

COMBINED SCIENCE

Paper 5129/11
Multiple Choice

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

General comments

Candidates performed very well on **Questions 3, 4, 6, 13, 14, 15, 20, 21, 28, 35 and 39**. **Questions 7, 9, 16, 18, 23, 26, 29, 33, and 38** proved the most challenging for candidates.

Comments on specific questions

Question 1

Many candidates knew the function of the cell membrane. Some candidates thought that the cell wall controlled the passage of substances into and out of the cell.

Question 2

Many candidates knew that an enzyme catalyses one reaction as its active site is only complementary to one type of substrate molecule.

Question 3

This was a very well answered question with the majority being able to work out which set of apparatus would achieve the highest rate of photosynthesis.

Question 4

Many candidates were able to correctly work out what happens to excess amino acids in the blood.

The majority of candidates who missed this mark thought that the kidneys broke down the excess amino acids into urea.

Question 5

This question required candidates to know the difference in composition between inspired air and expired air. Most candidates knew that the carbon dioxide concentration increases and many also knew that the water vapour concentration also increases.

Question 6

Most candidates knew that aerobic respiration uses oxygen to break down glucose to release energy.

Question 7

This question proved demanding for the candidates who had to work out the position of the atrioventricular and semilunar valves.

Question 8

Many candidates knew that the immediate effect of drinking alcohol was to slow down reaction times.

Question 9

This question proved demanding for some candidates. The order of the reflex arc was not known and many thought that it started with an effector rather than a receptor.

Question 10

Some candidates were able to correctly identify structure **B** as the place where fertilisation occurs. A number of candidates thought that fertilisation occurs in the ovary.

Question 11

This question tested one of the new areas of the syllabus. Some candidates read the information carefully and deduced that the bacteria had been genetically modified.

Question 12

This question also tested knowledge of genetic modification. This question focused on the benefits of genetic modification in crop plants. This question proved demanding. All of the modifications would be a benefit.

Question 13

Most candidates knew that photosynthesis removes carbon dioxide from the air.

Question 14

Most candidates identified the diagram representing a mixture of compounds as option **B**.

Question 15

Most candidates correctly identified option **D** as the correct definition for the nucleon number.

Question 16

Most candidates appreciated that ionic compounds have high melting points and conduct electricity when they are molten. However, a significant proportion thought that solid ionic compounds conduct electricity and selected option **B**.

Question 17

This question was answered well by the stronger candidates but there was evidence of guesswork amongst some candidates.

Question 18

A significant proportion of candidates did not appreciate the stoichiometry of the equation and ignored the 2 in front of the formula for ammonia. Consequently, these candidates selected option **B**.

Question 19

There was evidence of guesswork amongst many candidates. The examples of exothermic reactions were not well known with many candidates thinking that cracking is an exothermic process and selecting option **A**.

Question 20

Ideas about chemical and physical changes were well understood by most candidates.

Question 21

The test for oxygen was well known by the majority of candidates.

Question 22

Stronger candidates correctly related the colour of the universal indicator to the pH of the solution.

Question 23

The trends shown by the elements in Group VII of the Periodic Table were not well understood. There was evidence of guesswork as all options were selected by a significant proportion of candidates.

Question 24

There was evidence of widespread guesswork even amongst the stronger candidates. Ideas on the reactivity series of metals were not well understood.

Question 25

The disadvantages of using a hydrogen-oxygen fuel cell in a motor vehicle were well known by a large majority of the candidates.

Question 26

The properties of bitumen were not well known. There was a misconception amongst many of the candidates that the melting point of bitumen is lower than lubricating oil.

Question 27

Stronger candidates recognised that a compound that contains a carbon-to-carbon double bond is unsaturated and will therefore decolourise aqueous bromine.

Question 29

There was some uncertainty among candidates with some of the stronger candidates selecting option **D** and both distractors **A** and **C** attracting a significant response.

Question 30

Many candidates used the spring length rather than extension. The correct weight was option **B**.

Question 31

A small proportion of candidates selected option **B** rather than the correct option, **D**.

