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CHRIS HANI EAST DISTRICT

TUTORING MATERIAL

GRADE 12

LIFE SCIENCES

Essays for Paper 1 & Paper 2

Topics for paper 1

• Nervous coordination	40
• Human reproduction	31
• Human Impact on environment	25
• Endocrine system	15
• Homeostasis	11
• Plant hormones	11
• Meiosis	11
• Reproduction in invertebrates	<u>6</u>
	150

Topics for paper 2

• Evolution	66
• Genetics and inheritance	45
• DNA: code of life	27
• Meiosis	<u>12</u>
	150

Topics whose marks are less than 17 can be combined with other topics in essays. The essays in this document are previous years' essays and may not necessarily be repeated. It is important to note that essays are set anywhere in the content. A teacher can be creative and give learners new essays within the curriculum. **NB- learners must write essays in paragraphs not in point form as in memos**

- The essay question must be **read thoroughly** before attempting answering it
- Make sure that you **underline the parts** of the question that divide your essay into paragraphs eg. if this is your question:

A Explain the structural suitability of the sperm cell for its function and describe its involvement in the formation of a zygote and the development of this zygote until implantation.

This essay has the following three headings and will therefore have three paragraphs:

Explain

the structural suitability of the sperm cell for its function

Describe

its involvement in the formation of a zygote

and development of this zygote until implantation.

Please note that the circled action verbs are very important, for example, 'explain structural suitability...' needs you to mention the parts the sperm has and their significance which make the sperm able to fertilise an ovum.

B. One of the observations Darwin made during his study of pigeons was about artificial selection. In 1859 Darwin and Wallace jointly proposed that new species could develop by a process of natural selection. Using examples, describe natural and artificial selection and also highlight the differences between these two processes.

This essay has how many headings?.....

Let's see

Using examples

describe natural selection

artificial selection

and also **highlight the differences between these two processes.**

It is important to note that in this case you have to make use of an example to describe natural selection and make use of an example to describe artificial selection and thereafter differentiate between the two processes !!

1. Describe the interaction and the influence of hormones on the events during the menstrual cycle.

Content: (17)
 Synthesis: (3)
(20)
2. Describe the menstrual cycle and how it is influenced by different hormones.

Content: (17)
 Synthesis: (3)
(20)
3. Explain the structural suitability of the sperm cell for its function and describe its involvement in the formation of a zygote and the development of this zygote until implantation.

Content: (17)
 Synthesis: (3)
(20)
4. The unicellular zygote undergoes many developmental changes until it becomes a multicellular foetus, nourished and protected by the mother.
 Describe the changes that allow the zygote to eventually develop into a foetus and how this foetus is nourished and protected during the period of pregnancy.

Content: (17)
 Synthesis: (3)
(20)
5. Name the hormones produced by the testes and ovaries and describe the role of each hormone in human reproduction.

Content: (17)
 Synthesis: (3)
(20)
6. 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. Just before he dived, he heard his team-mate shout, 'your ball'.
 Describe how his eyes adjusted to see the ball as it travelled towards him and describe how he heard his team-mate and maintained his balance as he dived to save the ball.

Content: (17)
 Synthesis: (3)
(20)
7. Plants and animals are both able to sense and respond to light. Explain how plant stems respond to unilateral light and describe the path taken by light through the human eye until it is converted into an impulse.

Content: (17)
 Synthesis: (3)
(20)
8. The nervous and endocrine systems help to protect the human body. Use suitable examples to describe how this is achieved through a reflex action and by the hormone adrenalin.

Content: (17)
 Synthesis: (3)
(20)
9. A large spider fell on the lap of a person who was reading a book under a tree. The person dived out of the chair with a loud scream before running away at a high speed to a safer place. State what is meant by reflex action and describe how a reflex action functioned in order for the person to react quickly. Also explain how the adrenalin helped the person to react quickly as stated above.

Content: (17)
 Synthesis: (3)

10. Describe the role of the hypothalamus and the adrenal glands in bringing about changes to the blood vessels of the human skin and explain why these changes take place.

Content: (17)

Synthesis: (3)

(20)

11. Describe the negative feedback mechanism involving TSH and thyroxin and describe the consequences if this mechanism does NOT function well.

Content: (17)

Synthesis: (3)

(20)

12. Name and state the functions of FOUR hormones secreted by the pituitary gland in humans. Describe how the pituitary gland controls the functioning of the thyroid gland using negative feedback.

Content: (17)

Synthesis: (3)

(20)

13. Describe how the principle of negative feedback operates in controlling the glucose concentration of the blood in a normal healthy person. Also describe the causes, symptoms and management of the disease diabetes mellitus which results from an inability of the body to normalise the glucose concentration of the blood.

Content: (17)

Synthesis: (3)

(20)

14. A snake slithers (slides) over Sifiso's foot. He immediately jumps away from the snake in fear and manages to maintain his balance as it slithers away. Using your knowledge of nervous co-ordination and chemical co-ordination, describe all the events that lead to Sifiso's reaction to the snake.

Content: (17)

Synthesis: (3)

(20)

15. Describe the role of the ear in hearing and the maintenance of balance.

Content: (17)

Synthesis: (3)

(20)

16. While walking in the bush Paul hears a sound which he thinks is the roar of a lion. He immediately runs to safety.

Describe how he hears the sound and describe the role of adrenalin to ensure that his muscles are able to function efficiently while he runs away. Content: Synthesis:

Content : (17)

Synthesis (3)

(20)

17. A man was accidentally locked in a cool room in which the temperature was 8 °C. He was only released after six hours when a co-worker heard his cries for help.

Describe how his body maintained his temperature at 37 °C and how his co-worker heard his cries for help.

Content: (17)

Synthesis: (3)

(20)

18.

An increase in the metabolic rate during strenuous exercise causes a decrease in the glucose level and an increase in the CO_2 level in the blood.

Describe the mechanism that leads to an increase in the metabolic rate and the mechanisms involved in increasing the glucose level and decreasing the CO_2 level back to normal.

Content: (17)
Synthesis: (3)
(20)

QUESTION 1- The interaction and the influence of hormones on the events during the menstrual cycle

- **FSH** ✓/ follicle stimulating hormone
- is secreted by the pituitary gland✓
- FSH stimulates the development of a primary follicle✓
- into a Graafian follicle✓

- As the follicle develops it secretes **oestrogen**✓
- which causes the lining of the uterus✓/endometrium
- to become thicker✓/more vascular
- in preparation for a possible implantation of the embryo✓/development of the foetus

- The pituitary gland✓
- secretes **LH**✓
- which causes the Graafian follicle to rupture and release the ovum✓
- This is called ovulation✓

- The empty follicle changes and becomes a corpus luteum✓
- which begins to secrete **progesterone**✓
- which causes further thickening✓
- of the endometrium✓
- High levels of progesterone✓
- inhibit the secretion of FSH✓
- which prevents development of a new follicle in the ovary✓
- If there is no fertilisation, the corpus luteum degenerates✓
- which leads to a drop in progesterone✓
- The endometrium disintegrates and is shed during menstruation✓
- If fertilisation occurs, the corpus luteum remains intact✓
- which leads to the levels of progesterone remaining high✓
- to maintain pregnancy✓

(Any 17)

Content: (17)
Synthesis (3)

ASSESSING THE PRESENTATION OF THE ESSAY

Relevance	Logical sequence	Comprehensive
All information provided is relevant to the topic.	Ideas arranged in a logical/cause-effect sequence.	Answered all aspects required by the essay
All information relevant to the events of the menstrual cycle only (no pregnancy) and the hormones FSH, LH, oestrogen and progesterone.	All events of the menstrual cycle are in sequence.	All FOUR correct hormones mentioned with their functions.
1 mark	1 mark	1 mark

(20)

QUESTION 2- Describe the menstrual cycle 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✓

- Which involves ovarian cycle✓
- and the uterine cycle✓
- It takes an average of 28 days✓
- The pituitary gland✓/hypophysis
- secretes FSH✓
 - which stimulates the development of a primary follicle✓ in the ovary
- The developing follicle✓/Graafian follicle
- secretes oestrogen✓
 - which stimulates the thickening of the lining of the uterus✓/endometrium
- Around day 13 pituitary gland✓/hypophysis
- secretes LH✓
- which cause ovulation to occur✓
- The remains of the Graafian follicle develops into the corpus luteum✓ which secretes the progesterone✓
 - which continues to stimulate the thickening of the uterus✓
- High levels of progesterone✓
- inhibits the production of FSH✓
 - so that the ovaries are no longer stimulated to produce another follicle✓
- 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✓/ it degenerates and is shed together with blood/menstruation takes place

Any 17

Content: (17)

Synthesis (3)

ASSESSING THE PRESENTATION OF THE ESSAY

Relevance	Logical sequence	Comprehensive
All information provided is relevant to the topic	Ideas are arranged in a logical/cause-effect sequence	All aspects required by the essay have been addressed
Only information relevant to the <i>menstrual cycle</i> or the <i>role of hormones of the menstrual cycle</i> is given. (There is no irrelevant information)	The events of the menstrual cycle are presented in the correct sequence and the hormones linked to the appropriate events	The role of all 4 hormones in the menstrual cycle are mentioned
1 mark	1 mark	1 mark

(20)

Structural suitability of the sperm cell for internal fertilisation

- The front of the head of the sperm cell contains an acrosome✓/vesicle which carries enzymes to dissolve a path into the ovum✓
 - Nucleus of the sperm✓ carries genetic material of the male✓/ haploid number of chromosomes
 - The middle piece contains mitochondria✓ which release energy✓ so that sperms could swim
 - The presence of a long tail✓ enables sperm cells to swim✓ towards the ovum
 - The contents of the sperm cell such as the cytoplasm is reduced✓/condensed making the sperm light for efficient movement✓
- (Any 3 x 2)

Fertilisation

- In the Fallopian tubes✓
 - one sperm cell makes contact with the ovum's membrane✓
 - The nucleus of the sperm enters the ovum✓
 - Then the ovum membrane becomes impenetrable✓to other sperms
 - The nucleus of the sperm fuses✓
 - with the nucleus of the ovum✓
 - to form a diploid✓ zygote
 - This is called fertilisation✓
- (Any 5)

Events after fertilisation until implantation

- The zygote divides by mitosis✓many times
 - to form an embryo✓
 - It first consists of a ball of cells✓
 - called the morula✓
 - which then develops into a hollow ball of cells✓
 - called the blastula✓/blastocyst
 - It embeds itself into the uterus lining✓/endometrium
 - using chorionic villi✓
- (Any 6)

Content: (17)

Synthesis: (3)

(20)

