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General Certificate of Education
June 2010

APPLIED SCIENCE SC14

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 meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting 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 the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' 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 1

(a)(i)	Rectum; Line points to rectum (allow (lower) colon) ignore large intestine	(1) (AO1) (1) (AO1)	**2**
(a)(ii)	Water is reabsorbed/water content is reduced; Material becomes more solid/less liquid/faeces formed; Salts are reabsorbed;	(1) (AO1) (1) (AO1) (1) (AO1) Max 2	**2**
(b)(i)	(circular) muscles contract; Behind the food/bolus; Antagonistic action described in correct context; (Longitudinal) muscles restore shape; Peristalsis/ wave of contraction along gut	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) Max 2	**2**
(b)(ii)	Gut contents softer; Therefore less power/EW needed by muscles for peristalsis/EW	(1) (AO2) (1) (AO2)	**2**
(c)	(Increase intake of) fruit and/or vegetables; Drink more fluids; Answers suggesting “eat more fibre” do not gain credit here	(1) (AO2) (1) (AO2)	**2**
(d)	Protein levels are often low; Iron intake often low; Other correct named nutrient e.g. B12 or zinc or essential amino acids Energy intake low	(1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2)	**2**

Total Mark: 12

Question 2

(a)(i)	(Small) sample of blood is taken; Vitamin D measured by chromatography/radioimmunoassay	(1) (AO1) (1) (AO1)	**2**
(a)(ii)	5µg/200iu (Allow values in range 4-6 µg and 180-220iu) per dm_3 of blood	(1) (AO1)	**1**
(b)(i)	Vitamin D is produced by the skin; On exposure to sunlight;	(1) (AO2) (1) (AO2)	**2**
(b)(ii)	Rickets; (Leg) bones are bent;	(1) (AO1) (1) (AO1) Max 1	**1**
(b)(iii)	Vitamin D is needed for uptake of calcium; Calcium (carbonate/phosphate) provides strength /rigidity in bone	(1) (AO1) (1) (AO1)	**2**

Total Mark: 8

Question 3

<table>
<tr>
<td>(a)</td>
<td>
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.
<table>
<tr><th>Level</th><th>Marks</th><th>Descriptor
an answer will be expected to meet most of the criteria in the level descriptor</th></tr>
<tr><td>3</td><td>4-5</td><td>-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</td></tr>
<tr><td>2</td><td>2-3</td><td>-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</td></tr>
<tr><td>1</td><td>0-1</td><td>-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</td></tr>
<tr><td></td><td></td><td>Biological information to be credited would include:
sardines increase intake of omega (3 & 6) fatty acids
green salad increases fibre intake
green salad increases vitamin and mineral / micronutrient intake
wholemeal bread increases fibre intake
wholemeal bread increases vitamin intake/named vitamin
removing sausages reduces (saturated) fat intake
removing chips reduces fat intake
proportion of energy gained as fat is reduced overall
removing baked beans reduces salt/sugar intake

A suitable answer could be as follows:
The meal suggested by the student replaces the protein component of the meal that was sausages, with sardines. This will increase the intake of omega 3 and 6 fatty acids while reducing the intake of saturated fat.</td></tr>
</table>
</td>
<td>(5) (AO3)</td>
<td>5</td>
</tr>
</table>

(a) cont			The substitution of chips with wholemeal bread also reduces the fat intake, but at the same time increases the amount of fibre and increases vitamin B from the whole grain. Salad instead of baked beans also increases the intake of a variety of vitamins including vitamin A and C and will increase fibre in the diet while reducing the intake of salt and sugar which tend to be high in commercially produced baked beans.	(5) (AO3)	
(b)	Reduced risk of obesity / type 2 diabetes / cv disease / maintains mobility; Maintains vital capacity of pulmonary system (synoptic mark)			(1) (AO2) (1) (AO2)	**2**
(c)	Higher energy intake makes obesity more likely; Dental decay more likely; Reduced appetite for food with higher nutritional value; (Type 2) diabetes more likely			(1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2) Max 3	**3**

Total Mark: 10

Question 4

(a)(i)	(external) intercostal muscles	(1) (AO1)	**1**
(a)(ii)	Contraction (of muscle); causes ribcage to move up and outwards; Increasing volume of thorax; Reducing internal pressure (to below that of atmosphere); (So air flows) down pressure gradient	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) Max 3	**3**
(b)(i)	Deep breaths require diaphragm to move downwards; Legs/thighs push gut/liver upwards/compress abdomen; Making downward movement of diaphragm difficult;	(1) (AO2) (1) (AO2) (1) (AO2) Max 2	**2**
(b)(ii)	Stronger muscles lead to increased ventilation/deeper breaths/more air entering lungs; Increases oxygen uptake; Reduces proportion of anaerobic respiration/more aerobic which produces lactate/lactic acid	(1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2) Max 3	**3**

