L-Università ta' Malta

MATSEC
Examinations Board

Marking Scheme
SEC Biology

Main Session 2019

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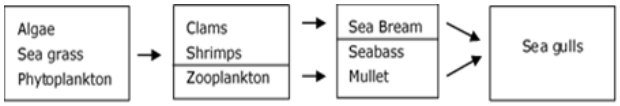
In the case of marking schemes that include model solutions or answers, it should be noted that these are not intended to be exhaustive. Variations and alternatives may also be acceptable. Examiners must consider all answers on their merits, and will have consulted with the MATSEC Examinations Board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

PAPER 1

Question			*Answer*	*Mark*	*Additional comments*
1	a		Greek yoghurt: reducing sugars, protein. Cornmeal: starch, protein.	1, 1 1, 1	Do not accept sugars. Do not accept named reducing sugars e.g. glucose or lactose.
	b		**Equal volume** of unknown / food stuff and Benedict's solution are added. Mixture is **heated** in a **boiling** water bath.	1 ½ ½	Do not award mark if heating (boiling or otherwise) is not included. Do not award marks for mentioning addition of Benedict's sol.
	c		The original yellowish colour of the cornmeal interferes with the final colour of the mixture.	1	Accept answers that indicate interference with final results e.g. colour change not as visible.
	d		Calcium	1	
	e		Greek yoghurt includes **sugars** which are **smaller molecules** and so are **absorbed faster.** **No digestion needed.** **OR** Cornmeal includes **starch** which is a **larger molecule** and needs to be **digested / broken down first** before it is absorbed**.**	½ ½ ½ ½	Award ½ mark for correct answer in bold.
			Total:	**10**	
2	a		 Any of the above combinations. Do not award marks if no arrows are present.	1 1	For correct chain. For correct arrow direction. Award 1 only for correct arrow direction when all organisms in same trophic level are included.
	b	i	If the population of fish is decreasing then the sea gull population in the region will decrease as well.	1	Do not accept reference to extinction/ die out/ all starve.
		ii	The phytoplankton will decrease as a decrease in the fish population, increases the zooplankton, clams and shrimp populations that feed heavily on the phytoplankton.	2	Accept phytoplankton will decrease and award 2 marks.
	c		Top consumers have much less energy available to support them then primary consumers. Therefore, there are less numbers.	1 1	Award 2 marks for reference to lower amount of energy available.
	d		If, too many juvenile fish are caught, they will not have time to breed, therefore the fish population will decrease.	 1 1	Do not accept extinct.
			Total:	**9**	
3	a	i	Enzymes function best/fastest at this temperature and hence bacteria reproduce.	1	Do not accept answers that do not refer to enzymes.
		ii	*Any two:* pH, oxygen, osmotic pressures, water (allowing moisture / humidity), nutrient availability.	1, 1	Accept food, salinity. Do not accept light or air.
	b	i	Lowering temperature will decrease enzyme activity. **OR**	1	Accept 'Bacteria lack energy to multiply'. Do not accept 'Bacteria are inactivated.'

			Freezing causes water to expand and also forms ice crystals, hence cells begin to rupture.		
		ii	Enzyme activity stops as proteins are denatured. **OR** Membrane becomes disrupted.	1	Do not accept 'Bacteria are denatured'. Accept 'Bacteria die due to excessive water loss
	c		<table><tr><th>Feature</th><th>TB Bacterium</th><th>Human Immuno-deficiency Virus (HIV)</th><th>Amoeba Protists</th></tr><tr><td>Presence of cell wall</td><td>Yes</td><td>No</td><td>No</td></tr><tr><td>Organism is a single cell</td><td>Yes</td><td>No</td><td>Yes</td></tr><tr><td>Living</td><td>Yes</td><td>No / Yes</td><td>Yes</td></tr><tr><td>DNA enclosed in membrane</td><td>No</td><td>No</td><td>Yes</td></tr><tr><td>Can only reproduce inside living cells</td><td>No</td><td>Yes</td><td>No</td></tr></table>	5	1 for each correct row **Accept both No and Yes for HIV – living (in bold) – as syllabus refers to virus as borderline.**
				Total:	**10**	
4	a		Title Axes labelled (with units) (Award full marks also when hours not included) Correct scale Correct plotting Plots joined using a ruler	½ ½ 1 1 1	If scales are inverted do not award any marks If scale on x axis is not correct deduct **3** marks.
	b		To ensure comparable results **OR** So that all larvae start developing at the same time/ one variable only. (Or equivalent)	2	Do not accept unqualified 'for fair testing'.
	c	i	As the concentration increases, the time for development decreases.	1	Re: c i & cii If candidates give a similar answer in both questions, e.g. Bacteria grow faster, award 2 marks for c ii.
		ii	As the concentration increases, the rate of development increases.	2	
	d		Protein is mainly responsible for growth / formation of cells	1	
				Total:	**10**	
5	a	i	By using less products that are individually packaged.	1	Accept other valid answers.
		ii	Recycling uses a high amount of energy and a number of chemicals that may pollute the environment in the recycling processes.	1 1	Accept other valid answers. Do not accept answers regarding 'recycling not popular as most people are lazy / just throw away waste).
	b	i	Compost **OR** Conversion into heat energy / electrical energy Biogas / Methane.	1	Do not accept fertiliser/ carbon dioxide.
		ii	Nutrients still found in organic waste cannot be recycled OR Methane is released in air (Methane is a greenhouse gas).	2	Accept other valid answers.

