A-level
BIOLOGY
7402/1

Paper 1

Mark scheme

June 2024

Version: 1.0 Final

2 4 6 A 7 4 0 2 / 1 / M S

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.

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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	1. Circle(s)/shape(s) drawn around H in one of the HO groups of the glycerol **and** the OH group of the fatty acid; 2. Ester (bond); 3. Condensation (reaction);	3 (3 x AO1)	1. Accept circle(s)/shape(s) drawn around the OH group of one molecule and the H of an OH group of the other molecule

Question	Marking Guidance	Mark	Comments
01.2	Stearic (acid);	1 (1 x AO1)	

Question	Marking Guidance	Mark	Comments
01.3	As (number of C) double bonds increases, melting point decreases **OR** As unsaturation increases, melting point decreases **OR** As saturation increases, melting point increases;	1 (1 x AO2)	Accept converse Accept C=C for double bonds Accept as (number of) hydrogen/H (atoms) increases, melting point increases

Question	Marking Guidance	Mark	Comments
01.4	1. More unsaturated fatty acids increases fluidity (in (cell-surface membrane); 2. (Making cell-surface) <u>membrane</u> more fluid/ flexible; 3. Easy to engulf;	3 (3 x AO2)	Accept for 2 marks, more unsaturated fatty acids increases membrane fluidity 3. Accept endocytosis for engulf 3. Accept more/easier for phagosomes to form

Question	Marking Guidance	Mark	Comments
02.1	1. (Movement of) polar/charged molecules; 2. (Facilitated diffusion) movement down a concentration gradient via carrier/channel protein; 3. (Active transport) movement against a concentration gradient via <u>carrier</u> protein using ATP;	3 (3 x AO1)	1. Accept ions **OR** non-lipid soluble for polar 1. Accept named polar molecule, eg glucose **OR** amino acids **OR** nucleotides 2. Reject if ATP used 2. Ignore along **OR** with for down 2. Ignore diffusion gradient 3. Reject channel protein

Question	Marking Guidance	Mark	Comments
02.2	(Highly) folded <u>cell</u>(-surface) <u>membrane;</u>	1 (1 x AO1)	Accept invaginated **OR** projections **OR** extensions for folded Reject hairs Ignore brush border

Question	Marking Guidance	Mark	Comments
02.3	1. Combine/mix/join with bile salts; 2. Make (more) soluble (in water); 3. (Micelles) breakdown close to cells **OR** Maintain high(er) concentration at cell(-surface membrane) **OR** Transport to cells/lining; 4. Diffuses (into cells/ileum);	3 max (3 x AO2)	Max 2 if context is related to digestion of vitamin A to phospholipids **OR** monoglycerides **OR** fatty acids Ignore emulsification of vitamin A 3. Accept 'fuse with' for 'breakdown close to' 4. Ignore facilitated 4. Ignore micelles are absorbed

Question	Marking Guidance	Mark	Comments
03.1	1. Diaphragm (muscle) contracts pulling diaphragm down; 2. External intercostal muscles contract pulling/moving ribs upwards/outwards; 3. (Causes) volume increase **and** pressure decrease in thoracic cavity;	3 (3 x AO1)	1. Accept flattening **OR** moves down for 'pulling diaphragm down' 2. Accept ribs lifted for 'pulling ribs upwards' 3. Accept thorax **OR** lung(s) for thoracic cavity

Question	Marking Guidance	Mark	Comments
03.2	1. (Create a) single/few layer(s) of cells/tissue; 2. (So) light can pass through;	2 (2 x AO1)	1. Accept to avoid overlapping cells

Question	Marking Guidance	Mark	Comments
03.3	Bronchiole(s);	1 (1 x AO1)	Accept broncheole(s) **OR** bronchiol(les) **OR** broncheol(les) **OR** bronkiol(les) **OR** bronkeol(les) **OR** brochiol(les) **OR** brocheol(les) Reject bronchiolus **OR** broncheolus **OR** **OR** branchiol(les) **OR** brancheol(les) **OR** bronchus **OR** bronchi

