AQA

# AS
# Biology

7401/2 - Paper 2

Mark scheme

June 2018

Version/Stage: 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.

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# Level of response marking instructions

Level of response mark schemes are broken down into levels, each of which has a descriptor. The descriptor for the level shows the average performance for the level. There are marks in each level.

Before you apply the mark scheme to a student's answer read through the answer and annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

## Step 1 Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level. The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer. With practice and familiarity you will find that for better answers you will be able to quickly skip through the lower levels of the mark scheme.

When assigning a level you should look at the overall quality of the answer and not look to pick holes in small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level and then use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 3 with a small amount of level 4 material it would be placed in level 3 but be awarded a mark near the top of the level because of the level 4 content.

## Step 2 Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this. The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do not have to cover all of the points mentioned in the Indicative content to reach the highest level of the mark scheme.

An answer which contains nothing of relevance to the question must be awarded no marks.

| Question | Marking Guidance | Mark | Comments |
|---|---|---|---|
| **01.1** | B;<br>A;<br>E; | 3 | |
| **01.2** | 1. (Many mitochondria) release energy / ATP **for** movement of vesicles / synthesis of protein / active transport;<br><br>2. (Many Golgi) vesicles transport protein / glycoprotein / milk **to** cell membrane / **out of** cell; | 2 | Must include function of organelle **and** use in context of milk production.<br><br>Ignore reference to lipid / triglyceride<br><br>1. Reject reference to mitochondria undergoing anaerobic respiration<br>1. Reject "produce energy".<br>1. Reject "energy for respiration"<br>2. Accept exocytosis as transport and release<br>2. Ignore references to protein synthesis |

| Question | Marking Guidance | Mark | Comments |
|---|---|---|---|
| **02.1** | 1. Condensation (reaction) / loss of water;<br>2. Between amine / $NH_2$ and carboxyl / COOH; | 2 | Accept each marking point if shown clearly in diagram.<br>2. Accept between amino (group) and carboxylic / acid (group) |
| **02.2** | 1. Hydrogen bonds;<br>2. Between NH (group of one amino acid) and C=O (group);<br>**OR**<br>Forming β pleated sheets / α helix; | 2 | Accept as a diagram<br>1. Reject N - - - C / ionic / disulfide bridge / peptide bond |
| **02.3** | 1. Different sequence of amino acids<br>**OR**<br>Different primary structure;<br>2. Forms ionic / hydrogen / disulfide bonds in different places; | 2 | 1. If candidate assumes proteins are the same, accept effect of different pH/ temperature |

| Question | Marking Guidance | Mark | Comments |
|---|---|---|---|
| **03.1** | As size increases, ratio (of surface area to volume) decreases; | 1 | Accept converse.<br>Comparison required, e.g., small<u>er</u> organisms have a larg<u>er</u> ratio |
| **03.2** | Two marks for correct answer in range of 1.75 to 1.76032;; | 2 | Accept for 1 mark, incorrect answer using radius 0.87 / 0.88 / 0.880 / 0.8802 / 0.88015;<br>**OR**<br>Accept for 1 mark, incorrect answer with correct rearranged equation, e.g.,<br>Radius = $\sqrt{(\text{surface area} \div 4\pi)}$<br>**OR**<br>$= \sqrt{9.73 \div 12.56}$<br>**OR**<br>$= \sqrt{0.77} / \sqrt{0.774} / \sqrt{0.775}$<br>**OR**<br>$r^2$ = surface area ÷ 4 π<br>**OR**<br>$r^2 = 9.73 \div 12.56$<br>**OR**<br>$r^2 = 0.77 / 0.774 / 0.775$ |
| **03.3** | (Measures) small uptake / amount / quantity / volume / concentration / rate (of oxygen uptake);<br>**OR**<br>Avoids use of powers of ten / standard form / many decimal places; | 1 | Ignore weight / accuracy |

