

Biology for University Study [Final term]

2024

Examination Paper

Sample Assessment


Answer ALL questions in section A, section B and section C.

Time: 2 hours

The maximum mark for this paper is 100.

Any reference material brought into the examination room must be handed to the invigilator before the start of the examination.

Candidates are allowed to use a scientific calculator during this examination.



Section A – 24 MCQs Total 24 marks**Answer all the questions in this section – there is just ONE (1) correct answer for each multiple-choice question unless stated otherwise****Marks****Question 1 (AC 7.6)**

Which of the following is NOT a pathway for water transport in plants?

1

- a. Xylem
- b. Phloem
- c. Apoplast
- d. Symplast

Mark Scheme
c. Apoplast

Question 2 (AC 7.8)

What is the main driving force behind transpiration?

1

- a. Root pressure
- b. Cohesion of water molecules
- c. Diffusion
- d. Active transport

Mark Scheme
c. Diffusion

Question 3 (AC 7.11)

Which of the following is NOT a function of phloem?

1

- a. Transporting sugars
- b. Transporting amino acids
- c. Transporting water
- d. Transporting hormones

Mark Scheme
c. Transporting water

Question 4 (AC 7.14)		
Which of the following is NOT a product of the light-dependent reactions?		1
a.	Oxygen	
b.	ATP	
c.	NADPH	
d.	Glucose	
Mark Scheme d. Glucose		
Question 5 (AC 7.15)		
The enzyme responsible for carbon dioxide fixation in the Calvin cycle is:		1
a.	Rubisco	
b.	ATP synthase	
c.	Cytochrome c oxidase	
d.	Pepsin	
Mark Scheme a. Rubisco		
Question 6 (AC 6.4)		
The main function of the kidneys is to:		1
a.	Produce hormones	
b.	Filter blood	
c.	Digest food	
d.	Transport oxygen.	
Mark Scheme b. Filter blood		

Question 7 (AC 6.8)		
ADH is released when:		1
a.	Blood sugar is high	
b.	Blood pressure is low	
c.	Body temperature is cold	
d.	Blood osmolarity is high.	
Mark Scheme d. Blood osmolarity is high.		
Question 8 (AC 6.8)		
What is the term for the process by which the kidneys remove excess water from the body?		1
a.	Filtration	
b.	Reabsorption	
c.	Osmoregulation	
d.	Excretion	
Mark Scheme c. Osmoregulation		
Question 9 (AC 6.15)		
Abscisic acid (ABA) promotes stomatal closure by:		1
a.	Increasing potassium ion influx into guard cells	
b.	Decreasing potassium ion efflux from guard cells	
c.	Stimulating the production of cellulose in the cell walls	
d.	Inhibiting the production of auxin.	
Mark Scheme b. Decreasing potassium ion efflux from guard cells		

Question 10 (AC 6.19)		
What type of neuron carries signals away from the CNS?		1
a. Sensory neuron		
b. Motor neuron		
c. Interneuron		
d. All of the above		
Mark Scheme d. All of the above		
Question 11 (AC 6.30)		
Which hormone is responsible for regulating blood sugar levels?		1
a. Insulin		
b. Glucagon		
c. Thyroxine		
d. Testosterone		
Mark Scheme a. Insulin		
Question 12 (AC 6.33)		
What is the function of auxin in plant growth?		1
a. Stimulates elongation		
b. Inhibits growth		
c. Controls flowering		
d. Regulates water balance		
Mark Scheme a. Stimulates elongation		
Question 13 (AC 6.29)		
Which part of the eye is responsible for focusing light?		1
a. Cornea		
b. Lens		
c. Retina		
d. Iris		
Mark Scheme b. Lens		

Question 14 (AC 2.23)		
During meiosis, chromosomes are separated. What is the purpose of this separation?		1
a.	To create identical copies of the parent cell	
b.	To introduce genetic variation	
c.	To ensure each gamete receives half the genetic material	
d.	To repair damaged DNA	
Mark Scheme c. To ensure each gamete receives half the genetic material		
Question 15 (AC 2.28)		
Which of the following is NOT a type of allele?		1
a.	Dominant	
b.	Recessive	
c.	Codominant	
d.	Multiple	
Mark Scheme d. Multiple		
Question 16 (AC 2.29)		
A dihybrid cross involves parents with different genotypes for two unlinked genes. What is the expected phenotypic ratio in the F2 generation?		1
a.	3:1	
b.	9:3:3:1	
c.	1:1:1:1	
d.	Impossible to determine without specific allele information	
Mark Scheme b. 9:3:3:1		

