Diploma Programme
Programme du diplôme
Programa del Diploma

Markscheme

May 2018

Biology

Standard level

Paper 3

16 pages

Section A

Question			Answers	Notes	Total
1.	a		chlorophyll *a* ***OR*** β carotene ✓		1
1.	b		a. horizontal axis for both is wavelength/colour ***OR*** «for a chloroplast/cells/leaves/plants extract» they will have the same/similar shape ✓ b. an action spectrum shows the rate of photosynthesis «in chloroplasts/ cells/leaves/plants» and an absorption spectrum shows the absorption of light ✓	*Marking point a. may be shown with a diagram.*	2 max
1.	c	i	a. the pigment didn't dissolve / was insoluble when the pigments from the algae were extracted ✓ b. the pigment was not moved by / was insoluble in the solvent used to separate the pigments ✓		1
1.	c	ii	orange/yellow/green/blue/violet ✓		1

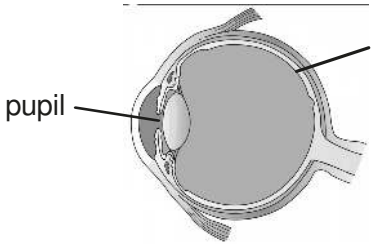
Question			Answers	Notes	Total
2.	a		9.0 m^2 / 9 m^2 ✓	*Units required for the mark.*	1
2.	b		a. in each quadrat determine the presence/absence «of plants» of each type ✓ b. null hypothesis is that the presence of one is random/independent in relation to the presence of the other plant ***OR*** alternate hypothesis is that the presence of one is associated with the presence or absence of the other ✓ c. $x^2 = \sum \frac{(O-E)^2}{E}$ ✓ d. accept alternative hypothesis / reject null hypothesis if the difference between observed and expected is statistically significant / p<0.05 / calculated X^2 higher than tabulated X^2 / critical value ***OR*** it supports the association between the two species if the difference between observed and expected is statistically significant / p<0.05 / calculated X^2 higher than tabulated X^2 / critical value ✓	*Equation may be written out in words.*	3 max

Question			Answers	Notes	Total
3.	a		a. four breaths in $10\,s = 4 \times 6$ «breaths min^{-1}» ***OR*** six breaths in $15\,s = 6 \times 4$ «breaths min^{-1}» ✓ b. 24 «breaths min^{-1}» ✓		2
3.	b		a. measure a volume difference for an individual breath ***OR*** maximum – minimum for an individual breath ✓ b. repeat for several breaths and determine a mean ✓		2
3.	c		increased due to increased demand for ATP/energy «from muscle activity» ✓		1
3.	d		diaphragm ***OR*** <u>external</u> intercostal muscles ✓		1

Section B

Option A — Neurobiology and behaviour

Question			Answers	Notes	Total
4.	**a**		a. *name*: rod ***OR*** cone ✓ b. *function*: rod detects wide range of wavelengths/monochrome/low light intensity/dim light ***OR*** detects coloured light / colour «photoreceptor» ✓		**2**
4.	**b**	**i**	a. maintenance metabolism/respiration of the neuron ✓ b. use of Na-K/sodium potassium pump to maintain resting potential ✓ c. cell repair «consumes energy» ✓		**2 max**
4.	**b**	**ii**	*S. carnaria* / *Sarcophaga carnaria* ✓		**1**
4.	**b**	**iii**	a. energy consumption increases from rest to signalling «in all three species» ✓ b. faster transmission consumes more energy ***OR*** positive correlation ✓ c. doubling of transmission rate requires more than double the increase in energy consumption ***OR*** exponential increase ***OR*** the higher the energy consumption at rest, the higher the energy consumption at signalling ✓		**2**

Question			Answers	Notes	Total
5.	a		retina ✓ pupil ✓	*eg:*  [Source: Holly Fischer https://en.wikipedia.org/wiki/Human_eye#/media/File:Three_Internal_chambers_of_the_Eye.png]	**2**
5.	b		a. «bright» light is shone in to the eye ✓ b. the pupil reflex is when the pupils constrict ✓ c. if not observed could indicate damage to the optic nerve/ocular motor nerve/medulla oblongata ***OR*** brain stem death ***OR*** depressant drug use ✓		**3**
5.	c		plasticity ✓		**1**