Relevance	Logical sequence	Comprehensive
All information provided is relevant to the topic	Ideas arranged in a logical/cause-effect sequence	Covered all aspects required by the essay
Only information regarding: - The structural suitability of the sperm cell - Events during fertilisation - Events after fertilisation until implantation No irrelevant information.	All structures are related to the respective functions of the sperm cell. The sequence of events in fertilisation and post fertilisation until implantation is in the correct order.	At least the following points should be included: - The structural suitability of the sperm cell (4/6) - Events during fertilisation (3/5) - Events after fertilisation until implantation (4/6)
1 mark	1 mark	1 mark

DEVELOPMENTAL CHANGES FROM ZYGOTE TO FOETUS

- The zygote divides by mitosis✓
 - to form a ball of cells✓
 - called the morula✓
 - More mitotic divisions of the morula occurs to form a hollow ball of cells✓
 - called a blastocyst✓

 - The blastocyst attaches to the endometrial lining✓
 - The outer wall of the blastocyst, called the chorion✓ ,
 - develops projections called villi✓ which
 - embeds/implants✓ into the uterine wall
 - The cells of the embryo continues to divide✓
 - and differentiate✓
 - to form the different organs and limbs✓
 - and is now called a foetus✓
- any 10

PROTECTION OF FOETUS

- The foetus is enclosed in a sac called the amnion✓
 - filled with amniotic fluid✓
 - which protects the foetus against temperature fluctuations✓
 - protects the foetus against dehydration✓
 - and protects the foetus against mechanical injury✓/acts as a shock absorber
- any 3

NOURISHMENT OF FOETUS

- The chorionic villi and the endometrium form the placenta✓
 - where the blood of both the foetus and the mother✓
 - run close to each other✓
 - allowing for nutrients to diffuse✓ into the blood of the foetus
 - The umbilical vein✓
 - carries the absorbed nutrients from the mother to the foetus✓
- any 4

ASSESSING THE PRESENTATION OF THE ESSAY

Relevance	Logical sequence	Comprehensive
All information provided is relevant to the topic	Ideas arranged in a logical/cause-effect sequence	Covered all aspects required by the essay
Only information relating to the development of the zygote to the foetus and its protection and nutrition is included (there is no irrelevant information)	Events that lead to the change from a zygote to a foetus are stated in the order in which they occur + protection and nourishment of foetus	ALL three aspects are included: 1. Development of zygote to foetus(6/10) 2. Protection of the foetus (2/3) 3. Nutrition of the foetus (2/4)
1 mark	1 mark	1 mark

QUESTION 5 - hormones produced by the testes and ovaries and describe the role of each hormone in human reproduction

Testosterone

Produced by seminiferous tubules in the testes

During puberty testosterone stimulates:

- The deepening of the voice as vocal cords elongate in the larynx
- The development of muscles
- The growth of facial, pubic and body hair
- Development of the penis and testes
- The production of sperm in the testes

max (5)

Oestrogen

Produced by the Graafian follicles in the ovaries

- Causes the lining of the uterus/endometrium
- to become thicker/more vascular
- in preparation for a possible implantation of the embryo and development of the foetus

During puberty oestrogen stimulates:

- The widening of the pelvis/hips
- The growth and development of the breasts
- The growth of the female sex organs
- The start of the menstrual cycle, ovulation and menstruation

max (7)

Progesterone

Produced by the corpus luteum and placenta

- Progesterone causes further thickening of the endometrium
- so that it is ready for implantation of the embryo should fertilisation occur
- High levels of progesterone
- inhibits the secretion of FSH
- by the pituitary gland
- which in turn prevents the further development of any new ovum in the ovary

max (5)

Content (17)
Synthesis (3)

ASSESSING THE PRESENTATION OF THE ESSAY

Relevance	Logical sequence	Comprehensive
All information provided is relevant to the topic	Ideas arranged in a logical/cause-effect sequence	Covered all aspects required by the essay
No other hormones except testosterone, oestrogen and progesterone are mentioned	Each hormone named is linked to its correct role.	All THREE correct hormones mentioned with at least THREE roles described for each hormone.
1 mark	1 mark	1 mark

As the ball moved towards the goalkeeper:

- Accommodation✓ took place
- Ciliary muscles contracted✓
- Suspensory ligaments became slack✓
- This reduced the tension on lens✓
- Lens became more convex✓/round
- Refractive power of the lens increased✓
- Image of the ball fell on the retina✓

Any (5)

Hearing

The shout of his team-mate was heard by the goal keeper as follows:

- 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✓

Any (7)

Balance and equilibrium

As he dived:

- 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✓in the utricle and saccule
- 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✓

Any (5)

Content (17)
Synthesis (3)

RELEVANCE	LOGIC	COMPREHENSIVE
All information provided is relevant to the topic	Ideas arranged in a logical/cause-effect sequence	Covered all aspects required by the essay
Only information relating to accommodation, hearing and balance & equilibrium is included. (There is no irrelevant information)	Logical sequence of events in accommodation, hearing and balance & equilibrium.	Includes sufficient information on all 3 processes, i.e. accommodation (min 3/5), hearing (min 4/7) and balance & equilibrium (min 3/5)
1 mark	1 mark	1 mark

Plant stems response to unilateral light

- Plant stems response to light is positively phototropic✓
- Auxins✓
- produced in the tip of the stem✓
- move away from unilateral light✓
- so that there is a high concentration of auxins on the darker side✓
- which stimulates growth✓/cell division/cell elongation
- The low concentration of auxins on the side exposed to light✓
- inhibits growth✓
- This uneven growth✓
- causes the stem to bend towards the light✓

Max 7

(7)

How humans receive and interpret light stimuli

- Light enters the eye ✓
- through the cornea✓
- which refracts the light✓
- It then passes through the aqueous humour✓
- and the pupil✓
- The size of the pupil is adjusted by the iris✓
- to regulate the amount of light that enters the eye✓
- The light then passes through the lens✓
- which also refracts the light✓
- It then passes through the vitreous humour✓
- and reaches the retina✓
- which has the photoreceptors✓/rods and cones which convert the light stimulus into a nerve impulse

Max 10

(10)

Content:

(17)

Synthesis:

(3)

ASSESSING THE PRESENTATION OF THE ESSAY

Relevance	Logical sequence	Comprehensive
All information provided is relevant to the question	Ideas arranged in a logical/ cause-effect sequence	Answered all aspects required by the essay in sufficient detail
All the information provided is relevant to plant stems' response to unilateral light and how humans receive and interpret light stimuli. No irrelevant information.	All the information regarding how plant stems respond to unilateral light and how humans receive and interpret light stimuli are arranged in a logical manner.	At least the following points should be included: - Plant response to unilateral light (4/7) - How humans receive and interpret light stimuli (7/10)
1 mark	1 mark	1 mark

Mechanism of reflex action

Example: withdrawal of hand after being pricked by a pin✓/from hot surface/(any other suitable example) 1 mark

- Receptors in the skin✓
- receive the stimulus✓
- Stimulus is converted into a nerve impulse✓
- The impulse travels along the sensory neuron✓
- towards the spinal cord✓
- along the dorsal root✓ of the spinal nerve✓
- In the spinal cord, the sensory neuron makes synaptic contact✓
- with the connector✓/ interneuron
- and then the impulses are transmitted along the motor neuron✓
- along the ventral root✓ of the spinal nerve
- to the effector organ✓/muscle
- which contracts ✓and pulls the hand away✓
- The reflex action provides a quick response to the stimulus so injury is minimised✓

max (10)

Action of adrenalin

Example: chased by a ferocious dog✓/(any other suitable example) 1 mark

Adrenalin prepares the body to cope with the emergency, danger and stress in the following ways:

- Brain becomes aware of danger✓/emergency situation
- through impulses from the sense organs✓
- Adrenal gland✓ is stimulated to secrete adrenalin
- Messages are then sent to various parts of the body✓ (blood vessels, heart)
- Blood vessels of the skin✓/digestive system constrict✓,
- but the blood vessels to the heart muscles and brain✓
- (important vital organs during an emergency) dilate✓
- The heart rate also increases✓
- Rate and depth of breathing increases✓
- The conversion of glycogen to glucose is promoted✓ in the liver
- Vital organs receive more blood✓/oxygen/glucose
- to raise metabolic activities of cells ✓to release more energy
- muscle tone increases✓
- pupil dilate✓
- to allow a rapid response✓ to ensure safety

max (5)
Content: (17)
Synthesis: (3)

ASSESSING THE PRESENTATION OF THE ESSAY

Relevance	Logical sequence	Comprehensive
All information provided is relevant to the question	Ideas arranged in a logical/ cause-effect sequence	Answered all aspects required by the essay in sufficient detail
Only information relating to reflex action and role of adrenalin. (There is no irrelevant information)	Logical sequence of events in reflex action and the role of adrenalin	Includes sufficient information on all 2 aspects, i.e. reflex action adrenalin (min 6/11), (min 3/6)
1	1	1

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Reflex action

A reflex action is a rapid, automatic response to a stimulus

Mechanism of reflex action

- The sudden and unexpected body contact of spider stimulates✓
 - the receptors✓ and
 - generates nerve impulses✓
 - These impulses are then transmitted along dendrites
 - the cell body and the axon of sensory neurons✓
 - Many sensory neurons combined together to form a sensory nerve✓
 - and therefore, the impulses are transmitted along the sensory nerve
 - towards the spinal nerve✓, to the
 - spinal ganglion✓ in the dorsal branch of the spinal nerve
 - Instead of transmitting the impulse to the brain✓
 - impulses are transferred directly to the connector neuron ✓and
 - to dendrite, cell body and axon of the motor neuron✓
 - Since many motor neurons form part of the spinal nerve
 - impulses are transmitted through the ventral branch✓ of spinal nerve
 - towards the effector✓ (muscle) where it causes
 - a quick response✓ such as diving out of the chair with a loud scream
 - to counter the potentially dangerous condition✓
 - A quick reaction to a dangerous stimulus is called a reflex action✓
 - Impulse to the brain is delayed✓ fractionally
 - to save valuable time to protect✓ the body from the potential danger
- any 7 (7)

Role of adrenalin to enhance fight or flight response

- Increases the rate and depth of breathing✓ so that more oxygen is obtained quickly✓
- Causes the liver to convert more glycogen to glucose✓ so that more energy can be produced by high rate of cellular respiration✓
- increases the rate of heartbeat and blood pressure✓ so that blood with more glucose can be carried quickly to the skeletal muscles and brain✓
- Causes the blood vessels of the muscles, heart and brain to dilate✓ so that more blood with glucose and oxygen can be taken to these parts✓
- Causes the blood vessels of the digestive system and skin to constrict✓ so that less blood is sent to these parts and more blood becomes available for the heart, brain and skeletal muscles✓
- Increases the metabolic rate of the cells in the brain and skeletal muscles✓ so that more energy is released for muscular activity and clear thought✓
- Increases the tone of skeletal muscles✓ so that they can function more effectively

any 4x2 (8)
[17]

