

# COMBINED SCIENCE

**Paper 5129/11**  
**Multiple Choice**

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

## General comments

Candidates performed very well on **Questions 2, 4, 7, 8, 10, 12, 13, 17, 21, 24, 25 and 39**. **Questions 3, 6, 14, 16, 18, 23, 26 and 38** proved the most challenging for candidates.

## Comments on specific questions

### **Question 1**

Many candidates knew that chloroplasts and sap vacuole are only found in plant cells. A number incorrectly thought that the cellulose cell wall and mitochondria are only found in plant cells.

### **Question 2**

Many candidates knew that the enzyme amylase is made of protein and acts as a catalyst. Many also knew that as an enzyme, amylase is used to speed up chemical reactions in living cells. Those candidates that missed this mark tended to select option **C**, enzymes not being made of protein whilst working in living cells and acting as catalysts.

### **Question 3**

The diagram of the transverse section of a leaf proved challenging. Many incorrectly opted for the epidermis. Candidates need to know that the most chloroplasts are found in the palisade mesophyll layer of the leaf.

#### Question 4

The majority of the candidates knew the functions of the stomach, ileum and liver.

#### Question 5

Many candidates knew that urea is excreted from the kidneys and that carbon dioxide is excreted through the lungs. Some candidates incorrectly thought that the liver excretes urea.

#### Question 6

This question on anaerobic respiration proved demanding. Candidates had to identify the substances needed for anaerobic respiration and the substances produced by anaerobic respiration. Many candidates incorrectly opted for lactic acid and carbon dioxide as products of anaerobic respiration.

#### Question 7

This was a well answered question with many of the candidates knowing why the ventricles have a thicker wall of muscle compared to the atria.

#### Question 8

Most candidates could link the consequences of damage of alveoli to the effect of this on the carbon dioxide concentration on the blood.

#### Question 9

Many candidates knew that in a reflex arc the electrical impulse in the relay neurone is travelling towards the motor neurone. A significant number thought that the electrical impulse travels towards the receptor.

#### Question 10

The majority of candidates were able to identify the prostate gland from the diagram of the male reproductive system.

#### Question 11

Many candidates knew that bacteria have a rapid rate of reproduction. Fewer knew that there are no ethical concerns linked to using bacteria.

#### Question 12

The majority of candidates could identify the three different processes in the carbon cycle.

#### Question 13

The majority of candidates knew that the Sun is the source of energy for all food chains.

#### Question 14

The effect of increasing the pressure on a sample of gas at constant temperature was not well understood by the vast majority of the candidates. There is a misconception amongst a large proportion of the candidates that the kinetic energy of the molecules increases.

#### Question 15

Most options were equally selected suggesting that candidates were guessing. Statements 2 and 4 were correct, hence, option **D** was the correct choice.

#### Question 16

Many candidates did not appreciate that the particle being described was an ion and chose option **B** from the number of electrons in the ion. The number of protons identifies the ion as being of an element in Group II.

#### Question 17

Most candidates were able to correctly identify the correct dot-and-cross diagram for the compound formed between element Q and element R.

#### Question 18

There was evidence of uncertainty with regard to this question. Candidates are expected to calculate reacting masses from chemical equations.

#### Question 19

Many candidates recognised that physical changes are reversible. A significant number thought that the products have the same formulae as the reactants and chose option **A**.

#### Question 20

Many candidates knew that oxidation and reduction take place simultaneously but many of these candidates thought that the substance that is reduced gains oxygen and therefore chose option **A**.

#### Question 21

The majority of the candidates knew that acids have a pH value below 7.

#### Question 22

The method used to obtain a salt using a metal oxide was not well known. Option **A** was the correct response.

#### Question 23

There was some uncertainty with this question. Candidates should know that metals are placed on the left side of the Periodic Table and that they form basic oxides.

#### Question 24

Most candidates were able to correctly determine the order of reactivity of the metals.

#### Question 25

The purification of water supplies was well understood by the vast majority of the candidates.

#### Question 26

The use of bitumen for making roads was well known and most correctly selected option **D**.

#### Question 27

The use of cracking for the manufacture of ethene from decane was well known by the stronger candidates.

#### Question 28

Many candidates correctly selected option **C**. Option **D** was a popular incorrect choice.

#### Question 29

This question showed that the definition of gravitational field strength was not well known. Some of the stronger candidates selected option **D** rather than correct option, **C**.

#### Question 30

Many candidates correctly selected option **B**. Option **C** (the cylinder volume) was a popular incorrect choice.

**Question 31**

This question was well answered and most candidates correctly selected option **B**.

**Question 32**

Most candidates knew that uranium is the energy source in nuclear power stations.

**Question 33**

There was some uncertainty with this question. Most candidates chose between the correct answer, option **A**, and option **D**.