Question 32

Some candidates missed the relevance of the cool breeze as part of a convection current and selected option **A** or option **B** rather than the correct option, **C**.

Question 33

More candidates selected option **D** (using 2 the wavelength) than the correct option, **C**.

Question 34

Most candidates interpreted the diagram correctly and selected option **D**.

Question 36

There was uncertainty over this question. Those who correctly chose the ammeter symbol were equally divided between options **A** and **B**. Many selected options **C** and **D** which had a voltmeter symbol rather than an ammeter symbol.

Question 37

The unsafe use of an extension cable was well known, although some candidates did incorrectly select option **B**.

Question 38

Most candidates omitted to convert the time into seconds, therefore selecting options **B** or **C**.

Question 40

This question was well answered, although some candidates selected option **B** rather than the correct option, **D**.

COMBINED SCIENCE

Paper 5129/12
Multiple Choice

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

General comments

Candidates performed very well on **Questions 2, 4, 6, 8, 13, 14, 20 and 21**. **Questions 5, 11, 16, 18, 27, 30, 31, 35, 36 and 39** proved the most challenging for candidates.

Comments on specific questions

Question 1

Many candidates knew that all cells have a cell membrane, irrespective of the specialisation of the cell. A number thought that red blood cells have a nucleus. The nucleus is one of the organelles removed during specialisation to help the cell transport more oxygen.

Question 2

This question on enzymes and the functions of enzymes was answered correctly by many candidates.

Question 3

Many candidates knew that palisade mesophyll cells were responsible for both photosynthesis and gas exchange, and the stoma was involved in gas exchange.

Question 4

Most candidates knew the order: digestion → absorption → assimilation

Question 5

This question proved demanding for many candidates. Many candidates opted for the wrong direction of movement of the carbon dioxide gas and thought that the carbon dioxide moved into the blood rather than from the blood.

Question 6

The majority of candidates knew that breathing is not respiration. A number opted for the production of lactic acid in muscles during exercise rather than the correct response of the release of energy from glucose.

Question 7

Many candidates knew that age, smoking and stress could all increase the likelihood of the thickening of a coronary artery wall. Many of the candidates who did not score this mark thought that a high fibre diet also contributed to the thickening.

Question 8

This question was very well answered, almost all of the candidates knew the effects of smoking.

Question 9

This question was well answered with most candidates being able to correctly identify the parts of the central nervous system.

Question 10

The diagram of the side view of the female reproductive system was challenging to many of the candidates. Many could not recognise the location of the site of implantation or where the zygotes are formed.

Question 11

This question assessed the topic of genetic modification. Many candidates were uncertain about this topic.

Question 12

Many candidates knew that the majority of the energy was stored in the leaves as a result of photosynthesis.

Question 13

The majority of candidates knew that cutting down trees would reduce the oxygen concentration and increase the carbon dioxide concentration in the atmosphere.

Question 14

The vast majority of the candidates were able to interpret the chromatogram.

Question 15

The properties of an electron and a neutron were well known. A significant number thought that the relative mass of an electron is 1 and selected option D.

Question 16

There was evidence of guesswork with this question. The formation of ionic bonds between a metallic element and a non-metallic element was not well understood.

Question 17

A large proportion of the candidates thought that the number of ions present in the formula is the same as the charges on the ions and selected option C. Candidates are expected to be able to construct the formula of a compound from the ions present and *vice versa*.

Question 18

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

Question 19

The fact that a catalyst remains unchanged at the end of a reaction was known only by a small number of candidates. A significant number thought that a catalyst increases the total amount of energy released by a reaction and selected option **B**.

Question 20

The test for oxygen was well known by the majority of candidates.

Question 21

Most candidates recognised the pH values of alkaline soils.

Question 22

Stronger candidates were able to identify the soft metal with a low melting point as an alkali metal and that it therefore reacts violently with cold water.

Question 23

Candidates were expected to deduce the colour and state of fluorine from trends in information given in the table. They found this challenging.

Question 24

Stronger candidates were able to use the reactivity series to determine which reaction would occur.

