COMBINED SCIENCE

Paper 0653/12
Multiple Choice (Core)

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

General comments

Candidates performed very well on **Questions 1, 4, 7, 17**, **26, 29 and 39**. **Question 28** caused difficulty for many candidates.

Comments on specific questions

Question 2

Many candidates answered this question correctly. Where candidates did not answer correctly, they usually chose an option with a plant and animal cell structure (option **B** or **C**).

Question 3

Most candidates recognised that fats are made up of fatty acids and glycerol. Some candidates thought that proteins were made of glycogen and starch from amino acids.

Question 5

Some candidates found this question more challenging, with some choosing the cuticle as the epidermis (option **A**) and others choosing the palisade mesophyll layer (option **C**).

Question 6

Most candidates selected the correct option. Some other candidates chose option **C** or **D**. Candidates should ensure they have experience of 'apply' questions. These questions test the science in an unfamiliar context.

Question 8

Option **D** was a common incorrect answer. This indicated that some candidates thought that the volume of breath during exercise and rest was the same, and that it was only the frequency of breaths that changed.

Question 9

Many candidates answered this correctly. Options **C** and **A** were common incorrect answers. Very few candidates chose option **D** (photosynthesis).

Question 10

This was answered well by many candidates. Some candidates chose option **B**, recognising the increase in pulse rate, but not the pupil dilation.

Question 11

Most candidates identified that asexual reproduction only requires a single parent, but some thought that the offspring were genetically different. It may be that these candidates did not read the question and options carefully enough.

Question 12

Some candidates found this question challenging. It may have helped these candidates if they had annotated the diagram to help them answer the question.

Question 13

Some candidates selected option **B**. While the burning of fossil fuels does release carbon into the atmosphere as carbon dioxide, fossilization itself traps carbon in the ground.

Question 14

Many candidates answered this correctly. The most common incorrect answer was option **B**.

Question 16

This question was generally answered well. A common incorrect answer was option **A**.

Question 18

Some candidates chose the incorrect option **D** rather than the correct answer, **A**. They were expected to know the factors that affect the rate of a reaction, and thereby deduce the set of conditions that results in the highest rate of reaction.

Question 19

Many candidates answered this correctly, but some chose the incorrect option **D** rather than the correct answer, **B**. Candidates needed to know that redox reactions involve the loss and gain of oxygen, and to interpret simple symbol equations.

Question 20

While most candidates answered correctly, some chose the incorrect option **B** rather than the correct answer, **A**. They are required to know the test for ammonium ions and that this test produces ammonia gas.

Question 22

Many candidates knew that Group I elements increase in reactivity down the group.

Question 23

Some candidates chose the incorrect option **A** rather than the correct answer, **C**. Candidates needed to be able to place the named metals in order of reactivity by reference to their reactions with water and dilute hydrochloric acid, and to know the position of carbon in the reactivity series.

Question 25

Most candidates chose the correct answer, **B**. A common incorrect answer was option **C**. They needed to know that the combustion of fossil fuels uses up oxygen and produces carbon dioxide.

Question 28

Many candidates found this question challenging. Some candidates understood that neither graph represented the motion of a car moving at constant speed. Both options **A** and **B** were popular incorrect choices.

Question 29

This calculation question on density was very well answered.

Question 31

Some candidates thought that the gravitational potential energy of the load increases, as well as the elastic potential energy of the spring (option **D**).

Question 32

The topic in this question was renewable energy sources. A significant number of candidates chose option **D**, which included coal.

Question 35

Some candidates chose the incorrect option **B**, perhaps considering a reflected ray but failing to realise that this option could only be correct for an angle of incidence of 0°.

Question 37

This question was well answered. A small number of candidates chose option **D**.

Question 40

Although most candidates realised that the parallel arrangement in **A** had the smallest resistance, some candidates thought that the answer must be the single resistor in option **D**.

COMBINED SCIENCE

Paper 0653/22
Multiple Choice (Extended)

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

General comments

Candidates performed very well on **Questions 1, 4, 12, 13, 15, 26, 29** and **34**. **Question 16** proved the most challenging.