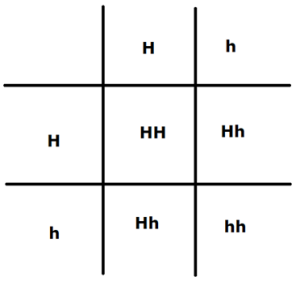
	c		Reduce plastic waste by not using single use plastics **OR** Use plastic containers several times.	2	Accept other valid answers such as educational and awareness campaigns. Do not accept biodegradable plastic but accept biodegradable items.
			Total:	**8**	
6	a		The amount of water that a given soil can retain for plant use.	1	
	b	i	Soil must be completely dry/ soil must be well packed	1	
		ii	Deduct the volume of water in the measuring cylinder from the volume of water poured on the soil.	2	
	c		Microorganisms/fungi/organisms and plant/animal residues.	1 1	
	d		It increases water infiltration and storage, acts as a pH buffer (to maintain an acid-base balance), decomposes organic material and releases nutrients.	1 1 1 1	Accept other valid answers. Do not accept to make soil more fertile.
			Total:	**10**	
7.	a	i	B	1	
		ii	C - temperature receptor/sensory nerve ending D - sweat gland.	1 1	
		iii	Temperature receptor/sensory nerve ending triggers a message to the hypothalamus/brain Sweat gland release sweat.	1 1	
	b	i	The Masai, being tall with slender bodies with long limbs is less compact and offers a **large surface area** relative to their body mass. The greater the surface area, the **faster body heat will be lost** to the environment. The **stocky body and short limbs of Eskimos offer more efficiency at maintaining body heat** as there is **less surface area** compared to body mass.	1 1 1 1	Accept - lack of insulating layer of fat in the Masai to increase heat loss, as contrasted to the presence of an insulating layer of fat in Eskimos to reduce heat loss
		ii	Fatty food is effective in providing a layer for insulation/ is an energy store.	1	
			Total:	**10**	
8	a		Pituitary gland	1	
	b	i	X = oestrogen; Y = progesterone	1 1	
		ii	Day 14. Oestrogen (reaches a peak followed by decline) before day 14. LH rises after oestrogen peak (from graph) to give ovulation/peaking.	1 2	Accept: Day 14/15
		iii	Oestrogen building up to inhibit FSH **OR** progesterone build up inhibiting FSH and LH.	2	
	c.	i	Infertility is a disease of the reproductive system defined by the failure to achieve pregnancy after 12 months or more of regular unprotected sexual intercourse.	1	Accept: Infertility is the inability to become pregnant.

		ii	*Any one of:* Ovulation problems, endometriosis, unhealthy body weight, abnormal cervical mucus, damaged or block fallopian tubes, uterine abnormalities, chlamydial infections.	1	Accept drugs use /radiation and STD
		iii	Organ – ovary Implantation – uterus	1 1	Accept – uterine lining/ endometrium
			Total:	**12**	
9	a		A: No change in levels B: Level in manometer moves up/rises/ increases	1 1	B – Do not accept level changes; do not accept explanation to description. Deduct ½ mark.
	b		As carbon dioxide is produced from aerobic respiration it is immediately absorbed by soda-lime. Oxygen is used up for respiration. Volume of gases decreases.	1 1	
	c		If soda lime is not present, the volume of carbon dioxide replaces the volume of oxygen. Therefore there is no change in the position of the manometer.	1 1	
	d		It is to keep temperature as a constant variable.	2	Award 1 mark for – To keep same temperature
	e	i	Germination starts off when water is absorbed. This will produce simple sugars for respiration.	1 1	
		ii	Water is given to both to keep factors constant.	1	Accept fair testing/ test tube A is control.
			Total:	**11**	
10	a	i	It has a sac-like body plan, with only one opening/ radial symmetry.	1 1	Do not accept one mouth but accept one mouth/anus.
		ii	Type of cells: Stinging cells/nematocytes/cnidocytes Functions: Capturing/ Paralysing prey/protection	1 1	
	b		A: Mauve stinger B: Barrel jellyfish C: Boxed jellyfish D: By the wind sailor	1, 1 1, 1	
	c		Cnidaria do not need a circulatory system as diffusion allows adequate exchange of water, nutrients, waste and dissolved gases. In complex organisms, diffusion is not enough. A circulatory system supplies nutrients and oxygen to all cell to remove waste.	1 1	Refer to diffusion
			Total:	**10**	

