



ADVANCED SUBSIDIARY (AS)
General Certificate of Education

Biology

Assessment Unit AS 1
assessing
Molecules and Cells

[SBY11]

Assessment

**MARK
SCHEME**

General Marking Instructions

The main purpose of the mark scheme is to ensure that each question is marked accurately, consistently and fairly.

Mark schemes are not intended to be totally prescriptive. No mark scheme can cover all the responses which students may produce. In the event of unanticipated answers, teachers and lecturers are expected to use their professional judgement to assess the validity of answers.

Mark Scheme Notation

The use of a solidus (/) denotes alternative answers which can be awarded within the same question (or marking point in a question worth more than one mark).

The use of a semi-colon (;) denotes separate marking points. These are particularly relevant when separating the different marking points in a question worth more than one mark.

Part of an answer within brackets indicates that this part is not essential to gain credit – the bracketed section is usually to set context or for the purpose of completeness.

Some answers are shown as 'Any **two** from' (or any number between two and six). This means that any two (or other specified number) answers from the bullet-pointed list can be credited in this question or question part.

Some answers have 'Other appropriate response' (OAR) as an alternative answer which may be credited. OAR is most likely to appear in an answer where there are a wide range of possible answers worthy of credit and it is unlikely that the mark scheme contains all the possible answers.

Marking Calculations

Full marks are normally awarded for the correct answer – irrespective of whether working out has been shown (even when asked to show working out.) The principle of 'error carried forward' (ECF) usually applies in that if a student makes a mistake in the first part of a three-mark, three-stage calculation then the final two marks can be awarded if the second and third stage processes are carried out correctly. The same principle applies to a mistake at any stage in a calculation.

Essays

The mark scheme includes indicative points for essays. Each indicative point is numbered to aid marking. Following the indicative points in the mark scheme, a table is included which shows how many marks should be awarded for an answer that is credited with having a particular number of indicative points.

Additional Guidance

The Additional Guidance column in the mark scheme provides extra information to aid the marking process. This column includes clarification concerning some marking points: this may include naming key words which may be required in an answer or may provide a range of alternative answers which would be considered creditworthy under OAR, or examples of the ECF principle. It may also include examples of answers which would not be considered creditworthy.

Question	Answer	Additional Guidance	Mark
1 (a)	β-glucose; prion; DNA/RNA/protein; conjugated protein; disaccharide;	Allow polypeptide/nucleic acid but not amino acid/nucleotide (for nitrogen-containing polymer).	[5]
(b)	Nucleus; close association with DNA/part of the chromosome;		[2] [7]

2 (a) (i)	Any two from: <ul style="list-style-type: none"> light microscope allows use of live specimens is cheaper than electron microscope allows colour to be seen is more portable less training required to use 	Bullet point (bp) 1– allow light microscope suitable for larger specimens. If not specified, assume referring to light microscope (based on wording in question). Allow converse throughout if answering in context of disadvantages with the electron microscope.	[2]
(ii)	Magnification is the increase of the size of the object (in the field of view); resolution is the ability to see two adjacent points as separate;	Marking point (MP) 2 – credit the degree of detail visible or equivalent.	[2]
(b)	Scanning electron microscope;	Allow SEM.	[1] [5]

3 (a)	X – lacteal; absorption/transport of fatty acids and glycerol;	(MP) 2 – need both fatty acids and glycerol. Alternatively, credit absorb/transport <i>products</i> of fat/lipid digestion but not absorption/transport of fats/lipids.	[2]
(b)	Any two from: <ul style="list-style-type: none"> microvilli/brush border/increased surface area to maximise absorption of nutrients extensive capillary network for transport of products of digestion goblet cells to produce mucus/ reduce friction muscle fibres (connected to muscularis mucosa) can move the villus to improve contact with the products of digestion short distance/single epithelial layer to decrease diffusion distance 	Each alternative requires both the description (adaptation) and explanation (benefit of the adaptation).	[2]

Question	Answer	Additional Guidance	Mark
(c)	Any three from: <ul style="list-style-type: none"> • blunting and loss of shape reduces surface area of the villi • reduction of Crypts of Lieberkuhn reduces ability to produce new cells • reducing the absorption of nutrients from the ileum • loss of epithelial lining may lead to inflammation/discomfort/nausea/loss of appetite 	(bp1) allow references to villi being less distinct (or implied) but reduced surface area also needed. (bp3) can be in context of bp1 or bp2.	[3] [7]

