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GCSE (9-1)

Examiners' report

TWENTY FIRST CENTURY SCIENCE COMBINED SCIENCE B

J[redacted]60
For first teaching in 2016

J260/04 Summer 2018 series

Version 1

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Contents

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Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates. The reports will include a general commentary on candidates' performance, identify technical aspects examined in the questions and highlight good performance and where performance could be improved. The reports will also explain aspects which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

Where overall performance on a question/question part was considered good, with no particular areas to highlight, these questions have not been included in the report. A full copy of the question paper can be downloaded from OCR.

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Paper J260/04 series overview

Combined Science B (Twenty First Century Science) – Learners study biology, chemistry and physics using a narrative-based approach. Ideas are introduced within relevant and interesting settings which help candidates to anchor their conceptual knowledge of the range of scientific topics required at GCSE level. Practical skills are embedded within the specification and candidates are expected to carry out practical work in preparation for a written examination that will specifically test these skills.

Paper J260/04 is a foundation level paper and tests grades 1-5. It is worth a total of 75 marks and lasts 1 hour 45 minutes. The paper carries a weighting of 20.8% of the marks for the GCSE and tests content from all areas of the specification.

Candidates who did well in the examination	*Candidates who did not do so well in the examination*
• Applied their knowledge and understanding to new situations • Showed clear working out in numerical questions • Made clear, concise and unambiguous statements in the Level of Response question (6e) • Used the maximum number of marks available for each question and wrote the same number of correct statements to ensure they scored the full mark for the question • Used a ruler to draw bar graphs and lines of best fit • Correctly used a range of scientific terms in their answers	• Found it difficult to apply their knowledge and understanding to new situations • Only gave their incorrect final answer in numerical questions, therefore missing out on marks for working out • Repeated information given in the question without applying or processing it • Gave answers that did not address what the question was asking or did not give enough specific detail • Gave chemical formulae with incorrect cases, e.g. NAcL • Did not tick the correct number of boxes in multiple choice questions • Had difficulty in interpreting scales on graph axes

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Question 1(a)

1 Eve is making sodium chloride in the school laboratory.

(a) Eve makes the sodium chloride by reacting hydrochloric acid with sodium carbonate solution.

Complete the risk assessment in **Table 1.1** for the hydrochloric acid.

Source of hazard	Hazard	Risk	Safety precaution
Hydrochloric acid		Irritating to skin and eyes if spilt or splashed	....

Table 1.1

[1]

This question was getting candidates to think about assessing risk in a neutralisation experiment. Most candidates scored the mark on this question.

Where they didn't get the mark, it was because their answer was not specific enough.

Common answers that scored zero were 'cover the skin' without telling us what to cover it with (i.e. gloves) and 'wear glasses' without the word 'safety'.

Other candidates mentioned about washing hands/washing out eyes, but this was not a pre-emptive measure and so gained no credit. The term 'PPE' was too vague and also gained no credit.

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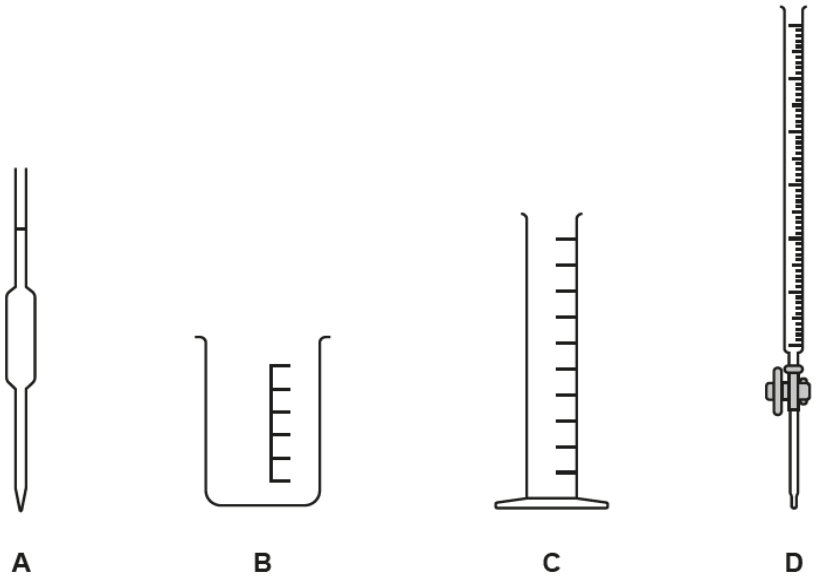
Question 1(b)(i)

(b) Eve uses a **titration** to react the hydrochloric acid and sodium carbonate solution in the correct quantities.

(i) Which piece of apparatus, **A**, **B**, **C** or **D**, should she use to add the hydrochloric acid?

Put a (ring) around the correct answer.



[1]

Roughly half of candidates scored the mark here. A, the pipette, was the most common wrong answer.

Question 1(b)(ii)

(ii) Eve adds a few drops of a chemical to a conical flask containing the sodium carbonate solution. The chemical added changes colour.

What is the name of this type of chemical?

..... **[1]**

80% candidates wrote a creditworthy answer to this question. Common wrong answers were 'acid', 'alkali' and 'iodine' (showing confusion with testing for starch).

The most common correct answer was where candidates named a particular indicator (Universal Indicator being the most popular) rather than the generic word 'indicator'.

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Question 1(c)(i)

(c) (i) Complete and balance the chemical equation for the reaction between sodium carbonate solution and hydrochloric acid.

sodium carbonate + hydrochloric acid → sodium chloride + carbon dioxide + water

Na_2CO_3 (aq) + 2 HCl (aq) → 2 ..... (aq) + ... (g) + H_2O (l)

[2]

This question was testing candidates' recall of chemical formulae. Two thirds of candidates scored either one or both marks here. The mark for CO_2 was the most common creditworthy answer.