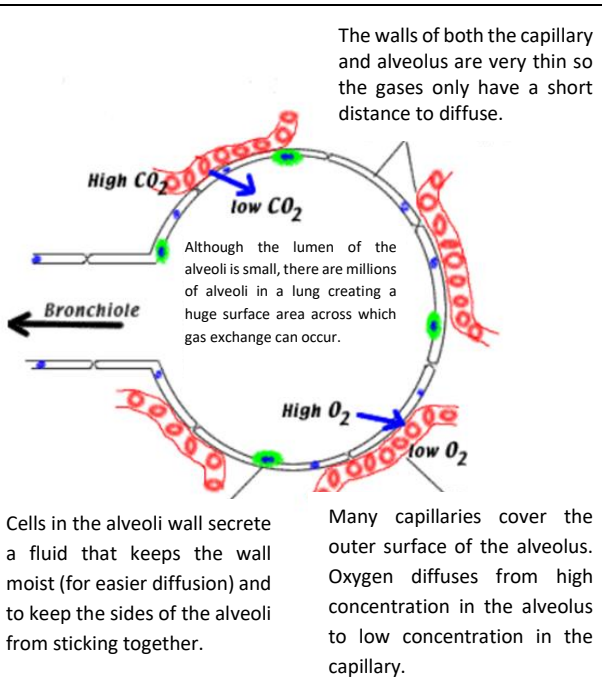
PAPER 2A

Question			*Answer*	*Mark*	*Additional comments*
1	a	i	hoverflies, butterflies, moths	1	Any two of - ½ mark each.
		ii	Body has jointed appendages or legs Body is covered with a firm but flexible exoskeleton	1 1	
		iii	Species: destructor **OR** jacobsoni	1	Deduct ½ mark if not underlined.
	b		Habitats are not affected by organic farming since it relies on natural biological cycles, organic manure and biological pest control without the application of artificial/ chemical fertilisers and plant protection products.	1 1	Accept: no use of inorganic fertilizer and no use of pesticides.
	c		Increasingly unbalanced diets or health problems, such as malnutrition and non-communicable diseases.	1	Accept other valid answers. Deduct ½ mark if disease is not specified.
	d		**Plants form the building blocks** of all ecosystems and **disruption to their pollination and subsequent fertilization to produce seeds** is likely to result in similar **declines in plant species diversity or plant density** which in turn **affects the animals and birds that rely on them**. This threatens ecosystem function and other ecosystem services that nature provides.	2	Any two of the bold statements.
	e		Help provide farm animals diverse forage sources and hence more flexibility to adapt to an increasingly changing climate.	1	Accept other valid answers.
	f		i. Degradation or loss of their habitats. ii. Changes in land use and landscape structure.	2	Accept other valid answers. Do not accept killing of bees.
			Total:	**12**	
2	a		Title included Axes are labelled and appropriate units are stated Correct plotting of points Plots joined with straight lines Key / legend included Adequate scales used (more than half of page used)	1 1 1 1 1 1	Do not award any marks if: graph is drawn on squared paper / or graphs are drawn separately or only one set of data is drawn / if axes are swapped.
	b		Rate of photosynthesis in shade plants is higher than rate of photosynthesis in sun plants. Shade plants are adapted to photosynthesize efficiently at low light intensities.	1 1	
	c		Shade plants: rate of photosynthesis reaches a maximum and constant of 15 a.u. above 200 a.u. Sun plants: rate of photosynthesis reaches 40 a.u. and is still increasing / still not max and constant at 600 a.u.	1 1	Expect reference to values from curve. Award 1 mark if no values are given. Acknowledge reference to shape of curves.
	d		Predicted value: 30 a.u. Reason: CO_2 concentration also affects the rate of photosynthesis. The higher the CO_2 concentration the higher the rate.	1 2	± 10 a.u. Deduct ½ mark if no units. Do not accept answers such as "it would double" or any answer where a **value** is not given.
			Total:	**13**	