Question 25

The sources and effects of atmospheric pollutants were not well understood by many candidates. A large proportion thought that carbon monoxide causes global warming and selected options **C** or **D**.

Question 26

The size of molecules, viscosity and volatility of the molecules in the fractions obtained by the fractional distillation of petroleum were not well known. There was evidence of guesswork even amongst the stronger candidates.

Question 27

Candidates are expected to recognise the molecular formulae of alkenes and know that alkenes decolourise aqueous bromine.

Question 28

There was confusion over the interpretation of non-zero acceleration. Many candidates selected option **D** (zero acceleration) rather than the correct option, **A**.

Question 29

There was confusion over mass and weight with more selecting option **D** than the correct option, **C**. This is perhaps due to the everyday misuse of expressing weight in kg.

Question 30

Few candidates correctly selected option **B**. Many used 15 cm as the extension and selected option **D**.

Question 31

This question was not well understood with many associating thermal energy with the Sun.

Question 32

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

Question 33

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

Question 34

As many candidates selected option **A** (the vertical distance from crest to trough as the amplitude) as selected the correct option, **C**.

Question 35

This proved to be very demanding with few correctly selecting option **C**. Option **A** and option **B** were commonly selected.

Question 36

There was uncertainty among candidates with option **D** being selected more often than the correct option, **A**. The question required knowledge of the electrostatic laws to be applied to the particles in an atom.

Question 37

Most candidates correctly selected option **C**. Option **B** was the most popular incorrect option.

Question 38

Slightly more candidates selected option **C** than the correct option, **A**.

Question 39

This question was not well understood. As many selected option **C** as selected the correct option, **D**.

Question 40

This question was well known with most correctly selecting option **D**. Options **A** and **B** were popular incorrect choices.

COMBINED SCIENCE

<p>Paper 5129/21 Theory</p>

Key messages

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

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

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

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

General comments

This theory paper is the first examination of the 2023 – 2025 syllabus. Some new content was assessed for the first time. The style and accessibility of the questions were familiar to candidates and there were very few questions where candidates were unable to enter a response. The questions required candidates to demonstrate skills of handling information and problem solving as well as knowledge with understanding.

Comments on specific questions

Question 1

- (a) (i) Most candidates interpreted the bar chart data correctly.
- (ii) Most candidates were able to draw conclusions about the effect of exercise.
- (b) Most candidates selected appropriate words from the list to describe aerobic respiration.

Question 2

- (a) Many candidates were unable to convert the speed in km/h to m/s – the short cut is to divide by 3.6. Candidates struggled to convert km to m (1 km = 1000 m) and hours to seconds (1 h = 3600 s). A minority of candidates were able to give an answer to 2 significant figures.
- (b) Candidates gained marks for multiplying their speed from (a) by 60 s with an appropriate unit. Candidates need to consider whether their calculated value is reasonable. It was not unusual to see answers such as 5280 km for the distance travelled by a horse in one minute.

Question 3

- (a) (i) Most candidates calculated the M_r of tin chloride correctly
- (ii) Candidates recognised that 19 g is one-tenth of the answer to (a)(i) and used the equation to calculate 4.8 g of Mg (one-tenth of 2 moles \times 24) and one-tenth of 48 g of tin (also 4.8).

- (b) Many candidates referred to the chemical bonding of atoms. This is not sufficient. A compound has atoms from different elements bonded together. Some incorrectly referred to a compound as a mixture.
- (c) Most candidates were able to describe an appropriate property of titanium.

Question 4

- (a) Most candidates correctly identified the forces on the parachutist.
- (b)(i) Many candidates referred to potential energy. This is not sufficient in this context. When falling from a height, energy is transferred from the gravitational potential energy store.
- (ii) All candidates found this question very demanding. In (a), one of the forces is drag (air resistance). Any movement against this force causes work done. Drag is friction so energy is transferred to the thermal store.
- (iii) In the question, candidates are told that 3.5 MJ of energy is transferred. Since energy is conserved, the total transfer is also 3.5 MJ. Many candidates attempted a calculation, commonly dividing 3.5 MJ by 40 s and so determining power not energy.