Comments on specific questions

Question 2

Some candidates selected the incorrect option **B**. The large permanent vacuole that is found in plants is not found in animals. It is not expected that candidates at this level are taught about smaller temporary vacuoles found in animals (e.g. contractile vacuoles).

Question 3

Some candidates selected the incorrect option **B**. Candidates should ensure they read the question very carefully and if needed draw a diagram on the question paper to work out their answer.

Question 5

Most candidates answered this question well, but some chose option **A** (the cuticle) as the epidermis.

Question 6

Most candidates were able to eliminate option **B** (constipation) but all the other options were selected.

Question 7

Most candidates answered correctly. The most common incorrect choices were options **C** or **D**. In preparation for the exams it is essential that candidates have experience of 'apply' questions. These questions test the science in an unfamiliar context.

Question 8

This was usually answered correctly. The most common incorrect answer was option **B**.

Question 9

Most candidates associated mucus in the gas exchange system in mammals with trapping pathogens. However, some candidates incorrectly thought that the function of the cilia was to make mucus.

Question 10

Most candidates answered this question correctly. Some candidates chose the incorrect option **B**, recognising the increase in pulse rate, but not the pupil dilation.

Question 11

Most candidates answered this well. Where candidates did not choose the correct answer, they usually chose option **B** or **C**.

Question 16

Candidates chose the incorrect option **C** more often than the correct answer, **D**. Although most candidates clearly understood that ionic bonding is strong, they did not recognise that the boiling points of simple covalent molecules are relatively low because the attractive forces between the molecules is weak. Candidates should also understand that when simple covalent substances boil, the covalent bonds within the molecules do not break.

Question 17

Most candidates answered this well. The most common incorrect answer was option **D**.

Question 19

Some candidates found this more challenging. Many candidates chose option **B** or **C**.

Question 22

While most candidates answered correctly, some chose the incorrect option **B** rather than the correct answer, **A**. They are required to know the test for ammonium ions and that this test produces ammonia gas.

Question 24

Some candidates chose the incorrect option **D** rather than the correct answer, **A**. Candidates needed to know the colours of aqueous halogens, and that these colours only change when a more reactive halogen is mixed with a less reactive aqueous halide.

Question 28

Many candidates found this question challenging. Some candidates understood that neither graph represented the motion of a car moving at constant speed. Both options **A** and **B** were popular incorrect choices.

Question 30

Some candidates did not realise that it was the difference of the masses that had to be divided by the difference in volumes. This led them to make the mistake of dividing the combined final mass of the oil and measuring cylinder by the final volume of the oil, therefore selecting the incorrect option **D**.

Question 31

Some candidates thought that the gravitational potential energy of the load increases, as well as the elastic potential energy of the spring (option **D**).

Question 33

A common misconception here was that molecules gain kinetic energy and move along the bar (option **C**).

Question 36

The topic here was the magnifying glass, and some candidates found the question challenging. Many knew that the object is placed on the opposite side of the lens to the eye but chose the wrong object distance (option **A**). Other candidates chose the correct object distance but thought that the object is placed on the same side of the lens as the eye (option **D**).

Question 37

Many candidates made the common mistake of failing to convert the time given to seconds, leading them to choose the incorrect option **B**.

Question 40

Although this was well answered overall, some candidates selected either option **B** (having the smaller value of individual resistances) or option **D** (having a single resistor).

COMBINED SCIENCE

Paper 0653/32
Theory (Core)

Key messages

- Candidates should be reminded to read the information given in the question carefully.
- Where a question refers to a trend, candidates should ensure this is what is described.
- Care should be taken when drawing diagrams and annotations to ensure accuracy. Candidates should use a ruler when appropriate.

General comments

Many candidates had prepared well for the examination across all three science disciplines and gave good answers. Some candidates found interpretation of data challenging.

The use of space on the paper was good, with few candidates either repeating the question in the answer or having to continue their responses beyond the allocated space. On occasion answers were very unclear and handwriting was poor.

Comments on specific questions

Question 1

(a) (i) Most candidates identified the organs of the human body correctly.

(ii) Most candidates gave the correct answer, absorption. Incorrect responses included various descriptions of digestion, which was given in the question.

