AQA

# A-LEVEL
# Biology

Paper 2
Mark scheme

7402
June 2017

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

| Question | Marking Guidance | Mark | Comments |
|---|---|---|---|
| 01.1 | 1. Chemoreceptors detect rise in $CO_2$/$H^+$/acidity/carbonic acid/fall in pH<br>OR<br>Baro/pressure receptors detect rise in blood pressure;<br>2. Send impulses to cardiac centre/medulla;<br>3. More impulses to SAN;<br>4. By sympathetic (nervous system for chemoreceptors/$CO_2$)<br>OR<br>By parasympathetic (nervous system for baro/pressure receptors/blood pressure); | 4 | 1. Ignore: location of receptors.<br>1. Ignore: chemoreceptors detect oxygen.<br>2 and 3. Accept: action potentials.<br>2. Reject: 'messages', 'signals', 'an impulse' or an 'action potential'.<br>3. Ignore: messages', 'signals', 'an impulse' or an 'action potential' as emphasis here is on increase in frequency. |
| 01.2 | 1. Less/no malonyl-CoA;<br>2. (More) fatty acids transported/moved into mitochondria;<br>3. Respiration/oxidation of fatty acids provides <u>ATP</u>; | 3 | 1. 'Inhibition of malonyl-CoA' on its own is not enough but accept production of malonyl-CoA is inhibited.<br>2. Accept: 'transport of fatty acids into mitochondria is not inhibited'.<br>2. Ignore: method of entry.<br>3. Accept: for respiration any stage of aerobic respiration e.g. Krebs (cycle), link (reaction) etc.<br>3. Reject: production of energy, **but** accept production of energy in the form of <u>ATP</u>.<br>3. Accept: acetyl CoA can enter Krebs cycle/mitochondria to provide ATP. |

| Question | Marking Guidance | Mark | Comments |
|---|---|---|---|
| 02.1 | 1. Compete (with fertile males) to mate/for food/resources<br>OR<br>intraspecific competition;<br><br>2. Do not reproduce/breed<br>OR<br>Reduces population (of mosquitoes); | 2 | 1. Must convey idea of competition.<br><br>2. Accept: 'fewer mosquitoes'/'fewer offspring'. |
| 02.2 | 1. Capture/collect/sample, mark **and** release;<br>2. Leave time for mosquitoes/*Aedes* to disperse before second sampling/collection;<br>3. (Population =) number in first sample × number in second sample divided by number of marked in second sample/number recaptured; | 3 | 3. Accept: correct equation. |
| 02.3 | (Radiation) affects their 'attractiveness'/courtship /survival/ life span; | 1 | Accept: 'die/less likely to survive **due** to radiation'.<br>Accept: 'disease can be transmitted by other means' (other than mosquitoes). |
| 02.4 | To maintain number/competition as they die/have a short life span; | 1 | Accept: to replace mosquitoes that have died. |
| 02.5 | 1. Number (of mosquitoes in treated area) is low/lower at/after 12/13/14/15/16 weeks = **2 marks**;;<br><br>2. For one mark accept number (of mosquitoes in treated area) is low/lower without reference to relevant week; | 2 | Accept: amount for number.<br>Accept: comparison of numbers (of mosquitoes) for lower/low. |

| Question | Marking Guidance | Mark | Comments |
|---|---|---|---|
| 03.1 | Increase in aerobic respiration<br>OR<br>Increase in/more mitochondria<br>OR<br>Increase in/more slow muscle fibres; | 1 max | Ignore: reference to Krebs cycle as this in the stem of the question. |
| 03.2 | 1. (More aerobic respiration) produces more ATP;<br>2. Anaerobic respiration delayed;<br>3. Less or no lactate; | 3 | 1. Accept: produces ATP faster.<br>2. Accept: aerobic respiration can continue.<br>2. Accept : no anaerobic respiration.<br>3. Accept: lactic acid. |
| 03.3 | 1. Correct answer in range 84 to 84.2 = 2 marks;;<br>2. For one mark accept incorrect answer but shows<br>r (radius) = 0.63 (mm)<br>OR<br>d (diameter) = 1.26 (mm); | 2 | 2. Ignore: numbers after 0.63 and 1.26. |
| 03.4 | 1. A numerical comparison of range = **2 marks** i.e.<br>Young (fibres) range 14/15 – 47/48 (μm) **and** adult (fibres) 17/18 - 86/87/88 (μm)<br>OR<br>Young (fibres) range 32/33/34 **and** adult (fibres) range 68/69/70/71;<br>2. Comparison of range without numbers = one mark i.e.<br>Adult (fibres) greater range/spread/variation (of diameters)<br>OR<br>Young (fibres) smaller range/spread (of diameters); | 2 max | 1. Accept: **one** mark for comparison of minimum values i.e.<br>14/15 compared to 17/18<br>Allow **one** mark for comparison of maximum values i.e.<br>47/48 compared to 86/87/88.<br>1. Note: comparison of both maximum and minimum values = **2 marks.** |