**Question 34**

This question was well known but options **B** and **D** were also popular choices.

**Question 35**

There was some uncertainty with this question. Many candidates selected option **B** rather than correct answer, option **D**.

**Question 36**

Most candidates knew that charge is measured in coulombs although option **B** was a popular incorrect choice.

**Question 37**

Many candidates knew that voltage is measured in parallel and they could also identify the fixed resistor in the circuit. Option **A** was a popular incorrect choice.

**Question 38**

This question was not well answered with candidates equally divided between options **C** and **D**.

**Question 39**

Most candidates correctly used their knowledge of atomic structure to identify the correct equation, option **D**.

**Question 40**

This question was not well answered with many candidates selecting either option **A** or option **C**.

# COMBINED SCIENCE

**Paper 5129/12**  
**Multiple Choice**

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

## General comments

Candidates performed very well on **Questions 1, 4, 13, 21, 28 and 39**. **Questions 2, 17, 18, 19, 34 and 38** proved the most challenging for candidates.

## Comments on specific questions

### Question 1

Many candidates identified the chloroplasts as the organelle only found in plant cells.

### Question 2

This question proved demanding for candidates. Many knew that enzymes work best at a certain temperature but many did not know that enzymes are made of protein.

### Question 3

Candidates were asked to identify structures in the leaf and to correctly match one structure with its function. Many candidates correctly selected option **C**.

### Question 4

A minority of the candidates knew that the role of fat in the human body is to provide a source of energy. Some incorrectly thought that the role of fat was to provide amino acids.

### Question 5

This question required candidates to link their knowledge of pH and enzyme activity with an enzyme that could be active in the stomach. Whilst some candidates knew this, many opted for a higher pH than the stomach provides.

### Question 6

The question on the products of anaerobic respiration proved challenging for candidates. Many opted for the products being carbon dioxide + lactic acid + water rather than lactic acid only.

### Question 7

Many candidates were able to identify the two types of white blood cells and link them both to defence against pathogens. Some candidates mixed up the diagrams and stated that red blood cells are also responsible for defence against pathogens.

### Question 8

Most candidates knew that it is the tar in tobacco smoke that leads to lung cancer. However, a significant number opted for nicotine.

### Question 9

Many candidates knew that either glucose was changed to glycogen or that the target organ for insulin was the liver. However, few knew both pieces of information.

### Question 10

This question required candidates to identify the prostate gland and to know that its function was to produce the fluid for sperm to swim in. Many thought that the function was to maintain the correct temperature for sperm production.

### Question 11

Candidates need to know that:

- bacteria are genetically modified because there are no ethical concerns about their use
- crop plants can be genetically modified so that they produce additional vitamins
- genetically modified bacteria can be used to produce insulin.

Some candidates were awarded this mark but many thought that only two of the statements were correct.

### Question 12

Candidates were provided with a diagram of the carbon cycle with arrows showing processes adding and removing carbon dioxide from the atmosphere. Many knew that both animals and plants respire.

### Question 13

This was a very well answered question with most candidates knowing the effects of deforestation.

### Question 14

A majority of the candidates recognised that the particles in a substance become closer together when a gas condenses.

### Question 15

There was evidence of uncertainty with regard to this question. Statements 1, 2 and 4 were correct so option B was the correct choice.

#### Question 16

A large proportion of the candidates incorrectly thought that noble gases exist as diatomic molecules and chose options **A** and **C**. Candidates are expected to know that the noble gases are unreactive monatomic gases.

#### Question 17

There was evidence of uncertainty with regard to this question. Option **B** was the correct choice.

#### Question 18

There was evidence of uncertainty even amongst the strongest candidates. Candidates are expected to calculate reacting masses from chemical equations.

#### Question 19

The idea that the concentration of the dilute hydrochloric acid decreases as the reaction proceeds was not understood by many of the candidates.

#### Question 20

The use of a glowing splint to identify oxygen was well known by many candidates.

#### Question 21

Most candidates appreciated that the pH value of a solution is a measure of its acidity and selected option **D**.

#### Question 22

Most candidates recognised that the filtrate passes through the filter paper but many candidates thought that the solvent remains in the filter paper and selected option **C**.

#### Question 23

Ideas about the arrangement of the Periodic Table were not well understood by the candidates.

#### Question 24

Stronger candidates worked through the options to identify option **D** as the correct choice.

#### Question 25

There is a common misconception that carbon dioxide is produced by the incomplete combustion of fossil fuels. Incomplete combustion produces carbon monoxide.

#### Question 26

Stronger candidates used the information in the question to deduce that the oils fraction burns less well than kerosene.

#### Question 27

The manufacture of hydrogen from long chain hydrocarbons by cracking was not well known. A significant proportion of the candidates incorrectly thought that combustion of long chain hydrocarbons produces hydrogen and chose option **B**.