(iii) Most candidates identified the heart as the organ that pumps blood around the body.

(iv) Many candidates stated anus correctly. The most common wrong answer was rectum.

(b) (i) Many candidates found this question challenging, with only some gaining full credit. Correct responses described how the activity of enzyme **A** changes as the pH increases. Many candidates identified the pH optimum at pH2, but did not describe the increase in activity between 0 and 2, and the decrease in activity between 2 and 4. Credit was not given to responses which referred to pepsin, or the proteolytic activity of enzyme **A**. Identification of the enzyme was not necessary to gain full credit.

(ii) Candidates found identifying enzyme **B** straightforward, but their explanations often did not refer to the activity of the enzyme. Many candidates stated that enzyme **B** is amylase and included references to starch digestion. No credit was awarded for this information. Full credit was awarded for correct interpretation of the graph.

(iii) Most candidates identified platelets correctly.

Question 2

(a) This question was generally answered well. Incorrect answers included examples of fuels, for example, diesel, kerosene and methane.

(b) Many candidates answered this question correctly. Common incorrect answers were coal, gas, oxygen and carbon dioxide.

(c) (i) Most candidates gained full credit for this question.

(ii) The use of bitumen in road making was widely known. Other valid uses such as waterproofing were also given credit.

(d) (i) Candidates answered this question well.

(ii) Most candidates gave a valid difference between ethane and ethene, either by description or formulae. A small number of candidates confused ethane and ethene.

(e) Most candidates answered this correctly.

Question 3

(a) Most candidates wrote 10 (m/s) and gained full credit. The most common errors were 9 or 9.5 m/s.

(b) (i) There were some good responses here. However, some candidates did not mention a change in speed.

(ii) Many candidates placed their **X** at some point on the sloping lines of the graph and gained credit.

(c) This question was generally answered well. Most candidates were familiar with the equation needed for the calculation. Candidates should remember to include the equation they are using in their calculation and to show their working, so that some credit may be gained if an error leads to the wrong answer.

(d) (i) The arrow showing the driving force was drawn correctly by many candidates. To gain full credit it had to be horizontal. In some cases, the drawing was not precise enough for credit to be awarded.

(ii) Candidates found this question challenging. Most of the responses, worded in different ways, stated that the car would slow down or stop without a driving force. There were few references to the frictional forces acting against the forward motion of the car.

(e) Candidates knew that the energy contained in gasoline is chemical energy. Most also stated that the energy of the moving car is kinetic energy. Some candidates gave mechanical energy for this response which could not be credited.

Question 4

(a) Most candidates gained full credit by connecting the parts of the male reproductive system to their function.

(b) The correct letters of the female reproductive system were given by many candidates. Candidates should be aware that they should supply only letters if this is stated in the question. Credit could not be awarded to a correct letter accompanied by an incorrect name.

(c) (i) Most candidates stated the correct body temperature of the female.

(ii) Many candidates stated ovary and gained credit.

(iii) While most candidates interpreted the graph correctly to state the trend of decreasing temperature, there were some candidates who did not gain credit. Generally, these candidates just read the temperatures from the graph on day 25 and day 29 and did not describe what was happening on the days between, as requested in the question.

(iv) Some candidates answered this part correctly. Others either stated that the lining of the uterus is increasing between days 1 and 5, or interpreted the temperature graph, and stated that the lining increased and decreased.

Question 5

(a) Candidates found it challenging to decide which property of metals was appropriate for a paperclip. Only some candidates wrote malleability. Magnetic properties, high melting and boiling points and the ability to conduct heat and electricity were not considered essential for a paperclip. Therefore, these responses did not gain credit.

(b) (i) Most candidates described an alloy correctly. It was important to state that the alloy is a mixture, so any reference to compounds did not gain credit.

(ii) Many candidates gained full credit by stating that the alloy gives the spanner more strength, or increased resistance to corrosion.

(c) Some candidates stated the trends correctly. Others either got the trends the wrong way around or did not include any sort of trend in their answers.

(d) (i) Most candidates answered this question correctly.

(ii) The formation of coloured compounds was the most popular correct answer. Incorrect responses included any of the properties included in the question and other properties of metals that are not unique to copper and iron, for example conduction of heat or electricity.