A significant number of candidates incorrectly gave the symbol for cobalt, Co, either with or without the 2 as their formula for carbon dioxide. Candidates also had difficulty in differentiating the sizes of the letters C and L in NaCl and where this was not entirely clear, examiners did not give credit.

Question 1(c)(ii)

(ii) Which statement about the reaction between sodium carbonate solution and hydrochloric acid is correct?

Tick (✓) **one** box.

- All the products are in the aqueous state. ☐
- Sodium carbonate is neutralised during the reaction. ☐
- All of the carbon dioxide produced dissolves in the reaction mixture. ☐

[1]

This question was correctly answered by about half of the candidates.

Question 1(d)

(d) Which process is used to produce **solid** sodium chloride from sodium chloride solution?

Tick (✓) **one** box.

- Chromatography ☐
- Crystallisation ☐
- Filtration ☐

[1]

Most candidates gave the correct answer.

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Question 1(e)

(e) Sodium chloride is more commonly known as salt.

In some countries, water contains high levels of salt. The salt has to be removed from the water so people are able to drink it.

Which process would separate pure water from the salt water?

Tick (✓) **one** box.

- Chromatography ☐
- Crystallisation ☐
- Distillation ☐
- Filtration ☐

[1]

Less than half of the candidates were credited the mark on this question.

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Question 1(f)(i)

(f) Sodium chloride (salt) is used to add flavour to food. Many people are concerned about the effects of high intakes of sodium on human health.

The graph in **Fig. 1.1** shows data from a study in 1995. It shows the relationship between intake of sodium and the rate of stomach cancer in different countries.

Fig. 1.1

(i) Describe the relationship between average sodium intake and deaths from stomach cancer.

.....

.....

..... **[1]**

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Three quarters of candidates were credited this mark.

'Positive correlation' was a very common correct response but most candidates linked the increase in one variable with the increase in the other.

Where candidates did not score the mark, it tended to because they only mentioned one variable e.g. 'the number of deaths goes up', they discussed risk of cancer rather than number of deaths or they discussed data about one of the countries without linking the changes in the variables.

Question 1(f)(ii)

(ii) Which statement about the graph in **Fig. 1.1** is correct?

Tick (✓) **one** box.

- The death rate in England and Wales is 10 per 100 000 people per year. ☐
- The study is too old for data to be reliable. ☐
- The data point from Portugal is an outlier. ☐
- The death rate in South Korea is higher than expected from the trend. ☐

[1]

Most candidates were credited the mark here.

Question 1(g)

(g) Some studies have suggested that a bacterium called *Helicobacter* is linked with stomach cancer.

One idea is that salt affects the growth of *Helicobacter*.

Suggest an experiment to test this idea.

.....

.....

.....

..... **[2]**

Here, we were looking for the idea of growing bacterial cultures in different concentrations of salt – the minimum being two (one with salt and one without).

Where candidates scored both marks it tended to be those who mentioned Petri dishes where one contained salt and bacteria and the other dish contained only bacteria.

Many candidates gave responses about feeding people salty foods and testing their stomachs for helicobacter, thereby missing the idea of culturing the bacteria in laboratory conditions. Others wrote about just growing helicobacter in salt alone and missed the idea of comparison. Some candidates thought helicobacter would spontaneously appear if salt was left alone for a while.

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Question 2(a)(i)

2 Amir is investigating electric circuits and magnetism.

(a) Amir sets up a solenoid.

(i) Describe how a solenoid can be made.

.....

..... **[1]**

Few candidates answered this question well. Most candidates did not understand the word 'solenoid' or have an idea what a solenoid was. Lots of candidates then made use of the diagram of the solenoid in 2aii and incorrectly described it as a spring in this part of the question.

We were insistent on the word 'wire' as the question asked how a solenoid could be made and not just to say what a solenoid was. Many candidates got the idea of a coil but did not mention the wire. 'Coiled metal' was a common answer that didn't get the mark as they didn't realise we wanted the word 'wire'.

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Question 2(a)(ii)

(ii) Amir connects the solenoid in a circuit. The circuit is shown in **Fig. 2.1**.

Amir closes the switch.

On the diagram in **Fig. 2.1**, draw:
- the direction of current flow through the solenoid
- the magnetic field lines and their direction
- the poles of the magnetic field produced.

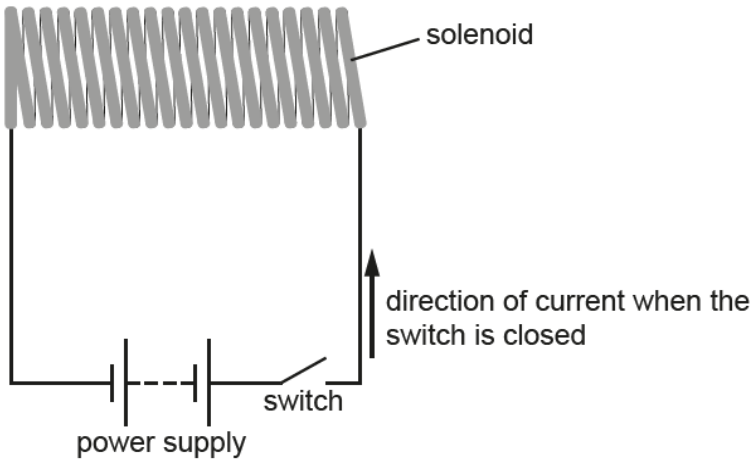

Fig. 2.1

[3]

It would appear candidates have very little knowledge about electromagnetism, with more than half of candidates gaining no credit for this question.