ASSESSING THE PRESENTATION OF THE ESSAY

RELEVANCE	LOGIC	COMPREHENSIVE
All information provided is relevant to the topic	Ideas arranged in a logical/cause-effect sequence	Covered all aspects required by the essay
Only information relevant to the definition, mechanisms of reflex action and the role of hormone adrenalin to enhance 'fight or flight' response are discussed (There is no irrelevant information)	The mechanism of reflex action is described in the correct sequence and the effect of adrenalin is appropriately linked to the relevant significance in a logical manner	The definition, mechanism of reflex action thoroughly discussed with at least 4 effects of adrenalin is described together with the significance of each
1 mark	1 mark	1 mark

QUESTION 10**Hypothalamus**

- The change in temperature is detected✓ by the thermo-receptors ✓ in the skin
- Stimulus converted to nerve impulse✓
- Transmitted to the hypothalamus ✓
- Hypothalamus sends impulses to the muscle layer in the arterioles ✓ of the skin

Max 3

- **On a cold day** the arterioles close to the surface constrict✓/vaso-constriction occurs
- Less blood✓ flows to capillaries close to the surface
- Sweat production decreases✓ / less sweat is lost
- less heat is radiated from the body✓/less heat is lost

Max 4

- **On a hot day** the arterioles close to the surface dilate✓/ vaso-dilation occurs
- More blood✓ flows to the capillaries close to the surface
- Sweat production increases✓/ more sweat is lost
- More heat is radiated✓ from the body/more heat is lost

Max 4

Adrenal gland

- Secretes adrenalin✓
- Hormone that prepares the body to cope with emergency✓/danger /stress situations
- Adrenalin causes the blood vessels of the skin to constrict✓
- Less blood flows to the surface of the skin✓
- Because the skin is not an important organ during an emergency✓
- Re-directing more blood /more oxygen and food to vital organs✓ such as the muscles, heart & the brain
- To enable the body to respond during an emergency✓

Max 6

ASSESSING THE PRESENTATION OF THE ESSAY

Relevance	Logical sequence	Comprehensive
All information provided is relevant to the topic	Ideas are arranged in a logical/cause-effect sequence	All aspects required by the essay have been addressed
Only information relevant to the role of the hypothalamus and the adrenal glands in bringing about changes to the blood vessels of the human skin (There is no irrelevant information)	the role of the hypothalamus and the adrenal glands in bringing about changes to the blood vessels of the human skin in the correct sequence	At least the following points should be included: - The role of all hypothalamus on a cold and on a hot day (6/11) - The role of adrenal glands (3/6)
1 mark	1 mark	1 mark

QUESTION 11

The pituitary✓ is sensitive to the concentration of the hormone, thyroxin✓ in the blood✓
 When the thyroxin concentration in the blood decreases✓ below the normal level:

- The pituitary is stimulated to secrete more TSH✓
- TSH stimulates✓
- the thyroid ✓ gland
- to secrete more thyroxin✓
- Thus increasing the level of thyroxin✓
- in the blood to normal levels✓

When the thyroxin concentration in the blood increases✓ above the normal level:

- The pituitary is not stimulated to secrete TSH✓
- There is less stimulation of the thyroid gland to secrete thyroxin✓
- Thus decreasing the level of thyroxin✓ in the blood to normal levels✓

Max 10 (10)

Consequences of mechanism not working

The concentration of thyroxin will not be regulated✓

(1)

When the thyroxin level increases beyond normal limits✓ it causes

Hyperthyroidism✓

Hyperthyroidism causes an increase in rate of metabolism✓ resulting in:

- Weight loss✓
- Irritable✓/anxiety
- Hyperactive✓
- Increase in heart rate✓
- Tiredness✓

Thyroid gland swells✓/goitre

Eyeballs protrude✓

Max (3)

When the thyroxin level decreases beyond normal limits✓ it causes

Hypothyroidism✓

Hypothyroidism causes an decrease in rate of metabolism✓ resulting in:

- Weight gain✓
- Decrease in heart rate✓
- Slow growth of hair and fingernails✓

Max (3)
 Content: (17)
 Synthesis: (3)

Relevance	Logical sequence	Comprehensive
All information provided is relevant to the topic	Ideas are arranged in a logical/cause-effect sequence	All aspects required by the essay have been addressed
Only information relevant to the negative feedback related to thyroid gland and consequences if it fails (There is no irrelevant information) (There is no irrelevant information)	The ideas are in the correct sequence	At least the following points should be included: - The negative feedback (6/10) - hypethyroidism (2/3) - hypothyroidism (2/3)
1 mark	1 mark	1 mark

QUESTION 12

Hormones secreted by the pituitary gland

Growth Hormone✓/(GH)

- Stimulates the growth of the long bones✓/skeletal muscles.

Follicle Stimulating Hormone✓/FSH

- Stimulates follicle development ✓in the ovaries of females.

Luteinising Hormone✓(LH)

- Stimulates ovulation✓/formation of the corpus luteum in the ovaries

Thyroid Stimulating Hormone✓/TSH

- Regulates the growth of the thyroid gland✓/secretion of thyroxine

Prolactin✓

- Stimulates the production of milk✓ by the mammary glands

ADH✓

- Regulates the water content✓ in the blood

Any 4x2 (8)

Pituitary Control of Thyroid Function

- The pituitary is sensitive to the concentration of the hormone thyroxine✓ in the blood
- When the thyroxine concentration in the blood decreases✓ below a certain level
- the pituitary gland is stimulated to secrete more TSH✓
- TSH stimulates the thyroid gland✓
- to secrete more thyroxine✓
- thus increasing the level of thyroxine in the blood✓
- back to the normal level✓
- When the thyroxine concentration in the blood increases✓ above a certain level
- the pituitary gland secretes less TSH✓
- The lower TSH level means that the thyroid gland secrete less thyroxine✓
- This decreases the level of thyroxine in the blood✓
- back to the normal level✓

Max (9)

ASSESSING THE PRESENTATION OF THE ESSAY

Description	Marks
All information given is relevant to the hormones of the pituitary gland and negative feedback involving the thyroid gland	1
The different events in negative feedback are presented in the correct sequence	1
Provided sufficient information on the hormones and negative feedback	1

(20)

QUESTION 13

When abnormal levels of glucose are detected✓

- by the pancreas✓,
- the Islets of Langerhans✓ secretes hormones
- into the bloodstream✓

When blood glucose level rises✓

- Insulin✓ is secreted
- to decrease the blood glucose level✓
- back to normal✓
- insulin secretion is then inhibited✓

When blood glucose level falls✓

- Glucagon✓ is secreted
- to increase the blood glucose level✓
- back to normal✓
- glucagon secretion is then inhibited✓

Any (10)

Causes of diabetes mellitus

- Inadequate secretion✓
- Non-secretion of insulin✓
- Production of defective insulin✓
- Body cells resistant to the action of insulin✓
- Inability of the cells to use glucose efficiently✓

Any (2)

Symptoms

- Glucose in the urine✓
- Frequent urination✓
- Extreme thirst✓
- Fatigue✓/lethargy/faintness
- Nausea✓/Vomiting
- Weight loss✓
- Blurred vision✓
- Non-healing of wounds✓

Any (3)

Management of diabetes mellitus

- Exercise✓
- Eating diet suitable for diabetic person✓
- Using prescribed medication/drugs ✓ for the management of diabetes

Any (2)

Content: (17)

Synthesis (3)

ASSESSING THE PRESENTATION OF THE ESSAY

Relevance	Logical sequence	Comprehensive
All information provided is relevant to the question	Ideas arranged in a logical/ cause-effect sequence	Answered all aspects required by the essay in sufficient detail
Only the description of how the principle of negative feedback operates in controlling the glucose concentration AND the causes, symptoms and management of diabetes (no irrelevant information)	All information is arranged in the correct sequence	At least the following points should be included: - The negative feedback for glucose control (6/10) - The causes of diabetes (1/2) - symptoms (2/3) - management (1/2)

(20)

QUESTION 14

Possible answer

Reflex action

- when the snake slides over Sifiso's foot, receptors are stimulated✓
- and generate nerve impulses✓
- which are transmitted along the sensory neuron✓
- to the spinal cord✓ by the spinal nerve
- within the spinal cord the sensory neuron makes a synaptic contact
- with a connector neuron✓
- The connector neuron makes a synaptic contact with a motor neuron✓
- The impulse is relayed via the motor neuron✓ along the ventral root of the spinal nerve
- to the muscles✓ of the foot / leg
- The muscles are stimulated to contract✓
- to allow Sifiso to respond rapidly ✓/ move his foot/leg

Max 6

Role of Adrenalin

- When Sifiso gets a fright the adrenal glands✓
- secrete adrenalin ✓
- This hormone causes the following changes which allow him to respond rapidly✓
- Increases the rate of the heartbeat✓
- Increases the blood pressure ✓
- Causes the liver to convert stored glycogen to glucose✓
- Constricts blood vessels of the skin✓ so that more blood is available to the muscles
- Increases the metabolic activity of the cells✓

Max 6

Balance

- Various structures in Sifiso's inner ear✓ ensure that he maintains his balance as he jumps away
- Cristae ✓found in ampullae✓ at the base of semi-circular canals✓ respond to changes in direction and speed✓
- Maculae✓ in the utricle and sacculus✓ respond to changes in the position of the head due to gravity✓
- Both these stimuli are converted into a nerve impulse✓ and are taken via the vestibular branch of the auditory nerve✓ to the cerebellum✓
- The cerebellum sends impulses to the muscles✓ / tendon and ligaments to ensure that Sifiso's balance is maintained while he jumps away from snake

Max 5

Content (17)

Synthesis (3)

ASSESSING THE PRESENTATION OF THE ESSAY

RELEVANCE	LOGIC	COMPREHENSIVE
All information provided is relevant to the topic	Ideas arranged in a logical/cause-effect sequence	Covered all aspects required by the essay
Only information relevant to the reflex action and the role of hormone adrenalin and balance are discussed (There is no irrelevant information)	The mechanism of reflex action, the effect of adrenalin and maintenance of balance are presented in the correct sequence	The learner must obtain at least -4/6 marks for reflex action -4/6 marks for role of adrenalin and -3/5 marks for balance
1 mark	1 mark	1 mark

