

COMBINED SCIENCE

Paper 5129/11
Multiple Choice

Question Number	Key	Question Number	Key	Question Number	Key	Question Number	Key
1	B	11	D	21	D	31	B
2	D	12	D	22	D	32	D
3	C	13	C	23	A	33	D
4	C	14	C	24	B	34	A
5	B	15	A	25	C	35	C
6	B	16	A	26	A	36	B
7	A	17	C	27	B	37	B
8	D	18	B	28	A	38	A
9	B	19	B	29	C	39	C
10	C	20	D	30	B	40	D

General comments

Candidates performed very well on **Questions 2, 6, 11, 12, 14, 16, 18, 19, 20, 25** and **36**. **Questions 10, 13, 17** and **37** proved the most challenging for candidates.

Comments on specific questions

Question 1

Many candidates were able to identify the cell structures in the diagram of a plant cell which are also present in an animal cell. Most candidates that did not score this mark knew that both cells contained a nucleus and a cell membrane but they thought that the vacuole was the cytoplasm.

Question 2

Most candidates knew that enzymes are proteins that can increase the rate of a chemical reaction.

Question 3

This question was demanding for some candidates, with option **A** often being selected. Most candidates knew that the palisade and spongy mesophyll cells contain chloroplasts but most of those who missed this mark did so because they thought that the cuticle also contains chloroplasts rather than the guard cells.

Question 4

Many candidates knew that translocation is the movement of sucrose in the phloem but many thought that the process involves the movement of water in the xylem or the movement of amino acids in the xylem. Candidates should check the wording carefully as many confused transpiration and translocation.

Question 5

A significant number of candidates did not know that maltose is broken down into glucose in the ileum.

Question 6

Most candidates knew that carbon dioxide moves from the blood into the alveolus due to the higher concentration of carbon dioxide in the blood.

Question 7

Many candidates knew that aerobic respiration produces carbon dioxide and water and releases more energy than anaerobic respiration.

Question 8

Some candidates answered this question correctly, identifying the semilunar valves as the valves which open when the ventricles contract. Many candidates who did not gain this mark thought that it was the atrioventricular valves which open when the ventricles contract.

Question 9

Many candidates knew that alcohol is a depressant. The majority of candidates who did not gain this mark thought that the kidneys, rather than the liver, break down alcohol.

Question 10

This question proved demanding for candidates who were asked to identify the effector involved when a person picks up a very hot plate and immediately drops it. Many thought that the effector was the hot plate rather than the muscles in the arm, confusing the stimulus with the effector.

Question 11

Most candidates were able to identify the uterus as the place where the embryo develops.

Question 12

Many candidates knew that respiration is the process which causes living organisms to release carbon-containing compounds from their bodies. Candidates who were not awarded this mark tended to think that the process is combustion.

Question 13

Many candidates struggled to identify why it is more energy efficient for humans to eat crop plants than to eat livestock. Many candidates selected option **D**, the Sun as the principal source of energy input into most biological systems, which is a correct statement but one which does not address the question asked. Candidates need to know that less energy is transferred to the environment when humans eat crop plants.

Question 14

Ideas about the arrangement and kinetic energy of particles in a gas were well understood.

Question 15

There was evidence of guesswork in this question. There is a misconception that the nucleon number is the number of neutrons in the nucleus.

Question 17

The general properties of covalent compounds were not well known.

Question 20

The test for oxygen was well known, although a significant number thought that a glowing splint is used to test for hydrogen and selected option **C**.

Question 21

The vast majority knew that acids turn damp blue litmus red but the fact that aqueous solutions of acids contain hydrogen ions was less well known.

Question 22

There was evidence of guesswork in this question. The trends in the properties of the elements in Group I of the Periodic Table were not well understood.

Question 24

Many candidates appreciated that aluminium is used to make food containers because of its resistance to corrosion. A significant proportion thought that aluminium is used because it is a good thermal conductor.

Question 26

The fact that chlorine is used to kill microbes to make water suitable for drinking was well known.

Question 27

There was evidence of guesswork in this question. Candidates are expected to be able to identify an alkane from a molecular formula.

Question 28

This was not well known with option **C**, the total length of the string, being the most popular choice.

Question 29

Option **B**, an incorrect option, was selected more often than the correct answer, option **C**.

Question 32

Candidates were split between options **B** (60 N / 15m) and the correct answer, option **D** (60N × 15m).

