General comments

The paper produced a good range of marks and correct responses were seen in all parts of all questions.

Students frequently scored poorly where they were instructed to give explanations, or were told to use information or data provided in questions. In questions with a perceived How Science Works component, students often ignored the context and produced stock phrases and expressions.

Question 1

This question was intended to provide an accessible start to the paper. In practice, it discriminated quite highly, with students who scored highly on the paper as a whole tending to get the highest marks.

(a) About two thirds obtained both marks. Quite a few students used the terms hydrophilic and hydrophobic the wrong way round. Others appeared confused about the position of the ‘heads’ and ‘tails’ of phospholipids. Some had them the wrong way round in the membrane and others had heads facing out of the cell and tails facing into the cell.

(b) (i) There were many good answers and just over 60% obtained both marks. Some students confused the roles of the rough endoplasmic reticulum and the Golgi apparatus.

(b) (ii) A range of related functions was allowed in (b)(ii) and just over 70% obtained this mark.

Question 2

(a) About 70% of students were able to identify correctly two risk factors for coronary heart disease. Some students thought that having coronary heart disease or having a heart attack were risk factors and failed to score.

(b) About half of students scored all three marks in (b) and very few scored nothing. One of the mark points required the use of the term ‘coronary artery’ and another required reference to ‘respiration’; some students failed to use these terms.

Question 3

(a) It was pleasing to see many good answers to part (a) that focused on how bacteria are destroyed by phagocytes. Some students drifted into general accounts of the immune response and others began by writing at length about how phagocytes find bacteria. About 30% obtained all three marks. It was common for students to be vague or wrong about the role of lysosomes. It was not uncommon to see references to lysosomes fusing with bacteria, rather than with the vacuole containing the bacteria. The examiners were looking for references to hydrolytic or digestive enzymes destroying the bacteria, rather than just enzymes breaking down bacteria.

(b) 80% obtained both marks. Those who failed to score usually included features of eukaryotic cells in their answers.
Question 4

(a) (i) About two thirds of students obtained both marks in (a)(i). By far the commonest error was a suggestion that the cell had villi.

(a) (ii) Students were not penalized for the error mentioned in part (a)(i) again in part (a)(ii) and were allowed to state that villi increased the surface area for absorption. Some students failed to obtain a mark related to mitochondria because they did not link them to ATP for active transport.

(b) It was pleasing to see that most students understood that glucose would lower the water potential inside the cell, leading to entry of water by osmosis. Those who failed to score did not mention water potentials, osmosis, or either.

Question 5

(a) The most noticeable features of answers to (a) and (b) were the failure to use the information in the figure and attempts to use rote answers based on, often flawed, factual recall. A few very good answers to (a) were seen where students noted the delay between increase in pressure in the ventricle and flow into the aorta. These went on to link this to the pressure gradient required to open the (semilunar) valve. Most students wrote simple and incorrect descriptive statements along the lines of, ‘pressure and flow go up together’.

(b) More correct responses were seen than in (a). About 20% of answers correctly related the increase in thickness to contraction of the wall of the ventricle and this contraction to increase in pressure. Many students wrote that thickness of the ventricle wall increases to cope with pressure, or drifted into accounts of the relative thicknesses of the walls of the left and right ventricle.

Question 6

The examiners noted that many students appeared not to have read the main stem of the question carefully.

(a) Quite a large number wrote about amylase in yoghurt, rather than an inhibitor of amylase. About two thirds identified that Group A allowed the effect of the inhibitor to be seen. Very few noted that it also allowed the effect of yoghurt on its own to be seen. Quite a large number simply stated that the group ‘allowed for comparison’.

(b) 60% identified that different foods might affect glucose intake. Very few went on to identify that they could also contain different amounts of starch, the substrate of amylase. Quite a few simply wrote about ‘removing a variable’.

(c) A third of students obtained both marks. These students displayed a clear understanding of the digestion of starch, including the enzymes involved, the products produced and the impact of the inhibitor. About 40% failed to score, with the commonest error being a statement that starch is ‘broken down’ directly into glucose.
(d) The examiners had identified six different reasons why the results might not support the use of the inhibitor, based on the context of this question. Many students resorted to rote How Science Works answers about correlation not causing causation, or bias. Nearly half of students failed to score.

