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General Certificate of Education (A-level) Applied
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Applied Science SC14

(Specification 8771/8773/8776/8777/8779)

Unit 14: The Healthy Body

Mark Scheme

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all examiners participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for standardisation each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, examiners encounter unusual answers which have not been raised they are required to refer these to the Principal Examiner.

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Question	Part	Sub-part	Marking guidance	AO	Mark	Comment
1	(a)	(i)	Image should show rapid irregular peaks	1 (AO1)	1	synoptic
1	(a)	(ii)	Description of cycle may begin at any point, but events need to be in the correct order. Whole heart in diastole; Atria fill with blood; From the veins; Atrial systole / atria (muscle) contracts; Atrioventricular valves open (allow bicuspid / tricuspid); Due to pressure of blood; Blood moves into ventricles; Ventricular systole / ventricle (muscle) contracts; Semilunar valves open; Blood moves into arteries; Semilunar valves close (as heart returns to diastole)	 1 (AO1) 1 (AO1) 1 (AO1) 1 (AO1) 1 (AO1) 1 (AO1) 1 (AO1) 1 (AO1) 1 (AO1) 1 (AO1) 1 (AO1)	Max 5	
1	(b)	(i)	(Dilation means) blood vessels are wid**er** / carry **more** blood; (More blood brings) **more** glucose / oxygen (to the muscle); Used by the heart (muscle) in respiration; Respiration is aerobic / no lactic acid build-up; No lactic acid reduces pain; Muscle will contract more strongly / more rhythmically;	1 (AO2) 1 (AO2) 1 (AO2) 1 (AO2) 1 (AO2) 1 (AO2)	Max 2	
1	(b)	(ii)	Volunteers may not understand risks involved; Information, and signed consent forms; Potential for abuse / harm to subjects; Independent monitoring / review of procedure;	1 (AO2) 1 (AO2) 1 (AO2) 1 (AO2)	1	synoptic

1	(b)	(iii)	Consider whether or not to pay / reward volunteers; Payment would induce poorer people to volunteer perhaps regardless of other concerns for well-being; Other valid points acceptable. Second mark must address issue raised in first mark.	1 (AO2) 1 (AO2) 1 (AO2) 1 (AO2)	1	synoptic

2	(a)		Clot prevents blood flow (to brain tissue); Without blood, cells do not receive oxygen / glucose; Cells begin to die / cease functioning;	1 (AO2) 1 (AO2) 1 (AO2)	Max 2	

2	(b)		$C_6H_{12}O_6 + 6O_2$; $\rightarrow 6CO_2 + 6H_2O$	1 (AO1) 1 (AO1)	2	

2	(c)	(i)	Capillaries	1 (AO1)	1	

2	(c)	(ii)	Thin walls; Walls highly permeable; Walls made of single cell layer; Lumen similar in width to single RBC; Lumen diameter to wall thickness ratio very high / EW;	1 (AO1) 1 (AO1) 1 (AO1) 1 (AO1) 1 (AO1)	Max 2	

2	(d)		The marking scheme for this part of the question includes an assessment of the Quality of Written Communication (QWC). There are no discrete marks for the assessment of written communication but QWC will be one of the criteria used to assign the answer to an appropriate level below.	5x(AO3)	5	

Level	Marks	Descriptor an answer will be expected to meet most of the criteria in the level descriptor
3	4-5	- answer is full and detailed and is supported by an appropriate range of relevant points such as those given below - argument is well structured with minimal repetition or irrelevant points

					- accurate and clear expression of ideas with only minor errors in the use of technical terms, spelling, punctuation and grammar			
				2	2-3	-answer has some omissions but is generally supported by some of the relevant points below -the argument shows some attempt at structure the ideas are expressed with reasonable clarity but with a few errors in the use of technical terms, spelling, punctuation and grammar		
				1	0-1	-answer is largely incomplete. It may contain some valid points which are not clearly linked to an argument structure -unstructured answer -errors in the use of technical terms, spelling, punctuation and grammar or lack of fluency		
						A typical answer would include: Substances / correct named substance in smoke increase risk of stroke; So smokers should give up; Alcohol increases risk; So heavy drinkers should stop / cut down; Increased aerobic exercise reduces risk; So daily 30 minutes exercise; Obesity increases risk; So weight loss or no weight gain as appropriate; Dietary factors such as high salt intake; High cholesterol / saturated fatty acids both increase risk; Reduction or elimination of these from the diet;		