(e) In general, candidates found this challenging and only some candidates seemed to be familiar with this type of question. Some candidates did not copy the inner-circle electrons properly. Others did not produce complete outer shells in their responses.

Question 6

(a) Conduction and convection were correctly stated by most candidates.

(b) (i) Many answers showed the U-tube with a lower water level on the left and these gained full credit. Incorrect responses had a higher level of water on the left, or the level of water in both arms of the U-tube at the same height. The expansion of gas from the flask forces the level of water in the left-hand tube to go downwards.

(ii) Many candidates found this question challenging. The motion and separation of the gas molecules after the gas in the flask is heated had to be compared with the motion and separation of gas molecules before heating. Therefore, answers should have been comparative. For example, “the molecules move faster and the distance between them becomes greater”.

(c) The term boiling was needed here. Some candidates stated evaporation.

(d) (i) Most candidates were successful in placing visible light in the correct box in the middle of the electromagnetic spectrum.

(ii) Many candidates found this question challenging. Many candidates did not identify the wavelength correctly. Some candidates attempted to indicate the wavelength on the diagram but were not accurate enough. Candidates needed to annotate as accurately as possible, so there is no doubt in their response.

Question 7

(a) (i) This question was generally well answered. A tertiary consumer was identified by most candidates.

(ii) Most candidates correctly identified a herbivore.

(iii) Most candidates drew two correct arrows on the diagram. A few candidates either drew their arrows facing the wrong direction or connected the wrong organisms.

(b) (i) Oxygen was correctly stated by most candidates. The most common error was carbon dioxide.

(ii) Most candidates gained full credit for this question. However, some candidates did not mention photosynthesis, stating for example, that the reaction shuts down in the dark.

(c) Xylem was stated by many candidates. Incorrect answers included phloem and root hair cells.

(d) Generally, this question was quite well answered. Incorrect responses included transpiration and photosynthesis.

Question 8

(a) (i) There were many correct calculations shown. However, some candidates did not subtract the atomic number from the mass number to get the number of neutrons. Therefore, 82 and 207 were the most common errors. Incorrect answers for the number of electrons included 207 and 125.

(ii) Many candidates did not give a complete response to this question. To gain credit, answers had to refer to a number of protons in the nucleus. Many responses just stated that the protons are positively charged. Others stated that the proton number is the number of protons in the lead.

(iii) This was usually answered well. Candidates were aware of the charges in the subatomic particles.

(b) (i) Most candidates knew the term electrolysis.

(ii) Many candidates knew the correct name of the negative electrode where the lead forms. The most common error was anode.

(c) (i) The idea of a reaction taking in heat from the surroundings was known by most candidates. However, some candidates described an exothermic reaction.

(ii) Many candidates completed the word equation correctly using the given information. Some candidates referred to the electrolysis at the top of the page and included lead bromide in the equation so did not gain credit. Careful reading of the question indicates that **(c)** is a separate reaction. Other candidates used water as one of the reactants. The two reactants, lead oxide and carbon were given in the question and needed to be written in the boxes on the left. The other product carbon dioxide should have been written in the box on the right.

(iii) Candidates who were familiar with reduction being the removal of oxygen gained full credit. Some candidates circled reduced, but did not give any, or good enough explanations. Many candidates wrote oxidised so gained no credit.

(d) Some candidates gained credit by stating lead carbonate. Other candidates stated the salt product of the reaction, namely lead chloride, which did not gain credit.

Question 9

(a) (i) Some candidates drew a parallel circuit successfully. Others drew a series circuit. In the parallel circuits drawn, some candidates mistakenly drew one switch in the main circuit, and one in one of the branches. Candidates needed to be aware that there should not be any extra components in their circuit diagrams.

(ii) Most candidates carried out a successful calculation using Ohm's Law. Fewer candidates knew the unit for resistance, the ohm. Incorrect answers included **I**, **V/I**, **A**, λ and **C**.

(iii) Knowledge that the current in the main circuit is divided in a parallel circuit was needed for this question. Many candidates answered this correctly.