| | | | |
|---|---|---|---|
| **03.4** | More accurate / less error (in measuring mass);<br>**OR**<br>Causes less distress / damage to animal (to measure mass);<br>**OR**<br>Easier / quicker (to find mass) **because** irregular shapes;<br>**OR**<br>Fewer measurements / calculations; | 1 | Ignore references to **human** error<br>Accept converse if reference made to volume<br>Reject if comparison is made with surface area. |

| Question | Marking Guidance | Mark | Comments |
|---|---|---|---|
| **03.5** | (Oxygen used in) respiration, **which** provides energy / ATP;<br>**OR**<br>(Oxygen is used in) respiration, **which** is a metabolic process / chemical reaction; | 1 | Reject produces energy<br>Reject references to anaerobic respiration |
| **03.6** | 1. No information about egg;<br>2. So cannot compare all stages (in Table 2);<br>3. No statistical information / test / t-test / comparison of standard deviations;<br>**OR**<br>No measure of significant differences; | 3 | 2. Idea of comparing all three stages needed<br>3. Reject statements that "results" are not significant<br>3. Reject references to chi squared or correlation coefficient |

| Question | Marking Guidance | Mark | Comments |
|---|---|---|---|
| **04.1** | 1. (Movement) down a gradient / from high concentration to low concentration;<br><br>2. Passive / not active processes;<br>**OR**<br>Do not use energy **from** respiration / **from** ATP / **from** metabolism;<br>**OR**<br>Use energy **from** the solution; | 2 | 1. Ignore along / across gradient<br>1. Reject movement from gradient to gradient<br>2. Reject do not use energy unqualified |
| **04.2** | 1. Movement through carrier proteins;<br>**OR**<br>Facilitated diffusion;<br>**Between A and B**<br>2. Rate of uptake proportional to (external) concentration;<br>**Between C and D**<br>3. All channel / carrier proteins in use / saturated / limiting; | 3 | Accept MP1 in either section<br>1. Ignore co-transport / active transport<br>1. Accept channel proteins<br>2. Accept description of proportional<br>3. Accept used up<br>3. Accept transport proteins |
| **04.3** | 1. Rate of uptake is proportional / does not level off (so diffusion occurring);<br>2. (Lipid-soluble molecules) diffuse through / are soluble in phospholipid (bilayer); | 2 | 1. Accept as one increases the other increases |

| Question | Marking Guidance | Mark | Comments |
|---|---|---|---|
| **05.1** | 1. Where dividing cells are found / mitosis occurs;<br>**OR**<br>No dividing cells / mitosis in tissue further away / more than 5mm from tip;<br>**OR**<br>To get (soft) tissue that will squash;<br>**OR**<br>Length that will fit under cover slip;<br>2. Single / thin layer of cells / spread out cells **so** light passes through (making cells / nuclei visible); | 2 | 1. Accept most dividing cells<br>2. Accept thin layer of tissue<br>2. Ignore to see cells clearly |
| **05.2** | 3.57 / 3.6 / 3.7 / 3.71 / 3.8 (%);; | 2 | If the answer includes additional decimal places, award the marks if it would round to a correct answer<br>There are 3 cells in anaphase<br>Accept for 1 mark, 101.25 / 101 (students estimate in minutes)<br>OR<br>3.75 (difference between scientist estimate and student's estimate in minutes)<br>Ignore plus or minus signs |
| **05.3** | Cytokinesis; | 1 | |

| | | | |
|---|---|---|---|
| **05.4** | Description;<br>Explanation;<br>E.g,<br>1. Examine large number of fields of view / many cells;<br>2. To ensure representative sample;<br>**OR**<br>3. Repeat count;<br>4. To ensure figures are correct;<br>**OR**<br>5. Method to deal with part cells shown at edge /count only whole cells;<br>6. To standardise counting; | 2 max | Mark as pairs only<br>1. Accept large number / 20 or more for many<br>2. Accept typical / reliable |

| | | | |
|---|---|---|---|
| **05.5** | 1. Stops anaphase / cell division / mitosis;<br>2. (By) stopping / disrupting / spindle fibres forming / attaching / pulling;<br>3. Preventing separation of (sister) chromatids;<br>4. (So) no new cells added (to root tip); | 3 max | 1. Accept prevents telophase / cytokinesis<br>2. Ignore affects anaphase<br>3. Ignore chromosomes separate / split<br>3. Accept chromatids split |

