

Markscheme

November 2020

Biology

Standard level

Paper 3

15 pages

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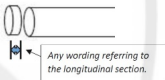
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Section A

Question		Answers	Notes	Total
1.	a	25	Accept 24.5 to 26 Units not required	1
	b	a. BMI could indicate if a person is overweight/obese/too heavy for their height; b. overweight/obesity increases the probability of developing type II diabetes;	Do not accept "High BMI increases the risk of diabetes."	2
2.	a	a. <i>Independent</i> : mass; b. <i>Dependent</i> : (vertical) diameter/length;	Do not accept elasticity	2
	b	a. width/section depth/slice of the ring; b. same animal/age/freshness/temperature;	Don't accept thickness or diameter 	1 max
	c	a. veins have thinner walls (than arteries); b. veins sustain lower (blood) pressure (than arteries); c. when stretched, veins become longer (than arteries); d. veins have less muscle/elastic (fibre in their) walls (than arteries); e. veins have lower elasticity/recover less/remain more stretched (than arteries after weights removed);	Accept inverse for arteries in all cases Do not accept a listing of numerical values without explanation	3 max
3.	a	a. same apparatus with carbon dioxide present; b. (control has) no sodium hydroxide/alkali; c. control irrigated with untreated water/water with CO ₂ ;	"Same apparatus" alone does not get the mark	2 max
	b	a. boiling (and cooling) the water; b. expose the water to a vacuum;	Allow distillation of water	1

(continued...)

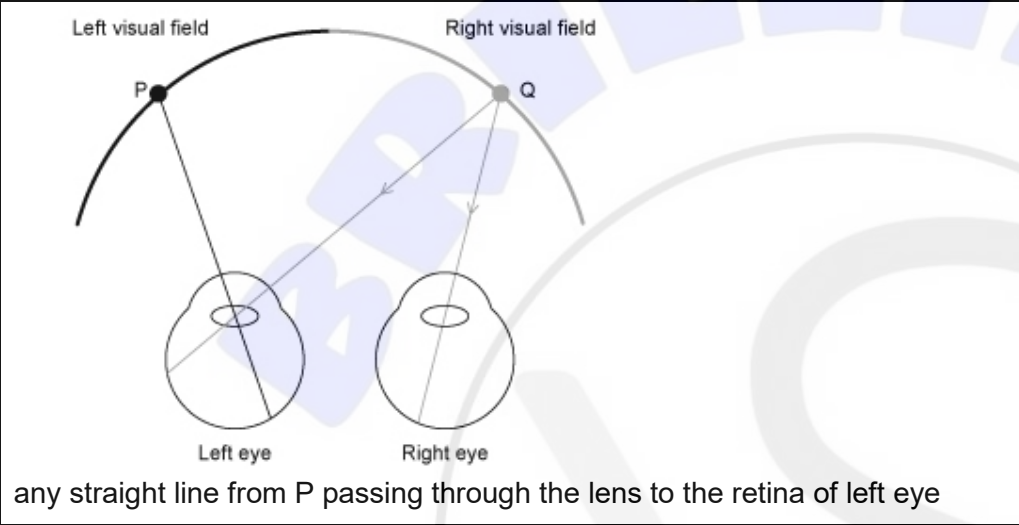
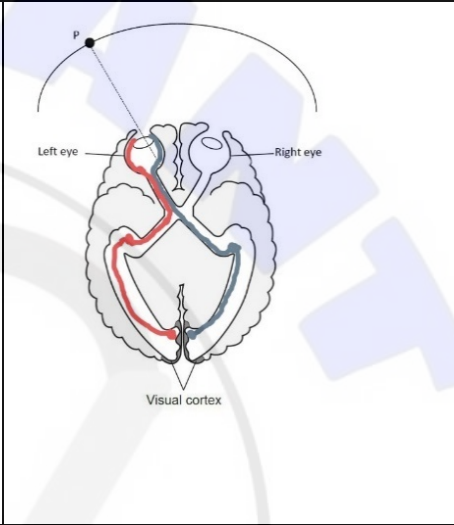
(Question 3 continued)

	c	<p>a. to prevent CO₂ from (organisms in) the soil affecting the experiment; b. the plastic bag is impermeable to gases;</p>		1
	d	<p>a. the distance travelled from the origin/O to the solvent front; b. the distance travelled by the pigment (from the origin O to X);</p>	<p><i>Accept X to solvent front if the candidate indicates that this allows O to X to be calculated</i></p>	2

