AQA

AS
Biology

Paper 7401/2
Mark scheme

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Mark schemes are prepared by the Lead Assessment Writer 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 associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' 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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Mark scheme instructions to examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information in the 'Comments' column is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for the same mark are indicated by the use of **OR**. Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error / contradiction negates each correct response. So, if the number of errors / contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (often prefaced by 'Ignore' in the 'Comments' column of the mark scheme) are not penalised.

3.2 Marking procedure for calculations

Full marks can be given for a correct numerical answer, without any working shown.

However, if the answer is incorrect, mark(s) can usually be gained by correct substitution / working and this is shown in the 'Comments' column or by each stage of a longer calculation.

3.3 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.4 Errors carried forward, consequential marking and arithmetic errors

Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation ECF or consequential in the mark scheme.

An arithmetic error should be penalised for one mark only unless otherwise amplified in the mark scheme. Arithmetic errors may arise from a slip in a calculation or from an incorrect transfer of a numerical value from data given in a question.

3.5 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.6 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.7 Ignore / Insufficient / Do not allow

Ignore or insufficient is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

Question	Marking Guidance	Mark	Comments
01.1	Dipeptidase/s;	1	Accept: membrane bound dipeptidase/s.
01.2	1. Endopeptidases hydrolyse internal (peptide bonds) **OR** Exopeptidases remove amino acids/hydrolyse (bonds) at end(s); 2. More ends or increase in surface area (for exopeptidases);	2	1. Accept: break for hydrolyse. 1. Accept: endopeptidases break (proteins) into shorter chains.
01.3	1. No/less ATP produced **OR** No active transport; 2. Sodium (ions) not moved (into/out of cell); 3. No diffusion gradient for sodium (to move into cell with amino acid) **OR** No concentration gradient for sodium (to move into cell with amino acid);	3	Accept: converse for all three points. 2. Accept: sodium (ions) increase in cell. 2. Accept: sodium (ions) cannot diffuse into cell. Note: no active transport of sodium (ions) equals 2 marks.

Question	Marking Guidance	Mark	Comments
02.1	Stomata per mm^2 or cm^2 **OR** Number per mm^2 or cm^2;	1	Accept: mm^{-2} or cm^{-2}. Reject: per μm^2 or μm^{-2}. Reject: the use of a solidus / as being equivalent to per. Ignore: 'amount'.
02.2	1. Single/few layer(s) of cells; 2. So light can pass through;	2	1. Accept: more/too many/overlapping. 1. 'single layer' without reference to cells/tissue should **not** be credited.
02.3	1. Distribution may not be uniform **OR** So it is a representative sample; 2. To obtain a (reliable) mean;	2	1. Accept: more/fewer stomata in different areas 1. Ignore: anomalies/random/bias 2. Accept: 'average'.
02.4	1. Hairs **so** 'trap' water vapour and water potential gradient decreased; 2. Stomata in pits/grooves **so** 'trap' water vapour and water potential gradient decreased; 3. Thick (cuticle/waxy) layer **so** increases diffusion distance; 4. Waxy layer/cuticle **so** reduces evaporation/transpiration. 5. Rolled/folded/curled leaves **so** 'trap' water vapour and water potential gradient decreased; 6. Spines/needles **so** reduces surface area to volume ratio;	2 max	1, 2 and 5. Accept: humid/moist air as 'water vapour' but **not** water/moisture on its own. 1, 2 and 5. Accept: diffusion gradient as equivalent to water potential gradient. 1, 2 and 5. Accept: less exposed to air as an alternative to water potential gradient. 6. Accept: spines/needles s**o** 'reduce area'.

02.5	1. Water used for support/turgidity; 2. Water used in photosynthesis; 3. Water used in hydrolysis; 4. Water produced during respiration;	2 max	

Question	Marking Guidance	Mark	Comments
03.1	(Simple) diffusion;	1	Reject: facilitated diffusion.
03.2	1. Thin/small **so** short diffusion pathway; 2. Flat/long/small/thin **so** large surface area to volume ratio/surface area : volume;	2	1. Reject: thin membrane/wall/cells. 2. Accept: small volume to surface area ratio.
03.3	1. High/50% saturation (with oxygen) below (pO_2 of) 0.2 kPa; 2. (Oxygen) for respiration;	2	1. Accept: fully saturated **or** above 50% saturation below 0.2kPa. 1. Accept: any number between 0.08 and 0.2 kPa
03.4	1. Water potential higher in worm **OR** Lower water potential in seawater; 2. Water leaves by osmosis (and worm dies);	2	1. Accept: correct reference to water potential gradient if direction of water movement is given. 1. Accept: Ψ for water potential. 2. Reject: worm/cells burst.