3	a	i	Water is a liquid / fluid/solvent and so acts as a transport medium.	1 1	Do not accept keeps shape of cell. Do not accept hydration; for swallowing; form the bolus, moisten the food.
		ii	Water acts as a solvent providing a medium for chemical reactions to occur.	1 1	
		iii	Water acts as a reactant in catabolic reactions.	1 1	
	b		All gas exchange surfaces have a higher concentration of water (vapour) inside them compared to the air outside.	2	Award 1 mark for "high surface area" and for "permeable to water".
	c	i	Leaves: stomata Insects: spiracles	1 1	
		ii	Lungs / Gas exchange surface is an internal structure. **OR** Narrow tubes lead to the gas exchange surface.	2	
		iii	Fish live in water. There is a difference in concentration gradients between water and blood.	1 1	
	d		Water tends to enter both *Amoeba* and *Chlorella* by osmosis. *Chlorella* is surrounded by a cellulose cell wall and so cannot burst. *Amoeba* lacks a cell wall and may burst. So it needs a contractile vacuole to remove the water that enters in its cytoplasm.	1 1 2	
	e	i	Cold day: No sweating; volume of water in blood increases; higher amount of filtration in kidney. Hot day: Sweating; volume of water in blood decreases; less filtration of water in kidney.	2 2	
		ii	Glomerulus/Bowman's capsule.	1	
		iii	ADH; Collecting duct.	1 1	
			Total:	**25**	
4	a	i	The burning of fossil fuels (often associated with driving cars) release carbon dioxide into the atmosphere. The cutting down of trees reduces the amount of carbon dioxide that can be taken out of the atmosphere. Methane gas released into the atmosphere by cattle farms, is much harder to take out of the air than CO_2.	2 2 2	
		ii	Respiration and decomposition release carbon containing compounds into the atmosphere, into the soil and oceans. Sedimentation allows carbon trapped in the bodies of phytoplankton and other micro marine photoautotrophs, upon death some will sink to the ocean's bottom and become sediment.	2 2	Accept: reference to sedimentation and fossilisation; photosynthesising plants absorb carbon dioxide and convert in to glucose.
	b		Urea contains the **element nitrogen**, needed to **make protein** required for **growth** and hence provides more food for humans.	3	

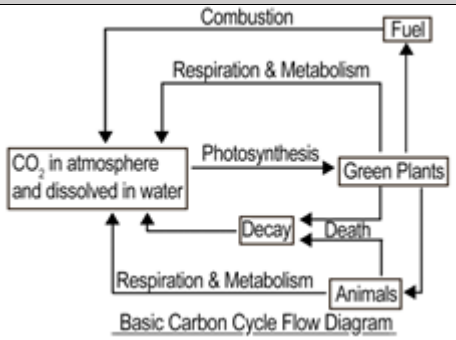
	c	i	Nitrogen fixing bacteria convert atmospheric nitrogen into ammonia/ammonium compounds or oxides of nitrogen.	2	
		ii	The production of fertilizer accounting for more than half of the annual amount of nitrogen fixation attributed to human activity. Over production of manure.	1 1	Accept Planting legumes which are attractive hosts for nitrogen-fixing microbes and therefore enrich the soil where they grow.
	d	i	Denitrification Denitrification bacteria	1 1	
		ii	Ammonification/or decomposition Saprophytic/decomposing bacteria	1 1	
	e		Nitrogen fixing bacteria *(Rhizobium)* synthesises nitrogen containing compounds which pass to the plant to use. This allows legumes to grow in low fertility soil/soil which lacks nitrogen. Plant syntheses products (e.g. carbohydrates) which pass to the *Rhizobium* are used for respiration.	2 1 1	Do not accept fixes nitrogen. Accept – plant provides protection to the bacteria.
			Total:	**25**	
5	a	i	Person 1 = Hh, person 2 =hh. Person 1 suffers from the disease therefore he has at least one dominant allele. He appears to be heterozygous as two of his offspring are normal. Person 2 is normal and is therefore homozygous recessive.	3	
		ii	Since both person 6 and 7 are heterozygous, person 11 must have inherited the recessive allele from each parent and therefore does not suffer from the disease.	2	
		iii	Mother: Hh Father: Hh Gametes: H h H h  75% probability that the child will suffer from Huntington's disease.	1 1 1 1	Award ½ mark if gametes are not in circle.
	b		Traits carried on chromosomes 1-22 are autosomal traits. Traits carried on the X and Y chromosomes are sex linked traits. A sex-linked trait usually affects one gender more than the other while an autosomal trait affects both genders equally.	1 1	Comparison is expected.
	c	i	A = Cerebral hemispheres/Cerebrum/Cerebral cortex B = Medulla Oblongata C = Cerebellum	1 1 1	Do not accept medulla (on its own) and brain stem.