Question 5

- (a) Only the strongest candidates were able to identify the pulmonary vein and vena cava.
- (b) Most candidates correctly determined the correct direction of blood flow.
- (c) Many candidates gained one mark, usually for the idea that the valve closes when the ventricle contracts. There was a misconception that the valve closes and opens itself. The pressure of blood acting on the valve causes it to close which allows blood to be pushed into the aorta.

Question 6

Most candidates gained marks by selecting appropriate words from the list to complete the sentences.

Question 7

- (a) The instruction to use ideas about particles was ignored by many candidates. There must be some reference to particles. Responses such as 'it gains energy' are ambiguous and do not gain credit.
- (b) There are three processes by which thermal energy is transferred. Only the strongest candidates recognised that convection is the main process from a candle flame. There was a common misconception that exothermic is a process of energy transfer whereas it is a type of reaction.

Question 8

- (a) Most candidates recalled that natural gas and coal are fossil fuels.
- (b)(i) Very few candidates understood that the fractions in a fractionating column are separated by their different boiling points.
- (ii) Most candidates recognised that viscosity increases towards the bottom of the column where molecular chains are longer.
- (iii) Only a very small number of candidates knew that naphtha is used as a chemical feedstock for making other chemicals.
- (c) Many stronger candidates recognised that the molecule had only single bonds between its carbon atoms, making it an alkane.

Question 9

- (a) Most candidates were able to match at least one structure with a correct description.

- (b)(i) Most candidates correctly identify chlorophyll. A common error was to state chloroplast, which is the structure that contains chlorophyll.
- (ii) The strongest candidates correctly recalled the balanced chemical equation for photosynthesis. Some common errors included $6C$ rather than C_6 in the glucose molecule and CO instead of CO_2 .

Question 10

- (a) Most candidates gained at least one mark knowing that waves transfer energy not matter. The misconception with this question was that it had something to do with sound.
- (b)(i) The stronger candidates identified three full wavelengths in the diagram giving 1.6 m for each one. The common error was six wavelengths (these are half-wavelengths) to give 0.8 m for each.
- (ii) Some candidates did not recognise 1.2 waves per second as the frequency. Some candidates did not recognise that (i) and (ii) were a connected sequence and so did not make use of their wavelength calculation in (i).

Question 11

Most candidates gained several marks for correctly connecting the small biological structures with the larger structures of which they are a part.

Question 12

- (a) Most candidates determined the correct number of protons and neutrons from the description of a calcium nucleus.
- (b)(i) Very few candidates recalled that the reaction with water ($H_2O \rightarrow H^+ + OH^-$) produces the hydroxide ion which causes the solution to be alkaline.
- (ii) Most candidates suggested an appropriate pH value for an alkaline solution.
- (iii) Most candidates found this demanding. The rate of reaction is decreased by lowering the temperature or decreasing the surface area of the reactants.

Question 13

- (a) Most candidates correctly recalled and applied the equation $Q = I t$
- (b) There was a common misconception that a wide cable reduces the risk of an electric shock or a short circuit.

Question 14

- (a) Only the strongest candidates were able to name two types of neurone.
- (b) Similarly, only the strongest candidates recognised the description of a reflex action.
- (c) Many candidates knew that hormones are produced by glands.
- (d) Most candidates were able to name one human hormone.

Question 15

- (a)(i) Candidates found this question demanding. Very few were able to give correct state symbols. A common error when balancing the equation was to omit 2 from $2K$ that is need to react with Cl_2 .
- (ii) Only the strongest candidates recognised that the positive and negative charges must alternate on the top and on the bottom of the ionic lattice.

- (iii) Only the strongest candidates determined the correct concentration. This is an example of proportional reasoning. If 100 cm^3 has 2 g, then $10 \times$ the volume (1000 cm^3) has ($10 \times 2 =$) 20 g/dm^3 .
 - (iv) This content is new to the syllabus. Candidates were unable to describe the correct test for chloride ions. A white precipitate is observed with the addition of aqueous silver nitrate.
- (b) Most candidates knew that distilled water contains fewer impurities than tap water.