| | | | |
|---|---|---|---|
| | 3. Comparison of mode = one mark i.e.<br>Adult (fibres) peak/most common/frequent/mode at 50 (µm) **and** young (fibres) peak/most common/frequent/mode at 30 (µm); | | 3. Accept: adult (fibres) peaks at higher diameter or young (fibres) peak/most frequent at lower diameter.<br>3. Reject: reference to mean/average. |

| Question | Marking Guidance | Mark | Comments |
|---|---|---|---|
| 04.1 | 1. Osmosis does not occur;<br>2. Chloroplast/organelle does not burst/lyse/shrivel/shrink; | 2 | 1. Accept: osmosis would occur if water potentials were not the same.<br>1 and 2, Accept: correct reference to osmotic lysis for **2 marks**.<br>2. Accept: chloroplast would burst/lyse/shrivel/shrink if water potentials were not the same.<br>2. Reject: 'cell bursts/shrivels'<br>2. Ignore: damage to chloroplasts on its own is not enough for a mark.<br>2. Reject: becomes turgid/flaccid. |
| 04.2 | 1. To show light does not affect DCPIP;<br>2. To show chloroplasts are required; | 2 | Ignore: comparison with other tubes. |
| 04.3 | 1. Reduction of DCPIP by electrons;<br>2. (From) chlorophyll/light dependent reaction; | 2 | 1. Accept: hydrogen/H for electrons but not protons/hydrogen ions/$H^+$ on their own.<br>2. Accept: from chloroplasts/photosystems/water. |

| | | | |
|---|---|---|---|
| 04.4 | Provides a standard / reference point<br>OR<br>Can compare different chemicals/weed-killers<br>OR<br>Can compare different concentrations of chemicals/weed-killers; | 1 | Accept: decolourises quicker than 100% **or** saves time waiting for complete decolourisation.<br>Note: comparisons must be qualified.<br>Accept: find the most effective weed-killer **or** the most effective concentration.<br>Accept: answers relating to cost effectiveness. |

| | | | |
|---|---|---|---|
| 04.5 | 1. Less/no ATP produced;<br>2. Less/no reduced NADP produced;<br>3. Less/no GP reduced/converted to TP; | 2 max | 2, Accept: less/no $NADPH/NADPH_2$/NADPH + H |

| Question | Marking Guidance | Mark | Comments |
|---|---|---|---|
| 05.1 | Used to produce named phosphate compound in cells;<br>e.g. ATP/ADP/phospholipids/DNA/ RNA/RuBP/TP /GP etc. | 1 | |
| 05.2 | Example of a carbon-containing biological compound e.g. carbohydrate/ amino acid/vitamin; | 1 | Accept: sugars/organic (compounds).<br>Ignore: products of photosynthesis.<br>Ignore: starch. |
| 05.3 | 1. Represents dry mass / mass of carbon;<br>2. Represents gross production minus respiratory losses; | 2 | 2. Accept: NPP = GPP – R.<br>2. Accept: Chemical energy minus respiratory losses.<br>1 and 2. Chemical energy store minus respiratory losses = 2 marks. |
| 05.4 | 1. For the control an increase in phosphate increases (plant) growth;<br>2. For *Entrophospora* an increase in phosphate reduces (plant) growth;<br>3. *Scutellospora* reduces (plant) growth (compared to control);<br>4. *Entrophospora and Glomus* increases (plant) growth(compared to control);<br>5. No SD/statistical test to determine significance;<br>6. Only 20 weeks of growth;<br>7. Underground/root growth not known; | 4 max | 5. Accept: no error bars.<br>7. Accept: only shows shoot growth. |
| 05.5 | 1. Answer in range 0.07 to 0.09 = **2 marks**;;<br>2. Answer in range 9.97 to 12.2<br>OR<br>Shows division by 140 or 20 x 7 = 1 mark; | 2 | |

