

**GCE**

**Biology B (Advancing Biology)**

Unit **H022/01**: Foundations of biology

Advanced Subsidiary GCE

**Mark Scheme for June 2016**

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.













All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

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## Annotations

Annotation	Meaning
	Correct response
	Incorrect response
	Ignore
	Could be used for Point already given (i.e. Given max)
	Underline (for ambiguous / contradictory wording)
	Omission
	Marking point partially met
	Benefit of doubt
	Benefit of doubt not given
	Contradiction
	Error carried forward
	Blank page

**Subject-specific Marking Instructions****INTRODUCTION**

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

## SECTION A

Question	Answer	Marks	Guidance
1	C	1	
2	B	1	
3	B	1	
4	C	1	
5	B	1	
6	A	1	
7	C	1	
8	A	1	
9	A	1	
10	C	1	
11	B	1	
12	C	1	
13	C	1	
14	B	1	
15	C	1	
16	B	1	
17	D	1	
18	C	1	
19	A	1	
20	D	1	
	<b>Total</b>	<b>20</b>	

## SECTION B

Question		Answer	Marks	Guidance
21	(a)	<p>cell surface / plasma , membranes have been disrupted ✓ (because) water has entered the cells by osmosis ✓  (because) water potential of the sodium chloride solution is higher ✓</p>	2 max	<p><b>ACCEPT</b> description of osmosis e.g. by moving from higher to lower water potential <b>CREDIT</b> ORA <b>IGNORE</b> water concentration</p>
	(b)	<p>gives time for haemolysis to occur (in the solution) <b>OR</b> <i>idea that</i> gives time for water potential to equilibrate between solution and cytoplasm /AW <b>OR</b> osmosis may be slow depending on water potential gradient ✓</p>	1	<p><b>DO NOT ACCEPT</b> allows time for <u>reaction</u> to occur  <b>ACCEPT</b> time for osmosis OR to reach equilibrium</p>
	(c)	<p>colorimeter gives quantitative results ✓  observing haemolysis is qualitative / AW ✓  <i>advantages of colorimeter</i> takes away human subjective judgement on haemolysis / AW ✓  allows calibration to give concentration at which cells are isotonic with sodium chloride solution / AW ✓</p>	3 max	<p><b>ACCEPT</b> colorimeter gives data with numbers OR allows (numerical) data to be plotted on a graph</p>

Question			Answer	Marks	Guidance
21	(d)	(i)	<p><i>idea that</i> absorbance in both solutions is similar up to <math>0.10 \text{ moldm}^{-3}</math> ✓  for both solutions as concentration increases absorbance increases ✓  <i>idea that</i> sodium chloride has higher absorbance at concentrations of , <math>0.15 / 0.20 \text{ moldm}^{-3}</math> ✓</p> <p>in <math>0.05</math> and <math>0.10 \text{ moldm}^{-3}</math> for both solutes haemolysis has occurred ✓</p> <p>in sodium chloride solution no haemolysis occurs above <math>0.15 \text{ moldm}^{-3}</math>  <b>OR</b>  in glucose haemolysis occurs at concentrations between <math>0.05</math> and <math>0.20 \text{ moldm}^{-3}</math> ✓</p> <p>comparative figures with units given at least once ✓</p>	2 max	<p><b>MUST</b> be linked to another mark point  e.g. for <i>sodium chloride at concentration of <math>0.15 \text{ moldm}^{-3}</math> the absorbance of <math>0.70 \text{ a.u.}</math> is higher than glucose which is only <math>0.18</math> gets mps 3 and 6</i></p>
		(ii)	<p><i>idea that</i> the critical point for determining the concentration of solute at which haemolysis occurs is between <math>0.20 \text{ moldm}^{-3}</math> and <math>0.30 \text{ moldm}^{-3}</math> / AW ✓</p>	1	<p><b>look for idea that</b> absorbance shows that at <math>0.20 \text{ moldm}^{-3}</math> haemolysis occurs but at <math>0.30 \text{ moldm}^{-3}</math> there is no haemolysis so <math>0.25 \text{ moldm}^{-3}</math> could go either way  e.g. they could conclude that haemolysis occurs at the wrong concentration such as <math>0.30</math> but it could have happened at <math>0.25 \text{ moldm}^{-3}</math>  the haemolysis could have occurred earlier at <math>0.25</math> rather than <math>0.30 \text{ moldm}^{-3}</math></p> <p><b>IGNORE</b> ref to anomalous result</p>
			<b>Total</b>	<b>9</b>	

