AQA

GCSE

COMBINED SCIENCE: SYNERGY

Higher Tier – Paper 2 Life and Environmental Sciences
Report on the Examination

8465/2H
June 2022

Version: 1.0

Further copies of this Report are available from aqa.org.uk

Questions 1 and 2 were common with the Foundation tier, and were set at standard demand.

Question 1

01.1 The vast majority of students correctly listed the heart, muscle cell and nucleus in order of decreasing size.

01.2 Approximately two-fifths of students identified the correct route that blood travels through the heart to the lungs.

01.3 When explaining why the wall of the left ventricle is thicker than the wall of the right ventricle a comparative statement was needed. The only exception to this was to state that the left ventricle had to pump blood all around the body. This was the most common mark scored. Fewer than a fifth of students scored 2 marks, but just over half scored 1 or more marks. Quite a lot of students stated that the left ventricle pumped more blood or worked harder than the right ventricle. These were ignored.

01.4 Half of the students knew that the valve labelled in the diagram would prevent blood from flowing backwards through the heart. Incorrect responses included stating the valve controls blood flow, opens and closes or prevents oxygenated and deoxygenated blood from mixing together.

01.5 Two-fifths of students knew that the pacemaker is located in the right atrium of the heart.

01.6 Half of the students knew that the function of the pacemaker is to control the heart rate. Stating that it keeps the heart pumping or working was insufficient. The idea of regulating the heart beat was required.

01.7 Students had to study data given in the table and then explain the effect of an exercise training programme on the cardiac output of a person. Quite a lot of students just described what happened to heart rate, stroke volume and cardiac output without attempting an explanation. For the first mark, stating cardiac output increased was ignored as some value had to be added to the data presented in the table. Few said the cardiac output was similar, but saying it increased by 2 cm^3 per minute, or it only changed a little was allowed. Just over half of the students scored at least 1 mark, with few scoring both marks. Linking cardiac output to the stroke volume was rarely seen.

01.8 Some students gave information about healthy diets and lifestyles, which did not answer the question. Others did give risk factors, but often they were not clearly linked to poor health or diseases. In order to move into Level 2 several linked ideas were needed, and to enter Level 3 these had to include both risks from diet and from lifestyle, with clear examples. Very few students entered Level 3, but half of the students scored 3 marks or more, and four-fifths scored 2 marks or more.
A vague statement such as ‘eating too much junk food leads to obesity’ was a Level 1 idea. Specific examples such as eating too much fat can cause heart disease, or smoking can cause lung cancer, were required for the higher levels. On the Higher tier these were two common examples of linked ideas. CHD can lead to a heart attack, and blocked arteries can lead to a heart attack were also frequently seen. For lifestyle risk factors, smoking and a lack of exercise were the most common examples seen.

Question 2

02.1 Only a fifth of students scored this mark. When testing a leaf for starch, the green colour needs to be removed from the leaf before carrying out the test so that the colour of the iodine solution can be seen. Stating 'because it contains chlorophyll', or 'because it contains starch' were ignored.

02.2 Over half the students scored at least 1 mark. The first marking point for saying the white area of the leaf turned brown, or did not turn black, with iodine solution, was the one most commonly awarded. Approximately a fifth of students went on to explain that this indicated that there was no starch present. Very few linked the lack of starch to an absence of photosynthesis.

02.3 A third of students identified both the mobile phase and the stationary phase in the chromatography investigation, and a third knew just one of these.

02.4 Four-fifths of the students demonstrated experience of carrying out chromatography and gained the mark for saying a start line drawn in ink would run or spread, or that it is soluble or would dissolve. Stating that the ink would mess up the results was insufficient.

02.5 Calculating the distance moved by the yellow leaf pigment was straightforward for those who could rearrange the equation. Most students scored 3 or 4 marks for a correct calculation. Where an incorrect calculation had been made, the final mark for rounding an incorrect answer could only be awarded if working had been shown, and the calculation used values given in the question.

02.6 Most students correctly analysed information given in the two tables to conclude that phaeophytin is brown.

02.7 Only a third of students realised that different Rf values for the same pigments would be the result of a different solvent being used. Most students thought it was because the solvent moved further up the chromatography paper.

Question 3

03.1 Almost three-quarters of students knew that an alternating current is created in a radio receiver when the radio waves are absorbed.

03.2 Almost four-fifths of students identified the diagram showing refraction of a radio wave.

03.3 A third of students gave one difference between radio waves and sound waves. The most common correct response was that radio waves are transverse waves and sound waves are longitudinal waves. A few knew that radio waves travel at a faster speed. Responses had to be comparative statements, so stating that radio waves are electromagnetic waves, without reference to sound waves, did not score a mark.

