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Oxford Cambridge and RSA

GCSE (9-1)

Examiners' report

TWENTY FIRST CENTURY SCIENCE PHYSICS B

J259
For first teaching in 2016

J259/02 Summer 2019 series

Version 1

Contents


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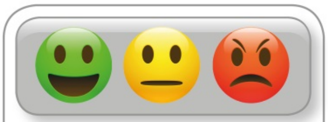


Introduction

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.

Paper 2 series overview

J259/02 is the foundation tier of one of the two examination components for the GCSE (9-1) Physics B specification (21st Century Science.) Candidates will have already sat the examination for the Breadth in Physics component and this is the examination for the Depth in Physics component. The last three Questions, 8, 9 and 10, are also on the higher tier and are marked with the same mark scheme. These are the most challenging questions on this paper.

This component accesses content from across the whole specification. It allows candidates to demonstrate their depth of understanding of specific aspects of the content. To do well on this component, candidates need to be able to apply their knowledge and understanding to new contexts and to be able to analyse the information and ideas presented by the questions. In calculations, they should write down the equation they are going to use and show their working.

Candidates who did well on this paper generally did the following	*Least successful topic/question/set texts*
• Used the information given in the question and their own knowledge in their answers. • Could do required calculations and showed their method clearly. • Were able to apply their knowledge and understanding to new situations. • Attempted all the questions.	• Did not show the steps in their calculations. • Remembered equations incorrectly. • Gave no response to a number of questions. • Did not understand some of the unfamiliar situations and either did not have the knowledge or could not apply it.

More candidates showed their working than was the case last year. They had the skills and knowledge to do very well on Question 6 and Question 8.

Most candidates managed their time well and attempted the last question, although they were less successful with this harder question.

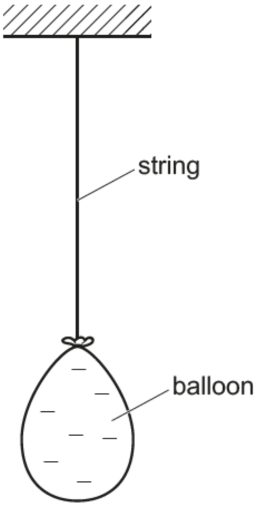
Other questions they found difficult were Questions 1 and 7.

Question 1 (a)

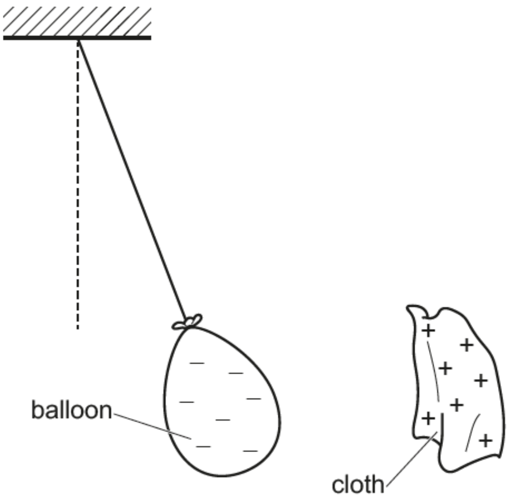
1 This question is about static electricity.

Jack rubs a rubber balloon with a dry cloth. The balloon becomes negatively charged and the cloth becomes positively charged.

He hangs the negatively charged balloon from a long piece of string. The balloon hangs vertically.



He now brings the positively charged cloth close to the balloon. The balloon now hangs at an angle to the vertical.



(a) What is the name of the **field** that surrounds the charged balloon and cloth?

Put a (ring) around the correct answer.

electric **electromagnetic** **gravitational** **magnetic** **[1]**

Very few candidates knew that the field was electric. The most common answers were electromagnetic and magnetic.

?	**Misconception** Electric and magnetic fields	Whilst a common misconception in questions of magnetic field is to introduce the notion of electric charge and to consider electrostatic attraction and repulsion, this question demonstrates the converse, confirming that candidates are unclear as to the distinction between electric and magnetic fields.

Question 1 (b)

(b) Explain why the balloon no longer hangs vertically.

....

