L-Università ta' Malta

MATSEC
Examinations Board

Marking Scheme

SEC Biology

Main Session 2024

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In the case of marking schemes that include model solutions or answers, it should be noted that these are not intended to be exhaustive. Variations and alternatives may also be acceptable. Examiners must consider all answers on their merits, and will have consulted with the MATSEC Examinations Board when in doubt.

PAPER I

<table>
<tr><th colspan="3">Question No</th><th>Suggested Answers</th><th>Marks</th><th>Additional Comments</th></tr>
<tr><td rowspan="5">1</td><td>a</td><td></td><td>Both are involved in the digestion of food material they ingest by breaking them down into forms which could be easily absorbed to the body.</td><td>1</td><td>Accept other equivalent answers.</td></tr>
<tr><td>b</td><td></td><td>Herbivore digestive system has a longer digestive tract with multiple stomachs(ruminants)/ one stomach (non-ruminants).
This is because plant material, mainly cellulose, is more difficult to digest.</td><td>1

1</td><td>Accept statements showing difference with carnivores.
Presence of bacteria in digestive system.</td></tr>
<tr><td>c</td><td></td><td><table><tr><th>Herbivore Dentition</th><th>Carnivore Dentition</th></tr><tr><td>Large, broad, chisel shaped incisors</td><td>Short sharp incisors</td></tr><tr><td>Short/small/reduced canines</td><td>Long, pointed canine teeth</td></tr><tr><td>Broad, flat premolars and molars with rough surfaces</td><td>Ridged premolars and molars / Carnassial teeth (Sharp and blade like)</td></tr><tr><td>Horny pad instead of upper incisors</td><td>No horny pad</td></tr><tr><td>Large diastema (gap between incisors and premolars)</td><td>No gap</td></tr><tr><td>Open rooted teeth</td><td>Closed rooted teeth</td></tr></table></td><td>4</td><td>Any FOUR differences</td></tr>
<tr><td>d</td><td></td><td>Cellulose digestion is more difficult to digest.
Herbivores have a highly developed ceacum and large intestine where cellulose is fermented by symbiotic gut bacteria, which produce enzymes that degrade the cellulose to produce energy.
Such behavior in both rabbits and the cows enables the undigested cellulose to be fully digested to obtain the maximum amount of energy from cellulose.</td><td>1
1

1</td><td>Accept nutrients still present in food – 1 mark</td></tr>
<tr><td colspan="4">Total:</td><td>10</td><td></td></tr>
</table>

2	**a**		The rate of photosynthesis depends on the light intensity. In daytime hours light intensity increases from dawn to mid-day and then decreases from mid-day to dusk.	1 1	
	b		Light does not affect the rate of respiration. An increase of the levels of oxygen/glucose from photosynthesis/ higher temperature/increase in rate of enzymic reactions May increase slightly the rate of respiration.	1 1 1	
	c		The compensation point is when the rate of respiration is equal to the rate of photosynthesis. This occurs at low light intensity (dawn or dusk). The glucose produced by photosynthesis is equal to the glucose used up in respiration.	2 1	
	d	i	CO_2 concentration	1	Accept chlorophyll molecules to light availability and low temperature/ water.
		ii	If there is more CO_2 in mesophyll spaces, then the rate of photosynthesis will keep on increasing; OR At an increase in temperature the rates of reaction of enzyme activity increases. OR At maximum light intensity, the number of chlorophyll molecules may not be enough to absorb the light energy.	2	
Total:				**11**	
3	**a**		Light, humidity or temperature	1	Any ONE
	b		Correct title with units Correct axes with units Plotting of coordinates Scale with 2/3 of paper used	1 1 1 1	Do not award marks if axes are inverted. Deduct 1 mark if coordinates are not joined with a ruler.
	c		In still air, the rate of transpiration increases as the stomatal width increase, until 17 µm when a plateau is reached (value remains the same).	1	
	d		In still air, the air surrounding the stomata becomes saturated with water. This limits the evaporation of water out of the stomata.	1 1	

			In moving air, the air currents/wind carry away the water droplets from the region surrounding the stomata. There is **a high concentration difference** between the inside and outside of leaf and water moves out of the leaf.	1 1	
Total:				**10**	
4	**a**	i	Same genus	1	Accept all species of Sea Lavender/ all found in Malta/ all endemic species/ all endemic to the Maltese Islands
		ii	The advantage of the binomial nomenclature is that every organism on earth has a unique name which allows it to be identified.	1	
	b		Due to it highly restricted distribution, so as to safeguard it due to its rarity.	1	
	c		Species - a group of organisms that are genetically related and capable of interbreeding under natural conditions to produce fertile offspring. Such groups of organisms have common distinctive features	2	
	d		Thick cuticles, succulence, leaf wax, hairy leaves, leaf rolling, stomata that can be closed.	2	Any TWO (1 mark each) Accept have a thicker testa
	e		Crop production is affected by environmental threats that are likely to become more significant under climate change and the pressures of an ever-growing human population. Research into the genetic makeup of the new endemic plant will determine which genes are responsible for its resilience to environmental threats. Such 'resilient' genes may be transferred to crops, enabling them survive in extreme temperatures, and resist pests.	1 1 1	
Total:				**10**	