Question	Marking Guidance	Mark	Comments
03.4	Correct answer for 2 marks, 75 (µm);; Accept for 1 mark, evidence of $\textit{Real/actual} = \frac{\textit{Image}}{\textit{Mag(nification)}}$ (correct rearranged magnitude word equation) **OR** ÷ 40 (correct denominator from equation) **OR** 3000 (µm) (correct mean diameter)	2 (2 x AO2)	

	OR × 1000 (correct conversion of mm to µm) **OR** 0.075 (correct calculation with incorrect units (mm)) **OR** Answer shows correct number but incorrect number of decimal places eg 0.75 / 7.5 / 750		

Question	Marking Guidance	Mark	Comments
03.5	1. (Uncertainty ±) 1 (mm); 2. (Percentage error) 25 (%);	2 (2 x AO2)	2. Accept, if incorrect uncertainty ÷ 4 and multiplied by 100 **OR** – for example 50% (if uncertainty is 2) **OR** 12.5% (if uncertainty is 0.5) **OR** 2.5% (if uncertainty is 0.1)

Question	Marking Guidance	Mark	Comments
04.1	2;	1 (1 x AO1)	Accept glucose **and** fructose

Question	Marking Guidance	Mark	Comments
04.2	1. **Heat** with Benedict's (solution/reagent); 2. Red (colour/precipitate); 3. (Because) glucose/fructose is/are reducing sugars **OR** (Because) glucose/fructose is/are detected;	3 (3 x AO1)	1. Ignore water bath unqualified 1. Ignore warm 1. Accept Fehling's for Benedict's 1. Reject if heat with acid 2. Accept green **OR** orange **OR** brown **OR** yellow 2. Ignore emulsion 3. Reject if sucrose is detected

Question	Marking Guidance	Mark	Comments
04.3	1.6 / 1.62;	1 (1 x AO2)	Accept 2

Question	Marking Guidance	Mark	Comments
04.4	1. Molasses/solution has a lower water potential **OR** Water (in beaker) has higher water potential; 2. Water moves in (across) partially/selectively permeable bladder; 3. Increased (molasses/solution) volume **OR** Decreased air volume;	3 (3 x AO2)	1. Accept more negative for lower **OR** less negative for higher 1. Accept Ψ for water potential 2. Accept semi-permeable

Question	Marking Guidance	Mark	Comments
04.5	Suggested change 1. Diluted (molasses) **OR** Decreased (molasses) concentration **OR** Increased (molasses) water potential **OR** Decreased water potential gradient; 2. (Reduction by) 80% / 5 times **OR** (Reduction to) 20% **OR** (Used) 1 in 5 molasses to water **OR** (Used) 1 : 4 molasses to water;	2 (2 x AO3)	Ignore reduced temperature 1. Accept less negative for increased 1. Accept Ψ for water potential 2. Accept description of 1 : 4 ratio, eg 20 (cm^3) molasses (added) to 80 (cm^3) water **OR** 2. Accept fivefold **OR** factor of 5 for 5 times dilution

Question	Marking Guidance	Mark	Comments
05.1	Max **two marks** for prophase (In prophase) 1. Chromosomes/chromatids (continue to) condense; 2. Chromosomes/chromatids (become/are) visible; 3. Chromosomes attach to spindle (fibres) **OR** Chromatids attach to spindle (fibres) **OR** Centromeres attach to spindle (fibres); (In anaphase) 4. Centromeres divide/split; 5. Chromosomes/chromatids moved/pulled to opposite poles/sides/ends;	4 max (4 x AO1)	1. Accept chromatin for chromosomes 1. Accept shorten **OR** thicken **OR** coils **OR** a description of condensing for condense 2. Accept appear **OR** form **OR** present **OR** distinct for visible 5. Reject homologous chromosomes moved to opposite sides

Question	Marking Guidance	Mark	Comments
05.2	Number of cells in mitosis ÷ Total number of cells (in field of view);	1 (1 x AO1)	Accept cells 'with visible chromosomes' for 'in mitosis' Reject if x100

