AS
BIOLOGY
7401/2

Paper 2

Mark scheme

June 2023

Version: 1.0 Final

2 3 6 A 7 4 0 1 / 2 / M S

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

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 not 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	Site of translation, catalyse the joining of amino acids by condensation reactions;	1 (AO1)	

Question	Marking Guidance	Mark	Comments
01.2	Any **two** from: rRNA; (Pre) mRNA; tRNA;	1 max (AO1)	Ignore capitalization of r, m and t

Question	Marking Guidance	Mark	Comments
01.3	1. Less <u>phospholipids</u> in rough **OR** More protein/glycoprotein in rough **OR** Presence of ribosomes in rough; 2. (More protein/glycoprotein/ribosomes) Rough – production/transport of proteins; 3. (More phospholipid) Smooth – production/modification/packaging/transport of lipids;	3 (2 x AO2, 1 x AO3)	1. Accept references to percentages from Table 1. 2.Accept modifies/packages proteins 3.Accept storage/synthesis of carbohydrates 3. Accept storage of lipds

Question	Marking Guidance	Mark	Comments
02.1	Quaternary Condensation/phosphorylation/redox Release/loss/formation (Aerobic) respiration;; All correct = **2 marks**, 2–3 correct = **1 mark**, 0–1 correct = **0 marks**	2 (2 x AO1)	Accept 'elimination', 'production' for release

Question	Marking Guidance	Mark	Comments
02.2	(Catalyses the synthesis of ATP) 1. Active site <u>complementary</u> to ADP + Pi; 2. Enzyme-substrate complex forms; (Allows the movement of H^+ ions) 3. Channel (in membrane/protein/enzyme); 4. Allows <u>facilitated</u> diffusion of H^+ **OR** (Channel) has tertiary structure specific for (only) H^+;	4 (4 x AO2)	2. 'E-S' alone is insufficient Accept 'pore'

Question	Marking Guidance	Mark	Comments
03.1	Any **two** from: 1. Galactose is a monosaccharide/monomer; 2. (Polysaccharide is a) carbohydrate polymer; 3. (Several) monosaccharides/monomers/galactose joined by condensation reactions **OR** (Several) monosaccharides/monomers/galactose joined by glycosidic bonds;	2 max (2 x AO2)	

Question	Marking Guidance	Mark	Comments
03.2	1. Lactose contains (alpha) glucose **and** GOS does not **OR** Lactose contains (alpha)glucose + galactose **and** GOS contains only galactose; 2. Lactose is a disaccharide **and** GOS is a polysaccharide; 3. Lactose has one glycosidic bond **and** GOS has many glycosidic bonds;	2 max (2 x AO2)	3. Accept 'more than one' for many

Question	Marking Guidance	Mark	Comments
03.3	1. Active site (only) complementary to starch **OR** Active site not complementary to GOS; 2. (Due to) tertiary structure;	2 (2 x AO1)	1. Ignore 'hydrolysis'

Question	Marking Guidance	Mark	Comments
03.4	1. Provides galactose/sugar/monosaccharide; 2. (Bacteria use the galactose/sugar) for respiration; 3. (Bacteria use the galactose/sugar) for binary fission;	3 (3 x AO3)	Reject 'glucose' for galactose/sugar once only 3. Accept (cell) division /replication/reproduction for binary fission 3. Reject mitosis;

<table>
<tr><th>Question</th><th>Marking Guidance</th><th>Mark</th><th>Comments</th></tr>
<tr><td>04.1</td><td>
<table>
<tr><td>Aorta</td><td>6</td><td>Pulmonary vein</td><td>1</td></tr>
<tr><td>Left atrioventricular valve</td><td>3</td><td>Left semi-lunar valve</td><td>5</td></tr>
<tr><td>Right atrioventricular valve</td><td></td><td>Vena cava</td><td></td></tr>
<tr><td>Left atrium</td><td>2</td><td>Left ventricle</td><td>4</td></tr>
<tr><td>Right atrium</td><td></td><td>Right ventricle</td><td></td></tr>
<tr><td>Pulmonary artery</td><td></td><td>Right semi-lunar valve</td><td></td></tr>
</table>
All correct 2 marks,
3–4 correct 1 mark,
0–2 correct 0 marks
</td><td>2
(2 x AO1)</td><td>Ignore numbers 7-12

Penalise more than one use of numbers 1-6</td></tr>
</table>

Question	Marking Guidance	Mark	Comments
04.2	1. (Rest to medium-intensity exercise) Increased stroke volume **and** increased heart rate; 2. (Medium-intensity exercise to high-intensity exercise) Increased heart rate;	2 (2 x AO2)	1. Accept description of increased stroke volume 2. Reject reference to increase stroke volume here. 1. and 2. Ignore figures.