Question 16

- (a) Only a few candidates recalled that beta emission is an electron.
- (b)(i) Candidates need to know that emitters used inside the body for medical purposes must have a short half-life to limit the exposure of living cells to the ionising radiation.
- (ii) Most candidates correctly suggested gamma radiation.

COMBINED SCIENCE

<p>Paper 5129/22 Theory</p>

Key messages

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

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

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

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

General comments

This theory paper is the first examination of the 2023 – 2025 syllabus. Some new content was assessed for the first time. The style and accessibility of the questions were familiar to candidates and there were very few questions where candidates were unable to enter a response. The questions required candidates to demonstrate skills of handling information and problem solving as well as knowledge with understanding.

Comments on specific questions

Question 1

- (a) Only the stronger candidates were able to recall the syllabus definition of gravitational field strength.
- (b) Most candidates gained at least one mark for the weight calculation.
- (c) (i) Many candidates attempted a calculation. The command word was 'state' so candidates needed only to record the gravitational field strength as the acceleration.
 - (ii) Candidates found difficulty in recalling that a change in speed is due to the action of a force.

Question 2

Most candidates recognised the relevant leaf structures but often confused the order of the mesophyll cells.

Question 3

- (a) (i) Most candidates were able to calculate the relative formula mass. A common error was to add the M_r of the two carbon atoms ($151 + 24$) and then calculate the ratio $151/175$.
 - (ii) Candidates who calculated 151 in (a)(i) generally recognised the proportion 15.1 to deduce a tenth of the mass of carbon (2.4 g) and a tenth of the mass of tin (11.9 g).
- (b) Common misconceptions about carbon monoxide were that it produces acid rain and that it is a greenhouse gas that causes climate change. In syllabus terms, CO is a toxic gas.

Question 4

- (a) Many candidates were uncertain how to calculate the volume of the block but were able to substitute their value into the equation for density and gain some of the marks. There were also errors in determining the unit even among candidates that performed the calculation correctly.
- (b) Most candidates found this question demanding. This is an example of proportional reasoning in problem solving. 7.5 kg causes a 6 cm extension. Therefore, 5 kg causes only two-thirds of the extension.

Question 5

The most common misconception was that the loss of oxygen is oxidation. Stronger candidates were more likely to distinguish correctly between exothermic and endothermic and also between saturated and unsaturated.

Question 6

- (a) Most candidates describe at least one trend in the data. Some candidates gave more precise answers that referred to particular years e.g. 'from 2014 until 2018' or 'after 2018' and this usually gained them more marks. A minority of candidates made no reference to the quantity being measured. Candidates should always refer to the axes labels when describing graphical data.
- (b) Most candidates recognised the harmful effect of smoking. Some candidates recalled the effect of nicotine on heart rate. Few candidates recalled the toxic component (carbon monoxide) in cigarette smoke.
- (c) Most candidates were able to express the idea of addiction (e.g. 'hard to stop' or 'because they are used to it') but it is important that they recall and use correct scientific language.

Question 7

- (a) Candidates must be discouraged from discussing costs when identifying advantages and disadvantages. Claiming that a source of energy is cheap or expensive does not gain credit.
- (b) Most candidates identified another source of renewable energy.
- (c) Candidates found this question demanding. Most candidates know that solar panel absorbs radiation or heat. However, only the candidates that gave comparative answers gained any credit. The key phrases in the question are: 'heats more water' and 'the surface is made larger'.

Question 8

- (a) Most candidates were able to name an enzyme in the digestive system. Very few candidates knew that an enzyme is a protein molecule and that a gene is the area on a chromosome that codes for an enzyme. The common error was DNA instead of gene.
- (b) The lock and key mechanism to explain enzyme action is new to the syllabus. However, most of the stronger candidates were able to draw a correct diagram.
- (c) Only the strongest candidates gained either of these marks. Some candidates made use of the information in the question and referred to the active site from Fig. 8.1. By drawing a complimentary shape for the substrate in (b) they realised that the shape of the active site changes so that the substrate no longer fits (denaturing).