#### Question 28

Many candidates knew that a ruler and a stopwatch would be required to calculate speed.

**Question 29**

Many candidates were equally divided between the correct answer, option **A**, and option **C**, the acceleration from 0 to 5 s.

**Question 30**

This question was well answered although the total mass of the spheres, option **B**, was a popular incorrect choice.

**Question 31**

Many candidates knew that hydroelectric power transfers gravitational potential energy to kinetic energy. Option **D** was a popular incorrect choice.

**Question 32**

Many candidates ignored the units and selected option **B**. The correct choice was option **D**.

**Question 33**

Many candidates correctly selected option **A**, although option **D** was a popular incorrect choice.

**Question 34**

This was not well answered with a large number of candidates ignoring the units, choosing option **D** rather than the correct answer, option **B**.

**Question 35**

This frequency order of components in the electromagnetic spectrum was not well known. A minority correctly selected option **C**. Option **D** was a popular incorrect choice.

**Question 36**

This question was not well answered with most candidates omitting to convert the time into seconds, choosing either option **B** or option **C**, with option **B** attracting the greater response.

**Question 37**

The fact that component Y was a resistor was very well known but candidates were uncertain as to the type of resistor with more choosing option **B** than the correct option **D**.

**Question 38**

This question had each of options **A**, **B** and **C** selected by equal numbers of candidates. Option **C** was the correct choice.

**Question 39**

Many candidates correctly identified option **A** as safety features. Some candidates incorrectly selected option **B**.

**Question 40**

A minority of candidates correctly selected option **B** with the remainder choosing each option in almost equal numbers.



# COMBINED SCIENCE

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<p><b>Paper 5129/21</b> <b>Theory</b></p>
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## **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**

Candidates demonstrated knowledge and understanding in all three science disciplines with good recall of scientific terms and phrases.

This theory paper is the second examination of the 2023 – 2025 syllabus, but the first 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. The questions required candidates to demonstrate skills of information handling and problem solving as well as knowledge with understanding.

## **Comments on specific questions**

### **Question 1**

- (a) (i) Most candidates correctly identified regions of non-zero acceleration on this speed–time graph.
- (ii) Most candidates identified a region of changing acceleration on the graph.
- (b) Most candidates recalled and rearranged the equation for speed = distance  $\times$  time. However, many candidates misread the graph. On this scale a small square is 0.4 m/s.

### **Question 2**

In this question candidates drew lines between six structures (cells and tissues) in plants and their functions. Five functions are shown and the rubric explains that each can be used once, more than once, or not at all. Candidates should be guided by the number of marks for the question, in this case six marks. However, many candidates only drew five lines. The common error was to omit the connection between the spongy mesophyll which produces glucose as well as the palisade mesophyll.

### **Question 3**

- (a) (i) Most candidates could calculate the  $M_r$  value.
- (ii) Only the most able candidates were able to apply the ratio of the reacting molecules to determine the correct reacting masses.

- (b)(i) Some candidates recalled the number of electrons in the bonds between hydrogen and nitrogen atoms in this molecule of ammonia. They may also have used the Periodic Table to deduce that covalency between these non-metals requires two electrons in each bond (hydrogen has only one) and this leaves nitrogen with two unbonded electrons.
- (ii) Candidates should recall that substances with low boiling points have weak forces between their molecules. This is also essential for an understanding of fractional distillation.

#### Question 4

- (a) Most candidates recalled the equation  $F = ma$  and rearranged it to calculate acceleration. Although  $\text{N/kg}$  is dimensionally accurate, the block is changing speed and so candidates should record the unit as  $\text{m/s}^2$ . Many candidates did not recall this unit.
- (b) Most candidates correctly recalled the equation  $W = Fd$  to calculate the work done when moving the block against a frictional force.

#### Question 5

- (a) Candidates used words from a list to complete sentences about the circulatory system. Less able candidates often confused veins and arteries.
- (b)(i) Many candidates stated that the diagram showed a white blood cell. Candidates should know that engulfing pathogens is only carried out by specific white blood cells – phagocytes.
- (ii) Most candidates could name one other type of blood cell.

#### Question 6

- (a)(i) Most candidates recognised that two Na atoms are needed to react with a  $\text{Br}_2$  molecule to balance the symbol equation.
- (ii) The bond between a metal atom and a non-metal atom is ionic. The common error was to state that it is covalent.
- (b)(i) Many candidates seemed unfamiliar with the term halogen as they often named elements from different parts of the Periodic Table. Candidates should understand how these common displacement reactions show the changing reactivity down Group VII. A more reactive halogen than bromine should be named here.
- (ii) A less reactive halogen than bromine should be named here.
- (iii) Candidates should learn through laboratory practice or from demonstrations how silver nitrate is used to identify halogens.

