

Markscheme

November 2018

Biology

Standard level

Paper 3

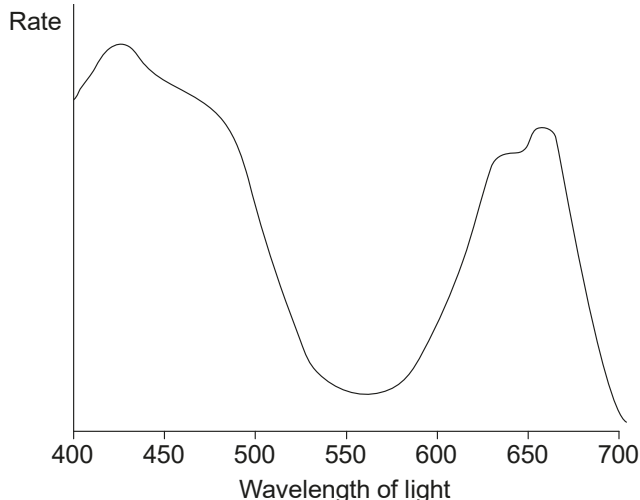
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Section A

Question			Answers	Notes	Total
1.	a		to remove any starch already in the leaf OR so any starch found in the leaf was made during the experiment OR to prevent further production of starch ✓		1
1.	b	i	X AND Y ✓	<i>Both needed</i>	1
1.	b	ii	W AND X ✓	<i>Both needed</i>	1
1.	b	iii	<p><i>pro (yes it could be evidence):</i></p> <p>a. starch is a product of photosynthesis ✓</p> <p><i>con (not necessarily evidence):</i></p> <p>b. starch could be made elsewhere «in the plant» and transported to/stored in leaves OR starch could be made by another process «other than photosynthesis» OR starch is being detected although glucose is the direct product ✓</p> <p><i>limitations of experiment:</i></p> <p>c. starch depletion may take more than 24 hours «of dark» OR starch production may take more than 6 hours «of light» OR starch should have been measured before and after ✓</p>	OWTTE	2 max

(continued...)

(Question 1 continued)

Question			Answers	Notes	Total
1.	c	i	sketch showing 2 peaks at either end of the spectrum ✓		1
1.	c	ii	it would be a straight line/have no peaks OR no photosynthesis ✓	<p><i>Accept a labelled horizontal line in the bottom third of the y-axis.</i></p> <p><i>Do not accept "lower line" or "lower photosynthesis"</i></p>	1
1.	d		«having the leaf partly white would be» no selective advantage/cannot compete OR natural selection would reduce the frequency of the mutation causing variegated leaves OR occur due to artificial selection ✓	<p><i>Some reference to evolution or natural selection required</i></p> <p><i>Do not accept reference to photosynthesis alone</i></p>	1

Question		Answers	Notes	Total
2.	a	12 breaths per minute/6 litres per minute ✓	<p><i>breaths per minute.</i></p> <p><i>Accept answers from 5.5 to 6 litres per minute.</i></p> <p><i>Answer must include breaths or litres and a standard unit of time.</i></p> <p><i>Correct:</i> eg: 12 breaths / minute eg: 0.1 L sec⁻¹ or 6 L min⁻¹</p> <p><i>Incorrect:</i> eg: but 12 breaths = 0 marks</p>	1
2.	b	a. the volume of air per breath increases OR the volume of each breath reaches a maximum/levels off OR frequency of ventilation/breaths per minute increases ✓ b. exercise increases «rate of cellular» respiration/energy use/blood CO ₂ /acidity ✓ c. exercise causes increased demand for oxygen/removal of carbon dioxide ✓ d. maximum rate/depth of ventilation is determined by the capacity of the student ✓		2 max
2.	c	«total resting lung volume» would be greater ✓		1


3.	a	a. telophase ✓ b. chromatids/chromosomes have been pulled to the poles of the cell OR «2» new/daughter nuclei forming ✓	<i>Do not accept cytokinesis</i>	2
3.	b	0.3 <i>or</i> 30% ✓		1