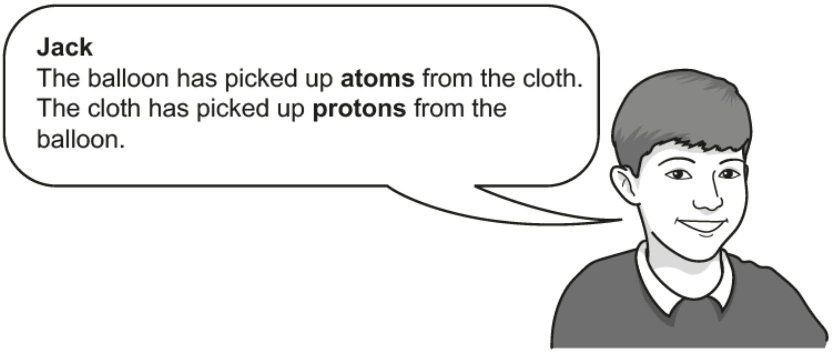
....

.... **[2]**

Most candidates knew that this was because the balloon was attracted to the cloth. A few said that this was because unlike charges attract, or positive and negative charges attract, and some said electrons and positive ions attract. Other candidates thought this was a magnetic interaction, or tried to state (but did not know) the particles that were interacting. For example, some suggested positive and negative electrons.

Question 1 (c)

(c) Jack makes the following comment to explain the charges on the balloon and the cloth.



Is Jack correct?

☐ Yes

☐ No

Explain your choice.

....

....

....

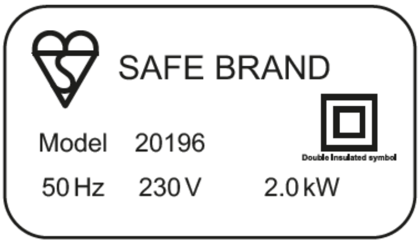
.... **[2]**

The most common correct response was to say that the balloon had gained electrons. Some candidates said that the cloth lost electrons. Many candidates did not say enough for 2 marks. There were many incorrect statements about atoms, protons, neutrons and ions moving between the balloon and the cloth.

Question 2 (a) (i)

2 Kareem is researching a kettle to buy for his grandad.

(a) This is the label for one kettle he found on the Internet.



Kareem makes the following comment.

(i) What is the frequency and potential difference (voltage) of the domestic supply in the UK?

Frequency = ...

Potential difference (voltage) = ...

[1]

A common error here was to omit the units.

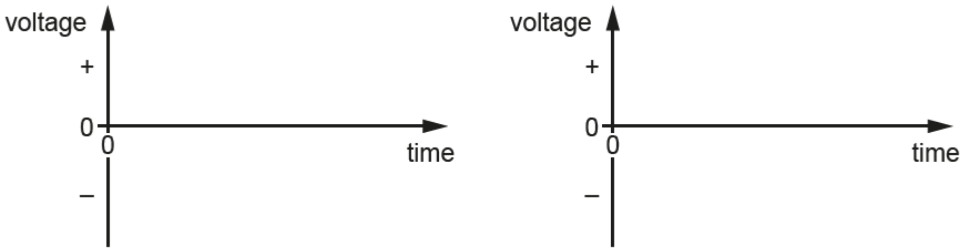
Text in the right hand column to indicate how this callout is relevant to the question.

	AfL	Three consistent areas which will lose marks for candidates.
		Candidates should always put units to support any measured value.
	Units	Answers are always acceptable in standard form.
	Standard form	Candidates often overlook the link between powers of ten and prefixes to units
	Powers of ten	Whilst there may be occasions where credit is given for inappropriate numbers of significant figures or numerical answers with no units, candidates will never lose marks for answering in standard form with the correct units

Question 2 (a) (ii)

(ii) On the axes, sketch a graph for a direct voltage and an alternating voltage.

direct voltage **alternating voltage**



[3]

Few candidates gave the standard horizontal line for direct voltage and sine curve for alternating voltage. The direct voltage was often shown increasing from zero. For the alternating voltage, it was good to see that many candidates who drew a varying voltage understood that this should vary between positive and negative.

Question 2 (a) (iii)

(iii) The power of the kettle is 2000 W.

How many joules of energy are transferred by the kettle in a time of 1 second?