<table>
<tr><td>5</td><td>a</td><td></td><td>Bees transfer pollen grains from anther of a flower to the stigma</td><td>1
1</td><td></td></tr>
<tr><td></td><td>b</td><td></td><td>Decrease in plant species/extinction of some plant species and other organisms depending on plants/loss in agricultural yields</td><td>1
1</td><td>Any TWO or equivalent
Do not accept honey production.</td></tr>
<tr><td></td><td>c</td><td></td><td>Urbanisation/degradation of natural habitats/introduction of alien/invasive species/ excessive use of pesticides/fungicides/insecticides/herbicides/ intensive farming practices such as mono-cropping/ rising temperatures/extreme weather changes/diseases/parasites.</td><td>1
1</td><td>Any TWO or equivalent.
Accept air pollution.
Accept increase in predator populations</td></tr>
<tr><td></td><td>d</td><td></td><td>Control or reduce use of pesticides and chemicals in soil/increase green spaces/restore habitats/better conservation of habitats/ enhance pollinator habitats in urban areas/plant more trees/ encourage biological control.</td><td>1
1</td><td>Any TWO or equivalent.
Accept law introduction / reinforcement / farmer subsidy / creating bee farms</td></tr>
<tr><td></td><td>e</td><td></td><td>Bright daytime flowers with a pleasant strong Scent</td><td>1,1</td><td>Accept other insect pollinated flower characteristics</td></tr>
<tr><td colspan="4">Total:</td><td>10</td><td></td></tr>
<tr><td>6</td><td>a</td><td colspan="3"><table>
<tr><th></th><th>Carbohydrates</th><th>Fats (solids), oils (liquids)</th><th>Proteins</th></tr>
<tr><td>Elements</td><td>C, H, O</td><td>C, H, O</td><td>C, H, O, N (often S)</td></tr>
<tr><td>Examples</td><td>Glucose</td><td>Phospholipid</td><td>Haemoglobin
Insulin</td></tr>
<tr><td>Smallest unit</td><td>monosaccharide</td><td>Glycerol / fatty acids</td><td>Amino acids</td></tr>
<tr><td>Larger molecules</td><td>Polysaccharides</td><td>_____
_____</td><td>Polypeptides</td></tr>
<tr><td>Function</td><td>Energy supply
Structural: cellulose cell walls</td><td>Heat insulation</td><td>Growth and repair
Movement (muscles)
Catalysts (enzymes)
Hormones/ Enzymes
Energy supply</td></tr>
</table></td><td>10</td><td>1 mark each

Any ONE example of protein.

Any ONE function for each.</td></tr>
</table>

			Chemical test	Glucose: **Blue Benedict's solution + reducing sugar** **orange precipitate**	Translucency: greasy spot	**NaOH + CuSO4** **mauve/pale bluish purple**	Award ½ mark for name of test and ½ mark for result
Total:						**10**	
7	**a**		The **lungs** are a mammal's organs of gaseous exchange. Air entering the nose/ mouth passes via the **larynx**, trachea, bronchus and **bronchioles**, finally reaching the tiny air sacs, the **alveoli**. The trachea and bronchus are held permanently open by incomplete rings of **cartilage**, are lined with tiny hair- like **cilia** and glandular cells which secrete sticky **mucus**. The air sacs are the site of gaseous exchange. Before diffusion, oxygen dissolves in the moisture of the thin lining. Diffusion occurs as there is a **concentration gradient** from the air in the lungs to the blood in the capillaries.	4	½ mark for each correct answer.
	b	i	Insects: Tracheoles Fish: Lamellae			1 1	Do not accept gills.
		ii	Large surface area to trap oxygen Oxygen dissolved in fluid. Thin surface to allow oxygen to diffuse easily A concentration gradient			1 1	Any TWO. Accept permeability
		iii	The absence of a network of blood capillaries. Oxygen that travels to the body cells is immediately taken up and respired leaving a concentration gradient.			1 1	
Total:						**10**	
8	**a**		Heart/brain/liver/kidneys/small intestine			1	Any ONE or equivalent Do NOT accept muscle.
	b		glucose			1	
	c		ATP - Adenosine Triphosphate			1	Accept ATP
	d	i	Cell membrane/nucleus/cell wall/chloroplast/vacuole			1	Accept Lysosomes/nucleoli

		ii	Position slide in centre right under objective lens; adjust condenser for maximum amount of light/start with lowest objective lens change to medium power objective and then to high power objective.	1 1	Any TWO Accept clean lenses with a microfibre cloth/use metal clips to keep slide in place.
	e		**ONE** organelle present in plant cells and not in animal cells; — cell wall / chloroplast / permanent vacuole. **ONE** organelle present in all eukaryotes. — nucleus/ vacuole/ cell membrane	1 1	Accept ribosomes. Accept vacuoles.
	f		Prokaryotes	1	
	g		Cell nucleus	1	
Total:				**10**	
9	**a**	i	Cnidaria have a sac-like body/with a single opening/ surrounded by tentacles armed/ with stinging cells. Molluscs have a soft unsegmented body. Most have an external/ or an internal shell.	1 1	
		ii	the body of these animals is thin /flat.	1	Accept they do not have a circulatory system
	b	i	A – Medulla Oblongata B - Cerebellum	1,1	
		ii	Controls all voluntary actions/ sensory processing/ motor control/ personality/ learning/ problem solving/ language and speech/ visual information/ spatial information/ cognition and higher thought/ imagination and creativity/ receiving and interpreting much of the physical world around the body.	1	Any ONE.
	c	i	synapse	1	Any ONE.
		ii	The chemical triggers a new impulse in the other neurone.	1	
	d		It is an involuntary reaction / and needs to be quick.	1	Do not accept causes an effector to react.
Total:				**9**	
10	**a**		AB	1	
	b		O	1	
	c	i	AO/ BO	1,1	
		ii	Ann: AO (Do not accept OA) Keira: BO (Do not accept OB)	1,1	
		iii	25%	1	
	d	i	AB	1	
		ii	AO	1	
		iii	50%	1	
Total:				**10**	