(b) Candidates found this question challenging. Care should be taken when drawing ray diagrams. A ruler should be used, and arrows added to the ray to show the direction of travel. In this question candidates had to show the normal, so a protractor should also have been used. Many candidates did not do this, and the normal rays were not at 90° to the mirror. A protractor would also have helped candidates to make the angle of incidence equal to the angle of reflection. In some responses the ray did not originate from the lamp or enter the eye.

COMBINED SCIENCE

Paper 0653/42
Theory (Extended)

Key messages

Candidates who did well on this paper:
- read the questions carefully and avoided lengthy, irrelevant details in their answers
- recalled syllabus definitions
- drew electric circuit symbols as they are shown in the syllabus
- where appropriate, included the symbolic formula in calculations in addition to clearly presented working
- avoided using chemical symbols in chemical word equations.

General comments

Many candidates had a very good understanding of the syllabus and gave clear, well-organised answers. Performance across the three science disciplines was well balanced. Candidates usually showed their working in questions requiring calculation, which is good practice. There was no evidence that candidates had difficulty in finishing the paper in the time allowed.

In Biology, candidates showed that they had learned and understood the details and importance of photosynthesis as shown in **Questions 1(b)** and **(c)**, feeding relationships in **Question 4(a)** and the circulatory system in **Questions 7(a)** and **(b)**. Not all candidates had a clear understanding of the term trophic level in **Question 4(a)(ii)**.

In Chemistry, most candidates had a good knowledge with understanding of atomic structure as shown in **Questions 2(a), (b)** and **(c)**, oxidation and reduction in **Question 5(b)(iii)**, metal reactivity in **Question 5(c)** and acids and bases in **Question 8(b)(i)**. Not all candidates had learned how to draw a dot-and-cross diagram of carbon dioxide in **Question 2(c)**.

In Physics, most candidates could use a speed-time graph to calculate acceleration and distance in **Questions 3(b)** and **(c)**. They understood the concept of balanced forces in **Question 3(d)(i)** and could describe the characteristics of molecules in the gaseous state in **Question 6(a)(i)**. Not all candidates could describe the propagation of sound in terms of compression and rarefaction or draw a clear diagram to show this, as evident in some answers to **Question 6(b)(iii)**.

Comments on specific questions

Question 1

(a) (i) Most candidates recognised the liver.

(ii) Most candidates gained credit for stating that hydrochloric acid in the stomach kills bacteria. Some candidates also understood the importance of the acidic environment needed for stomach enzymes to work. A few candidates incorrectly stated that the acid provides a high pH needed by enzymes.

(iii) Most candidates gave correct answers. Candidates should be advised to use the term “mechanical” rather than “physical” digestion.

(b) (i) The equation for photosynthesis including chlorophyll was known by most candidates. Candidates should be advised to avoid using chemical formulae in word equations.

(ii) The use of iodine to test for starch was very familiar to most candidates. To gain full credit, candidates needed to make it clear that glucose is first formed and that this is then converted to starch or simply stored as starch. Some candidates incorrectly stated that starch is produced by photosynthesis directly.

(c) Many candidates described the relationships clearly. However, some candidates did not include any reference to temperature, or attempted to describe a relationship connecting light intensity and temperature.

Question 2

(a) Most candidates gained full credit.

(b) The relationship between the number of outer shell electrons and group number was familiar to most candidates. However, some answers lacked sufficient detail. A typical example of this was "the number of electrons in the outer shell of Group VI is similar".

(c) Many candidates added the electrons to the diagram correctly. Some gained partial credit for showing the two double bonds but omitted the lone pairs on the oxygen atoms.

(d) Many candidates deduced that the physical state of carbon dioxide would be a gas.

(e) Many candidates gained full credit for describing both the global temperature increase and an environmental problem caused by it. Some candidates gave detailed explanations of the processes that cause increased carbon dioxide to increase global temperatures. Full credit was awarded only if an example of an environmental problem was also described.

Question 3

(a) Most candidates correctly read 9 (m / s) from the graph. Common mistakes included stating the speed at the top of the hill and misreading the scale on the speed axis.