Section B

Option A — Neurobiology and behaviour

Question		Answers	Notes	Total
4.	a	1000 ✓	<i>Working not required</i>	1
4.	b	a. skeletal muscle uses more total energy than the brain ✓ b. the brain uses more energy per kg than skeletal muscle OR the brain has higher metabolic rate ✓	<i>Accept numerical answers if comparative terms are used</i>	2
4.	c	a. «brain requires more» energy to maintain a proper ionic balance/homeostasis/active transport ✓ b. «brain requires more» energy for synapses/neurotransmitters ✓ c. «brain requires more» energy for thinking and memory ✓ d. skeletal muscle active on demand but brain constantly active ✓		1 max
4.	d	a. does not require conscious thought ✓ b. can respond to emergency situation and «actively» return the body to normal ✓ c. medulla/brain stem controls involuntary activities ✓ d. eg: swallowing/breathing/heart rate ✓	<i>Accept other valid examples</i>	2 max

Question		Answers	Notes	Total
5.	a	a. «the process shows» the growth of an axon/dendrites/extensions ✓ b. differentiation/forming a specialized neuron ✓ c. responding to a chemical stimulus ✓		2 max
5.	b	a. the neuron forms synapses/multiple connections «with other neurons» OR a neural network forms OR more dendrites ✓ b. some synapses/connections in excess of what is required OR some synapses/connections not used ✓ c. it could be removed by neural pruning/apoptosis ✓ d. it could migrate to another place ✓		2 max
5.	c	a. allows brain to change/adjust/make new synapses throughout lifetime/with experience/learning ✓ b. allows regeneration of neurons after brain trauma OR allows other area «of the brain» to take over a function after brain trauma ✓ c. selective advantage/increases chance of survival ✓	OWTTE	1 max

Question			Answers	Notes	Total
6.	a	i	 <p>visual cortex ✓</p>	Accept any label within the area shown on the image	1
6.	a	ii	pituitary gland ✓		1
6.	b		<p>a magnetic field is used to make pictures of brain/organs/structures ✓</p> <p>b. an fMRI shows changes in blood flow ✓</p> <p>c. increased blood flow associated with activity in specific areas of the brain ✓</p> <p>d. performance of task matched with active area of brain ✓</p>		2 max
7.	a		pinna/auricle ✓		1
7.	b		<p>a. sound travels in «longitudinal» waves/vibrations ✓</p> <p>b. vibrations in the air cause vibration of the eardrum ✓</p> <p>c. the vibrations/sounds are passed on to the bones/ossicles «of the middle ear» ✓</p> <p>d. the bones amplify the sound/vibrations ✓</p> <p>e. «bones» transmit sound/vibrations to the oval window ✓</p> <p>f. vibration of oval window causes fluid movement in the cochlea «in the inner ear» ✓</p> <p>g. hair cells move with the vibrations/sound ✓</p>		4 max

Option B — Biotechnology and bioinformatics

Question		Answers	Notes	Total
8.	a	phytoene synthase ✓		1
8.	b	a. by detecting a marker/resistance/sequencing gene ✓	<i>Accept using PCR to detect the marker gene</i>	1
8.	c	a. «Ti/tumour inducing» plasmid of <i>A. tumefaciens</i> /bacterium causes tumours/galls ✓ b. Ti incorporates genes «of β-carotene synthesis» OR Ti is used as a vector of the gene «for β-carotene» ✓ c. recombinant plasmids reintroduced into <i>A. tumefaciens</i> /bacterial cells ✓ d. bacteria infect rice plant cells ✓ e. the newly incorporated gene produces β-carotene/Golden Rice ✓		3 max
9.	a	a. amylopectin is «more» branched/has 1,6 bonds OR amylopectin is less soluble in water ✓ b. both made up of glucose OR both are polysaccharides OR both are helical in shape OR both contain glycosidic bonds ✓	<i>Accept converse statements</i>	2 max
9.	b	amflora contains «almost» no amylose/«almost» all amylopectin ✓		1

(continued...)