QUESTION 15

Capturing and transmission of sound waves at the outer ear

- Sound waves which travel through the air are captured and directed by the pinna✓
- through the auditory canal ✓
- to the tympanic membrane ✓
- causing it to vibrate✓

(Max 2)

Transmission of sound vibrations at the middle ear

- The vibrations are transferred to the ossicles ✓ (malleus, incus and stapes) of the middle ear
- The stapes transfers the sound vibrations on to the oval window ✓

(Max 2)

Transmission of pressure waves/vibrations at the inner ear

- In the inner ear pressure waves are set up in the perilymph✓
- of the vestibular canal in the inner ear. ✓
- The vibrations are transferred through the membrane of the middle canal✓ to the endolymph.
- The pressure waves created in the endolymph stimulate the hair cells✓
- of the organs of Corti. ✓
- The hair cells send impulses along the auditory nerve✓
- to the cerebrum. ✓
- The signals received from ear are then processed and interpreted. ✓
- The pressure waves are then transferred to the tympanic canal ✓
- where they are finally absorbed by the round window. ✓

(Max 7) (11)

Role of the ear in the maintenance of balance

- The ampullae ✓ /broader bases of semi-circular canals
- consist of cristae. ✓
- The three semicircular canals are positioned in three different planes ✓
- and therefore, any sudden changes in the speed and direction of body movement, ✓
- cause the endolymph to move ✓ at least in one of the semi-circular canals.
- The movement of endolymph stimulates ✓
- the cristae to generate and send impulses. ✓
- The sacculae and utriculae✓
- consist of special receptor structures called maculae. ✓
- When the direction of the head changes, ✓
- gravitational pull stimulates ✓
- hair cells (receptors) of maculae to generate impulses. ✓
- the impulses generated from both cristae and maculae are sent to cerebellum. ✓
- The cerebellum sends impulses to the muscles to restore the balance. ✓

(Max 6) (6)

ASSESSING THE PRESENTATION OF THE ESSAY

RELEVANCE	LOGIC	COMPREHENSIVE
All information provided is relevant to the topic	Ideas arranged in a logical/cause-effect sequence	Covered all aspects required by the essay
Only information relevant to the hearing and balance is given (There is no irrelevant information)	Events of hearing and balance are provided in the correct sequence	The learner has scored at least half of the marks of the hearing process and described the function of cristae and maculae in the maintenance of balance
1 mark	1 mark	1 mark

QUESTION 16

Hearing

- Pinna traps/directs the sound waves✓
- into the ear canal✓/meatus
- This causes the tympanic membrane to vibrate✓
- The vibration is transmitted to the auditory ossicles✓
- The ossicles amplify the vibration✓
- and transmit it to the oval window✓
- The oval window vibrates✓
- creating waves✓
- in the fluid/endolymph of the cochlea✓
- which 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 as the roar of the lion

Max 10

Role of Adrenalin

- More adrenalin is secreted✓
- Adrenalin increases muscle tone✓
- And causes the liver/muscles to convert glycogen into glucose✓
- The heart rate increases✓
- so that the muscles receive more glucose✓
- and oxygen✓
- needed for cellular respiration✓
- to provide the energy✓ for the muscles to contract efficiently
- The rate of breathing increases✓
- and the depth of breathing increases✓
- to exhale carbon dioxide from the muscles faster✓
- and inhale oxygen faster✓
- Constriction of blood vessels to the gut✓/skin
- and dilation of blood vessels to the vital organs✓/brain/muscles
- allowing more blood to be supplied to vital organs✓/brain/muscles

Max 7

Content: 17
Synthesis: 3

ASSESSING THE PRESENTATION OF THE ESSAY

ASSESSING THE PRESENTATION OF THE ESSAY

Relevance	Logical sequence	Comprehensive
All information provided is relevant to the question	Ideas arranged in a logical/cause-effect sequence	Answered all aspects required by the essay in sufficient detail
All the information provided is relevant to hearing and how adrenalin ensures that muscles function efficiently There is no irrelevant information	All the information regarding hearing and how adrenalin ensures that muscles function efficiently is arranged in a logical manner	At least the following marks should be obtained for each of the following: - Hearing (7/10) - How adrenalin ensures that muscles function efficiently (4/7))

QUESTION 17

Thermoregulation✓

- Receptors✓ in the skin detect the stimulus
- Send the impulses to the hypothalamus✓ of the brain
- The hypothalamus sends impulses to the blood vessels✓ of the skin
- Blood vessels constrict✓ (become narrow)/vasoconstriction occurs
- Less blood flows to the skin✓
- Less heat is lost✓ from the skin
- Less blood is sent to the sweat glands✓
- Sweat glands become less active✓/Less sweat is released
- There is less evaporation of sweat✓
- and less cooling of the skin✓

Max (8)

Hearing

- The pinna traps the sound waves✓
- and directs them into the auditory canal✓/meatus
- This causes the tympanic membrane to vibrate✓
- The vibration is transmitted to the auditory ossicles✓/(malleus, incus, stapes)
- The ossicles amplify the vibration✓
- and transmit it to the oval window✓
- The oval window vibrates✓
- creating pressure waves✓
- in the endolymph✓
- which stimulates the Organ of Corti✓
- The stimulus is converted to an impulse✓
- The impulse is transmitted via the auditory nerve✓
- to the cerebrum✓
- where sound is interpreted✓

Max (9)

Content: (17)
 Synthesis: (3)
(20)

ASSESSING THE PRESENTATION OF THE ESSAY

Relevance	Logical sequence	Comprehensive
All information provided is relevant to the question	Ideas arranged in a logical/ cause-effect sequence	Answered all aspects required by the essay in sufficient detail
Only information regarding: - Thermoregulation in cold conditions and - Hearing is described No irrelevant information.	The sequence of events in thermoregulation and hearing is in the correct order.	At least the following points should be included: - Thermoregulation in cold conditions (5/8) - Hearing (6/9)
1 mark	1 mark	1 mark

TOTAL SECTION C: 20

QUESTION 18

Increasing the metabolic rate

- To increase the metabolic rate the level of thyroxine must increase✓
- The pituitary gland is stimulated✓
- to secrete more TSH✓
- which stimulates the thyroid gland✓
- to secrete more thyroxine✓

(Any 4) (4)

Increasing the level of glucose

- As a result of the decrease in glucose level the pancreas is stimulated✓
- to secrete glucagon✓
- which stimulates the conversion of stored glycogen to glucose✓
- in the liver✓/muscles
- The glucose is then released into the bloodstream✓
- The glucose level in the blood increases✓ and returns to normal

(Any 5) (5)

Decreasing the level of CO₂

- High CO₂ levels stimulate the receptor cells in the carotid artery✓
- The stimulus is converted to an impulse✓
- and sent to the medulla oblongata✓
- which stimulates the heart✓
- to beat faster✓
- bringing blood with CO₂ quickly to the lungs ✓
- It also stimulates the breathing muscles✓
- to increase the depth and rate of breathing✓
- CO₂ is exhaled quickly from the lungs✓
- The CO₂ level in the blood decreases✓ and returns to normal

(Any 8) (8)
 Content: (17)
 Synthesis: (3)
(20)

ASSESSING THE PRESENTATION OF THE ESSAY

Relevance	Logical sequence	Comprehensive
All information provided is relevant to the question	Ideas arranged in a logical/ cause-effect sequence	Answered all aspects required by the essay in sufficient detail
All the information provided is relevant to the: - Mechanism to increase metabolic rate - Mechanism to increase glucose level - Mechanism to decrease CO₂ level There is no irrelevant information.	All the information regarding the: - Mechanism to increase metabolic rate - Mechanism to increase glucose level - Mechanism to decrease CO₂ level is arranged in a logical manner.	At least the following points should be included: - Mechanism to increase metabolic rate (3/4) - Mechanism to increase glucose level (3/5) - Mechanism to decrease CO₂ level (5/8)
1 mark	1 mark	1 mark

TOTAL SECTION C: 20

POSSIBLE ESSAYS FOR PAPER 2

1. Describe the process of protein synthesis and the way in which this process would be affected by a gene mutation.

Content: (17)
 Synthesis: (3)
(20)

2. Describe the mechanisms by which meiosis contributes to genetic variation and describe how abnormal meiosis leads to Down's syndrome.

Content: (17)
 Synthesis: (3)
(20)

3. Describe how point mutations, frame-shift mutations and meiosis contribute to genetic variation.

Content: (17)
 Synthesis: (3)
(20)

4. Start with a cell containing FOUR chromosomes and describe ALL the chromosomal changes that occur during meiosis, resulting in the formation of abnormal gametes due to non-disjunction in meiosis 1.

Content: (17)
 Synthesis: (3)
(20)

5. Describe how meiosis and different types of mutations contribute to genetic variation and the role of this variation in natural selection.

Content: (17)
 Synthesis: (3)
(20)

6. Describe how genetic variation is brought about in gametes through cell division and name and describe the specific process that takes place in the formation of an ovum.

Content: (17)
 Synthesis: (3)
(20)

7. One of the observations Darwin made during his study of pigeons was about artificial selection. In 1859 Darwin and Wallace jointly proposed that new species could develop by a process of natural selection. Using examples, describe natural and artificial selection and also highlight the differences between these two processes.

Content: (17)
 Synthesis: (3)
(20)

8. Describe the structural changes to the skull that characterise the evolution of modern humans from their ape-like ancestors, and explain the significance of these changes.

Content: (17)
 Synthesis: (3)
(20)

9. Charles Darwin and Jean Baptiste de Lamarck had different ideas to explain evolution. Describe how each of them would have explained the evolution of the long necks of giraffes. Justify whose idea is more acceptable in the science community today.