Section B

Option A — Neurobiology and behaviour

Question		Answers	Notes	Total
4.	a	<p>a. both initially show an increase in density (followed by a decline) OR both peak at same density /65; b. the decline in density in the visual cortex occurs before the prefrontal cortex OR the visual cortex peaks earlier before 2 years old and the prefrontal cortex later / at 4 years old OR prefrontal declines with age / visual constant after 10;</p>	<p><i>“Both peak” is insufficient for mark point a.</i></p>	2
	b	<p>neural pruning occurs OR elimination of unused neurons;</p>		1
	c	<p>a. axons/dendrites grow out from the (immature) neuron; b. these axons reach other parts of the body; c. in response to chemical stimuli; d. neurons synapse/form connections with (multiple) other neurons; e. some neurons migrate;</p>		3 max

<p>5. a</p>			<p>1</p>
<p>b i</p>	<p>visual cortex/occipital lobe;</p>	<p>any straight line from P passing through the lens to the retina of left eye</p>	<p>1</p>
<p>ii</p>	<p>right;</p>	<p><i>See note/diagram in 5a</i></p>	<p>1</p>
<p>c</p>	<p>ganglion (cell);</p>		<p>1</p>

6.	a	<p>a. the implant lowered the threshold of hearing OR allowed quieter sounds to be heard; b. the person would be able to hear human speech;</p>		2
	b	<p>the implant is not connected to the bones (whose function is to amplify sound) OR the implant bypasses the middle ear OR the amplifier replaces the function of the bones</p>		1
	c	<p>a. vibrations cause fluid in the cochlea to move; b. (movement of fluid) causes stimulation/movement of hair cells/mechanoreceptors; c. higher frequency is detected closer to the base of the cochlea / vice versa OR each frequency stimulates specific hair cells; d. hair cells generate impulses; e. connected to the brain by the auditory nerve;</p>		3 max
7.		<p>a. an autopsy occurs after death/post-mortem; b. lesions occur in the brain because of injury/illness c. changes in function/behaviour can be attributed to damaged areas; d. can be diagnosed using fMRI/CAT scan/PET scan; e. one example e.g. damage to Broca's area affects speech;</p>		4 max

Section B

Option B — Biotechnology and bioinformatics

Question		Answers	Notes	Total
8.	a	sterilizes/kills unwanted microorganisms in the fermenter;		1
	b	cold water is added to the jacket if the temperature is too high;		1
	c	a. takes place in (deep-tank) <u>batch</u> fermenters; b. <u>Penicillium</u> (fungus) is grown on sugar/starch/nutrients; c. penicillin is produced when the nutrients are used up; d. penicillin secreted by the fungus is separated and purified; e. occurs under aerobic conditions/ <u>Penicillium</u> is an obligate aerobe;		3 max
9.	a	2006;		1
	b	a. glyphosate use increased and other herbicide use decreased; b. during this period there was no increase/decrease in the EIQ OR the data shows that there was not much change in environmental impact; c. data insufficient to reach conclusion;	<i>Both must be mentioned for the mark</i>	2
	c	a. (Ti plasmid) modified to include a gene coding for glyphosate resistance; b. the bacterium inserts a plasmid into plant cells; c. the Ti plasmid induces tumours in plants; d. (Ti plasmid) integrates its DNA into the plant genome OR plasmid is used as a vector to introduce glyphosate resistance gene; e. tumour/gall tissue is cultured to form plants with the gene for glyphosate resistance;		3 max

10.	a	indicates successful uptake of recombinant DNA;	1
	b	a. an electrical field/potential is applied to cells; b. increases the permeability of the cell membrane (to DNA);	2
	c	a. can be identified with bioinformatics software / example of software; b. locate a sequence corresponding to a start codon/ATG (sense strand); c. read this sequence until a stop codon/TGA/TAG /TAA is reached;	2 max
11.		a. biofilms are formed by bacteria; b. bacteria in the biofilm secrete a matrix/EPS; c. (matrix of biofilm) attaches (firmly) to the trickle bed/rocks/gravel/plastic/other media; d. the biofilm breaks down organic material / feed on sewage OR the bacteria in the biofilm are saprophytic; e. aerobic conditions are maintained through the bed / by aerating sprinklers;	4 max