6.	a		fMRI / functional MRI ✓	*f or functional required.*	**1**
6.	b		visual cortex / occipital lobe ✓		**1**
6.	c		hemisphere ✓		**1**

Question			Answers	Notes	Total
7.			a. development of neurons occurs in the neural tube/plate ✓ b. produces large numbers of cells that differentiate into neurons ✓ c. some neurons migrate ✓ d. axons grow out from the immature neuron ✓ e. in response to chemical stimuli ✓ f. neurons synapse/form connections with «multiple» other neurons ✓ g. some neurons removed by neural pruning ✓		**4 max**

Option B — Biotechnology and bioinformatics

<table>
<tr><th colspan="3">Question</th><th>Answers</th><th>Notes</th><th>Total</th></tr>
<tr><td>8.</td><td>a</td><td>i</td><td>the bacteria would be clear/colourless ✓</td><td></td><td>1</td></tr>
<tr><td>8.</td><td>a</td><td>ii</td><td>would stain pink ✓</td><td>Do not accept “violet” or “lilac”.</td><td>1</td></tr>
<tr><td>8.</td><td>b</td><td>i</td><td>a. oxygen ✓
b. temperature ✓
c. pH levels ✓
d. CO_2 ✓</td><td></td><td>2 max</td></tr>
<tr><td>8.</td><td>b</td><td>ii</td><td>a. name of a factor ✓
b. description ✓</td><td>eg
a. pH
b. lowered by «ethanoic» acid production.

eg
a. increase in temperature
b. due to metabolism.

eg
a. increased population size/reproduction
b. would limit resources.

eg
a. increased metabolic waste
b. reduce population.</td><td>2</td></tr>
<tr><td>8.</td><td>b</td><td>iii</td><td><table><tr><th></th><th>batch</th><th>continuous</th></tr><tr><td>a.</td><td>nutrients added at the start</td><td>nutrients added continuously ✓</td></tr><tr><td>b.</td><td>single harvest of product</td><td>continuous harvest of product ✓</td></tr></table></td><td>Table format is not required.</td><td>2</td></tr>
</table>

(continued…)

(Question 8 continued)

Question			Answers	Notes	Total
8.	**c**		a. emergent properties arise from the interaction of the elements of a system ✓ b. behaviours exhibited which are not shown by individuals ✓ c. quoroum sensing ***OR*** matrix production ***OR*** water channels ***OR*** antibiotic resistance ***OR*** other correct example ✓		**2 max**

Question			Answers	Notes	Total
9.	a		decrease with time «exponential» ***OR*** negative correlation ✓		1
9.	b		bioremediation ✓		1
9.	c	i	a. GM tomatoes could be used to grow a crop on salinized soil «that otherwise would kill the plants» ✓ b. tomato crop could be used to remove salt from the soil «if the harvested crop was removed» ***OR*** phytoremediation ✓		1
9.	c	ii	a. use bioinformatics tools «to search for similar sequences» ✓ b. conduct database/Blast search ✓ c. evaluate sequence alignment ✓		3 max
10.			a. Ti plasmid is found in *A tumefaciens* / Agrobacterium ✓ b. add transgene along with antibiotic resistance gene into Ti plasmid ✓ c. Ti plasmid injected into host cell/plant «by *A tumefaciens*» ✓ d. Ti plasmid induces tumors ✓ e. Ti DNA becomes incorporated in host DNA ✓ f. apply antibiotic to select for cells that have been transformed ✓		4 max

Option C — Ecology and conservation

Question			Answers	Notes	Total
11.	**a**		0. 5 «m» ✓		**1**
11.	**b**		*C. stellatus* ***AND*** *S. balanoides* ✓	*Both needed with the C. and S. in answer.*	**1**
11.	**c**		a. *E. modestus* ✓ b. is invasive because it is found in all niches / locations / heights above the tide ✓	*E. required.*	**2**
11.	**d**		a. a species that has a disproportionate effect on its environment ✓ b. ecosystem is dramatically altered in the absence of the species ***OR*** helps to maintain ecosystem structure ✓		**2**

12.	**a**		200 m / 0 to 200 m ✓	*Units required.*	**1**
12.	**b**		a. species whose numbers/abundance are affected by a particular environmental condition ***OR*** species used to assess a specific environmental condition ✓ b. «the presence of disturbance adapted beetles» indicates that the environment has been disturbed ✓ c. «the presence of disturbance adapted beetles» indicates that there is an edge «within 200 m» ✓		**2 max**

(continued….)