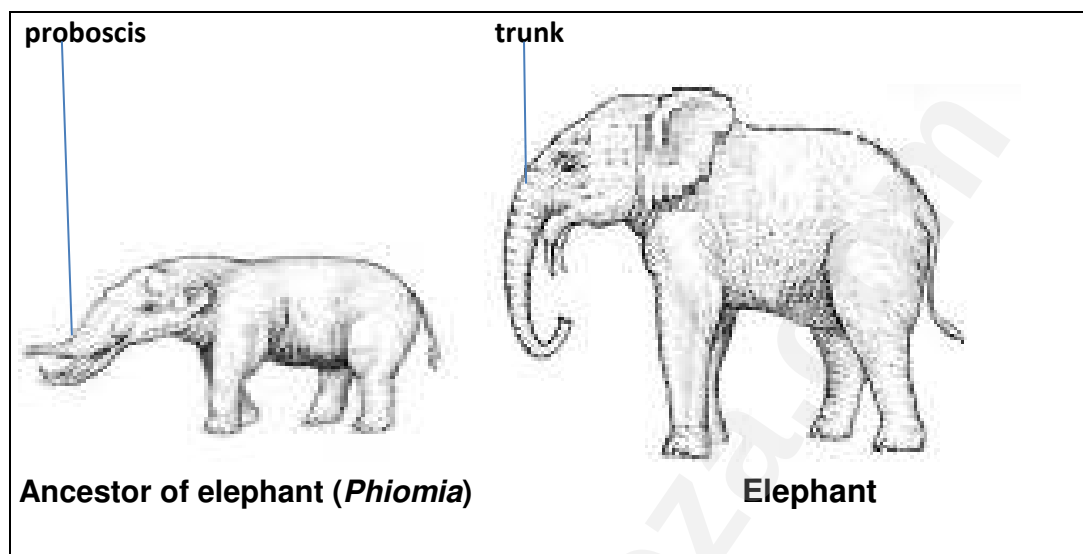
Content: (17)
 Synthesis: (3)
(20)

10. Describe how Lamarck and Darwin explained evolution, and compare Darwin's ideas to the ideas of Punctuated Equilibrium.

Content: (17)
 Synthesis: (3)

(20)

11. An ancestor of the elephant, *Phiomia*, had a long nose-like structure called a proboscis which evolved into the trunk of the elephant. The proboscis was used to gather leaves as food. The proboscis of *Phiomia* and the trunk of the elephant are shown below. The diagrams have been drawn to scale.



Explain the evolution of the elephant's trunk in terms of Lamarckism and Darwinism as well as the way in which an increase in the length of the trunk of the elephant could be achieved through artificial selection.

Content: (17)

Synthesis: (3)

(20)

12. It is thought that modern humans evolved gradually from ape-like beings over millions of years through speciation.

Describe how a single species can form new species that are so different from each other and explain how the differences in the skulls and other parts of the skeleton of primitive ape-like beings and modern humans support the idea that the general trend in human evolution has been towards bipedalism and a change in diet from raw food to cooked food.

Content: (17)

Synthesis: (3)

(20)

13. Describe what stem cells are, and give THREE sources from which human stem cells may be harvested. Also explain THREE arguments, with reasons, for the use of stem cells and THREE arguments, with reasons, against the use of stem cells in humans.

Content: (17)

Synthesis: (3)

(20)

14. Clones are a group of genetically identical organisms. Describe how cloning of a sheep can be conducted and explain THREE advantages and THREE disadvantages with reasons of cloning.

Content: (17)

Synthesis (3)

(20)

15. Using genetically modified organisms as a source of food is supported by some people and rejected by others. Describe how genetic modification in plants and animals is performed by humans to satisfy their needs and explain SIX advantages of using genetically modified organisms as a source of food. Also discuss disadvantages / opposition to genetic modification of food and give your opinion on the labelling of genetically modified foods as these foods are currently not labelled.

Content: (17)

Synthesis: (3)

(20)

16. Fossils of the bipedal primates *Ardipithecus*, *Australopithecus* and early *Homo* species are used to support the 'Out of Africa' hypothesis.

State the 'Out of Africa' hypothesis. Describe the evidence that supports the 'Out of Africa' hypothesis and the evidence that shows that the three primate genera mentioned above, were all bipedal.

Content: (17)

Synthesis: (3)

(20)

17. Differentiate between a population and a species, describe speciation by geographic isolation and explain how speciation and extinction affect biodiversity.

Content: (17)

Synthesis: (3)

(20)

18. The anole lizard of the Caribbean Islands represents a group of about 150 closely related species, which evolved within the past 50 million years from a single species.

Use this example to describe how natural selection led to the process of speciation that gave rise to the 150 different species of lizards.

Content: (17)

Synthesis: (3)

(20)**19.**

Describe how a gene mutation may influence the structure of a protein. Also use ONE example to describe the role of mutations in evolution in present times.

Content: (17)

Synthesis: (3)

(20)

QUESTION 1**PROTEIN SYNTHESIS****Transcription✓ (T)**

- Double stranded DNA unwinds ✓
- and unzips when✓
- the hydrogen bonds break✓
- and this is controlled by enzymes✓
- One strand is used as a template✓
- to form mRNA✓
- using free RNA nucleotides from the nucleoplasm✓
- The mRNA is complementary to the DNA✓
- mRNA now has the coded message for protein synthesis✓

Translation✓ (S)

- mRNA moves from the nucleus✓/to the ribosome
- Each tRNA carries an amino acid✓
- tRNA carries the amino acid to the ribosome✓
- When the anticodon on the tRNA✓
- matches the codon on the mRNA✓
- Amino acids become attached✓ in the sequence determined by the mRNA
- by peptide bonds✓
- to form the required protein✓

Max 13

EFFECTS OF A MUTATION (M)

- A gene mutation affects arrangement/type of the nitrogen bases✓/nucleotides
- This changes the code on the DNA ✓
- which changes the code on the RNA✓
- A different amino acid✓ may be coded for
- which causes a change in the amino acid sequence✓ in the protein
- leading to the formation of a different/alternate/no protein

Max 4

Content: (17)

Synthesis: (3)

ASSESSING THE PRESENTATION OF THE ESSAY

Criterion	Relevance (R)	Logical sequence (L)	Comprehensive (C)
Generally	All information provided is relevant to the question	Ideas are arranged in a logical/cause-effect sequence	All aspects required by the essay have been sufficiently addressed
In this essay in Q4	Only information relevant to the description of protein synthesis and the effects of mutation on the process is given	The description of protein synthesis and the effects of mutation on the process given are logical and sequential	At least 5 correct points in the description of transcription and 5 correct points in the description of translation and 2 correct points on the effects of mutation
Mark	1	1	1

(20)

QUESTION 2**Crossing – over✓**

- Homologous chromosomes✓/bivalents pair up
- Each chromosome has 2 chromatids✓
- Chromatids overlap/cross over✓
- Points at which crossing-over takes place are referred to as chiasmata✓
- Genetic material is exchanged✓ between non-sister chromatids✓
- After the process of crossing-over chromosomes have genes from its homologous partner ✓
- This means that each gamete formed will have a mix of genes from maternal and paternal parents✓
- Brings about variation in the gametes ✓formed and also the offspring

Max 7**Random arrangement of chromosomes at the equator ✓**

- Each pair of homologous chromosomes ✓ may line up either way on the equator of the spindle ✓
- Independently of what the other pairs are doing✓/ independent assortment
- This means that gametes will have differing number/mix of maternal and paternal chromosomes✓

Max 4**Down's syndrome**

- In meiosis 1✓ the chromosome pair 21 does not separate ✓ or
- In meiosis II ✓ the chromatids of chromosome 21 do not separate✓/ centromere does not divide
- Referred to as non-disjunction✓
- One gamete will have an extra copy of **chromosome number 21** ✓/ two copies of chromosome number 21
- If this gamete fuses with a normal gamete✓ /gamete with 23 chromosomes
- The resulting zygote will have 3 copies ✓of chromosome number 21 instead of 2 / zygote has 47 chromosomes leading to Down's syndrome

Max 6

Content: (17)
Synthesis: (3)
 (20)

QUESTION 3**Possible answer****GENE MUTATIONS**

- Errors✓/mistakes/changes may occur during transcription✓/ DNA replication
- **Point mutations**: replacing/substituting one base of a codon with another✓
- Small change that may possibly result in one amino acid ✓changing in a protein
- **Frame-shift mutations**: addition/deletion of one or more bases of a codon✓
- Resulting in changing the order/sequence of all the bases of the codons ✓
- Resulting in forming a different protein✓ with different functions✓
- Lead to different phenotypes✓

Max (6)**MEIOSIS****Crossing-over✓**

- Homologous chromosomes✓/bivalents pair up
- Each chromosome has 2 chromatids✓
- Non-sister chromatids overlap/cross over✓
- Points at which crossing-over takes place are referred to as chiasmata✓
- Genetic material is exchanged✓ between non-sister chromatids✓
- After the process of crossing-over chromosomes have alleles from its homologous partner ✓
- This means that each gamete formed will have a mix of alleles from both parents✓
- Brings about variation in the gametes ✓formed and also the offspring

Max (7)**Random arrangement of chromosomes ✓at the equator**

- Each pair of homologous chromosomes ✓may line up either way up on the equator of the spindle ✓
- Independently of what the other pairs are doing✓
- This means that gametes will have differing number/mix of both parental chromosomes ✓

Max (4)

Content: (17)
Synthesis: (3)

ASSESSING THE PRESENTATION OF THE ESSAY

Relevance	Logical sequence	Comprehensive
All information provided is relevant to the topic	Ideas are arranged in a logical/cause-effect sequence	All aspects required by the essay have been sufficiently addressed
Only information relevant to gene mutations, crossing over and random arrangement of chromosomes at equator (there is no irrelevant information)	Information regarding crossing over, random arrangement of chromosomes, mutation and natural selection arranged in logical way within each aspect	At least the following points should be included: • gene mutations (3/6), • crossing over (4/7) and • random arrangement of chromosomes at equator (2/4)
1	1	1

QUESTION 4**Possible Answer**

- Each chromosome shortens and becomes visible✓
- as two chromatids✓
- joined by a centromere✓
- Homologous chromosomes come to lie next to each other✓
- Chromatids from each homologous chromosome overlap✓/crossing over occurs
- The point of overlap is called the chiasma✓
- Genetic material is exchanged✓ between the homologous chromosomes
- The chromosomes line up along the equator✓
- in homologous pairs✓
- attached to the spindle fibres✓
- When the spindle fibres shorten✓/contract
- * **All 4 chromosomes are pulled to one pole**✓ due to non-disjunction
- Resulting in two cells✓
- * **one with 4 chromosomes**✓
- * **and one with no chromosomes**✓
- The cell with 4 chromosomes undergoes meiosis 2✓
- The 4 chromosomes line up at the equator✓
- in a single row✓
- When the spindle fibres shorten✓/contract
- the centromeres split✓
- and chromatids✓/daughter chromosomes
- are pulled to the opposite poles of the cell✓
- Two cells result✓
- * **Each with a nucleus containing 4 chromosomes**✓
- * **Resulting in diploid gametes**✓

Any 4 compulsory* points + any other 13

17 marks

Content: (17)

Synthesis (3)

ASSESSING THE PRESENTATION OF THE ESSAY

Relevance	Logical sequence	Comprehensive
All information provided is relevant to the topic	Ideas are arranged in a logical/cause-effect sequence	All aspects required by the essay have been sufficiently addressed
All information given is relevant to chromosomal changes only and non-disjunction (there is no irrelevant information)	The events of meiosis are presented in the sequence in which they occur	Provided information on both the normal and abnormal events in meiosis
1	1	1