4 (a)	An enzyme is a globular protein that acts as a biological catalyst/that reduces the activation energy of a reaction/that speeds up metabolic reactions;	Allow an enzyme is a biological catalyst that speeds up (metabolic) reactions. (Answer requires two components: feature, e.g. biological catalyst/globular protein and function.)	[1]
(b) (i)	Any two from: <ul style="list-style-type: none"> • peptide (bonds) • ionic (bonds) • hydrogen (bonds) 	Not hydrophilic or hydrophobic interactions (as not bonds). Word 'bonds' not required in answer (as in question).	[2]
(ii)	The amino acids (at the points of enzyme action) are different; enzyme active sites are complementary to a specific type of molecule; ref to lock and key/induced fit;	MP2 requires reference to the active site and not just enzyme shape.	[3]
(c)	Change to the primary structure/ amino acid sequence; loss of disulfide bond; resulting in altered shape/folding/ tertiary structure;	'Will change bonding which affects shape' = MP 3 but not specific enough for MP2.	[3]
(d) (i)	Golgi body;	Allow Golgi apparatus or Golgi unqualified.	[1]
(ii)	(Insulin is) packaged into vesicles which fuse with the plasma membrane/exocytosis occurs;	Credit exocytosis unqualified.	[1]
(e) (i)	B; at lower substrate concentration, increasing the substrate concentration increases the amount of product formed; at higher substrate concentrations, enzyme concentration becomes a limiting factor/all active sites are occupied;	(MP2) credit more enzyme-substrate complexes able to form as an alternative to more product formed. (MP3) allow enzyme concentration by implication – e.g. activity levels off because all active sites are occupied.	[3]

Question	Answer	Additional Guidance	Mark
(ii)	A; little activity at low temperature due to lack of kinetic energy/increasing temperature increases the rate of reaction up to a point; at higher temperatures, the enzymes have become denatured/active site is distorted and can no longer catalyse the reaction;		[3] [17]

5 (a) (i)	2.8 minutes/2 minutes 48 seconds;	Allow 2.8 – 6 minutes.	[1]
(ii)	Water enters the cells due to osmosis/ water potential gradient; cell wall prevents further intake of water;	(MP1) key point is linking increasing pressure potential to water entering the cells. (MP2) key point here is reason for pressure potential failing to increase further.	[2]
(b) (i)	$\Psi = \Psi_s + \Psi_p$; –2.10 – 0.15; –2.25;	If correct answer (–2.25) shown without working credit MP2 (and MP3).	[3]
(ii)	Variety 1; shows the highest rate of assimilation even in drought conditions; or Variety 4; shows the lowest assimilation rate difference between drought and non-drought conditions;	MP2 needs to match correct MP1 for both marks to be awarded. (Variety 4) allow only shows small change in drought conditions.	[2]
(iii)	Maintains water movement into root cells; due to the lower water potential created;	Maintains osmotic gradient between plant cells and soil = 1 (MP2).	[2] [10]

6 (a) (i)	A – Plasmid; B – Cell membrane; C – (Peptidoglycan) cell wall;	B – allow plasma membrane but not just membrane.	[3]
(ii)	Plasmids (present); no membrane-bound organelles/by example;	(MP2) examples include nucleus/ mitochondria/Golgi bodies but not organelles only found in plants, e.g. chloroplasts.	[2]
(b)	Increasing number of bacteria will allow less light to pass through/ absorption of light increases;	Allow converse but answer needs to make clear whether change is referring to increasing or decreasing number of bacteria.	[1]

Question	Answer	Additional Guidance	Mark
(c) (i)	With no antibiotic, the numbers of bacteria continue to increase (over time); when tetracycline has been added, bacterial numbers increase until hour 3, then decrease; when rifamycin has been added, bacterial numbers increase until hour 6, but more slowly than without antibiotic;	(MP2) not just with tetracycline increase until 3 hours. (MP3) need both increases (over the six hours) and comparison with when without antibiotic – although ‘increases more slowly’ implies comparison.	[3]
(ii)	Rifamycin should not be used (to treat an infection caused by this bacteria)/tetracycline should be used (to treat an infection caused by this bacterium);		[1]
(d) (i)	10^8 ;	Credit if correct but in expanded form.	[1]
(ii)	Bacteriophages invade bacteria/inject DNA into bacteria; bacteria allow the production of new bacteriophage; bacterial lysis occurs/new bacteriophage are released;	(MP3 first alternative) credit idea that bacteriophage infection kills bacteria.	[3] [14]
		Section A	[60]