Question 17 (AC 2.29)		
A red flower (RR) is crossed with a white flower (rr). What is the predicted phenotype of the offspring?		1
a.	All red	
b.	All white	
c.	All pink	
d.	50% red, 50% white	
Mark Scheme c. All pink		
Question 18 (AC 8.4)		
Which of the following is NOT a factor that can drive natural selection?		1
a.	Variation within a population	
b.	Heritability of traits	
c.	Overproduction of offspring	
d.	Random chance.	
Mark Scheme d. Random chance		
Question 19 (AC 8.11)		
According to the Darwin-Wallace theory of evolution by natural selection, individuals with traits that are better suited to their environment will:		1
a.	Be eliminated from the population	
b.	Reproduce more successfully	
c.	Have no advantage or disadvantage	
d.	Be artificially selected by humans	
Mark Scheme b. Reproduce more successfully		

Question 20 (AC 8.17)		
The five-kingdom classification system includes:		1
a.	Monera, Protista, Fungi, Plantae, Animalia	
b.	Bacteria, Archaea, Eukarya	
c.	Both A and B	
d.	Neither A nor B	
Mark Scheme c. Both A and B		
Question 21 (AC 9.13)		
The process of inserting a foreign gene into a host organism is called:		1
a.	Transduction	
b.	Transformation	
c.	Transversion	
d.	Transcription	
Mark Scheme b. Transformation		
Question 22 (AC 9.19)		
What is the main ethical concern surrounding genetic engineering in food crops?		1
a.	The potential for harm to human health	
b.	The impact on biodiversity	
c.	The economic implications for farmers	
d.	The ownership of genetically modified organisms.	
Mark Scheme d. The ownership of genetically modified organisms.		

Question 23 (AC 9.9)		
In electrophoresis, DNA fragments are separated based on:		1
a.	Size	
b.	Colour	
c.	Shape	
d.	Chemical composition	
Mark Scheme		
a. Size		
Question 24 (AC 9.11)		
Which of the following sentences is true about mining with microorganisms:		1
a.	It uses microbes to extract metals from ores	
b.	More environmentally friendly than traditional mining methods	
c.	Can be used in the bioremediation of contaminated sites	
d.	All of the above.	
Mark Scheme		
a. It uses microbes to extract metals from ores		

**SECTION B – 21 questions. Total 45 marks. Short answer questions.
Answer ALL questions.**

Marks

Question 25 (AC 7.7)

Briefly explain the difference between the apoplast **and** symplast pathways for water transport in plants.

2

Mark Scheme

The apoplast pathway involves water moving through cell walls and intercellular spaces (1 mark), while the symplast pathway involves water moving through the cytoplasm of connected cells (1 mark).

Question 26 (AC 7.3)

State TWO (2) adaptations of xylem vessels for efficient water transport.

2

Mark Scheme

*(1 mark for each of the following points up to a maximum of 2):
Xylem vessels are adapted for efficient water transport by having:
(a) a large diameter,
(b) thick cell walls with lignin for support,
(c) no cytoplasm or nucleus to reduce friction, and
(d) interconnected pits for lateral movement of water.*

Question 27 (AC 7.8)

How does temperature affect the rate of transpiration?

2

Mark Scheme

Temperature affects the rate of transpiration in two ways: (a) Higher temperatures increase the kinetic energy of water molecules, making them evaporate more readily (1 mark). (b) Higher temperatures open stomata wider, allowing more water to escape (1 mark).

Question 28 (AC 7.15)

Explain the importance of water in light-dependent reactions.

2

Mark Scheme

Water is broken down in the light-dependent reactions (1 mark), providing electrons and protons for ATP and NADPH production (1 mark).