Question 33

There was uncertainty with some candidates selecting option **B** rather than the correct answer, option **D**.

Question 34

There was evidence of guesswork in this question. All options were popular choices.

Question 37

Many did not convert the unit used in the question with many selecting option **A** rather than the correct answer, option **B**.

Question 38

The symbol for a fixed resistor was not well known. Options **B** and **C** attracted a greater response than the correct answer, option **A**.

Question 39

Uncertainty between mass and neutron number had many candidates selecting option **B** rather than the correct answer, option **C**.

Question 40

The nature and properties of radioactive emissions were not well known with each option being selected by an almost equal number of candidates.

COMBINED SCIENCE

Paper 5129/12
Multiple Choice

Question Number	Key	Question Number	Key	Question Number	Key	Question Number	Key
1	B	11	A	21	B	31	C
2	B	12	A	22	C	32	D
3	C	13	D	23	A	33	A
4	A	14	A	24	C	34	D
5	B	15	C	25	A	35	B
6	D	16	B	26	D	36	A
7	C	17	D	27	D	37	C
8	B	18	B	28	D	38	B
9	D	19	C	29	C	39	C
10	D	20	A	30	B	40	A

General comments

Candidates performed very well on **Questions 1, 3, 9, 16, 17, 21 and 37**. **Questions 5, 6, 7, 8, 10, 18, 23, 29, 31 and 32** proved the most challenging for candidates.

Comments on specific questions

Question 1

This question was well answered. Many candidates knew that a smaller cube in a warmer temperature would absorb the solution surrounding it more quickly.

Question 2

Many candidates knew that enzymes are proteins and that they control the metabolic activities of cells. A few candidates thought that enzymes are changed in a reaction.

Question 3

Most candidates were able to recognise the palisade mesophyll and spongy mesophyll layers from the diagram and knew that they both contained chloroplasts.

Question 4

This question required candidates to know the pathway taken by water from the soil to the leaves. Many knew that this starts at the root hair cells, however, some thought that the pathway starts with the xylem. Candidates needed to look at the question carefully as it directed candidates to the start of the process in the soil.

Question 5

Candidates found this question demanding. Some candidates thought that the blood vessel carrying blood to the liver from the ileum is either the pulmonary artery or the pulmonary vein.

Question 6

This question proved demanding. Many thought that diffusion of oxygen and carbon dioxide occurs in the bronchi rather than the alveolus.

Question 7

The products of anaerobic respiration proved demanding for candidates. Many thought that carbon dioxide is produced during anaerobic respiration and therefore did not score the mark.

Question 8

Many candidates recognised the capillary, but fewer were able to distinguish between the artery and the vein.

Question 10

Many candidates knew that hormones are produced by glands and have specific target organs. A number of candidates thought that hormones were carried by neurones.

Question 11

Candidates are expected to identify different parts of the male reproductive system on a diagram and to describe their functions. Many were able to identify the testes as the part which produces a hormone, but the majority selected one of the incorrect options.

Question 12

This question on the carbon cycle required candidates to match the arrow on the diagram with the correct process. Many candidates knew that label **A** is the process of photosynthesis.

Question 13

Many candidates knew that deforestation leads to a loss of soil and to an increase in the concentration of carbon dioxide in the atmosphere. Candidates who did not gain this mark had not appreciated that deforestation can lead to soil erosion.

Question 14

A large proportion of the candidates knew that the particles in a gas are in constant random motion but the fact that an increase in pressure causes the particles to become closer together was less well known.

Question 15

The relative mass of a proton was well known, but a significant proportion of the candidates thought that a proton is negatively charged and selected option **A**.

Question 17

The vast majority were able to work out the value of x in the equation, but some had difficulty deducing the value of y . Candidates should be aware that in a balanced equation there are equal numbers of atoms on each side of the equation.

Question 19

There was evidence of guesswork in this question. Ideas about exothermic and endothermic reaction were not well understood.

Question 21

There was a misconception that the rate of a chemical reaction increases as the reaction proceeds.

Question 22

The test for hydrogen was well known. A significant number thought that a glowing splint is used rather than a lighted splint and selected option **B**.

Question 23

The trends in the properties of the elements in Group I of the Periodic Table were not well understood.

Question 25

Most candidate recognised that chlorine is used in the treatment of domestic water to kill microbes.

