Diploma Programme
Programme du diplôme
Programa del Diploma

Markscheme

November 2020

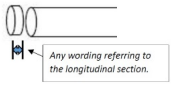
Biology

Standard level

Paper 3

15 pages

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.** *Independent*: mass; **b.** *Dependent*: (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...)

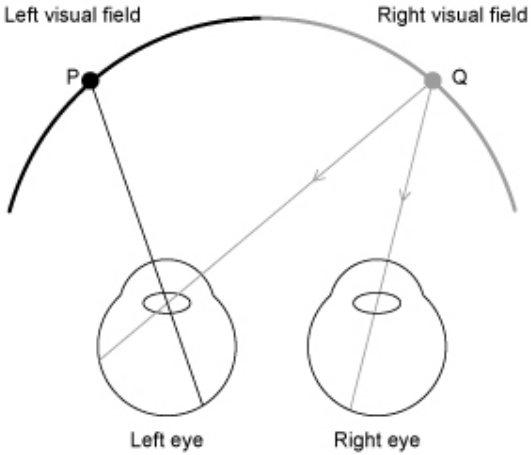
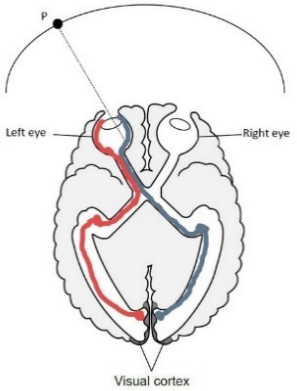
(Question 3 continued)

	c		**a.** to prevent CO_2 from (organisms in) the soil affecting the experiment; **b.** the plastic bag is impermeable to gases;		**1**
	d		**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);	*Accept X to solvent front if the candidate indicates that this allows O to X to be calculated*	**2**

Section B

Option A — Neurobiology and behaviour

Question			Answers	Notes	Total
4.	**a**		**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;	*"Both peak" is insufficient for mark point* ***a*****.**	**2**
	b		neural pruning occurs ***OR*** elimination of unused neurons;		**1**
	c		**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;		**3 max**

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

6.	**a**		**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;		**2**
	b		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		**1**
	c		**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;		**3 max**

7.			**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.** o ne example e.g. damage to Broca's area affects speech;		**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) batch fermenters; **b.** *Penicillium* (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/*Penicillium* 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;	*Both must be mentioned for the mark*	**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

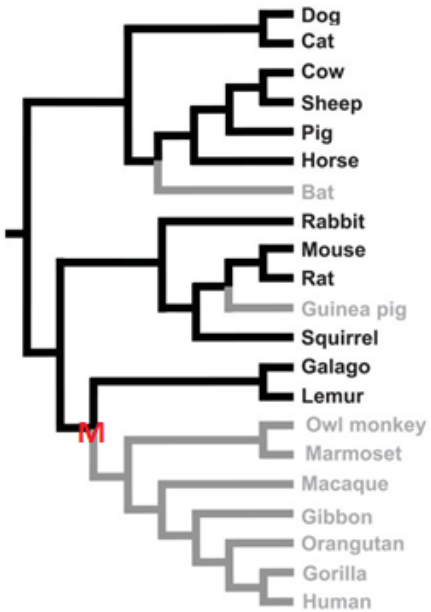
Question			Answers	Notes	Total
12.	**a**		**a.** *D. tigrina* lives higher in the tree than *D. coronata*; **b.** *D. coronata* occupies a greater area/height range than *D. tigrina*; **c.** *D. tigrina* found in the outer regions and *D. coronata* found on the inside;	*Accept vice-versa*	**1 max**
	b		**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;		**2**
	c		**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;	*Do not accept "different habitats"*	**2 max**
	d		**a.** the realized is the actual niche and the fundamental is in the absence of competition; **b.** with no competition the *D. castanea* would have a larger habitat/more food ***OR*** *D. castanea* could occupy the niches currently occupied by the other warbler species;	*Accept named species*	**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;	*Accept vice-versa. Do not accept greater Simpson's reciprocal diversity index.*	**1**
	c		(the larger islands contain) more species as there are more habitats;		**1**

15.			**a.** shows the amount of energy at each trophic level (of a food chain/web); **b.** (energy) measured over a period of time/year ***OR*** units are energy per area per time/kJ m^{-2} $year^{-1}$; **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; ***OR*** 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	*Some answers may be displayed in a diagram*	**4 max**

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**		*Secretion*: gastrin; *Function*: *Secreting cells*: parietal;	*If more than one answer do not give the mark unless all are correct.*	**3**
	b		**a.** *H. pylori* weakens/degrades the mucous coating; **b.** (this) allows acid to get through to the epithelial layer; **c.** the acid damages the stomach wall;		**2 max**
18.	**a**	**i**	Kupffer (cell);		**1**
		ii	(hepatic) portal vein/venule;	*"Portal" alone is insufficient*	**1**
	b		**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;		**2 max**
	c		**a.** both have walls 1 cell thick/same thickness ***OR*** both have a basement membrane; **b.** sinusoids have pores/holes/fenestrations ***OR*** sinusoids have a wider lumen;		**2 max**

19.			**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;		**4 max**