

# Markscheme

November 2020

Biology

Standard level

Paper 3

15 pages

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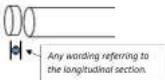
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**Section A**

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 <sub>2</sub> ;	"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...)

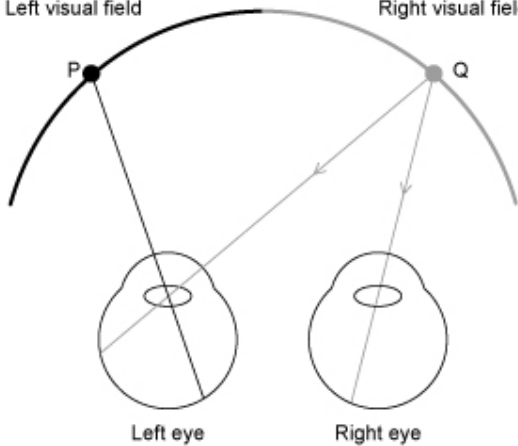
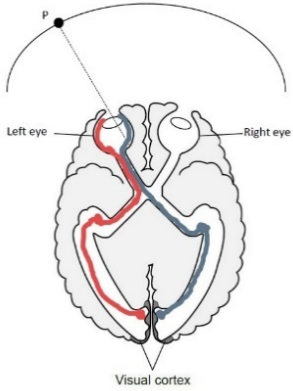
(Question 3 continued)

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

**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)  <b>OR</b>                      both peak at same density /65;                      b. the decline in density in the visual cortex occurs before the prefrontal cortex  <b>OR</b>                      the visual cortex peaks earlier before 2 years old and the prefrontal cortex later / at 4 years old  <b>OR</b>                      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  <b>OR</b>                      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><b>5. a</b></p>		 <p>any straight line from P passing through the lens to the retina of left eye</p>		<p><b>1</b></p>
<p><b>b</b></p>	<p><b>i</b></p>	<p>visual cortex/occipital lobe;</p>		<p><b>1</b></p>
	<p><b>ii</b></p>	<p>right;</p>	<p><i>See note/diagram in 5a</i></p>	<p><b>1</b></p>
<p><b>c</b></p>		<p>ganglion (cell);</p>		<p><b>1</b></p>

6.	a	<p>a. the implant lowered the threshold of hearing  <b>OR</b>                  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)  <b>OR</b>                  the implant bypasses the middle ear  <b>OR</b>                  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  <b>OR</b>                  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 <b>OR</b> 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 <b>OR</b> 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 <b>OR</b> 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>	<b>1 max</b>
	b	<p>a. no two species can occupy the same niche;                      b. competition between them would cause one species to drive the other out  <b>OR</b>                      one of the two species would need to adapt and evolve accordingly;</p>		<b>2</b>
	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>	<b>2 max</b>
	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  <b>OR</b>  <i>D. castanea</i> could occupy the niches currently occupied by the other warbler species;</p>	<i>Accept named species</i>	<b>2</b>

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) <b>OR</b> 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

<b>15.</b>		<p>a. shows the amount of energy at each trophic level (of a food chain/web); b. (energy) measured over a period of time/year <b>OR</b> units are energy per area per time/kJ m<sup>-2</sup> year<sup>-1</sup>; c. the width/size of each bar represents the amount of energy; d. the bottom level represent the producers; e. subsequent levels represent consumers; f. each level should be roughly one tenth of the size/10% of the preceding level; <b>OR</b> organisms at the top of the food chain are shown to have much less energy available to them; 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><b>4 max</b></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	<p>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  <b>OR</b>                      4.2J of heat energy causes a 1°C rise in 1g of water;</p>		2 max

17.	a	<p>Secretion: gastrin; Function: Secreting cells: 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; b. (this) allows acid to get through to the epithelial layer; 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; b. (the plasma proteins) are modified/secreted by the Golgi apparatus; c. protein/globin is broken down into amino acids;</p>		2 max	
	c	<p>a. both have walls 1 cell thick/same thickness <b>OR</b> both have a basement membrane; b. sinusoids have pores/holes/fenestrations <b>OR</b> sinusoids have a wider lumen;</p>		2 max	

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