The most common non-zero answer was credited 1 mark for an arrow on or near the solenoid pointing to the left to show us the direction of the current. Correct identification of the N and S poles was rare and correct diagrams showing the lines of magnetic field were extremely rare. Several candidates labelled the poles with + and – rather than N and S.

Many candidates left this question blank. Candidates should be taught to look for the marks in brackets near diagrams, charts tables as an indicator of there being marks available for adding something to them.

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Question 2(b)(i)

(b) Amir places an iron core in the solenoid. The iron core becomes magnetised.

Amir uses the magnetised iron core to pick up paper clips. He counts the number of paper clips picked up.

He then repeats the experiment several times, each time changing the number of turns in the solenoid.

Amir's results are shown in **Table 2.1**.

Number of turns in the solenoid	Number of paper clips picked up by the iron core
10	5
20	10
30	14
40	19
50	25
60	31

Table 2.1

(i) Complete the graph in **Fig. 2.2** by plotting the results from **Table 2.1** and draw a line of best fit. Some have been plotted for you.

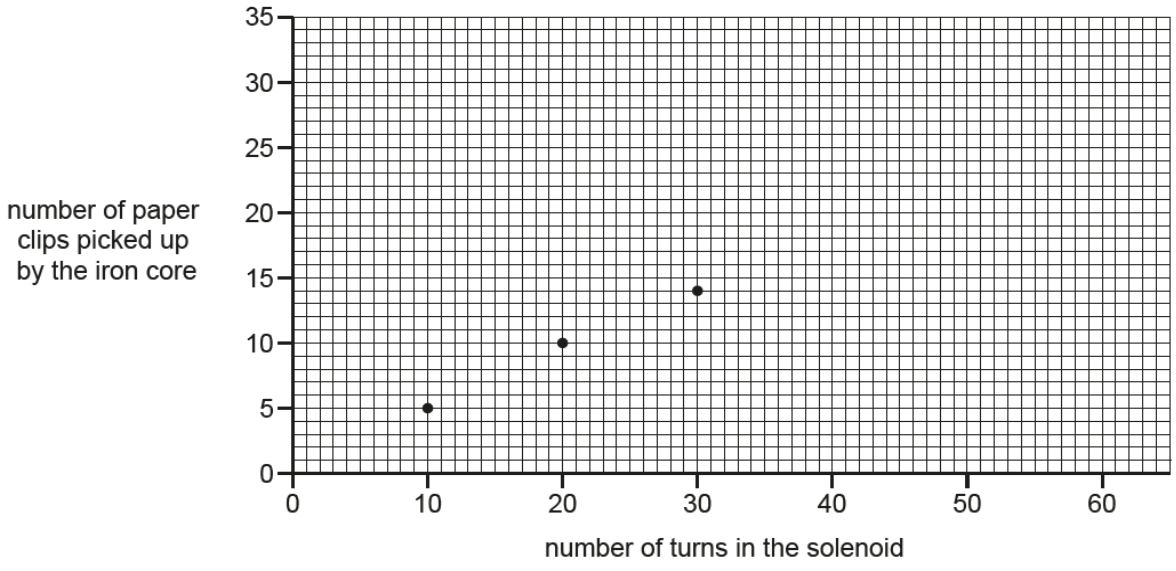

Fig. 2.2

[2]

This question was well answered. Most candidates gained both marks.

Where only 1 mark was credited it was usually because the candidate's line of best fit was either absent or poorly drawn. We saw many dot-to-dot lines and wonky ones that were drawn without a ruler.

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Question 2(b)(ii)

(ii) Describe the trend shown in the graph in **Fig. 2.2**.

.....

.....

..... **[2]**

Most candidates were credited one mark here.

The second mark, about the linear nature of the relationship, was very rarely seen by examiners. Teachers would be well advised to train candidates to look at the number of marks allocated to 'describe the trend' questions and to realise if there is more than one then an extra, more detailed, statement about the relationship is required to gain the other mark(s).

Question 2(b)(iii)

(iii) State **one** other way to increase the strength of the magnetic field around the solenoid.

..... **[1]**

Most candidates were credited this mark. The most common incorrect answers were vague and related to power or larger batteries rather than current or voltage or talked about increasing the number of coils/turns, hinting that the candidates had not read the question properly before writing their answer.

Question 2(c)

(c) Electromagnets are often used in scrapyards.

Which statement about electromagnets is correct?

Tick (✓) **one** box.

- The electromagnets that lift waste use weak magnetic fields. ☐
- Electromagnets are not permanent magnets. ☐
- Electromagnets can be used to pick up all metal waste. ☐
- Electromagnets can work when the current is on or off. ☐

[1]

Only around one third of candidates gained the mark with most thinking all metals are magnetic.

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Question 3(a)

3 Nina is investigating alcohol (ethanol) production as a sample of beer is brewed.

Ethanol is produced by a chemical process called fermentation.

Fermentation can be represented by the following equation.

glucose → ethanol + carbon dioxide

(a) Nina measures the rate of the reaction by recording the volume of ethanol produced by 1 dm^3 of beer over a period of time.

Suggest **one** other method for recording the rate of this reaction.

.....

..... **[1]**

Few candidates were credited this mark. Many candidates gave answers relating to measuring the rate of a generic chemical relation rather than the specific one mentioned in the question. Others mentioned measuring the amount/volume of ethanol produced by different volumes of beer.

Question 3(b)

(b) Nina plots the graph in **Fig. 3.1** to show the volume of ethanol produced over a period of time.

Fig. 3.1

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Question 3(b)(i)

(i) What volume of ethanol has been produced after 120 hours in **Fig. 3.1**?

Volume = ... cm^3 **[1]**

Many candidates were credited this mark. Those who did not gain the mark, tended to misread the scale on the time axis and assumed that one box was 10 hours rather than 5 hours.

