AS
BIOLOGY
7401/2

Paper 2

Mark scheme

June 2021

Version: 1.0 Final

216A7401/2/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.

Further copies of this mark scheme are available from aqa.org.uk

Copyright information

AQA retains the copyright on all its publications. However, registered schools/colleges for AQA are permitted to copy material from this booklet for their own internal use, with the following important exception: AQA cannot give permission to schools/colleges to photocopy any material that is acknowledged to a third party even for internal use within the centre.

Copyright © 2021 AQA and its licensors. All rights reserved.

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	Carboxyl;	1	Accept carboxylic acid

Question	Marking Guidance	Mark	Comments
01.2	Type of R group 1. Unsaturated (fatty acid/hydrocarbon); Explanation 2. Double bond (between carbons);	2	1. Accept alkene 2. Accept for 'double bond', C=C

Question	Marking Guidance	Mark	Comments
01.3	1. Add ethanol/alcohol **then** add water **and** shake/mix **OR** Add ethanol/alcohol **and** shake/mix **then** pour into/add water; 2. White/milky (emulsion) **OR** (emulsion) test turns white/milky;	2	1. Reject heating the emulsion test 1. Accept 'Add Sudan III **and** mix' 1. Ignore a second shake 2. Ignore cloudy 2. Reject precipitate 2. Accept (for Sudan III) top (layer) red

Question	Marking Guidance	Mark	Comments
01.4	**(Similarity)** 1. Both have a phospholipid bilayer **OR** Both have fatty acid/hydrophobic tails pointing in/face each other **OR** Both have phosphate/polar/hydrophilic heads pointing out **OR** Both have protein; **(Differences)** 2. No channel/carrier proteins, whereas fluid mosaic does **OR** Protein layer outside (phospholipids), fluid mosaic is 'dotted'; 3. Cholesterol is not present whereas it is present in fluid mosaic; 4. Glycoprotein is not present whereas it is present in fluid mosaic; 5. Glycolipid is not present whereas it is present in fluid mosaic;	3 max	Accept 2 marks max if 1. is not achieved 2., 3., 4., and 5. accept first answer refers to 1935 model unless otherwise stated 2. Accept for 'no channel/carrier', no intrinsic 2. Accept only one type of protein whereas fluid mosaic has many (types)

TOTAL		8	

Question	Marking Guidance	Mark	Comments
02.1	Mark in pairs: 1 **and** 2 OR 3 **and** 4 1. Flattened cells **OR** Single layer of cells; 2. Reduces diffusion distance/pathway; 3. Permeable; 4. Allows diffusion of oxygen/carbon dioxide;	2	1. Reject thin cell wall/membrane 1. Accept thin cells 1. Accept 'one cell thick' 4. Ignore gas exchange

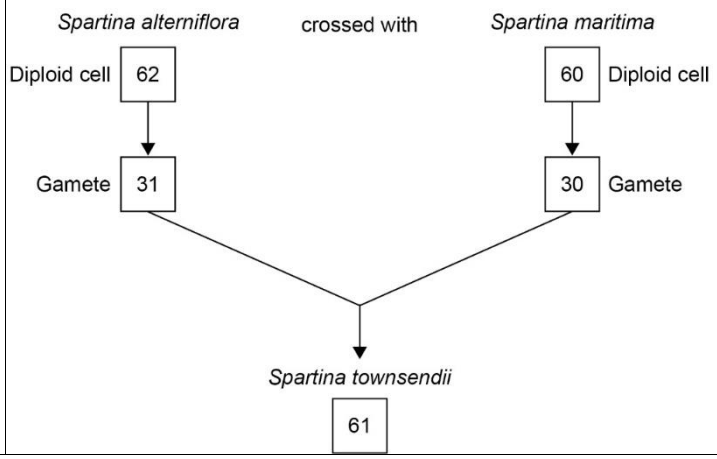
Question	Marking Guidance	Mark	Comments
02.2	Correct answer for 2 marks = 1.10–1.15;; Accept for 1 mark, 0.6(1) : 1 (correct FEV_1 : FEC ratio)	2	

Question	Marking Guidance	Mark	Comments
02.3	1. Less carbon dioxide exhaled/moves out (of lung) **OR** More carbon dioxide remains (in lung); 2. (So) reduced diffusion/concentration gradient (between blood and alveoli); 3. Less/slower movement of carbon dioxide out of blood **OR** More carbon dioxide stays in blood;	3	