Question 9

- (a) (i) Most candidates used the data to predict the correct number of carbon atoms.
- (ii) Many candidates also used the data to identify fuel oil (with the largest number of carbon atoms per molecule) as the fuel at the bottom of the fractionating column.
- (iii) Only the strongest candidates recalled that kerosene is a fuel for jet engines.

- (b) Most candidates were able to draw a propane molecule.
- (c) Candidates found this question demanding. The main reason for cracking large hydrocarbon molecules is that there is much higher demand for the smaller molecules.

Question 10

Many candidates did not identify the type of cell division for forming sex cells (meiosis) or the correct description (diploid) of a zygote with two sets of chromosomes. Many candidates were also confused about where the zygote develops (wall of the uterus). Candidates generally gained a mark for knowing that fertilisation involves the sperm and the female gamete.

Question 11

- (a) (i) Only the strongest candidates recalled that sound waves in air are longitudinal waves.
- (ii) Very few candidates were able to recognise a wavelength between repeating points on the longitudinal wave. A common misconception was that the wavelength is either the length of the compression only or the length of the rarefaction only.
- (b) (i) Most candidates drew the reflected ray at an acceptable angle.
- (ii) Very few candidates could recall any correct application of ultraviolet light. The most common applications were for security marking (invisible ink glows in ultraviolet light) and sterilisation (ultraviolet is a common method for killing bacteria in drinking water).

Question 12

- (a) Most candidates gained at least one mark, either for recalling that the number of protons is the atomic number or for calculating the difference between 65 and 29 as the number of neutrons.
- (b) Most candidates recalled at least one property of copper that makes it suitable for electrical wiring.
- (c) (i) Only the strongest candidates were familiar with rearranging the molecules in this displacement reaction. Some candidates lost marks for a lack of precision when transferring 'sulfate' in the reactants to 'sulfur' 'sulfide' or 'sulfite' in the products. Another common error was to lose one of the substances e.g. \rightarrow copper + sulfate implying that the iron is lost.
- (ii) Only the strongest candidates understood that displacement occurs when an aqueous solution of an ionic compound encounters a more reactive metal.
- (iii) Very few candidates recalled that the rate of a reaction increases with temperature, surface area or concentration.

Question 13

- (a) Most candidates recalled the equation linking resistance with voltage and current. Most were also able to use the graph to extrapolate a current value. A very common error at this stage was to not convert A to mA ($\times 10^{-3}$).
- (b) Many candidates were unable to recall $E = VIt$ or convert 10 minutes to 600 seconds for one of these marks.

Question 14

Most candidates gained marks for identifying when anaerobic respiration occurs and what its products are.

Question 15

- (a) Few candidates were able to construct the symbol equation and fewer still were able to state the correct state symbols.

- (b) Many candidates are able to draw a dot-and-cross diagram. However, a common misconception was that fluorine loses an outer shell electron rather than gains one. Very few candidates recognised that they also had to state the charge (negative) since they have drawn an ion.
- (c) Only a handful of candidates recalled the flame test and result (red flame) for lithium.

Question 16

- (a) A small number of candidates knew that the way to distinguish between the different types of emissions from radioactive substances is by the materials (absorbers) they pass through and how this affects the count rate.

Question 17

Most candidates gained at least three marks for connecting the biological activities with the structures where they occur.

COMBINED SCIENCE

<p>Paper 5129/31 Experimental Skills and Investigations</p>

Key messages

When drawing tables, candidates should put the units in the table headings and they 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.

General comments

Candidates are advised to look at the number of marks available as this is a good indication of the number of individual 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) Candidates found this question accessible. Many knew the function of the zero and the unit buttons.
- (b) Many candidates were able to record the distance between the spanner and the magnet. They were also able to record the reading on the balance. Candidates should be reminded to record the units in the heading and not in the body of the table. Appropriate units for each measured quantity can be found in the syllabus. Headings and units must have a separator (/) between them.
- (c) Candidates found this question demanding. Many knew that the balance was more accurate or precise but many of the cohort thought that the electronic balance was reliable and fast to use and gave one of these as the second part of their answer, therefore failing to gain a second mark.
- (d)(i) Many candidates were able to describe the trend in the results.
 - (ii) This question proved demanding. Only the most able candidates suggested that the magnetic attraction changed with distance. Many candidates repeated their answer to (d)(i) and suggested that the spanner was getting lighter.
- (e) In this question candidates were asked why repeating the investigation improves the experiment. Many of the candidates wrote about this improving the accuracy of the results. Candidates need to be reminded that repeating enables anomalous results to be identified and allows the repeatability of the experiment to be checked.