PAPER IIA

Section A

<table>
<tr><th colspan="3">Qn No</th><th>Suggested Answers</th><th>Marks</th><th>Additional Comments</th></tr>
<tr><td>1</td><td>a</td><td></td><td>A highly- controlled environment keeps a number of variables (factors) constant
Which if varied can change the outcome of the experiment/trial</td><td>1

1</td><td>Award 1 mark for fair trial.</td></tr>
<tr><td></td><td>b</td><td>i</td><td><table><tr><th>Bacteria</th><th>Viruses</th></tr><tr><td>Are cellular</td><td>Are not cellular</td></tr><tr><td>Have cell membrane, cytoplasm & cell wall/ (non-membrane bound) organelles/flagella</td><td>Does not have these structures</td></tr></table></td><td>1</td><td>Any one.

Or Vice versa</td></tr>
<tr><td></td><td></td><td>ii</td><td>Both contain genetic material.</td><td>1</td><td>Do not accept both have DNA. Accept proteins</td></tr>
<tr><td></td><td></td><td>iii</td><td>Both have cell walls.
Both have DNA.
Both have cytoplasm.</td><td>1</td><td>Any one.</td></tr>
<tr><td></td><td></td><td>iv</td><td><table><tr><th>Bacteria</th><th>Fungi</th></tr><tr><td>No membrane bound organelles/prokaryotic</td><td>Membrane bound organelles/eukaryotic</td></tr><tr><td>DNA not enclosed in membrane</td><td>DNA enclosed in membrane</td></tr><tr><td>May have flagella</td><td>Do not have flagella</td></tr><tr><td>Unicellular</td><td>May be multicellular</td></tr></table></td><td>1</td><td>Any one.
Accept<table><tr><td>Peptidoglycan cell wall</td><td>Chitin cell wall</td></tr></table></td></tr>
<tr><td></td><td>c</td><td></td><td>Protists</td><td>1</td><td>Accept algae</td></tr>
<tr><td></td><td>d</td><td></td><td>Saprophytes digest/ break down organic matter releasing nutrients in the soil/environment.
OR
Nitrifying bacteria convert ammonium compound to nitrites to nitrates
Which are then assimilated by the plant.
OR
Nitrogen-fixing bacteria convert nitrogen gas in air
To ammonium compounds used by the plant</td><td>1

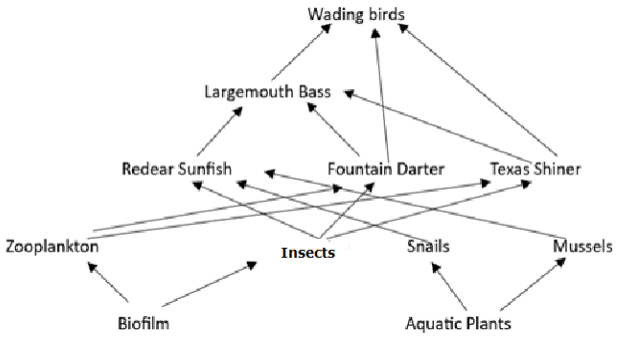
1</td><td>Any one</td></tr>
<tr><td></td><td>e</td><td></td><td>It is written in italics and with the first word capital as it is a genus name</td><td>1</td><td></td></tr>
<tr><td></td><td>f</td><td></td><td>Phagocyte - Surrounds microbe and engulfs it
OR
Lymphocyte - Produces antibodies</td><td>1

1</td><td>Any one</td></tr>
<tr><td colspan="4">Total:</td><td>12</td><td></td></tr>
</table>

2	**a**		Title included with units Axes are labelled and appropriate units are stated Legend/key Correct plotting of points Plots joined with straight lines Adequate scales chosen (more than half of area fits in under curve)	1 1 1 1 1 1	Do not award any marks if graph is drawn on squared paper / if axes are swapped. No marks awarded if one graph is drawn.
	b	i	Low 115 - 78 = 37 beats min^{-1}	1	Units to be included in answer.
		ii	Person B had poor fitness level or potential health problems, as compared to person A.	1	Accept difference in age
	c		During exercise **muscles work harder**, consequently, the **rate of respiration increases** to meet increased demands. Muscles **require more oxygen** **and need to get rid of more carbon dioxide**. As a result, the breathing rate increases.	1 1 1 1	
	d		The primary finding of this study was that 2 different exercise intensities elicited distinctly different post-exercise patterns of recovery. OR Higher preceding exercise intensity resulted in a slower post-exercise recovery in a progressive dose. OR The heart rate returned to baseline values within 5 min of recovery following **Low** whereas recovery was markedly delayed following **High**. Or The heart rate was less throughout the recovery period throughout the whole exercise as compared to the high	1	Any one conclusion.
Total:				**13**	