Question 29 (AC 6.1)	
What is homeostasis and why is it important?	2
Mark Scheme	
<i>Homeostasis is the dynamic equilibrium of an organism's internal environment, maintaining constant conditions despite changes in the external environment or within the organism itself (1 mark). It is crucial for survival as it allows the body's organs and systems to function optimally. Without homeostasis, even slight changes in factors like temperature, pH, or blood sugar levels can disrupt vital processes and lead to illness or death (1 mark).</i>	
Question 30 (AC 6.4)	
Name and describe in brief the THREE (3) main regions of the kidney.	3
Mark Scheme	
<i>(1 mark for each of the following points up to a maximum of 3):</i>	
<ol style="list-style-type: none"> <i>1. Renal cortex- which is the outer region of the kidney, between the renal capsule and the renal medulla. It consists of a space that contains blood vessels that connect to the nephrons.</i> <i>2. Renal medulla- which is the innermost region of the kidney, consisting of the bulk of the nephron and is arranged into a pyramid-like structure.</i> <i>3. Renal pelvis- Is it where blood vessels and nerves enter and exit the kidney. It connects the kidney to the bladder, which holds the urine until it passes through the urethra and excreted out of the body.</i> 	
Question 31 (AC 6.14)	
Briefly describe the structure of guard cells and their role in stomatal opening and closing.	3
Mark Scheme	
<i>Guard cells are kidney-shaped cells surrounding the stomatal pore. (1 mark).</i>	
<i>They control opening and closing by changing their turgor pressure (water content). When turgid (i.e., enlarged and swollen with water), they swell and pull the pore open. (1 mark).</i>	
<i>When flaccid (i.e., soft), they shrink and close the pore. (1 mark).</i>	

Question 32 (AC 6.15)	
Name FOUR (4) plant growth regulators.	2
Mark Scheme	
<i>(1 mark for THREE (3) correctly named regulators, 2 marks for FOUR (4) correctly named regulators). The plant growth regulators are- Auxin, Gibberellin (GA), cytokinin, ethylene and abscisic acid (ABA).</i>	
Question 33 (AC 6.8)	
In TWO (2) key points, describe how sensory receptor cells detect stimuli and initiate impulse transmission in sensory neurons.	2
Mark Scheme	
<i>(1 mark for each of the following points up to a maximum of 2):</i>	
<ol style="list-style-type: none"> <i>1. Sensory receptor cells convert stimuli into electrical signals.</i> <i>2. These signals trigger the release of neurotransmitters from the receptor cell, stimulating the sensory neuron.</i> 	
Question 34 (AC 6.25)	
What is a synapse, and which is the key neurotransmitter used throughout the nervous system?	2
Mark Scheme	
<ul style="list-style-type: none"> <i>• The synapse is a specialised junction or connection between two nerve cells, where signals are transmitted from one cell to another. (1 mark)</i> <i>• The key neurotransmitter used throughout the nervous system is acetylcholine (ACh). (1 mark)</i> 	
Question 35 (AC 2.21)	
What is the term for the process by which haploid cells are produced from a diploid cell? In humans, are gametes (sperm and egg cells) haploid or diploid?	2
Mark Scheme	
<i>The process by which haploid cells are produced from a diploid cell is called meiosis. (1 mark)</i>	
<i>Gametes (sperm and egg cells) in humans are haploid. (1 mark)</i>	

Question 36 (AC 2.23)	
In THREE (3) key points, explain the need for a reduction division during meiosis in the production of gametes.	3
Mark Scheme	
<i>(1 mark for each of the following points up to a maximum of 3):</i>	
<ul style="list-style-type: none"> • <i>Reduction division is a type of nuclear and cell division in which the number of chromosomes is reduced from diploid to haploid.</i> • <i>If diploid gametes were produced, the offspring would have double the number of chromosomes from each parent, leading to imbalances and developmental problems.</i> • <i>Meiosis (also called reduction division) reduces the chromosome number in half by separating homologous chromosomes, ensuring that offspring have the correct number of chromosomes and genetic material.</i> 	
Question 37 (AC 2.24)	
How does the number of cell divisions in mitosis compare to that in meiosis?	2
Mark Scheme	
<i>Mitosis involves one round of cell division (1 mark), while meiosis involves TWO (2) rounds of cell division (1 mark).</i>	
Question 38 (AC 2.24)	
What is the significance of cytokinesis in meiosis?	2
Mark Scheme	
<i>Cytokinesis in meiosis is crucial because it results in the formation of four distinct haploid daughter cells, each with a unique combination of chromosomes (1 mark). This process ensures that the genetic material is properly divided between the daughter cells, contributing to genetic diversity and the formation of gametes in sexual reproduction (1 mark).</i>	