(Question 12 continued)

Question			Answers	Notes	Total
12.	**c**		a. small reserve has greater edge «relative to area therefore more edge effects» ✓ b. changing shape can change edge length/perimeter for a given area «changing edge effects» ✓ c. «at the edge there is» interaction of two communities ***OR*** different species may be better at invading into neighbouring community ***OR*** edge favors disturbance-adapted species ✓	*OWTTE.*	**3 max**

13.	**a**		a. Process A: decomposition/decay ✓ b. Process B: leaching/erosion/run-off/weathering ✓		**2**
13.	**b**		a. ecosystem I ✓ b. low levels of litter due to high rates of decomposition ***OR*** high amounts of biomass related to high rates of productivity ***OR*** weathering/leaching due to high rates of precipitation ✓		**2**

Question			Answers	Notes	Total
14.			a. DDT is a pesticide/insecticide ✓ b. reduction in disease vectors ***OR*** reduction in mosquitos carrying malaria ✓ c. leading to a reduction in disease/malaria rates ✓ d. biomagnification in food chains ✓ e. negative impact on health of top predators / example of top predator ✓ f. thin eggs shells ***OR*** reduced reproductive success in birds of prey ✓	*Accept other diseases such as typhus carried by lice.*	**4 max**

Option D — Human physiology

15.	**a**		14/15 «%» ✓		**1**
15.	**b**		«essential» amino acids ✓		**1**
15.	**c**		a. hypertension is high blood pressure ✓ b. systolic is when the heart is contracting and diastolic is relaxing ✓ c. systolic pressure higher than 120/130/140 «mm Hg in an adult» ✓ d. diastolic pressure higher than 80/90 «mm Hg in an adult» ✓	*For answers c. and d. the units are not required.* *Accept 12/13/14 for systolic and 8/9 for diastolic as this is how it is expressed in many countries.*	**3 max**

(continued….)

(Question 15 continued)

Question			Answers	Notes	Total
15.	**d**		a. poor bone mineralization ✓ b. rickets/osteoporosis/osteomalacia ✓ c. poor absorption of dietary calcium ✓	*Allow for other verifiable answers.*	**2 max**

16.	**a**		a. *V. cholerae* releases toxin ✓ b. chloride channels activated ✓ c. chloride ions are pumped out of cells ✓ d. leading to fluid loss from intestine/diarrhea ✓ e. associated vomiting contributes to dehydration ✓		**3 max**
16.	**b**		a. defibrillator is electrodes / a metal paddle or / a pad that is placed on the patient's chest ✓ b. the device determines whether fibrillation is happening ✓ c. a series of electrical shocks are delivered «through the electrodes» ✓ d. electrical impulse is used to depolarize the heart muscle ✓ e. to re-establish the function of the SA node / natural pacemaker / natural rhythm «of the heart» ✓		**3 max**

Question			Answers	Notes	Total
17.			a. ensure correct transit rate / movement of food through the intestines ✓ b. avoid constipation / difficulty in empty bowels / difficulty in egestion ✓ c. correct levels of water reabsorbed ✓ d. avoid overlong exposure to fat soluble chemicals ✓ e. decreased risk of colon cancer/hemorrhoids/appendicitis ✓ f. decreases the rate of absorption of glucose ✓ g. decreases hunger so less obesity/diabetes ✓		**4 max**

18.			a. phagocytosis of erythrocytes by Kupffer cells ✓ b. hemoglobin is split into globin and heme group ✓ c. globin is hydrolysed to amino acids ✓ d. amino acids used in protein synthesis ✓ e. heme group broken down into iron and bilirubin ✓ f. iron is (carried back to the bone marrow to be) used for production of new erythrocytes ✓ g. bilirubin is secreted into bile ✓	*In b. both globin and heme required.* *In e. both iron and bilirubin required.*	**4 max**