Question 27

The substances produced by cracking alkanes were well known although a significant proportion of the candidates thought that water is produced.

Question 29

Many candidates did not read the question carefully enough with option **D** being the most popular choice.

Question 31

Candidates were divided between the correct answer, option **C**, and options **B** and **D**.

Question 32

Candidates were divided between the correct answer, option **D**, and options **B** and **C**.

Question 35

Some candidates did not read carefully enough with many choosing option **C** (the voltmeter reading).

Question 38

There was evidence of guesswork with more choosing option **C** than the correct answer, option **B**.

Question 39

This was answered well although some selected option **B**, confusing the proton and neutron symbols.

COMBINED SCIENCE

Paper 5129/21 Theory

Key messages

Candidates should take care to read each question carefully. To be awarded full marks, candidates should ensure that they complete all the instructions contained within the question.

Candidates should try to match the answers they give to the number of marks available for each part of a question. A two-mark question will require two separate points to be made.

Candidates should write down the equation that is being used in all calculations, using the correct symbols for the quantities involved. All steps of the calculation should be shown.

Candidates should use data provided in the question to explain or justify conclusions.

General comments

This theory paper is the third examination of the 2023 – 2025 syllabus, but the second for the November series. Some new content was assessed for the first time. The style and the accessibility of the questions were unchanged and were therefore familiar to candidates who prepared for the exam using past papers. The questions required candidates to demonstrate skills of information handling and problem solving alongside the greater focus on knowledge with understanding.

Comments on specific questions

Question 1

- (a) Most candidates correctly interpreted the graph to find the height at 5.0 s.
- (b) Very few candidates understood that when the rocket is at maximum height, just before it falls back to the ground, it is stationary. Many candidates suggested that the rocket had constant speed. This was only awarded a mark if they specified a constant speed of zero.
- (c) Most candidates recalled the equation for speed. Few candidates realised that it was the change in distance between 5 and 10 s that was needed, not the total distance at $t = 10$.
- (d) Very few candidates gained credit. Candidates needed to recognise that the line on the graph was curved, hence showing acceleration.

Question 2

- (a) Most candidates identified A as the stomach (located between the oesophagus and the small intestine). Some candidates did not recall the name of the rectum.
- (b) Only a few candidates scored well on this question about fat digestion. The common error was in not using the information in the diagram. Some candidates may not have understood that if 100% of the fat eaten is present e.g. in the mouth, then none has been digested. Candidates also needed to explain fat digestion, and for this they needed to recall the action of lipase.

Question 3

- (a) (i) Many candidates correctly added the relative atomic masses of four atoms of phosphorous to 10 atoms of oxygen.
- (ii) Some candidates recognised that 62 g is 0.5 moles of phosphorous (P_4), then only half the mass of 5 O_2 molecules ($160/2 =$) 80 g is needed.
- (b) (i) Candidates who balanced the number of phosphorous atoms in the products and reactants generally gained this mark.
- (ii) Candidates needed to recall that distilled water is neutral pH 7. Candidates who read the information carefully correctly suggested a pH of less than 7 for the solution of phosphoric acid produced in the reaction.
- (iii) Determining the concentration of the solution was demanding for many candidates. In this example, 12 g was dissolved in one-quarter of the volume of a decimetre. So, one dm^3 would have 48 g at the same concentration.

Question 4

- (a) Many candidates recalled the equation for density and knew how to calculate the volume using length, breadth and height.
- (b) (i) A few candidates recalled that this is the angle of refraction.
- (ii) Stronger candidates drew the reflected ray at a suitable angle. Many candidates, however, drew refracting rays leaving the glass block at point B.

Question 5

- (a) Most candidates correctly identified at least one of the blood cells.
- (b) Most candidates knew that blood clots form in order to prevent further loss of blood. Another function is to prevent the entry of pathogens. Reference to infection alone was insufficient.

Question 6

Most candidates correctly joined the boxes to make at least two correct sentences about starch.

Question 7

- (a) (i) Stronger candidates used the names of the reactants (calcium and sulfuric acid) to deduce the product, calcium sulfate. A common error was calcium sulphide.
- (ii) Very few candidates were able to demonstrate a familiarity with the arrangement of apparatus that is used to collect and measure a volume of gas produced in a reaction.
- (iii) Very few candidates recalled that the positive result of the test for hydrogen is a popping sound in the presence of a flame.
- (b) Most candidate gained at least one mark for deducing the correct rate of reaction sequence.