Question 39 (AC 2.27)	
How does the random assortment of chromosomes during gamete fusion contribute to genetic variability?	2
Mark Scheme	
<i>The random assortment of chromosomes during gamete fusion creates unique combinations (1 mark) of genes in offspring (1 mark), leading to genetic diversity.</i>	
Question 40 (AC 2.34)	
Describe the differences between repressible enzymes and inducible enzymes	2
Mark Scheme	
<i>Repressible enzymes-They are synthesised as normal until a repressor protein binds to an operator. The synthesis of the enzyme is repressed by the presence of the repressor protein, by causing the transcription of the gene for the enzyme to stop. (1 mark).</i>	
<i>Inducible enzyme s- They are only synthesised when their substrate is present. The synthesis of the enzyme is induced by the presence of the substrate by causing the transcription of the gene for the enzyme to start. (1 mark).</i>	
Question 41 (AC 8.6)	
How does genetic variation play a role in both natural and artificial selection?	2
Mark Scheme	
<i>Genetic variation provides the raw material for both natural and artificial selection. (1 mark).</i>	
<i>It is the diversity in a population's gene pool that allows for the development of different traits over time through selective processes. (1 mark).</i>	
Question 42 (AC 8.8)	
What does the Hardy-Weinberg principle state and what is it used for?	2
Mark Scheme	
<ul style="list-style-type: none"> <i>• The Hardy-Weinberg principle states that the allele frequencies of a gene within a population will not change from one generation to the next if certain conditions are met. (1 mark).</i> <i>• The Hardy-Weinberg principle is used to calculate allele and genotype frequencies in populations. (1 mark).</i> 	

Question 43 (AC 8.13)	
What is allopatric speciation, and how does it occur?	2
Mark Scheme	
<p><i>Allopatric speciation is a type of speciation where new species arise due to geographical isolation. (1 mark).</i></p> <p><i>Populations become separated by physical barriers, such as mountains, rivers, or other geographical features, preventing gene flow between them. (1 mark).</i></p>	
Question 44 (AC 8.16)	
Illustrate the difference between archaea and bacteria in terms of membrane lipids and composition of cell walls.	2
Mark Scheme	
<ul style="list-style-type: none"> • <i>Membrane lipids are found in Archaea which is completely unique, but not found in bacterial cells. (1 mark).</i> • <i>Organisms from the Bacterial domain have cells that always possess cell walls with peptidoglycan, whereas from the Archaea domain do not have cell walls with peptidoglycan. (1 mark).</i> 	
Question 45 (AC 9.4)	
Give a key difference between restriction endonucleases and DNA ligase in their specific roles in the transfer of a gene into an organism.	2
Mark Scheme	
<p><u>Restriction endonucleases:</u> These enzymes are responsible for cleaving DNA at specific recognition sites. They are often used to cut the DNA at precise locations, facilitating the insertion of foreign genes into a vector (such as a plasmid). (1 mark).</p> <p><u>DNA ligase:</u> After the foreign gene has been inserted into a vector, DNA ligase plays a crucial role in the ligation or joining of the DNA fragments. (1 mark).</p>	

**SECTION C – 6 questions Total 31 marks long answer questions
Answer ALL questions.**

Marks

Question 46 (AC 7.13)

Define translocation **and** in SIX (6) key points, explain the process of translocation in phloem, including the role of active loading and mass flow.

7

Mark Scheme

Translocation in phloem is the process by which organic nutrients, mainly sugars, are transported from the source tissues (usually photosynthetic leaves) to the sink tissues (such as roots, fruits, and developing seeds) in plants. (1 mark).

The translocation mechanism involves the active loading of sugars into the phloem, followed by mass flow through the phloem tubes.