Energy = ... J **[1]**

Some higher ability candidates were able to write this down, while others successfully used the equation energy = power × time to calculate it. A number of lower ability candidates omitted this part of the question. There were many different incorrect answers.

Question 2 (b) (i)

(b) The table shows data on three kettles **A**, **B** and **C** found by Kareem.

Kettle	Power (W)	Lifetime of kettle (hours of use)	Total energy transferred (kW h)
A	1500	400	
B	2000	200	400
C	2500	100	250

(i) Calculate the total energy, in kilowatt hours (kW h), transferred by kettle **A** during its lifetime.

Use the equation: energy transferred = power × time

Total energy transferred = ... kW h **[3]**

It was pleasing to see candidates correctly calculating the energy. The majority scored the full 3 marks here. A few forgot to convert to kWh, but almost all those who knew how to do the calculation also remembered the conversion.

Question 2 (b) (ii)

(ii) Which kettle, **A**, **B** or **C**, will take the longest time to boil **one** litre of water?

Give **one** reason for your answer.

Kettle ....

Reason ....

.... **[2]**

Answers were split fairly evenly between kettle A and kettle C. Those who correctly selected kettle A almost always give the correct reason and scored full marks

Question 2 (c)

(c) What is the name of the device used to change low-voltage to high-voltage at power stations?

Put a (ring) around the correct answer.

diode **National Grid** **thermistor** **transformer** **[1]**

Most candidates knew that a transformer changes the voltage.

Question 3 (a) (i)

3 Sarah investigates what happens when light shines on different coloured cards.

(a) She places two coloured square cards next to each other, as shown in **Fig. 3.1**.

Card **R** is red and card **G** is green.

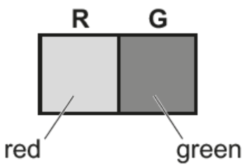


Fig. 3.1

Sarah shines **green** light on both cards.

Fig. 3.2 shows the observed colour of the cards.

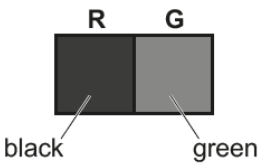


Fig. 3.2

(i) Complete the following sentences about the observation in **Fig. 3.2**.

Use words from the list.

You may use each word once, more than once, or not at all.

absorbs **refracts** **scatters** **transmits**

Card **R** looks black because it .... the green light.

Card **G** looks green because it .... the green light. **[2]**

Many candidates knew that card R absorbed the green light, but very few knew that card G scattered the green light, in this instance reflects was also an allowed answer even though it was not on the list. The more common incorrect response was 'refracts'.

Question 3 (a) (ii)

(ii) What colour light can Sarah shine on the red and green cards to make them both appear **black**?

Put a (ring) around the correct colour.

blue **green** **red** **white** **[1]**

Most candidates of all abilities knew that Sarah should shine blue light on the cards, a small number chose white.

Question 3 (b)

(b) Sarah is now investigating the refraction of light.

A narrow beam of green light is incident on a plastic block.

She measures the angle of incidence, *i*, and the angle of refraction, *r*, as shown in **Fig. 3.3**.

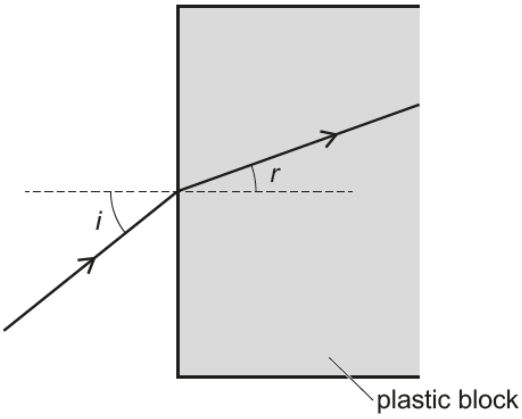


Fig. 3.3

Sarah then draws a graph of angle of refraction, *r*, against angle of incidence, *i*, as shown in **Fig. 3.4**.