(b) Many candidates gained full credit, showing the relationship used, clear working and correct units. Some candidates gained at least partial credit for stating the expression "change in speed ÷ time taken for the change" even if they could make no further progress with the calculation. Where candidates had shown clear working, it was often possible to award full or partial credit by allowing an error carried forward from **(a)**.

(c) Many candidates were familiar with this type of calculation and knew that an area under the line on the graph had to be calculated. Partial credit was awarded when a correct but incomplete area calculation was clearly shown.

(d) (i) Most candidates gained credit, identifying force **Q** either as friction and/or air resistance.

(ii) Some candidates gained full credit showing that they understood the concept of balanced forces acting on an object moving with constant speed. Other candidates thought that because the car moved forward, force **Q** had to be smaller than force **P**.

(iii) Most candidates were familiar with the use of "work done = force × distance" and gained full credit.

Question 4

(a) (i) Most candidates gained full credit.

(ii) Some candidates had learned the syllabus definition of trophic level and gained full credit. Other candidates seemed to be familiar with the concept but found it difficult to express the idea clearly.

(iii) Many candidates could extract the required information from the food web and gained full credit. Some candidates incorrectly suggested that the primary consumer was the aphid. Some candidates did not describe the feeding relationships, using vague phrases such as "it goes to the slug and hedgehog and then the fox".

(b) Candidates needed to explain both of the processes leading to increased carbon dioxide. A common omission was the release of carbon dioxide during combustion. Some candidates did not make it clear enough that removal of trees would decrease the removal of carbon dioxide. A typical answer illustrating this was “because there are no trees there won’t be any photosynthesis”. A small number of candidates seemed unfamiliar with this part of the syllabus and described problems caused by a lack of oxygen.

Question 5

(a) Most candidates selected either iron(II) oxide or iron(III) oxide.

(b) (i) Many candidates correctly identified equation 1.

(ii) Most candidates identified carbon monoxide. Carbon dioxide was the most common incorrect answer.

(iii) Some candidates gained full credit. At least partial credit was awarded to most candidates because they identified the substance which was oxidised in equation 1. Common mistakes in the second part included carbon and oxygen. Common mistakes in the third part included reversal of carbon monoxide and iron oxide and giving iron rather than iron oxide.

(c) (i) Full credit was frequently awarded.

(ii) Most candidates selected a correct metal, and many went on to explain that the metal of their choice is more reactive than carbon.

(iii) The use of electrolysis to extract the metal of their choice in **(ii)** was very familiar to most candidates.

Question 6

(a) (i) Many candidates gained full credit. Most candidates gave correct descriptions of at least one of the three required characteristics. Candidates should be advised to avoid the term “packing” when describing the arrangement of molecules in a gas. Credit was not awarded for suggestions such as “packed freely”.

(ii) Most candidates answered this question correctly.

(iii) Some candidates gained credit for realising that the temperature would increase or that thermal energy (heat) would be released. Candidates should be advised to avoid suggesting that energy, in this case thermal energy, is created. Suggestions that could not be awarded credit included references to increased kinetic energy or increased pressure as these were already given in the question parts.

(b) (i) Most candidates correctly indicated the amplitude on the diagram. The best arrows or lines were drawn carefully with a ruler and were touching the axis and the middle of the peak or trough.

(ii) Most candidates knew that the relevant variables were (wave) speed, frequency and wavelength. Many knew the correct relationship between these variables and gained full credit.

(iii) Some candidates were familiar with one of the usual diagrams used to show sound waves, and many used the terms compression and rarefaction. Most candidates attempted a diagram but many of these were inaccurate.

Question 7

(a) (i) A small number of candidates gained full credit. When answering questions involving coronary heart disease, candidates need to take care to distinguish between blood going to the heart and blood supplied to the heart muscle. Only some candidates went on to discuss the effect on respiration in heart muscle cells.

(ii) Most candidates were familiar with the risk factors for coronary heart disease.

(b) Most candidates gained at least partial credit. The strongest answers referred to arteries having thick muscular walls which can withstand high blood pressure, and capillaries having thin walls which allow easy diffusion or exchange of materials. Credit was not awarded for vague answers such as “arteries are thick because of high blood pressure”.

Question 8

(a) Most candidates answered this correctly.

