AS
BIOLOGY
7401/2

Paper 2

Mark scheme

June 2024

Version: 1.0 Final

246A7401/2/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.

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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. Buffers changes in temperature; 2. (Provides a) cooling effect (via evaporation);	2 (2 x AO1)	1. Accept descriptions of buffering changes in temperature, eg resists temperature changes

Question	Marking Guidance	Mark	Comments
01.2	1. Evaporation/transpiration (from the porous pot); 2. Tension created moves water (upwards); 3. Cohesion maintains the column of water **OR** Cohesion is due to hydrogen bonds between water (molecules);	3 (1 x AO2, 2 x AO3)	2. Accept 'negative pressure' for tension or 'water pulled' or 'suction'. Ignore adhesion but reject mark point 3 if adhesion used to describe attraction between water molecules.

Question	Marking Guidance	Mark	Comments
01.3	0.8/0.85/0.848/0.8478 (using 3.14); OR 0.8482 (using π on calculator)	1 (1 x AO2)	

Question	Marking Guidance	Mark	Comments
02.1	Correct answer within range of 7 to 7.5 = **2 marks**;; Incorrect but shows division by 5500 = **1 mark** **OR** Answer shows correct number but incorrect decimal place eg 70 / 727 / 0.72 = **1 mark**;	2 (2 x AO2)	

Question	Marking Guidance	Mark	Comments
02.2	Correct answer of 3 / 2.5 / 2.52 x 10^{13} in any correct mathematical form = **2 marks**;; Incorrect but shows 5250 in any correct mathematical form = **1 mark** **OR** Incorrect but answer shows first three numbers as 252 = **1 mark**;	2 (2 x AO2)	

Question	Marking Guidance	Mark	Comments
02.3	1. Osmosis does not occur; 2. (Red blood) cells do not burst/lyse/shrink;	2 (2 x AO2)	1. Accept no **net** flow of water for osmosis. 2. Accept crenation (of red blood cells). 1. and 2. Accept converse eg osmosis would occur and cells would burst/lyse/shrink. 2. Accept cells would be larger/smaller.

Question	Marking Guidance	Mark	Comments
02.4	1. Binding/complex between antigen A and (antibody) anti-A; 2. (Causes red blood) cells to join/clump;	2 (2 x AO2)	1. Ignore reference to (antibody) anti-B in donor. 2. Reject 'clot/clotting'.

Question	Marking Guidance	Mark	Comments
02.5	A, B, AB and O;	1 (1 x AO2)	Accept all the blood groups.

Question	Marking Guidance	Mark	Comments
03.1	1. Use cold, buffered solution with same water potential; 2. Homogenise tissue and (then) filter; 3. Centrifuge at low speed and remove supernatant **OR** Centrifuge at low speed to remove/separate nuclei; 4. Centrifuge supernatant at higher speed (and pellet containing mitochondria is mixed with new supernatant);	4 (4 x AO1)	1. Accept isotonic for same water potential. 2. Accept blend OR grind for homogenise. 3. and 4. Accept solution for supernatant. 3. Accept heavier/denser organelles

Question	Marking Guidance	Mark	Comments
03.2	**MP1 must be included for max marks.** (For) 1. SDs do not overlap so significant difference/increase (in respiratory capacity); 2. Increase in ATP linked to increase in muscle contraction; **OR** Increase in ATP linked to increase in exercise capacity; (Against) 3. Only males (in investigation) **OR** No females (in investigation); 4. Only 11 (individuals in investigation) **OR** Small sample size; 5. RET may not strengthen required muscles **OR** Don't know which (skeletal) muscles affected **OR** Athletic performance not investigated; 6. Results may differ depending on age **OR** Only young (individuals) tested;	5 max (5 x AO3)	1. Accept 'difference/increase is not due to chance' for significant difference/increase. 1. Accept 'error bars' for SDs 5. Accept examples of athletic performance eg running. Ignore reference to 'no statistical test'

	7. No idea of exercise done by individuals before investigation;		

Question	Marking Guidance	Mark	Comments
04.1	Nucleus;	1 (1 x AO1)	

Question	Marking Guidance	Mark	Comments
04.2	1. Loops (of DNA) contain introns; 2. DNA forming hybrid (molecule) contain exons; 3. Complementary base pairing occurs between DNA and mRNA **OR** Hydrogen bonding occurs between DNA and mRNA; 4. Introns removed during splicing **OR** Introns removed to produce mRNA; 5. (The) mRNA is shorter (than original DNA/pre-mRNA strand) due to splicing;	3 max (3 x AO3)	1. Accept 'non-coding' for introns, but only for mark point 1.