(20)

QUESTION 5**Meiosis**

- **Crossing over**✓
- occurs during prophase I✓
- Homologous chromosomes / chromatids overlap✓
- at points called chiasma✓/ chiasmata
- Genetic material is exchanged✓
- resulting in new combinations of genetic material ✓
- **Random arrangement**✓**of chromosomes**
- occurs during metaphase✓
- so that they separate in a random✓/ independent manner
- resulting in new combinations of genetic material✓

Max 3

Max 3

Mutations

- A gene✓/ (point and frameshift) mutation occurs
- as a result of a change in sequence of nitrogen bases✓ in the DNA molecule
- A chromosome✓ mutation occurs as a
- result of a change in the structure of a chromosome✓/ number of chromosomes during meiosis
- Mutations that occur in sex cells✓
- are passed on to the new generations✓
- creating new characteristics✓

Max 5

Role of variation in natural selection

- Organisms of a particular species shows a great deal of variation✓
- Some individuals may have characteristics that are favourable✓ / any example
- Others may have characteristics/any example that are unfavourable✓
- If there is competition/changing environmental conditions✓/ Selective pressure by the environment
- organisms with favourable characteristics survive✓
- and reproduce✓
- and pass this favourable characteristics to their offspring✓
- while organisms with unfavourable characteristics will die out✓
- Over time the whole population will have this favourable trait✓

Max 6

Content: (17)

Synthesis:(3)

ASSESSING THE PRESENTATION OF THE ESSAY

Criterion	Relevance (R)	Logical sequence (L)	Comprehensive (C)
Generally	All information provided is relevant to the topic	Ideas are arranged in a logical sequence for each process	All aspects required by the essay have been sufficiently addressed
In this essay	Only information relevant to the contribution of crossing over, random arrangement of chromosomes, mutation and natural selection is given	Information regarding crossing over, random arrangement of chromosomes, mutation and natural selection arranged in logical way within each aspect	At least three correct points included on each of the three aspects: meiosis, mutations and natural selection
Mark	1	1	1

(20)

QUESTION 6

Genetic variation is brought about in gametes through meiosis✓ in two ways:

Crossing-over ✓

- During Prophase I✓
 - Homologous chromosomes✓/bivalents pair up
 - Each chromosome has 2 chromatids✓
 - Non-sister chromatids of the homologous pair overlap✓/cross over
 - Points at which crossing-over takes place are referred to as chiasmata✓
 - Genetic material is exchanged✓
 - between non-sister chromatids✓
 - After the process of crossing-over chromosomes have genes from its homologous partner✓
 - This means that each gamete formed will have a mix of genes from maternal and paternal parents✓
- Max (7)

***Random arrangement of chromosomes at the equator ✓**

- During Metaphase I✓
 - Each pair of homologous chromosomes✓
 - *may line up either way✓/randomly on the equator of the spindle
 - *Independently of what the other pairs are doing✓/ independent assortment
 - During Metaphase II✓
 - Each individual chromosome✓
 - *may line up either way✓/flipped on the equator of the spindle
 - *This means that gametes will have differing number/mix of maternal and paternal chromosomes✓/chromatids
- Max (5)
- (at least 1 of the *compulsory and any 4 which could include compulsory points)**

Formation of an ovum

- During oogenesis✓
 - diploid cells✓
 - in the ovary✓
 - undergo meiosis✓
 - to form a primary oocyte✓
 - consisting of haploid cells✓
 - One cell✓ develops into an ovum
- Max (5)

ASSESSING THE PRESENTATION OF THE ESSAY

Relevance	Logical sequence	Comprehensive
All information provided is relevant to the question	Ideas arranged in a logical/ cause-effect sequence	Answered all aspects required by the essay in sufficient detail
All the information provided is relevant to crossing over, random arrangement and development of an ovum.	All the information regarding crossing over, random arrangement and development of an ovum is arranged in a logical manner.	At least the following marks should be obtained: - Crossing over (5/7) - Random arrangement (3/5) - Development of an ovum (3/5)
There is no irrelevant information		
1 mark	1 mark	1 mark

TOTAL SECTION C: 20

QUESTION 7

Natural selection e.g. Finches*✓/or any other example

- Organisms of a particular species shows a great deal of variation✓
- Some individuals may have characteristics /any example that are favourable✓ /some individuals may be adapted to the environment
- Others may have characteristics/any example that are unfavourable✓
- Selective pressure by the environment✓ due to competition✓/changing environmental conditions
- Organisms with favourable characteristics survive✓ and reproduce✓
- to pass favourable characteristics to their offspring✓
- while organisms with unfavourable characteristics will die out✓
- Over time the whole population will have this favourable trait✓
- Over time these organisms might develop genotypically and phenotypically independently✓
- into different species✓ which cannot interbreed

***Compulsory mark**

Max 7 + 1 for example*

Artificial selection e.g. Production of improved fruit/ meat production*✓

- Organisms of a particular species/any example show a great deal of variation✓
- Humans✓ select organisms
- with a particular desirable characteristic✓
- and interbreed✓ them
- with other organisms that also✓ have the same desirable characteristic
- to improve this characteristic further✓ in the offspring
- They may also choose organisms with different✓ desirable characteristics
- to get offspring with a combination✓ of these desirable characteristics

***Compulsory mark**

Max 4 + 1 for example*

Differences between Natural and Artificial selection

Natural selection	Artificial selection
Selective pressure by the environment✓	Humans select the desirable characteristic✓
Selection is in response to suitability to the environment✓	Selection is in response to satisfying human needs✓
Organisms can survive on their own✓ in the environment (since they were selected on the basis of their suitability to the environment)	Organisms may often not survive on their own✓ in the environment (since they were selected on the basis of human needs and not on suitability to the environment)
No human effort/cost involved✓	Could be labour intensive✓/expensive

Any 2x2

(4)

QUESTION 8- structural changes to the skull that characterise the evolution of modern humans from their ape-like ancestors, and explain the significance of these changes.

Foramen magnum

- The foramen magnum was in a backward position in the ape-like beings✓^F
- but in a forward/ central/ ventral position in modern humans✓^F

Significance

- This represents a change from quadrupedalism in ape-like beings✓^S
- To bipedalism/(walking upright) in modern humans✓^S, leading to the following in modern humans:
 - o Increased awareness of the environment✓^S in sensing danger/food
 - o Freeing of the hands to use implements✓^S/ carry objects/ weapons/ offspring
 - o Exposure of a large surface area for thermoregulation✓^S/losing body heat to surroundings in hot conditions/reducing overheating
 - o Display of sex organs /breasts as part of courtship behaviour✓^S

Cranium

- Modern humans have a larger cranium✓^F *than the ape-like beings*✓^F
- Modern humans have a less sloping forehead✓^F *than the ape-like beings*✓^F
- Modern humans have a cranium that is more rounded✓^F *than the ape-like beings*✓^F

Significance

- This allowed space for a larger brain✓^S in humans *than in ape-like beings*✓^S, making the following possible:
 - o Better co-ordination of movement✓^S
 - o Processing of a large amount of information✓^S
 - o Processing information faster✓^S
 - o Development of spoken and written languages to communicate✓^S

Jaws

- Humans have smaller jaws✓^F *than the ape-like beings*✓^F
- Humans have jaws that are non-prognathous✓^F/ flat face compared to the jaws of ape-like beings which are prognathous✓^F/sloping face
- Humans have C-shaped jaws✓^F/jaws that are gently curved compared to the U shaped jaws✓^F in the ape-like beings

Significance

- This corresponds with a change in diet from hard, raw food✓^S in the ape- like beings
- To softer, cooked food✓^S in humans

Dentition/Teeth

- In ape-like beings there are gaps✓^F/diastema between incisors and canines
- but no gaps✓^F between the teeth in humans
- Humans have smaller teeth✓^F/incisors and canines *than the ape-like beings*✓^F
- Humans have flatter molars and pre-molars✓^F *than the ape-like beings*✓^F

Significance

- This corresponds with the decreased need to bite and tear^{✓^s}
- and an increased need to grind and chew^{✓^s} in humans
in view of the change in diet to soft, cooked food^{✓^s}

Relevance	Logical sequence	Comprehensive
All information provided is relevant to the topic	Ideas are arranged in a logical/cause-effect sequence	All aspects required by the essay have been sufficiently addressed
Only information relevant to the <i>structural changes</i> or <i>significance</i> is given (there is no irrelevant information)	Generally each significance is appropriately linked to the relevant structural change to the skull	At least 3 structural changes described together with the significance of each
1	1	1

QUESTION 9**Charles Darwin explanation**

- As a result of genetic variation✓/ some giraffes have longer necks than others✓
- Environmental change✓/ when the leaves became scarce in short trees
- competition for resources occurred✓
- causing those with shorter necks to die✓
- and those with longer necks to survive✓
- This is natural selection✓/survival of the fittest
- The genes✓/genotype for longer necks
- were passed on to subsequent generations✓
- as a result now the population of giraffe have long necks✓

Max (8)

Jean Baptiste de Lamarck explanation

- All giraffes had short necks✓originally
- When the leaves became scarce in short trees✓ / lower parts of trees
- Giraffes stretched✓ / used their neck more often to reach to the taller trees
- As a result the neck became longer✓ /developed
- This acquired characteristic ✓was passed on to the offspring✓
- The next generation of giraffes had long necks✓

Max (6)

An idea accepted in the science community today

Charles Darwin✓ - there is evidence✓ that genes are inherited from the parents,✓and is not the acquired characteristics✓

Max (3)

Content: (17)
 Synthesis (3)
(20)

ASSESSING THE PRESENTATION OF THE ESSAY

Relevance	Logical sequence	Comprehensive
All information provided is relevant to the topic	Ideas are arranged in a logical/cause-effect sequence	All aspects required by the essay have been sufficiently addressed
Only information relevant to evolution according to Charles Darwin and Lamark and mention of a scientist whose idea is accepted by science community (there is no irrelevant information)	Information regarding evolution according to Charles Darwin and Larmark arranged in logical way	At least the following points should be included: • Darwinism (4/8), • Larmarck (3/6) and • Accepted idea in science community (2/3)
1	1	1

QUESTION 10Evolution according to Lamarck

Lamarck explained evolution using the following two 'laws':

The law of use and disuse: ✓

- As an organism uses a structure or organ more regularly✓, it becomes better developed or enlarged in that organism✓.
- If an organism does not use a structure or organ frequently✓, it becomes less developed or reduced in size and may disappear altogether in that organism✓

