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.

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	B – Pulmonary vein; E – Renal artery;	2 (2 x AO1)	

Question	Marking Guidance	Mark	Comments
01.2	A, C, F;	1 (1 x AO2)	All three needed for **one** mark Accept in any order Reject if there are additional letter(s)

Question	Marking Guidance	Mark	Comments
01.3	1. (Polypeptides have) different sequences of amino acids/different primary structures; 2. (So different) secondary structure determined by (position of) hydrogen bonds; 3. Different hydrogen/ionic/disulfide bonds (in tertiary structure);	3 (3 x AO1)	1. Ignore different amino acids 2. Reject ionic/disulfide bonds 2 and 3. Reject peptide bonds

Question	Marking Guidance	Mark	Comments
01.4	1. Loads/associates with oxygen more readily at low(er) partial pressures **OR** Has a higher affinity for oxygen at lower partial pressures; 2. (Supplies tissues with sufficient) oxygen for respiration;	2 (2 x AO2)	1. Accept low(er) pO_2 for lower partial pressures 1. Accept low(er) KPa

Question	Marking Guidance	Mark	Comments
02.1	1. Mitochondrion; 2. Aerobic respiration;	2 (2 x AO1)	2. Reject produces/makes energy

Question	Marking Guidance	Mark	Comments
02.2	1. (Digestive) enzymes are proteins; 2. Y/rough endoplasmic reticulum produces proteins/enzymes; 3. Z/Golgi apparatus modifies/packages proteins/enzymes; 4. (Golgi) vesicles transport (modified) proteins/enzymes to (cell-surface) membrane;	4 (4 x AO2)	2. Ignore RER/ER 2. Accept ribosomes 3. Accept Golgi body/complex 4. (Golgi) vesicles transport (modified) proteins/enzymes for exocytosis;

Question	Marking Guidance	Mark	Comments
02.3	1. Curve S/with oxygen active transport of glucose occurs **OR** Curve S/with oxygen the cells to use ATP to take up glucose; 2. Curve S levels off when all carrier proteins are in use; 3. Curve T/without oxygen facilitated diffusion occurs **OR** Curve T/without oxygen movement through channel/carrier proteins **OR** At 6 mg dm^{-3} facilitated diffusion; 4. Uptake in curve T/without oxygen starts when glucose concentration outside cells is greater (than inside cells);	3 max (3 x AO3)	1. Accept co-transport for active transport

Question	Marking Guidance	Mark	Comments
02.4	2.5 : 1;	1 (1 x AO2)	

Question	Marking Guidance	Mark	Comments
03.1	<table><tr><th></th><th>Cellulose</th><th>Triglyceride</th><th>Antibody</th></tr><tr><td>**B**</td><td>C, H, O</td><td>C, H, O</td><td>C, H, O, N, S</td></tr></table>	1 (1 x AO1)	

Question	Marking Guidance	Mark	Comments
03.2	1. Add ethanol then water and shake/mix **OR** Add ethanol and shake/mix then add water; 2. White/milky <u>emulsion</u> **OR** <u>Emulsion</u> test turns white;	2 (2 x AO1)	2. Ignore cloudy 2. Reject precipitate

Question	Marking Guidance	Mark	Comments
03.3	(Fatty acid **B**) Double bond between carbon (atoms) **OR** Two carbons with only one hydrogen;	1 (1 x AO2)	Accept symbols C = C

Question	Marking Guidance	Mark	Comments
03.4	1. S.D. (bars) do not overlap so a significant difference/decrease; 2. Unknown side effects of treatment(s); 3. Time scale/duration too short **OR** Only investigated for 1 month; 4. Small sample size **OR** **Only** 10 people (investigated); 5. No details on sex/age/diet;	5 (5 x AO3)	1. Allow error bars for SD bars 1. Reject 'results are significant' 1. Accept 'difference not due to chance' for significant

Question	Marking Guidance	Mark	Comments
04.1	Correct answer of 120 = **3 marks**;;; Answers in range 117 to 119 = **2 marks**;; 0.1017 - 0.1018 or 0.102 (correct calculation of πr^2) = **1 mark** **OR** 12 divided/multiplied by their incorrectly calculated area = **1 mark**;	3 (3 x AO2)	

Question	Marking Guidance	Mark	Comments
04.2	Count the number of stomata in many parts of leaf **and** calculate a mean/average;	1 (1 x AO1)	Accept multiple/many fields of view/samples Ignore several Ignore multiple leaves/plants If number stated must be 10 or more