03.4 Almost half the students gave two correct conclusions, and most gave one conclusion. Some students wrote three separate statements for each substance, stating that the speed increases as the temperature increases. These, in total, only scored 1 mark. Other students stated the speed is fastest in steel and is the slowest in air. These were both

correct statements for the third marking point, so only scored 1 mark. The second marking point was rarely seen.

03.5 This question was set at high demand. A third of students scored 1 mark, but few scored more than this. Only a few students said that the waves on a photograph would be still, and therefore easier to measure. The second marking point was rarely seen. The idea that a greater distance would be measured across more waves, and so a mean wavelength could be calculated was the most common mark awarded.

Question 4

04.1 Fewer than half of the students gave a factor that causes cells to form tumours. The most common correct responses were a mutation or smoking. Quite a lot of students stated radiation or sunlight, but these were both ignored as ionising radiation or ultraviolet was required.

04.2 Two differences between malignant and benign tumours were asked for. References to treatments, level of harm or size were ignored. Fewer than a third of students scored at least 1 mark, which was usually for stating that benign tumours don't spread, which was allowed.

04.3 Two control variables that the scientist should have used in the drug test were needed. Several control variables were given in the stem of the question, so repeating these was not creditworthy. Many students scored a mark for saying that the type of mice used should be the same. A common error was to say the dose or mass of drug used should be the same, but this was the independent variable, so was incorrect.

04.4 The question asked what treatment would have been given to a control group of mice, so saying no treatment was incorrect. At high demand, students had to be more specific. The most common correct answer was a placebo, which was allowed. Vague responses, such as a fake drug, were not creditworthy.

04.5 Students had to give a reason why a control group of mice was needed in the investigation. The idea that it was so the effect of the drug could be compared to when no drug was given, was required. Stating it was to see if the drug worked was insufficient. Very few students scored this mark.

04.6 A percentage increase calculation was asked for. Many students scored a mark for taking two correct readings from the graph. The question was set at high demand, and the two readings were both on major gridlines, so no tolerance was allowed on these readings. Students could still go on to score the next 2 marks if only a minor error was made when reading the volume at 20 days.

Common errors when carrying out the calculation included:

- not subtracting the two readings, which gave an answer of 900%
- not multiplying by 100, which gave an answer of 8
- dividing by 2500 or 2250 instead of by 250

04.7 Two conclusions about the effectiveness of the different doses of the drug were needed. The most common correct response was that the greater the dose the more effective the

drug. However, many stated the higher the dose the greater the reduction in the volume of the tumour. This was incorrect, as only the highest dose, 0.06 mg, reduced the volume of the tumour. The other doses only decreased the rate of growth. Some students thought the drug actively increased the volume of the tumour, as they had not studied the graph carefully enough to compare the results with the control group.

04.8 This question was set at the highest level of demand. Few students realised that the volume of the tumour was measured, rather than its width, because tumours have an irregular shape. Most stated it was because it would be more accurate.

04.9 Half of the students gained the mark, usually for stating that testing the drug on mice would show side effects of the drug. Stating 'to see the effect on mice' was too vague.

Question 5

05.1 Almost half of the students knew that a random sampling method is used when estimating the number of plants in a field in order to avoid bias. This was sometimes described in terms of the uneven distribution of plants. References to reliability and accuracy were ignored.

05.2 Most students calculated the area of the field, and many also calculated the area of the quadrat. A third scored full marks. Quite a lot of students did not know how to calculate the total number of quadrats that would fit on the field, and some randomly multiplied numbers by 100.

05.3 The most common correct answers for why the results for estimating the number of insects may not be valid included:

- different numbers of traps were used
- the traps weren't evenly distributed
- the insects might escape.

Most students gave confused responses. Many referred to the hedge in field B, or that the fields would have different numbers of insects, which were ignored.

05.4 Two-thirds of students scored the mark, which was usually for stating that field B had a greater biodiversity because there were more types of plants. Few looked at the data as a whole to conclude that there are more different species in field B. Quite a lot said there were more insects in field B, but this does not mean there is greater biodiversity, as there were fewer species of insects in field B compared to field A.

05.5 Three-quarters of students scored at least 1 mark, and just over half scored both marks. A few thought that planting hedges would lead to a decrease in the number of birds because the birds would fly into the hedges, or the hedges would increase the number of predators which would like more birds. Quite a lot of students said hedges would provide more food, shelter or nesting sites for birds, but they didn't clearly state how this would affect the number of birds, so they only scored 1 mark.

Question 6

06.1 In order to score the first marking point the idea that a mosquito bites, or drinks the blood of an infected person was needed, so stating malaria is transmitted by mosquito bites was insufficient.