The inheritance of acquired characteristics: ✓

- Characteristics developed during the life of an individual✓
- (Acquired characteristics) can be passed on to their offspring. ✓ (Max 5)

Evolution according to Darwin

- Organisms produce a large number of offspring✓
- There is a great deal of variation✓ amongst the offspring
- Some have favourable characteristics✓
- and some do not✓
- When there is a change in the environmental conditions✓/or
- there is competition
- Then organisms with characteristics which are more favourable survive✓
- Whilst organisms with less favourable characteristics die✓
- This is called natural selection✓
- The organisms that survive reproduce✓
- And thus pass on the favourable characteristics to their offspring✓
- The next generation will therefore have a higher proportion of individuals with the favourable characteristics✓ (Max 8)

Darwin's ideas about gradualism compared to Punctuated Equilibrium

- Darwin believed that evolution takes place through an
- accumulation of small✓
- gradual changes that occur over a long period of time✓
- supported by transitional forms in fossil record✓
- Punctuated equilibrium suggested that evolution sometimes involves long periods of time where species do not change✓/very little change occurs
- This alternates with short periods of time where rapid changes occur✓
- New species are formed in a short period of time✓/relative to the long period of no/little change
- supported by the absence of transitional forms✓ (Max 4)

Content: (17)

Synthesis: (3)

ASSESSING THE PRESENTATION OF THE ESSAY

Relevance	Logical sequence	Comprehensive
All information provided is relevant to the topic	Ideas are arranged in a logical/cause-effect sequence	All aspects required by the essay have been sufficiently addressed
Only information relating to the theories of Lamarck and/or Darwin and/or Punctuated Equilibrium is/are given. (there is no irrelevant information)	The information provided for each of the theories of Lamarck and/or Darwin and/or Punctuated Equilibrium is/are arranged logically.	At least three points included on each of the 3 theories: Lamarck, Darwin and Punctuated Equilibrium
1	1	1

(20)

QUESTION 11Lamarckism

- The ancestral elephant stretched its proboscis✓
- to get leaves✓ in trees/further from the body
- The more it used the proboscis✓,
- the longer it became✓
- The offspring then inherited the acquired longer proboscis ✓
- Over many generations the length of the proboscis increased✓
- until it became a trunk✓ as in the modern elephant

Any 5

Darwinism

- There was a great deal of genetic variation✓ amongst the offspring
- Some had long proboscis✓
- and some had short proboscis✓
- There was a change in environmental conditions✓/competition amongst the animals for food
- They had to reach higher in the trees to get leaves✓
- The animals with shorter proboscis died✓
- Those individuals with the longer proboscis survived✓
- They then reproduced✓
- and passed on this characteristic to their offspring✓
- The next generation of animals had a greater proportion✓ of animals with longer proboscis

Any 9

Artificial selection

- Humans✓ select the elephants with
- desirable characteristics✓/long trunk
- and mate them to produce offspring with longer trunks✓
- Those that are pure breeding✓ for long trunks
- are further selected to mate to produce offspring with further longer trunks✓

Any 3

Content: (17)
Synthesis: (3)

ASSESSING THE PRESENTATION OF THE ESSAY

Criterion	Relevance (R)	Logical sequence (L)	Comprehensive (C)
Generally	All information provided is relevant to the question	Ideas are arranged in a logical/cause-effect sequence	All aspects required by the essay have been sufficiently addressed
In this essay in Q4	Only information relevant to the explanations in terms of Lamarckism, Darwinism and artificial selection are provided	Explanations in terms of Lamarckism, Darwinism and artificial selection are provided in a logical and sequential manner.	At least 3 correct points for the explanation using Lamarckism, 6 correct points for the explanation using Darwinism and 2 correct points using artificial selection
Mark	1	1	1

(20)

QUESTION 12**The development of a new species**

- If a population splits into two populations✓.
- There is now no gene flow between the two populations. ✓
- Since each population may be exposed to different environmental conditions✓,
- Natural selection occurs independently in each of the two populations✓
- such that the individuals of the two populations become very different from each other✓
- genotypically and phenotypically✓.
- Even if the two populations were to mix again✓,
- they will not be able to reproduce with each other✓, thus becoming different species

(any 5)

The development of bipedalism

- The backward position of the foramen magnum on the skull✓,
- the narrow pelvis✓
- and the less-curved spine✓
- indicates that the ape-like beings were quadrupedal✓
- The forward position of the foramen magnum on the skull✓,
- the wider pelvis✓
- and the curved spine✓
- indicates that modern humans are bipedal✓

(any 3)

(any 3)

Change in the diet from raw food to cooked food

- The large teeth, especially the canines✓
- as well as the large and long jaws✓
- which makes the skull prognathous✓
- as well as cranial/brow ridges associated with large muscles that operate the jaws✓
- indicate that the ape-like beings ate raw food that required a great amount of processing✓/tearing, biting and chewing.
- The smaller teeth, including the canines✓
- as well as the smaller jaw size✓
- which makes the skull less prognathous✓
- as well as the absence of cranial/brow ridges due to the presence of smaller muscles for chewing✓
- indicate that modern humans rely on a diet of cooked food that does not require the same amount of processing✓/tearing, biting and chewing.

(any 3)

(any 3)

Content: (17)

ASSESSING THE PRESENTATION OF THE ESSAY

Criterion	Relevance (R)	Logical sequence (L)	Comprehensive (C)
Generally	All information provided is relevant to the question	Ideas are arranged in a logical/cause-effect sequence	All aspects required by the essay have been sufficiently addressed
In this essay in Q4	Only information regarding development of a new species, the development of bipedalism and change in diet is given (no irrelevant information).	Generally, the development of a new species, the development of bipedalism and change in diet are explained logically.	All three aspects of the question are described correctly.
Mark	1	1	1

QUESTION 13

Stem cells are (actively) dividing ✓ cells that are not yet differentiated ✓ / not yet mature and could give rise to different types of cells (2)

Sources of stem cells

Embryo ✓

Blood in umbilical cord ✓ / cord blood

Placenta ✓

Bone marrow ✓

any 3 (3)

Arguments for use of stem cells

- **Provide replacements for tissues** ✓^S / organs damaged by age ✓^R / trauma / disease / improve quality of life
- **Used for research** ✓^S to see whether it can cure different diseases ✓^R e.g. cancer / more reliable results when human stem cells are used
- **Stem cells from e.g. the blood from the umbilical cord can be stored** ✓^S when needed in future because it would not be rejected ✓^R by the body's immune system

3 x 2 (6)

Arguments against use of stem cells

- **Expensive** ✓^S research money could be used for other needs ✓^R
- **Only rich people** ✓^S / **expensive** can afford to store ✓^R stem cells for later use
- **Interfere with religion** ✓^S / **culture/creation** because it is immoral ✓^R / unethical / we cannot play God
- **Moral** ✓^S / **ethical objection** because we are destroying a human life ✓^R
- **The dangers** ✓^S of using stem cells are unknown and may be a risk ✓^R
- **Can lead to illegal trade** ✓^S in embryos / the placentas of new-born babies / to make money ✓^R
- **Embryos conceived and then aborted** ✓^S / abandoned / to use ✓^R the stem cells from the placenta

3 x 2 (6)

Content (17)

Synthesis (3)

(20)

ASSESSING THE PRESENTATION OF THE ESSAY

Criterion	Relevance (R)	Logical sequence (L)	Comprehensive (C)
Generally	All information provided is relevant to the question	Ideas are arranged in a logical/cause-effect sequence	All aspects required by the essay have been sufficiently addressed
In this essay in Q4	Only information regarding stem cells is included (no irrelevant information).	Definition, use, arguments for and against use of stem cells explained logically.	All three aspects of the question are described correctly. -Sources 2/3 -arguments for at least 4/6 - arguments against at least 4/6
Mark	1	1	1

QUESTION 14**Process of cloning**

- an ovum is removed from sheep A by surgery✓
- the haploid nucleus of an ovum is then removed by microsurgery✓
- An actively dividing somatic cell is removed from sheep B of the same species ✓
- The diploid nucleus is removed from the somatic cell of sheep B and inserted into the ovum of sheep A✓
- The ovum with the diploid nucleus ('zygote') is then activated to divide to form an embryo✓/the ovum behaves like a fertilised egg
- the embryo is then inserted into the uterus of a surrogate sheep (Sheep C) for implantation and thereafter growth and development of the young sheep follows✓
- a sheep that is genetically identical to Sheep B is born and is called a clone✓

any 5

Advantages of cloning

- Producing individuals with desired traits✓to eliminate unwanted characteristics✓
- Better yield✓to increase the amount of food✓for a large population
- Resistant to diseases✓to save on the use of pesticides and herbicides✓
- Organisms produced in a shorter time✓to increase yield✓
- Saving endangered species✓no need for mating partners✓/looking for partners
- Producing body parts✓reducing rejection of transplanted parts✓
- Produce offspring✓ for organisms that are infertile and cannot have their own offspring✓
- Reproduction✓ is not seasonally dependent✓

(3 x 2) (6)

Disadvantages of cloning

- Objection✓/religious beliefs to interfering with God's/Supreme Being's creation✓/nature
- Reducing the gene pool ✓by reducing variation✓/reduces genetic diversity
- Cloned organisms may have developmental/morphological problems✓and not survive long✓
- Costly process✓ not all farmers/people/government can afford it✓
- May generate more experimental waste✓causing ethical✓ issues around disposal of waste
- May lead to killing of clones✓ to obtain spare body parts✓

(3 x 2) (6)

Content (17)

Synthesis (3)

(20)**ASSESSING THE PRESENTATION OF THE ESSAY**

Criterion	Relevance (R)	Logical sequence (L)	Comprehensive (C)
Generally	All information provided is relevant to the question	Ideas are arranged in a logical/cause-effect sequence	All aspects required by the essay have been sufficiently addressed
In this essay in Q4	Only information regarding cloning is given (no irrelevant information).	Generally, the process of cloning, advantages and disadvantages are explained logically.	At least the following marks should be obtained: - 3/5 for the process of cloning - 4/6 on advantages of cloning -4/6 on disadvantages
Mark	1	1	1

QUESTION 15

Advantages of using GMO's as a source of food

- Control pests with **specific genes inserted into the crop**✓ which is **less harmful to the environment than pesticides**✓ / Reduce the need for the use of chemicals
- Selecting the best genes to **produce better resistant crops**✓ stronger offspring to **withstand harsh environmental conditions**✓
- Using specific genes to **increase crop yields**✓ life stock improvement **for food security**✓
- Selecting genes to **increase shelf life of plant products**✓ so that there is **minimal waste**✓
- Selecting genes that **delay ripening of fruits**✓ to **meet the demand**✓ locally and internationally
- Using specific genes to **improve nutritional value**✓ of food **for better health**✓
- Using specific genes to **introduce new traits in crops** to **suit specific needs** of a population (e.g. to increase vitamin A in food)

any (5 x 2) (10)