Section B

<table>
<tr><td>3</td><td>a</td><td></td><td>The dying out of
all organisms of a species on Earth.</td><td>1
1</td><td></td></tr>
<tr><td></td><td>b</td><td>i</td><td>Are all vertebrates/have a backbone/spine.</td><td>1</td><td>Do not accept have a spinal/vertebral column.</td></tr>
<tr><td></td><td></td><td>ii</td><td>They are covered with hair or fur.
They are endothermic.
They give birth to live young.
After birth the young are fed with milk that is produced by mammary glands.</td><td>1
1</td><td>Any two or other valid characteristics
Do not accept warm blooded
Accept external ear</td></tr>
<tr><td></td><td></td><td>iii</td><td><table><tr><th>Birds</th><th>Reptiles</th></tr><tr><td>Body covered in feathers</td><td>Body covered in scales</td></tr><tr><td>Endothermic</td><td>Ectothermic</td></tr><tr><td>Lay hard shelled eggs</td><td>Lay soft leathery eggs</td></tr><tr><td>Forelimbs adapted to wings for flying</td><td>Forelimbs like hindlimbs for walking/ No fore and hind limbs (snakes)</td></tr><tr><td>Light weight air filled bones</td><td>Dense bones</td></tr></table></td><td>1
1</td><td>Any two comparisons.</td></tr>
<tr><td></td><td></td><td>iv</td><td>Habitat destruction.</td><td>1</td><td>Accept deforestation.</td></tr>
<tr><td></td><td>c</td><td>i</td><td>Give birth to live young
Fish usually lay eggs in water while it is a mammalian characteristic to give birth to live young. (Any)</td><td>1
1</td><td></td></tr>
<tr><td></td><td></td><td>ii</td><td>Streamlined body with fins,
Gills for gaseous exchange
Scales covering the body.
Swim bladder for buoyancy
Lateral line for sensitivity</td><td>1
1</td><td>Any two.</td></tr>
<tr><td></td><td></td><td>iii</td><td>Insect larvae are the (second) stage
of complete metamorphosis</td><td>1
1</td><td>Or equivalent. Where the larva is different in structure and habits from the adult.</td></tr>
</table>

		iv		6	1 mark for each tropic level Do not allot marks if arrows are not present or incorrect. 1 mark for correct organisation of food web
	d	i	Arthropods	1	
		ii	Exoskeleton Segmented body Jointed appendages	1 1	Any two.
		iii	Wasps: 3 pairs of jointed appendages. Spiders: 4 pairs of jointed appendages or Wasps: Body divided in three parts. Spiders: Body divided in two parts.	1 1	Any comparison Accept other valid comparisons
Total:				**25**	
4	**a**	i	Vitamin A, C or D	1	Any one or any other vitamin
		ii	Vitamin A Lack of development and maintenance of teeth and skeletal and soft tissues/ Lack of maintenance of skin and the mucous membrane OR Vitamin C Lack of growth and repair of body tissues/ wounds do not heal or take long to heal / poor absorption of iron/ lack of maintenance of cartilage, teeth and bones OR Vitamin D poor formation of bones/ low maintenance of normal blood levels of phosphorus and calcium	2	Accept leads to night blindness/scurvy/rickets Accept one valid function or equivalent for the correct vitamin stated.
	b	i	Photosynthesis Energy from light is converted to chemical energy in the production of glucose.	1 1 1	Award ½ mark for sugar
		ii	A substrate for photosynthesis is carbon dioxide. This is a by-product of human respiration and is harmful in high concentrations. A product of photosynthesis is oxygen. Needed for aerobic respiration to occur.	1 1 1 1	

<table>
<tr><td></td><td>c</td><td>i</td><td>Root grow (downwards)towards this stimulus and are positive geotropic
/ for better anchorage/ absorb more water
Shoots grow away (upwards) from the stimulus and are negative geotropic
/ for photosynthesis</td><td>½
1
½
1</td><td></td></tr>
<tr><td></td><td></td><td>ii</td><td>Too much water reduces the oxygen arriving to the roots/waterlogging
causing the root cells to die/ rot.</td><td>1
1</td><td></td></tr>
<tr><td></td><td></td><td>iii</td><td>Light is also a stimulus to plants./Phototropism
The chemical auxin is in high concentrations in areas of the plant that are shaded.
High concentration of auxin induces growth in the area
Leading to the shoot of the plant growing towards light.</td><td>1
1
1
1</td><td></td></tr>
<tr><td></td><td></td><td>iv</td><td>Magnesium
For the production of chlorophyll OR
Nitrogen/Nitrate/synthesis of protein
For the growth and repair of cells</td><td>1
1</td><td>Any mineral and correct function.</td></tr>
<tr><td></td><td>d</td><td>i</td><td><table><tr><td>Monocots</td><td>Dicots</td></tr><tr><td>One cotyledon</td><td>Two cotyledons</td></tr><tr><td>Veins usually parallel</td><td>Veins usually netlike</td></tr><tr><td>Vascular bundles in stem randomly arranged</td><td>Vascular bundles in stem arranged in ring</td></tr><tr><td>Fibrous root system</td><td>Tap root system</td></tr><tr><td>Floral parts in multiple of three</td><td>Floral parts in multiple of four or five</td></tr></table></td><td>1
1</td><td>Any two comparisons.</td></tr>
<tr><td></td><td></td><td>ii</td><td>Moist habitat
Absorb water through thin, cuticle less leaves. OR
No roots but rhizoids for anchorage and not water absorption. OR
No vascular bundles/system
Reproduction: male gamete swims to female gamete.</td><td>1
1</td><td>Any one reason.</td></tr>
<tr><td colspan="4">Total:</td><td>25</td><td></td></tr>
</table>