Active Loading:

- ***The photosynthetic leaves or storage organs like roots produce sucrose (the main sugar transported). (1 mark).***
- ***The sucrose needs to get to the sieve tube elements, specially elongated cells in the phloem with perforated ends. (1 mark).***
- ***Companion cells which are smaller cells attached to sieve tube elements, actively pump hydrogen ions out using ATP. (1 mark).***
- ***This creates a concentration gradient, attracting hydrogen ions back into the companion cells along with sucrose through protein channels. This active transport against the concentration gradient is the crucial step of active loading. (1 mark).***

Mass Flow:

- ***Creation of a Pressure Gradient: As sucrose accumulates in the sieve tube elements, the concentration of solutes in the phloem sap increases. This leads to the creation of a positive pressure potential (turgor pressure) at the source end of the phloem tube. (1 mark).***
- ***The high concentration of solutes in the sieve tube at the source end creates a pressure gradient that drives the movement of sap towards areas of lower pressure, typically the sink tissues. This passive movement is called as mass flow. (1 mark).***

Question 47 (AC 7.7 & 7.8)																			
Discuss the FOUR (4) factors that affect the rate of transpiration.	4																		
Mark Scheme																			
<p>(1 mark for each of the points below up to a maximum of 4 marks): Factors affecting transpiration rate include:</p> <ol style="list-style-type: none"> 1. Temperature: Higher temperatures increase evaporation. 2. Humidity: Lower humidity increases evaporation. 3. Wind speed: Higher wind speed increases evaporation. 4. Light intensity: Higher light intensity increases photosynthesis, leading to more water loss. Plants can regulate transpiration by opening and closing their stomata. Stomata close when water loss is not desired, such as during drought or high temperatures. 																			
Question 48 (AC 6.31)																			
Explain in brief, the functions of the EIGHT (8) hormones (Insulin, Leptin, Triiodothyronine, Cortisol, Ghrelin, Progesterone, Testosterone and Estrogen) in regulating and controlling a proper metabolism functioning in the human body.	4																		
Mark Scheme																			
<p>1 mark for up to three correctly stated hormone functions 2 marks for up to five correctly stated hormone functions 3 marks for up to seven correctly stated hormone functions 4 marks for up to eight correctly stated hormone functions</p>																			
<table border="1"> <thead> <tr> <th>Hormones</th> <th>Functions</th> </tr> </thead> <tbody> <tr> <td>Insulin</td> <td>Controls the level of glucose in the blood</td> </tr> <tr> <td>Leptin</td> <td>Maintains the normal body weight on a long-term basis. It inhibits hunger and regulate energy balance so that the body doesn't trigger a hunger response when it doesn't need energy.</td> </tr> <tr> <td>Triiodothyronine</td> <td>It is a thyroid hormone that plays a vital role in the body's metabolic rate, heart and digestive functions, muscle control. Brain development and function and the maintenance of bones.</td> </tr> <tr> <td>Cortisol</td> <td>It helps the body to respond to stress or danger. It increases body's metabolism of glucose. It controls of blood pressure. It reduces inflammation.</td> </tr> <tr> <td>Ghrelin</td> <td>It signals the brain when the stomach is empty and it's time to eat. It increases between mealtimes and decreases when the stomach is full.</td> </tr> <tr> <td>Progesterone</td> <td>It is key in maintaining uterus lining, prevents breakdown of the uterus lining from day 15 onwards. Key in the end of the menstrual cycle, where it's fall at day 28 leads to the breakdown of the uterus lining.</td> </tr> <tr> <td>Testosterone</td> <td>Is involved in the development of the male secondary sex characteristics such as facial hair, pubic hair, increased muscular build and deep voice. Increases protein synthesis in muscles, increasing the muscle mass in males.</td> </tr> <tr> <td>Oestrogen</td> <td>Oestrogen is involved in controlling the female fertility cycle and is also responsible for stimulating sperm production in males.</td> </tr> </tbody> </table>		Hormones	Functions	Insulin	Controls the level of glucose in the blood	Leptin	Maintains the normal body weight on a long-term basis. It inhibits hunger and regulate energy balance so that the body doesn't trigger a hunger response when it doesn't need energy.	