A-level
BIOLOGY
7402/1

Paper 1

Mark scheme

June 2025

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256A7402/1/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	(Emulsification) 1. (Small droplets) increase surface area; 2. (So) faster/increased (rate of) lipase/enzyme hydrolysis/activity; (Micelles) 3. Carry fatty acids/monoglycerides/glycerol to cell(-surface membrane) **OR** Make fatty acids/monoglycerides (more) soluble **OR** Maintain high(er) fatty acid/monoglyceride/ glycerol concentration at cell(-surface membrane); 4. (So) fatty acid/monoglyceride /glycerol diffuses (into cell);	4 (4 x AO1)	Accept correct answers in either subheading 1. Ignore reference to 'volume ratio' 2. Ignore 'digestion' OR 'breakdown' 2. Accept 'more' for 'increased' 3. Accept transport/ bring/contain/'combine with' for 'carry' 3 Accept 'lining of ileum' OR 'epithelium' for 'cell' 3. and 4. Ignore lipid/fat/triglyceride for 'fatty acid/ monoglyceride' 4. Ignore 'facilitated' diffusion 4. Ignore if micelles themselves are absorbed by diffusion

Question	Marking Guidance	Mark	Comments
01.2	1. Bilayer (of phospholipids); 2. (Because) hydrophilic heads/phosphate attracted/point to water **OR** (Because) hydrophobic tails/fatty acids repel/point away from water;	2 (2 x AO1)	1. Accept a correctly labelled diagram of bilayer OR description of bilayer 2. Accept polar/charged for 'hydrophilic' 2. Accept non-polar/not charged for 'hydrophobic

Question	Marking Guidance	Mark	Comments
02.1	Introns removed (and exons joined);	1 (1 x AO1)	Accept description of non-coding DNA for 'introns'

Question	Marking Guidance	Mark	Comments
02.2	1. Phosphodiester bond; 2. (By) <u>condensation</u> (reaction);	2 (2 x AO1)	1. Reject if phosphodiester bond is between incorrect molecules, eg joins AU/GC **OR** complementary nucleotides/bases

Question	Marking Guidance	Mark	Comments
02.3	(D – C);	1 (1 x AO1)	

Question	Marking Guidance	Mark	Comments
02.4	**Similarities** 1. Enzymes are not changed/can be reused (in reactions); 2. Increase rate of reaction at low/ordinary/ normal/room temperature **OR** (Causes/allows) reaction(s) at low/ordinary/normal/room temperature **OR** (Both) lower activation energy; **Differences** 3. <u>Active site</u> changes shape (in induced fit model); 4. Enzyme-substrate complex forms **OR** Enzyme/active site and substrate bind/touch;	4 (4 x AO2)	4. Accept 'E-S complex' 4. Ignore 'ESC'

<table>
<tr><th>Question</th><th>Marking Guidance</th><th>Mark</th><th>Comments</th></tr>
<tr><td>03.1</td><td>1 mark for each correct column;;;
<table>
<tr><th></th><th colspan="3">Biological molecule</th></tr>
<tr><th>Feature</th><th>Glycogen</th><th>Sucrose</th><th>DNA</th></tr>
<tr><td>Contains glucose</td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>Contains galactose</td><td></td><td></td><td></td></tr>
<tr><td>Contains fructose</td><td></td><td>✓</td><td></td></tr>
<tr><td>Contains phosphate</td><td></td><td></td><td>✓</td></tr>
<tr><td>Formed by condensation reaction(s)</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Is a polymer</td><td>✓</td><td></td><td>✓</td></tr>
</table></td><td>3
(3 x AO1)</td><td></td></tr>
</table>

Question	Marking Guidance	Mark	Comments
03.2	Correct answer of 14/14.2 = **1 mark**;	1 (1 x AO2)	Accept numbers that round to 14.2

Question	Marking Guidance	Mark	Comments
03.3	1. (**X**) Galactose/inhibitor binds to active site; 2. (**X** so) slows/reduces/inhibits lactose hydrolysis; 3. (**Y**) **all/more** lactose/substrate is hydrolysed **OR** (**Y**) (more) lactose hydrolysed so **more** glucose/>100 (produced); 4. (**Z**) no lactose/substrate (so no product) **OR** (**Z**) Galactose is not hydrolysed by lactase **OR** (**Z**) Galactose is not a (lactase) substrate;	4 (4 x AO2)	2, 3 and 4 Accept digest/breakdown for hydrolysis 2. Reject 'stops' hydrolysis 3. Accept faster substrate hydrolysis for 'all/more' 4. Accept (Z) (only) lactose is the substrate