Question 8

- (a) (i) Most candidates knew that the force of attraction between the magnet and the iron was magnetism.
- (ii) Very few candidates recalled that the force in the stretched spring was tension or elastic force.
- (b) Many candidates performed well on this question. Either they recalled the spring equation or recognised from the units for the quantities, that $m \times N/m$ produces an answer in newtons, N.
- (c) Most candidates stated that the stretching of the spring indicated the action of a force.

Question 9

Most candidates gained between three and five marks by selecting words from the list to complete the sentences about the movement of water out of plants. Candidates should be reminded that they may use words more than once.

A common misconception was that water evaporates from the stomata. Candidates should also learn that the process of osmosis is by water in the liquid phase and not in the vapour phase after evaporating from the mesophyll cells.

Question 10

- (a) Many candidates recognised that sodium is oxidised because it gains oxygen.
- (b) An ionic bond is an attraction between oppositely charged ions. Many candidates tried to explain how ions are formed or described the properties of ionic compounds and gained no credit.
- (c) Most candidates used the Periodic Table correctly to suggest a more reactive metal than sodium from the same group.
- (d) Stronger candidates understood that there are four bonding electrons. An error that was commonly seen was candidates not including the two shared electrons in the octet, hence drawing 6 unbonded electrons instead of 4 on each oxygen.

Question 11

- (a) Most candidates recognised from the greater distance between the crests, that the wavelength had increased in this wave diagram. However, since candidates were told that the frequency stayed the same, they needed to show understanding of the wave equation to deduce that the speed must also increase. Most candidates simply assumed that the wave slows down.
- (b) (i) Very few candidates recalled the term amplitude to describe the maximum height of a wave above its mean position.
(ii) A common misconception was that the wave pushes the turbine, despite the diagram clearly showing air next to the turbine. Some candidates recognised that the turbine rotates and that it is attached to a generator and that it is here that the electrical power is produced.

Question 12

- (a) (i) Most candidates knew the location of the cytoplasm in the plant cell diagram.
(ii) Some candidates could not distinguish between chloroplasts and ribosomes.
- (b) Most candidates could place a symbol for a nucleus in the cytoplasm.
- (c) Structure Z was the vacuole, and most candidates knew at least one of its functions.
- (d) Many candidates knew that mitochondria are associated with the release of energy in plant cells. Candidates should be guided by the number of marks for the question. In this case, there were two marks, but few candidates made an additional comment about respiration.

Question 13

- (a) (i) Stronger candidates recognised from the symbol equation that this combustion reaction did not produce carbon dioxide due to a lack of oxygen.
(ii) Most candidates knew that carbon particulates in the atmosphere can cause respiratory illnesses.
- (b) (i) Most candidates knew how to draw the displayed formula of methane.
(ii) Only the strongest recalled that the fossil fuel consisting mainly of methane is called natural gas.

- (iii) The strongest candidates correctly understood the negative temperatures to deduce the state of methane between melting and boiling.
- (iv) Methane is not a conductor as it has no delocalised (free) electrons.
- (v) Most candidates correctly identified methane as an alkane.

Question 14

- (a) Many candidates recognised that the negative charges were distributed as shown because they repel each other. A few candidates made the additional point that these charges are electrons that are free to move.
- (b)(i) Most candidates could identify one of the two reasons why electrostatic charges build up on aircraft when they are flying.
- (ii) Most candidates knew that there is a risk of fire or an explosion. A few candidates referred to the sudden discharge, called a spark, which causes the fire to begin.

Question 15

Most candidates correctly interpreted the bar chart showing changes in breathing rate following a period of exercise.

COMBINED SCIENCE

Paper 5129/22 Theory

Key messages

Candidates should take care to read each question carefully. To be awarded full marks, candidates should ensure that they complete all the instructions contained within the question.

Candidates should try to match the answers they give to the number of marks available for each part of a question. A two-mark question will require two separate points to be made.

Candidates should write down the equation that is being used in all calculations, using the correct symbols for the quantities involved. All steps of the calculation should be shown.

Candidates should use data provided in the question to explain or justify conclusions.

General comments

This theory paper is the third examination of the 2023 – 2025 syllabus, but the second for the November series. Some new content was assessed for the first time. The style and the accessibility of the questions were unchanged and were therefore familiar to candidates who prepared for the exam using past papers. The questions required candidates to demonstrate skills of information handling and problem solving alongside the greater focus on knowledge with understanding.