Triiodothyronine	It is a thyroid hormone that plays a vital role in the body's metabolic rate, heart and digestive functions, muscle control. Brain development and function and the maintenance of bones.	Cortisol	It helps the body to respond to stress or danger. It increases body's metabolism of glucose. It controls of blood pressure. It reduces inflammation.	Ghrelin	It signals the brain when the stomach is empty and it's time to eat. It increases between mealtimes and decreases when the stomach is full.	Progesterone	It is key in maintaining uterus lining, prevents breakdown of the uterus lining from day 15 onwards. Key in the end of the menstrual cycle, where it's fall at day 28 leads to the breakdown of the uterus lining.	Testosterone	Is involved in the development of the male secondary sex characteristics such as facial hair, pubic hair, increased muscular build and deep voice. Increases protein synthesis in muscles, increasing the muscle mass in males.	Oestrogen	Oestrogen is involved in controlling the female fertility cycle and is also responsible for stimulating sperm production in males.
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Question 49 (AC 6.8)	
Define what osmoregulation is and state FIVE (5) parts of the endocrine system that play crucial roles in osmoregulation, explaining the role of each.	8
<p>Mark Scheme</p> <p><i>Osmoregulation is the physiological process that organisms use to maintain a balance of water and electrolytes in their bodies, ensuring internal stability despite changes in the external environment. (1 mark).</i></p> <p><i>The (1) hypothalamus, (2) posterior pituitary gland, (3) antidiuretic hormone (ADH), (4) aquaporins, and (5) collecting ducts play crucial roles in osmoregulation. (1 mark for stating up to FOUR (4) structures, and 2 marks for stating all FIVE (5)).</i></p> <p><i>(1) <u>The hypothalamus</u> (1 mark for stating any TWO (2) points of the below).</i></p> <ul style="list-style-type: none"> <i>•The hypothalamus senses changes in blood osmolarity.</i> <i>•If the blood osmolarity is high, it triggers ADH release and stimulates thirst.</i> <i>•If the blood osmolarity is low, then it decreases ADH secretion.</i> <p><i>(2) <u>The posterior pituitary gland</u> (1 mark for stating both points below).</i></p> <ul style="list-style-type: none"> <i>•The posterior pituitary gland secretes ADH, which is also known as vasopressin, in response to the signals from the hypothalamus.</i> <i>•In response to dehydration, it enhances ADH secretion prompting the kidney to conserve water.</i> <p><i>(3) <u>ADH</u> (1 mark for stating any TWO (2) points of the below).</i></p> <ul style="list-style-type: none"> <i>•ADH enhances water permeability in the distal convoluted tubule and collecting duct.</i> <i>•It facilitates the insertion of aquaporin channels in renal tubule cells.</i> <i>•Increased water reabsorption from the urine back into the bloodstream.</i> <p><i>(4) <u>Aquaporins</u> (1 mark for stating any TWO (2) points of the below).</i></p> <ul style="list-style-type: none"> <i>•Aquaporins are proteins which form water-transporting channels across the cell membranes.</i> <i>•They enable water movement in and out of the cell.</i> <i>•Higher aquaporin numbers enhance water reabsorption in the kidneys.</i> <p><i>(5) <u>Collecting ducts</u> (1 mark for stating any TWO (2) points of the below).</i></p> <ul style="list-style-type: none"> <i>•Collecting ducts is important for the final concentration adjustment of urine.</i> <i>•Low ADH levels lead to less permeable collecting ducts, which results in dilute urine.</i> <i>•Higher ADH levels increase the permeability and hence promote water reabsorption which results in urine concentration.</i> 	

Question 50 (AC 9.8)	
What is Polymerase Chain Reaction (PCR) and what are the THREE (3) stages involved in PCR?	4
<p>Mark Scheme</p> <p><i>Polymerase chain reaction (PCR) is a common molecular biology technique, used to make many copies of a particular region of DNA. (1 mark).</i></p> <p><i>The THREE (3) stages in a PCR reaction are: (1 mark each):</i></p> <ul style="list-style-type: none"> • <i>Denaturation- The double stranded DNA is heated to 95°C, which breaks the hydrogen bonds that hold the two DNA strands together.</i> • <i>Annealing- In this, the temperature is lowered to 50-60°C, where the primers bind to the ends of the single strands of DNA.</i> • <i>Chain elongation/extension- Here the temperature is increased to 72°C, for at least 1 minute, which is the optimal temperature for the Taq polymerase enzyme to build the complementary strands, of DNA to produce the new identical double stranded DNA molecule.</i> 	

