AS BIOLOGY 7401/1

Paper 1

Mark scheme

June 2025

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256A7401/1/MS

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 Examiner.

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.

No student should be disadvantaged on the basis of their gender identity and/or how they refer to the gender identity of others in their exam responses.

A consistent use of 'they/them' as a singular and pronouns beyond 'she/her' or 'he/him' will be credited in exam responses in line with existing mark scheme criteria.

Further copies of this mark scheme are available from aqa.org.uk

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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 <u>not</u> 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.

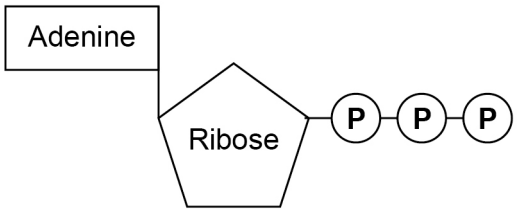
Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

Question	Marking Guidance	Mark	Comments
01.1	NH_2 = amine **and** COOH = carboxyl; Both required for 1 mark.	1 (1 x AO1)	Accept 'amino' Accept 'carboxylic acid/group'

Question	Marking Guidance	Mark	Comments
01.2	1. (Type of bond) peptide; 2. (Type of molecule) dipeptide;	2 (2 x AO1)	Answers must be on the correct lines

Question	Marking Guidance	Mark	Comments
01.3	Serine;	1 (1 x AO2)	

Question	Marking Guidance	Mark	Comments
01.4	Correct answer of 450 = **2 marks**;; 449.8 = **1 mark** (correct calculation for one heavy chain but not rounded to nearest whole number) **OR** 900 = **1 mark** (incorrectly calculated for two heavy chains but rounded to nearest whole number);	2 (2 x AO2)	Reject answer of 899.6 (two errors)

Question	Marking Guidance	Mark	Comments
02.1	1. Adenine, ribose and 3 x phosphate correctly labelled; 2. Bonds (between ribose and adenine **and** between ribose and phosphates) in correct positions;  	2 (2 x AO1)	1. Accept P in a circle/P_i/PO_4^{-3} for phosphate. Reject phosphorus 1. Ignore pentose, reject deoxyribose 1. Ignore labelling of bonds 1. Ignore shapes of adenine and phosphates

Question	Marking Guidance	Mark	Comments
02.2	1. Hydrolysis; 2. ATP hydrolase; 3. Phosphorylate other substances **to** make them more reactive/change their shape **OR** To form DNA/RNA/phospholipids;	3 (3 x AO1)	1. Reject hydrolysis of hydrogen bond 1. Ignore other named bonds 2. Accept ATPase 3. Accept description of phosphorylation 3. Accept any named biological molecule containing phosphate e.g. triose phosphate 3. Ignore to form ATP

Question	Marking Guidance	Mark	Comments
02.3	1. Sodium ions actively transported out (of cells); 2. Maintains/generates a concentration/diffusion gradient (for sodium ions); 3. <u>Co-transport</u> (with sodium ions);	3 (3 x AO1)	1, 2 and 3. Accept Na^+ for sodium ions 1. Accept 'pumped using ATP' for active transport 1,2 and 3. Reject lack of 'ions' once 3. Accept 'co-transporter' for 'co-transport'

Question	Marking Guidance	Mark	Comments
03.1	Max 5 from: 1. DNA helicase unwinds DNA/double helix **OR** DNA helicase separates strands **OR** DNA helicase breaks hydrogen bonds; 2. Both strands act as templates; 3. (Free DNA) nucleotides line up in complementary pairs/A-T and G-C; 4. DNA polymerase joins nucleotides (of new strand); 5. Forming phosphodiester bonds; 6. (Each new DNA molecule consists of) one old/original/template strand and one new strand;	5 max (5 x AO1)	1. Reject hydrolyses hydrogen bonds 1. Accept 'unzip' for unwind 2. Accept description of 'template', eg exposed bases on single (polynucleotide) strands 4. Reject forms hydrogen bonds/joins bases

Question	Marking Guidance	Mark	Comments
03.2	1. (Produced by) semi-conservative replication **OR** One old/original strand and one new strand; 2. (Contains) ^{14}N/light (strand) **and** ^{15}N/heavy (strand);	2 (2 x AO2)	

Question	Marking Guidance	Mark	Comments
03.3	One band level with band in sample 2 **and** one band higher, drawn onto the sample 3 tube;	1 (1 x AO2)	Allow lines of any thickness Ignore lines drawn on the other tubes Both lines needed for mark

<table>
<tr><th>Question</th><th>Marking Guidance</th><th>Mark</th><th>Comments</th></tr>
<tr><td>04.1</td><td>(Locus)
1. (Fixed) position of a gene on DNA (molecule)/chromosome;

(Exon)
2. (Base sequence) coding for amino acid sequence(s);

(Universal)
3. The same codon/triplet (always) codes for the same amino acid;</td><td>3
(3 x AO1)</td><td>2. Ignore polypeptide chain/protein