Question			Answer	Marks	Guidance
22	(a)	(i)	S ✓	1	
		(ii)	waxy cuticle (to prevent water loss) ✓ roots (for obtaining water) ✓ gas exchange structures ✓	1 max	<b>CREDIT</b> named gas exchange structures e.g. correct references to stomata or lenticels <b>IGNORE</b> chloroplasts
		(iii)	large <b>and</b> multicellular ✓ have small SA:V ✓ <i>idea that</i> diffusion distance is large and diffusion is too slow to meet need ✓	1 max	
	(b)		removes sucrose from phloem ✓ decreases hydrostatic pressure at (sink) end of sieve tube ✓ <i>idea that</i> it lowers sucrose concentration because sucrose is used for respiration / metabolism ✓ <i>idea that</i> sucrose removed from phloem (so) water potential increases in phloem ✓	3 max	<b>ACCEPT</b> assimilates for sucrose
			<b>Total</b>	<b>6</b>	



Question			Answer	Marks	Guidance
23	(a)	(i)	<p><i>opsonin</i> protein / antibody , that enhances phagocytosis by marking antigens / AW ✓</p> <p><i>phagocytosis</i> (the process by which) cell / phagocyte , engulfs bacteria / pathogens / cell debris ✓</p>	2	<p><b>CREDIT</b> other named cells e.g. macrophage <b>IGNORE</b> references to engulfing antigens <b>IGNORE</b> digests <b>DO NOT CREDIT</b> lymphocyte for a phagocyte</p>
		(ii)	<p><i>in mammalian cells</i> <i>idea that</i> the protein is synthesised on , rough endoplasmic reticulum / rER</p> <p><b>OR</b> protein synthesis on , larger / 80S , ribosomes ✓</p> <p><i>idea that</i> the protein is, packaged / modified , by Golgi (apparatus) ✓</p> <p><i>idea that</i> the protein is packaged into vesicles which fuse with cell surface membrane ✓</p>	2 max	<p><b>CREDIT</b> ORA throughout for bacterial cells</p> <p><b>CREDIT</b> exocytosis occurs</p>

Question		Answer	Marks	Guidance
23	(b)	<p><b>X</b> variable region <b>AND</b> where antibody binds to specific antigen ✓</p> <p><b>Y</b> constant region <b>AND</b> allows attachment to phagocytes ✓</p> <p><b>Z</b> hinge region <b>AND</b> allows the antibody to flex <b>OR</b> to attach to more than one antigen ✓</p>	3	<p><b>ACCEPT</b> antigen-binding site for variable region</p> <p><b>ACCEPT</b> complementary as AW for specific</p> <p><b>ACCEPT</b> macrophage for phagocyte</p>
	(c)	<p>flow cytometry ✓</p> <p><i>idea that bacteria / L.monocytogenes , are tagged by antibodies labelled with fluorescent markers</i> ✓</p> <p><i>idea of antibodies being immobilised</i> ✓</p> <p>antibodies may, bind / attach to , (test) antigen / protein / p60 ✓</p> <p><i>idea that antibodies may be linked to enzymes producing colour reaction</i> ✓</p>	3 max	<p><b>ACCEPT</b> <i>idea of binding leading to production of colour</i></p> <p><b>ACCEPT</b> description of ELISA</p>
		<b>Total</b>	<b>10</b>	