					An answer that would gain full credit could be: Smoking greatly increases the risk of a stroke because substances in the smoke make the blood more likely to clot. Therefore they should stop smoking if they are smokers. Heavy alcohol consumption also increases the risk of strokes so alcohol intake should be reduced. Increasing daily exercise levels to 30 minutes of aerobic activity daily would reduce the likelihood of a stroke. Any of his friends who were obese should make a serious effort to bring their BMI down to below 23, in other words lose weight. In terms of diet, the reduction of salt intake, the substitution of animal fats with monounsaturates such as olive oil and the overall reduction in fat intake would all help to reduce the liklihood of a stroke in the future.			

3	(a)	(i)	All female; All ate same diet; All probably similar age; All non-smokers;	1 (AO3) 1 (AO3) 1 (AO3) 1 (AO3)	Max 2	

3	(a)	(ii)	Oranges have variable vit C content; Symptoms will be very subjective; Flu will show cluster effect; Method of recording does not differentiate between occasional and consecutive days;	1 (AO3) 1 (AO3) 1 (AO3) 1 (AO3)	Max 1	

3	(b)	(i)	4 students eating oranges had no symptoms at all whereas only 2 students taking tablets had no symptoms;	1 (AO2)	1	

3	(b)	(ii)	Calculation of means for each group; Calculations correct: 1.5 days for tablet and no extra groups, 3.1 days for oranges group (accept 3); Tablets therefore seem to produce no benefit; First impression is that oranges make things worse; Two students from oranges group had 14 and 10 days illness which greatly increases their group's mean value; And these two were probably suffering from "real" flu as opposed to other virus; Data does not record any difference between consecutive days illness and occasional, so not possible to decide whether any protection given; Other valid points acceptable	1 (AO2) 1 (AO2) 1 (AO2) 1 (AO2) 1 (AO2) 1 (AO2) 1 (AO2)	Max 4	

3	(c)		Control group/ Allows investigators to see that any effect is due to extra vitamin C intake only/ As comparator (allow baseline)	1 (AO3) 1 (AO3) 1 (AO3)	Max 1	

4	(a)	(i)	Tissue fluid; (Environment) derived from the blood / formed at capillary beds; Homeostatically controlled / constant levels of glucose / ions / water / temperature / other named substance;	1(AO1) 1(AO1) 1(AO1)	Max 2	

4	(a)	(ii)	Value is higher / more alkaline / accept normal range is 7.35 – 7.45;	1(AO2)	1	

4	(b)	(i)	To produce 1% requires 1g nutrient in every 100cm^3 solution; 1g nutrient is found in 5 cm^3 stock solution; Water required = 1440cm^3 Stock required = 72cm^3 Reject 1440cm^3 <u>solution</u> Full marks can only be awarded if the answer includes the correct volumes of **both** water and stock solution;	1 (AO2) 1 (AO2) 1 (AO2) 1 (AO2)	Max 3	

4	(b)	(ii)	Oxygen; Necessary for respiration; Water potential / EW; Maintains cytoplasmic concentration; Temperature; Stated correct effect on enzyme activity / too high denatures; Sodium / other named ion; Maintains ionic balance in cytoplasm;	1 (AO2) 1 (AO2) 1 (AO2) 1 (AO2) 1 (AO2) 1 (AO2) 1 (AO2) 1 (AO2)	Max 4	

4	(b)	(iii)	Cells produce heat / carbon dioxide / waste products; that would all affect the conditions in the culture; constant adjustment would be needed to maintain correct levels / EW;	1 (AO2) 1 (AO2) 1 (AO2)	Max 2	