Question	Marking Guidance	Mark	Comments
03.4	1. Increase lactose/substrate (concentration); 2. More product/glucose (is formed) **OR** Increased rate of reaction;	2 (2 x AO3)	

Question	Marking Guidance	Mark	Comments
04.1	Capsule, plasmid(s), flagellum/a;; 3 correct = **2 marks** 2 correct = **1 mark** 1 or 0 correct = **0 marks**	2 (2 x AO1)	Accept pili/pilus OR photosynthetic lamellae

Question	Marking Guidance	Mark	Comments
04.2	(Optical/light microscope – no mark) 1. Detects living (cells/organisms/sample/ specimen); 2. Detects colour/stain/dye; 3. Resolution is enough/0.25 μm (to view cells); (Scanning electron microscope/SEM – no mark) 4. Resolution is high(er)/enough/0.02 μm (to view mitochondria); 5. Detects three dimensions/surface structures;	4 max (2 x AO2, 2 x AO3)	Accept converse eg electron microscopes do not detect colour Max 2 marks from 1. 2. and 3. 1. 2. and 3. optical/light must be the named microscope If 4 and 5 not achieved accept for 1 mark, TEM/electron microscope to see internal structures OR TEM/electron microscope has high(est)/enough/ 0.0002 μm resolution 5. Accept 3-D for 'three dimensions'

Question	Marking Guidance	Mark	Comments
05.1	1. (Hydrolase/ATP hydrolysis) releases <u>energy</u>; 2. (For) active transport (by X) of H^+ in(to vacuole); 3. (Causes) <u>co-transport</u> (by Y) of H^+ out **and** fructose in; 4. Decreases water potential **so** water moves in(to vacuole) by osmosis;	4 (4 x AO2)	1. Reject make/ create/produce energy 2 and 3 Reject hydrogen once 2 and 4 Accept 'cell' for 'vacuole' 4. Accept more negative water potential for 'decreases water potential' 4. Accept Ψ for 'water potential', but ignore WP

Question	Marking Guidance	Mark	Comments
05.2	1. No/less ATP (produced/available); 2. (So) no/less ATP hydrolysed **OR** (So) no/less energy released/transferred **OR** (So) ATP hydrolase/enzyme inactive/less active; 3. Less/no H^+ enters (vacuole) **so** pH increases **OR** H^+ (still co-) transported out (of vacuole) **so** pH increases;	3 (3 x AO2)	2. Reject no energy produced 3. Accept 'cell' for 'vacuole' 3. Accept acidity decreased OR becomes neutral OR becomes alkali OR a relevant change in pH value (eg from pH 4 to pH 5) 3. Ignore method of H^+ transport

Question	Marking Guidance	Mark	Comments

05.3	1. Increased/more (gene) expression/transcription (produces) more carrier (proteins)/X/Y; 2. (So) more/faster active transport H^+ (in)	2 (2 x AO2)	1. Accept "it increases" for 'increased (gene) expression'

	OR (So) more/faster co-transport **OR** (So) more/faster H+/fructose movement **OR** (So) carrier (proteins) not saturated/limiting;		2. Reject fructose moving out

Question	Marking Guidance	Mark	Comments
06.1	1. At low pO_2/in tissues, Hc unloads more O_2 at high(er) temperature/15°C **OR** At low pO_2/in tissues, Hc (O_2) affinity decreased at high(er) temperature/15°C; 2. At high pO_2/in gills, temperature (change) has no effect on (O_2) loading **OR** At high pO_2/in gills, temperature (change) has no effect on (changing) Hc (O_2) affinity;	2 (2 x AO2)	Accept pO_2 figures below 7 for 'low pO_2' Accept pO_2 figures above 7 for 'high pO_2' 1 Reject references at low pO_2/tissues to Hc being loaded 1. Accept reference at low pO_2/tissues to unloading less readily/has high(er) affinity at low(er) temperature/ 4°C 1. Accept 'more readily'/quicker' for 'more oxygen' 2 Reject references at high pO_2/gills to Hc being unloaded

Question	Marking Guidance	Mark	Comments
06.2	1. Use colorimeter/colorimetry; 2. Plot absorbance/transmission against (percentage oxygen) saturation (and draw line/curve of best fit); (Control variable) 3. Volume (of samples) **OR**	3 (3 x AO1)	1. Reject calorimeter 2. Reject if absorbance/ transmission is plotted on x-axis 2. Accept oxygen concentration for 'saturation'