#### Question 7

- (a) Candidates with good mathematical skills did well on this question. In general, they set out their equation to show a clockwise force  $\times$  distance equal to an anticlockwise force  $\times$  distance, substituting the numbers underneath. The more able candidates also realised that the mass needed to be converted to a force using the value for gravitational field strength provided.
- (b)(i) Most candidates could name the Sun as a renewable source of energy that emits infrared radiation.
- (ii) Most candidates correctly stated that the temperature of the block will not change or will fall slowly due to the thermal insulation. However, many candidates did not explain why. Candidates should recall that an insulator is a poor conductor.

#### Question 8

- (a) Most candidates knew that more oxygen is required during exercise and this is why the heart rate increases. More able candidates also explained that the increased heart rate allows more glucose

to be supplied to the muscles for more energy release and also allows more carbon dioxide to be removed from the body.

- (b)(i) Most candidates interpreted the line graph correctly to record the maximum heart rate before the period of training.
- (ii) Most candidates recognised that the three-week training program resulted in a lower overall heart rate for the student. Only the more able candidates were able to describe other trends in the data. Candidates need to practice data analysis skills. In this question, candidates should refer to the time from the x-axis and the corresponding heart rates from the y-axis. This way they will observe that after training the increase in heart rate is smaller between 5 and 10 minutes and the decrease in heart rate is larger between 15 and 20 minutes.

#### Question 9

Only a few candidates appeared to be familiar with this new syllabus content. Many recalled that waves are either longitudinal or transverse. A few knew that seismic waves are either p-waves or s-waves. Many candidates referred to 'shock waves', which is not a phrase used in this syllabus. The most able candidates also explained that these waves transfer energy and are carried by vibrations that are either in parallel with the direction of energy transfer or perpendicular to the direction of energy transfer.

#### Question 10

- (a) Most candidates correctly selected words from the list to complete sentences about the preparation of magnesium sulfate.
- (b) Most candidates understood that reactant powders react faster than pieces.
- (c) Most candidates either recalled or deduced that this carbonate releases carbon dioxide when it reacts with acid.
- (d) Only the most able candidates recalled that acidity is explained by the presence of hydrogen ions.

#### Question 11

- (a)(i) Only a few candidates knew that structure **X** was the prostate gland and could state one of its functions. Candidates should learn that it produces a liquid that carries the sperm cells.
- (ii) Most candidates knew the structure **Y** was a testis and that it produces sperm cells.
- (b) Most candidates knew that the male gamete is much smaller than the female gamete. They also knew that very few female gametes are released each month. Candidates were less precise in their understanding of how the male gamete moves. Many simply stated that it can move by itself. This mark was awarded to candidates who stated that it has a tail or that it swims.

#### Question 12

- (a)(i) Most candidates could describe the motion of gas particles in air.
- (ii) Candidates should recall that clean, dry air has between 20% and 21% oxygen.
- (b) Many candidates could not recall the products of incomplete combustion. Candidates should know that combustion and respiration are similar processes so that one product will always be water. Incomplete combustion means that insufficient oxygen is available so only carbon monoxide can form. However, even some able candidates stated that oxygen is one of the products.
- (c) Only a few candidates knew that the only product of the hydrogen-oxygen fuel cell is water. Many candidates made vague references to pollution and carbon dioxide which were not credited.

### Question 13

- (a) Many candidates were unable to distinguish between the two resistors that were in series and the single resistor that was in parallel with them. In consequence, they incorrectly added all of the resistances together.
- (b) Only the most able candidates recalled that in this circuit the current in the ammeter is the sum of the current in the two branches. In this situation candidates needed to deduct 0.045 A from 0.11 A.
- (c) (i) Most candidates knew that symbol **B** was a lamp. Many candidates stated that symbol **A** was a resistor, but this is not precise enough. It is a variable resistor.  
(ii) Many candidates had a simple idea of how this type of fuse works but they were often imprecise in their descriptions. Fuses do not explode, burn or cut out. They do not control the current but they do stop the current by melting, which breaks the circuit.

### Question 14

- (a) Most candidates knew some aspects of the carbon cycle and correctly linked it with combustion and respiration. A common error was to misunderstand the role of decomposers in returning carbon dioxide to the atmosphere as they respire.
- (b) Very few candidates were aware of the role of bacteria in biotechnology. Some candidates recalled that insulin is needed by some people to control diabetes. Candidates should recall that by modifying the DNA of bacteria with the human insulin gene, then a lot of insulin can be produced to treat people.