5	(a)	(i)	Lactic acid / 2-hydroxy propionic acid (accept lactate)	1 (AO1)	1	

5	(a)	(ii)	cytoplasm	1 (AO1)	1	

5	(b)		Aerobic respiration takes place in mitochondria; ETCs are where ATP is generated; Aerobic respiration provides far more ATP than anaerobic;	1 (AO2) 1 (AO2) 1 (AO2)	Max 3	

			Anaerobic respiration is unable to generate enough ATP for even mild activity;	1 (AO2)		
5	(c)	(i)	5.4mmol litre $^{-1}$	1 (AO1)	1	
5	(c)	(ii)	Low cholesterol has been linked to anxiety, depression, increased likelihood of suicide (one mark only for psychotic factors); Increased risk of haemorrhagic stroke; Low levels of bile can interfere with fat digestion; Reduction in levels of sex hormones; Inability to make cell membranes.	1 (AO1) 1 (AO1) 1 (AO1) 1 (AO1) 1 (AO1)	Max 2	
5	(d)		Cholesterol meter is more precise/quantitative – accept accurate; Meter is objective and removes element of human influence	1 (AO3) 1 (AO3)	2	
6	(a)	(i)	Protein	1 (AO1)	1	
6	(a)	(ii)	Any food example that is predominantly starch / sugar and / or fat;	1 (AO1)	1	
6	(b)	(i)	36960	1 (AO2)	1	
6	(b)	(ii)	Osteoporosis, due to lack of calcium; Anaemia; due to lack of iron; Amenorrhoea; due to low weight; Other correctly named problem + correct cause gains 2 marks Correctly named problem but incorrect cause gains 0 Correctly named problem but without cause given gains 1	2 (AO2) 2 (AO2) 2 (AO2) 2 (AO2)	Max 2	

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					The gymnast would sit or lie in a specialised, insulated chamber that has water running through the walls. She should have fasted for twelve hours before the investigation and should be completely at rest but remaining awake throughout. The difference in temperature between the water entering the chamber walls and the water leaving is due to the amount of heat given out by the gymnast as a result of her basic metabolism. The measurement would take place over a given period of time and the resulting figure calculated to give the energy produced over 24 hours.			

7	(a)	(i)	9.5mmol/litre is above the range for normal blood glucose; It confirms that the child has diabetes;	1(AO2) 1(AO2)	2	

7	(a)	(ii)	Extreme thirst; Frequent urination; Extreme tiredness; Weight loss;	1(AO2) 1(AO2) 1(AO2) 1(AO2)	Max 1	

7	(b)		The pancreas fails; to produce sufficient insulin; Glucose in the diet is not stored but remains in the blood; Glycogen is not formed; Diabetes is not caused by an infective agent / it is due to an error of metabolism / EW;	1(AO2) 1(AO2) 1(AO2) 1(AO2) 1(AO2)	Max 3	

7	(c)		Protein is denatured / destroyed by stomach acid; And digested by the enzymes / protease in the stomach; So would not reach the target organ / liver; Could not be absorbed into the blood;	1(AO2) 1(AO2) 1 (AO2) 1 (AO2)	Max 2	
8	(a)	(i)	Lines pointing correctly to one incisor and one premolar Premolar and incisor correctly named	1 (AO1) 1 (AO1)	2	
8	(a)	(ii)	Because molars/cusped surfaces crush food / without cusps molars would not crush food properly;	1 (AO2)	1	
8	(b)	(i)	Time on *x*-axis; Sensible scales for both axes; Points plotted correctly; Line of best fit does not carry marks, neither does joining points	1 (AO3) 1 (AO3) 1 (AO3)	3	
8	(b)	(ii)	Data show longer brushing removes more food; Most effect is given in the first 20 seconds / brush for at least 20 seconds; Removing food particles removes nutrient for microbes in mouth / EW; Without nutrient microbes produce less acid; Reduction in acid production makes remaining teeth less likely to decay;	1 (AO2) 1 (AO2) 1 (AO1) 1 (AO1)	Max 1 Max 2	