Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
January 2014

Biology

Assessment Unit AS 1

assessing

Molecules and Cells

[AB111]

WEDNESDAY 8 JANUARY, MORNING

MARK SCHEME

General Marking Instructions

Introduction

Mark schemes are published to assist teachers and students in their preparation for examinations. Through the mark schemes teachers and students will be able to see what examiners are looking for in response to questions and exactly where the marks have been awarded. The publishing of the mark schemes may help to show that examiners are not concerned about finding out what a student does not know but rather with rewarding students for what they do know.

The Purpose of Mark Schemes

Examination papers are set and revised by teams of examiners and revisers appointed by the Council. The teams of examiners and revisers include experienced teachers who are familiar with the level and standards expected of students in schools and colleges.

The job of the examiners is to set the questions and the mark schemes; and the job of the revisers is to review the questions and mark schemes commenting on a large range of issues about which they must be satisfied before the question papers and mark schemes are finalised.

The questions and the mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes, therefore, are regarded as part of an integral process which begins with the setting of questions and ends with the marking of the examination.

The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all the markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed using the mark scheme and samples of the students' work in the form of scripts. Consideration is also given at this stage to any comments on the operational papers received from teachers and their organisations. During this meeting, and up to and including the end of the marking, there is provision for amendments to be made to the mark scheme. What is published represents this final form of the mark scheme.

It is important to recognise that in some cases there may well be other correct responses which are equally acceptable to those published: the mark scheme can only cover those responses which emerged in the examination. There may also be instances where certain judgements may have to be left to the experience of the examiner, for example, where there is no absolute correct response – all teachers will be familiar with making such judgements.

/ denotes alternative points
; denotes separate points
Comments on mark values are given in bold
Comments on marking points are given in italics

AVAILABLE MARKS

Section A

1 Nucleotides
condensation
antiparallel
hydrogen
complementary
histones
All six for [5], five for [4], four for [3], three for [2], two for [1]; [5] 5

2 **(a)** **Any two from**
- solvent should be placed in sealed chromatography jar/container beforehand (to allow vapour to saturate jar)
- avoid touching chromatography paper with bare hands
- all marks on chromatography paper should be in pencil
- solutions under investigation should not be placed too close together/ too close to the edge of chromatography paper/samples are same distance from bottom (starting from same point)
- solutions should be concentrated by repeated application in the same position
- chromatography paper should not touch the sides of the jar/container [2]

(b) Distance to solvent front = 74 mm, distance to middle of spot = 37 mm;
R_f = 37/74 = 0.5 [*consequential to values above*]; [2]

(c) Fructose
glucose
maltose
sucrose
4 correct for [3], 3 correct for [2], 2 correct for [1]; [3]

(d) α-glucose; [1] 8

				AVAILABLE MARKS
3	**(a)**	**(i)**	A: telophase; B: anaphase; C: prophase *(not interphase, as question concerns mitosis)*; D: metaphase; [4]	
		(ii)	Spindle fibres; spindle fibres attach to the centromeres (at the start of metaphase); contraction of the spindle fibres pulls the chromatids apart (during anaphase); [3]	
		(iii)	C, D, F, B, A, E **All 6 in order for [2], 4 stages in correct order for [1];** [2]	
	(b)	**(i)**	Cytokinesis; [1]	
		(ii)	A cell plate would form (instead of a cleavage furrow); [1]	11
4	**(a)**	**(i)**	As temperature increases from –5 °C to 25 °C the lipase activity increases; above 25 °C lipase activity decreases dramatically *[Not 'decreases rapidly' or other suggestions of link to time]*; [2]	
		(ii)	Up to 25 °C increasing kinetic energy increases the chance of collision between the active site (enzyme) and the substrate/formation of ES complexes; above 25 °C vibrations within the lipase molecule break some of the hydrogen/ionic bonds; this distorts the shape of the active site so that it is no longer complementary to the substrate [*not simply 'enzyme is denatured'*]; [3]	
	(b)		Environmental soil temperatures would be low (possibly still around 0 °C); lipase activity in this range allows seeds to germinate early in the year to allow a long growing season/in springtime; [2]	7

