International AS
Biology

BL02– Biological systems and disease
Mark scheme

9610

June 2018

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It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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Question	Marking guidance	Mark	Comments
01.1	1. Salivary Glands; 2. Pancreas;	1	Both correct for 1 mark In either order
01.2	1. (Could be correct as) Benedict's test indicates the chewed bread contains a reducing sugar (which could be glucose); **BUT** 2. (The student's conclusion is incorrect because) Glucose is not the only reducing sugar/maltose is also a reducing sugar; **BECAUSE** 3. Amylase hydrolyses starch to maltose (a reducing sugar) hence positive test;	3	 3 Subsumes 2
01.3	1. Villi and/or microvilli provide large/increased surface area; 2. Thin walls decrease the diffusion pathway; 3. Presence of channel/carrier proteins (for glucose) for facilitated diffusion/active transport/co-transport; 4. Mixing by movement of villi maintains a concentration gradient; OR Good blood supply to maintain a concentration gradient;	3 max	1. Accept description, e.g. walls are highly folded 2. Accept description, e.g. blood vessels are near the surface 4. Accept description, e.g. many capillaries/network of capillaries/blood flows

Question	Marking guidance	Mark	Comments
02.1	1. Small B-cell = $\frac{4}{3} \times \pi \times 3^3$ = 113 µm^3 and Plasma cell = $\frac{4}{3} \times \pi \times$ 6.5^3 = 1150 µm^3; 2. Ratio is 10:1/10.17:1/10.2:1;	2	Accept 1:10 (10.17/10.2) for 1 mark Accept ratio = 6.5^3 : 3^3 or 13^3 : 6^3 for 1 mark (since = $\frac{4}{3} \times \pi$ cancels out) Reject 10 alone as needs to be a ratio

02.2	Cause agglutination/stimulate phagocytosis;	1	Accept description

02.3	(The deliberate) introduction of an antigen/weakened pathogen/attenuated pathogen to cause an immune response;	1	Accept description

02.4	(BCG unsuitable as) Live bacteria so may cause disease (in immunocompromised/people with CVID);	1	

02.5	*(For)*	5 max	For full marks mp1 plus any four other mp
	1. There are 5 samples at or above normal expected response of 1.0 IUcm^{-3} so they might not have CVID;		
	(Against)		
	2. Only one measurement (of antibody)/only one batch of vaccine used;		2. Accept only one type of antigen tested/only tetanus tested
	3. No control/no people with normal immune system so maybe vaccine defective;		
	4. Time lapse before measuring antibodies too short;		
	5. Could be secondary response/already had tetanus/had vaccine;		
	6. CVID is variable/sufferers may produce normal antibody response sometimes;		6. Accept lots of variation in levels of antibodies measured
	7. Antibodies other than those for tetanus present;		
	(Other causes of CVID)		
	8. Has CVID but caused by something other than lack of plasma cells/reduced antibody production;		
	9. Sensible suggestion of other cause, eg lack of T-helper cells;		

Question	Marking guidance	Mark	Comments
03.1	1. glucose; 2. ions/named ions/electrolytes	2	1. Ignore starch 2. Accept salt(s) /named salt e.g. NaCl Accept chemical symbols e.g. Na$^+$ but reject metals e.g. sodium/Na
03.2	1. Standard ORS plus PHGG/study shortens duration of symptoms; 2. Mass of watery diarrhoea decreases from d1 to d3 in both control and study groups; 3. Larger reduction in the mass of watery diarrhoea over the 3 days in study group than in control; 4. Differences are significant/not due to chance because standard deviation bars do not overlap;	4	4. Accept converse – differences are not significant/are due to chance because standard deviation bars overlap
03.3	(More sodium ions taken into cells of walls of colon) 1.Lowers water potential (of cells in the walls of colon/in blood); 2.So water is taken in by osmosis;	2	1. Accept converse re gut lumen 2. Accept converse
03.4	1. Standard ORS works so it's not ethical to withhold known effective treatment for a trial/ water is not effective treatment; OR Patients could become more ill/become worse/die;	1	

Question	Marking guidance				Mark	Comments
04.1		Binary fission	Mitosis		2	Mark by column
	Genetically identical cells are produced	✓	✓			
	Nuclear membrane breaks down	x	✓			
	Chromosomes are arranged on the spindle	x	✓			
04.2	A change in the DNA sequence/base sequence;				1	Accept change in a base/gene/chromosome
04.3	Horizontal gene transmission;				1	
04.4	Correct answer 3.3 per min = 2 marks;; For one mark accept incorrect answer if shows converted mutation rate to per min i.e. division by 30 (min); **OR** 1. multiplication of mutation rate by 10^5 /100000;				2	Accept 3/3.33 for 1 mark