		ii	Acts as a bridge between brain and spinal cord/ controls functions related to breathing, heartbeat, blood pressure / centre for reflex actions such as sneezing, coughing and vomiting.	1	
		iii	Homeostasis is the state of steady internal conditions maintained by living things.	1	
	d	i	For pain to be felt, the impulse has to travel to the brain.	1	
		ii	A reflex action is a **rapid** response to a stimulus, which **minimises any damage** to the body from potentially harmful conditions.	1 1	
	e	i	Before drinking coffee, average distance = 18.4 cm After drinking coffee, average distance = 12.4 cm	1 1	No units deduct ½ mark. Do not award marks if an average of the two answers is given.
		ii	Caffeine decreases reaction time.	1	
		iii	The two sets of results overlap/ small sample (just one person).	1	
		iv	*Any two:* More repetitions/ perform investigation on several other people/use equal amounts of coffee/ use more time intervals.	2	Accept other valid answers.
			Total:	**25**	
6	a	i	Diffusion	1	
		ii	Flat body/ thin body/ large surface area	2	
	b	i	As the blood flows in the opposite direction to the water, to maintain steep concentration gradient This increases the surface area for gas exchange. This way, the blood is absorbing more and more oxygen as it moves along.	1 1	
		ii	Highly vascularised - to provide a rich blood supply to carry oxygen and carbon dioxide. Thin to decrease distance of diffusion.	1 1	
	c	i	Air enters the tracheae through the spiracles and travels through the tracheoles to the fluid-filled tips, where O_2 diffuses directly from the tracheoles into the muscle cells, and CO_2 diffuses from the muscle cells into the tracheoles.	1 1	
		ii	Fish get oxygen from water, insects get oxygen from air. / In fish oxygen and carbon dioxide are transported by the circulatory system while insects don't have a circulatory system.	1	Accept other valid answer. Award mark if comparison is mentioned.
		iii	Insects possess a trachea and through them, insects inhale oxygen that eventually reaches the cells. If insects were to become any larger, the amount of oxygen that they would need in order to survive would be too great to fit through an insect's narrow trachea.	2	Accept: "Exoskeleton too heavy."

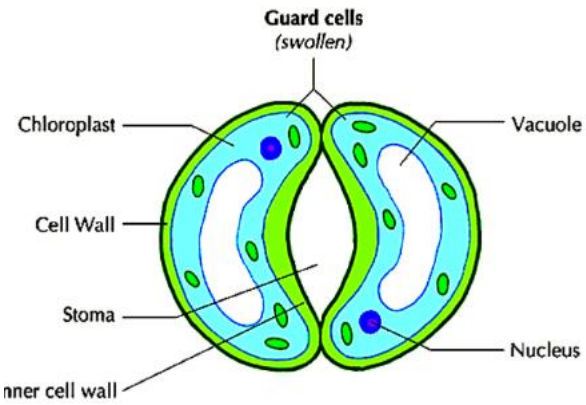
	d			2 3	For diagram. For features.
	e	i	A = Goblet cell / Mucus secreting cell B = Ciliated epithelial cell	1 1	Do not accept mucus. Accept epithelial cell with microvilli.
		ii	The goblet cells lining the trachea make slimy mucus. Dust and germs get trapped in the slime. The epithelial cells have tiny hairs or cilia on them. These beat to carry mucus up to the nose and throat.	2	Accept the use of the term microvilli instead of cilia.
	f	i	82.95 dm^3	1	Deduct ½ mark if units not given.
		ii	Diaphragm / external intercostal muscle must contract more rapidly/frequently. Breaths become heavier/ deeper.	1 1	
		iii	More (oxygen / cell respiration / energy / muscle contraction) needed.	1	Any one
			Total:	**25**	
7	a	i	Bryophytes/Mosses	1	
		ii	Bryophytes have rhizoids for anchorage / lack true roots; primitive stems with no vascularisation; very thin leaves. All these contribute to the plants remaining small as nutrients are poorly transported.	1 1	Any one of the 3 characteristics.
		iii	Development of roots/ leaves. Specialisation of cells into vascular tissue/Vascular bundles.	1 1	Accept presence of waxy cuticle.
		iv	Development of roots – resulting in absorption of water and mineral ions. Vascular bundles transport water/ mineral ions from roots to leaves and photosynthetic products from leaves to all the plant.	2 2	Accept waxy cuticle reduces water loss from the top of leaves.
	b	i	Reduced leaf surface area.	1	Accept needle like leaves.
		ii	Vertebrata / vertebrates / Chordata	1	
		iii	Have: hair/ fur; mammary glands; outer ear; diaphragm.	2	Any two.

