AQA

AS
Biology

7401/1 Paper 1
Mark scheme

7401
June 2016

Version: 1.0 Final

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 Assessment Writer.

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 © 2016 AQA and its licensors. All rights reserved.
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.

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.

<table>
<tr><th>Question</th><th>Marking Guidance</th><th>Mark</th><th>Comments</th></tr>
<tr><td>01.1</td><td>
<table>
<tr><th>Feature</th><th>Bacterium</th><th>Human immunodeficiency virus (HIV) particle</th></tr>
<tr><td>RNA</td><td>✓</td><td>✓</td></tr>
<tr><td>Cell wall</td><td>✓</td><td></td></tr>
<tr><td>Enzyme molecules</td><td>✓</td><td>✓</td></tr>
<tr><td>Capsid</td><td></td><td>✓</td></tr>
</table>
</td><td>2</td><td>1 mark for each correct vertical column</td></tr>
<tr><td>01.2</td><td>1. (Complementary) nucleotides/bases pair
OR
A to T <u>and</u> C to G;
2. DNA polymerase;
3. Nucleotides join together (to form new strand)/phosphodiester bonds form;</td><td>3</td><td>1. & 3. Ignore ‘(DNA polymerase) forms base pairs/nucleotide pairs’
If clearly writing rote answer about DNA replication <u>2 max</u> e.g. helicase or separating strands</td></tr>
<tr><td>01.3</td><td>1. DNA double stranded/double helix and mRNA single-stranded;
2. DNA (very) long and RNA short;
3. <u>Thymine/T</u> in DNA and <u>uracil/U</u> in RNA;
4. Deoxyribose in DNA and ribose in RNA;
5. DNA has base pairing and mRNA doesn’t/ DNA has hydrogen bonding and mRNA doesn’t;
6. DNA has introns/non-coding sequences and mRNA doesn’t;</td><td>3 max</td><td>Contrast requires both parts of the statement
2. Accept ‘RNA short<u>er</u>’ or ‘DNA bigg<u>er</u>/long<u>er</u>’
4. R Deoxyribonucleic/ ribonucleic acid
Ignore ref. to histones
Ignore ref. to helix and straight chain alone
6.Ignore ref to splicing</td></tr>
</table>

Question	Marking Guidance	Mark	Comments
02.1	1. In phospholipid, one fatty acid replaced by a phosphate;	1	Ignore references to saturated and unsaturated 1. Accept Pi/PO_4^{3-} / (P) 1. Reject P/Phosphorus Accept annotated diagrams
02.2	1. Add ethanol, then add water; 2. White (emulsion shows lipid);	2	1. Reject ethanal/ethonal Accept 'Alcohol/named alcohol' 2. Accept milky – Ignore 'cloudy' Sequence must be correct If heated then DQ point 1 Reject precipitate
02.3	Saturated single/no double bonds (between carbons) **OR** Unsaturated has (at least one) double bond (between carbons);	1	Accept hydrocarbon chain/R group for 'between carbons' for either Accept Sat = max number of H atoms bound 'It' refers to saturated
02.4	1. (Fat substitute) is a different/wrong shape/not complementary; **OR** Bond between glycerol/fatty acid and propylene glycol different (to that between glycerol and fatty acid)/no ester bond; 2. Unable to fit/bind to (active site of) lipase/no ES complex formed;	2	If wrong bond name given (e.g. peptide/glycosidic), then penalise once
02.5	It is hydrophilic/is polar/is too large/is too big;	1	Ignore 'Is not lipid soluble'

Question	Marking Guidance	Mark	Comments
03.1	1. From ADP and phosphate; 2. By ATP synthase; 3. During respiration/photosynthesis;	2 max	1. Accept Pi/PO_4^{3-} / (P) 1. Reject P/Phosphorus 1. Reject use of water in the reaction
03.2	1. To provide energy for other reactions/named process; 2. To add phosphate to other substances **and** make them more reactive/change their shape;	2	Reject 'produce' energy
03.3	(Can see) 3D image;	1	
03.4	Crista/cristae;	1	Ignore matrix
03.5	Value between 20,750 (83mm) and 21,250 (85mm) two marks;; Formula given/used but calculation wrong, award 1 mark	2	Magnification = image size / Object size (Large number divided by 4)