| Question | Marking Guidance | Mark | Comments |
|---|---|---|---|
| **06.1** | 1. Used to compare effect of other treatments / as a baseline;<br>2. Shows / Measures effect of substance (X);<br>**OR**<br>Accounts for effect of substances produced naturally; | 2 | Accept for 2 marks, substance (X) and not agar / block / water that caused the difference in the number of roots.<br>1. Do not accept unqualified reference to "compare results".<br>2. Accept measures effect of independent variable |
| **06.2** | 1. (**D** shows) substance (X) is not required for (some) root growth / production of roots;<br>**OR**<br>Substances (already) present in stem cause (some) root growth;<br>2. Substance X moves through plant;<br>3. (**E** shows) substance (X) causes / increases / doubles number of roots / root growth; | 3 | 2. Accept X moves through stem / phloem |
| **06.3** | **In support of mass flow hypothesis**<br>1. **(F** shows) phloem is involved;<br>2. **(G** shows) respiration / active transport is involved (in flow / movement);<br>3. Because 4 °C / cooling reduces / slows / stops flow / movement;<br>4. The agar block is the source;<br>5. Roots are the sink;<br>**Against the mass flow hypothesis**<br>6. No bulge above ringing (in **F**);<br>7. No (role for) osmosis / hydrostatic pressure / water movement;<br>8. Movement could be due to gravity;<br>9. Roots still grow without (intact/functioning) phloem;<br>10. No leaves / sugars / photosynthesis to act as a source; | 4 max | Each point must be clearly made in the context of support or against.<br>Ignore sugar / sucrose<br>3 max for "support" and 3 max for "against"<br>7. Accept no turgor pressure |

| Question | Marking Guidance | Mark | Comments |
|---|---|---|---|
| **07.1** | 1. Hydrolysis (of);<br>2. (Large / insoluble substances) to small(er) / soluble substances; | 2 | Ignored named examples<br>Accept polymer to monomer |
| **07.2** | 1. Active sites are different shapes;<br>2. So different enzyme-substrate complexes (are formed);<br>**OR**<br>So complementary to different parts of cellulose / substrate; | 2 | |
| **07.3** | 2 x $10^{-3}$ / 2.0 x $10^{-3}$ / 2.01 x $10^{-3}$;; | 2 | If the answer includes additional decimal places, award the marks if it would round to a correct answer<br>Accept for 1 mark, correct answer not in standard form 0.002 / 0.00201 / 0.002014;<br>OR<br>Correct calculation using incorrect figure from table (9.2) 0.003 / 0.0031 / 0.00319 / 3 x $10^{-3}$ / 3.0 x $10^{-3}$ / 3.19 x $10^{-3}$ / 3.2 x $10^{-3}$<br>OR<br>Correct calculation with answer expressed as g $hr^{-1}$, 0.12 / 0.121 / 1.2x$10^{-1}$ |
| **07.4** | 1. Endocellulase create more ends / increases surface area;<br>2. For exocellulase to act on / hydrolyse / digest; | 2 | |

| | | | |
|---|---|---|---|
| **07.5** | $\frac{\text{Initial Mass} - \text{Final Mass}}{\text{Initial Mass}} \times 100$ | 1 | Accept<br>((final mass – initial mass) ÷ initial mass) x100<br>OR<br>((change in mass) ÷ initial mass) x100<br>OR<br>100 – ( $\frac{final\ mass}{initial\ mass}$ x 100)<br>OR<br>(1 – (F/I)) x100<br>OR<br>((I – F) ÷ I)x100 / ((F – I) ÷ I) x100<br>OR<br>((15 – final mass) ÷ 15)x100 / ((final mass - 15) ÷ 15) x100 |