TOTAL		**7**	

Question	Marking Guidance	Mark	Comments
03.1	Binomial;	1	

Question	Marking Guidance	Mark	Comments
03.2	(A factor that) increases (the rate of) mutations;	1	

Question	Marking Guidance	Mark	Comments
03.3	Correct answer - 60, 31 **and** 30;  	1	

Question	Marking Guidance	Mark	Comments
03.4	Name of mutation 1. Non-disjunction; Explanation 2. (In) meiosis; 3. Chromosomes not separated **OR** All chromosomes stay in one cell **OR** Chromosomes do not form (homologous) pairs;	3	Ignore homologous 2. Accept reference to first division or second division as indicating meiosis 2. Ignore mitosis 3. Accept 'move to one side' **OR** 'move to one pole'

Question	Marking Guidance	Mark	Comments
3.5	1. Random fusion of gametes **OR**	2	1. Accept for 'gametes',

	Random fertilisation; 2. (Produces) new allele combinations **OR** (Produces) new maternal and paternal chromosome combinations;		Reproductive cells 2. Ignore genes

TOTAL		**8**	

Question	Marking Guidance	Mark	Comments
04.1	1. Cell**(**-surface**)** membrane; 2. Ribosomes; 3. Cytoplasm; 4. DNA;	2 max	2. Ignore 70S

Question	Marking Guidance	Mark	Comments
04.2	Mark in pairs: 1 **and** 2 **OR** 3 **and** 4 1. (Amino acids used in) protein synthesis; 2. (So) more enzymes (for DNA/plasmid replication) **OR** (So) more DNA polymerase; 3. (Amino acids used in) respiration; 4. (So) more energy/ATP (for DNA/plasmid replication);	2	1. Accept for 'protein synthesis', translation

Question	Marking Guidance	Mark	Comments
04.3	1. Circular DNA is bigger/heavier/denser; 2. (Because band) moved further/is lower (in tube)/closer to bottom (of tube);	2	1. and 2. Accept converse for plasmids

Question	Marking Guidance	Mark	Comments
04.4	1. Plasmid replication continues/increases (with X) as band is wider; 2. Circular DNA replication stops/not increased (with X) as band is identical;	2	1. Accept for 'replicate', copy OR reproduce 1. Accept for 'continues', is not affected 1. Accept for 'wider', thicker OR 'there are more'

TOTAL		8	

Question	Marking Guidance	Mark	Comments

05.1	1. Amylase <u>hydrolyses</u> starch; 2. (To) maltose;	2	

Question	Marking Guidance	Mark	Comments
05.2	1. (E) Amylase/enzyme is denatured; 2. **(**F) amylase is needed for/causes starch hydrolysis/breakdown/digestion **OR** (F) water (alone) does not (cause starch) hydrolysis/breakdown/digestion;	2	1. Accept a description of denaturation 2. Ignore 'it is a control'

Question	Marking Guidance	Mark	Comments
05.3	1. Heat in Benedict's (solution); 2. Red/green/orange (precipitate/colour) (shows maltose/reducing sugar);	2	1. Reject description of non-reducing sugar test 2. Accept for 'heat', water bath

Question	Marking Guidance	Mark	Comments
05.4	Correct answer for 2 marks = 7;; Accept for 1 mark, 7.2 (correct answer but not rounded) **OR** Evidence of 1.6 ÷ 4.0/0.4/40% (correct dilution factor) **OR** Evidence of 0.08 (correct amylase volume in $0.2cm^3$)	2	

Question	Marking Guidance	Mark	Comments
05.5	1. Reduces (human) error/uncertainty; 2. (It is) the resolution of a ruler; 3. (For a ruler measurement) the uncertainty is ±1(mm) **OR**	1 max	Ignore can only measure to whole numbers Ignore reliability and precision

	(For a ruler measurement) the true value lies with ±1(mm);		Accept, the uncertainty of a ruler reading is (±)0.5(mm) OR readings of <1mm are not accurate