Question 2

- (a) (i) Candidates found this question demanding. Incorrect answers included the amount of water that evaporated and the temperature of the water. Stronger candidates knew that the difference between the initial and final mass of the fuel was needed to measure the energy released per gram of fuel. Candidates should read the question carefully to make sure they answer the question stated.
- (ii) The majority of candidates were able to read the thermometer correctly.
- (b) (i) This was a very well answered question. Most of the candidates were able to calculate the temperature change from the data given.
- (ii) The axes were provided on the graph which enabled most candidates to score one mark for the plotting of the points. Many candidates drew an appropriate line of best fit. However, only the most able candidates were able to identify the anomalous data point. Centres are reminded that anomalous data is data which does not fit the normal pattern of other data recorded in the experiment.
- (iii) Many candidates were able to extend their line of best fit and provide a suitable temperature change for undecane.
- (iv) Many candidates had not appreciated that the temperature change for dodecane would be greater than the boiling point of water and therefore could not be measured using water with an initial temperature of 20 °C
- (v) In general, candidates did not understand why the energy released per gram would be less than the true value. Many discussed the fact that the thermometer was not read correctly or that the fuel was not measured properly. Many candidates made no response to this question.

Question 3

- (a) (i) Most candidates correctly recorded the starting and final masses of the eggs. A small number recorded the values of the change in mass to an inconsistent number of significant figures or rounded incorrectly.
- (ii) The majority of candidates were able to calculate the average change in mass for the eggs.
- (b) (i) Many of the candidates scored one mark, usually for either a reference to controlling the temperature or the time that the carrots were placed in the solution or for suggesting the use of the same carrot for all cylinders. The most common incorrect answer was the concentration of the sodium chloride solution. Candidates are reminded to read the information thoroughly as, within the procedure, the candidates were told that the concentration of sodium chloride solution was changed.
- (ii) This question proved demanding. Most of the candidates did not understand that there will always be slight differences in mass between the carrot cylinders regardless of them being similar length and that by calculating the percentage change in mass the results from the different carrot cylinders could be compared fairly.
- (iii) Although candidates were given the information that there would be no change in mass when the sodium chloride concentration in the carrot was the same as the surrounding solution, many were not able to use the graph provided to determine the concentration of sodium chloride inside the carrot cylinders.

Question 4

It is the first time that candidates have had to plan their own practical for this exam. Strong responses from candidates addressed the bullet points in the question. Centres need to note that these bullet points are there to help the candidates and maximum marks can only be obtained if the candidate addresses all four bullet points.

Many candidates knew that a voltmeter would measure the voltage and that ear defenders or earplugs would protect the ears during the investigation.

Stronger candidates knew to repeat experiments and average results. Some candidates knew that variables that were not being investigated needed to be kept constant.

COMBINED SCIENCE

<p>Paper 5129/32 Experimental Skills and Investigations</p>

Key messages

When drawing tables, candidates should put the units in the table headings and they 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.

General comments

Candidates are advised to look at the number of marks available as this is a good indication of the number of individual 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) Using iodine to test for starch was the most common answer, although some candidates incorrectly suggested biuret.
- (ii) Many candidates knew that the Benedict's solution is blue but many thought that it turned purple or milky white. Only the strongest candidates were able to identify the colour change for a positive result.
- (b) Many candidates knew that the solution changed to purple if a protein was present. Fewer candidates knew that the test for protein was the biuret test.
- (c) (i) Nearly all diagrams were sufficiently large. Candidates need to make sure that their outline is a single clean line with no shading or feathering. It is important that candidates draw the correct overall shape of the leaf in the photograph provided, rather than a general shape of a leaf. Some of the candidates misunderstood the question and tried to draw a cross section of a leaf.
- (ii) Many candidates were able to correctly measure the length of the caterpillar to the nearest mm. Candidates who did not score this mark usually gave a cm value rather than the mm value as required by the question.
- (iii) In this question candidates had been given the equation for magnification. Many candidates were able to calculate the value correctly. When candidates had calculated the length of the caterpillar to be 5 in (ii), they were still able to access this mark due to error carried forward. Many of the candidates who missed this mark had incorrectly inserted data into the equation.