Question 3(b)(ii)

(ii) Calculate the rate of ethanol produced over the first 120 hours in **Fig. 3.1**.

Rate = ... cm^3/h **[3]**

Most candidates either gained no marks or 3 marks in this question, despite us allowing mark for correct working. Many candidates attempted the question but **only** gave an incorrect answer without showing any working at all and would have scored some marks had they shown us what they were trying to do.

The most common answer given was 2.5, showing candidates realised division was necessary but getting it upside down – the larger number divided by the smaller number. Candidates should not fear getting an answer lower than 1.

AfL A useful teaching tip is to use the units cm^3/h as a guide as to which numbers go on the top and bottom of the division, i.e. the cm^3 goes on the top and the h on the bottom.

Key

AfL Guidance to offer for future teaching and learning practice.

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Question 3(c)(i)

(c) Some other students carry out investigations to determine the rate of this reaction at different temperatures.

The graph in **Fig. 3.2** shows how the rate of reaction changes over a range of temperatures.

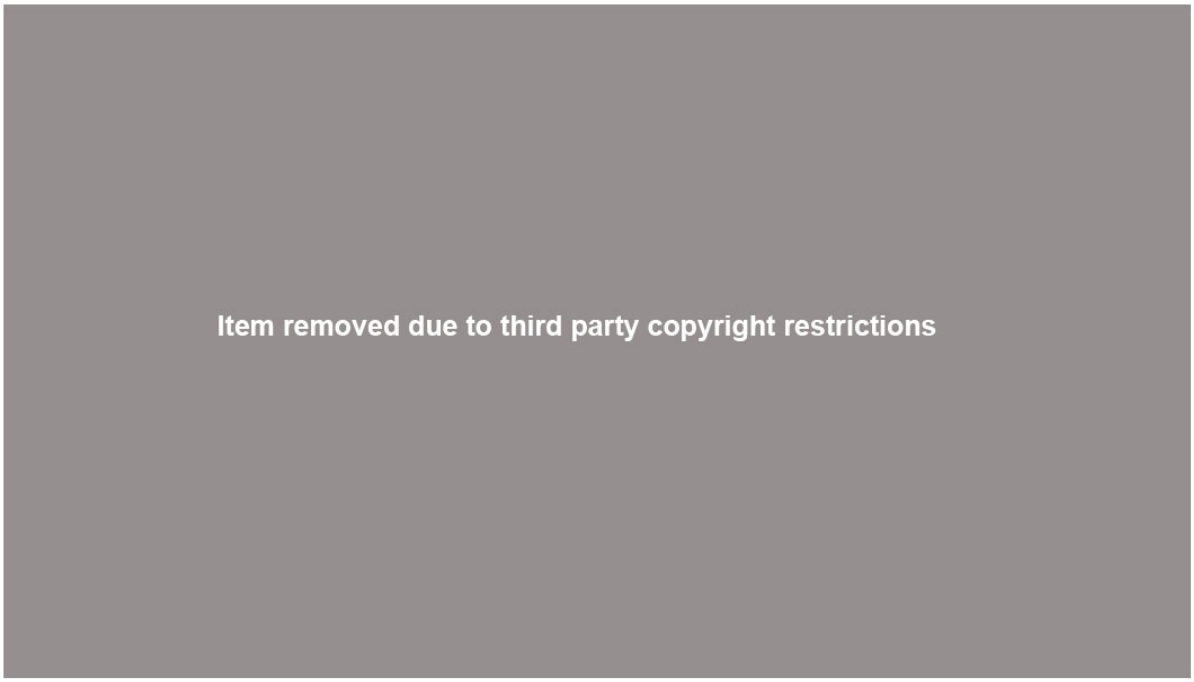

Fig. 3.2

(i) What was the temperature range of the investigation?

Temperature range = ... °C to ..... °C **[1]**

About half of candidates were credited this mark.

The most common mistake was incorrectly stating the temperature at the bottom end of the range as 0.35 or a number close to this.

Question 3(c)(ii)

(ii) Using information from **Fig. 3.2**, estimate the optimum temperature for fermentation.

Optimum temperature = ... °C **[1]**

Most candidates were credited this mark, but many did not seem to understand the meaning of the term 'optimum'.

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Question 3(iii)

(iii) The students want to find a more accurate estimate of the optimum temperature for fermentation.

How could they do this?

Tick (✓) **two** boxes.

- Carry out the experiment at higher temperatures. ☐
- Measure the reaction rate at smaller temperature intervals. ☐
- Brew a larger volume of beer. ☐
- Brew the beer over a shorter period of time. ☐
- Carry out the experiment again between 30 °C and 35 °C. ☐

[2]

Most candidates were credited one of the marks. The most common reason for not gaining both marks was candidates only ticking one box despite the question asking for two.

Question 3(d)

(d) The ethanol concentration of beer can be found by measuring its density.

Describe how to measure the density of a liquid.

.....

.....

.....

..... **[2]**

Most candidates gained no marks on this question. Most candidates who gained no marks discussed using Eureka/displacement cans to find the volume of an irregularly shaped object but then didn't mention mass or they mentioned 'weighing' an object rather than mentioning the word 'mass'.

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Question 4(a)

4 Alex and Beth are investigating reaction time.

(a) Alex drops a 30 cm ruler. Beth catches the ruler between her thumb and fingers, as shown in **Fig. 4.1**.

The distance the ruler fell before being caught is recorded.