Question	Marking Guidance	Mark	Comments
04.3	Any **one** of: Hairs **so** 'trap' water vapour **and** water potential gradient decreased/low **OR** Stomata in pits/grooves/sunken stomata **so** 'trap' water vapour/reduce air movement/maintain humidity **and** water potential gradient decreased/low **OR** Thick (waxy) cuticle **so** increases diffusion distance **OR** (Thick) waxy cuticle **so** prevents/reduces evaporation/transpiration;	1 (1 x AO1)	Accept: humid/moist air as 'water vapour' but **not** water/moisture on its own Accept: diffusion/concentration gradient as equivalent to water potential gradient Ignore 'no' water loss

Question	Marking Guidance	Mark	Comments
04.4	1. As wind speed increases the rate of transpiration increases, but at a slower rate; 2. Rate of transpiration/evaporation is higher in the non-xerophyte (than the xerophyte) **OR** Higher wind speed has a greater effect on the non-xerophyte than the xerophyte; 3. Some transpiration/evaporation occurs (in both types) in still air/no wind;	2 max (2 x AO3)	

Question	Marking Guidance	Mark	Comments
05.1	RNA/rRNA/ribosomal RNA **AND** Protein/polypeptide/amino acids;	1 (1 x AO1)	Both molecules needed for **one** mark Accept in either order Reject other types of RNA e.g. mRNA or tRNA Reject histone

Question	Marking Guidance	Mark	Comments
05.2	Similarities 1. <u>DNA</u> replication; 2. Division of the cytoplasm **OR** Formation of the cell-surface membrane **OR** One division into two cells; 3. Synthesis of proteins/ribosomes; Differences 4. No histones synthesised in binary fission **OR** No histones associated with DNA in binary fission; 5. No mitosis/interphase in binary fission; 6. No membrane-bound organelles replicated in binary fission;	4 max (4 x AO2)	2. Allow cytokinesis 4./5./6. Allow 'only' 4./5./6. Accept prokaryote/bacteria for binary fission 5. Accept a named stage of mitosis 6. Accept named membrane bound organelles

Question	Marking Guidance	Mark	Comments
05.3	1.(DNA is checked for) mutations; 2. (Mutations) could result in non-functioning proteins/enzymes **OR** (Mutations) could lead to uncontrolled cell division/tumours/cancerous cells;	2 (2 x AO2)	1. Accept change in base sequence 1. Accept correctly named mutation 2. Accept descriptions eg change in secondary/tertiary/ quaternary structure/length of polypeptide/different protein

Question	Marking Guidance	Mark	Comments
06.1	1. The shape of the active site becomes <u>complementary</u> (to the hydrogen peroxide/ substrate); 2. (So) tension/strain/twisting/bending of the bond(s) (in hydrogen peroxide); 3. (So) less energy needed to break the bond(s) **OR** Lowers activation energy;	3 (3 x AO1)	1. Reject catalase has similar/same shape as hydrogen peroxide 2. Ignore 'weakens bonds'

Question	Marking Guidance	Mark	Comments
06.2	1. Label glassware/beaker/flasks/boiling tubes/hydrogen peroxide because hydrogen peroxide could be mistaken for water; 2. Wear gloves to prevent hydrogen peroxide/solution making contact with skin/damaging skin; 3. (Work in) a well-ventilated room or fume cupboard to prevent inhaling hydrogen peroxide (fumes) **OR** to prevent respiratory damage; 4. Wear (safety) glasses/goggles to prevent hydrogen peroxide entering the eyes/damaging the eyes;	2 max (2 x AO2)	Each mark needs precaution and reason 2. Accept lab coat or mask/visor but only if idea of covering the skin is clear 3. Allow mask

Question	Marking Guidance	Mark	Comments
06.3	To expose all of the surface (to the hydrogen peroxide/substrate) **OR** To maximise the surface exposed (to the hydrogen peroxide);	1 (1 x AO2)	Ignore increasing the surface area

Question	Marking Guidance	Mark	Comments
06.4	Correct answer of 1.3/1.25 = **3 marks**;;; Incorrect answer but shows 3140 **and** 2512 = **2 marks** **OR** Incorrect answer but shows 3142 **and** 2513 = **2 marks** **OR** Incorrect answer of 1.5/1.47 = **2 marks**;; Incorrect answer but shows 628/628.3 = **1 mark**;	3 (3 x AO2)	Surface areas 3140 and 2512 if 3.14 used for π Surface areas 3142 and 2513 if calculator used for π 0.8 if surface area of cylinder divided by surface area of discs 1.5/1.47 if diameter used instead of radius 628 for surface area of one disc

Question	Marking Guidance	Mark	Comments
06.5	(Total surface area greater so) more enzyme-substrate complexes;	1 (1 x AO2)	Accept E-S complexes

Question	Marking Guidance	Mark	Comments
07.1	Flagellum/flagella Plasmid(s) Capsule;; Accept in any order. 3 correct = **2 marks** 2 correct = **1 mark** 1 or 0 correct = **0 marks**	2 (2 x AO1)	