(Question 9 continued)

Question		Answers	Notes	Total
9.	c	used in the paper/glue/textile/concrete industry ✓		1
9.	d	a. encourages monocultures/reducing biodiversity ✓ b. may reduce natural resistance to pests/disease ✓ c. may cross-pollinate with non-GM crops ✓ d. disruption of practices of farming/agricultural land not being used for food production ✓ e. crop-to-crop gene flow ✓		1 max

10.	a	AUG ✓		1
10.	b	5' end contains a phosphate group «on carbon 5» OR 3' carbon contains a hydroxyl/OH group «on carbon 3» ✓		1
10.	c	a. the gene code occurs in triplets ✓ b. the stop codon would not be part of the reading frame ✓ c. the code for a polypeptide would contain more codons ✓		2 max
10.	d	a. bioinformatics is the application of computer technology to biological information OR information is stored in a database OR bioinformatics is used in analyzing genomes ✓ b. allows for searches/comparisons/analysis of ORF/open reading frame ✓ c. the computer searches for a start codon and a stop codon «and within a distance of 60+ codons» ✓		2 max

Question	Answers	Notes	Total
11.	<p>a. bacteriophages are viruses of bacteria/prokaryotes ✓</p> <p>b. each bacteriophage is specific to certain bacterial groups OR they can be used to target specific bacteria ✓</p> <p>c. can be used in sewage plants OR can kill bacteria that cause water contamination/disinfect water OR can kill bacteria that form biofilms at water purification plants ✓</p> <p>d. can kill strains resistant to antibiotics OR can kill strains resistant to chlorine/chemical disinfectants ✓</p> <p>e. «presence of» bacteriophages also act as indicators of bacteria present ✓</p> <p>f. generally not harmful to humans ✓</p>		4 max

Option C — Ecology and conservation

Question		Answers	Notes	Total
12.	a	1 kg ✓	<i>Working not required</i>	1
12.	b	120 kg ✓	<i>Working not required</i>	1
12.	c	a. small amount of/least food resources used in production ✓ b. high yield means less energy lost in respiration OR high yield means less waste of inedible material ✓ c. other resources/cost of production/nutritional values not mentioned ✓ d. sustainability requires knowledge of the effect on the environment/ pollution/contamination of water supply OR sustainability requires minimal use of drugs/chemicals/antibiotics ✓ e. example of ethical issue ✓	 <i>eg: habitat, heating, water</i> <i>eg: it may spread diseases to wild population</i>	2 max

Question		Answers	Notes	Total
13.	a	dragonfly nymph AND midge larva OR all except mayfly ✓	<i>Both needed</i>	1
13.	b	indicator species ✓		1
13.	c	richness is how many species there are in an area while evenness is how similar in number the populations of each species are ✓		1
13.	d	a. the edge of an ecosystem has different features from the centre ✓ b. the edge has greater biodiversity ✓ c. it is an area of overlap between two ecosystems/habitats ✓ d. it has species from both ecosystems OR it has species not found in either ✓ e. reduction in biodiversity due to human interference ✓	<i>eg: amount of wind, light</i>	2 max

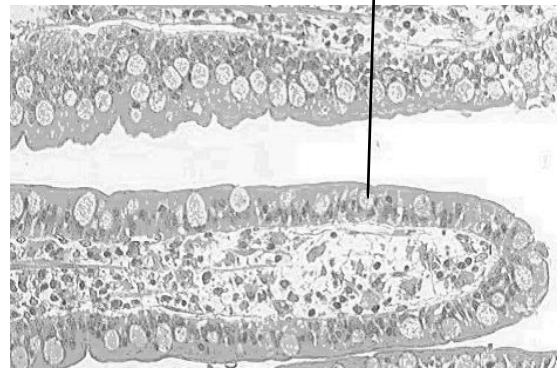
Question		Answers	Notes	Total
14.	a	Japanese stiltgrass ✓		1
14.	b	produce seeds which spread when cutting OR avoid vegetative proliferation/cloning OR may provide habitats for other species ✓	<i>Accept any other reasonable answer</i>	1
14.	c	a. «biotic» competition with native plants OR disrupt the food chain/ecosystem ✓ b. competition for abiotic factors ✓ c. reduce competitive exclusion / avoid overlapping niches ✓ d. can cause changes to soil ✓ e. break/damage/cause death/extinction of native plants ✓	<i>Accept competition for light/space/water/etc for b</i> <i>eg: Rhododendrons/conifers acidify the soil, making it difficult for other species to grow</i>	2 max
14.	d	a. «control» introduced species should only target alien plants OR «control» introduced species should not outcompete endemic species ✓ b. should not upset food chains/habitats ✓ c. should have some natural control/predator ✓ d. should not spread outside required area/not become invasive themselves OR field testing for effectiveness ✓		2 max