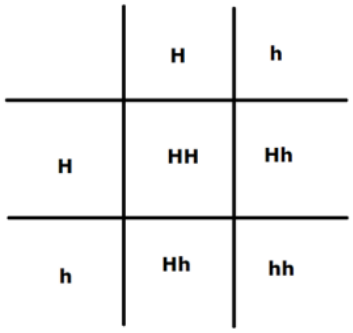
	c		Epigeal germination	1	
	d	i	Starch	1	
		ii	Allows for the passage of water into seed.	1	
	e		Plants take in water and mineral ions from roots; CO_2 is taken up from the stomata. Other substances needed for growth are produced in plant cells. These include sugars from photosynthesis and growth hormones	1 1 1	
	f	i	Static dish: The radicle of P_1 and Q_1 turn downwards while that of R_1 remains moving downwards Rotating dish: All radicles remain growing in the direction they were growing.	1 1	Accept straight down but not straight.
		ii	Gravity acts positively on the roots in the static dish. As the other dish is rotating the effect of gravity is annulled.	1 1	
		iii	Only one variable is tested.	2	
			Total:	**25**	

PAPER 2B

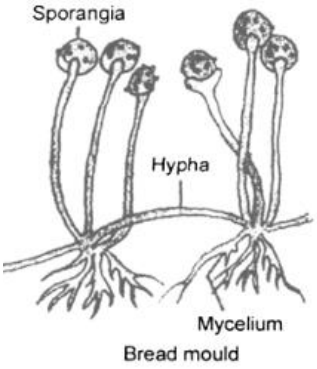
Question			Answer	Mark	Additional comments
1	a		 Basic Carbon Cycle Flow Diagram	10	1 mark each for: CO_2 in atmosphere, fossil fuels, green plants, animals decay, combustion, respiration and metabolism of plants, respiration and metabolism of animals, photosynthesis, death.
	b		Nitrogen fixation is the process by which bacteria in root nodules of leguminous plants convert atmospheric nitrogen into ammonia/ ammonium salts.	2	
	c		The production of fertilizer accounting for more than half of the annual amount of nitrogen fixation attributed to human activity. Over production of manure.	2 2	Accept: Planting legumes which are attractive hosts for nitrogen-fixing microbes and therefore enrich the soil where they grow.
	d		Denitrification Denitrification bacteria	1 1	
	e	i	Amino acids	1	Accept proteins.
		ii	Urea contains nitrogen used by cattle to form proteins for growth.	2	
	f		Nitrogen fixing bacteria (*Rhizobium)* synthesises nitrogen containing compounds which pass to the plant to use. Allows legumes to grow in low fertility soil/soil which lacks nitrogen.	2 2	Accept – plant provides protection to the bacteria
			Total:	**25**	
2	a	i	hoverflies, butterflies, moths	2	Any two
		ii	The transfer of pollen by insects from the anther to the stigma.	1 1	Do not accept plant to plant.
	b	i	Insecta	1	
		ii	Body has jointed appendages or legs Body segmentation Body is covered with a firm but flexible exoskeleton	2	Any two 1 each
		iii	<u>destructor</u> or <u>jacobsoni</u>	1	Deduct ½ mark if not underlined.
		iv	Arachnida	1	
	c		The number of pollinators are decreasing. Because of human interaction, invasive species and parasites. So farmers have to pay the service of pollination.	1 1 1	

	d		Plants form the **building blocks of all ecosystems** and **disruption to their pollination and subsequent fertilization to produce seeds** is likely to result in similar **declines in plant species diversity or plant density** which in turn **affects the animals and birds** that rely on them. This would threaten ecosystem function and other ecosystem services that nature provides.	3	Any three of the bold statements
	e		Increasingly unbalanced diets and health problems, such as malnutrition and non-communicable diseases.	2	
	f		Pollinators: *(Any one)* Help provide farm animals diverse forage sources and hence more flexibility to adapt to an increasingly changing climate. Provide certain medicines, biofuels, fibres and construction materials. Some species also provide materials such as beeswax. Perform pollination/ increase genetic diversity in plants/ Plant control/habitat of plants will not be destroyed.	3	
	g		Degradation or loss of their habitats; changes in land use and landscape structure; intensive agricultural practices / management; environmental pollution; pesticide use; invasive alien species; parasites / pests spread diseases; climate change; deforestation/ global warming/ destruction of hives.	5	Award full marks for at least three correct answers. Accept: monocultures, higher temperatures, droughts, floods, other extreme climate events. Do not accept killing of bees.
			Total:	**25**	
3	a	i	A parasite is an organism, living in or on the host, causing it some harm, and is structurally adapted to this way of life.	1	Do not accept the parasite feeds on host.
		ii	Thin body/ flat body/ large surface area	2	Any two
		iii	Diffusion	1	
		iv	No specialised gas exchange structures are needed as the body is thin so the diffusion distance is small	1 1	Accept: flat to provide a large surface area to volume ratio.
	b	i	Highly folded - large surface area; Thin - short diffusion distance; Rich blood supply - steep concentration gradient/ counter current flow.	1 1 1	Accept: Gases can dissolve in water or aqueous solution in order to travel across cell membranes.
		ii	Lamellae increase the surface area for absorption of dissolved gases from water to gills and vice versa	1 1	
	c	i	Arthropods	1	
		ii	Protection, support and muscle attachment/ allows movement/ prevents camouflage/water loss.	1,1,1	
		iii	Fish get oxygen from water, insects get oxygen from air. / In fish oxygen and carbon dioxide are transported by the circulatory system while insects don't have a circulatory system.	1	Accept other valid answer. Award mark if comparison is mentioned.