Disadvantages of (objections to) using genetically modified organisms

Genetically modified crops

- can be costly as it involves modern biotechnology which requires highly skilled people and sophisticated and expensive equipment✓
- may cause allergic reactions in humans✓
- could reduce biodiversity in a specific habitat✓
- can easily be destroyed by new diseases✓
- can interbreed with wild plants and spread to future generation✓
- may include a pesticide resistant gene that spread to wildlife with bad results✓

Opposition

- organic farmers could have their crops contaminated with pollen from GM crops✓
- new pathogens can be developed which may not be controlled by conventional or traditional methods✓
- patented crops may lead to an increase in the price of seeds. This forces poor countries to depend on rich countries✓
- plants modified for pesticide resistance could cross pollinate with wild relatives, creating "super weeds" ✓
- unknown effects on human health can develop✓
- Poor countries do not have the know-how or economic stability to deal with any of the possible shortcomings.(to implement bio-safety) ✓

Ethical and moral concerns

- Main focus is on profit-making and not the wellbeing of ordinary citizens✓
- Regarded as unfair business practice✓
- Ordinary citizens are regarded as guinea pigs to study the long term physiological effects✓
- Scientists have no right to manipulate the laws and change the course of nature✓
- Giant companies tend to decide and dictate food safety norms✓
- Multinational corporations become the sole patent of the newly created organism and monopolise the market with the aim of accumulating wealth✓

- Increases the dependency of poor countries on wealthier countries✓
- Governments will not be able to implement the bio-safety protocol✓
- Subsistent farmers become unable to compete with giant multinational biotechnology corporations and therefore, cease to exist✓
- Huge amounts budgeted for genetic engineering could have been allocated for alleviating poverty, hunger, housing shortages and improving the standard of education and health sectors✓

Religious and cultural objections:

- God is the creator of everything and manipulating genes and thereby creating new organisms is an act against the will of God✓
- Vegetarians believe that consuming plant products that contains animal genes is an insult to their way of life and culture ✓

(Any 5)

Genetically modified food products should be labelled because:

- Every citizen has a right to information✓
- Everyone has a right make their own choice✓
- The consumers should not be misled✓
- It gives the consumer an opportunity to compare GM products with naturally grown (organic) food products✓
- It denies the public to challenge if a product has an undesirable effect on health✓
- It curtails any deliberate attempt of companies to capitalise on public ignorance✓✓
- Many people believe that absence of labels on GM product is a deliberate attempt to divert attention and discourage further evidence against the development of more GM products✓
- Labelling prevents GM products being camouflaged with naturally grown food and priced the same ✓

Any relevant answer (Any 2) (2)

Content: 17
Synthesis 3

ASSESSING THE PRESENTATION OF THE ESSAY

Criterion	Relevance (R)	Logical sequence (L)	Comprehensive (C)
Generally	All information provided is relevant to the question	Ideas are arranged in a logical/cause-effect sequence	All aspects required by the essay have been sufficiently addressed
In this essay in Q4	Only information regarding use of genetically modified food is given (no irrelevant information).	Generally, the, advantages and disadvantages of use of GMOs are explained logically.	At least the following marks should be obtained: - 7/10 on explaining advantages of using GMOs as food -3/5 on disadvantages -1/2 on labelling
Mark	1	1	1

QUESTION 16

HYPOTHESIS

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

2(*compulsory) +1 (3)

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 ✓

Max (4)

GENETIC EVIDENCE ✓

- Mitochondrial DNA ✓
- Is inherited only from the maternal line ✓
- Analysis of mutations ✓ on this mitochondrial DNA
- shows that the oldest female ancestor were located in Africa ✓
- and that all humans descended from her ✓/mitochondrial Eve
- The Y chromosome shows the paternal line ✓

Max (4)

CULTURAL EVIDENCE ✓

- The **OLDEST**/most primitive artefacts (tools, cutlery, art etc.)
- were found in Africa ✓

(2)

TOTAL FOR EVIDENCE: (8)

BIPEDALISM

The fossils of all three genera indicate that:

- The foramen magnum ✓
- is located in a more forward position ✓
- The pelvis ✓
- is wider and shorter ✓
- The spine ✓
- is S-shaped ✓

(6)

Content: (17)

Synthesis: (3)

Assessing the presentation of the essay

Criterion	Relevance (R)	Logical sequence (L)	Comprehensive (C)
Generally	All information provided is relevant to the question	Ideas are arranged in a logical/cause-effect sequence	All aspects required by the essay have been sufficiently addressed
In this essay in Q4	In this essay in Q4 Only information relevant to the 'Out of Africa' hypothesis and bipedal fossils of the three genera are described. No irrelevant information included.	The description of the evidence for the 'Out of Africa' hypothesis and the evidence of bipedalism is presented in a logical and sequential manner.	At least the following marks should be obtained: - 7/11 for the 'Out of Africa' hypothesis and the evidence - 4/6 on evidence for bipedalism
Mark	1	1	1

QUESTION 17

Differences

- A species is a group of organisms with similar characteristics ✓^D
- that are able to interbreed ✓^D
- to produce fertile offspring ✓^D
- A population is a group of organisms of the same species ✓^D
- found in the same habitat ✓^D
- at the same time ✓^D

Speciation by geographic isolation

- A population of organisms becomes split ✓^S
- by a geographical barrier ✓^S/example of a geographical barrier.
- The two populations cannot interbreed ✓^S/there is no gene flow between the two.
- Natural selection occurs independently ✓^S in each population.
- Due to different environmental conditions ✓^S on either side of the barrier,
- the two populations become genotypically and phenotypically ✓^S
- different ✓^S from each other.
- Even if the geographical barrier is removed, the individuals will not be able to interbreed ✓^S
- We say that the original population has now become two separate species ✓^S

Effect of speciation and extinction on biodiversity

- Since there is an increase in the number of species ✓^B
- speciation increases ✓^B biodiversity
- Extinction results in the loss of the number of species ✓^B
- therefore results in a decrease ✓^B in biodiversity

Any 17

Content: (17)

Synthesis: (3)

(20)

Criterion	Relevance (R)	Logical sequence (L)	Comprehensive (C)
Generally	All information provided is relevant to the question	Ideas are arranged in a logical/cause-effect sequence	All aspects required by the essay have been sufficiently addressed
In this essay in Q4	Only information relevant to the differences between population and species; the description of speciation and effect of speciation and extinction on biodiversity is given	All the information regarding the differences between population and species, the description of speciation and the effect of speciation and extinction on biodiversity is given in a logical manner	At least: - 4 correct points for the differences, - 5 for the description of speciation and - 2 for effects of speciation and extinction on biodiversity
Mark	1	1	1

QUESTION 18

Natural selection and speciation

- The original species of anole lizards was separated^{✓^s}
- into different populations^{✓^s}
- by a geographical barrier^{✓^s}
- which is the sea^{✓^s}
- There was no gene flow^{✓^s}
- between the separated populations^{✓^s}
- Each population was exposed to different environmental conditions^{✓^N} on each island
- Because there is variation^{✓^N} amongst the lizards
- Natural selection occurred independently^{✓^N} in each population
- Some had favourable characteristics^{✓^N} to survive on a specific island
- while others did not^{✓^N}
- The ones that did not have the favourable characteristics died^{✓^N}
- The ones with the favourable characteristic survived^{✓^N}
- and reproduced^{✓^N}
- to pass the gene for the favourable characteristics^{✓^N}
- to the next generation^{✓^N}
- And over many generations the favourable characteristic becomes more frequent in the population^{✓^N}
- each population became different from the other^{✓^s} over time
- genotypically^{✓^s}
- and phenotypically^{✓^s}
- Even if the populations were to mix again^{✓^s}
- they would not be able to reproduce/interbreed with each other^{✓^s}

Max 17

NOTE: ^{✓^s} = SPECIATION
^{✓^N} = NATURAL SELECTION

Content: (17)
 Synthesis: (3)

(20)**ASSESSING THE PRESENTATION OF THE ESSAY**

Criterion	Relevance (R)	Logical sequence (L)	Comprehensive (C)
Generally	All information provided is relevant to the topic.	Ideas arranged in a logical sequence.	Answered all aspects required by the essay.
In this essay (Q4)	Only information relevant to the description of natural selection and speciation is given.	The descriptions for natural selection and speciation are logical and sequential.	At least 6 correct points in the description of natural selection and 6 correct points on speciation are given.
Mark	1	1	1

QUESTION 19

MUTATIONS AND PROTEIN SYNTHESIS

- A mutation is a change in the nucleotide/nitrogenous base sequence✓
- of a DNA molecule✓/a gene
- since mRNA is copied from the DNA molecule✓
- during transcription✓
- This will result in a change in the codons✓
- As a result, different tRNA✓ molecules
- carrying different amino acids✓ will be required
- The sequence of amino acids changes✓
- resulting in the formation of a different protein✓
- If the same amino acid ✓is coded for
- there will be no change✓in the protein structure

Any 9 (9)

MUTATIONS AND EVOLUTION IN PRESENT TIMES

- In a population of insects✓/bacteria/HI viruses/Galápagos' finches
- mutations are a source of variation✓
- which may make some organisms more resistant✓/better suited
- to insecticides✓/antibiotics/antiretroviral medication/ drought
- Those individuals that are not resistant/suited will die✓ whereas
- those that are resistant/ well suited, will survive✓
- to pass the resistant allele/resistance on to their offspring✓
- This is known as natural selection✓
- As a result, individuals of the future generations will be resistant to the insecticides✓/antibiotics/antiretroviral medication/adapted to drought

Any 8 (8)
 Content (17)
 Synthesis (3)
(20)

ASSESSING THE PRESENTATION OF THE ESSAY

Criterion	Relevance (R)	Logical sequence (L)	Comprehensive (C)
Generally	All information provided is relevant to the question.	Ideas are arranged in a logical sequence.	All aspects of the essay have been sufficiently addressed.
In this essay in Q4	Only provided information relevant to: - Mutations and protein synthesis - Mutations and evolution in present times. There is no irrelevant information.	Information on: - Mutations and protein synthesis - Mutations and evolution in present times is presented in a logical sequence	At least the following marks should be obtained: - Mutations and protein synthesis (7/9) - Mutations and evolution in present times (5/8)
Mark	1	1	1

TOTAL SECTION C: 20