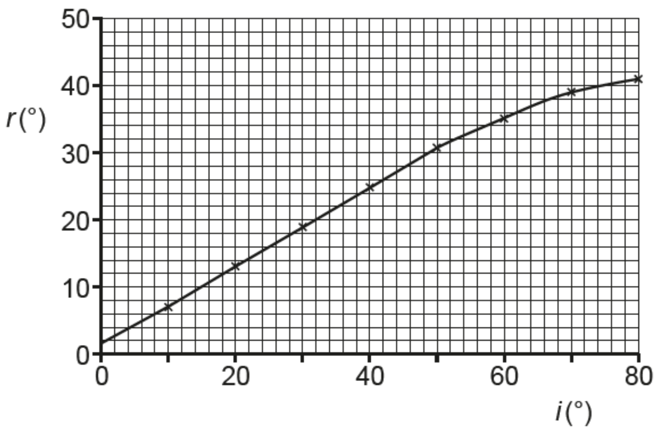
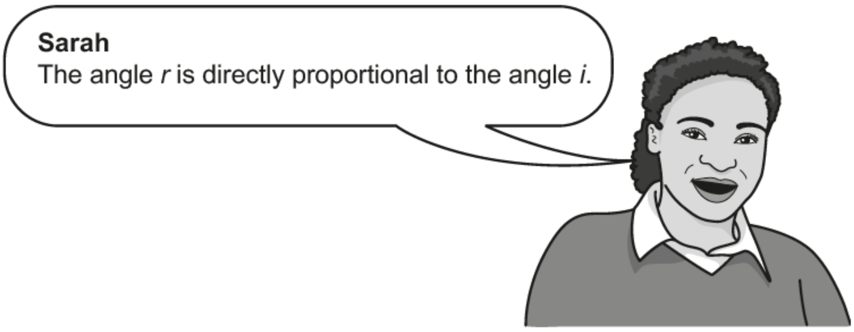


Fig. 3.4

Sarah makes the following hypothesis.



Use **Fig. 3.4** to explain if Sarah is correct.

....

....

....

.... **[2]**

Candidates found this difficult. They seemed reluctant to say that Sarah was wrong; some said she was right, or mostly right, and then went on to say, for example, 'But the lined curved at the end'. Many of these answers were acceptable, depending on the exact wording. Those who said Sarah was wrong usually said only that the line wasn't straight or that it curved, and not enough for 2 marks. A common incorrect answer was to say that the incident angle should be the same as the refracted angle each time.

Question 3 (c)

(c) Green light has wavelength 5.6×10^{-7} m and frequency 5.4×10^{14} Hz.

Calculate the **wave speed** of the green light.

Use the equation: wave speed = frequency × wavelength

Give your answer in standard form and to **2** significant figures.

Wave speed = ... m/s **[3]**

Most candidates used the equation and successfully handled the numbers to get the correct answer and scored 2 marks here. In most cases they were unable to write their answer in standard form to 2 significant figures. Some wrote the number out as a decimal without a power of 10, and others gave 1 or 3 significant figures.

Question 4 (a) (i)

4 Large telescopes, on the Earth and in space, have been used to make exciting discoveries.

(a) (i) What is the difference between a planet like the Earth and a star like our Sun?

....

.... **[1]**

Predictably examiners saw many different good answers here. Not all candidates gave a comparison, and some didn't say which body their answer referred to; for example. 'One is hotter.'

Question 4 (a) (ii)

(ii)* In 2010 the star HD10180 was discovered. It is a yellow-colour star like the Sun and it has at least 7 planets orbiting it to create a planetary system.

Scientists believe the star, HD10180, and the planets orbiting it, were formed in a similar way to our Solar System.

Draw a labelled diagram of the HD10180 planetary system, **and** describe how the star and its planets may have been formed.

....

....

....

....

....