Question	Marking Guidance	Mark	Comments
04.1	Transport through a channel protein Q	1	
	Transport of small, non-polar molecules P	1	
	Transport of glucose with sodium ions S	1	
04.2	1. (Y is) an enzyme/has active site/forms ES complex; 2. That makes cellulose/attaches substrate to cellulose/joins β glucose; **OR** 3. Makes cellulose/forms glycosidic bonds; 4. From β glucose;	2	1. Accept catalyst Mark in pairs (1&2 or 3&4)
04.3	Cell wall forms outside cell-surface membrane/has cellulose on it (on the outside);	1	
04.4	(Tick in box next to) Hydrogen;	1	

Question	Marking Guidance	Mark	Comments
05.1	1. Glucose; 2. Fructose;	2	Accept answers in either order Ignore α and β glucose
05.2	1. Line graph with rate on y axis and days/time in days on x axis and linear scales; 2. Correct units of μg min^{-1}/per minute/$minute^{-1}$ $\times 10^{-3}$; 3. Rates correctly calculated and plotted, with line connecting points/line of best fit and no extrapolation;	3	Correct answers $\times 10^{-3}$ 1.17, 1.50, 1.83, 2.50, 3.33, 4.00, 4.00 (accept to 1DP) 2. Reject m^{-1} 2. Reject if put 10^{-3} on axis for each point 2. '/' means separating units from what goes before i.e. accept sucrose hydrolysis per min / $\mu g x 10^{-3}$ 3. Do not accept a ruled **straight line** of best fit Accept y axis starting at 1
05.3	1. Sucrose hydrolysis linked to some aspect of growth; 2. Greater the rate of/faster hydrolysis/more SPS activity as plant grows/cells divide (up to 8/10 days); 3. Growth/division remains the same/slows after 8/10 days (because SPS activity is levelling off);	3	1&2. Accept 'breakdown' 2. Accept converse of greater rate of growth, greater rate of hydrolysis 2. Reject 'sucrose broken down' 3. Accept after 8 days/at 10 days growth rate maximum/growth stops

Question	Marking Guidance	Mark	Comments
06.1	1. (before reaction) active site not complementary to/does not fit substrate; 2. Shape of active site changes as substrate binds/as enzyme-substrate complex forms; 3. Stressing/distorting/bending bonds (in substrate leading to reaction);	2 max	Note. Points 1 and 2 may be made in one statement and 'complementary' introduced at any point. 2. Ignore references to how shape change is caused Points 1&2 – active site mentioned once applies for both points
06.2	1. Tangent to curve drawn; 2. Value in range of 8 to 11;	2	1.Tangent drawn at about 10 minutes 2.1 mark only for correct answer
06.3	1. (Rate of) increase in concentration of maltose slows as substrate/starch is used up **OR** High initial rate as plenty of starch/substrate/more E-S complexes; 2. No increase after 25 minutes/at end/levels off because no substrate/starch left;	2	1.Reject ref. to amylase being used up 2. accept 'little' 2. Ignore references to substrate a limiting factor
06.4	1. Make/use maltose solutions of known/different concentrations (and carry out quantitative Benedict's test on each); 2. (Use colorimeter to) measure colour/colorimeter value of each solution and plot calibration curve/graph described; 3. Find concentration of sample from calibration curve;	3	2.Axes must be correct if axes mentioned, concentration on x-axis and colorimeter reading on y-axis