		iv	The tiny hairs surrounding the spiracles help to trap humid air reducing the concentration gradient of water vapour which reduces water loss.	1 1	
		v	Thick fleshy leaves; very narrow leaves; spiny, or thicker waxy leaves; deep root systems; shallow roots.	3	Any three valid answers.
	d	i	A = Goblet cell / Mucus secreting cell B = Ciliated epithelial cell	2	Do not accept mucus. Accept epithelial cell with microvilli.
		ii	The goblet cells lining the trachea make slimy mucus. Dust and germs get trapped in the slime. The epithelial cells have tiny hairs or cilia on them. These beat to carry mucus up to the nose and throat.	2	Accept the use of the term microvilli instead of cilia.
			Total:	**25**	
4	a	i	Water is a liquid / fluid/ solvent and so acts as a transport medium.	1 1	Do not accept keeps shape of cell Do not accept hydration; for swallowing; form the bolus, moisten the food.
		ii	Water acts as a solvent providing a medium for chemical reactions to occur	1 1	
		iii	Water acts as a reactant in catabolic reactions.	1 1	
	b		All gas exchange surfaces have a higher concentration of water (vapour) inside them compared to the air outside.	2	Award 1 mark for "high surface area" and for "permeable to water".
	c	i		2 1, 1	For diagram. For two different labels.
		ii	Lungs / Gas exchange surface is an internal structure. **OR** Narrow tubes lead to the gas exchange surface.	2	
	d	i	The contractile vacuole has taken up the excess water entering the Amoeba by osmosis. This water is expelled out of the cell.	1 1 1	
		ii	Water tends to enter the Chlorella by osmosis. Chlorella is surrounded by a cellulose cell wall and so cannot burst.	1 1	
	e	i	Process: Sweating Significance: Cooling effect	1 1	
		ii	Cold day: No sweating; volume of water in blood increases; higher amount of filtration in kidney. Hot day: Sweating; volume of water in blood decreases; less filtration of water in kidney.	2 2	
			Total:	**25**	

5	a		An allele is one of the possible forms of a gene. Most genes have two alleles, a dominant allele and a recessive allele.	1	
	b		Person 1 = Hh, person 2 =hh. Person 1 suffers from the disease therefore he has at least one dominant allele. He appears to be heterozygous as two of his offspring are normal. Person 2 is normal and is therefore homozygous recessive.	3	
	c	i	The gene has two alleles one being dominant and the other recessive.	1	
		ii	Since both person 6 and 7 are heterozygous, person 11 must have inherited the recessive allele from each parent and therefore does not suffer from the disease.	2	
	d		Mother: Hh Father: Hh Gametes: H h H h  75% probability that the child will suffer from Huntington's disease.	1 1 1 1	Award ½ mark if gametes are not in circle
	e		An autosome is a chromosome from nos 1 – 22 (not sex chromosome)	1	
	f	i	A = Cerebral hemispheres/Cerebrum/Cerebral cortex B = Medulla Oblongata C = Cerebellum	1 1 1	Do not accept medulla (on its own) and brain stem.
		ii	Acts as a bridge between brain and spinal cord/ controls functions related to breathing, heartbeat, blood pressure / centre for reflex actions such as sneezing, coughing and vomiting.	1	
	g	i	Cerebrum	1	
		ii	Intelligence, emotions and acquired skills.	1	
		iii	Damage must be between arms and legs/ below arms/ below waist. Since information from the nerves in the arms still reaches the brain/ information from the legs does not reach the brain.	1 1	
	h	i	A reflex action is a rapid, automatic, involuntary, unlearned response to a stimulus.	1	Accept any two adjectives

