Diploma Programme
Programme du diplôme
Programa del Diploma

Markscheme

May 2017

Biology

Standard level

Paper 2

15 pages

Section A

Question			Answers	Notes	Total
1.	a	i	there is a significant «statistical» difference between two experimental values ***OR*** there is a less than 5 % chance that the difference is random ***OR*** 95 % or more probability that results are due to the experiment «IV» and not random/can reject the null hypothesis ***OR*** there is a relationship/correlation between doing exercise and capillary density ✓	*OWTTE*	**1**
		ii	a. exercise «significantly» increased the density with both water and Epi ✓ b. Epi «significantly» increased the density with and without exercise ✓ c. Epi–exercise had the greatest increase in the density ***OR*** Epi increases the density more than exercise alone ✓	*"both" or OWTTE must be mentioned*	**2 max**
	b		a. increases amount of blood taken to the muscle ✓ b. increases the delivery of oxygen/glucose/nutrients for aerobic respiration ✓ c. increases the removal of carbon dioxide/wastes ***OR*** increased gas exchange ✓		**2 max**

(continued…)

(Question 1 continued)

Question			Answers	Notes	Total
	c	**i**	175 **«**seconds**»** ✓	*Accept 170 to 180 «seconds».*	**1**
		ii	a. in both cases the tension decreased over time ✓ b. Epi–no exercise lasts longer/more time until **«**onset of**»** fatigue **«**than water–no exercise**»** ✓ c. the rate of decrease in tension is the same/similar in both ✓ d. Epi–no exercise has more contractions per second before fatigue point **«**than water–no exercise**»** ✓	*Do not accept numerical comparisons without justification.*	**3 max**
	d		a. **«**exercise with**»** water has no impact ✓ b. **«**exercise with**»** Epi promotes higher levels of tension for more time ✓ c. **«**exercise with**»** Epi increases the time to fatigue ✓		**2 max**
	e		a. exercise has no/very little effect with water ✓ b. exercise with Epi increased III/IV ✓ c. **«**it appears that**»** exercise with Epi has no/very little effect on II ***OR*** Epi relative to water increases all 4 ***OR*** exercise has little/no effect on protein I/II ✓ d. exercise with Epi **«**appears to**»** decrease I ✓		**2 max**

(continued…)

(Question 1 continued)

Question			Answers	Notes	Total
	f		a. protein channels ***OR*** pumps in membranes of mitochondria ***OR*** hormone binding sites ✓ b. structural/integral/peripheral/glyco/surface proteins ✓ c. enzymes/catalysts ✓ d. electron transport chain proteins ✓	*Accept verifiable names of specific membrane enzymes.*	**1 max**

(continued…)

(Question 1 continued)

Question			Answers	Notes	Total
	g		*Limitations:* a. study done on mice and may not apply to humans ✓ b. levels of Epi administered in experiment may exceed levels in a sample of dark chocolate ***OR*** levels of Epi administered in experiment may have different levels in a sample of dark chocolate ***OR*** chocolate may have other components with unknown effects on aerobic capacity ✓ c. mitochondrial proteins may not improve aerobic capacity ✓ *Strengths:* d. data supports as dark chocolate contains EPI ✓ e Epi improves capillary density and would therefore increase aerobic capacity ✓ f. Epi improves fatigue resistance ✓ g. Epi in combination with exercise improves it further ✓ h. Epi increases mitochondrial proteins therefore/presumably increasing aerobic capacity ✓	*OWTTE*	**3 max**

<table>
<tr><th colspan="3">Question</th><th>Answers</th><th>Notes</th><th>Total</th></tr>
<tr><td>2.</td><td>a</td><td></td><td>a. controls circadian rhythms/biological clocks «in mammals» ✓
b. production is controlled by amount of light detected by the retina ✓
c. high production/secretion in the dark
OR
no production/secretion in the day
OR
production/secretion is directly proportional to night time duration ✓
d. affects «seasonal» reproduction/sleep-wake cycles/jet lag ✓</td><td></td><td>2 max</td></tr>
<tr><td></td><td>b</td><td>i</td><td>«digestive» enzymes ✓</td><td></td><td>1</td></tr>
<tr><td></td><td></td><td>ii</td><td>
<table>
<tr><th>organelle</th><th>name</th><th>principal role</th><th></th></tr>
<tr><td>I</td><td>rough endoplasmic reticulum
OR
ribosome</td><td>protein production/synthesis «for excretion»</td><td>✓</td></tr>
<tr><td>II</td><td>mitochondrion/mitochondria</td><td><u>aerobic</u> «cell» respiration
OR
ATP/energy production</td><td>✓</td></tr>
</table>
</td><td></td><td>2</td></tr>
</table>