| Question | Marking Guidance | Mark | Comments |
|---|---|---|---|
| **08.1** | 1. Add 1 part (bacteria) culture to 9 parts (sterile) liquid (to make $10^{-1}$ dilution);<br>2. Mix (well);<br>3. Repeat using 9 parts fresh (sterile) liquid and 1 part of $10^{-1}$ and $10^{-2}$ dilutions to make $10^{-3}$ dilution;<br>OR<br>Add 1 part $10^{-1}$ (suspension) to 99 parts (sterile) liquid (to make $10^{-3}$ dilution); | 3 | 1. and 3. Accept water / nutrient / broth for liquid<br>2. Accept stir<br>3. Reject 1 part (undiluted) culture added to 999 parts liquid |
| **08.2** | 3.75 x $10^9$ / 3 750 000 000;; | 2 | Accept for 1 mark: 3750 000 / 3.75 x $10^6$ (cells per $mm^3$)<br>OR<br>3.75 x $10^{12}$ (wrong volume conversion)<br>OR<br>3750 (cells per $mm^3$ of diluted culture)<br>OR<br>Evidence of using correct dilution conversion and correct volume conversion, i.e., x1000 and x 1000 |
| **08.3** | 1. **Count** unlikely to be accurate / repeatable / reproducible / reliable;<br>2. Because too many cells;<br>OR<br>Because cells overlapping / not spread out; | 2 | |

| Question | Marking Guidance | Mark | Comments |
|---|---|---|---|
| **08.4** | 1. Tetracycline used more often / in higher doses;<br>2. Resistant bacteria more likely to (survive and reproduce and) pass on allele/gene for (tetracycline) resistance;<br><br>OR<br><br>3. More / higher frequency of mutations (for tetracycline resistance);<br>4. (so) gene passed on to more bacteria;<br><br>OR<br><br>5. Tetracycline used over longer time period;<br>6. More time for (chance) mutation to occur / for selection to occur; | 2 | Ignore reference to resistant animals<br><br>Ignore reference to immunity<br><br>3. Reject reference to mutation being caused by use of antibiotic |
| **08.5** | No selection against resistant bacteria / resistance gene/allele;<br><br>OR<br><br>Bacteria pass on (resistance) gene / allele when they reproduce;<br><br>OR<br><br>Bacteria resistant to tetracycline are passed on from one generation of farm animals to the next (probably via faeces);<br><br>OR<br><br>Environment does not change, so stabilising selection occurs; | 1 | Accept no selection to get rid of it<br><br>Reject reference to mitosis or immunity |

| Question | Marking Guidance | Mark | Comments |
|---|---|---|---|
| **09.1** | **Comparisons**<br>1. Nucleotide structure is identical;<br>2. Nucleotides joined by phosphodiester bond;<br>**OR**<br>Deoxyribose joined to phosphate (in sugar, phosphate backbone);<br>3. DNA in mitochondria / chloroplasts same / similar (structure) to DNA in prokaryotes;<br>**Contrasts**<br>4. Eukaryotic DNA is longer;<br>5. Eukaryotic DNA contain introns, prokaryotic DNA does not;<br>6. Eukaryotic DNA is linear, prokaryotic DNA is circular;<br>7. Eukaryotic DNA is associated with / bound to protein / histones, prokaryotic DNA is not; | 5 max | 1. Accept labelled diagram or description of nucleotide as phosphate, deoxyribose and base<br>3. Accept shorter than nuclear DNA/is circular not linear/is not associated with protein/histones unlike nuclear DNA; |
| **09.2** | 1. Mutations change base / nucleotide (sequence);<br>2. (Causing) change in amino acid sequence;<br>3. Mutations build up over time;<br>4. More mutations / more differences (in amino acid / base / nucleotide sequence / primary structure) between distantly related species;<br>OR<br>Few(er) mutations / differences (in amino acid / base / nucleotide sequence / primary structure) in closely related species;<br>5. Distantly related species have earlier common ancestor;<br>OR<br>Closely related species have recent common ancestor; | 5 | Accept "order" for "sequence"<br>1. Reject if mutation in amino acid<br>If neither MP4 or MP5 accept for 1 mark, idea of more mutations /differences as evidence of earlier common ancestor OR converse |