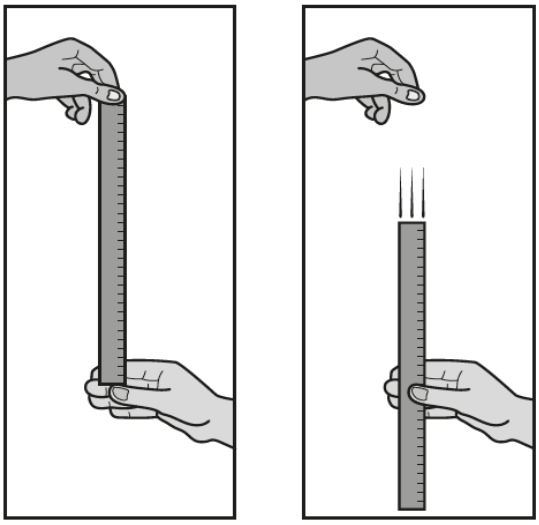

Fig. 4.1

(i) Suggest why the students work in pairs when carrying out the experiment.

.....

..... **[1]**

Over half of the candidates answered this question well, however many missed the point and discussed reliability. Others got the idea but were too vague or talked about 'not being able to cheat'. A few of candidates thought the students were timing the drop itself rather than using the ruler as a proxy for this – which underlines the importance of candidates actually doing experimental work themselves in their lessons.

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Question 4(a)(ii)

(ii) Suggest **three** factors that need to be kept constant when carrying out the experiment.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

Most candidates did well on this question. Those who did not tended to talk about risk assessment or the same timer/stop clock being used. Other candidates were vague and mentioned keeping 'the distance' or 'the height' the same but without telling us this was the distance between the ruler and the catcher's fingers or the height the ruler was dropped from.

Question 4(a)(iii)

(iii) Suggest **one** factor that must be kept constant when making the measurements.

..... **[1]**

Most candidates did not answer this question well. Candidates mostly repeated their answer to the previous question or did not explain their answer fully enough despite having an idea along the right lines, presumably as a result of having done the experiment themselves. A few more words would have scored them the mark. A lot of candidates thought the units would have to be the same, but we could easily convert these if we needed to. Other candidates thought about the ruler being the same despite it being a standardised/calibrated piece of measuring equipment.

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Question 4(b)(i)

(b) The students' results are shown in **Table 4.1**.

Trial	Distance the ruler dropped before being caught (mm)
1	115
2	113
3	109
4	111
5	112
6	107
7	109
8	108
9	109
10	108

Table 4.1

(i) Calculate the mean distance the ruler dropped.

Give your answer to **3** significant figures.

Mean distance = ... mm **[2]**

Most candidates were credited some of the marks here. The most common error was to arrive at 110.1 and then not truncate to 3 significant figures.

110.100 was reasonably common showing confusion between significant figures and decimal places.

Question 4(b)(ii)

(ii) What was the median distance the ruler dropped?

Put a (ring) around the correct answer.

107 mm **109 mm** **110 mm** **110.5 mm** **115 mm**

[1]

Generally well answered. Most candidates showed their working and listed the numbers in order and then chose the middle one.

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Question 4(c)(i)

(c) When the students' reaction times are measured, different parts of the nervous system are involved.

(i) Which sequence places the parts of the nervous system in the correct order?

Tick (✓) **one** box.

eye → sensory neuron → spinal cord → brain → spinal cord → motor neuron → muscle ☐

eye → sensory neuron → spinal cord → motor neuron → muscle ☐

eye → sensory neuron → brain → spinal cord → motor neuron → muscle ☐

eye → motor neuron → spinal cord → brain → spinal cord → sensory neuron → muscle ☐

[1]

Half of candidates were credited the mark here.

Question 4(c)(ii)

(ii) How are nerve impulses transmitted between neurons?

Tick (✓) **one** box.

Neurons are physically connected ☐

Through the brain ☐

Through the spinal cord ☐

Across gaps called synapses ☐

[1]

Half of candidates were credited the mark here.

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Question 4(d)(i)

(d) The students read an article about a study on the effects of alcohol on reaction time.

Scientists investigated the reaction times of two groups of adults.

The adults belonged to either a control group or an experimental group.

The different groups of adults were given a different drink, as shown in **Table 4.2**.

Ingredient used to make the drink	Volume of ingredient (cm^3)	
	Control group	Experimental group
Orange drink (contains no alcohol)	240	200
Alcoholic drink	0	40

Table 4.2

(i) Suggest why orange drink was added to both groups' drinks.

.....

..... **[1]**

Correct answers to this question were rarely seen. We were after the idea of disguising the taste or appearance of the alcohol so as to make the experiment a blind test. Many candidates explained that some people don't drink alcohol, might want the choice of the two drinks or that orange juice is popular mixer to put in with your alcoholic drink.

Question 4(d)(ii)

(ii) Suggest why 240 cm^3 of the drink was given in each experiment.

.....

..... **[1]**

Again, correct answers were very rare. We were after the idea of ruling out volume of liquid as a contributory factor or even the disguising idea again. We saw lots of 'so the volume was the same' but without telling us why this was important.

Most candidates wrote the generic 'to make it a fair test' statement, which is far too vague and seems to be a fall-back answer candidates use to avoid leaving a blank space. Teachers would be advised to get candidates to explain their meaning. Again, a fuller answer would probably have scored a mark for many candidates.

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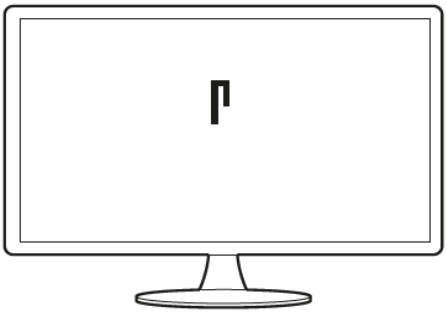
Question 4(d)(iii)

(iii) The reaction times of the two groups were monitored using a computer.

Two connected lines of different length appear on the computer screen. The longer line could appear on the left or on the right.