TOTAL		**9**	

Question	Marking Guidance	Mark	Comments
06.1	1. Different primary structure/amino acid sequence; 2. Different tertiary structure/shape of active site; 3. Enzyme-substrate complexes more likely (with enzyme from AD^F allele);	3	3. Accept converse for AD^S 3. Accept is more complementary
Question	**Marking Guidance**	**Mark**	**Comments**
06.2	Avoids bias **OR** Results (likely to be) reliable/repeatable;	1	
Question	**Marking Guidance**	**Mark**	**Comments**
06.3	1. Flies with AD^F/allele have selective advantage (in presence of alcohol); 2. So insects (with AD^F more likely to) reproduce; 3. Pass on AD^F (allele/gene); 4. (So) allele frequency increases;	4	Accept converse for AD^S 1. Accept description of selective advantage
Question	**Marking Guidance**	**Mark**	**Comments**
06.4	Answer = Directional selection	1	
TOTAL		**9**	

Question	Marking Guidance	Mark	Comments
07.1	1. and 2. Accept for 2 marks correct names of three components adenine, ribose/pentose, <u>three</u> phosphates;; 3. Condensation (reaction); 4. ATP synthase;	4	1. and 2. Accept for 1 mark, correct name of two components 1. and 2. Accept for 1 mark, ADP **and** phosphate/Pi 1. and 2. Ignore adenosine 1. and 2. Accept suitably labelled diagram 3. Ignore phosphodiester 4. Reject ATPase

Question	Marking Guidance	Mark	Comments
07.2	Correct answer for 1 mark = 57/57.1;	1	

Question	Marking Guidance	Mark	Comments
07.3	1. (Amino acid uptake by) active transport; 2. Cyanide reduces/stops amino acid uptake; 3. ATP production stops on <u>membranes</u> **OR** Enzymes not working on <u>membranes</u>; 4. ATP production continues in cytoplasm **OR** Enzymes active in cytoplasm;	3 max	1. Accept for 'transport', process

TOTAL		**8**	

Question	Marking Guidance	Mark	Comments
08.1	All three correct and no other substances = 1 mark Gluconic acid, water, green pigment;	1	Accept in any order

Question	Marking Guidance	Mark	Comments
08.2	Correct answer for 3 marks = 544 **and** nm^3;;; Accept for 2 marks: 612 (cage volume occupied by enzymes) **OR** 68 (volume of HRP) **OR** 544 (correct answers with no unit) Accept for 1 mark: 6800 (cage volume)	3	

Question	Marking Guidance	Mark	Comments
08.3	1. (Trapping) increases enzyme/GOx/HRP activity; 2. Difference/increase is significant **OR** Difference is not (likely to be) due to chance; 3. (Because) SDs do not overlap;	3	3. Accept for 'standard deviations', error bars

Question	Marking Guidance	Mark	Comments
08.4	Denatured enzymes **OR** Inactivated enzymes **OR** Empty cages (in water);	1	Accept any valid method of denaturing/inactivation

TOTAL		**8**	

Question	Marking Guidance	Mark	Comments
09.1	1. A metabolite **in** condensation/hydrolysis/ photosynthesis/respiration; 2. A solvent **so** (metabolic) reactions can occur **OR** A solvent **so** allowing transport of substances; 3. High (specific) heat capacity **so** buffers changes in temperature; 4. Large latent heat of vaporisation **so** provides a cooling effect (through evaporation); 5. Cohesion (between water molecules) **so** supports columns of water (in plants); 6. Cohesion (between water molecules) **so** produces surface tension supporting (small) organisms;	5 max	3. For 'buffer' accept 'resist'. 4. Reject latent heat of evaporation 5. For 'columns of water' accept 'transpiration stream'. Do not credit 'transpiration' alone but accept description of 'stream'. 5. For 'columns of water' accept 'cohesion-tension (theory)'. 5. and 6. For cohesion accept hydrogen bonding Ignore reference to pH. Allow other suitable properties but must have a valid explanation. For example • ice floating **so** maintaining aquatic habitat beneath • water transparent so allowing light penetration for photosynthesis

Question	Marking Guidance	Mark	Comments
09.2	1. DNA helicase unwinds DNA/double helix **OR** DNA helicase breaks hydrogen bonds; 2. Both strands act as templates; 3. (Free DNA) nucleotides line up in complementary pairs/A-T and G-C; 4. DNA polymerase joins nucleotides (of new strand); 5. Forming phosphodiester bonds; 6. Each new DNA molecule consists of one old/original/template strand and one new strand;	5 max	2. Accept description of 'template', eg exposed bases on single (polynucleotide) strands 4. Reject forms hydrogen bonds/joins bases

TOTAL		**10**	