| Question | Marking Guidance | Mark | Comments |
|---|---|---|---|
| 06.1 | 1. (Usually)Type II produce insulin;<br>2. Cells/receptors less sensitive/responsive (to insulin)<br>OR<br>Faulty (insulin) receptors;<br>3. (Treated/controlled by) diet/exercise; | 2 max | 2. Accept: cells/receptors do not respond.<br>2. Accept: 'fewer receptors'<br>3. Accept: (Treated/controlled by) weight loss/medication/drugs.<br>3. Ignore: diabetes is caused by diet/exercise. |
| 06.2 | Auto-marked – tick in box 4 | 1 | |
| 06.3 | 1. Attach to gene/DNA/promoter region;<br>2. Stimulate/inhibit transcription/RNA polymerase; | 2 | Note: Genes being expressed/inhibited or switched on/off is not enough on its own. |
| 06.4 | 1. (Effective as) group A/with iPS/treated lower than group B/with diabetes;<br>2. (Effective as) group A similar to group C/without diabetes;<br>3. (Investigation) done on mice not humans;<br>4. Only shows results for 12 weeks/short-time period / long-term effects not known; | 4 | Ignore: Only one study / not repeated / sample size.<br>2. Accept: 'healthy' or 'normal' or control for group C. |

| Question | Marking Guidance | Mark | Comments |
|---|---|---|---|
| 07.1 | 1. (Expression / appearance / characteristic due to) genetic constitution/genotype/allele(s);<br>2. (Expression / appearance / characteristic due to) environment; | 2 | 1. Accept: named characteristic.<br>1. Accept: homozygous / heterozygous / genes / DNA.<br>1. Ignore:chromosomes. |
| 07.2 | Epistasis<br>OR<br>Epistatic (interaction/control); | 1 | Accept: phonetic spellings.<br>Ignore: preceding word e.g.(recessive/dominant) epistasis. |
| 07.3 | **AAbb** - white<br>**aaBB** - yellow; | 1 | Both correct for one mark. |
| 07.4 | 1. AaBb, Aabb, aaBb, aabb;<br>2. White, (white), yellow, green;<br>3. 2 : 1 : 1; | 3 | Note: If genotypes are incorrect = zero marks.<br>1. Accept: equivalent genotypes e.g. ABab for AaBb.<br>Accept: sequence of phenotypes does not need to mirror genotypes but must be correct.<br>3. Accept: ratios of 2:1:1 or 1:2:1 or 1:1:2 even if sequence of phenotypes do not match if mark points 1 **and** 2 have been awarded.<br>3. Accept: alternative ratios in correct proportions e.g. 4:2:2<br>3. Ignore: percentages/fractions. |
| 07.5 | 1. Correct answer of 32% = **2 marks**;;<br>2. Incorrect answer but shows understanding that 2pq = heterozygous/carriers = 1 mark; | 2 | 2. Accept: understanding of 2pq by using a calculation involving 2 x two different numbers. |