The times when the lines appear is random. Whether the longer line is on the left or right is also random.



When the line is seen by those involved, they have to click a key for 'left' or 'right'.

The time taken for a response is measured by the computer.

Give **two** reasons why this method of measuring reaction times gives improved results when compared to using a ruler.

1 .....

.....

2 .....

.....

[2]

Most candidates were credited some marks here. The idea of being more accurate was the most common correct answer, with less chance of there being mistakes coming second. Other correct answers were rare. We saw lots of vague answers about 'it' being 'easier' with no explanation of why.

Candidates should be discouraged from using the word 'it' as this will then force them into giving us the extra detail that can pick up marks.

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Question 5(a)(i)

5 Plastics are important in our everyday lives. Plastics are made of polymers.

(a) Scientists have studied the environmental impact of plastics. They have looked at their production, use and disposal.

People do not always dispose of plastic waste carefully. This means that it can end up in the sea.

Table 5.1 shows the density of some polymers used to make plastics that pollute the sea.

Polymer	Density (kg / m^3)
LDPE	920
HDPE	960
Nylon	1120
Polyester	1040
PET	1041

Table 5.1

The density of seawater is approximately 1025 kg / m^3.

The density of pure water is 1000 kg / m^3.

(i) Which statement about the behaviour of polymers in seawater is correct?

Tick (✓) **one** box.

- HDPE waste would float in seawater, but LDPE would sink. ☐
- PET waste would eventually sink in seawater. ☐
- Nylon is less dense than seawater. ☐
- Polyester has a higher density than seawater, but is less dense than pure water. ☐

[1]

Just over half of candidates gained the mark here.

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Question 5(a)(ii)

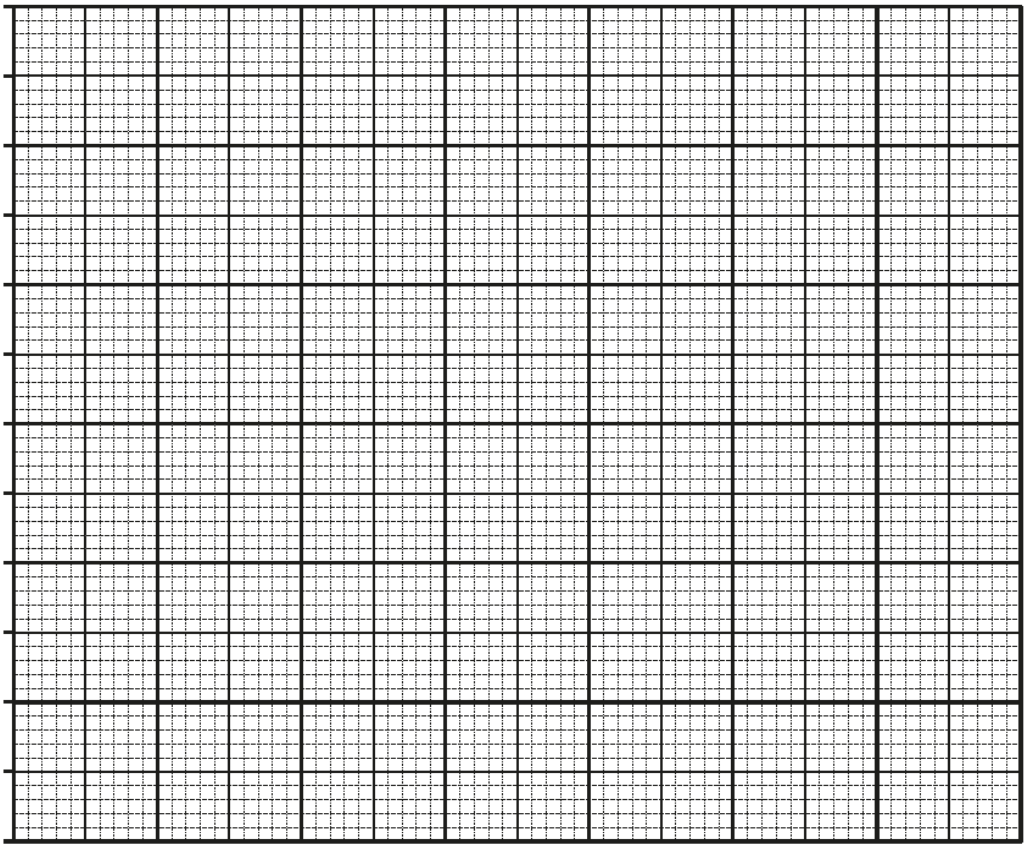
(ii) A study identified the types of plastic litter in samples of seawater.

Some of the results are shown in **Table 5.2**.

Type of plastic litter	Amount of plastic litter (%)
Beads	3
Fibres	57
Plastic fragments from larger pieces	34
Larger pieces of plastic (> 5 mm)	5

Table 5.2

Draw a bar chart of the data from **Table 5.2**.



[2]

Despite bar charts being fairly straightforward, a few candidates did not gain either of the two marks in the question.

We were quite strict with marking point 1 and many candidates did not label their horizontal axis with 'type of plastic' or similar or omitted the % symbol on the vertical axis. The scale on the vertical axis was generally well done, even if the first marking point was not credited for a different reason.

It seemed obvious that many candidates had not brought a ruler into the examination and examiners found it difficult to award the second mark for wonky horizontal lines at the top of bars.