### Question 15

- (a) Most candidates knew how the electronic configuration can be used to determine the group number of an element.
- (b) Most candidates also knew that element **D** forms a negative ion.
- (c) More able candidates could explain that different periods contain elements with different numbers of electron shells.
- (d) Most candidates identified element **A** or **E** as a noble gas.

### Question 16

- (a) Candidates should be guided by the two marks available in this question. Many candidates knew that background radiation is in the surroundings but only a few gave the name of a source such as rocks, the Sun or even the air.
- (b) Candidates should learn that alpha radiation can also be detected in a cloud chamber or by a spark counter.

# COMBINED SCIENCE

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<p><b>Paper 5129/22</b> <b>Theory</b></p>
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## **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**

Candidates demonstrated knowledge and understanding in all three science disciplines with good recall of scientific terms and phrases.

This theory paper is the second examination of the 2023 – 2025 syllabus, but the first 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. The questions required candidates to demonstrate skills of information handling and problem solving as well as knowledge with understanding.

## **Comments on specific questions**

### **Question 1**

- (a) Most candidates recalled that distance is involved in the definition of speed but few also referred to a unit of time.
- (b) Candidates familiar with speed in km/h usually gained this mark. Many candidates suggested a speed value for a moving car but did not give a unit.

### **Question 2**

- (a) Most candidates recalled the function of red blood cells and many also recalled the function of platelets. Few candidates recalled that lymphocytes produce antibodies. Most candidates stated that white blood cells engulf pathogens but this is not correct for all types so only reference to phagocytes gained this mark.
- (b) (i) Candidates often gained a mark for recognising a vein and an artery. Very few used the term 'hepatic' even though this was part of the label in the diagram.
  - (ii) Only the most able candidates had a clear understanding of the vessels carrying blood into and out of the liver.

### **Question 3**

- (a) (i) The  $M_r$  calculation was usually correct.

- (ii) Only the most able candidates were able to apply the ratio of the reacting molecules to determine the correct reacting masses.
- (iii) More able candidates knew the effect of catalysts on reaction rate.
- (iv) There was a common misconception that the mass of a catalyst decreases during a reaction.
- (b)(i) Some candidates recalled the number of electrons in the bond between hydrogen atoms. They may also have used the Periodic Table to deduce that each atom only has one electron to share.
- (ii) Only the most able candidates recalled that electrical conduction requires free moving electrons. Candidates should be advised that linked questions such as (b)(i) and (ii) often apply similar ideas.

#### Question 4

- (a)(i) Less able candidates generally stated gravity. However, this force does not oppose motion and it is not a horizontal force.
- (ii) This resultant force calculation is new to the syllabus and many candidates were unfamiliar with it. A common error was to multiply the two opposing forces together rather than subtract them.
- (b)(i) Many candidates were unable to recall the equation  $F = ma$ .
- (ii) Candidates often gained an error-carried-forward mark here.

#### Question 5

- (a)(i) Most candidates identified a palisade mesophyll cell although there was some confusion with spongy mesophyll cells.
- (ii) Most candidates identified the air space in this leaf cross-section diagram.
- (b)(i) Only the most able candidates recalled the names of the cells where chloroplasts are found. Even though the chloroplast structures are shown (but not labelled) on the diagram. Candidates who correctly identified the mesophyll cell in (a)(i) often did not recognise the presence of chloroplasts in these cells.
- (ii) Only the most able candidates recalled that magnesium ions are needed to produce chlorophyll. A very common misconception was water. This is not a mineral or an ion.
- (c) Most candidates could name one of the gases that move or are exchanged in the air space. Some also recognised that they are connected to the stomata. Few candidates used the term diffusion when describing the movement of gases. However, those that do often discuss the higher surface area of exposed cells inside the air space.

#### Question 6

- (a) Many candidates deduced that diatomic means two atoms. Less precise answers such as 'two or more atoms' or 'two molecules' were not credited.
- (b) Candidates seemed to be unfamiliar with the phrase 'adverse effect'. Consequently, very few candidates recalled that bromine is toxic.
- (c) Water is a solvent so in this example of dissolving, bromine is the solute. Many candidates seemed to think that the question was more complicated and often stated that bromide was the solute.
- (d)(i) Only the most able candidates were familiar with the results of these hydrocarbon (alkane and alkene) reactions with aqueous bromine.
- (ii) Candidates seemed unfamiliar with the term 'halide'. Consequently, few candidates were able to suggest any halogen from group VII.

- (iii) Many candidates could suggest the name of an alkane.

#### Question 7

- (a) (i) The energy transfer between stores is still relatively new to the syllabus. Candidates need to be familiar with the names of the energy stores listed in this part of the syllabus.
- (ii) Many candidates identified elastic energy. Some went too far and called it elastic band energy, which is incorrect. Few candidates stated thermal or heat energy however. Ideally this should be the first answer they give since all energy transfers result in some release of heat to the surroundings i.e., the thermal store.
- (b) Few candidates understood the phrase 'energy is conserved'. A common error was that since the 100 J is transferred to two other stores, then 200 J is gained.