Question	Marking Guidance	Mark	Comments
04.3	1. Arteriole; 2. (Circular/smooth) muscle relaxes; 3. Vasodilation increases blood flow **OR** Widens/dilates (lumen of) blood vessel so increases blood flow;	3 (1 x AO1, 2 x AO2)	

Question	Marking Guidance	Mark	Comments
05.1	After first meiotic division – **B**; After second meiotic division – **E**;	2 (2 x AO2)	

Question	Marking Guidance	Mark	Comments
05.2	(Similarities) 1. (Both populations) have (variation due to) independent segregation/assortment (of chromosomes/chromatids); 2. (Both populations) have (variation due to) random fertilisation (of gametes); 3. Both (populations) have (further) mutations; (Difference) 4. Crossing over causes variation in non-mutant only;	3 max (3 x AO2)	**Max 2** for similarities 4. Comparison can be implied

Question	Marking Guidance	Mark	Comments
06.1	1. Breaking of ester bonds; 2. By addition of water;	2 (2 x AO1)	2. Accept 'using', 'with' for addition

Question	Marking Guidance	Mark	Comments
06.2	1. Emulsify lipids/fats; 2. Increases surface area (of lipid/fat) for (increased) lipase activity; 3. Form micelles;	2 max (2 x AO1)	1. Allow descriptions Ignore 'neutralise'/ 'increase the pH'

Question	Marking Guidance	Mark	Comments
06.3	1. Mutation results in (a new) allele; 2. Those with the (new) allele able to digest milk/triglycerides; 3. Individuals with CEL/allele more likely to (survive and) reproduce; 4. Directional selection; 5. Increase in frequency of (this) allele in population;	4 max (4 x AO2)	Allow ECF for use of gene rather than allele after not awarding mark in the first instance but **max 3** overall. 3. Accept 'pass on allele/characteristic' for reproduce 5. Accept description of increasing frequency, eg 'more common', 'higher proportion' but ignore increase in number of allele 2. 3. 5. Accept 'mutation' for allele

Question	Marking Guidance	Mark	Comments
07.1	1. Mass of DNA equals 1 (indicates) (early) interphase **OR** No cells with mass of DNA less than 1 (indicates) mitosis only type of division occurring; 2. Mass of DNA equals 2 (indicates) mitosis **OR** Mass of DNA equals 2 (indicates) each chromosome consists of 2 chromatids; 3. Mass of DNA between 1 and 2 (indicates) some of the DNA has been replicated;	3 (3 x AO3)	1. Accept G1 phase Accept no meiosis 2. Accept G2 / any named phase of mitosis 3. Accept S phase

Question	Marking Guidance	Mark	Comments
07.2	1. Fewer cells with mass of DNA = 1 **OR** More cells with mass of DNA between 1 and 2 **OR** More cells with mass of DNA 2; 2. Cell division is faster/uncontrolled **OR** More mitosis/cell division/cell replication;	2 (2 x AO3)	'Mass of DNA is higher' is insufficient 2. Ignore 'growth' 2. Accept 'uncontrolled mitosis'

Question	Marking Guidance	Mark	Comments
07.3	1. (Chromosomes) condense; 2. (Chromosomes) line up on equator/centre of cell **OR** (Chromosomes) attached to spindle;	2 (2 x AO1)	1. Accept 'shorten' or 'thicken'

Question	Marking Guidance	Mark	Comments
07.4	Correct answer of 20 = **2 marks**;; **1 mark** for evidence of 2×10^{-8} (m s^{-1})	2 (2 x AO2)	

<table>
<tr><th>Question</th><th>Marking Guidance</th><th>Mark</th><th>Comments</th></tr>
<tr><td>08.1</td><td>One mark for each row.
If values do not match the given unit, max 1.
<table><tr><th>Concentration of copper sulfate solution / g kg^{-1}</th><th>Volume of 100 g kg^{-1} copper sulfate solution / cm^3</th><th>Volume of water / cm^3</th></tr><tr><td>75</td><td>22.5</td><td>7.5</td></tr></table></td><td>2
(2 x AO3)</td><td>Accept dm^3 / mm^3 for volume unit.
Accept 0.0225/2.25 × 10^{-2}/22 500 and 0.0075/7.5 × 10^{-3}/7500
Ignore units in 2nd row.
Do not accept mm^{-3}/cm^{-3}/dm^{-3}/ml</td></tr>
</table>