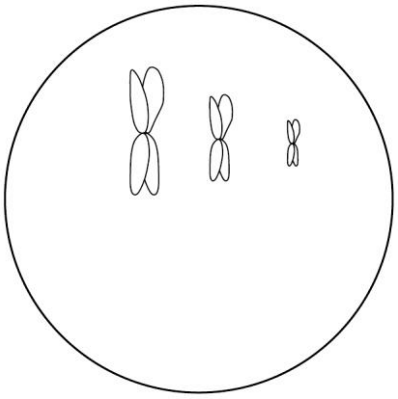
	Temperature **OR** Filter (in colorimeter);		3. Ignore 'amount' 3. Accept (same) wave length/colour (of light) for 'filter'

Question	Marking Guidance	Mark	Comments
06.3	Correct answer of 403/403.2 (m) = **2 marks**;; 1.8(h)/108(mins) (correct reading from the Figure) = **1mark** **OR** 0.8(h)/48(mins)/2880(s) (correct time until tired) = **1 mark** **OR** 907/907.2(m) (correct total distance covered) = **1 mark** **OR** Incorrect reading from graph x 0.14 – 504 = **1 mark;**	2 (2 x AO2)	

Question	Marking Guidance	Mark	Comments
06.4	1. Only 3/limited number of speeds (investigated); 2. (Crab) number/sample varies at different speeds; 3. Difference in range/spread of (stopping) times at different running speed; 4. Small sample size/few crabs (investigated);	3 max (3 x AO3)	2. Accept correct figures for 'different speeds'

Question	Marking Guidance	Mark	Comments
07.1	Correct answer of 5.859375×10^4 = **2 marks**;; 2^6 / 64 (correct number of cells from 6 mitotic cycles) = **1 mark** **OR** 2.34×10^5 or 234375 (correctly dividing 1.5×10^7 by 64) = **1 mark** **OR** 2^8 / 256 (correct number of sperm cells produced from one A_1 cell) = **1 mark** **OR** Correct answer not in standard form, eg 58594 = **1 mark;**	2 (2 x AO2)	Accept, correct rounding of 5.859375×10^4, eg 5.9×10^4 / 6×10^4 = 2 marks Accept, correct rounding of 2.34×10^5 / 234375 = 1 mark Accept, correct rounding of 58593.75 = 1 mark

Question	Marking Guidance	Mark	Comments
07.2	1. Correct labels with cell phases on the x-axis, **and** DNA mass per cell with arbitrary units/au on y-axis with linear scale **and** bars not touching; 2. (Early interphase plotted at) 8 **and** (late interphase at) 16; 3. (End of 1st meiotic division plotted at) 8 **and** (end of 2nd meiotic division at) 4;	3 (3 x AO3)	1. Reject if Y axis does not cover at least half of the grid 1. Accept appropriate labels OR key **and** DNA mass in a/one cell If 2 **and** 3 not achieved, accept for 1 mark, bars showing halving of DNA content during meiosis

Question	Marking Guidance	Mark	Comments
07.3	Accept for 1 mark, 3 chromosomes, each of different size and each with 2 chromatids, drawn in any order; For example, 	1 (1 x AO1)	

Question	Marking Guidance	Mark	Comments
07.4	1. Non-disjunction; 2. Homologous chromosomes/pairs **not separated** **OR** Chromatids **not separated**; 3. (Because) both chromosome(s)/chromatid(s) pulled/moved to (one) pole/end/side (of cell) **OR** (Because) both chromosome(s)/chromatid(s) not attached to spindle (fibres);	3 max (3 x AO1)	1. Accept trisomy **OR** aneuploidy 1. Reject polyploidy/ multiple sets 2. Accept segregated for 'separated' 2. Accept 'bivalent' for 'homologous chromosomes' 3. Accept labelled diagram showing chromosome /chromatid movement to one pole/cell

Question	Marking Guidance	Mark	Comments
08.1	1. Antibiotic use is common/regular (in hospitals) **OR** (Resistant) bacteria easily/readily/often spread (in hospitals); 2. Bacteria with resistant <u>allele</u> (survive), reproduce and pass on <u>allele</u>; 3. (So resistant) <u>allele</u> frequency increases **OR** (So) number of bacteria with (resistant) <u>allele</u> increases;	3 (3 x AO1)	2. and 3. Reject immunity for resistance only once Ignore reference to mutation 2 and 3. Penalise gene for allele once only 2. Accept divide/replicate OR binary fission for reproduce

Question	Marking Guidance	Mark	Comments
08.2	Correct answer of – 0.9 = **2 marks**;; 228 (correct numerator) = **1 mark** **OR** 120 (correct denominator) = **1 mark** **OR** 1.9 (correct calculated quotient) = **1 mark** **OR** 0.9 (correct answer but positive integer) = **1 mark;**	2 (2 x AO2)	Accept for 2 marks, - 0.9 as a fraction