Total Mark: 9

Question 5

<table>
<tr><td>(a)(i)</td><td>aorta</td><td>(1) (AO1)</td><td>1</td></tr>
<tr><td>(a)(ii)</td><td>Line points to vessel before join with bypass graft</td><td>(1) (AO2)</td><td>1</td></tr>
<tr><td>(a)(iii)</td><td>
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</table>
Biological information to be credited could include
bypass increases/blockage had reduced blood flow;
to cardiac/ventricle muscle
increasing supply of oxygen
increasing suppy of glucose
respiration faster (in cardiac muscle)
producing ATP
ATP available at the rate needed for normal activity
so angina/EW symptoms should disappear
greater level of physical activity should be possible
A suitable answer might be:
The operation should improve the health of the patient because the bypass increases the flow of blood to the ventricle muscle. This supplies the cells with more oxygen and glucose, allowing respiration to take place more efficiently and provide sufficient ATP for the heart muscle to contract sufficiently for normal activities. The patient should therefore be able to increase his level of physical activity and be free of the pain that the fatigue in the heart muscle was causing.
</td><td></td><td>5</td></tr>
<tr><td>(b)(i)</td><td>Meter has a digital display so removes human error;
dipstick is analogue and therefore subjective</td><td>(1) (AO1)
(1) (AO1)</td><td>1
1</td></tr>
</table>

(b)(ii)	This is higher than normal; Normal reading would be in range 4.0-6.5mmol/l	(1) (AO2) (1) (AO1)	**1** **1**

Total Mark: 11

Question 6

(a)(i)	Within similar age range/sex; Non-hypertensive/EW/medical condition; Similar health profile re: smoking/diet/alcohol intake/drugs/medicines/regular caffeine intake Size measurement (mass, height, BMI etc) similar	(1) (AO3) (1) (AO3) (1) (AO3) (1) (AO3) Max 3	**3**
(a)(ii)	Body weight/blood volume will differ between individuals; Adjusting fluid to match body weight will make results more comparable	(1) (AO3) (1) (AO3)	**2**
(b)	Control experiment; Shows effect can only be due to the caffeine and no other aspect of the investigation	(1) (AO3) (1) (AO3)	**2**
(c)(i)	6.67 $cm^3 min^{-1}$; Allow 1 mark for one or both correct rates: 10.83 with caffeine, 4.17 with placebo	(1) (AO2)	**2**
(c)(ii)	Caffeine increases rate of output up to 90 mins; Total volume over two hours is not affected	(1) (AO3) (1) (AO3)	**2**
(c)(iii)	Because time for caffeine to be absorbed via gut would vary /injecting – time doesn't vary	(1) (AO3)	**1**
(d)	Volunteers must receive full information about likely effects / informed consent; Independent evaluation to prevent abuse of subjects; Subjects must not be coerced into participation/forced to contnue; Religious/ethical views of researchers/subjects must be respected; Reject *it might be against some peoples' religion* without further qualification	(1) (AO2) (1) (AO2) (1) (AO2) (1) (AO2) Max 2	**2**

Total Mark: 14

Question 7

(a)	Evaporation/change of state from liquid to gas requires energy/heat Evaporation causes cooling; Heat / energy is taken from skin; (Colder skin) cools blood flowing through it; (Cooler) blood returning to core lowers temperature (synoptic marks)	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) Max 2	**2**
(b)(i)	Pulse oximeter; Because it is non-invasive	(1) (AO1) (1) (AO1)	**1** **1**
(b)(ii)	Sa O_2 % / SAO_2%	(1) (AO1)	**1**
(b)(iii)	8 / eight	(1) (AO1)	**1**
(c)	5.4 babies per month. Allow 5 or 6 (nearest whole baby) Allow 2 marks for answer of 16.2, being difference in deaths over the three months; Allow I mark for use of correct formula: % change = (difference/original) x 100	(3) (AO2)	**3**

Total Mark: 9

Question 8

(a)(i)	Bile emulsifies fats/reduces size of droplets/ breaks down droplets (reject breaks down fat); Larger surface area/greater substrate availability; For lipase;	(1) (AO1) (1) (AO1) (1) (AO1) Max 2	**2**
(a)(ii)	Enzymes are sensitive to pH changes/operate at optimum pH Tertiary structure (of protein) changes; Substrate no longer fits into active site/no ES complexes; No/slower reaction;	(1) (AO1) (1) (AO1) (1) (AO1) (1) (AO1) Max 3	**3**
(b)	To be avoided: (any two of bacon, full-fat cheese or double cream; Replacement: check individual answers, e.g. chicken to replace bacon, cottage cheese to replace full fat, fromage frais or yogurt to replace double cream (other suitable alterntaives accepted)	(1) (AO2) (1) (AO2)	**1** **1**

Total Mark: 7