Question 7

(a) There were many good descriptions of the results in (a) and three quarters scored all three marks.

(b) This part discriminated far more. About half of the students obtained all three marks. These students were able to link fibrosis to scar tissue, loss of elasticity of the lungs and the effects of this on inhalation and exhalation. Some students wrote about loss of surface area of the lungs and did not address changes in FEV. Quite a large number of students found it very hard to express their ideas clearly. It would be beneficial to students if they did not use the term ‘respiration’ when writing about breathing or ventilation of the lungs.

Question 8

A number of misconceptions about the immune system, immune response and vaccination were commonly expressed by students in different parts of this question. The same, or similar, misconceptions have been seen in previous papers and have been commented upon in the reports.

(a) (i) Many students did not focus on a comparison of a vaccine consisting of whole cells that had been heat treated with one containing only parts of the bacterial cell. The former might not have been killed, or might contain toxins, whereas the latter could not be alive and would not contain toxin. Many students felt that the introduction of whole cells with their many antigens might overwhelm the immune system. These students did not seem to appreciate that our immune systems are exposed to multiple antigens on a daily basis and are not overwhelmed.

(a) (ii) The examiners were looking for the idea that a whole-cell vaccine would contain many different antigens and each would lead to the production of an antibody specific to it. Only about a fifth of students obtained both marks here. Most students simply wrote that there would be more antigens and thus more antibodies. This made it impossible for examiners to know whether or not they understood the ideas of different antigens and different, specific antibodies.

(b) This part produced roughly equal percentages of students obtaining 3, 2, 1 or 0 marks. Many started with the assumption that people with whooping cough would have no antibody against the toxin; because if they had the antibody, they wouldn’t get ill. Indeed, many stated that only people who had been vaccinated against whooping cough could have antibody against the toxin. In essence, they did not seem to understand that an immune response occurs naturally when someone becomes infected with a pathogen.
(c) Many appeared to find it difficult to accept that a doctor’s diagnosis might be wrong and wrote about vaccines not working and the bacterium mutating. About a quarter of students did spot that the scientists’ work suggests there might not be a real rise in whooping cough cases and that this might be linked to mis-diagnosis. Another quarter identified one of these points.

**Question 9**

Both parts of this question discriminated well but for different reasons. Part (a) tested understanding of how enzymes work and (b) tested recall of how inhibitors of enzymes work.

(a) Many students obtained one or two marks by referring to the tertiary structure of the enzyme and/or the complementary fit; demonstrating understanding of why maltase only catalyses the reaction involving maltose. Only students with an understanding of how enzymes act as catalysts that lower activation energy obtained further marks. These students wrote about how the formation of the enzyme-substrate complex involved an induced fit. They went on to write about how this stressed bonds in the substrate molecule, making it more reactive and thus lowering the activation energy for the reaction. They also noted that the enzyme, as a catalyst, remains unchanged after the reaction. Many students appeared to be triggered by the word ‘temperature’ and wrote about why the enzyme would not work if the temperature was above or below normal body temperature; denaturing being frequently mentioned. These responses were not answering the question and did not receive any credit.

(b) About half of students obtained all five marks in (b), displaying good recall of how competitive and non-competitive inhibitors work. It was encouraging to see that quite a few wrote about the relative effects of increasing substrate concentration on the two types of inhibition. Some students got the two types of inhibitor mixed up and failed to score one or two of the marks. Poor expression also hindered quite a few, with statements such as, “The competitive inhibitor has the same shape as the substrate.”, or “The non-competitive inhibitor binds to the other active site of the enzyme”.

**Mark Ranges and Award of Grades**

Grade boundaries and cumulative percentage grades are available on the [Results Statistics](https://www.aqa.org.uk/resultsстатistics) page of the AQA Website.

**Converting Marks into UMS marks**

Convert raw marks into Uniform Mark Scale (UMS) marks by using the link below.

[UMS conversion calculator](https://www.aqa.org.uk/umsconversion)