Question	Marking Guidance	Mark	Comments
08.3	Strong/significant negative correlation;	1 (1 x AO3)	

Question	Marking Guidance	Mark	Comments
08.4	Correct answer of 8910;; 3510 (correct difference between total number of plasmid kbp and non-plasmid kbp) = **1 mark** **OR** x1.65 (correct multiplication factor for percentage change) = **1 mark** **OR** Incorrect answer, but correct answer shown in working = **1 mark;**	2 (2 x AO3)	

Question	Marking Guidance	Mark	Comments
08.5	**Germination phase** 1. No DNA replication **OR** No plasmid (B) replication **OR** No binary fission; **Growth phase** 2. Plasmid (B) replication occurs **OR** (Rate of) plasmid (B) replication increases **OR** Binary fission (only) occurs; **Dormant phase** 3. Plasmid (B) replication occurs **and** no binary fission;	3 max (3 x AO3)	Each mark point must be clearly linked to the correct phase. Accept correct time references to indicate each phase Accept references to numbers to identify each phase, eg first phase for 'germination phase' Accept 'cell division' for 'binary fission' Ignore 'cloudiness' and 'number of cells'

Question	Marking Guidance	Mark	Comments
09.1	Tissue **and** organ;	1 (1 x AO1)	Answers must be in this order

Question	Marking Guidance	Mark	Comments
09.2	(**Q**) starch (grain) **OR** lipid/fat (droplets) **and** (**R**) stroma;	1 (1 x AO1)	Reject stoma

Question	Marking Guidance	Mark	Comments
09.3	1. Fewer grana/lamella(e)/thylakoids; 2. (So) less chlorophyll **and** less light absorbed so less photosynthesis;	2 (2 x AO3)	Accept converse for healthy plants 1. Accept thinner Or smaller for fewer 2. Accept 'less light-dependent reactions' for 'less light absorbed so less photosynthesis' 2. Ignore LDR

Question	Marking Guidance	Mark	Comments
09.4	1. (Mutant) has less chlorophyll (but) more photosynthesis; 2. (Mutation) increased (chlorophyll) a:b **OR** (Mutation) increased (chlorophyll) ratio; 3. (Mutant) absorbs more light;	3 (3 x AO2)	2. Accept 'relatively more a than b' OR 'proportion of a to b increases' for ratio 3. Reject if more chlorophyll a in mutant 3. Accept (Mutant) absorbs more OR greater range of (light) wavelengths

Question	Marking Guidance	Mark	Comments
10.1	1. Ribosome attaches to mRNA; 2. Ribosome covers 2 (mRNA) codons/base triplets **OR** Ribosome moves/attaches to start codon/AUG; 3. ATP (energy) used when amino acid attaches to tRNA; 4. tRNA brings specific amino acid (to ribosome); 5. (tRNA) anticodons bind to complementary (mRNA) codons; 6. ATP (energy) used to form <u>peptide</u> bond(s); 7. Ribosome moves along mRNA forming polypeptide **OR** Ribosome moves along mRNA to stop codon;	6 max (6 x AO1)	1. Accept rough endoplasmic reticulum for ribosome 1. Accept associates/binds/joins for 'attaches' 1. Ignore rER 2. Accept has/ presents/attaches/ exposes for 'covers' 2. Accept 'first codon' for 'start' codon 4. Accept corresponding/'amino acid coded for by codon' for 'specific'

Question	Marking Guidance	Mark	Comments
10.2	1. Many <u>stomata</u>; 2. Stomata allow (gas) diffusion; 3. Air spaces in <u>mesophyll</u>; 4. Large surface area of cells/cell membranes for (rapid) diffusion; 5. Large (leaf) surface area to volume ratio **so** high/increases diffusion (rate); 6. Thin (leaves) **so** short diffusion distance/ pathway;	4 max (4 x AO1)	Ignore moist membranes

Question	Marking Guidance	Mark	Comments
10.3	1. Renal vein (to) vena cava (to) right atrium; 2. (Via) atrio-ventricular valve (to) right ventricle; 3. (Via) semi-lunar valve (to) pulmonary artery (to) pulmonary vein; 4. Left atrium (via) atrio-ventricular valve (to) left ventricle; 5. (Via) semi-lunar valve (to) aorta to coronary artery;	5 (5 x AO1)	2. Accept tricuspid valve 2 and 4 Penalise using 'AV valve' for atrio-ventricular valve only once 3. Accept pulmonary valve for 'semi-lunar valve 4. Accept bicuspid/mitral valve 5. Accept aortic valve for 'semi-lunar valve