Question		Answer	Marks	Guidance
24	(a)	a disease that , has a slow onset / has symptoms that worsen over time / lasts a long time ✓	1	<b>IGNORE</b> caused by pathogens or may be incurable
	(b)	(i)		
		(i)	1 max	<b>DO NOT CREDIT</b> any type of cell alone OR many types of cell unqualified
		(ii)	1	<b>CREDIT</b> <i>idea that</i> each chromosome in normal pairs (of 22 and 9) would be same length
		(iii)	3 max	<b>CREDIT</b> cells taken using amniocentesis or CVS  <b>ACCEPT</b> cell cycle for mitosis
		(iii)		
		(iii)		

Question		Answer	Marks	Guidance	
24	(c)	<p>drug is tested on people with the disease ✓ tests how effective the drug is against the disease ✓</p> <p>gathers information about dosage of the drug ✓ determines if the drug is, more effective / better than , existing drugs ✓ <i>idea that</i> more people participate than in previous phases ✓</p> <p>qualified reference to placebo ✓</p>	2 max	<p>disease only needs to be referred to once if awarding both <b>mps 1</b> and <b>2</b> e.g. <i>the drug is given to people with the disease to see how effective it is gets</i> <b>mps 1</b> and <b>2</b>.</p> <p><b>IGNORE</b> references to side effects <b>ACCEPT</b> compares effectiveness with existing drug</p> <p><b>ACCEPT</b> <u>larger</u> scale than previous trials</p> <p>e.g. don't usually have placebo because it would be unethical to give to a person with the disease</p>	
	(d)	(i)	83.3 % ✓✓	2	<p><b>ALLOW</b> for 1 mark 1250 / 1500 x 100 <b>OR</b> 83.3333...</p>
		(ii)	<p>(y axis) patient <b>G</b> had a much higher blast count (at the start of the trial) <b>AND</b> (x axis) patient <b>G</b> was being given a higher dose <b>OR</b> (x axis) <i>idea that</i> patient <b>G</b> did not continue with the treatment✓</p>	1	<p><b>CREDIT</b> ORA for patient <b>F</b> <b>ACCEPT</b> very different blast counts</p> <p>e.g. patient <b>G</b> had much less time on the drug e.g. patient <b>G</b> decided to opt out of the trial e.g. blast count of patient <b>G</b> had reduced sufficiently e.g. patient <b>G</b> had stabilised</p>
			<b>Total</b>	<b>11</b>	

Question		Answer	Marks	Guidance
25	(a)	<p><i>age</i> students (in AS class) would not provide a big enough range</p> <p><b>AND</b> <i>environmental temperature</i> <i>idea that</i> it would be, unsafe / unethical, to test temperature on humans / AW</p> <p><b>OR</b> <i>idea that</i> could not get a wide enough range of temperatures (in the classroom) ✓</p>	1	<p><b>ACCEPT</b> students (in AS class) would be same age</p> <p><b>IGNORE</b> reference to homeostasis</p> <p><b>IGNORE</b> same environment <b>CREDIT</b> <i>idea that</i> environmental temperature is difficult to measure or control (in a classroom)</p>
	(b)	(i)	1 max	<p><b>IGNORE</b> counting errors as heart rate was measured electronically</p> <p><i>Other examples</i> e.g. read it wrong e.g. wasn't taken exactly 4 minutes into exercise e.g. allowed to recover before taking heart rate e.g. didn't try as hard (during exercise)</p>
		(ii)	1 max	<b>CREDIT</b> <i>idea that</i> they had an exercise programme
				<p>(student) was , fitter / undertaking athletic training ✓ (student) had a higher stroke volume ✓ (student) had <b>correctly named</b> heart condition ✓ genetic reasons ✓</p>

