AQA

AS
BIOLOGY
7401/2

Paper 2

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	A sequence of DNA (nucleotide) bases that codes for a polypeptide;	1 (AO1)	Ignore codes for a protein. Accept 'codes for a functional RNA' or 'codes for rRNA/tRNAs' or 'codes for a sequence of amino acids/primary structure'

Question	Marking Guidance	Mark	Comments
01.2	1. Pre-mRNA (only) produced in eukaryote (cell); 2. Splicing (only) occurs in eukaryote (cell); 3. Introns removed in eukaryote (cell) **OR** Introns not present in prokaryote (cell);	2 max (2 x AO1)	

Question	Marking Guidance	Mark	Comments
01.3	1. PNA is complementary to DNA **OR** PNA forms base pairs with DNA; 2. Preventing/reducing RNA polymerase activity/binding **OR** Prevents RNA nucleotides binding **OR** Reducing/stopping transcription;	2 (2 x AO2)	

Question	Marking Guidance	Mark	Comments
01.4	1. Releases/provides energy; 2. (So) peptide bonds form between amino acids **OR** (So) amino acid joins to tRNA;	2 (2 x AO1)	1. Reject 'produce energy'

Question	Marking Guidance	Mark	Comments
02.1	Isomer(ism);	1 (AO1)	Accept phonetic spelling Ignore structural

Question	Marking Guidance	Mark	Comments
02.2	High(er) absorbance (has more sugar) **OR** Low(er) transmission (has more sugar);	1 (AO2)	Accept a description of absorbance or transmission

Question	Marking Guidance	Mark	Comments
02.3	1. Benedict's (solution) <u>volume</u>; 2. Benedict's (solution) <u>concentration</u>; 3. (Fruit) juice <u>volume</u>; 4. (Water bath/water/solution) temperature; 5. Duration of heating (in water bath);	2 max (2 x AO2)	Accept examples of volumes and concentrations and temperatures

Question	Marking Guidance	Mark	Comments
02.4	Correct answer for 2 marks = 12;; Accept for 1 mark, 30 (correct mass of apple core) **OR** 150 (correct mass of apple flesh) **OR** $0.08 / \frac{8}{100}$ × incorrect mass **calculated** using the ratio **OR** 14.4 (correct mass in whole apple);	2 (2 x AO2)	

Question	Marking Guidance	Mark	Comments
02.5	1. Starch hydrolysed; 2. Maltose is soluble, (so reduces Ψ) **OR** Starch is insoluble;	2 (2 x AO2)	2. Accept glucose for maltose 2. Ignore sugar

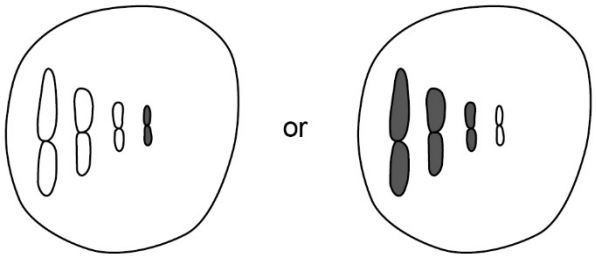
Question	Marking Guidance	Mark	Comments
03.1	1. Microvilli increase surface area **for** diffusion/facilitated diffusion/active transport/co-transport **OR** Microvilli increase surface area **for** (more) channel/carrier proteins; 2. (Many) mitochondria release energy/ATP **for** active transport;	2 (2 x AO2)	1. Accept folded cell (surface) membrane or brush border for microvilli 1. Accept high/large for 'increased' 1. Accept 'they' for microvilli 2. Accept 'uptake' for 'transport' 2. Accept 'cotransport' for 'active transport'

Question	Marking Guidance	Mark	Comments
03.2	Correct answer for 2 marks, 40–41(:1);; Accept for 1 mark, 0.32–0.33 (correct surface area of a microvillus) **OR** 321–322 (correct cell surface area) **OR** Ratio not simplified e.g. 321:8;	2 (2 x AO2)	

Question	Marking Guidance	Mark	Comments
03.3	1. ZO-1 is located in cell (surface) <u>membrane</u>; 2. Antibody is <u>complementary</u> (to ZO-1); 3. (So) binds/attaches to the ZO-1/protein; 4. (Cells identified with) dye/stain/ fluorescent marker linked to antibody;	3 max (3 x AO2)	2. and 3. Reject 'active site' once 3. Accept 'forms antigen-antibody complex' 4. Accept attachment of coloured substance to antibody, but 'colour production' on its own is insufficient. 4. 'Marker' on its own is insufficient.