Question	Marking Guidance	Mark	Comments
04.3	1. No loops (of DNA); 2. (Because) no introns (in prokaryotic DNA);	2 (2 x AO2)	

Question	Marking Guidance	Mark	Comments
04.4	Change in base sequence (of exons) occurs **OR** Deletion/addition of bases occurs **OR** Deletion of exons;	1 (1 x AO1)	Accept description of exons. Accept nucleotide/s for base/s. Ignore references to DNA or RNA.

Question	Marking Guidance	Mark	Comments
05.1	1. Compare the DNA base/nucleotide sequence; 2. More closely related (species) the more similar the genes/DNA;	2 (2 x AO1)	2. Accept RNA (to prevent ecf) 2. Accept 'more recent common ancestor' for more closely related 2. Accept 'clear phylogenetic relationship' for more closely related

Question	Marking Guidance	Mark	Comments
05.2	All (cellular organisms) have ribosomes **OR** All (cellular organisms) have ribosomal RNA/rRNA;	1 (1 x AO2)	

Question	Marking Guidance	Mark	Comments
05.3	1. Obtain (more sun)light for photosynthesis; 2. Reduces transpiration/evaporation **OR** Reduces water loss;	2 (2 x AO2)	2. Accept 'prevents/stops' water loss

Question	Marking Guidance	Mark	Comments
05.4	1. Single/few layer(s) of (cells/tissue); 2. So light can pass through;	2 (2 x AO1)	1. Accept: to avoid overlapping cells

Question	Marking Guidance	Mark	Comments
05.5	1. Use single/continuous/joined lines **OR** Do not use sketching **OR** No crossing or hanging lines; 2. Do not use shading/hatching; 3. Draw (only) the outline of tissues **OR**	3 max (3 x AO1)	

	Do not draw cells (detail); 4. Draw parts to the same scale/relative size; 5. Show labels/annotations/title; 6. Show magnification/scale (bar);		

Question	Marking Guidance	Mark	Comments
06.1	3 cm^3 of (undiluted) disinfectant and 2 cm^3 of (distilled) water;	1 (1 x AO2)	

Question	Marking Guidance	Mark	Comments
06.2	1. (Uncertainty =) 0.05 (cm^3); 2. (Percentage uncertainty =) 2.5;	2 (2 x AO2)	2. Allow correct percentage uncertainty from student's incorrect answer to MP1.

Question	Marking Guidance	Mark	Comments
06.3	1. Equally effective at 80% as at 100%; 2. Not effective at 20% **OR** Need higher than 20% concentration to be effective; 3. Light absorbance may not indicate number of living bacteria/cells **OR** Dead cells/bacteria absorb light **OR** Don't know if cells alive/dead at 80/100 %; 4. 100% not totally effective as still 10%/some absorbance; 5. Only (tested on) one species; **OR** Only tested on *B. subtilis*; 6. Only tested in laboratory/test tube **OR** May not be as effective on other surfaces; 7. Only (tested) at 25^{o}C;	4 max (4 x AO3)	6. Accept any description which indicates not tested on non-living surfaces. Ignore statistical test, sample size and reference to repeats.

Question	Marking Guidance	Mark	Comments
07.1	1. Chromatids do not separate; 2. Non-disjunction;	2 (2 x AO2)	1. Accept 'chromosomes' for chromatids but reject **homologous** chromosomes.