3. Accept 3 bases for triplet/codon</td></tr>
<tr><th>Question</th><th>Marking Guidance</th><th>Mark</th><th>Comments</th></tr>
<tr><td>04.2</td><td>1. Correct mRNA sequence;

2. Correct amino acid sequence;

<table>
<tr><td>DNA base sequence</td><td>G</td><td>C</td><td>T</td><td>C</td><td>T</td><td>A</td><td>C</td><td>A</td><td>G</td></tr>
<tr><td>mRNA base sequence</td><td>C</td><td>G</td><td>A</td><td>G</td><td>A</td><td>U</td><td>G</td><td>U</td><td>C</td></tr>
<tr><td>Amino acid sequence</td><td colspan="3">ARG</td><td colspan="3">ASP</td><td colspan="3">VAL</td></tr>
</table>
</td><td>2
(2 x AO2)</td><td></td></tr>
<tr><th>Question</th><th>Marking Guidance</th><th>Mark</th><th>Comments</th></tr>
<tr><td>04.3</td><td>1. (Deletion would cause) frame shift

OR

(Deletion) would change all following codons/triplets

OR

(Deletion) would change next codon/triplet from GAU (Asp) to AUG (Met);

2. (Substitution) would result in codon/triplet 1 being CGU/CGG/CGC;

3. (All) code for same amino acid/Arg/arginine

OR

Code is degenerate;</td><td>3
(3 x AO2)</td><td>1,2,3 Reject ‘produce’ amino acids once only</td></tr>
</table>

Question	Marking Guidance	Mark	Comments
05.1	1. **Base** sequence of DNA; 2. **Base** sequence of mRNA; 3. Amino acid **sequence** of (same) polypeptides/ proteins;	2 max (2 x AO1)	1 and 2. Only penalise once if the word 'base' is not used Accept: 1. DNA hybridisation with reference to bases 3. Immunological comparisons using proteins/ antibodies/antigens

Question	Marking Guidance	Mark	Comments
05.2	1. Random sample **so** no bias; 2. Large sample/number **so** representative **OR** Large sample/number **so** can calculate **reliable** mean **OR** Large sample /number **so** (sufficient) for statistical test;	2 (2 x AO1)	2. Accept ≥ 10 for large number 2. Accept many/multiple but ignore several

Question	Marking Guidance	Mark	Comments
05.3	1. (Uncertainty =) 1 mm; 2. (Percentage uncertainty =) 1.2/1.16/1.163/1.1628;	2 (1 x AO1, 1 x AO2)	2. Allow correct percentage uncertainty from student's incorrect answer to MP1 e.g. if uncertainty = 0.5, the answer is 0.5814, accept correct rounding

Question	Marking Guidance	Mark	Comments
06.1	42.5 %	1 (1 x AO2)	

Question	Marking Guidance	Mark	Comments
06.2	Correct answer within range of 0.3 to 0.5 (dm^3 s^{-1}) **= 2 marks**;; Incorrect answer but shows correct tangent (at 2 seconds) = **1 mark** **OR** 2.5 (for incorrect method with correct reading at 2 seconds (5) and division by correct time (2)) = **1 mark**;	2 (1 x AO1, 1 x AO2)	Ignore tangent on emphysema line

Question	Marking Guidance	Mark	Comments
06.3	1. Low FEV1/Figure 7 shows less air exhaled; 2. (Destruction of alveoli walls means) decrease in surface area (for gas exchange); **OR** (Destruction of alveoli walls may) increase diffusion distance (due to scar tissue); 3. Lack of (elastic) recoil/tissue makes exhalation more difficult **OR** Lack of (elastic) recoil/tissue reduces concentration gradient (between alveoli and blood);	3 (1 x AO1, 2 x AO2)	

Question	Marking Guidance	Mark	Comments
06.4	1. **Positive** correlation between smoking and COPD deaths in men; 2. **No** correlation shown between smoking and COPD deaths in women; 3. Named/other factors not taken into consideration;	3 (3 x AO3)	1 and 2. Accept description of correlation 2. Accept '(slight) negative correlation' for 'no correlation' 3. Other factors include e.g. passive smoking, occupational exposure, medical improvements

Question	Marking Guidance	Mark	Comments
07.1	Sucrose;	1 (1 x AO1)	

Question	Marking Guidance	Mark	Comments
07.2	1. Insoluble (in water), **so** doesn't affect water potential/osmosis; 2. Coiled/spiral/(*α*-)helix, **so** compact **OR** Coiled/spiral/(*α*-)helix **so** can fit many (molecules) in small area; 3. Many (*α*-)glucose **for** respiration; 4. Branched/more ends **so** fast breakdown/hydrolysis; 5. Large (molecule), **so** can't leave the cell;	3 max (3 x AO1)	1. Accept Ψ for water potential 4. Ignore surface area 4. Accept branched **so** glucose readily released

Question	Marking Guidance	Mark	Comments
07.3	1. Some **sugars** converted to cellulose/starch; 2. Some **sugars** used in respiration; 3. Some **sugars** not moved down; 4. Some **sugars** moved further down than E;	1 max (1 x AO2)	1, 2, 3 and 4. Accept 'organic substance' for sugars or any suitably named organic substance for sugars, e.g. glucose 3. Accept some sugars remain in the leaf