Question	Marking Guidance	Mark	Comments
04.1	1. DNA replication (during late interphase); 2. Two divisions; 3. Separation of homologous chromosomes (in first division); 4. Separation of (sister) chromatids (in second division); 5. Produces 4 (haploid) cells/nuclei;	4 max (4 x AO1)	2. Accept for 'two divisions', meiosis I **and** meiosis II **OR** examples of stages, e.g. anaphase I **and** anaphase II 2. Accept description that clearly indicates two divisions Ignore references to stage names (except above) 2, 3. and 4. Accept annotated diagrammatic representations 3 and 4. Reject 'diploid cells' once. 4. Accept 'chromosomes' for 'chromatids' but reject homologous chromosomes 5. Accept 'gametes' for cells

Question	Marking Guidance	Mark	Comments
04.2	Correct answer for 2 marks, 18–19;; Accept for 1 mark, 0.06–0.07 / $(½)^4$ / $\frac{1}{16}$ (correct probability) **OR** 16 (correct number of arrangements);	2 (2 x AO2)	

Question	Marking Guidance	Mark	Comments
04.3	 or Four chromosomes shaded correctly;	1 (AO2)	Accept chromosomes in any order Reject evidence of 2 chromatids per chromosome

Question	Marking Guidance	Mark	Comments
04.4	Mitosis;	1 (AO2)	

Question	Marking Guidance	Mark	Comments
05.1	1. Hierarchy (of groups) with no overlaps **OR** (smaller) groups within (larger) groups with no overlaps; 2. (Grouped) according to evolutionary origins/relationships/history;	2 (2 x AO1)	2. Accept 'common ancestry'

Question	Marking Guidance	Mark	Comments
05.2	Perissodactyla;	1 (AO2)	Accept incorrect spellings provided the word looks close to Perissodactyla Ignore upper/lowercase letters Accept 'order'

Question	Marking Guidance	Mark	Comments
05.3	Oval/shape drawn inside the *Rhinoceros* oval and not overlapping the *unicornus* oval or the *Rhinoceros* oval;	1 (AO2)	
05.4	1. (Genetic) variation/difference (exists) between Indian rhinos; 2. Indian rhinos most/more related to Javan rhinos; 3. Indian rhinos least/less related to White/Black rhinos; 4. Comparisons only made to one Indian rhino **OR** Sample size (of other rhinos) not known; 5. Cannot conclude anything about relationship between other species (with each other) **OR** (same) percentage differences may not refer to same base sequences;	4 max (4 x AO3)	2. Accept more recent common ancestor for 'most/more related' 3. Ignore 'Sumatran' 4. Ignore 'sample size too small'

Question	Marking Guidance	Mark	Comments
05.5	1. (Likely) either White or Black (rhinoceros) as identical/same/14 percentage **OR** Not from Indian/Javan (rhinoceros) as (very) different percentages **OR** Cannot be certain as White, Black and Sumatran have similar percentages; 2. Use a different reference (species of) rhinoceros **OR** Use a different gene/protein **OR** Use more than one gene **OR** Compare (DNA) base sequence (not percentage differences) **OR** Compare amino acid sequences **OR** Compare mRNA sequences;	2 (2 x AO3)	2. Accept black/white rhino, but reject Javan/Sumatran if named 2. Ignore amino acid sequence of cyt b

Question	Marking Guidance	Mark	Comments
06.1	Accept for 2 marks, three correct responses, one of which MUST be MP1. Accept for 1 mark, any two correct responses. 1. Carry with blade protected **OR** Do not carry if likely to be jostled; 2. Cut away from body; 3. Cut onto hard surface; 4. Use sharp blade; 5. Disinfect/dispose of used scalpel (blade) as instructed;	2 (2 x AO1)	More than one correct answer can be given in each cell row Ignore wear safety glasses **OR** gloves Ignore 'no running' Ignore washing **OR** disinfecting hands/surfaces Ignore taking care **OR** act safely **OR** keep away from fingers 1. Accept for 'protected', e.g. in tray **OR** pointing down 3. Accept for 'hard surface', e.g. board **OR** tile. Ignore 'flat' 5. Accept for 'as instructed', e.g. in tray/beaker/as directed (by teacher)

Question	Marking Guidance	Mark	Comments
06.2	Accept for 2 marks, 6150;; Accept for 1 mark, 82 (correct blood volume pumped in one heartbeat) **OR** Evidence of 120 and 38 (correct readings from graph) **OR** 75 (correct heart rate, bpm) **OR** e.c.f. from graph, e.g. 120 – 40 = 80 and 80 × 75 = 6000;	2 (2 x AO2)	

Question	Marking Guidance	Mark	Comments
06.3	1. Treatment 2 reduces bp/risk more (than treatment 1) **OR** Treatment 2 is more effective (than treatment 1) 2. Neither treatment achieves ideal bp **OR** Neither treatment achieves low(est) risk; 3. With treatment 1, patients (still) have high bp/ 20.3 bp so (still) at high risk 4. With treatment 2, patients in pre-high bp/18 bp so (still) at higher risk than normal; 5. No statistics test so do not know if changes/differences (in bp) are significant **OR** No statistics test so do not know if changes/differences (in bp) are due to chance; 6. Unknown side effects of treatment(s); 7. Unknown duration of treatments; 8. Large sample size so results representative;	4 max (4 x AO3)	5. Reject 'results are significant'