Question	Marking Guidance	Mark	Comments
04.1	14;	1	
04.2	Number (of individuals) in each species (of dung beetle);	1	Accept: population of each species.
04.3	1. No overlap in standard deviations; 2. (Difference in mean total) significant/is not due to chance/is real;	2	Accept: no overlap in error bars.
04.4	No bias;	1	Ignore: 'representative sample'.
04.5	1. Removes species/types of plant/insect; 2. Fewer food sources; 3. Fewer habitats/niches;	3	1. Accept: decrease in plant/insect diversity. 2. Ignore: less food. 2. Accept: less variety of food. 2. Accept: removes a food source. 3. Accept: loss/removal/destruction/ of a habitat. 3. Accept: no habitat. 3. Ignore: homes/shelters.

Question	Marking Guidance	Mark	Comments
05.1	Hydrolysis (reaction);	1	
05.2	1. (Phosphate required) to make RNA; 2. (Phosphate required) to make DNA; 3. (Phosphate required) to make ATP/ADP; 4. (Phosphate required) to make membranes; 5. (Phosphates required) for phosphorylation;	2 max	1 and 2. If neither DNA or RNA are named allow one mark for nucleotide/nucleic acid/phosphodiester bonds/sugar-phosphate backbone. 4. Ignore: phospholipids without reference to membranes. Accept: as additional mark points any named biological molecule containing phosphate e.g. NADP, AMP, RuBP.
05.3	Accept answer in range from 3.7 : 1 to 4.1 : 1;	1	Reject any ratio not : 1.
05.4	1. Seeds/embryo remain dormant/inactive in winter/cold **OR** Growth/development of seed/embryo during winter/cold; 2. Seeds/plants develop in spring/summer **OR** Seeds/plants develop when temperature/light increases; 3. Plant photosynthesise (in spring/when warm); 4. Produce (more) seeds/offspring in spring/growing season;	3 max	1. Ignore: hibernate. 1. Accept: 'seed survives winter/cold'. 1. Reject: plant develops or seed germinates during winter/cold. 2. Accept: seeds/plants develop when more light or when temperature is higher. 2. Accept: seed germinates/'sprouts' during spring/summer or when temp/light increases.

Question	Marking Guidance	Mark	Comments
06.1	1. Large sample size; 2. Individuals chosen at random; 3. Are healthy; 4. Equal number of males and females; 5. Repeat readings;	2 max	1. Accept: 20 + as equal to large sample size. 4. Accept: same sex/gender.
06.2	1. (For) comparison; 2. To see effect of age/emphysema/smoking **OR** Takes into account outliers/anomalous results;	2	1. Accept: provides a benchmark/standard.
06.3	1. <u>Internal intercostal muscle(s)</u> less effective **OR** Less elasticity (of lung tissue);	1	1. Accept: different descriptions of less effective. 1. Recoil without reference to elasticity is insufficient. 1. Accept: 'less elastin'.
06.4	1. Less carbon dioxide removed; 2. Less oxygen (uptake/in blood); 3. Less (aerobic) respiration/ATP **OR** (More) anaerobic respiration;	3	1. Accept: carbon dioxide increases/high (in body/blood). 2. Accept: less oxygen inhaled. 1 and 2. Accept: 'low amount' as equivalent to 'less'. 2 and 3. Accept: less oxygen for respiration = 2 marks. 3. Accept: (more) lactic acid.