5	**a**		1. Place filter funnels in measuring cylinders. 2. Fold the filter papers and place inside the funnels. 3. Add the **same amount of the 3 different soil samples** in each of the filter funnel with filter paper. 4. Add **same amount of water** to each of the soil samples and leave for the **same amount of time**. 5. Measure the volume/amount of water that filtered through each soil sample.	8	1 mark for each statement Award 1 mark for mention of each variable constant conditions listed in bold. Accept Compare the volumes of the three different soil samples.
	b	i	Clay soil has very small spaces; sandy soil has very large spaces	1, 1	
		ii	Sandy soil has a low water holding capacity while clay soil retains most of the water.	1, 1	
		iii	Clay soil is more difficult to plough. Clay soil is dense/sticky/heavy.	1 1	
		iv	Sandy soil	1	
		v	Clay soil	1	
	c		Plant roots remain **confined to a small volume of soil** and thus cannot provide **adequate anchorage**, **water** and **nutrients**. Accept: germination is difficult; Root development/growth is restricted; And plant cannot grow very big.	2 1 1	
	d		Stirring helps to aerate the compost heap facilitating (aerobic) respiration for microorganisms thus, increasing the decomposition process.	1 1 1	
	e		Reduce watering/ helps soil retain moisture/ improve soil organic matter/ deter pests/ warm up soil in spring/ protect plant roots from extreme cold or hot temperatures/limits soil erosion.	1 1	Any TWO
Total:				**25**	

6	**a**	i	Blood from the patient circulates outside of the vascular system and passes through the dialysis machine containing **semipermeable membranes**. **Waste products in the blood**, such as **urea** as well as **excess mineral salts and excess water** pass across the membrane into the dialysis fluid and are removed. Cleaned blood is returned to the patient.	1 1 1 1	Award 1 mark if candidates refer to nephron
		ii	**Glucose**: To prevent its removal from the blood as the concentration of glucose is equal in the patient's blood and the thin-walled dialysis tubing. **Protein**: Protein molecules are too large to pass through the dialysis tubing.	1 1	
		iii	**Antidiuretic hormone (ADH)** has the primary role in **osmoregulation** by controlling the amount of urine formation. ADH is synthesized in the **hypothalamus** and secreted by **pituitary gland** in response to reduced water in the blood. **ADH increases reabsorption of water** from the collecting ducts/ into the blood by osmosis. As a result, urine becomes more concentrated.	2 1 1 1	Accept high OP/blood more concentrated).
	b		**Cells in salt solution A**: When red blood cells are placed in a hypotonic solution, i.e. a solution with a lower concentration, the cells **will swell** as a result of **more water moving into the cell than out**. This may lead to potential bursting of the cells. **Cells in salt solution B**: When red blood cells are in an isotonic solution, i.e. same concentration solution, the **same amount of water moves in and out of the cells**. This results in cells **not changing shape**. **Cells in salt solution C**: When red blood cells are in a hypertonic solution, i.e. higher concentration solution, **water moves out of the cell faster than it comes in**. This results in **shrinking** of the blood cell. The concentrated solution is a hypertonic solution compared to red blood cells, hence if placed in it the cell will shrivel.	2 2 2	Accept get bigger Accept do not change or remain the same Accept become smaller or shrivelled

	c		**Active transport** is an **energy-requiring** process that can transfer substances into, out of, and between cells. It moves substances from a **low solute** concentration to a region of **higher** concentration. or In the kidneys, active transport allows nutrients to be reabsorbed into the blood from the waste **against the concentration gradient**.	1 1 1, 1	Accept from a low concentration to a high concentration.
	d	i	Both diffusion and osmosis - molecules move along a concentration gradient. or Passive transport/ No energy is required for the movement of ions and water respectively.	2	
		ii	Osmosis and active transport are both processes that move substances across the membrane of a cell.	1	
Total:				**25**	
7	**a**		Sexual reproduction brings **genetic variety** that improves the plant's survival within its environment such as improved drought tolerance in a dry area. This increases the **chances of plant's survival**, reproduction, dispersal and decrease in competition. It contributes **species continuation/next generation** especially in cases of genetic disorders and resistance to infectious diseases or disasters.	2 2 1	Accept: It also leads to a big quantity of seeds that can remain dormant until optimum germination conditions. It also results in high yield in agriculture.
	b		Flowers contain the stamen that includes the male pollen gamete and the carpel that includes the ovule female gamete. Fertilisation occurs in the ovary of the carpel The fertilised ovule forms the seed While the ovary develops into the fruit.	1 1 1 1 1	
	c		In meiosis the sperm or egg/ ova contains the haploid number of chromosomes. Within this haploid number the sperm carries either an X or Y chromosome, While the egg will carry an X chromosome. Individuals homozygous for X (XX) are females while heterozygous individuals (XY) are males.	1 1 1 1	