Question	Marking Guidance	Mark	Comments
07.1	1. Four bands (upper epidermis, palisade, spongy, lower epidermis); 2. Band widths must look similar to photograph; 3. Correct label of one tissue;	3 (3 x AO2)	1. and 2. ignore waxy cuticle and vascular bundle/xylem/phloem Give benefit of doubt for use of printed box as borderlines of drawing bands. 2. Reject if cells drawn 2. Reject if lines are overlapping **OR** sketched 2. Ignore stomata and air spaces 2. Must be at least 3 bands shown 3. Accept (upper/lower) epidermis/palisade mesophyll/spongy mesophyll/ vascular bundle/ xylem/phloem 3. Accept cells for mesophyll 3. Reject stoma 3. Reject waxy cuticle 3. Reject cell

Question	Marking Guidance	Mark	Comments
07.2	1. SDs do not overlap for (mean) shelf life **OR** SDs do not overlap for (mean) transpiration rate **OR** SDs do overlap for (mean) number of stomata; 2. Shelf life significantly longer/different in April; 3. No significant difference in (mean) number of stomata so unlikely/not linked to shelf life; 4. Significant difference in (mean) transpiration rate so (likely) linked with shelf life;	4 (4 x AO3)	2. Accept converse for December 2. 3. and 4. Accept equivalent statements to significance in terms of chance, e.g. for 4. 'difference in (mean) transpiration rate is not due to chance…' If no marks awarded, allow 1 mark max for (mean) transpiration rate affects shelf life

Question	Marking Guidance	Mark	Comments
07.3	**Mark in groups** of either 1., 2. and 3. **OR** 4., 5. and 6. 1. Reduce light intensity; 2. Stomata close; 3. (So) decreased (rate of) evaporation/transpiration; 4. Increase humidity **OR** Prevent/reduce air movement (around cut flowers); 5. Reduces water potential gradient (between plant and air); 6. (So) decreased (rate of) evaporation/transpiration;	3 max (3 x AO3)	1. Accept a description of reducing light intensity, e.g. use a cupboard **OR** turn off lights 4. Accept description of reducing air movement e.g. close windows 5. Accept Ψ symbol for water potential

Question	Marking Guidance	Mark	Comments
08.1	Mating/courtship/sexual behaviour;	1 (AO2)	Ignore breeding/ reproduction

Question	Marking Guidance	Mark	Comments
08.2	1. Repeat (the investigation) without stones **OR** Repeat (the investigation) with uniformly coloured stones; 2. Presence of stones has no effect on behaviour **OR** Colour of stones has no effect on behaviour`;	2 (2 x AO3)	Accept dull/grey/one/same for uniformly coloured

Question	Marking Guidance	Mark	Comments
08.3	1. Directional; 2. Fish with more spots are more likely to be predated; 3. Alleles for (more) spots not passed on; 4. (So) frequency of (more) spots alleles decreases;	4 (4 x AO2)	2. 3. and 4. Accept converse 2. Accept killed/eaten for 'predated' 2. Accept more of them killed/eaten, for 'more likely' 3. and 4. Reject 'gene' once 4. Accept 'proportion' for frequency Ignore 'number of alleles decreases'

Question	Marking Guidance	Mark	Comments
09.1	1. Spiracles, tracheae, tracheoles; 2. Spiracles allow <u>diffusion</u> (of oxygen) **OR** (Oxygen) <u>diffusion</u> through tracheae/tracheoles; 3. Tracheoles are highly branched so large surface area (for exchange); 4. Tracheole (walls) thin so short diffusion distance (to cells) **OR** Highly branched tracheoles so short diffusion distance (to cells) **OR** Tracheoles enter cells so short diffusion distance; 5. Tracheole permeable to oxygen/air; 6. Cuticle/chitin/exoskeleton (impermeable) so reduce water loss; 7. Spiracles (can) close so no/less water loss **OR** Spiracles have valves so no/less water loss; 8. Hairs around spiracles reduce water loss;	5 max (5 x AO1)	Reference to these 3 structures anywhere in answer = 1mark If whole answer refers to MPs 1–5 only, award MAX 4 marks 3. Accept 'network' or 'large number' for highly branched 3., 4. and 5. If tracheae/tracheoles confused, penalise once only 4. Allow 'next/close to' for enter cells 6. Allow prevents water loss

Question	Marking Guidance	Mark	Comments
09.2	**Breathing in** 1. Diaphragm (muscles) contract **and** diaphragm flattens; 2. External intercostal muscles contract **and** ribcage pulled up/out; 3. (Causes) volume increase **and** pressure decrease in thoracic cavity (to below atmospheric pressure); **Breathing out** 4. Diaphragm (muscles) relaxes **and** diaphragm moves up; 5. External intercostal muscles relax **and** ribcage moves down/in; 6. (Causes) volume decrease **and** pressure increase in thoracic cavity (to above atmospheric pressure);	5 max (5 x AO1)	1. Accept 'pulled/moved down' for flattens. 3. and 6. Accept lungs or thorax for 'thoracic cavity' Reject 'chest' once 4. Accept 'returns to domed shape' for moves up 5. Accept internal intercostal muscles contract