Question	Marking Guidance	Mark	Comments
07.1	1. Change in DNA base/nucleotide (sequence); 2. Change in amino acid (sequence)/primary structure; 3. Alters (position of) hydrogen/ionic/disulfide bonds; 4. Change in tertiary structure (of receptor);	4	1. Accept: mutation in DNA base (sequence). 1. Accept: deletion/substitution/addition of a DNA base/nucleotide. 2. Reject: different amino acid formed. 2. Ignore: change in code for amino acid. 4. Reject: any reference to active site. 4. Ignore: 3^o.
07.2	1. (Receptor) is not complementary **OR** (HIV) cannot bind/attach and enter/infect (helper) T cell; 2. No replication (of virus) **OR** No destruction of (helper) T cell;	2	1. Accept: 'complimentary'. 1. Accept: invade as alternative to infect. 2. Accept: reproduction (of virus).
07.3	1. Low/lower exposure to HIV (in Europe) **OR** Low/lower number of HIV/AIDS (infections/cases); 2. (HIV) has only been present for a short time period **OR** (HIV relatively) recently evolved; 3. Mutation/CCR5 has been around for many years; 4. Mutation/CCR5 is advantageous (for something else);	2 max	1. Accept: converse. 3. Accept: frequency of mutation has always been high.

Question	Marking Guidance	Mark	Comments
08.1	Bacteria killed;	1	Ignore: no growth or growth of bacteria prevented. Accept: bacteria destroyed. Accept: no living bacteria.
08.2	1. Clear zone would be too large **OR** Clear zones would overlap/merge **OR** Could kill all bacteria (on the plate);	1	1. Must convey idea of too large.
08.3	1. (Same) size; 2. (Same) material/absorbency; 3. In solution for same time period;	2 max	1. Accept: any measure of size e.g. thickness, area, diameter. 1. Ignore: 'same shape' as shape shown on Figure 8. Ignore: reference to volume of disinfectant.
08.4	Any number between 2.5 to 3.2 = **two** marks;;	2	Allow **one** mark for an incorrect answer but shows method of calculating how many times more effective D is than B e.g. 22 divided by 13/14 or 11 divided by 6.5/7 or 1.57/1.6/1.69/1.7.

Question	Marking Guidance	Mark	Comments
09.1	66.7;	1	
09.2	70;	1	
09.3	1. More fluid forced/filtered out of capillary/blood (due to high pressure); 2. Less return of fluid (into capillary/blood) due to pressure **OR** Lymph(atic) (system) cannot drain away all excess fluid;	2	1. Accept: water for fluid. 1. Must convey idea of 'more'. 1. Reject: more tissue fluid is forced out. 1. Do not credit 'more plasma forced out'. 2. Accept: water for fluid.
09.4	1. Larger lumen/volume (of blood vessels); 2. Reduces (blood) pressure (in blood vessels); 3. Less friction/resistance (in blood vessels);	2	1. Accept: more 'space' or more 'room' (in blood vessels). 1. Accept: more blood flow (in blood vessels). 1. Accept: reduces stroke volume or less blood in ventricle.

Question	Marking Guidance	Mark	Comments
10.1	<u>Starch (max 3)</u> 1. Helical/ spiral shape **so** compact; 2. Large (molecule)/insoluble **so** osmotically inactive; 3. Branched **so** glucose is (easily) released for respiration; 4. Large (molecule) **so** cannot leave cell/cross cell-surface membrane; <u>Cellulose (max 3)</u> 5. Long, straight/unbranched chains of β glucose; 6. Joined by hydrogen bonding; 7. To form (micro/macro)fibrils; 8. Provides rigidity/strength;	5 max	2. Accept: does not affect water potential/Ψ. 3. Ignore: unbranched. 6. Note: references to 'strong hydrogen bonds' disqualifies this mark point.
10.2	1. (At source) sucrose is actively (transported) into the phloem/sieve element/tube; 2. By companion/transfer cells; 3. Lowers water potential in phloem/sieve element/tube **and** water enters by <u>osmosis</u>; 4. (Produces) high (hydrostatic) pressure; 5. <u>Mass</u> flow/transport towards sink/roots/storage tissue; 6. At sink/roots sugars are removed/unloaded;	5 max	1. Accept: 'sugar/s' for sucrose but reject other named sugars e.g. glucose. 1. Accept: co-transport (with H^+ ions). 4. Accept: pressure gradient. 5. Accept: sieve element/tube. 6. Accept: at sink/roots sugars are used in respiration/stored.