(b) (i) Most candidates gained credit for stating that fizzing occurs because hydrogen (or a gas) is produced. In the second part they needed to make clear that an alkaline (or basic) solution is formed rather than suggesting that the indicator goes purple because the metal is alkaline. The strongest answers gave the additional information that the alkalinity results from the formation of a metal hydroxide.

(ii) Many candidates gained full credit. Most candidates identified potassium, and many understood the connection between ease of ion formation, reactivity and rate of reaction. Explanations needed to be expressed in comparative terms particularly when candidates used the information given in the table. It was not enough to state that “there is very fast fizzing with potassium”. Instead candidates needed to express the idea that potassium produces the fastest or most vigorous fizzing.

(c) (i) Most candidates identified both products correctly. The most common mistakes were rubidium oxide and water.

(ii) Most candidates correctly predicted and explained that rubidium reacts more quickly than potassium because rubidium is the more reactive metal.

Question 9

(a) (i) Most candidates completed the series circuit correctly. Candidates should be advised to avoid adding components such as meters, cells or variable resistors when these are not required. Candidates should also be advised to draw circuit symbols exactly as they are shown in the syllabus. For example, the switch should be drawn in the open position.

(ii) Candidates who explained that the second lamp goes out because there is a break in the circuit gained credit. Answers such as “because it is a series circuit” or “both lamps have the same supply” did not gain credit.

(b) (i) Most candidates gave the correct answer.

(ii) The idea that the same potential difference would exist across each lamp in a parallel circuit was familiar to some candidates. Attempts to use the data in a calculation resulted in a variety of incorrect answers.

(iii) Many candidates were familiar with calculations involving the relationship $P = V \times I$. An incorrect value for potential difference from **(ii)** could be carried forward without loss of credit.

COMBINED SCIENCE

Paper 0653/52
Practical Test

There were too few candidates for a meaningful report to be produced.

COMBINED SCIENCE

Paper 0653/62
Alternative to Practical

Key messages

- Describing the investigation (**Question 3**) in a logical sequence can help candidates organise their answer. The bullet points in the question provide structure for the sections required.
- Undertaking regular practical work can help candidates to interpret and evaluate experimental methods and results, which was an area that needed improvement.
- Candidates should be reminded to read the questions carefully so that they answer what is being asked.

General comments

Although this is an Alternative to Practical paper, candidates are expected to be familiar with experimental technique, and to have carried out experiments similar to the ones shown in the paper. Candidates generally demonstrated a good understanding of basic practical knowledge and techniques. The standard of graph drawing was quite high, but some candidates need to remember that axes should be labelled with quantity and unit, all points need to be plotted, and the plotted points must cover at least half of the grid provided. Curves should be a single line and should be drawn taking into account all the points which are not anomalous.

Comments on specific questions

Question 1

(a) Many candidates answered this well. The most common incorrect response was gas given off. Other incorrect responses included water droplets, vapour and condensation.

(b) (i) Many candidates measured the height correctly. Other candidates measured from the bottom of the inner tube to the top of the liquid in either the outer tube or the inner tube, or from the bottom of the outer tube to the top of the liquid in the inner tube. Common incorrect responses included 6, 6.3, 9, 23, 49 and 91.

(ii) Candidates found this question challenging. Many restated the results rather than explaining the difference by linking glucose to respiration. Many candidates discussed the production of ethanol.

(iii) Candidates found this question challenging and many did not give a response. Some candidates discussed the need to control the amount of carbon dioxide, yeast or enzyme or to see if temperature makes a difference.

(iv) Many candidates found this challenging. Most discussed either misreading of the apparatus or parallax error rather than a difficulty in obtaining an accurate value.

(v) The carbon dioxide test was well known. A small number of candidates gave the test for hydrogen or oxygen.

(vi) Temperature and time were common correct responses. Some candidates gave vague answers, for example, volume rather than volume of glucose, or yeast rather than concentration of yeast.

(c) (i) Candidates needed to recognise that the value for 8% glucose solution was lower than the value expected and so the reason given needed to produce the lower volume of gas. Therefore, answers which referred to temperature or amount of glucose or amount of yeast were insufficient and needed to suggest that there was a lower temperature, or less time or less glucose or less yeast in order to gain credit. Other common non-creditworthy responses included parallax, misreading, incorrect percentage and no repeats.