Question			Answer	Marks	Guidance																																												
25	(b)	(iii)	column for $(x - \bar{x})^2$ completed correctly ✓  variance = 35 <b>or</b> 34.7 ✓  SD = 6 <b>or</b> 5.9 <b>or</b> 5.89 ✓	3	<p><b>DO NOT CREDIT</b> minus numbers in column</p> <table border="1"> <thead> <tr> <th>Student</th> <th>heart rate (x)</th> <th>(x - <math>\bar{x}</math>)</th> <th>(x - <math>\bar{x}</math>)<sup>2</sup></th> </tr> </thead> <tbody> <tr><td>1</td><td>55</td><td>-11</td><td>121</td></tr> <tr><td>2</td><td>67</td><td>1</td><td>1</td></tr> <tr><td>3</td><td>73</td><td>7</td><td>49</td></tr> <tr><td>4</td><td>73</td><td>7</td><td>49</td></tr> <tr><td>5</td><td>71</td><td>5</td><td>25</td></tr> <tr><td>6</td><td>59</td><td>-7</td><td>49</td></tr> <tr><td>7</td><td>65</td><td>-1</td><td>1</td></tr> <tr><td>8</td><td>67</td><td>1</td><td>1</td></tr> <tr><td>9</td><td>66</td><td>0</td><td>0</td></tr> <tr><td>10</td><td>62</td><td>-4</td><td>16</td></tr> </tbody> </table> <p><b>ECF</b> mp 2 if mp 1 incorrect                      mp3 if mp2 incorrect</p> <p>Figures should be no more than 1dp different between mps.</p>	Student	heart rate (x)	(x - $\bar{x}$ )	(x - $\bar{x}$ ) <sup>2</sup>	1	55	-11	121	2	67	1	1	3	73	7	49	4	73	7	49	5	71	5	25	6	59	-7	49	7	65	-1	1	8	67	1	1	9	66	0	0	10	62	-4	16
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Question			Answer	Marks	Guidance
25	(b)	(iv)	no / conclusion rejected <b>AND</b> <i>reason</i> <i>idea that</i> some students have heart rates that fall outside one SD of the mean ✓	1	<b>CREDIT</b> <i>idea that</i> a given heart rate (from results) is more than one SD away from mean heart rate e.g. 59 is more than one SD away from 66
			<b>Total</b>	<b>7</b>	

Question			Answer	Marks	Guidance
26	(a)	(i)	<u>lumen</u> of, blood vessel /arteriole / artery ✓	1	<b>IGNORE</b> capillary
		(ii)	(squamous epithelial cells) do not have cilia ✓ (squamous epithelial cells) are flattened ✓ (squamous epithelial cells) have fewer mitochondria ✓	1 max	<b>CREDIT</b> ORA for epithelial cells lining bronchioles <b>ACCEPT</b> thinner
		(iii)	<i>smooth muscle</i> contracts to , control / adjust / reduce lumen size ✓  <i>elastic fibres</i> allow , stretch / recoil <b>OR</b> allow lumen to , dilate / return to usual size ✓	2	
	(b)		(wall of) trachea <b>OR</b> bronchus <b>AND</b> support / prevents (airway) collapse ✓	1	<b>IGNORE</b> references to shape and flexibility <b>DO NOT CREDIT</b> cartilage increases flexibility
	(c)	(i)	RNA ✓	1	<b>IGNORE</b> ref to type of RNA e.g. messenger
		(ii)	antigens (on viral coat) constantly change ✓ <i>idea that</i> the virus is inside host cell so does not attract antibody ✓  <i>idea that</i> frequency of mutation is high ✓	1 max	
			<b>Total</b>	<b>7</b>	



**OCR (Oxford Cambridge and RSA Examinations)**  
1 Hills Road  
Cambridge  
CB1 2EU

**OCR Customer Contact Centre**

**Education and Learning**

Telephone: 01223 553998

Facsimile: 01223 552627

Email: [general.qualifications@ocr.org.uk](mailto:general.qualifications@ocr.org.uk)

[www.ocr.org.uk](http://www.ocr.org.uk)

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**OCR (Oxford Cambridge and RSA Examinations)**  
Head office  
Telephone: 01223 552552  
Facsimile: 01223 552553

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