Question 51 (AC 9.10)	
Define microarrays and explain both how they are used, and the steps followed in detecting mRNA in studies of gene expression.	4
<p>Mark Scheme</p> <p><i>Microarrays, also known as gene chips or DNA chips, are high-throughput invaluable tools in genome research that are used to simultaneously analyse the expression levels of thousands of genes. (1 mark).</i></p> <p><i>When a microarray is used in detecting mRNA: (1 mark for stating all the THREE (3) points below).</i></p> <ul style="list-style-type: none"> • <i>Many copies of mRNA are produced by transcription when genes are being expressed.</i> • <i>Hence, by quantifying the mRNA, the genes expressed in the cells are determined indirectly.</i> • <i>Hence, microarrays are used to determine whether a gene is being expressed by determining the quantity of mRNA present.</i> <p><i>Following steps to compare which genes are being expressed using microarray: (2 marks for stating the FOUR (4) points below, 1 mark for stating up to THREE (3)):</i></p> <ul style="list-style-type: none"> • <i>mRNA is collected from both types of cells and is converted into cDNA using reverse transcriptase.</i> • <i>The cDNA is amplified using PCR and fluorescent tags are added.</i> • <i>Single stranded DNA is produced by denaturing the cDNA, which are then hybridised with the probes on the microarray.</i> • <i>This is then analysed using the UV light.</i> 	

End of paper

Learning Outcomes matrix

Question	Learning Outcomes / Assessment Criteria assessed	Marker can differentiate between varying levels of achievement
Section A		
1	7.6	Yes
2	7.8	Yes
3	7.11	Yes
4	7.14	Yes
5	7.15	Yes
6	6.4	Yes
7	6.8	Yes
8	6.8	Yes
9	6.15	Yes
10	6.19	Yes
11	6.30	Yes
12	6.33	Yes
13	6.29	Yes
14	2.23	Yes
15	2.28	Yes
16	2.29	Yes
17	2.29	Yes
18	8.4	Yes
19	8.11	Yes
20	8.17	Yes
21	9.3	Yes
22	9.19	Yes
23	9.9	Yes
24	9.11	Yes
Section B		
25	7.7	Yes
26	7.3	Yes
27	7.8	Yes
28	7.15	Yes
29	6.1	Yes
30	6.4	Yes
31	6.14	Yes
32	6.15	Yes
33	6.8	Yes
34	6.25	Yes
35	2.21	Yes
36	2.23	Yes
37	2.24	Yes
38	2.24	Yes
39	2.27	Yes
40	2.34	Yes
41	8.6	Yes

42	8.8	Yes
43	8.13	Yes
44	8.16	Yes
45	9.4	Yes
Section C		
46	7.13	Yes
47	7.7 & 7.8	Yes
48	6.31	Yes
49	6.8	Yes
50	9.8	Yes
51	9.10	Yes

Learning Outcome	Pass (40-59%)	Merit (60-69%)	Distinction (70-100%)
1. Define and discuss cell structure, biological molecules and enzymes	Demonstrates an adequate awareness and understanding of concepts, terminology and processes with a reasonable discussion and application of principles and satisfactory reference to theory and science.	Demonstrates a consistent and accurate awareness and understanding of concepts, terminology and processes with a detailed discussion and application of principles and precise reference to theory and science.	Demonstrates an outstanding awareness and understanding of concepts, terminology and processes with a highly comprehensive and sophisticated discussion and application of principles and critical and meticulous reference to theory and science.
2. Recognise, describe and discuss the process of reproduction			
3. Define and discuss cell membranes, and the mammalian transport and cardiovascular systems			
4. Define and discuss gas exchange and the human respiratory and energy release systems			
5. Recognise, define and discuss diseases and infections, and the human body's immune system as a means of defences against them.			
6. Recognise, define and discuss the systems involved in the regulation, coordination and control of the human body and in plants			
7. Define, explain and discuss photosynthesis and transport in multicellular plants			
8. Define and discuss selection, evolution,			

classification, biodiversity and conservation		
9. Recognise, define and discuss genetic technology and its principles and advancements		