AQA

AS
BIOLOGY
7401/1

Paper 1

Mark scheme

June 2022

Version: 1.0 Final

226A7401/1/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.

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

Copyright information

AQA retains the copyright on all its publications. However, registered schools/colleges for AQA are permitted to copy material from this booklet for their own internal use, with the following important exception: AQA cannot give permission to schools/colleges to photocopy any material that is acknowledged to a third party even for internal use within the centre.

Copyright © 2022 AQA and its licensors. All rights reserved.

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	**B**: is hydrolysed in the ileum and a product of this hydrolysis is found in micelles; **A**: is formed by a condensation reaction between two α-glucose molecules; **C**: is formed by the action of DNA polymerase; **B**: gives a positive result in an emulsion test;	4 (4 x AO1)	

Question	Marking Guidance	Mark	Comments
01.2	1. Facilitated diffusion of amino acid (into cell when higher concentration in lumen); 2. Co-transport; 3. Sodium ions actively transported from cell to blood/capillary/tissue fluid; 4. Creating sodium ion concentration/diffusion gradient; 5. Facilitated diffusion of amino acid into blood/capillary;	4 max (4 x AO1)	1. and 5. Accept diffusion via channel/carrier proteins for 'facilitated diffusion' 3. Accept 'pumped' for transported 3. and 4. Accept Na^+ for sodium ion(s) 3. and 4. Max 1 if ions not mentioned

Question	Marking Guidance	Mark	Comments
02.1	1. RNA/rRNA; 2. Protein;	2 (2 x AO1)	Reject tRNA and mRNA Ignore amino acids

Question	Marking Guidance	Mark	Comments
02.2	1. DNA has deoxyribose, mRNA has ribose; 2. DNA has thymine, mRNA has uracil; 3. DNA long**,** mRNA short; 4. DNA is double stranded, mRNA is single stranded; 5. DNA has hydrogen bonds, mRNA has no hydrogen bonds **OR** DNA has (complementary) base pairing, mRNA does not;	4 max (4 x AO1)	Must be comparisons Ignore splicing/introns 4. Accept 'double helix' for 'double stranded' and 'single helix' for 'single stranded'

Question	Marking Guidance	Mark	Comments
03.1	Flagellum/flagella;	1 (AO1)	

Question	Marking Guidance	Mark	Comments
03.2	1. 3D with SEM, but 2D with TEM **OR** (Only) surface visible with SEM, but internal structures visible with TEM; 2. (Because) electrons deflected/bounce off (using SEM) **OR** Electrons transmitted/pass through (using TEM);	2 (2 x AO1)	2. Accept Resolution is lower (with SEM)

Question	Marking Guidance	Mark	Comments
03.3	Shorter wavelength between electrons **OR** Longer wavelength in light (rays);	1 (AO1)	Accept 'of electrons' **OR** 'of electron beam' for 'between electrons' Reject Electron microscope has a shorter wavelength Reject Light microscope has a longer wavelength

Question	Marking Guidance	Mark	Comments
03.4	Mark in pairs: 1 **and** 2 **OR** 3 **and** 4 1. Measure (length of structure) **and** divide by magnification; 2. Correct conversion from measured length to µm, either × 10 000 from cm **OR** × 1000 from mm; 3. Measure (length of structure) **and** divide by (image) length of scale bar; 4. Multiply by actual length of scale bar;	2 (2 x AO1)	1. Accept correct equation making reference to a measurement

Question	Marking Guidance	Mark	Comments
03.5	1. Circular DNA (molecule in cytoplasm); 2. Murein cell wall **OR** Peptidoglycan cell wall **OR** Glycoprotein cell wall; 3. Small(er)/70S ribosomes (in cytoplasm);	2 max (2 x AO1)	Accept mesosome

Question	Marking Guidance	Mark	Comments
03.6	1. Capsid; 2. Reverse transcriptase; 3. RNA genome; 4. Envelope;	2 max (2 x AO1)	1. Accept capsomere 1. Ignore protein coat 3. Accept 'genetic material' **OR** 'genes' for 'genome'

Question	Marking Guidance	Mark	Comments
04.1	1. Enters by diffusion; 2. **Down** a concentration gradient **OR** From high to low pO_2; 3. More/most across parts of body with gills; 4. Gills provide a larger surface area (for absorption); 5. 8.8 (kPa) over gills; 6. 2.4 (kPa - rest of body surface) / 1.9 (kPa - front end before gills) / 0.5 (kPa - rear end after gills);	4 max (4 x AO3)	1. Reject facilitated diffusion 1 and 2 'down a diffusion gradient' = 2 marks 2. Reject 'along' for 'down' 2. Accept description of O_2 is always higher in the water than the lugworm 4. Accept Gills increase SA:volume ratio