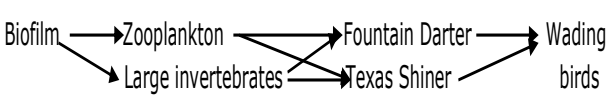
	d		Meiosis occurs in the reproductive cells of the testes and ovary. This cell division results in the formation of the haploid gametes sperm and egg from diploid cells. During the process genetic variation occurs.	1 2 1	
	e		The diaphragm fits into the female's vagina at the cervix and prevents sperm passing into the uterus Prevents fertilisation and pregnancy.	1 1 1	
	f		The progesterone levels in a pregnant female will be higher than in a non-pregnant female. Increased levels of progesterone during pregnancy continue to thicken the lining of the uterus once implantation has taken place. The thick lining of the uterus rich in blood vessels allows the development of the foetus after implantation. High progesterone levels inhibit ovulation.	1 1 1 1	
Total:				**25**	

PAPER IIB

<table>
<tr><th colspan="3">Qn No</th><th>Suggested Answers</th><th>Marks</th><th></th></tr>
<tr><td rowspan="11">1</td><td>a</td><td></td><td>The dying out of
all organisms of a species on Earth.</td><td>1
1</td><td></td></tr>
<tr><td rowspan="4">b</td><td>i</td><td>Are all vertebrates/have a backbone/spine.</td><td>1</td><td>Do not accept have a spinal/vertebral column.</td></tr>
<tr><td>ii</td><td>Body covered in feathers.
Endothermic.
Lay hard shelled eggs.
Forelimbs adapted to wings for flying.
Light weight air filled bones
Have a beak.</td><td>1</td><td>Any one.</td></tr>
<tr><td>iii</td><td><table><tr><th>Mammals</th><th>Reptiles</th></tr><tr><td>Body covered in hair or fur</td><td>Body covered in scales</td></tr><tr><td>Endothermic</td><td>Ectothermic</td></tr><tr><td>Give birth to live young</td><td>Lay soft leathery eggs</td></tr><tr><td>Suckle their young</td><td>Do not suckle their young</td></tr></table></td><td>1

1</td><td>Any two comparisons.</td></tr>
<tr><td>iv</td><td>Habitat destruction.</td><td>1</td><td>Accept deforestation</td></tr>
<tr><td rowspan="2">c</td><td>i</td><td>Give birth to live young
Fish usually lay eggs in water while it is a mammalian characteristic to give birth to live young. (Any)</td><td>1

1</td><td></td></tr>
<tr><td>ii</td><td>Streamlined body with fins,
Gills for gaseous exchange
Scales covering the body.
They are ectothermic
Swim bladder for buoyancy
Lateral line for sensitivity</td><td>1

1</td><td>Any two.</td></tr>
<tr><td rowspan="4">d</td><td>i</td><td>Largemouth Bass or Wading birds</td><td>1</td><td>Any one.</td></tr>
<tr><td>ii</td><td>Aquatic plants or Biofilm</td><td>1</td><td>Any one.</td></tr>
<tr><td>iii</td><td>Zooplankton/ large invertebrates/ snails/ mussels</td><td>1</td><td>Any one.</td></tr>
<tr><td>iv</td><td>Aquatic plants or Biofilm</td><td>1</td><td>Any one.</td></tr>
<tr><td>e</td><td></td><td> 
</td><td>2</td><td>Any correct food chain with 4 trophic levels.</td></tr>
</table>

	f	i	Arthropods	1	
		ii	Exoskeleton Segmented body	1	Any one.
		iii	Wasps – insects Spiders - arachnids	1 1	
	g	i	A unicellular, Eukaryotic organism	1 1	
		ii	*Amoeba* Traps organism by surrounding it by pseudopodia.	1 1	
Total:				**25**	
2	**a**	i	Acellular – virus May be multicellular - fungi All parasitic - virus	1 1 1	
		ii	Both have genetic material.	1	Do not accept both have DNA. Accept proteins
		iii	Both have cell walls. Both have DNA. Both have cytoplasm.	1	Any one or equivalent.
		iv	**Bacteria** / **Fungi** No membrane bound organelles/ prokaryotic / Membrane bound organelles/ eukaryotic DNA not enclosed in membrane / DNA enclosed in membrane May have flagella / Do not have flagella Unicellular / May be multicellular	1	Do not award any mark if comparison is not made. Accept peptidoglycan cell wall (bacteria) to chitin cell wall (fungi). Any one.
		v	A virus enters the host cell, Using its genetic material and the chemicals within the host cell it makes a copy of itself, Once replication is over, the host cell bursts releasing the viruses	1 1 1 1	
		vi	Binary fission The bacterium duplicates its genetic material. The bacterium divides into **two**, **identical cells with genetic material** in each cell.	1 1 2	
	b		A highly- controlled environment keeps a number of variables (factors) constant Which if varied can change the outcome of the experiment/trial	1 1	Award 1 mark for fair trial.

