AQA

A-LEVEL
Biology

Paper 2
Mark scheme

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Question	Marking Guidance	Mark	Comments
01.1	1. Chemoreceptors detect rise in CO_2/H^+/acidity/carbonic acid/fall in pH OR Baro/pressure receptors detect rise in blood pressure; 2. Send impulses to cardiac centre/medulla; 3. More impulses to SAN; 4. By sympathetic (nervous system for chemoreceptors/CO_2) OR By parasympathetic (nervous system for baro/pressure receptors/blood pressure);	4	1. Ignore: location of receptors. 1. Ignore: chemoreceptors detect oxygen. 2 and 3. Accept: action potentials. 2. Reject: 'messages', 'signals', 'an impulse' or an 'action potential'. 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; 2. (More) fatty acids transported/moved into mitochondria; 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. 2. Accept: 'transport of fatty acids into mitochondria is not inhibited'. 2. Ignore: method of entry. 3. Accept: for respiration any stage of aerobic respiration e.g. Krebs (cycle), link (reaction) etc. 3. Reject: production of energy, **but** accept production of energy in the form of <u>ATP</u>. 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 OR intraspecific competition; 2. Do not reproduce/breed OR Reduces population (of mosquitoes);	2	1. Must convey idea of competition. 2. Accept: 'fewer mosquitoes'/'fewer offspring'.
02.2	1. Capture/collect/sample, mark **and** release; 2. Leave time for mosquitoes/*Aedes* to disperse before second sampling/collection; 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'. 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**;; 2. For one mark accept number (of mosquitoes in treated area) is low/lower without reference to relevant week;	2	Accept: amount for number. Accept: comparison of numbers (of mosquitoes) for lower/low.

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

	3. Comparison of mode = one mark i.e. 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. 3. Reject: reference to mean/average.

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

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

04.5	1. Less/no ATP produced; 2. Less/no reduced NADP produced; 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; 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). Ignore: products of photosynthesis. Ignore: starch.
05.3	1. Represents dry mass / mass of carbon; 2. Represents gross production minus respiratory losses;	2	2. Accept: NPP = GPP – R. 2. Accept: Chemical energy minus respiratory losses. 1 and 2. Chemical energy store minus respiratory losses = 2 marks.
05.4	1. For the control an increase in phosphate increases (plant) growth; 2. For *Entrophospora* an increase in phosphate reduces (plant) growth; 3. *Scutellospora* reduces (plant) growth (compared to control); 4. *Entrophospora and Glomus* increases (plant) growth(compared to control); 5. No SD/statistical test to determine significance; 6. Only 20 weeks of growth; 7. Underground/root growth not known;	4 max	5. Accept: no error bars. 7. Accept: only shows shoot growth.
05.5	1. Answer in range 0.07 to 0.09 = **2 marks**;; 2. Answer in range 9.97 to 12.2 OR Shows division by 140 or 20 x 7 = 1 mark;	2	

Question	Marking Guidance	Mark	Comments
06.1	1. (Usually)Type II produce insulin; 2. Cells/receptors less sensitive/responsive (to insulin) OR Faulty (insulin) receptors; 3. (Treated/controlled by) diet/exercise;	2 max	2. Accept: cells/receptors do not respond. 2. Accept: 'fewer receptors' 3. Accept: (Treated/controlled by) weight loss/medication/drugs. 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; 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; 2. (Effective as) group A similar to group C/without diabetes; 3. (Investigation) done on mice not humans; 4. Only shows results for 12 weeks/short-time period / long-term effects not known;	4	Ignore: Only one study / not repeated / sample size. 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); 2. (Expression / appearance / characteristic due to) environment;	2	1. Accept: named characteristic. 1. Accept: homozygous / heterozygous / genes / DNA. 1. Ignore:chromosomes.
07.2	Epistasis OR Epistatic (interaction/control);	1	Accept: phonetic spellings. Ignore: preceding word e.g.(recessive/dominant) epistasis.
07.3	**AAbb** - white **aaBB** - yellow;	1	Both correct for one mark.
07.4	1. AaBb, Aabb, aaBb, aabb; 2. White, (white), yellow, green; 3. 2 : 1 : 1;	3	Note: If genotypes are incorrect = zero marks. 1. Accept: equivalent genotypes e.g. ABab for AaBb. Accept: sequence of phenotypes does not need to mirror genotypes but must be correct. 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. 3. Accept: alternative ratios in correct proportions e.g. 4:2:2 3. Ignore: percentages/fractions.
07.5	1. Correct answer of 32% = **2 marks**;; 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. 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; 2. As this DNA would be amplified/replicated;	2	1. Must be idea of removal/destruction. 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**;; 2. One mark for answers which shows incorrect ratio but Shows 0.24 as a number or line on the graph OR Ratio in correct range, but the wrong way round OR Ratio in correct range but not expressed to 1 OR Ratio shown the other way round in range 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: 3:2 or simply as 1.5 for one mark.
08.5	Limited number of primers/nucleotides;	1	Accept: DNA polymerase (eventually)denatures Accept: primers/nucleotides 'used up'.
08.6	1. Base sequences differ; 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. 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; 2. Mutation/s cause different flowering times; 3. Reproductive separation/isolation OR No gene flow OR Gene pools remain separate; 4. Different allele/s passed on/selected OR Change in frequency of allele/s; 5. Disruptive (natural) selection; 6. Eventually different species cannot (inter)breed to produce fertile offspring;	5 max	1. Accept: are **not** geographically isolated /separated. 1. Accept: same place 3. Accept: no interbreeding but must be a separate idea from mark point 6 which relates to definition of a species. 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% **OR** 19.47/19.5% = **2 marks**;; 2. Incorrect answer but shows increase of 1,048,320 **OR** 1,051,200 = one mark;	2	Accept: 19.46% for one mark.
10.2	1. Less/no acetylcholine broken down; 2. Acetylcholine attaches to <u>receptors</u>; 3. (More) Na^+ enter to reach threshold/for depolarisation/action potential/impulse;	3	1. Accept: more acetylcholine present/remains. 1 and 2. Accept: remains attached for longer = 2 marks. 3. Must be sodium ions.
10.3	1. Isolated **so** inbreeding/low genetic diversity/small gene pool; 2. <u>Allele</u> inherited (through generations) from (common) ancestor;	2	1. Ignore: Founder effect. 1. Accept: no interbreeding with other populations. 1. Reject: interbreeding within the population.
10.4	1. AD/symptoms develops late/at 49; 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; 2. methylation (of genes) OR acetylation (of histones);	2	1. Ignore: gender and lifestyle. 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**;; 2. For one mark has two alleles/chromosomes;	2	1. Accept; homozygous dominant genotype e.g. 'one person has AA' for 2 marks. 2. Accept: is diploid or

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