Question	Marking Guidance	Mark	Comments
05.3	1. Strong/significant negative (correlation); 2. (Because probability of) correlation occurring by chance is less than / < 0.05 / 5% **OR** (Because) more than / > 0.95 / 95% (probability) that correlation is not due to chance; 3. Reject null hypothesis;	Max 2 (2 x AO3)	2. Accept relationship for correlation 2. Reject 'statistical test' **OR** 'results' **OR** 'differences' are significant/not due to chance

Question	Marking Guidance	Mark	Comments
05.4	1. More/larger proportion of cells in mitosis closer to tip **OR** Fewer/lower proportion of cells in mitosis further from tip; 2. More/larger proportion of cells in interphase further from tip **OR** Fewer/smaller proportion of cells in interphase closer to tip; 3. No cells in mitosis at/after 2 (mm) **OR** All cells in interphase at/after 2 (mm);	3 (3 x AO3)	Ignore references to cytokinesis 1. and 3. Accept a named stage of mitosis 2. and 3. Accept G1 **OR** S **OR** G2 for interphase

<table>
<tr><th>Question</th><th>Marking Guidance</th><th>Mark</th><th>Comments</th></tr>
<tr><td>06.1</td><td>
<table>
<tr><th>mRNA</th><th>tRNA</th></tr>
<tr><td>1. (Has) codon(s)</td><td>(Has) anticodon;</td></tr>
<tr><td>2. No hydrogen/H bonds/base pairs</td><td>Has hydrogen/H bonds/base pairs;</td></tr>
<tr><td>3. No amino acid binding site</td><td>Has amino acid binding site;</td></tr>
<tr><td>4. Linear/straight/not folded</td><td>‘Clover (leaf’ shape)/ folded;</td></tr>
<tr><td>5. Long/many nucleotides/bases</td><td>Short/few nucleotides/ bases;</td></tr>
</table>
</td><td>3 max
(3 x AO1)</td><td>Must be comparisons

3. Accept description of binding site, eg amino acid only bound to tRNA
3. Accept mRNA cannot carry an amino acid, tRNA can</td></tr>
</table>

Question	Marking Guidance	Mark	Comments
06.2	Phe, Arg, Ala;	1 (1 x AO2)	Reject if order is different

Question	Marking Guidance	Mark	Comments
06.3	(Name of mutation) 1. (Single base) substitution; (Change in DNA) 2. Guanine to thymine **OR** G to T **OR** GCC to TCC; (Explanation) 3. (So) Arg (still) present **OR** No change in amino acid; 4. (So) no change in primary structure **OR** (So) no change in tertiary structure **OR**	4 (4 x AO2)	Marks can be achieved in any section 2. Reject thiamine 3. Reject amino acids are formed

	(So) no change in active site (shape);		

<table>
<tr><th>Question</th><th>Marking Guidance</th><th>Mark</th><th>Comments</th></tr>
<tr><td>07.1</td><td>1. Variety and D and E in left column;
2. Time and ‘/ min’ and Mean (time) ‘/ min’ in column heading only;
3. Correctly calculated times and means calculated to one decimal place;
Examples achieving 3 marks
<table>
<tr><th>Variety</th><th>Time / minutes</th><th>Mean / minutes</th></tr>
<tr><td rowspan="3">D</td><td>15.8/15.83/16</td><td rowspan="3">16.1 OR 16.2 OR 16.3</td></tr>
<tr><td>18</td></tr>
<tr><td>14.5/15</td></tr>
<tr><td rowspan="3">E</td><td>6.5/7</td><td rowspan="3">7.2 OR 7.3</td></tr>
<tr><td>8</td></tr>
<tr><td>7</td></tr>
</table>
<table>
<tr><th>Apple</th><th>Time / s</th><th>Mean / s</th></tr>
<tr><td>D</td><td>950</td><td></td></tr>
<tr><td></td><td>1080</td><td>966.7</td></tr>
<tr><td></td><td>870</td><td></td></tr>
<tr><td>E</td><td>390</td><td></td></tr>
<tr><td></td><td>480</td><td>430.0</td></tr>
<tr><td></td><td>420</td><td></td></tr>
</table>
</td><td>3
(3 x AO2)</td><td>Accept if no table lines are shown, figures clearly written in rows and columns
Accept tables where mean is given in middle column and time is given in right column
1. Accept type OR apple for variety
1. Accept D and E in either order
2. Accept mean values shown in rows rather than in columns
2. Accept brackets OR “in” for solidus
2. Ignore average for mean
2. Accept min OR mins for minutes
2. Accept seconds OR secs OR sec for seconds
2. Reject mixed units eg “/ minutes and seconds”
3. Accept correct times and correct means however presented</td></tr>
</table>