| Question | Marking Guidance | Mark | Comments |
|---|---|---|---|
| 08.1 | Produces (c)DNA using (m)RNA; | 1 | Accept: 'converts' (m)RNA to (c)DNA.<br><br>Reject: tRNA |
| 08.2 | Joins nucleotides to produce (complementary strand/s of) DNA; | 1 | Accept: 'joins DNA nucleotides'. |
| 08.3 | 1. To remove any DNA present;<br>2. As this DNA would be amplified/replicated; | 2 | 1. Must be idea of removal/destruction.<br>2. Accept: idea of DNA not being used as template. |
| 08.4 | 1, Ratio in range of 1.4 :1 to 1.5 :1= **2 marks**;;<br>2. One mark for answers which shows incorrect ratio but<br>Shows 0.24 as a number or line on the graph<br>OR<br>Ratio in correct range, but the wrong way round<br>OR<br>Ratio in correct range but not expressed to 1<br>OR<br>Ratio shown the other way round in range<br>1: 0.67 to 1:0.71; | 2 | Note: ratio not expressed to 1 in correct range may be shown in different ways, for example as:<br>3:2 or simply as 1.5 for one mark. |
| 08.5 | Limited number of primers/nucleotides; | 1 | Accept: DNA polymerase (eventually)denatures<br>Accept: primers/nucleotides 'used up'. |
| 08.6 | 1. Base sequences differ;<br>2. (Different) complementary primers required; | 2 | 1. Accept: reference to either RNA or DNA base sequences but reject reference to DNA base sequence in viruses. |

| Question | Marking Guidance | Mark | Comments |
|---|---|---|---|
| 09.1 | All the alleles in a population; | 1 | Accept: The number of alleles in a population.<br><br>Note: All or number of alleles in a species on its own is not enough on its own. |
| 09.2 | 1. Occurs in the same habitat/environment/population;<br>2. Mutation/s cause different flowering times;<br>3. Reproductive separation/isolation<br>OR<br>No gene flow<br>OR<br>Gene pools remain separate;<br>4. Different allele/s passed on/selected<br>OR<br>Change in frequency of allele/s;<br>5. Disruptive (natural) selection;<br>6. Eventually different species cannot (inter)breed to produce fertile offspring; | 5 max | 1. Accept: are **not** geographically isolated /separated.<br>1. Accept: same place<br>3. Accept: no interbreeding but must be a separate idea from mark point 6 which relates to definition of a species.<br>Note: Answers relating only to allopatric speciation = 3 max, mark points 3, 4 and 6. |

| Question | Marking Guidance | Mark | Comments |
|---|---|---|---|
| 10.1 | 1. Correct answer of 19.4/19.41%<br>**OR**<br>19.47/19.5% = **2 marks**;;<br>2. Incorrect answer but shows increase of<br>1,048,320 **OR** 1,051,200 = one mark; | 2 | Accept: 19.46% for one mark. |
| 10.2 | 1. Less/no acetylcholine broken down;<br>2. Acetylcholine attaches to <u>receptors</u>;<br>3. (More) $Na^+$ enter to reach threshold/for depolarisation/action potential/impulse; | 3 | 1. Accept: more acetylcholine present/remains.<br>1 and 2. Accept: remains attached for longer = 2 marks.<br>3. Must be sodium ions. |
| 10.3 | 1. Isolated **so** inbreeding/low genetic diversity/small gene pool;<br>2. <u>Allele</u> inherited (through generations) from (common) ancestor; | 2 | 1. Ignore: Founder effect.<br>1. Accept: no interbreeding with other populations.<br>1. Reject: interbreeding within the population. |
| 10.4 | 1. AD/symptoms develops late/at 49;<br>2. Have already reproduced; | 2 | Note: 'It' is not equivalent to AD/symptom as the question stem relates to the mutation. |
| 10.5 | 1. Epigenetics/environment/named factor e.g. stress, alcohol, toxins, diet, exercise, smoking;<br>2. methylation (of genes)<br>OR<br>acetylation (of histones); | 2 | 1. Ignore: gender and lifestyle.<br>2. If further details are provided the context must be correct e.g. increased methylation or decreased acetylation inhibit gene expression/transcription. |
| 10.6 | 1. One person was homozygous dominant/has two dominant alleles = **2 marks**;;<br>2. For one mark has two alleles/chromosomes; | 2 | 1. Accept; homozygous dominant genotype e.g. 'one person has AA' for 2 marks.<br>2. Accept: is diploid or |

| | | | |
|---|---|---|---|
| | | | has two copies of the gene. |
| 10.7 | 1. (GCA/triplet) is common/found in other places;<br>2. Would not know if it was the mutation/allele/gene<br>OR<br>Produces 'false positives'; | 2 | 1. Accept: Probe will bind elsewhere. |