Question	Marking Guidance	Mark	Comments
07.2	1. Has (specific) <u>tertiary</u> structure/shape; 2. Structures are <u>complementary;</u>	2 (2 x AO2)	1. Ignore 3D shape 1. Accept in context of receptor or toxin 2. Accept in correct context of receptor and/or toxin in relation to MP1. Reject only once reference to active site/enzyme/ substrate/induced fit/antibody

Question	Marking Guidance	Mark	Comments
07.3	1. (The chloride ions) lower the water potential (in the ileum) **OR** (Loss of chloride ions) increases the water potential in the cells; 2. Water moves out of the (epithelial) cells by <u>osmosis</u> **OR** Water moves into the ileum by <u>osmosis</u> **OR** Water does not enter the cells by <u>osmosis</u> **OR** Water does not move out of the ileum by <u>osmosis</u>;	2 (2 x AO2)	1. Accept correct description of lower water potential eg more negative Accept Ψ for water potential but not wp/WP 2. Accept small intestine for ileum

Question	Marking Guidance	Mark	Comments
07.4	Correct answer for **2 marks** = 108;; Incorrect answer but shows 1260 **or** 1152 = **1 mark** **OR** Incorrect answer but four correct readings 350 000, 0.36, 90 000, 1.28 = **1 mark** **OR** Incorrect reading(s) from the graph but correct method (number of cases × FP) ÷ 100 = **1 mark**;	2 (2 x AO2)	

Question	Marking Guidance	Mark	Comments
07.5	(Uses) reported cases only/not all cases reported **OR** Misdiagnosis/not diagnosed (as cholera);	1 (1 x AO2)	

Question	Marking Guidance	Mark	Comments
08.1	1. (After 11 years) there is a **large** decrease in the number of helper T-cells **OR** (After 11 years) there are few/low number of helper T-cells; 2. (So) fewer B cells divide by mitosis **OR** (So) fewer B cells undergo clonal selection; 3. (So) fewer plasma cells produce antibodies;	3 (3 x AO3)	1. Allow other words for large eg significant/big 2.and 3. Accept 'no' for fewer 2. Accept clonal expansion

Question	Marking Guidance	Mark	Comments
08.2	**Mark as pairs 1 and 2 or 3 and 4 or 5 and 6 or 7 and 8. Justification must match action.** 1. Lift lid of (agar) plate at an angle; 2. To prevent contaminating the dish **OR** Prevent spread of bacteria outside the dish; 3. Flame the spreader **OR** Use a sterile spreader **OR** Flame the neck of the container of the culture; 4. To maintain a pure culture **OR** To prevent contaminating the dish **OR** Prevent spread of bacteria outside the dish; 5. Work close to a Bunsen burner/flame; 6. To create a convection current to carry other contaminants away/prevent them landing on the dish **OR** To create upward air movement to carry other contaminants away/prevent them landing on the dish; 7. Place used pipette/spreader into (container of) disinfectant; 8. To ensure no transfer of bacteria to bench;	2 max (2 x AO3)	1. Accept lift lid slightly **OR** keep lid over plate **OR** open lid of petri dish as little as possible 3. Accept loop for spreader Ignore ‘wash hands’

Question	Marking Guidance	Mark	Comments
09.1	1. Two divisions produce 4 (haploid) cells/gametes/nuclei; 2. Separation of homologous chromosomes (in first division); 3. Separation of chromatids (in second division); 4. Independent segregation/assortment of homologous chromosomes; 5. Crossing over leads to exchange of parts of chromatids/alleles between homologous chromosomes;	5 (5 x AO1)	1. Accept meiosis I **and** meiosis II 1. Accept description that clearly describes two divisions 3. Accept 'chromosomes' for 'chromatids' but reject homologous chromosomes. Accept annotated diagrams for MP1–MP3 4. Accept description eg maternal and paternal chromosomes are reshuffled in any combination

Question	Marking Guidance	Mark	Comments
09.2	(Formation at arterial end) 1. Water/small molecules/glucose/ions (forced) out of the capillary/blood; 2. (Due to) high hydrostatic/blood pressure (at arterial end); 3. (Plasma) proteins remain in capillary/blood; (Return at venous end) 4. (Plasma) proteins create water potential gradient **OR** (Plasma) proteins reduce/low(er) water potential (of blood/in capillary) **OR** (Plasma) proteins cause more negative water potential (of blood/in capillary); 5. Water moves (into blood/capillary) by <u>osmosis</u>; 6. Excess (tissue) fluid enters lymph (system/capillaries/vessels);	5 max (5 x AO1)	2. Accept hydrostatic/blood pressure greater than osmotic effect 3. Accept named plasma proteins 4. and 5. Accept Ψ for water potential but not wp/WP 6. Accept lacteals