Question	Marking Guidance	Mark	Comments
07.4	(In support of mass flow hypothesis) 1. Radioactivity is higher in phloem than xylem; 2. Radioactivity found in sections below leaf **so** it moved down stem/plant; 3. Leaf is source **OR** Leaf produces organic substances; (Against mass flow hypothesis – **max 3**) 4. Some radioactivity present in xylem; 5. Only tested in one species **OR** Only tested in geraniums; 6. No evidence for transport above the leaf; 7. Movement could be due to gravity;	4 max (4 x AO3)	3. Accept leaf produces any named organic substance 6. Accept other leaves/fruit/flowers

Question	Marking Guidance	Mark	Comments
08.1	1. A = <u>phospholipid</u> **and** form a barrier to water-soluble/charged/ions/polar substances **OR** A = phospholipid **and** allows lipid soluble/non-polar/hydrophobic substances to pass (through the cell membrane) **OR** A = <u>phospholipid</u> **and** simple diffusion; 2. B = <u>protein</u> **and** allow large/charged/ions/polar molecules to pass (through the cell membrane) **OR** B = <u>protein</u> **and** facilitated diffusion **OR** B = <u>protein</u> **and** active transport **OR** B = <u>protein</u> **and** maintain different concentrations (either side) **OR** B = <u>protein</u> **and** providing support/shape;	2 max (2 x AO1)	**Both** name and function should be correct for 1 mark 1 and 2. Accept hydrophilic for polar Accept for 'water-soluble' non-lipid soluble 2. Ignore the type of protein

Question	Marking Guidance	Mark	Comments
08.2	Mark in pairs: 1 **and** 2 **OR** 3 **and** 4. 1. Volume of water; 2. (Varying volumes of water) affects the concentration/colour (of the resulting solution); 3. Diameter/thickness of disc **OR** Surface area of disc **OR** Volume of disc **OR** Mass of disc **OR** Same beetroot; 4. Affects quantity/amount of pigment **OR** Affects rate of release of pigment;	2 max (2 x AO2)	1. Ignore **amount** of water 3. Allow length for thickness 3. Ignore shape/size 3. Allow weight for mass 3. Accept 'beetroot' for disc

Question	Marking Guidance	Mark	Comments
08.3	MP1 must be credited to achieve maximum 4 marks. 1. As temperature increases, (percentage) concentration of pigment increases but levels off at 80°C; 2. As temperature increases, the membrane becomes damaged/more permeable; 3. Because the membrane proteins denature at high temperatures; 4. As temperature increases, fluidity of the cell membrane/phospholipids increases; 5. At 80°C the membrane is fully permeable **OR** At 80°C maximum damage to membrane;	4 max (2 x AO1, 2 x AO2)	

Question	Marking Guidance	Mark	Comments
08.4	1. (Use colorimeter to) measure absorbance/transmission of diluted solutions/series/standards; 2. Produce a calibration curve; 3. Measure absorbance/transmission of sample **and** find concentration (on calibration curve);	3 (3 x AO3)	1. Accept description of absorbance or transmission 2. Accept descriptions of calibration curve

Question	Marking Guidance	Mark	Comments
09.1	Directional;	1 (1 x AO1)	

Question	Marking Guidance	Mark	Comments
09.2	1. (Use of) penicillin/antibiotic creates selection pressure **OR** Penicillin/antibiotic kills susceptible/non-resistant *S. aureus*/bacteria; 2. (Resistant *S. aureus*/bacteria) are more likely to survive **and** reproduce to pass on *blaZ*/penicillin-resistance/beta lactamase allele; 3. Increased frequency of (*blaZ)* allele (in s offspring/next generation);	3 (1 x AO1, 2 x AO2)	2 and 3. Reject '*gene*' for '*allele*' once

Question	Marking Guidance	Mark	Comments
09.3	1. (PRSA) can be resistant to many antibiotics **OR** Many antibiotics destroyed (by PRSA) **OR** Many antibiotics ineffective (against PRSA); 2. Bacteria would be able to synthesise cell walls **and** continue reproducing; 3. New/different antibiotics needed **OR** No new antibiotics in recent years;	2 max (2 x AO2)	1. Accept 'most' for many

Question	Marking Guidance	Mark	Comments
09.4	Correct answer, of 0.19 / 0.2 = **2 marks**;; Incorrect but shows 1.19596 **and** 1.3875 (accept any correct rounding) = **1 mark** **OR** Incorrect but shows 675 ÷ (5.644 ×10^7 ÷ 100 000) **and** 787 ÷ (5.672 ×10^7 ÷ 100 000) = **1 mark**;	2 (2 x AO2)	

Question	Marking Guidance	Mark	Comments
09.5	1. Weaker immune systems **so** more susceptible **OR** More likely to be infected **as** close contact with large numbers of people; 2. More likely to be infected **as** close contact with large numbers of people; 3. More MRSA sufferers **so** more likely to come into contact with it;	2 max (2 x AO2)	