Question	Marking Guidance	Mark	Comments
07.1	1. Vaccine/it contains antigen (from HPV); 2. Displayed on antigen-presenting cells; 3. Specific helper T cell (detects antigen and) stimulates specific B cell; 4. B cell divides/goes through mitosis/forms clone to give plasma cells; 5. B cell/plasma cell produces antibody;	4 max	1. Term 'antigen' may be first mentioned with point 2 2. Accept named example, e.g. macrophage/phagocyte/B cells 3. Accept 'helper T cell with receptor on surface' for 'specific' and B cells with receptor/antibody on surface that bind to antigen for 'specific'
07.2	1. Two (doses) because got more antibody; 2. With three doses, second dose/dose at 1 month doesn't lead to production of any more antibody (than the two-dose group)/get same/similar response; 3. Three doses would be more expensive/less popular with parents/girls (and serves no purpose);	2 max	1. Accept more effective in producing antibody 3.Accept 'less painful'
07.3	t-test, because comparing two means;	1	Mark for correct test and explanation correct Accept 'comparing the mean' Reject 'to show that the results/means are significant'

07.4	1. Compare (base sequences of) DNA; 2. Look for mutations/named mutations (that change the base sequence); 3. Compare (base sequences of) (m)RNA;	2 max	1 and 3 accept triplet/codon sequences for comparisons Ignore references to 'introns/non-coding DNA'

Question	Marking Guidance	Mark	Comments
08.1	**C**	1	Auto mark
08.2	1. No separation of chromatids/chromosomes/centromeres; 2. Chromatids/chromosomes all go to one pole/end/sides of cell/not pulled to opposite poles; 3. Doubles chromosome number in cell/one daughter cell gets no chromosomes or chromatids;	2 max	1. Accept anaphase prevented 1. Accept nondisjunction 1.Reject homologous pairs 3. Accept DNA for chromosomes 3. Accept ploidy 3. Ignore references to 'genetic information' Ignore simple descriptions of what normally happens in mitosis
08.3	1. (No, because) at 100 there are still **some** (7%) cancer cells dividing/undergoing mitosis; 2. So, cancer not destroyed/may continue to grow/spread/form tumours; 3. Best concentration may be between 100 and 1000/need trials between 100 and 1000; 4. This research in culture, don't know effect of KI on people; 5. (Yes, because) above 100 produces little increase in % of cells not dividing/undergoing mitosis/at 100, **most** (93%) cancer cells unable to divide/dead; 6. Above 100 may be harmful (to body); 7. Higher concentrations more expensive; 8. (above 100) will have more effect on (rapidly dividing) cancer cells;	4 max	1. Accept idea that all division stops only at 1000 2. Must refer to cancer spreading not cells dividing 4. Reject 'not tested on humans' 4.Reject 'done in animals' 5. Must clearly link lack of monopolar mitotic spindles with cell division 6. Accept '**above 100/high concentrations** produce harmful side effects/named effects' 8.Must relate to 100

08.4	1. 10 cm^3 of 10 000 nmol dm^{-3}/ (original) solution; 2. 90 cm^3 of water;	2	If ratio correct but make wrong volume e.g. 1 litre, award 1 mark

Question	Marking Guidance	Mark	Comments
09.1	1. Different parts/areas/amino acid sequences (of amyloid-precursor) protein; 2. Each enzyme is specific /fits/binds/ complementary to a different part of the APP;	2	1.Accept APP 2.Point 2 subsumes point 1 and is worth 2 marks total.
09.2	1. Peptide bond broken; 2. Using water;	2	Hydrolysis in stem
09.3	1. Mutations prevent production of enzyme(s)/functional enzyme; 2. (Increase in β-secretase) leads to faster/more β-amyloid production **OR** (Decrease in α-secretase) leads to more substrate for β-secretase; 3. (Leads to) more/greater plaque formation;	3	2.'This' must refer to α-secretase
09.4	1. (Inhibitor) binds to/blocks active site of β-secretase/enzyme; 2. Stops/reduces production of β-amyloid/plaque;	2	
09.5	1. Some β-amyloid required/needed (to prevent side effects) **OR** (Some) β-secretase needed; 2. Leads to build-up of amyloid-precursor protein (that causes harm) **OR** Too much product of α-secretase (causes harm);	1 max	1.Accept 'Both enzymes needed' 2. Accept build-up of substrate (leads to harm)