#### Question 8

In this question candidates drew lines between boxes to make correct statement about the use of bacteria in biotechnology. Most candidates recognised that bacteria reproduce quickly and they can make complex chemicals. They should also appreciate that there are no ethical concerns about using them.

#### Question 9

- (a) (i) Many candidates balanced the chemical equation. However, very few candidates knew how to determine the state symbols.
- (ii) Most candidates correctly identified the type of reaction.
- (b) Candidates needed to be familiar with filtration for this question. In this situation, lead chloride is separated from a mixture by filtering and therefore it must be insoluble.

#### Question 10

- (a) Few candidates recalled that mobile phones use microwaves. A common error was to state radio waves.
- (b) (i) Many candidates knew the speed of electromagnetic radiation in metres per second.
- (ii) As with **Question 4 (b)(i)** many candidates could not recall the equation, in this case  $v = f\lambda$ . A common error was to use  $w$  in place of  $v$  and since this can be confused with wavelength it does not gain credit.

#### Question 11

- (a) Most candidates interpreted the bar chart correctly
- (b) Most candidates could describe at least one trend in the data.
- (c) Most candidates could recall the risk factors associated with coronary heart disease.

#### Question 12

- (a) (i) Most candidates could describe the arrangement of gas particles in air.
- (ii) Most candidates recalled that nitrogen is between 78% and 79% of dry air. A common error was to state the percentage of oxygen.
- (b) Most candidates correctly stated that carbon dioxide is a product of complete combustion. fewer could recall water as the other product. Candidates should learn that combustion and respiration have the same products. Common incorrect gases included hydrogen and oxygen.
- (c) Candidates needed to give this question more consideration. Many assumed that deforestation only occurs because of fire hence the carbon dioxide in the atmosphere increases. This is partially



correct but does not gain credit. Trees remove carbon dioxide from the atmosphere. Candidates can also refer to photosynthesis. To gain both marks, candidates needed to refer to the mechanism of global warming and state that carbon dioxide is a greenhouse gas.

### Question 13

- (a) Another question where recall of the simple formula was needed:  $\text{power} \times \text{time} \times \text{cost per hour}$ . A unit conversion was needed and candidates who realised that one day has 24 hours generally gained the first mark. Multiplying this answer by 8 cents was problematic for some candidates who tried to convert to dollars, often incorrectly, and so missed the second mark.
- (b) Most candidates recognised the risk of connecting many appliances to a single extension lead. However, many good answers were negated by incorrect science. Candidates should learn that the extension lead will not explode or electrocute a person. In terms of the explanation candidates should learn that the overheating and fire risk is due to more electrical current.
- (c) Most candidates named two wires in a mains circuit. A common error was to give the colour or the wire.

### Question 14

In this question, candidates drew lines between digestion processes and the biological structures where they occur. A few candidates missed marks by drawing more than one line from a box. The most common errors related to where urea is produced and where glycogen is stored. This means that candidates are unsure about the functions of the liver.

### Question 15

- (a) Most candidates interpreted the electronic configuration data correctly and named elements **B** and **D**.
- (b) Most candidates identified the metal as element **C**.
- (c) Only the most able candidates could explain the period in relation to the number of electron shells.
- (d) Many candidates identified element **A** as helium. However, this was not the question being asked. With reference to the electronic configuration, it has one shell, which is full.

### Question 16

- (a) Most candidates recalled the name of one type of ionising radiation.
- (b) Most candidates understood that exposing food to ionising radiation kills bacteria or allows the food to last longer before it decays. Some candidates were guided by the 2 marks for this question and gave both answers.
- (c) (i) Most candidates knew that half-life is a measure of time. However, only the most able candidates referred to half of the nuclei of the isotope decaying.  
(ii) Many candidates selected technetium. However, with a 6 hour half-life, there would only be the slightest trace left in two days. The factory would need an isotope that does not need to be replaced frequently.



# COMBINED SCIENCE

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<p><b>Paper 5129/31</b> <b>Experimental Skills and Investigations</b></p>
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## Key messages

When drawing tables, candidates should put the units in the table headings. Units should not be included in the body of the table.

When drawing graphs, candidates should plot points to cover at least half of the grid and draw a line of best fit as a single smooth line. It is important that candidates read and understand the instructions given prior to plotting any graphs, as these questions may involve candidates circling anomalous data which should then be ignored when plotting the line of best fit.

## General comments

Candidates are advised to look at the number of marks available as this is a good indication of the number of specific points that have to be made in order to gain full marks.