Section B

Option C — Ecology and conservation

Question		Answers	Notes	Total
12.	a	<p>a. <i>D. tigrina</i> lives higher in the tree than <i>D. coronata</i>; b. <i>D. coronata</i> occupies a greater area/height range than <i>D. tigrina</i>; c. <i>D. tigrina</i> found in the outer regions and <i>D. coronata</i> found on the inside;</p>	<i>Accept vice-versa</i>	1 max
	b	<p>a. no two species can occupy the same niche; b. competition between them would cause one species to drive the other out OR one of the two species would need to adapt and evolve accordingly;</p>		2
	c	<p>a. different food/prey; b. different predators; c. active at different times of the day; d. present at different times of the year; e. different nest sites; f. different temperatures;</p>	<i>Do not accept "different habitats"</i>	2 max
	d	<p>a. the realized is the actual niche and the fundamental is in the absence of competition; b. with no competition the <i>D. castanea</i> would have a larger habitat/more food OR <i>D. castanea</i> could occupy the niches currently occupied by the other warbler species;</p>	<i>Accept named species</i>	2

13.	a	i	2;		1
		ii	a. birds are unable to fly/swim for food; b. unable to escape predators; c. birds drown; d. birds suffocate / are strangled;		1 max
	b	i	C / albatrosses, petrels and shearwaters;		1
		ii	a. fill up the stomachs (of young birds) so they feel full / starve to death; b. damage the digestive system / cut the gut/stomach/oesophagus/intestines (leading to internal bleeding); c. block passage of food (causing starvation); d. cause choking (so cannot breathe); e. contain/decompose to toxic chemicals (poisoning birds) OR toxins/microplastics in seawater build up/biomagnify (and poison wildlife);		2 max
14.	a	i	A;		1
		ii	B;		1
	b		B is more diverse/biodiverse than A;	<i>Accept vice-versa. Do not accept greater Simpson's reciprocal diversity index.</i>	1
	c		(the larger islands contain) more species as there are more habitats;		1

15.		<p>a. shows the amount of energy at each trophic level (of a food chain/web);</p> <p>b. (energy) measured over a period of time/year OR units are energy per area per time/kJ m⁻² year⁻¹;</p> <p>c. the width/size of each bar represents the amount of energy;</p> <p>d. the bottom level represent the producers;</p> <p>e. subsequent levels represent consumers;</p> <p>f. each level should be roughly one tenth of the size/10% of the preceding level;</p> <p>OR organisms at the top of the food chain are shown to have much less energy available to them;</p> <p>g. the energy that enters a community is ultimately lost as heat/in respiration</p>	<p><i>Some answers may be displayed in a diagram</i></p>	<p>4 max</p>
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Section B

Option D — Human physiology

Question		Answers	Notes	Total
16.	a			1
	b	cannot be synthesized by the body;		1
	c	250 (mL)		1
	d	a. the volume/mass of water is measured; b. the energy from the burning food raises the temperature/heats the water; c. knowing the specific heat of water allows energy of the food to be calculated OR 4.2J of heat energy causes a 1°C rise in 1g of water;		2 max

17.	a	<p><i>Secretion:</i> gastrin;</p> <p><i>Function:</i></p> <p><i>Secreting cells:</i> parietal;</p>	<p><i>If more than one answer do not give the mark unless all are correct.</i></p>	3	
	b	<p>a. <i>H. pylori</i> weakens/degrades the mucous coating;</p> <p>b. (this) allows acid to get through to the epithelial layer;</p> <p>c. the acid damages the stomach wall;</p>		2 max	
18.	a	i	Kupffer (cell);	1	
		ii	(hepatic) portal vein/venule;	<p><i>"Portal" alone is insufficient</i></p>	1
	b	<p>a. they produce/secrete <u>plasma</u> proteins;</p> <p>b. (the plasma proteins) are modified/secreted by the Golgi apparatus;</p> <p>c. protein/globin is broken down into amino acids;</p>		2 max	
	c	<p>a. both have walls 1 cell thick/same thickness OR both have a basement membrane;</p> <p>b. sinusoids have pores/holes/fenestrations OR sinusoids have a wider lumen;</p>		2 max	

19.		<p>a. a thrombosis is a blood clot which occurs in a blood vessel; b. often after an injury/surgery/atheroma OR can happen if you do not move for a long time/inactivity/long-haul flight; c. can cause swelling/pain; d. can break away and travel to other parts of the body; e. can cause blood flow to organs to be blocked; f. in lung causing pulmonary embolism OR in coronary artery causing cardiac arrest OR in brain causing stroke;</p>		4 max
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