	c		Nitrifying bacteria – convert soil ammonium compounds/ammonia to nitrates. Saprophytic fungi – break down dead matter to release nutrients in the soil.	2 2	Accept use inorganic compounds/ammonium compounds as an energy source.
	d		**Greenhouse gas emissions** are released in the atmosphere. Energy is transferred from the sun to the Earth via **infrared rays**. The greenhouse gases **absorb** the infrared energy **Trapping the heat** in the atmosphere Resulting in an i**ncrease** in atmospheric temperatures.	1 1 1 1 1	
Total:				**25**	
3	**a**	i	Amount of soil placed in filter paper; amount of water added to each soil sample; amount of time allocated for water to pass through soil.	1, 1	Any two.
		ii	Volume of water that filtered through each soil sample./how much water soil is holding	2	
	b	i	Sandy soil	1	
		ii	Clay soil	1	
		iii	Clay soil	1	
		iv	Sandy soil	1	
		v	Clay soil	1	
	c		Increase soil organic matter by adding humus to the soil and mixing well. or by adding compost and mixing well.	1 1	Award 1 mark for adding clay soil.
	d		Not enough space for plant roots therefore, cannot provide adequate anchorage, water and nutrients for plant growth.	1 1 1	
	e	i	Reduces interspecific competition; To prevent weeds competing for space; To reduce nutrient/ water take up by plants	1 1	Any two
		ii	This helps the land to regain lost nutrients Improves soil structure. Allows soil to recover and store more organic matter	1 1	Accept to increase soil fertility. Any two
		iii	To prevent soil erosion; To conserve soil fertility; Contributes to water conservation; Reduces sedimentation; Increases food production by adjusting hilly land for farming.	1, 1	Any two

		iv	To minimize moisture loss; reduces evaporation; minimizes weed growth; maintains/regulates soil temperature; prevents erosion, enhances crop yield	1 1	Any two Accept to increase nutrient levels.
	f		Legumes contain nitrogen-fixing bacteria in their root nodules These bacteria take up nitrogen from the air spaces in soil. And change it to nitrates to be absorbed by plants		
Total:				**25**	

4	**a**		Monocots / Dicots	1	Any three comparisons
			One cotyledon / Two cotyledons		
			Veins usually parallel / Veins usually netlike		
			Vascular bundles in stem complexly arranged / Vascular bundles in stem arranged in ring	1	
			Fibrous root system / Tap root system	1	
			Floral parts in multiple of three / Floral parts in multiple of four or five		
	b	i	photosynthesis	1	
		ii	Carbon dioxide	1	
		iii	Oxygen	1	
		iv	Carbon dioxide is also a by-product of human respiration and is harmful in high concentrations. Oxygen is needed for aerobic respiration to occur. So the uptake of carbon dioxide and release of oxygen is beneficial as it keeps a balance of concentrations of these two gases.	1 1 1	
	c	i	Roots grow towards the gravitational pull And so are positively geotropic	1 1	
		ii	Water absorption is necessary for mineral uptake and for plant cells to remain turgid.	2	Any three comparisons
		iii	Too much water reduces the oxygen arriving to the roots causing the root cells to die/ rot.	1 1	
	d	i	auxin	1	Accept IAA
		ii	The chemical auxin is in high concentrations in areas of the plant that are shaded.	1 1	

			High concentration of auxin induces growth in the area Less auxin in the lit area brings about less growth, Leading to the shoot of the plant bending towards light as it grows.	1 1	
	e	i	dumping of rubbish building debris increased lead content in soils	1	Any one. Accept chemical waste, and plastic
		ii	dumping of rubbish – rubbish not thrown in bins/ rubbish not taken to waste management units building debris – debris for construction sites increased lead content in soils – shotgun shells/ leaded gasoline/ exterior lead-based paint/ industrial sources	1	Any one.
		iii	Increased N content oil spillage sewage plastics (single use)	1	Any one.
		iv	Increased N content – from extensive use of fertilisers oil spillage – oil-carrying ships sewage – leakage from sewers plastics - from rubbish/ ships carrying nurdles	1	Any one
		v	Increased N content – eutrophication oil spillage – harm/ death to aquatic/ marine organisms sewage – eutrophication/ may be toxic to aquatic/ marine organisms. plastics - harm/ death to aquatic/ marine organisms	1	Any one
Total:				**25**	
5	**a**		**Cells in salt solution A**: When red blood cells are in a hypertonic solution, water **moves out of the cell faster than it comes** in. This results in **shrinking** of the blood cell/ will shrivel. **Cells in salt solution B**: When red blood cells are in an isotonic solution, i.e. same concentration solution, the **same amount of water moves in and out of the cells**. This results in cells **not changing shape**.	2 2	Accept get smaller or shriveled Accept remain the same

			Cells in salt solution C: When red blood cells are placed in a hypotonic solution, i.e. a solution with a lower concentration, the cells will **swell** as a result of more water **moving into the cell than out**. This may lead to potential bursting of the cells.	2	Accept get bigger
	b	i	Blood from the patient circulates outside of the vascular system and passes through the kidney machine containing **semipermeable membranes**. **Waste products in the blood**, such as **urea,** as well as **excess mineral salts and excess water** pass across the membrane into the dialysis fluid and are removed. Cleaned blood is returned to the patient	1 1 2 1	
		ii	To prevent its removal from the blood as the concentration of glucose is equal in blood and the thin-walled tubes.	1 1	
		iii	**Antidiuretic hormone (ADH)** has the primary role in **osmoregulation** by controlling the amount of urine formation. ADH is synthesized in the **hypothalamus** and secreted by **pituitary gland**. **ADH increases reabsorption of water** from the collecting ducts/ into the blood by **osmosis**. As a result, urine becomes more concentrated.	1 1, 1 1 1	accept high OP/blood more concentrated
		iv	Increased life expectancy, fewer dietary restrictions, better quality of life, lower risk of complications no longer need dialysis.	3	Any three
	c		In osmosis, water moves across the cytoplasmic membrane, whereas in active transport, a substance like an ion or a large molecule is moved across. Osmosis is the movement of water molecules, down the concentration gradient, through a partially permeable membrane. The water moves from the area of high concentration of water to low concentration of water. Active transport, an energy requiring process, is the movement of solutes from an area of low concentration to high concentration so against the concentration gradient.	1 1 1 1	Accept from a dilute to a concentrated solution
Total:				**25**	