				AVAILABLE MARKS
5	**(a)**	**(i)**	Restriction enzymes/endonucleases; [1]	
		(ii)	DNA will be cut in different places; each enzyme recognises/binds to/cuts at a specific base sequence; [2]	
	(b)		The show-dog did not sire the puppy; those bands which the puppy does not have in common with the mother are not all found in the show-dog's genetic fingerprint; [2]	
	(c)		**Any three from** • the genetic evidence is more valid than the breeder's evidence • the mother may have mated with another male prior to mating with the show-dog/the mating with the show-dog may never have occurred • the genetic fingerprint is produced under controlled conditions/represents experimental evidence • although contamination could invalidate the genetic evidence [3]	
	(d)		Destroys/cuts viral DNA; [1]	9
6	**(a)**		A large molecule/molecule consisting of subunits; including carbon (and hydrogen)/originating in living organisms; [2]	
	(b)	**(i)**	Amino acid; [1]	
		(ii)	Peptide; [1]	
	(c)	**(i)**	Villi are flattened/destroyed; [1]	
		(ii)	The surface area of the ileum is reduced; resulting in less effective absorption of nutrients; [2]	
		(iii)	To improve the chances of finding the symptoms (since they are patchy) [*not to improve reliability*]; [1]	8

		AVAILABLE MARKS
7	**(a)** Nuclei; [1]	
	(b) **(i)** The buffer resists changes in pH; and prevents loss/gain of water by the organelles; [2]	
	(ii) To ensure equal volumes in each test tube; [1]	
	(iii) Caption refers to oxygen concentration, mitochondria and cyanide present/absent (and time); data organised in columns/rows; appropriate column headings (cyanide present/absent must be clear, not just 'tube **A**/tube **B**'); units included (min and μM); [4]	
	(iv) **Any two from** • in both tubes oxygen concentration falls over time • the oxygen concentration falls much faster when mitochondria are not treated with cyanide (in tube B) • with cyanide present (tube A), oxygen concentration in the suspension stops decreasing (after 6 minutes)/with cyanide absent, oxygen concentration continues to decrease [2]	
	(v) Cyanide inhibits respiration/ATP production; [1]	
	(vi) Rate of respiration/oxygen consumption is limited by availability of respiratory substrates/mitochondria are running out of e.g. glucose; [1]	12

Oxygen concentration over time in a suspension of mitochondria with and without cyanide added

Time/min	Oxygen concentration/μM	
	with cyanide	without cyanide
0	520	505
1	511	475
2	505	444
3	500	415
4	497	386
5	495	355
6	493	324
7	493	304
8	493	297
9	493	292
10	493	290

Section A **60**

Section B

AVAILABLE MARKS

8 **(a)** Any **six** points from:

- both simple and facilitated diffusion are passive/require no energy
- and movement is down the concentration gradient
- simple diffusion is possible between the phospholipid molecules
- while facilitated diffusion requires transmembrane proteins
- active transport carries substances against the concentration gradient which requires ATP for energy
- active transport also requires specific carriers
- the carriers undergo a change of shape to move the substance across the membrane
- use of protein carriers in active transport and facilitated diffusion confers selectivity

(b) Any **seven** points from:

- some molecules are hydrophobic/non polar/very small (e.g. oxygen and carbon dioxide)
- and so can pass directly between the phospholipid molecules in the bilayer
- ions are polar/charged/hydrophilic
- and therefore cannot pass between the phospholipid molecules
- therefore they need hydrophilic pores/channel proteins through which to pass
- transport through bilayer/pore/channel is non-selective/but channel selective if gated
- larger polar molecules (such as glucose) depend on protein carriers in the membrane
- which have specific receptor sites *[not active sites]*
- that are complementary to the molecule being carried
- these carriers are therefore selective in what they can carry
- also the relative abundance of different carriers will influence the relative amount of different substances able to cross the membrane [13]

Quality of written communication

2 marks:
The candidate expresses ideas clearly and fluently through well-linked sentences, which present relationships and not merely list features. Points are generally relevant and well-structured. There are few errors of grammar, punctuation and spelling.

1 mark:
The candidate expresses ideas clearly, if not always fluently. The account may stray from the point or may not indicate relationships. There are some errors of grammar, punctuation and spelling.

0 marks:
The candidate produces an account that is of doubtful relevance or obscurely presented with little evidence of linking ideas. Errors in grammar, punctuation and spelling are sufficiently intrusive to disrupt the understanding of the account.

[2] 15

Section B **15**

Total **75**