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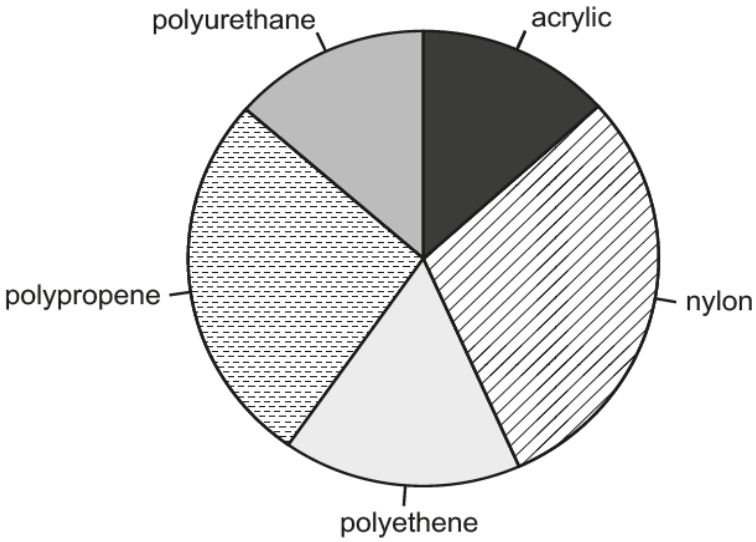
Question 5(a)(iii)

(iii) The samples of plastic litter were analysed and the type of polymer was identified.

The main types of polymer found are shown in the pie chart.



Which **two** conclusions about the main types of polymer in the plastic waste are **true**?

Tick (✓) **two** boxes.

- Polyethene forms about 5% of the waste. ☐
- The proportions of acrylic and polyurethane are approximately the same. ☐
- The proportion of polypropene is approximately double that of acrylic. ☐
- Polypropene forms the smallest proportion of waste. ☐
- Acrylic forms the largest proportion of waste. ☐

[2]

This question was generally very well answered, but many candidates only ticked one of the boxes.

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Question 5(b)

(b) PET is the main type of polymer used for manufacturing plastic drinks' bottles.

Describe **one** of the processes for recycling PET from drinks' bottles.

.....

.....

.....

.....

.....

..... **[4]**

This question was not well answered with not very many candidates being credited over 1 mark. The most common answer was related to making new products, closely followed by washing the bottles.

Many candidates misinterpreted the question and rather than discussing recycling, they discussed reusing the bottles by refilling them. The most common non-creditworthy answer related to melting the bottles down before turning them into something new. Other candidates thought that burning the bottles and using what was left to make new ones was how recycling worked.

Question 5(c)(i)

(c) PET was considered non-biodegradable.

In 2016, scientists in Japan discovered a type of bacterium living on the surface of waste PET bottles. The bacterium produces enzymes that break down the PET.

(i) The scientists think that the bacterium may be useful in the recycling of PET.

Suggest **two** ways in which the bacterium might improve recycling.

1 .....

2 .....

[2]

This question was not well answered.

This question did involve a bit of thinking outside of the box. The most common mark related to fewer bottles ending up in the sea, which we took to mean less litter. The other marking points were very rarely seen.

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Question 5(c)(ii)

(ii) The bacterium is thought to have evolved from an existing species of bacterium.

The stages in its evolution are described below.

They are not in the correct order.

A Some bacteria are able to produce enzymes to break down PET.

B Mutations occur in some bacteria.

C The altered gene spreads through the population.

D Natural selection occurs.

Put the stages in the correct order.

Complete the table below.

[2]

It was rare to see 2 marks credited here. Most candidates gained 1 mark for having B before C.

Question 6(a)

6 Parkinson's disease is a condition that affects the nervous system. There is currently no cure for the disease.

(a) It is estimated that 145 000 people will have Parkinson's disease in 2018.

It is predicted that by 2025 the number of people with Parkinson's disease will rise by $\frac{1}{5}$.

Calculate how many more people will have Parkinson's disease in 2025 than in 2018.

Number of people = ... **[2]**

Many candidates worked out the 29,000 that we wanted to see then penalised themselves by going further and doing something to then produce wrong final answer.

One common error was to add the correctly calculated 29,000 to the original 145,000. Other candidates then felt the need to multiply their correct answer by some kind of conversion factor, usually 10.

Many candidates gave an incorrect number and gained no marks but they may have gained a mark had they shown their working. Candidates should always show their working.

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Question 6(b)

(b) Scientists have observed that smoking affects people's risk of developing the disease.

The scientists investigated three groups of patients with Parkinson's disease.

A total of 1808 patients were studied.

Discuss the findings of the study.

.....

.....

.....

..... **[2]**

In this question we were looking for a comment about risk. Many candidates just quoted numbers from the table without interpreting them and didn't link their answer to the risk. Fewer than half of candidates gain any credit on this question and the number scoring the second marking point was very low.

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Question 6(c)(i)

(c) One hypothesis states that nicotine in cigarettes may protect against Parkinson's disease.

People use e-cigarettes because they may be a less harmful source of nicotine.

Pure nicotine is a liquid at room temperature.

Fig. 6.1 is a simplified diagram showing how an e-cigarette works.

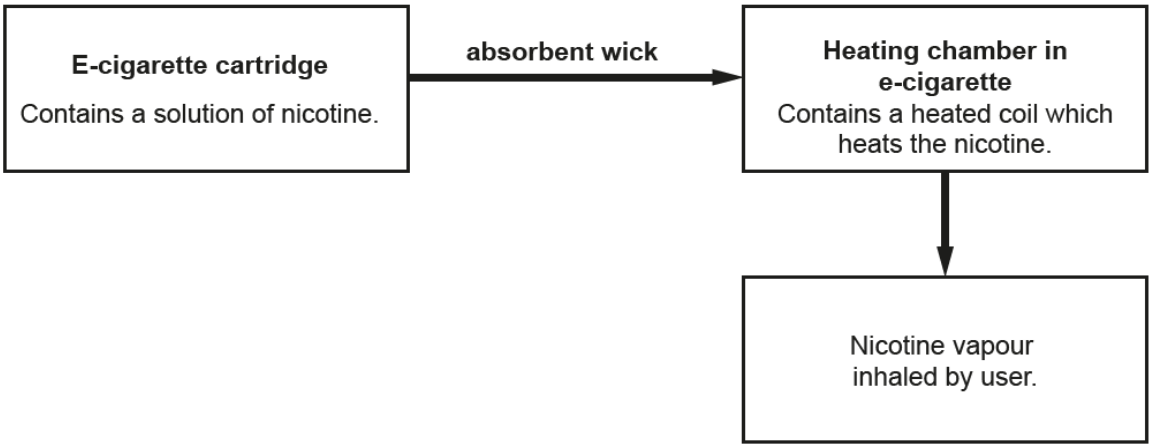

Fig. 6.1

(i) Describe what happens to nicotine **particles** in the heating chamber in an e-cigarette.