Question	Marking Guidance	Mark	Comments
07.2	1. More phenol/substrate in E **OR** More PPO/enzyme in E **OR** Higher PPO/enzyme activity in E; 2. (So) more enzyme-substrate/E-S complexes (form);	2 (2 x AO2)	1. and 2. Accept the converse for D 1. Ignore oxygen 2. Ignore ESC

Question	Marking Guidance	Mark	Comments
07.3	1. Use (enzyme's) higher/optimum temperature; 2. More kinetic energy **OR** (So) more active enzyme; 3. (Causing) increased rate of reaction **OR** (Causing) more enzyme-substrate complexes/collisions; **OR** 4. Use (enzyme's) lower/optimum temperature **OR** Use (enzyme's) optimum pH; 5. Less denaturation; **OR** (So) more active enzyme; 6. (Causing) increased rate of reaction **OR** (Causing) more enzyme-substrate complexes/collisions; **OR** 7. Crush/grind/blend/chop the apple (tissue);	3 max (3 x AO3)	Mark in groups, 1, 2 and 3. **OR** 4, 5 and 6 **OR** 7, 8 and 9 3. 6. and 9. Accept E-S complexes for enzyme-substrate complexes 3. 6. and 9. Accept a description of increased rate, eg 'speeds up reaction' 1 and 4 Accept change in temperature 7. Accept cube for apple

	8 (So) more PPO/phenol/substrate in contact with oxygen/air; 9. (Causing) increased rate of reaction **OR** (Causing) more enzyme-substrate complexes/collisions;		7. Accept dice **OR** homogenise **OR** cut up **OR** slice for crush If oxygen is suggested, no mark for oxygen but MP8 and MP9 are available

Question	Marking Guidance	Mark	Comments
07.4	Measure the intensity of brown colour by comparing apple tissue with a colour chart showing a range of apple tissues of known pigment concentration.	1 (1 x AO3)	

Question	Marking Guidance	Mark	Comments
08.1	1. (Smooth) muscle absorbs/resists/withstands high (blood) pressure; 2. Elastic (tissue/layer) stretches **and** recoils maintains/smooths blood pressure; 3. (Smooth) endothelium reduces friction; 4. Protein (coat) prevents (artery) wall splitting **OR** Protein (coat) absorbs/resists/withstands high (blood) pressure;	2 max (2 x AO1)	1. Ignore contraction 1. Ignore maintains pressure 2. Reject contracts/ relaxes for recoils 2. Accept dilate **OR** expand for stretch 4. Accept fibrous **OR** collagen for protein

Question	Marking Guidance	Mark	Comments
08.2	1. Small diameters are low risk of tears so unlikely to/do not have aneurysms **OR** As diameter increases, risk of tears increases and (risk of developing) aneurysms increase; 2. Few people have/at high risk of tear **OR** Few people have/at high risk of aneurysms; 3. Diameters > / above 4.5 (cm) at high risk (of tears) so may have aneurysms; 4. (High risk of) tear does not mean aneurysm will/has occurred;	3 max (3 x AO3)	1. Accept the converse 1. Accept ≤ 4.5 for small 2. Accept the converse, eg most people at low risk of tear/aneurysm 2. Accept 7/98/105 for few 3. Accept 'increases significantly'