Question	Marking Guidance	Mark	Comments
04.2	Correct answer for 3 marks, 9.3×10^{-6} / 0.000 0093;;; MP1 – correct reading from graph (1.5) MP2 – correct rearrangement of equation ($CdO_2 = 0.000\ 031 \times$ their pO_2) MP3 – their $CdO_2 \times 0.2$ **OR** their $CdO_2 \div 5$	3 (3 x AO2)	Accept correct rounding of 9.3×10^{-6}

Question	Marking Guidance	Mark	Comments
04.3	1. (Measure light) absorption/transmission; 2. Interpolate/draw line to curve/line then to pO_2 **OR** Read off (pO_2 figure) against absorbance/transmission value obtained;	2 (2 x AO3)	1. Accept 'absorbance' for absorption

Question	Marking Guidance	Mark	Comments
05.1	1. Condensation reaction between amino acids; 2. (Forming) peptide bonds; 3. Creating (specific) sequence/order of amino acids;	3 (3 x AO1)	1. Accept descriptions of condensation reaction: eg loss of water

Question	Marking Guidance	Mark	Comments
05.2	(Similarity) 1. Substrate fits/binds to active site **OR** Enzyme-substrate complex (formed); (Difference) 2. Active site changes shape, but does not change in lock and key **OR** (Initially) active site not complementary to substrate with induced-fit, but is complementary in lock and key;	2 (2 x AO2)	2. Reject 'substrate changes shape' 2. Accept 'flexible' for changes shape and 'rigid' for does not change

Question	Marking Guidance	Mark	Comments
05.3	Lower/reduce activation energy (needed to start a reaction);	1 (AO1)	

Question	Marking Guidance	Mark	Comments
05.4	Correct answer for 2 marks = 300;; Accept for 1 mark, 2 000 000 or 2×10^6 (correct calculation of maltase rate per second) **OR** $6 \times 10^8 \div 4 \times 10^7$ **OR** $\times$ 15 (correct division but not multiplied by 20)	2 (2 x AO2)	

Question	Marking Guidance	Mark	Comments
05.5	Increased maltase concentration;	1 (AO3)	

Question	Marking Guidance	Mark	Comments
06.1	1. (Is) charged/polar **OR** (Is) part of haem(oglobin); 2. (So) binds/associates/loads (with) oxygen **OR** (So) forms oxyhaemoglobin **OR** (So) transports oxygen;	2 (2 x AO1)	1. Accept Fe^{2+} **OR** Fe^{3+} for 'charged' 2. Accept 'carries' for transports

Question	Marking Guidance	Mark	Comments
06.2	1. Less/no ferroportin hydrolysis/breakdown; 2. (So) more ferroportin (in cell-surface membranes); 3. (So) more iron (ion) transport **from** cytoplasm/cell;	3 (3 x AO3)	1. and 2. Accept 'channel protein' for ferroportin 2. and 3. Accept 'many' for more

Question	Marking Guidance	Mark	Comments
06.3	Correct answer for 2 marks = 30.52:1 / 30.5:1 / 31:1;; Accept for 1 mark, 31 (ratio not given) **OR** 30:1 (incorrect rounding) **OR** 200 (correct mass in healthy person) **OR** 1526 (correct iron concentration in person with haemochromatosis) **OR** 6104 : 200 (correct ratio, but not simplified)	2 (2 x AO2)	Accept for 1 mark any correct ratio (not simplified) e.g. 763:25 or 1526:50

Question	Marking Guidance	Mark	Comments
07.1	1. Mass of <u>cells/tissue</u> **OR** Abnormal <u>cells/tissue</u>; 2. Uncontrolled mitosis/cell division;	2 (2 x AO1)	1. Accept idea of large number of cells in a lump/clump/cluster for 'mass' 2. Ignore growth

Question	Marking Guidance	Mark	Comments
07.2	1. Count cells in mitosis in field of view; 2. Divide this by total number of cells in field of view; 3. Repeat many/at least 5 times **OR** Select (fields of view) at random;	3 (3 x AO1)	1. and 2. Max 1 if 'field of view' not mentioned 3. Accept 'multiple' for 'many' 3. Ignore 'several' Ignore conversion of MI into a percentage.

