** or from **E** to **D**. (1)

Answers:

- 1.6.1 (a) E✓
(b) A✓
(c) C✓
- 1.6.2 F ✓– motor neuron✓
- 1.6.3 D to E✓

1.7 Study the diagram below.



- 1.7.1 Give ONE function of parts **E** and **F** respectively (2)
- 1.7.2 Write down the LETTER of the part where sound is transmitted in the form of a pressure wave in a liquid. (1)
- 1.7.3 Explain the effect if the receptors in region **C** are damaged. (3)
- 1.7.4 Describe how the parts of the middle ear, including the membranes, assist with amplifying sounds. (3)
- 1.7.5 Describe the role of the semi-circular canals in maintaining balance. (4)

Answers:

- 1.7.1 E – equalizes pressure on either side of the tympanic membrane✓
F – Releases pressure from the inner ear✓
- 1.7.2 C✓
- 1.7.3 The receptors cannot convert the stimuli into impulses✓
No impulses/fewer impulses are transmitted to the cerebrum✓ and the person does not hear anything✓/hearing is impaired
- 1.7.4 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
- 1.7.5 A change in speed/direction of movement✓ 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.

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