6	**a**		Title included Axes are labeled and appropriate units are stated Correct plotting of points; plots joined with straight lines Adequate scales chosen (more than half of area fits in under curve)	1 2 2 1	Do not award any marks if graph is drawn on squared paper / if axes are swapped.
	b		115 – 78 = 37 beats min^{-1} 170 – 140 = 30 beats min^{-1}	1 1	Answer should include units.
	c		This study shows that 2 different exercise intensities elicited distinctly different post-exercise patterns of recovery. OR Higher preceding exercise intensity resulted in a slower post-exercise recovery in a progressive dose. OR The heart rate returned to baseline values within 5 min of recovery following Low whereas recovery was markedly delayed following High.OR As recovery period increases the heart rate decreases	1	Any one
	d	i	Philip had poor fitness level or potential health problems as compared to Joe.	1	Accept different age/ different lung capacity
		ii	During exercise muscles work harder, consequently, the rate of respiration increases to meet increased demands. The muscles use more oxygen and get rid of more carbon dioxide. As a result, the breathing rate increases.	1 1 1 1	
	e	i	Aerobic respiration is much more efficient and produces ATP much more quickly, than anaerobic respiration./ More energy is converted in aerobic than anaerobic respiration	2	
		ii	As the muscles contract during exercise a larger amount of oxygen is needed. An oxygen debt occurs when not enough oxygen (cumulative) arrives at the muscles During the exercise period.	1 1 1	
		iii	Lactic acid	1	
		iv	Lactic acid travels to the liver via the bloodstream Where it is metabolised (converted/broken down) And used to produce ATP molecules	1 1 1	
		v	to **build large molecules** from smaller ones	1	Accept active transport. Or equivalent

			used by muscle cells for contraction which leads to **movement** to maintain a warm **body temperature** that is suitable for enzymes to work efficiently.	1	Any two
Total:				**25**	
7	**a**		Gymnosperms are **cone bearing plants** that reproduce by making **naked seeds**	2	
	b		This is a barrier method where The diaphragm fits into the female's vagina at the cervix and prevents sperm passing into the uterus. Prevents fertilisation or pregnancy	1 1 1 1	
	c		In Mitosis a single cell divides into two daughter cells Which carry the same identical DNA	1 1	
	d		Individuals homozygous for X (XX) are females while heterozygous individuals (XY) are males. In meiosis the sperm or egg/ ova contains the haploid number of chromosomes. Within this haploid number the sperm in the male will either have an X or Y chromosome In the female, the egg will carry only an X chromosome as there is no Y chromosome available.	1 1 1 1 1	
	e		In mammals the sperm and egg join inside the oviduct of the female body while in amphibians the male and female gametes are released from the amphibian bodies and meet and join outside the female body.	1 1 1	
	f		Luteinizing hormone in girls signals the **ovaries** to produce **oestrogen** while in boys the LH signals the **testes** to produce **testosterone**.	2 2	LH is produced by pituitary in both males and females – 1 mark
	g		Budding is a type of asexual reproduction whereby a bud/outgrowth is formed by mitosis. Later the nucleus of the parent Hydra/yeast cell is separated into two parts and one of the nuclei shifts into the bud. The newly created bud grows into a new cell.	1 1 1 1 1	
Total:				**25**	

8	**a**		Yeast respires anaerobically, it acts on sugar releasing carbon dioxide gas which forms the foam.	1 1 1	
	b		A ruler is placed against the **side of the test tube** and **held at eye level** to measure the distance from the meniscus (liquid surface) to the top of the foam.	1 1 1	
	c		Graph shows axes with height as the vertical axis and temperature on the horizontal axis. Units for height and temperature must be included.	1 1 2	No marks are allotted if axes are not the correct way round.
	d	i	Mixing provides a homogenous solution/ same concentration	1 1	
		ii	Same amount of mixture was used in each test tube. OR The test tubes were kept in the water baths for the same time.	1	
	e		Collect the bubbles of gas so that the volume can be measured properly. Repeat the experiment several times so that a mean can be calculated.	2 2	
	f		More sets of results improve the reliability of the data and any anomalous results would have less of an effect.	1 1	Accept: choosing the best results Do not accept accuracy
	g		Increasing temperature up to 40^{o}C causes increased rate of respiration in yeast, after which enzyme denaturation occurs, and the rate falls.	1 1 1	
	h		Glucose was the best substrate for the yeast because it gave the fastest rate of respiration, meaning that the most energy was released in the least amount of time for this substrate compared to the others	1 1 1	
Total:				**25**	