04.5	(For)	3 max	For full marks must have at least one for and one against
	1. Protein g3p would block pili/conjugation tube;		
	2. Stop conjugation/horizontal gene transfer;		
	3. Prevent/reduce transfer of plasmid/antibiotic resistance gene from bacterium to bacterium;		
	(Against)		
	4. Not all conjugation tubes blocked so some transfer of plasmid may still occur;		
	5. Would not prevent bacteria gaining antibiotic resistance by mutation;		
	6. Bacteria can still reproduce asexually/undergo binary fission so we get large numbers of resistant bacteria;		6. Accept mitosis as equivalent to asexual reproduction (as concept already tested in Q4.1)

Question	Marking guidance	Mark	Comments
05.1	(Genetic material) RNA used to synthesise DNA;	1	Reject RNA is converted into DNA
05.2	To attach to (host/human) cells/receptors/CD4 cells;	1	Ignore antigen-antibody binding unless qualified
05.3	<u>Helper-T</u> cells;	1	Accept T_H cells
05.4	1. Overall pattern: Initial decrease then increase/return to normal followed by decrease; 2. Suitable values from graph: Peak 530-550, trough 400;	2	 2. Accept calculated values, e.g. decreases by 150
05.5	1. Replication of HIV/virus/particles/increased viral load / destroys/infects/reduces number of T (helper) cells/CD4 cells; 2. T cells/CD4 cells required for immune response/stimulate B cells; 3. AIDS is a series of (opportunistic) diseases caused by immune system not working/insufficient T cells/CD4 cells;	3	 2. Accept antibody production if clearly stated by <u>B</u> /<u>plasma cells</u>

Question	Marking guidance	Mark	Comments
06.1	Any **three** from • age/age range • gender • level of fitness/exercise • no activity between step 3 and 4 • reference to time of day/food/drink intake beforehand/diet • ethnicity • health, e.g. not diabetic/heart conditions • size/body mass/BMI/weight • seated position of students • similar/normal caffeine intake • volume/amount of drink • type of drink/dose of caffeine • smoker/non-smoker	3 max	Ignore temperature Reject time to drink the drink as in stem of Q
06.2	Identical ingredients minus caffeine;	1	No caffeine alone is not enough Accept decaffeinated soft drink as mirrors wording of Q
06.3	1. Heart rate higher after caffeine/drug; 2. Standard deviations/error bars overlap; 3. Effect of caffeine/drug/difference between means not significant/may be due to chance/another factor;	3	1. Accept use of numbers 2. Reject standard error/SE bars 3. Reject results not significant

Question	Marking guidance	Mark	Comments
07.1	Glucose/sucrose;	1	Reject starch Accept sugars/any named sugar/amino acids
07.2	1. Present in leaves supplied with radioactive carbon dioxide/region A; 2. Not present in other leaves/leaves not supplied with radioactive carbon dioxide; 3. Present in stem <u>and</u> roots <u>and</u> flowers;	3	Everywhere = 0 marks Everywhere except leaves not given radioactive CO_2 = 3 marks
07.3	1. (Radioactive) carbon dioxide taken up by leaves in region A; 2. (Radioactive) sucrose/carbon compounds translocated /transported in phloem; 3. (Radioactive) glucose/sucrose/carbon compounds found in roots/flowers for respiration/growth/synthesis/storage; 4. Other leaves (those not in region A) using CO_2 from air to make their own carbon compounds;	3	Allow sugars throughout Accept organic substances throughout as matches Q stem
07.4	1. Co-transport/active transport/facilitated diffusion of sugars into phloem sieve tubes; 2. Water potential is lowered; 3. <u>Water</u> moves in by osmosis/diffusion;	3	1. Accept solutes, substances 2. Accept Ψ, Ψ_s, osmotic potential, solute potential
07.5	Comparing the difference between 2 means/to see if the difference is significant;	1	

07.6	The probability of the differences between the sets of data being due to chance is less than 5%/0.05; The differences are therefore significant/not due to chance/can reject the null hypothesis;	2	Reject "results" once

Question	Marking guidance	Mark	Comments
08.1	cardiac output = <u>stroke volume × heart rate</u>;	1	Accept CO= SV x HR
08.2	(At 20 dm^3 min^{-1}) heart rate is 120 (118-122) and stroke volume is 168 (166-170) 1. 120 × 168 2. 20,160/1000 = 20.2 dm^3 min^{-1}	2	Accept instructions on how to calculate without numbers Calculated values should lie between 19.5-20.4 2. Allow 20.16 or 20
08.3	1. Diastole/atria and ventricles relaxed; 2. Blood enters from pulmonary veins and vena cava; 3. Atrial systole/atria contract <u>and</u> increased pressure opens AV valves; 4. Ventricular systole/ventricles contract <u>and</u> increased pressure closes AV valves; 5. Increased pressure opens semi lunar valves; 6. Blood pumped into aorta and pulmonary artery;	6 max	Accept converse re closure of any valves If no marks gained from mp3, 4 or 5, accept prevents backflow

| 08.4 | 1. This group has highest incidence of coronary heart disease/CHD;

2. High(er) cholesterol and/or low(er) HDL concentration leads to atherosclerosis/atheroma/plaque formation/fatty deposits in <u>coronary arteries</u>;

3. High(er) blood pressure may damage walls of coronary arteries/cause aneurism/thrombosis; | 3 | |