Whenever there is a calculation worth two or more marks, candidates should show their working, as marks can be awarded for using correct formulae, irrespective of the final answer.

## Comments on specific questions

### Question 1

- (a) (i) This question required candidates to complete a table of results from data provided. Most candidates were able to complete the table correctly.
- (ii) Candidates had to use the data that they had put into the table to calculate the difference in the number of breaths before and after exercise. Many of the candidates who completed (a)(i) were able to use their data to correctly complete (a)(ii).
- (iii) Most candidates knew that a stop-watch should be used to measure time.
- (iv) Many candidates did not appreciate what was kept constant to make the investigation a fair test. An experiment is a fair test when only the independent variable and the dependent variable change. Controlled variables are kept constant.
- (b) (i) Most candidates knew that the apparatus in Fig. 1.2 was a measuring cylinder.
- (ii) This question required candidates to state the volume of air that the person had exhaled. Many did not appreciate that the volume needed to be measured at the bottom of the meniscus and so recorded a volume of 450 cm<sup>3</sup>.
- (iii) Candidates were asked to describe the colour of limewater which had exhaled air bubbled through it, and the colour of limewater which had atmospheric air bubbled through it. Many knew that the exhaled air contained more carbon dioxide and that this would turn the limewater milky. However, only a few candidates knew that the small concentration of carbon dioxide in atmospheric air would have no effect on the limewater and therefore the limewater would remain colourless.
- (iv) Stronger candidates were able to describe how to improve the investigation. Some candidates used vague terminology that could not be credited.

## Question 2

- (a) (i) Many candidates knew that apparatus **A** was a spring balance.
- (ii) Some candidates were able to describe how apparatus **B** could be used in the investigation. Many described how the weights could be attached to the spring balance. The most common incorrect response was candidates stating that this could measure the weight or the force exerted.
- (iii) Many candidates understood that apparatus **A** had greater precision, many candidates wrote that it was more accurate.
- (b) (i) This question required candidates to read the pressure measurement on the meter and most candidates were able to record the correct value.
- (ii) The graph was worth five marks. The instructions told candidates what to do to achieve full marks. A number of candidates did not draw the axes and few extended their line as instructed. Candidates should know what is meant by the x-axis and the y-axis and how to draw lines of best fit as well as understand how to spot anomalous data.
- (iii) Candidates were asked as part of (b)(ii) to extend their line of best fit to the y-axis. This question followed on from this and required candidates to determine the value of the y-intercept. This question was only answered correctly by a few candidates.
- (iv) Candidates found this question demanding. Many did not appreciate that there would be air in the tyre before the start of the investigation.

## Question 3

- (a) (i) Many candidates were able to identify the apparatus as a conical flask.
- (ii) Many candidates were unable to read the volume of gas collected in the syringe.
- (iii) This question required candidates to think about the set-up of the apparatus and why this method would result in less gas being collected in comparison to the volume of gas given off. Many candidates wrote about the reaction not being complete rather than the fact that some of the gas was lost before the bung was connected.
- (b) Candidates were asked to identify the gas released which relit a glowing splint. Many candidates missed this mark. Candidates should be aware that the last two pages of the alternative to practical paper are 'Notes for use in qualitative analysis' and include the tests for gases.
- (c) (i) Many knew that filtration could be used to separate a solid from a liquid.
- (ii) Candidates know that catalysts remain unchanged in a reaction and this question tests this in a practical way. Many candidates suggested that there would be less catalyst at the end of the investigation and a number thought that there would be more at the end.
- (d) (i) Candidates needed to predict the volume of gas produced and state a reason for their prediction. This was a well-answered question with many candidates recognising the pattern in the results.
- (ii) Many candidates could explain why the result was an anomaly, however, few understood that the experiment should be repeated and many just stated that a graph of the results could be drawn.
- (iii) This question required candidates to look at the data and see the pattern between the dependent and independent variables. Successful candidates described the increase in rate when the concentration of the hydrogen peroxide increases. Some gave answers that were too vague.

## Question 4

The question had five bullet points to guide candidates what points they need to address in their response. Many candidates were able to name at least one reagent and give details of how to control a variable. Most candidates knew the test for starch and were able to state the colour of the iodine in the presence of starch.

# COMBINED SCIENCE

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<p><b>Paper 5129/32</b> <b>Experimental Skills and Investigations</b></p>
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## Key messages

When drawing tables, candidates should put the units in the table headings. Units should not be included in the body of the table.

When drawing graphs, candidates should plot points to cover at least half of the grid and draw a line of best fit as a single smooth line. Unless instructed otherwise candidates should not extend the line beyond the plotted points. It is important that candidates read and understand the instructions given prior to plotting any graphs, as these questions may involve candidates circling anomalous data which should then be ignored when plotting the line of best fit.