<table>
<tr><th colspan="3">Question</th><th>Answers</th><th>Notes</th><th>Total</th></tr>
<tr><td>3.</td><td>a</td><td></td><td>a. «an inherited form of» degeneration of retinal layer/photoreceptor cells/blindness
OR
eye genetic disorder ✓
b. «hESC/stem cells» can provide/differentiate into healthy <u>retinal</u> cells ✓
c. injecting «hESC/stem cells» into the retina/eye can restore vision in animal/human trials ✓</td><td>OWTTE</td><td>2 max</td></tr>
<tr><td></td><td>b</td><td></td><td>a. correct allele identification ✓
«eg: S = dominant/normal; s = recessive/disease»

b. correct Punnett grid ✓

c. correct phenotypic ratio/outcome ✓</td><td>example:
s =recessive, disease-causing form of gene,
S =dominant,
normal form parents =Ss.
Any letter can be used as capital and lower case but a legend/key is not required if correct notation is used.

<table><tr><td></td><td>S</td><td>s</td></tr><tr><td>S</td><td>SS</td><td>Ss</td></tr><tr><td>s</td><td>Ss</td><td>ss</td></tr></table>
Do not award mp b if the gametes do not show heterozygous organisms

phenotypic ratio:
$\frac{3}{4}$ normal : $\frac{1}{4}$ with disease
OR
3 normal : 1 with disease
OR
«75 % normal :» 25 % disease</td><td>3</td></tr>
</table>

Question			Answers	Notes	Total
4.	**a**	**i**	a. radiation ✓ b. chemical mutagens/carcinogens/papilloma virus/cigarette smoke ✓		**1 max**
		ii	base substitution/insertion/deletion/frameshift ✓		**1**
	b	**i**	a. jointed appendages ✓ b. **«**chitinous**»** exoskeleton ✓ c. segmented body ***OR*** bilateral symmetry ***OR*** mouth ***AND*** anus ***OR*** paired appendages ✓		**2 max**

(continued…)

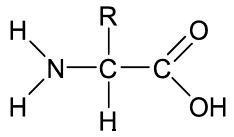
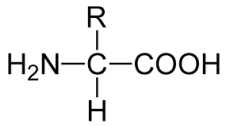
(Question 4 continued)

Question			Answers	Notes	Total
		ii	a. «scientists would accept» hypothesis A as the better one as mutations are random ✓ b. scientists would reject hypothesis B because characteristics acquired during the lifetime of the individual being inherited is Lamarckian/not part of the evolution by natural selection theory/not all mutations are heritable ✓ c. «the resistance» mutation would be present in the population initially and not caused by the shampoo «as hypothesis B states» ✓ d. both hypotheses include variation in the population of lice «resistant and non-resistant» ✓ e. variation is necessary for natural selection to occur ✓ f. frequency of the best adapted increases and these individuals <u>reproduce</u>/<u>pass on resistance to their offspring,</u> so the resistant population increases «so hypothesis A is better» ✓	*OWTTE can be used for any of the answers in this part.*	**3 max**

Section B

Clarity of communication: [1]

The candidate's answers are clear enough to be understood without re-reading. The candidate has answered the question succinctly with little or no repetition or irrelevant material.