For the second marking point reference to an organism being transferred from a mosquito to a different person was needed. The transfer of malaria, blood, infection or disease was insufficient. Only a quarter of students scored a mark, with very few scoring both marks.

06.2 Half of the students suggested that mosquitos living in the tunnels of the London Underground can stay active all year because they have a constant food supply or that it is warm all year.

06.3 A third of students knew that the process that causes evolution is called natural selection. Survival of the fittest, mutation and adaptation were all ignored.

06.4 The question was set at a high level of demand, so responses had to be detailed and logically described. A third of students scored zero marks. The majority of students only achieved Level 1.

Key ideas were detailed on the mark scheme, but just listing these headings was not creditworthy. Quite a lot of students thought that the mosquitos adapted to their surroundings by choice. Others thought the mosquitos passed characteristics on to their offspring, both of which are incorrect.

06.5 Four-fifths of students scored a mark for saying that feeding increases the body temperature of a mosquito. Few students linked this to a reduction of enzyme activity, or that the enzymes would be denatured. Very few stated that loss of enzyme activity would cause cell damage or death, and stating the mosquito would die was ignored.

Question 7

07.1 A third of students correctly identified the temperature at which nitrogen condenses as –196°C. Only a few students forgot to write the minus sign. Frequently seen incorrect responses included –195°C, –200°C and –210°C.

07.2 The idea that the nitrogen particles or molecules hit the sides of the cylinder to cause the pressure was needed. Particles colliding with each other was ignored. Only a third of students scored this mark.

07.3 When carbon dioxide sublimates it changes from a solid to a gas. Some thought the change was in the opposite direction, from a gas to a solid which is incorrect. Less than a fifth of students scored this mark.

07.4 Only a tenth of students scored this mark. The advantage of using solid carbon dioxide instead of frozen water had to relate to the fact that a liquid is not formed. This could be described as not making the packaging wet. Stating ‘carbon dioxide does not melt’ was insufficient.

07.5 Approximately two-thirds of students interpreted the data in the table to identify methane as the substance which could be the liquid in rivers on Titan. Nitrogen or water were the most common incorrect responses.

07.6 The most common limitations given about the particle model to describe change of state were:

- atoms, solids, liquids or gases are not 2-dimensional, or they are 3-dimensional
- particle movement is not shown
- the forces between the particles are not shown. The type of force was ignored.

Almost half the students scored 1 mark, with hardly any students giving two limitations of the model.

07.7 The calculation of the specific latent heat of vaporisation of water was set at the highest level of demand.

The first marking point was for the correct substitution into the equation to calculate the energy required to change the temperature of the water. The mass of water in kg was required. Those students who did not convert the mass could still score the remaining 5 marks.

Just over half the students scored 1 mark for the second marking point, which was allowed with or without the unit conversion. Only a third of students scored the first 2 marks.

To score further marks, the energy to change state had to be calculated. The energy to change temperature had to be subtracted from the total energy supplied to the water, which was given in the question.

Question 8

08.1 Just over a quarter of students knew that process X on the flow diagram was differentiation. Most said the process was called specialisation, which was ignored. A very common answer was mitosis. Other responses included mutation or adaptation.

08.2 This question was set at high demand, so simply stating that the plant grows when meristem cells divide was ignored. Detail about which part of the plant would grow was required.

08.3 For the first marking point a trend describing the results was needed. The second mark was to explain why the number of cells in mitosis decreases further from the tip of the shoot. Very few students scored the second mark, and this was usually for stating that meristem cells are only found in the tip of the shoot, which was allowed.

08.4 Dissolved sugars are transported around a plant by translocation. Diffusion was ignored, but there were many incorrect suggestions including transpiration, osmosis, mitosis, photosynthesis, active transport and transportation. Fewer than a third of students scored the mark.

08.5 Only a fifth of students scored a mark. The most common correct response was that phloem cells are living and xylem cells are dead. This mark was only allowed if no other marks were awarded, as the question asked for differences in the structure of the two types

of cell. Some students gained a mark for stating that xylem cells are hollow. References to the direction of flow within each tissue were frequently described, but as this was not a structural difference it was ignored.

08.6 A third of students could give some part of the explanation as to why the companion cell is needed to move sugar from the leaf cell into the phloem cell.

Some described the concentration gradient, to score mark point 1. Others knew that active transport was involved, and so required energy. Very few students scored the last marking point which required reference to mitochondria in the companion cells, as well as saying that these were the site of energy transfer or respiration.

Use of statistics

Statistics used in this report may be taken from incomplete processing data. However, this data still gives a true account on how students have performed for each question.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.