Comments on specific questions

Question 1

- (a) (i) (ii) Most candidates identified the stomach and the liver on the diagram of the digestive system.
- (b) Candidates needed to state a function for parts **Y** and **Z**. Many stated that food and then waste is transported through or stored in these structures. Stronger candidates described digestive processes – absorption of water in the colon and chemical breakdown of food in the ileum.
- (c) Most candidates gained marks for identifying correct conclusions about the graph of enzyme activity at different pH values. Some were not awarded full marks as they ticked too many boxes.

Question 2

- (a) (i) (ii) Only the strongest candidates sketched an appropriate curve to show smaller changes in distance with time on the distance–time graph. Many more candidates knew that constant acceleration is a straight line with a positive gradient on the speed–time graph.
- (b) Most candidates were able to determine a value for force and a mass that was half of that number. However, in determining the units of mass, there was a misconception amongst candidates that the gram (g) rather than the kilogram (kg) is the appropriate unit of mass. Since the acceleration has units of m/s^2 , a mass of 1g would have a much larger acceleration for the same force.

Question 3

- (a) Only the strongest candidates correctly balanced the chemical equation.
- (b)(i) Most candidates made additions to calculate the relative molecular mass of sulfuric acid.
- (ii) Candidates find proportions demanding. Here, 4 g of sulfur trioxide ($M_r = 80$) is $4/80 = 0.05$ of a mole. It reacts in a 1:1 ratio with water ($M_r = 18$) so that $0.05 \times 18 = 0.9$ g.
- (iii) Candidates needed to refer back to the stem of the question and see that sulfuric acid is produced. They also needed to recall that water is pH 7. Acids have low pH values' so the pH of the contents of the conical flask decreases when the acid is produced. A common error was to state a pH value rather than write a description of how the pH changes.
- (iv) Candidates should know that litmus only distinguishes between acids and alkalis. To get a pH value a much wider range of colour changes is needed and for this, universal indicator is required.
- (c) Candidates are required to understand proportion when determining mass from information about volume and concentration. Here, 250 cm^3 is 0.25 (a quarter) of 1000 cm^3 . So only a quarter of 10g (= 2.5g) will be dissolved in the smaller volume. Many candidates were out by factors of 10.

Question 4

In this question, candidates linked boxes containing the names of blood vessels with organs receiving blood from them. Candidates who had learned to associate coronary, pulmonary and hepatic with relevant organs performed well on this question.

Question 5

- (a) Many candidates knew that energy store in biofuel is chemical. A common misconception was that the energy store in biofuel is thermal.
- (b) Candidates should know that to release energy from biofuel gas, it must be burned. A common misconception was that it must be heated. Some candidates understood that to produce useful electrical energy a turbine must be turned (in this example by steam) and that it must be connected to a generator.
- (c) Many candidates knew that biofuels are a renewable source of energy.

Question 6

- (a)(i) Candidates generally deduced that calcium chloride was produced in this acid-carbonate reaction but few recalled that water is also produced.
- (ii) The apparatus used to collect the gas released in a chemical reaction is called a gas syringe. Many candidates gave the answer 'measuring cylinder', but a measuring cylinder alone is not sufficient as to collect gas, it needs to be filled with water and inverted in a trough.
- (iii) Most candidates could recall the test and the positive result of the test for carbon dioxide.
- (b) Most candidates gained at least one of the two marks for deducing the order of reactivity from the particle size, acid concentration and temperature.

Question 7

- (a) Most candidates gained at least one mark for making correct sentences relating to glucose. A common error was to link glucose to the list of elements but glucose does not contain nitrogen.

Question 8

- (a) Candidates should follow the instructions in the stem of the question. For these three marks, comments needed to be made about air particles in terms of their motion, their separation and the forces between them when they are heated. A common error was to try explain the observation in

terms of convection. Only a few of the strongest candidates were able to make one or two relevant comments. In this scenario, which is common to many others that assess kinetic theory, the particles move faster and move further apart when the forces between them weaken.

- (b) This was a demanding question for candidates. However, candidates should recognise that the air in the balloon will cool down unless it is re-heated. The balloon will lose altitude as the cooling air becomes denser. Candidates should learn about situations in which thermal energy is lost to the surroundings and why that that loss might be a problem.