Question			Answers	Notes	Total
5.	**a**		a. COO^- ***or*** COOH group at one end ✓ b. NH_2 ***or*** NH_3^+ at the other ✓ c. CH in middle with H or R group attached ✓	*If shown expanded, then carbonyl oxygen must attach to C* *If shown non-expanded, N of amine group must attach to C* *eg*:  ***OR*** 	**3**

(continued…)

(Question 5 continued)

Question			Answers	Notes	Total
	b		a. translation is the production of polypeptides/proteins ✓ b. mRNA binds to the ribosome ✓ c. tRNA binds to the ribosome ✓ d. at the site where its anti-codon corresponds to the codon on the mRNA ✓ e. amino acids of **«**consecutive tRNAs**»** bind by a peptide link **«**in the ribosomes**»** ✓ f. the ribosome moves along the mRNA ***OR*** continues with elongation of polypeptide chain ✓	*Accept annotated diagrams of the process.* *OWTTE*	**4 max**

(continued…)

(Question 5 continued)

Question			Answers	Notes	Total
	c			*Accept annotated diagrams of the process.*	**8 max**
			a. clotting factors **«**are proteins**»** that initiate the clotting cascade/process ✓		
			b. fibrin **«**is a protein that**»** permits blood clotting ***OR*** allows the formation of a clot ✓		
			c. **«**the protease**»** thrombin converts <u>fibrinogen to fibrin</u> ✓	*OWTTE*	
			d. fibrin forms a mesh/clot that prevents the entry of <u>pathogen</u>/<u>antigen into the blood</u> ✓		
			e. antibodies are **«**specific**»** proteins that lymphocytes make ✓		
			f. each antibody corresponds to a specific pathogen/antigen ***OR*** antibodies are specific **«**to certain pathogens/antigens**»** ✓		
			g. antibodies create <u>specific immunity</u> ✓		
			h. plasma cells produce large amounts of **«**specific**»** antibodies ***OR*** memory cells retain the ability to produce **«**specific**»** antibodies ✓		
			i. immunoglobulins are antibodies against pathogens ✓		
			j. <u>enzymes</u> in phagocytic white blood cells may digest pathogens ✓		

*(Plus up to **[1]** for quality)*

Question			Answers	Notes	Total
6.	a		*Structure*: a. «starch» is a polysaccharide/is composed of glucose molecules ✓ b. contains amylose which is a linear/helical molecule ✓ c. contains amylopectin which is a branched molecule ✓ *Function*: d. storage of glucose/energy in plants ✓ e. storage form that does not draw water ✓		**3 max**
	b		a. light is absorbed by <u>chlorophyll</u> ***OR*** <u>chlorophyll</u> absorbs more red and blue light ✓ b. «absorbed» light energy is converted to chemical energy ✓ c. some of the energy is used for production of ATP ✓ d. water molecules are split/photolysis ✓ e. produces oxygen «as waste product»/hydrogen/NADPH ✓ f. plants absorb/fix CO_2 «from air or water» ✓ g. ATP/energy is needed to produce carbohydrates/starch ✓		**4 max**

(continued…)

(Question 6 continued)

Question			Answers	Notes	Total
	c		a. CO_2 is produced from respiration in organisms/combustion of biomass/fossil fuels ✓ b. CH_4 is produced by anaerobic respiration of biomass/«methanogenic» bacteria ✓ c. CH_4 is oxidized to CO_2 and water ✓ d. CO_2 is converted into carbohydrates/organic compounds by autotrophs/producers/photosynthesis ✓ e. CO_2 can be converted to calcium carbonate/fossilized into limestone ✓ f. «partially» decomposed organic matter/biomass can be converted into peat/coal/oil/gas/fossil fuels ✓ g. CO_2 and CH_4 are both greenhouse gases/increase greenhouse effect ✓ h. both absorb long-wave radiation from the earth and retain the heat in the atmosphere ✓ i. increased CO_2 concentrations in the atmosphere correlate with increased combustion of fossil fuels ✓ j. rising average global temperatures correlate with more greenhouse gases in the atmosphere ✓ k. cattle production/rice paddy/defrosting of tundra increase CH_4 in the atmosphere ***OR*** increasing CO_2 leads to acidification of marine/aquatic environments ✓ l. the global temperature increase influences/disrupts climate patterns ✓	*OWTTE*	**8 max**

*(Plus up to **[1]** for quality)*