Question	Marking Guidance	Mark	Comments
07.2	1. Extra chromosome in gamete/egg/sperm/zygote **OR** All cells derived from a single cell/zygote; 2. (Body cells) produced by mitosis;	2 (2 x AO2)	1. Accept mutation for extra chromosome.

Question	Marking Guidance	Mark	Comments
07.3	Cells with extra chromosome (are produced) from cells with mutation **OR** Cells with correct number (of chromosome are produced) from cells without mutation;	1 (1 x AO2)	

Question	Marking Guidance	Mark	Comments
07.4	Automarked question – Correlation coefficient; (Box 1) Answer key: A – Correlation coefficient	1 (1 x AO2)	

Question	Marking Guidance	Mark	Comments
07.5	1. (More) blood moves from left to right ventricle (as left ventricle has thicker muscle); 2. Greater <u>volume</u> of blood to lungs **OR** (Higher blood pressure) in pulmonary artery;	2 (2 x AO2)	

Question	Marking Guidance	Mark	Comments
08.1	1. (Second antibody with) enzyme remains; 2. (So substrate converted to) coloured product;	2	1. Accept any description of antibody with enzyme

		(2 x AO2)	remaining eg 'not washed out'.

Question	Marking Guidance	Mark	Comments
08.2	Antibodies (produced against syphilis and *B. burgdorferi*) are similar **OR** Antibodies (to syphilis) are complementary to antigens (of *B. burgdorferi*) **OR** Antigen(s) (of syphilis and *B. burgdorferi*) are similar (in structure);	1 (1 x AO2)	

Question	Marking Guidance	Mark	Comments
08.3	1. Low concentration of antibodies (against *B. burgdorferi*) **OR** No/little antibody produced (during first two weeks); 2. (Only) primary response **OR** By plasma cells **OR** Plasma cells not produced **OR** B cells not divided/cloned;	2 (2 x AO2)	

Question	Marking Guidance	Mark	Comments
08.4	1. For all symptoms higher percentage in PTLDS group; 2. Significant difference/increase (in intensity of all symptoms) in PTLDS group; 3. Most significant difference/increase (in intensity) in fatigue/joint pain/muscle pain symptoms in PTLDS group **OR** Less significant difference/increase (in intensity) in depression/fever symptoms in PTLDS group; 4. Only (investigated) for 2 weeks **OR** Short time period (for investigation); 5. Difficult to determine intensity of symptoms **OR** Determining intensity of symptoms is subjective;	4 max (4 x AO3)	2. and 3. Reject 'results are significant' 2. Accept 'difference/increase in (all) results is significant'. 2. and 3. If neither mp 2 or mp 3 is awarded accept for one mark 'there is less than a 5% or less than 0.05 probability of difference (in intensity of symptoms) being due to chance'. 5. Accept any description of determining symptoms eg, judging symptoms.

Question	Marking Guidance	Mark	Comments
09.1	1. (Hb) loads/associates/binds oxygen in the lungs; 2. At high partial pressure of oxygen; 3. Binding of an oxygen (molecule to Hb) makes binding of another oxygen (molecule) easier; 4. (Oxygen transported as) oxyhaemoglobin in red blood cells; 5. (Hb) unloads/dissociates oxygen in the (respiring) cells/tissues; 6. At low partial pressure of oxygen **OR** At high partial pressure of carbon dioxide;	5 max (5 x AO1)	2. and 6. Accept pO_2 for partial pressure of oxygen. 6. Accept pCO_2 for partial pressure of carbon dioxide.

Question	Marking Guidance	Mark	Comments
09.2	1. (mRNA attaches) to ribosomes **OR** (mRNA attaches) to rough endoplasmic reticulum; 2. (tRNA) anticodons (bind to) complementary (mRNA) codons; 3. tRNA brings a specific amino acid; 4. Amino acids join by peptide bonds; 5. (Amino acids join together) with the use of ATP; 6. tRNA released (after amino acid joined to polypeptide); 7. The ribosome moves along the mRNA to form the polypeptide;	5 max (5 x AO1)	1. Full name required for RER. 3. Accept amino acid joined to tRNA using ATP.