Question	Marking Guidance	Mark	Comments
08.3	1. and 2. Correct answer of 35 / 35.1 / 35.3 / 35.7 / 36 / 40(%) = **2 marks**;; Accept for **1 mark**, incorrect answer but shows: Evidence of 45 (correct stroke volume for diseased heart) **OR** Evidence of 69.6 **OR** 70 (correct stroke volume for healthy heart) **OR**	3 (3 x AO3)	Accept positive or negative values

	Evidence of 24.6 **OR** 25 (correct difference between stroke volumes) **OR** Evidence of 48.6 to 50 (correct calculated volume change, not percentage change) 3. (Mathematical error) incorrect rounding;		

Question	Marking Guidance	Mark	Comments
09.1	20;	1 (1 x AO2)	

Question	Marking Guidance	Mark	Comments
09.2	Add (sexually active) female(s);	1 (1 x AO3)	Ignore add males

Question	Marking Guidance	Mark	Comments
09.3	(Effect on breeding) 1. Less mating/breeding **OR** Fewer offspring; (Explanation) 2. Fewer advertisement calls, so females not attracted **OR** Fewer advertisement calls, so males not located; 3. Fewer mating calls as males less (sexually) active; 4. More rasping calls as (more) males not (sexually) active; 5. Less time spent in courtship;	4 max (4 x AO2)	Maximum 3 marks for MP2 to MP5 4. Accept mature for active

Question	Marking Guidance	Mark	Comments
10.1	1. Homogenise (tissue) **to** break open cells **OR** Homogenise (tissue) **to** release organelles/nuclei; 2. Filter **to** remove (intact) tissue/cells/debris; 3. Cold (solution) **to** prevent enzyme activity; 4. (Solution with) equivalent water potential **to** prevent osmosis **OR** (Solution with) equivalent water potential **to** prevent organelles bursting/shrinking; 5. Buffered (solution) **to** stop enzymes/protein denaturing; 6. Centrifuge/spin at low(er) speed **so** <u>nuclei</u> in pellet/move to bottom **OR** Centrifuge at low(er) speed and supernatant/solution discarded;	6 (6 x AO1)	1. Accept blend **OR** grind **OR** chop for homogenise 3. Accept 'slow down' for prevent 4. Accept isotonic for 'equivalent water potential' 4. Reject if reference is made to cells 6. Accept up to 1000 revolutions min^{-1} **OR** 1000 × gravity for identified slow spin speed

Question	Marking Guidance	Mark	Comments
10.2	1. DNA in nucleus codes for enzyme/protein (production); 2. Ribosomes/rough endoplasmic reticulum produce enzyme/protein **OR** Translation on ribosomes/rough endoplasmic reticulum; 3. Rough endoplasmic reticulum transports/modifies/processes enzymes/protein; 4. Mitochondria produce ATP; 5. Golgi apparatus modify/process/ package/transport enzymes/protein **OR** Golgi apparatus make/transport glycoprotein **OR** Golgi apparatus forms/releases vesicles; 6. Vesicles move (protein) to cell(-surface) membrane **OR** Vesicles fuse with cell(-surface) membrane;	5 max (5 x AO1)	1. Accept genetic material/code **OR** gene for DNA Accept polypeptide for protein/enzyme 3. Ignore rER/RER only once 4. Reject produce energy 5. Accept body for apparatus 5 Accept 'adds lipid/carbohydrate to' for modify 5. Accept lipoprotein for glycoprotein 5 and 6 Accept lysosome for vesicle 6. Accept exocytosis for 'fuse with cell membrane'

Question	Marking Guidance	Mark	Comments
10.3	1. Ribose, Adenine **and** 3 phosphates; 2. ATP to ADP + Pi by ATP hydrol**ase** in hydrolysis (reaction); 3. ADP + Pi to ATP by ATP synth**ase**; 4. (In) condensation (reaction);	4 (4 x AO1)	1. Accept a labelled diagram showing ribose, adenine and 3 phosphates 1. Accept adenosine **and** 3 phosphates 1. Reject Adenosine and 3 phosphates if ribose/pentose is also mentioned 1. Ignore pentose sugar 2. Accept ATPase for ATP hydrolase 2. Accept hydrolayse 3. Accept synthayse