## General comments

Candidates are advised to look at the number of marks available as this is a good indication of the number of specific points that have to be made in order to gain full marks.

Whenever there is a calculation worth two or more marks, candidates should show their working, as marks can be awarded for using correct formulae, irrespective of the final answer.

## Comments on specific questions

### Question 1

- (a) (i) Many candidates were able to recognise that a thermometer was needed to measure the temperature of the water-bath.
- (ii) Stronger candidates knew that the volume of iodine needed to remain constant. However, many stated that the volume of the starch solution and the volume of the amylase solution needed to remain constant, which gained no marks as the stem of the question had already stated that these volumes needed to be kept constant.
- (b) (i) Many candidates did not realise that there were no units for temperature or that seconds had been repeated throughout the table. Candidates should know that table headings always need an appropriate unit and that there should be no units in the body of the table. Many described the fact that there were two sets of data recorded at 60 seconds and two other sets recorded at 90 seconds.
- (ii) Candidates should know that a measurement is described as accurate if it is close to the true value. Many candidates knew that the results should be repeated but failed to gain the mark for knowing that the experiment needed to be repeated at smaller intervals around the approximate value to gain a value closer to the true temperature at which the starch was broken down.
- (c) (i) Many candidates knew that starch turns iodine solution blue-black.
- (ii) This was a well-answered question with many of the candidates knowing that the test for glucose is Benedict's and that a positive result could be red, orange, yellow or green. The most common incorrect answer here was purple where candidates had confused the Benedict's and biuret test.

## Question 2

- (a) Many candidates knew that the insulating tape reduced the risk of suffering a burn.
- (b) Some candidates knew that an ammeter was the meter used to measure the electrical current. The most common incorrect answer was voltmeter.
- (c) (i) Many candidates recorded the correct current. Candidates who missed the mark tended to record 0.75 A
- (ii) This question relied on the answer from (c)(i) and therefore there was credit available for the correct answer using the error carried forward. A number of candidates correctly calculated the power value from the equation given and then placed a rounded version of the answer in the table and therefore failed to gain the mark. Candidates should be advised that they need to look at the data given as one of the points in the table was the value 10.7, which showed them that there was no need to round up the value.
- (d) Candidates should be reminded that graph questions are marked to some or all of the following criteria (where possible):
- A – axes labelled, including units, in the correct orientation
- S – linear scale so that plotted points cover half or more of the grid in both directions
- P – all points in the table plotted accurately using fine points or crosses to  $\pm$  half small square
- L – appropriate line, in this case a smooth curved line through all plotted points.
- (e) Candidates were asked to describe the relationship shown on the graph. It is important that candidates state what the graph is showing such as 'as the power increases, the time decreases'. Stating that the results show a negative correlation without any specific reference to the variables and values of the graph is insufficient.
- (f) (i) This proved to be a demanding question for all but a few of the candidates who knew that the convection of hot water could cause uncertainty in the candidate's measurements as there was no way of knowing whether the thermometer had been placed in exactly the same place for each experiment.
- (ii) Some candidates did not appreciate that the mixture should be stirred to mix the solution thoroughly and distribute the heat evenly. Many described covering the test-tube with an insulating material to prevent heat loss.

## Question 3

- (a) (i) This was a well-answered question. Many candidates knew that the apparatus labelled **X** was a measuring cylinder.
- (ii) Many candidates were able to measure the volume of gas in the measuring cylinder.
- (b) Most candidates did not appreciate that apparatus **A** would need the bung replacing after adding the acid, leading to some of the gas escaping. Many wrote that apparatus **B** had a funnel and a tap but did not explain that this would result in no gas escaping as the acid was added.
- (c) Many candidates knew that the gas collected was carbon dioxide.
- (d) (i) Many candidates knew that filtering could be used to separate the solid from the liquid. The most common incorrect response was evaporation.
- (ii) In this question candidates were asked to state the mass of the solid obtained. The value for this was any non-zero value less than 1.0g. To deduce this, candidates needed to look at the original value of the copper carbonate added.

- (e) (i) Many candidates were able to recognise the pattern in the results and suggest an appropriate concentration.
- (ii) This question proved demanding. To identify the anomalous result, candidates needed to look very carefully at the data provided to find the result which did not fit the trend in the data.
- (iii) This question required candidates to look at the data and see the pattern between the dependent and independent variables. Successful candidates described the increase in rate when the concentration of the hydrochloric acid increases. Candidates who missed this mark gave answers that were too vague.

#### Question 4

The question had four bullet points to guide candidates what points they need to address in their response. Many candidates were able to gain the mark for the safety aspect of the practical and some gained the mark for the general method point of placing the solutions in a test-tube. Many candidates did not follow the general information given in the prompt relating to the idea of the displacement reaction and therefore did not score any further marks.