(ii) Excluding the anomalous result, the volume of gas collected increased by 5 cm^3 for each 1% glucose solution increase, leading to an expected volume of 13 cm^3, which many candidates calculated correctly. Some gave values of 7 or below or above 18.

(iii) Most candidates correctly described the relationship between the percentage concentration of glucose solution and the volume of gas made up to 10% glucose solution. Only some candidates went on to discuss the maximum or plateauing after 10% glucose solution.

(iv) Many candidates named a suitably graduated piece of apparatus. Other candidates suggested apparatus that was not graduated, such as a pipette or test-tube, or with imprecise graduations, such as a beaker.

(v) Many candidates knew that a lower temperature would lead to a slower reaction and so less gas would be made after 5 minutes for each concentration of glucose solution. Some candidates incorrectly suggested there would be no gas or stated that the yeast dies.

Question 2

(a) (i) Many candidates recognised the greater precision of the smaller measuring cylinder. Common non-creditworthy answers included smaller volume and easier or better reading. Some candidates restated the question.

(ii) Most candidates knew that the filtrate is blue, but many contradicted their colour by adding precipitate.

(b) (i) Candidates found this question challenging. Common incorrect responses included filter, crystallise, distil, heat, evaporate and add sodium hydroxide.

(ii) The colour of barium sulfate was usually known. Yellow and red were common incorrect responses, but candidates gave a range of different colours in their answers.

(c) Many candidates produced a table which separated the tests from the observations. Some candidates did not differentiate between small amounts and excess of each reagent added, and dark blue precipitate was a common error for the addition of excess aqueous ammonia.

Question 3

Almost all candidates attempted this question and gained some credit and there were some candidates who gave detailed answers gaining full credit. Many candidates used the bullet points in the question as a guide for structuring their answers.

A small number of candidates were confused by the real-life context of soil and discussed adding calcium hydroxide to acidic soils or thought the calcium hydroxide was a solution and so described a titration.

Many candidates measured a volume of acid but did not include the apparatus needed to do this. Some candidates measured the mass of calcium hydroxide but did not include a balance.

Many candidates added Universal Indicator, but few added it to the acid to measure the pH before adding the calcium hydroxide. Many candidates measured the pH after the addition of one amount of calcium hydroxide and assumed it to be neutral. Some candidates repeated the experiment to increase reliability; however, candidates rarely had five different masses of calcium hydroxide added to the acid. Different masses could have been added as one continuous experiment or as several experiments. Some candidates thought that the pH would change with time rather than addition of alkali. Only a small number of candidates mentioned a pH colour chart to work out the pH from the colour of the Universal Indicator.

Control variables were well known. A small number of candidates incorrectly suggested keeping the mass of calcium hydroxide constant.

Candidates found processing results to draw a conclusion challenging with many giving a conclusion from prior knowledge rather than explaining how the results from their plan could be used to find a pattern.

Question 4

(a) (i) Many candidates did not answer this question or omitted the water in the test-tube. A small number of candidates had too much water in the test-tube.

(ii) Most candidates recorded the temperatures correctly. A small number of candidates omitted the .0 for 28.0.

(iii) Some candidates discussed reading the thermometer perpendicular to the scale. Common incorrect responses included suggesting repeating, using a thermometer, using two thermometers or viewing parallel to the scale.

(iv) Candidates found this challenging, with many discussing the movement of temperature rather than energy.

(b) (i) Many candidates chose a suitable linear scale. Some other scales were too small, and some did not allow for the highest temperature to be plotted. Units were often not included. The start of each axis needed to be labelled and many candidates wrote 0 but the temperature scale did not start from 0.

(ii) Drawing of the curve was often done well. Some candidates sketched a curve with multiple lines, joined the points with a ruler, or drew a curve which was too far away from the points. A small number of candidates drew a straight line.

(c) (i) Most candidates calculated the value correctly. Some did not give the value to two significant figures and 0.6 and 0.633 were quite common responses.

(ii) Some candidates discussed the rate of cooling, but many others discussed the change in temperature.