Question	Marking Guidance	Mark	Comments
08.2	1. Density of 10% protein solution = 1.028; 2. More dense (than 25 g kg^{-1} copper sulfate solution);	2 (2 x AO2)	

Question	Marking Guidance	Mark	Comments
08.3	16.5 **and** 22;	1 (AO3)	Must be in correct order

Question	Marking Guidance	Mark	Comments
08.4	Any **three** from: (Tom) 1. (Healthy donor) not allowed to donate; 2. Less blood collected OR Fewer patients treated; 3. Cause Tom anxiety (about his health); (Lucy) 4. (Gives blood) when it may not be safe (for her) to do so; 5. (Her blood) may not help patients; 6. Her (missed) low haemoglobin goes untreated;	3 max (3 x AO3)	**Max 2** for either Tom or Lucy If no credit awarded, max 1 mark for idea of too little haemoglobin left to carry oxygen in blood **OR** reduced oxygen to respiring tissues

Question	Marking Guidance	Mark	Comments
09.1	1. Random samples; 2. Large sample size;	2 (2 x AO3)	1. Allow in context of fish or gills 2. If a specified number is given, it must be 10 or more. 2. Accept 'many'/ 'multiple' for large sample but ignore 'several'

Question	Marking Guidance	Mark	Comments
09.2	Correct answer of 18 000/1.8 × 10^4 = **2 marks**;; **1 mark** for Correct answers not given to 2sf (17 969.952) **OR** Evidence of 1701.7 (total length of filaments) **OR** 27 227.2 – 27370 (total number of lamellae)	2 (2 x AO2)	Accept 17970/17969.9

Question	Marking Guidance	Mark	Comments
09.3	(*Trachurus trachurus*) – **no mark** 1. More oxygen uptake/diffusion **OR** More gas exchange; 2. More energy/ATP from respiration;	2 (2 x AO2)	Incorrect fish name = zero Accept just 'Trachurus' or 'trachurus' 'More' required once only

<table>
<tr><th>Question</th><th>Marking Guidance</th><th>Mark</th><th>Comments</th></tr>
<tr><td>09.4</td><td>1 mark for first column
1 mark for 2nd and 3rd column all correct
<table>
<tr><td>Kingdom</td><td>Animalia</td><td>Animalia</td></tr>
<tr><td>Phylum/Phyla</td><td>Chordata</td><td>Chordata</td></tr>
<tr><td>Class</td><td>Actinopterygii</td><td>Actinopterygii</td></tr>
<tr><td>Order</td><td>Batrachoidiformes</td><td>Carangiformes</td></tr>
<tr><td>Family</td><td>Batrachoididae</td><td>Carangidae</td></tr>
<tr><td>Genus</td><td>Opsanus</td><td>Trachurus</td></tr>
<tr><td>Species</td><td>tau</td><td>trachurus</td></tr>
</table></td><td>2
(2 x AO2)</td><td></td></tr>
</table>

Question	Marking Guidance	Mark	Comments
10.1	Similarities 1. Polymers of nucleotides; 2. (Nucleotide has) pentose, (nitrogen-containing organic) base and a phosphate (group); 3. Cytosine, guanine and adenine (as bases); 4. Have phosphodiester bonds; Differences 5. Deoxyribose v ribose; 6. Thymine v uracil; 7. Long v short; 8. Double helix/stranded v single stranded;	6 max (6 x AO1)	1. Accept 'chain' for polymer 2. Accept in correct context 'ribose/deoxyribose' for pentose 7. Accept DNA longer 7. Ignore 'large' and 'small'

Question	Marking Guidance	Mark	Comments
10.2	Similarities 1. Double membrane; 2. Both contain (circular) DNA; 3. Both contain ribosomes; Differences 4. Thylakoids/lamellae/grana v cristae; 5. Stroma v matrix; 6. Pigments v no pigments; 7. Starch grains v no starch grains;	4 max (4 x AO1)	Max 3 marks for differences 3. Ignore numbers in front of ribosomes 6. Accept 'chlorophyll v no chlorophyll'