AQA

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BIOLOGY
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Paper 1

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 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.

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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	1. Sequence/order of amino acids; 2. (Joined by) peptide bonds;	2 (2 x AO1)	

Question	Marking Guidance	Mark	Comments
01.2	1. (Universal) The same codon/triplet always codes for the same amino acid; 2. (Non-overlapping) Each base is only part of one triplet/codon **OR** (Adjacent) codons/triplets do not overlap; 3. (Degenerate) More than one codon/triplet codes for each amino acid;	3 (3 x AO1)	Accept '3 bases' for triplet 2. Accept 'base/triplets/codons only read once'

Question	Marking Guidance	Mark	Comments
02.1	1. Nucleus; 2. Nucleolus/nucleoli **OR** Nuclear membrane/envelope; 3. Mitochondria/chloroplast contain DNA;	2 max (1 x AO1, 1 x AO2)	Accept 'membrane bound nucleus' = 2 marks

Question	Marking Guidance	Mark	Comments
02.2	(In prokaryotes) Circular not linear **OR** Not associated with proteins/histones **OR** No introns;	1 (AO1)	Ignore 'loop' Ignore 'plasmid'

Question	Marking Guidance	Mark	Comments
02.3	1. Diaphragm (muscles) contract **and** diaphragm flattens/pulled down; 2. <u>External</u> intercostal muscles contract **and** ribcage pulled up/out; 3. (Causes) volume increase **and** pressure decrease in thoracic cavity (to below atmospheric pressure);	3 (3 x AO1)	3. Accept lungs or thorax for 'thoracic cavity'

Question	Marking Guidance	Mark	Comments
02.4	1. (Thicker capsule so phagocytes) less likely to bind to **murein** (in cell wall) **OR** (Thicker capsule so phagocytes) less likely to be stimulated by **murein** (in cell wall); 2. Reduced phagocytosis **so** more bacterial growth/division/reproduction/binary fission;	2 (2 x AO2)	2. Accept replicate/ multiplication but reject mitosis

Question	Marking Guidance	Mark	Comments
03.1	Everything other than the COOH inside drawn box;	1 (AO1)	

Question	Marking Guidance	Mark	Comments
03.2	(Triglyceride) 1. 3 fatty acids rather than 2; 2. 3 ester bonds rather than 2; 3. No phosphate group;	2 max (2 x AO1)	1, 2 and 3 Accept converse 1. Accept 'only 2 fatty acids'

Question	Marking Guidance	Mark	Comments
03.3	1. Phospholipid both hydrophobic and hydrophilic **OR** Phospholipid polar **OR** Phosphate group is charged; 2. Triglycerides only hydrophobic **OR** Fatty acid/triglyceride is non-polar; 3. Hydrophilic/phosphate group attracts water (to either side of bilayer);	3 (3 x AO1)	2. Accept 'Triglycerides not hydrophilic' 3. Accept 'faces water' for 'attracts water' 3. Ignore 'fatty acids repel water'

Question	Marking Guidance	Mark	Comments
03.4	1. Fatty acid A is saturated **OR** Fatty acid B is unsaturated; 2. (At 4 months) less fatty acid A **and** more fatty acid B **OR** Fish oil has more fatty acid B than fatty acid A; 3. Increase in fluidity caused by increased unsaturated fatty acids **OR** Increase in fluidity caused by increased fatty acid B (from the fish oil); 4. Double bonds/unsaturated fatty acids cause bends/kinks in fatty acid tail **OR** (Membrane more fluid because) phospholipids further apart;	3 max (2 x AO2, 1 x AO3)	1.and 2. Accept identification of A (as saturated) or B (as unsaturated) using numbers from table 1

Question	Marking Guidance	Mark	Comments
04.1	(Volume) Correct answer of 57.9 (μm^3) = **2 marks**;; **OR** If volume incorrect, evidence of 2.35-2.45 (as radius) = **1 mark** (Times larger) 8 (times larger) (or ECF) = **1 mark**;	3 (3 x AO2)	58 = **2 marks** 57.91 = **2 marks** Accept 54.3/54 = **2 marks** Accept 61.6/62 = **2 marks** Allow 7.5 – 8.52 ECF Allow any alternative for 8 which shows 463 ÷ their volume