Question	Answer	Additional Guidance	Mark																						
7 (a)	<p>Indicative points</p> <ol style="list-style-type: none">1. G_1, S phase and G_2 are the main events of interphase2. cellular events are monitored during the G_1 and G_2 phases3. G_1 – organelles and other cytoplasmic components are formed4. G_2 – spindle fibre proteins are synthesised/chromosomes are checked for errors5. S phase – DNA is replicated / chromosomes double6. prophase – chromatin in nucleus condenses to become visible/ nucleolus disappears/nuclear membrane breaks down/ centrioles move to opposite poles/spindle formation7. metaphase – chromosomes/ chromatids align along the equator attached to spindle fibres by the centromere8. anaphase – centromeres split/ spindle fibres contract pulling chromatids apart/to opposite ends of the cell9. telophase – sister chromatids at opposite poles of the cell/ chromosomes decondense/ nuclear membrane reforms10. cytokinesis – cell divides to produce two diploid daughter cells <table><tr><th>Indicative points</th><th>Marks</th></tr><tr><td>9+</td><td>9</td></tr><tr><td>8</td><td>8</td></tr><tr><td>7</td><td>7</td></tr><tr><td>6</td><td>6</td></tr><tr><td>5</td><td>5</td></tr><tr><td>4</td><td>4</td></tr><tr><td>3</td><td>3</td></tr><tr><td>2</td><td>2</td></tr><tr><td>1</td><td>1</td></tr><tr><td>0</td><td>0</td></tr></table>	Indicative points	Marks	9+	9	8	8	7	7	6	6	5	5	4	4	3	3	2	2	1	1	0	0	<p>(bp1) mark can be awarded if all of G_1, G_2 and S phase are mentioned anywhere in answer if context accurate (i.e. not as part of mitosis).</p> <p>(bp2) award if reference to G_1 and G_2 checkpoints.</p> <p>(bp3) allow by example, e.g. mitochondria are formed.</p> <p>(bp4) allow centrioles replicate/ energy stores (ATP) built up.</p> <p>(bp5) allow chromatids form.</p> <p>(bp8) need both centromeres split/spindle fibres contract and chromatids separating.</p> <p>(bp10) allow cell divides to produce two cells each with identical chromosome make up.</p>	
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8	8																								
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6	6																								
5	5																								
4	4																								
3	3																								
2	2																								
1	1																								
0	0																								

[9]

Question	Answer	Additional Guidance	Mark																
7 (b)	<p>Indicative points</p> <ol style="list-style-type: none">mitosis involves only one division/ meiosis involves two divisionsmitosis results in the formation of 2 (diploid) cells whereas meiosis results in 4 haploid cellsinterphase/prophase I of meiosis - homologous chromosomes are paired to form bivalents (unlike mitosis)during metaphase of mitosis, individual chromosomes (consisting of two chromatids) align along the equator whereas in meiosis I, bivalents align.during anaphase of mitosis, chromatids are separated and pulled to either side of the cell, in meiosis, chromatids remain together/ chromatids are only separated during anaphase IIindependent assortmentrandom alignment of chromosomes at the equator of metaphase Imillions of chromosomal combinations in gametescrossing over/chiasmaprophase I – exchange of sections of non-sister chromatidschanges the allele combinations in gametes compared to parent chromosome <table><tr><th>Indicative points</th><th>Marks</th></tr><tr><td>7+</td><td>6</td></tr><tr><td>6</td><td>5</td></tr><tr><td>5</td><td>4</td></tr><tr><td>4</td><td>3</td></tr><tr><td>3</td><td>2</td></tr><tr><td>1-2</td><td>1</td></tr><tr><td>0</td><td>0</td></tr></table>	Indicative points	Marks	7+	6	6	5	5	4	4	3	3	2	1-2	1	0	0	<p>Answer could be in context of how mitosis differs from meiosis or the converse.</p> <p>(bps1–2) the key points in each bp can be implied across the entire answer – they do not need to be explicitly linked together.</p> <p>(bp3) credit ‘in meiosis, bivalents form in prophase 1’ – involving homologous chromosomes can be implied (as long as correct stage is stated).</p> <p>(bps 3 and 4) – if fail to specify first division penalise once only unless understanding is incorrect.</p> <p>(bp7) must specify metaphase I.</p> <p>(bp8) allow idea that unique chromosome combinations formed.</p> <p>(bp10) must specify prophase I.</p>	<p>[6]</p> <p>Section B</p> <p>Total</p>
Indicative points	Marks																		
7+	6																		
6	5																		
5	4																		
4	3																		
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0	0																		
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