Question		Answers	Notes	Total
15.	a	«overall» water temperature increasing OR the range of fluctuations increases ✓	<i>Do not accept the trend is fluctuating</i>	1
15.	b	a. the coral and the algae have a symbiotic/mutualistic relationship OR two different organisms live together and depend on each other ✓ b. algae expelled from coral/relationship broken ✓ c. coral produces carbon dioxide from respiration ✓ d. the algae use the carbon dioxide to carry out photosynthesis/produce nutrients ✓ e. without the nutrients from the algae the coral are liable to starve ✓ f. coral dies/is susceptible to disease ✓	<i>Do not accept effects on species other than coral</i>	4 max

Option D — Human physiology

Question		Answers	Notes	Total
16.	a	loss of skeletal/heart muscle «containing protein» ✓		1
16.	b	a. adipose tissue has a high energy value ✓ b. adipose tissue may be lost before affecting body metabolism/homeostasis ✓ c. body will use up adipose reserves first before using muscle and organs for energy ✓	<i>Accept fat for adipose tissue</i>	2 max
16.	c	a. loss of mass similar in anorexia and starvation ✓ b. loss could also be due to disease/feeding difficulties/other disorder/poverty/social unrest ✓ c. lack of food intake in anorexia nervosa due to emotional disorder OR desire to lose weight/refusal to eat characteristics of anorexia nervosa ✓ d. loss of «cardiac» muscle is characteristics of anorexia nervosa ✓		2 max

17.	a	8 ✓		1
17.	b	a. «paddles/electrodes/defibrillator» deliver an electric shock to the heart ✓ b. depolarizes cardiac muscle ✓ c. enables the pacemaker/SA node to regain control ✓		2 max
17.	c	a. impulses initiated from the AV node spread across heart ✓ b. impulses travel along Purkinje fibres/across ventricles ✓ c. causing depolarization of the ventricles OR that triggers ventricular contraction ✓		2 max

Question		Answers	Notes	Total
18.	a	arrow pointing at an epithelial cell ✓	<p><i>Accept a bracket label to show the epithelium</i></p> <p>epithelial cell layer</p> 	1
18.	b	<p>a. microvilli/brush border to increase surface area ✓</p> <p>b. numerous mitochondria for energy for active transport ✓</p> <p>c. have transport proteins for specific nutrients ✓</p> <p>d. single layer of cells/short distance allowing for diffusion ✓</p>	<p><i>Explanation must be included for each characteristic</i></p> <p><i>eg: "glucose, amino acids"</i></p>	2 max

Question			Answers	Notes	Total
19.	a	i	Kupffer cell ✓		1
19.	a	ii	a. ingests red blood cells by phagocytosis ✓ b. splits the hemoglobin into heme «and globin» OR heme group broken down into iron «and bilirubin» OR hemoglobin broken down into iron ✓ c. releases iron for transport ✓		2 max
19.	b		a. the dual supply is the hepatic artery and the hepatic portal vein ✓ b. blood in «hepatic» artery provides oxygen to the liver «tissues» ✓ c. the «hepatic portal» vein carries blood from the gastrointestinal tract/intestines ✓ d. the «hepatic portal» vein carries blood rich in nutrients ✓ e. this allows the nutrients to be stored/processed OR sugar/glucose/glycogen is stored and released in response to hormones ✓ f. prevents osmotic imbalance due to absorbed nutrients in the blood ✓	<i>Both needed</i>	4 max