Question 2

- (a) Most candidates knew that a thermometer is used to measure temperature.

- (b)(i) Whilst most candidates were able to read the initial temperature of the thermometer, only the strongest candidates appreciated that there would be no change in temperature when no magnesium was added to the hydrochloric acid and a number of candidates recorded a temperature change of 18 °C, rather than 0 °C.
- (ii) Most candidates were able to calculate the temperature change.
- (iii) The graph question proved demanding for many of the candidates. Most were able to plot the data on the axes given. Some found it difficult to draw two different lines of best fit with a point of intersection. Only the strongest identified the anomalous data point and circled it. In order to be awarded all four marks, candidates were given four separate instructions on four separate lines. Centres should remind candidates to follow all the instructions given in the question.
- (iv) Candidates found explaining why the temperature change became constant as more magnesium was added very challenging. Only a few knew that this was because all of the acid had been used up. Incorrect responses included the temperature being the highest or the optimum temperature and many said that the temperature change remained constant because it remained the same.
- (v) In this question candidates needed to be able to find the minimum mass of magnesium required to react with all of the acid from their graph. This value was obtained from the point of intersection of the candidate's lines. Many candidates had not realised this and therefore failed to score this mark. A number quoted numerical values above 2.4 g, which was the maximum value on the graph.
- (c)(i) Some candidates did not understand that the energy changes in the procedure would be less than the true value due to energy losses to the environment. Many discussed the fact that the thermometer was not read correctly or that the correct amount of magnesium was not added or that it was the wrong volume of acid that had been measured out.
- (ii) Many candidates did not realise that the energy loss could be reduced by insulating the beaker.

Question 3

- (a)(i) Many candidates correctly identified the apparatus as a measuring cylinder. The most common incorrect response was beaker.
- (ii) This question required candidates to show the point on the scale where the volume reading should be taken. Many candidates knew that this should be taken from the bottom of the water level. Most candidates who did not gain this mark lost it for having their arrow where the top of the meniscus touched the measuring cylinder.
- (iii) Most candidates knew how to calculate the volume. Candidates who only scored one mark did not state that the volume without the spanner had to be subtracted from the volume including the spanner.
- (iv) Candidates found this question demanding and many of them thought that the air bubbles were introduced into the water as a result of adding the spanner. Many did not appreciate that the air bubbles would add to the volume of the water. Stronger candidates were able to suggest ways of removing the air bubbles before measuring the volume.
- (b)(i) Candidates were asked to state the units for the headings given in the table. Where candidates scored a mark, it was for the correct units. Most candidates did not include a separator and were not awarded the second mark.
- (ii) This was a well answered question with many candidates correctly calculating the density.
- (c)(i) This question was demanding for many candidates. Centres are reminded that the syllabus contains a section on the language of measurement which candidates should be familiar with.
- (ii) Candidates who knew how to gain a more accurate value tended to write about repeating and calculating an average result.

Question 4

It is the first time that candidates have had to plan their own practical for this exam. Strong responses from candidates addressed the bullet points in the question. Centres need to note that these bullet points are there to help candidates and maximum marks can only be obtained if all four bullet points are addressed.

Many candidates knew that variables such as the type and length of the pondweed had to be controlled. Some candidates understood the need for repeats and how the light intensity could be changed. The strongest candidates understood the need to control the temperature of the water surrounding the pondweed and how to interpret the results.

Some candidates did not use the information given in the introduction in their planning. This would have helped them realise that the bubbles of oxygen could be counted in, for example, one minute and therefore provide them with the means of comparing photosynthesis at different light intensities.