Question 9

- (a) Candidates needed to describe what happens to iron(III) oxide in the equation. Here, iron is produced because the iron(III) oxide loses oxygen, hence is reduced.
- (b) Many described ionic compounds as a metal combined with a non-metal. However, this was irrelevant as the question asked for properties not descriptions. Here, candidates needed to recall that ionic compounds have high melting points and that they conduct electricity in the molten state.
- (c) Carbon in Group IV has four bonding electrons, oxygen in Group VI has two. Each bond has two electrons from one carbon and two electrons from each oxygen to make four in each bond. Candidates who understand this correctly completed the remaining four unbonded electrons on each oxygen. Candidates should be encouraged to use the Periodic Table to deduce bonding rather than try to rely on recall.

Question 10

- (a) A few candidates recalled that water leaves the surface of the mesophyll cells inside the leaf but only the strongest understood that the process is evaporation. Some candidates also recalled that diffusion of water out of the leaf is through structures called stomata.
- (b)(i)(ii) Most correctly interpreted the graph of rate of transpiration against an environmental factor.
- (iii) Many candidates referred to photosynthesis but this was not a sufficient explanation. Only an *increase* in the rate of photosynthesis can explain why the rate of transpiration increases. Some candidates also referred to loss of water. Again, this is insufficient as it describes transpiration but does not explain why the rate changes. A commonly seen correct answer was the effect of sunlight on raising the temperature of the leaf.

Question 11

- (a) Many candidates recognised that the resistors are 'in the same line'. Candidates should be encouraged to use the terms series and parallel to describe the arrangement of components and meters in circuits.
- (b) Many candidates recalled the equation $V = IR$. By applying $V = 10$ and the resistance of one of the branches some candidates gained a second mark for calculating the current in one branch. A third mark was gained by candidates who calculated the sum of the currents in both branches.

Question 12

- (a)(i) Candidates should recall that for combustion to occur a fuel also requires the presence of oxygen. A common misconception was that hydrogen is required.
- (ii) Most candidates knew that carbon dioxide has an adverse effect on the global climate. The responses of some candidates indicate that they do not understand the phrase 'adverse effect'.
- (b)(i) Most candidates were able to construct a displayed formula. Candidates should recall that ethene is an alkene and therefore should have a double carbon-to-carbon bond.
- (ii) Most candidates knew that states of matter are described using the terms solid, liquid or gas. However, negative temperatures caused some difficulties for candidates. Here, a substance boils at -103.7°C . Therefore, at -90°C its temperature has increased so it will be a gas.

- (iii) Candidates should know that there are forces of attraction between the molecules of a substance. If the substance has a low boiling point it is due to the relative weakness of these forces. Candidates should also know that gases, such as ethene, are simple molecules or small molecules which is also a sufficient explanation for their low boiling temperatures.
- (iv) Many candidates recalled that cracking is the process of producing ethene from large alkanes.
- (v) Most candidates recognised from this list of options that ethene is an alkene. A commonly seen error was to draw a ring around two answers.

Question 13

Most candidates gained at least two of the five marks by selecting words to complete sentences about human reproduction. A common misconception was that the fertilised egg cell is called an embryo rather than a zygote.

Question 14

- (a) Most candidates gained both marks for correctly linking the listed regions of the electromagnetic spectrum with their applications.
- (b) Most candidates recalled that gamma rays are ionising.
- (c) (i) Only the strongest candidates could interpret the model of the atom. Candidates should know that the central structure is called the nucleus. A common error was to name either a proton or a neutron. Particles in orbit are electrons. A common error here was to name it as a beta particle. Particle **P**, was described as ionising radiation and it was shown composing of particles contained in the nucleus. A few candidates were able to deduce that this was an alpha particle.
- (ii) In this question candidates were directed to use the Periodic Table. However, many candidates were not able to interpret the Periodic Table correctly. It was clear from many responses that candidates did not realise the diagram represented boron because it had 5 protons and 6 neutrons.

COMBINED SCIENCE

Paper 5129/31 Experimental Skills and Investigations

Key messages

Candidates should be familiar with terms in 'The language of measurement' in the syllabus. This covers many of the key words whose understanding is tested in this paper.

When candidates refer to a quantity of a substance, they need to use specific terms such as volume rather than amount.

When drawing graphs, candidates should;

- label the axes fully with both a quantity and the specific unit
- use a sensible scale
- plot neat points to cover at least half of the grid
- draw a single line of best fit.