Question	Marking Guidance	Mark	Comments
04.2	1. Nuclear membrane /nucleolus /vesicles/ lysosomes/ribosomes distinct/visible; 2. EM has greater resolution;	2 (1 x AO1, 1 x AO2)	1. Accept invaginations of membrane distinct/visible 1. Reject nucleus 1. Reject mitochondrion 2. assume 'it' refers to electron microscope

Question	Marking Guidance	Mark	Comments
04.3	Stimulating cytotoxic T cells **OR** Stimulating B cells **OR** Stimulating phagocytes;	1 (AO1)	Accept 'activate' for stimulating

Question	Marking Guidance	Mark	Comments
04.4	1. Anticodon (on tRNA) binds to (complementary) codon (on mRNA); 2. (tRNA) brings/carries specific amino acid (to	2 (2 x AO1)	

	ribosome);		

Question	Marking Guidance	Mark	Comments
05.1	<table><tr><th>Shape</th><th>Surface area / cm^2</th><th>Volume / cm^3</th><th>Surface area to volume ratio</th></tr><tr><td>**C**</td><td>96</td><td>64</td><td>1.5 : 1</td></tr><tr><td>**D**</td><td>136</td><td>64</td><td>2.125 : 1</td></tr></table> ; ;	2 (2 x AO2)	Mark as columns Allow ECF for ratio Allow 2.1:1 and 2.13:1 for D Ignore fractions for ratio

Question	Marking Guidance	Mark	Comments
05.2	3520;	1 (AO2)	

Question	Marking Guidance	Mark	Comments
05.3	Repeat with an undamaged (shape C) block;	1 (AO1b)	Accept 'Replace with an undamaged (shape C) block and repeat' Allow 'Repeat with a new block (shape C)'

Question	Marking Guidance	Mark	Comments
05.4	Any **three** for **2 marks**;; Any **two** for **1 mark**; 1. Temperature 2. Concentration of indicator 3. pH/concentration of solution/acid 4. pH/concentration of alkali in blocks 5. Concentration/type of agar 6. Ensure total surface area of the block is in contact with the solution/acid	2 max (2 x AO3)	Ignore Mass, shape, volume

Question	Marking Guidance		Comments
05.5	1. Diffusion (across the cell surface membrane); 2. Large organisms have small(er) sa : vol ratio **OR** Single-celled organisms have a large(r) sa : vol ratio; 3. Diffusion pathway would be too long **OR** (Rate of) Diffusion too slow;	3 max (3 x AO1)	3. Must be in the context of larger organisms

Question	Marking Guidance	Mark	Comments
06.1	Capsid and attachment protein;	1 (AO1)	

Question	Marking Guidance	Mark	Comments
06.2	1. (DNA) helicase **and** (DNA) polymerase; 2. (Helicase) breaks hydrogen bonds (to unwind DNA); 3. (Polymerase) condensation reactions to join (adjacent) nucleotides **OR** (Polymerase) forms phosphodiester bonds between (adjacent) nucleotides;	3 (3 x AO1)	1. Accept (DNA) ligase for either enzyme. 2. Reject 'hydrolyse hydrogen bonds' Reject mp3 if polymerase forming hydrogen bonds or joining complementary base pairs 3. Accept (DNA) ligase joins DNA fragments. Note: Incorrect/no enzymes named but both roles outlined = 1 mark

Question	Marking Guidance	Mark	Comments
06.3	Uncontrolled cell cycle/division/mitosis;	1 (AO2)	Reject meiosis Ignore growth

Question	Marking Guidance	Mark	Comments
06.4	For: 1. Needs to be given early (age 10-12) before exposure to HPV; 2. Will reduce transmission to girls (for when they are older); 3. Boys can be infected with HPV **OR** (Vaccination) prevents HPV infection; 4. (Need boys) to ensure herd immunity **OR** (Need boys) to be above 50% vaccinated; 5. Boys can have increased risk of cancer (from HPV infection); Against: 6. Boys at less risk of cancer (from HPV infection) than females **OR** Cervical cancer only affects females; 7. May be side effects from vaccine;	4 max (4 x AO3)	**Max 3** for mark points 1-5 1. Accept 'Needs to be given before sexual activity' 2. Accept 'spread' for 'transmission'