		ii	<table><tr><th></th><th>Reflex action</th><th></th><th>How the reflex action helps the baby</th></tr><tr><td>1</td><td>If milk goes down the baby's wind-pipe, the baby coughs.</td><td>4</td><td>Helps to protect some of the baby's receptors.</td></tr><tr><td>2</td><td>If the mother strokes the baby's mouth, the baby begins to suck.</td><td>3</td><td>Helps the baby to hold on to the mother.</td></tr><tr><td>3</td><td>If the mother touches the palm of the baby's hand, the baby clenches its fist.</td><td>1</td><td>Prevents the baby from choking.</td></tr><tr><td>4</td><td>If a bright light shines on the baby, the baby's eyes shut.</td><td>2</td><td>Helps the baby to feed.</td></tr></table>	4	
			Total:	**25**	
6	a		Title included Axes are labelled and appropriate units are stated (Deduct ½ mark if units are not listed) Correct plotting of points; plots joined with straight lines Adequate scales used (more than half of page used)	1 1 2 1 1	Do not award any marks if graph is drawn on squared paper / if axes are swapped.
	b		Correct curve sketched. Max rate at 15 a.u.	1 1	Award mark for correct shape. Do not expect plotting of curve.
	c		Rate of photosynthesis in shade plants is higher than rate of photosynthesis in sun plants. Shade plants are adapted to photosynthesize efficiently at low light intensities.	1 2	
	d		Shade plants: rate of photosynthesis reaches a maximum and constant of 15 a.u. above 200 a.u. Sun plants: rate of photosynthesis continues to increase from 18 a.u. to 40 a.u. (at 600 a.u.)	1 1	Expect reference to values from table.
	e		Predicted value: 30 a.u. Reason: CO_2 concentration also affects the rate of photosynthesis. The higher the CO_2 concentration the higher the rate.	1 2	± 10 a.u. Deduct ½ mark if no units. Do not accept answers such as "it would double" or any answer where a value is not given
	f		At 600 a.u. 'sun' plants have a higher rate of photosynthesis. They produce biomass at a faster rate.	1 1	Allow produce food at a faster rate.
	g		Larger leaves = larger S.A. Horizontal position = more S.A. exposed to sunlight So, more light trapped, ensuring maximum rate of photosynthesis.	1 1 1	
	h	i	Site where photosynthesis occurs	1	
		ii	Chlorophyll.	1	Accept Carotenoid
		iii	More chlorophyll therefore more trapping of light. Ensures faster rate of photosynthesis	2	
			Total:	**25**	

7	a	i	Bryophytes have rhizoids instead of roots; need water for reproduction; primitive stems with no vascularisation'; very thin leaves.	2	Any one
		ii	The fact that they do not have transport mechanisms; means that the movement of sugars to all the parts of the plant is slow.	1 1	
		iii	Development of roots/leaves Vascular bundles	2	Accept presence of waxy cuticle.
		iv	Development of roots – resulting in absorption of water and mineral ions. Vascular bundles transport water/ mineral ions from roots to leaves and photosynthetic products from leaves to all the plant.	3	Accept waxy cuticle reduces water loss from the top of leaves.
	b	i	Reduced leaf surface area	2	Accept needle like leaves.
		ii	Vertebrata / vertebrates / Chordata	1	
		iii	Have: hair/ fur; mammary glands; outer ear; diaphragm	4	Any two
	c	i	 Bread mould	2 3	For diagram. 1 mark for each label.
		ii	Asexual reproduction in moulds is by means of spores. The sporangia burst open releasing the spores in the surrounding environment.	1 1	
		iii	The production and dispersal of many spores means that some may fall on a moist environment and germinate.	2	
			Total:	**25**	
8	a	i	Chemical digestion starts in the <u>mouth</u> with the breakdown of starch. The food is physically digested with chewing and mixed with saliva, which contains the enzyme salivary amylase that breaks down starch into maltose	1 1 2	
		ii	The pancreas secretes digestive enzymes into the <u>duodenum.</u> While the liver produces <u>bile which does not contain enzymes.</u> The pancreas produces different enzymes to break down macromolecules of food. The liver produces bile that is stored in the gall bladder before secretion. Enzymes and bile are both secreted into the small intestine.	2 1 2 1	Accept emulsification.

<table>
<tr><td></td><td></td><td>iii</td><td>The <u>small intestine</u> absorbs the digested products of food. / The large intestine absorbs water.
It is specifically the ileum where absorption occurs.
Digested molecules of carbohydrates, fats and proteins are absorbed through the villi of the ileum.</td><td>2

1
2</td><td></td></tr>
<tr><td></td><td>b</td><td></td><td><table><tr><th>Herbivore</th><th>Humans</th></tr><tr><td>4 chambered stomach</td><td>1 stomach</td></tr><tr><td>Incisors/ canines flat shaped</td><td>Incisors sharp and canines pointed</td></tr><tr><td>Molars flattened with cusps</td><td>Molars sharp blades or flattened</td></tr><tr><td>Long intestine</td><td>Shorter intestine</td></tr></table></td><td>4</td><td>2 marks each comparison.
Do not award marks if comparison is not made.</td></tr>
<tr><td></td><td>c</td><td>i</td><td>Mutualistic – when both organisms benefit from the association.</td><td>2</td><td></td></tr>
<tr><td></td><td></td><td>ii</td><td>The bacteria produce <u>enzymes</u> that break down <u>cellulose</u> into <u>smaller soluble molecules</u> for fermentation <u>producing energy for themselves and food for the ruminants.</u></td><td>4</td><td>1 for each underlined part.</td></tr>
<tr><td colspan="4">Total:</td><td>25</td><td></td></tr>
</table>