General comments

Candidates found the planning question demanding. Candidates should ensure they address all the bullet points in order to gain maximum marks.

Comments on specific questions

Question 1

- (a) (i)** Many candidates were able to record the temperature shown on the thermometer as 18.2 °C.
- (ii)** Many candidates were able to record the temperatures of the different water-baths with the correct precision. Many struggled with the correct recording of the minimum time needed to break down the starch.
- (b) (i)** This question proved demanding for those candidates that had not appreciated that the temperature at which the amylase would break down the starch most quickly would be their result from **(a)(ii)** which had the lowest recorded minimum time.
- (ii)** Many candidates were unsure about what would improve the repeatability of the experiment. Candidates who gained this mark knew that the experiment needed to be repeated under the same conditions and that an average could be calculated.
- (iii)** In the experiment the results were taken every 25 s, and the candidates were asked how the accuracy of the results could be improved. Many did not appreciate that 25 s between taking results was quite a long time and that by reducing the time interval to, for example, every 10 seconds a more accurate time for the starch to be broken down could have been obtained.
- (c)** Many candidates knew the test for glucose and were able to name the positive result. There were some candidates who thought that glucose was tested using iodine and that the positive result for glucose would be blue-black and therefore did not gain credit.
- (d) (i)** Many candidates were able to measure the length of the drawing. However, some candidates did not notice that the units on the answer line were in mm and gave a value in cm.

- (ii) The formula needed to calculate the magnification was given in the question and most candidates were able to use their values from (d)(i) to correctly calculate the magnification.

Question 2

- (a) (i) Most candidates were able to record the masses from the balance diagrams.
 - (ii) Many candidates were able to calculate the mass of the ethanol in the burner from their recorded results.
 - (iii) This question required candidates to calculate the temperature change from the data given and many of the candidates were able to calculate this value to the required level of precision.
 - (iv) The plotting of points and drawing the line of best fit was demanding for many candidates.
 - (v) Candidates who found the plotting demanding also found this demanding and could not always identify the anomalous result from the data.
 - (vi) In this question candidates needed to extend their line of best fit and use this to calculate the temperature change when 2.9 g of ethanol was burnt. Candidates who extended their line of best fit tended to score two marks on this question. However, there was a significant number of candidates who did not extend their line and just gave a value without any indication of how they achieved it.
- (b) The majority of the candidates had not considered the fact that heat might be lost to the surroundings in this experiment. Many thought that the student had not done the experiment correctly and therefore should repeat it.

Questions asking how to improve a procedure are common in this paper. Candidates should be reminded to look at the specific experiment when this question is asked, and give changes specific to that experiment, rather than give a general idea.

Question 3

- (a) Many candidates gained one mark for drawing the ruler. Candidates were asked to place the ruler so that it could accurately measure the height. This tended to be where candidates missed the mark as their rulers were drawn a long way away from where the ball was dropped.
 - (b) (i) Many candidates knew why the TARE button was pressed when the clay was placed on the balance.
 - (ii) Most candidates knew which result was anomalous.
 - (iii) In the previous question, candidates identified the anomalous result. Some candidates included this anomalous result in their calculation of the average value rather than excluding it as they should.
 - (iv) The instruction given required candidates to measure and record an average value of the diameter and show their working. Most candidates only gave an answer on the answer line, with no working given in the space provided, reducing the number of marks they could gain.
- (c) Many candidates were able to identify the trend in the graph.
- (d) This question proved demanding for many candidates. Suggestions included having a soft-landing area so that the ball did not roll away. Many had not appreciated the need to have sand or another material that the ball could land in and leave a mark that could then be observed.
- (e) Many candidates were able to identify a reason why the results may be different when one of the variables had been changed.

Question 4

The planning question always includes a set of bullet points which candidates need to address as part of their answer. Candidates needed to include at least one point from each bullet point and then any three others in order to gain full credit.

Stronger responses came from candidates who addressed the bullet points individually and who provided a table into which results could be added with correct labels and units in the headings.

Many knew that the heart rate would need to be measured before and after exercise. However, many did not describe what they would use to record their heart rate and many described the recording of breathing rates rather than heart rates.

Most candidates found it difficult to process the results from their experiment and to draw a conclusion based on their processed results with many giving a conclusion from prior knowledge rather than explaining *how* the results could be used to say if the given prediction is correct.