Question	Marking Guidance	Mark	Comments
07.1	1. Species richness – number of species (in a community/habitat/ecosystem/area); 2. Index of diversity – the relationship between the number of species (in a community) and the number of individuals in each species; 3. No SD overlap for species richness **so** significant difference shown **OR** No SD overlap for species richness **so** difference not due to chance; 4. SD overlap **so** no significant difference in index of diversity **OR** SD overlap **so** any difference shown due to chance;	4 (2 x AO1, 2 x AO2)	1. Reject number of species in a population. 2. Accept equation with N and n correctly explained

Question	Marking Guidance	Mark	Comments
07.2	1. DNA/genome sequencing now used; 2. (Now) can analyse every/more prokaryote species (in the community); 3. Rather than just recording measurable/observable characteristics;	2 max (2 x AO2)	1. Accept RNA/amino acid sequencing 2. Accept 'identify' for analyse

Question	Marking Guidance	Mark	Comments
07.3	(For farming method 2 has) 1. Better conservation as higher species richness, higher (prokaryotic) biomass and more carbon stored (than farming method 1); 2. More microbial mass – more organisms for food web; 3. Higher species richness – more organisms for food web; 4. More stored carbon, less CO_2 in the atmosphere; 5. Lower yield so less food/less profit;	2 max (2 x AO3)	Accept converse for farming method 1

Question	Marking Guidance	Mark	Comments
08.1	To break down links between cells/cell walls **OR** To separate cells/cell walls **OR** To break down/hydrolyse cellulose/cell wall **OR** Allowing the stain to pass/diffuse into the cells **OR** Allowing the cells to be (more easily) squashed **OR** To stop mitosis;	1 (AO1)	Accept: To stop mitosis continuing Accept: To stop cell division Accept: To stop the cell cycle Ignore references to enzymes

Question	Marking Guidance	Mark	Comments
08.2	1. Eye protection; 2. Gloves; 3. Add <u>water</u> to spills (immediately); 4. Do not pour away down sink;	2 max (2 x AO1)	1. Accept wear goggles Ignore references to using dilute acid

Question	Marking Guidance	Mark	Comments
08.3	1. There is no difference between the mitotic index (at 200 and 300 μm); 2. t-test;	2 (2 x AO3)	1. Ignore reference to 'significant' 1. Reject correlation

Question	Marking Guidance	Mark	Comments
08.4	Correct answer within the range 19.95 to 20.03= **2 marks**;; Incorrect answer of 57 or 57.2 (correct unit conversion and correct division) = **1 mark** **OR** Incorrect answer of 2×10^{-5} (no unit conversion, correct division and correct × 0.35) = **1 mark** **OR** Incorrect answer of 2×10^{x} except 20 e.g.0.2/2/200/2000 (incorrect conversion, correct division and x 0.35); = **1 mark**	2 (2 x AO2)	

Question	Marking Guidance		Comments
08.5	**Max 2** from 1. Roots/plant of the same age; 2. Same growing conditions (for all roots); 3. Same distance from root tip; 4. Same time in acid **OR** Same temperature of acid; 5. Same concentration of acid; 6. Same pressure of squash; 7. Several fields of view (for each species); 8. Same time of day;	2 max (2 x AO3)	2. Accept description of growing conditions

Question	Marking Guidance	Mark	Comments
09.1	Pressure increase at source generated by: 1. Sucrose co-tranported into phloem **OR** Sucrose actively transported into phloem; 2. Causes decrease in water potential (inside phloem); 3. Water enters by osmosis (into phloem);	3 (2 x AO1, 1 x AO2)	1. Ignore facilitated diffusion

Question	Marking Guidance	Mark	Comments
09.2	1. Carbohydrates made by photosynthesis (in the leaf); 2. Less sucrose transported into phloem at leaf/source **OR** Less sucrose transported to sink/potato/root **OR** Less sugar stored as starch;	2 (2 x AO2)	1. Accept 'sugars' or any named carbohydrate

Question	Marking Guidance	Mark	Comments
09.3	1. Increased respiration; 2. To provide more ATP for muscle contraction; 3. (More glucose being used so) concentration gradient for glucose **OR** Increased numbers of glucose transporter proteins in the membrane; 4. (Glucose enters by) facilitated diffusion;	(4 x AO2)	Marks can be awarded across the whole answer 3. For 'transporter proteins' accept channel or carrier proteins

Question	Marking Guidance	Mark	Comments
09.4	Answer key: 4 – The secondary structure is held by hydrogen bonds. The tertiary structure allows the protein to be positioned spanning the whole cell membrane.	1 (AO2)	