Question	Marking Guidance	Mark	Comments
07.3	**Good indicator** 1. Dogs with MI > 5 have shorter survival time; 2. (P value shows) <u>difference</u> is significant **OR** (P value shows) <u>difference</u> has low probability of being due to chance; 3. Dogs with MI > 5 have grade 2 or grade 3 tumours/medium or high level cancer; 4. Dogs with grade 1 tumours all have MI < 5; **But** 5. (Some) dogs with MI < 5 could have any tumour grade/cancer level; 6. So serious cancers missed; 7. Only know median survival time (not the range);	4 max (4 x AO3)	1. Accept dogs with MI > 5 only survive 2 months 1. Accept converse for MI < 5 1 and 2. Accept for 2 marks, dogs with MI > 5 have a significantly shorter survival time 2. Accept <u>Difference</u> not due to chance 2. Ignore 'results are significant' or 'results are not due to chance' 5. Accept grade 2 or 3 for 'any' 3 max if none of points 5, 6 or 7 awarded

Question	Marking Guidance	Mark	Comments
08.1	1. Unknown/new/different microorganisms/pathogens/microbes/bacteria (introduced); 2. (these bacteria) use food/space **OR** (these bacteria) produce toxins;	2 (2 x AO2)	1. Ignore chemical contaminant 2. Accept description of competition for other resources

Question	Marking Guidance	Mark	Comments
08.2	Correct answer, for 2 marks = 480 000;; Accept for 1 mark, 96 000 (correct number mm^{-3}) 120 (correct number in 0.000 25 mm^3 undiluted) **OR any one of:** $0.2 \times 5 \quad \frac{3}{15}$ (correct dilution factor) **OR** Evidence of dividing by 0.000 25	2 (2 x AO2)	4.8×10^5 = 2 marks

Question	Marking Guidance	Mark	Comments
08.3	Correct answer for 3 marks, 3 bars given 1. Correct labelling of x axis; eg culture **1**, culture **2** and culture **3** **OR** 1,2,3 **and** (bacterial) culture; 2. Height of culture 2 bar about <u>one fifth</u> height of culture **1** bar; 3. Height of culture **3** bar higher than culture **2** bar **and** lower than culture 1 bar; If 2 bars given **OR** if histogram given **OR** if graph given, accept for 2 marks, 1. Correct labelling of x axis; 2. Correct relative height of 2 bars/coordinates; eg height of culture **2** about <u>one fifth</u> height of culture **1** **OR** height culture **3** above height of culture **2** If no bar chart/histogram/graph given, accept for 1 mark, 1. Correct labelling of x axis;	3 (3 x AO2)	For labelling of x axis Accept 'no substance' for culture **1** Accept 'substance **J**' for culture **2** Accept 'substance **K**' for culture **3** Accept 'substance' for culture

Question	Marking Guidance	Mark	Comments
09.1	1. Fetal blood has more oxygen **OR** Fetal blood has less carbon dioxide; 2. (Because) gas exchange occurs in the placenta **OR** Gas exchange does **not** occur in (fetal) lungs;	2 (2 x AO2)	1. Accept converse for references to mother's pulmonary artery 1. Accept fetal blood is oxygenated 1. Accept high for 'more' OR low for 'less' 1. Ignore affinity

Question	Marking Guidance	Mark	Comments
09.2	1. (IgG) antibodies (from mother) are complementary/bind specifically; 2. To pathogens/antigens **crossing** the placenta; 3. Giving passive immunity (in fetus) **OR** Stopping symptoms forming (in fetus) **OR** Giving immediate/rapid protection (in fetus);	3 (3 x AO2)	1. Accept Antibodies bind with antigens / antigen-antibody complex

Question	Marking Guidance	Mark	Comments
09.3	(Against measles) 1. (To achieve) herd immunity to reduce spread; (Against tetanus) 2. No herd immunity **OR** Skin wounds are common (in children);	2 (2 x AO2)	1.Accept 'herd effect' for herd immunity 2. Accept Only protects the individual

Question	Marking Guidance	Mark	Comments
09.4	Reduced vaccination (in children) **OR** virus has mutated;	1 (AO2)	Accept 'more unvaccinated individuals entering the country/ population' Reject disease mutated

Question	Marking Guidance	Mark	Comments
09.5	1. (Production of) more memory cells; 2. (So) higher concentration of antibodies (in blood) **OR** (So) more rapid production of antibodies (on further infection);	2 (2 x AO2)	Ignore active immunity 2. Accept More antibodies (in blood)