.....

.....

..... **[2]**

Most candidates gained some of the marks available. Many candidates did not spot there were 2 marks available and only wrote one correct statement, thereby limiting their score to 1.

The most common answer was about the particles evaporating or boiling but answers about energy or spacing of particles were comparatively rare.

Common errors were stating that the particles started to vibrate as they turned into a gas – hinting at a misconception that the particles have no kinetic energy while in the liquid form.

Question 6(c)(ii)

(ii) Compare the changes that occur in an e-cigarette with those in a cigarette that burns tobacco.

.....

.....

..... **[1]**

Correct answers to this question were extremely rare. Candidates tended to consider one of the types of cigarette without writing about the other, thereby missing the idea of a comparison. A significant number of candidates gave answers that would have been good answers for the previous question.

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Question 6(d)(i)

(d) Some students are talking about using e-cigarettes to reduce the risk of Parkinson's disease.

Ali
Is it the nicotine that's involved in protection against Parkinson's disease, or some other factor?

Kai
Nicotine raises heart rate and blood pressure. It also increases the risk of cardiovascular disease.

Layla
Nicotine is very addictive and should be avoided, whether it's in tobacco cigarettes or e-cigarettes.

Sarah
Scientists have found that nicotine affects levels of a chemical transmitter molecule between neurons in the brain.

(i) Which student is discussing the idea of correlation and cause?

Tick (✓) **one** box.

- Ali ☐
- Kai ☐
- Layla ☐
- Sarah ☐

[1]

Few candidates were credited the mark here.

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Question 6(d)(ii)

(ii) Which student has suggested a possible mechanism for the action of nicotine?

Tick (✓) **one** box.

- Ali ☐
- Kai ☐
- Layla ☐
- Sarah ☐

[1]

Around half of candidates were credited this mark.

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Question 6(e)*

(e)* Food plants in the same family as tobacco also contain nicotine.

Scientists have studied how eating these foods affects the numbers of people with Parkinson's disease.

People with Parkinson's disease answered a questionnaire about their diet.

Scientists assessed the risk of developing Parkinson's disease in people that ate plant foods containing nicotine. The results are shown in **Table 6.1**.

Table 6.1

*This is the person's risk compared with patients who ate foods containing no nicotine.

For example:
- if the risk is 2.00, you are twice as likely to get the disease
- if the risk is 0.50, you are half as likely to get the disease.

Use the information to determine if there is a correlation between eating plant foods with different concentrations of nicotine and the risk of developing Parkinson's disease.

Use the data in **Table 6.1** to support your answer.

.....

.....

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..... **[6]**

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This question discriminated between candidates of differing abilities.

Only about a third of candidates were credited a level 3, a quarter did not attempt the question at all and the rest were evenly split between levels 1 and 2.

The question required candidates to carefully analyse the data and conclude about any possible correlation between the two variables.

Higher ability candidates made clear level 3 statements about the negative correlation or spotted the result for juice (which did not fit in with the otherwise negative correlation) and then went on to say there was no correlation. Examples of clear statements were 'there is no correlation', 'there is a negative correlation with juice as an anomaly' or 'the more nicotine you eat the less likely you are to get Parkinson's disease'.

Typical answers that met the criteria for level 2 were along the lines of identifying two foods that reduced the risk of the disease. For example, 'eating peppers and potatoes reduces your risk'.

Level 1 answers tended to have basic statements that identified one food and its change in risk - like 'potatoes lower your risk'. Some candidates thought that potatoes themselves are a low risk.

Many candidates interpreted the data for the control (foods containing no nicotine) as meaning you were certain to get the disease if you didn't eat nicotine containing foods, showing possible confusion between relative scales and probabilities.

Comments about there being 'weak' or 'low' correlation were common in lower ability candidates, showing some candidates use the word 'correlation' without demonstrating an understanding of what the word means – there was either a **negative** correlation or **no** correlation, which is very different to weak correlation. Others just quoted data back at us, which did not show they had thought about or processed it.

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Exemplar 1

Use the information to determine if there is a correlation between eating plant foods with different concentrations of nicotine and the risk of developing Parkinson's disease.

Use the data in **Table 6.1** to support your answer.

L3

The data in the table suggests that eating foods with less nicotine in them puts you at more risk of developing Parkinson's. For example, potatoes only have 19 µg of nicotine but have a 0.92 risk of developing Parkinson's whilst peppers that contain 8.3 µg more of nicotine than potatoes and have only a 0.24 chance. However this could be argued because tomato juice has a chance of 2.16 with a 30 µg of nicotine, which could be correct [6]
high.

This answer shows a reasoned answer as to how nicotine in food affects the change of developing Parkinson's disease. The candidate has used three sets of data from the table, two to show the correlation and third to show that tomato juice does not follow the trend of the other foods. This answer was credited Level 3, 6 marks.

Copyright acknowledgements

Question 5a(iii)

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Question 5a(ii), Table 5.2

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