COMBINED SCIENCE

Paper 5129/32 Experimental Skills and Investigations

Key messages

Candidates should be familiar with terms in 'The language of measurement' in the syllabus. This covers many of the key words whose understanding is tested in this paper.

When candidates refer to a quantity of a substance, they need to use specific terms such as volume rather than amount.

When drawing graphs, candidates should;

- label the axes fully with both a quantity and the specific unit
- use a sensible scale
- plot neat points to cover at least half of the grid
- draw a single line of best fit.

General comments

Candidates found the planning question demanding. Candidates should ensure they address all the bullet points in order to gain maximum marks.

Comments on specific questions

Question 1

- (a) Many candidates were able to draw one of the lines correctly from the information given.
- (b) Candidates tended to score at least one mark for $\theta_i > \theta_r$.
- (c) Candidates tended to score at least one mark for $a < b$.
- (d) Candidates were given the equation to use and were asked to provide their answers from (c) to produce a value to 3 significant figures. Many candidates were able to produce a value to the correct number of significant figures even when they gave the wrong values in their equation, scoring at least one mark.
- (e) Most candidates found this question very demanding, with many of them ticking one of the boxes but not showing a calculation to support their answer and not scoring the mark as a result.
- (f) Many of the candidates found this question demanding.

Question 2

- (a) (i) Most candidates knew that a thermometer was needed to measure the temperature of the solution. However, only the stronger candidates knew that a pipette or a burette would be needed to measure the volume of 25.0 cm^3 to the precision indicated by the decimal place.
- (ii) This mark was awarded to candidates who recorded the two values to the same level of precision. Many who did not gain this mark recorded 18, rather than 18.0.

- (iii) Most candidates were able to plot the two points on the graph.
 - (iv) Many candidates were able to follow the instructions and draw two lines that intersected.
 - (v) Candidates who were able to draw the lines and produce an intersection were then able to use the point of intersection to calculate the lowest temperature that the mixture reached.
 - (vi) This question proved demanding for many candidates. Many had not appreciated that they had to subtract their value from 21.5 °C. Many used the value of 21.0 °C.
- (b) (i) Candidates were asked to use the data to explain why the reaction was endothermic. Many candidates knew that an endothermic reaction gains heat from the surroundings, however, only the strongest candidates knew that this would cause a drop in temperature as seen in the results from 0 to 60 s.
- (ii) Candidates had to suggest why the results from the experiment were higher than the true values for the experiment. Many had not appreciated that the experiment was carried out in a beaker and therefore heat would transfer from the surroundings into the solution inside the beaker. A few candidates gained the mark for using insulation as a means of preventing the heat transfer.

Question 3

- (a) Many candidates knew that either the type or volume of the agar would need to be kept constant to ensure that the experiment was a fair test. Many of them wrote that the experiment would have to be carried out for the same length of time and did not gain a mark as this was given in the question. Candidates need to read through the information given to ensure that they do not repeat information as this will cause them to miss valuable marks.
- (b) (i) This was a well answered question with many candidates scoring the two marks available.
- (ii) Candidates were given the formula to use to calculate the area of the circle and were provided with the diameter of the circle in the table. Many candidates were able to convert the diameter value into a radius value and then correctly calculate the area of the circle.
- (iii) This question tested what is meant by accuracy in an investigation. Centres are reminded that there is a section in the syllabus 'The language of measurement' that covers such terms. Many candidates who did not gain this mark described repeating the experiment but did not include averaging their results.
- (c) Candidates were asked to make a large drawing of the thumb. Candidates are marked on their ability to produce a scientific drawing from the photograph provided. Drawings should have an outline drawn with a single clear line, no shading and a drawing that uses at least half of the available space.

Question 4

The planning question always includes a set of bullet points which candidates need to address as part of their answer. Candidates needed to include at least one point from each bullet point and then any three others in order to gain full credit.

Stronger responses came from candidates who addressed the bullet points individually and who were able to sketch a graph of the results they would obtain if the suggested relationship was correct.

Many were able to suggest the use of a protractor to measure the angle at which the block slides or a set of scales to measure the mass.

Many candidates found it difficult to suggest repeating the experiment or to give a range of values of mass of the block to use. However, many were able to give one of the control variables, the most common one given being the material from which the slide was made. Many stated 'use the same block' which was not creditworthy.