.... **[6]**

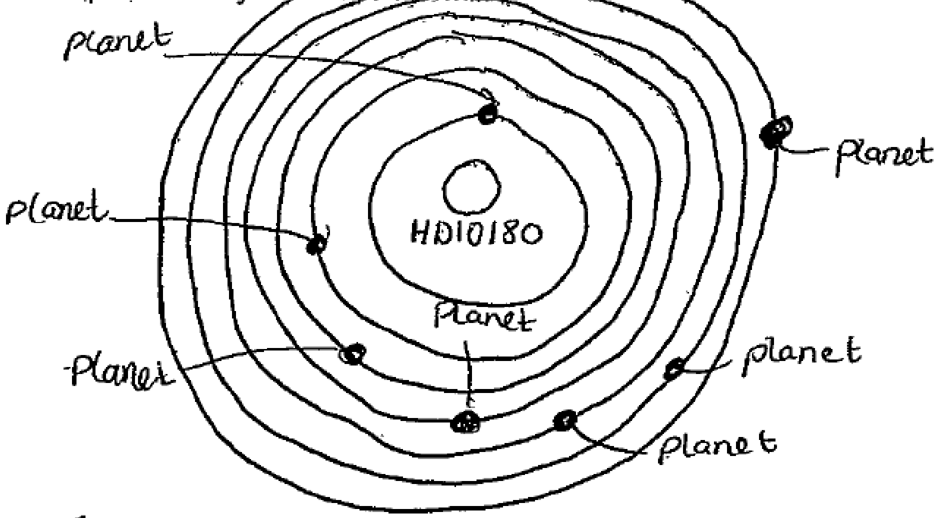
This extended writing question was marked by level of response, and candidates found it difficult. Level 3 responses were seen from a small minority who drew a labelled diagram showing orbiting planets and wrote something about the formation of both planets and star which mentioned gravity and fusion. Others drew a diagram and mentioned one process, usually either gravity or fusion, which was sufficient for a level 2. Most candidates did not know that the planets were formed from the same dust/gas cloud as the Sun – from the dust/gas left over from the Sun formation. Some candidates thought the planets were magnetically attracted to the star. Some drew diagrams that did not show that the planets orbited the star. There were a number of candidates who could not access this question, some confused star formation with the big bang, others with an explosion, or sometimes a supernova. Some diagrams were not labelled at all.

Exemplar 1

In 2010 the star HD10180 was discovered. It is a yellow-colour star like the Sun and it has at least 7 planets orbiting it to create a planetary system.

Scientists believe the star, HD10180, and the planets orbiting it, were formed in a similar way to our Solar System.

Draw a labelled diagram of the HD10180 planetary system, **and** describe how the star and its planets may have been formed.

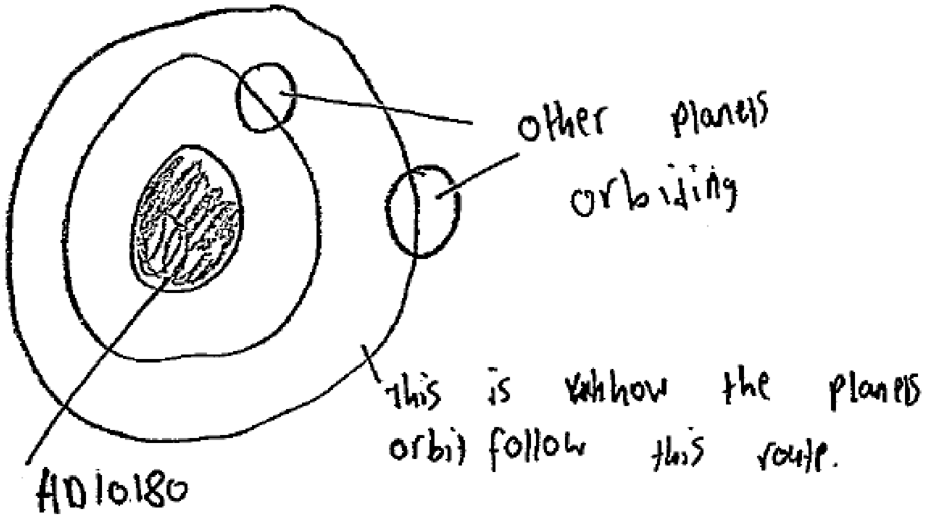


The star would've started off as being a nebula which is where fussion happens for the star until it is released. The planets orbiting may have been formed by bits of rock floating around then suddenly got drawn in by gravity into the suns orbit.

This is a Level 3 exemplar. The candidate has drawn a clear labelled diagram showing that the planets orbit at different distances. They have given some detail of the star formation; that it started from a nebula and fusion occurred. They have recognised the role of gravity and that the planets have formed from 'bits of rock' i.e. dust. The candidate has not made it clear that gravity caused the nebula to condense and fusion to start. It is not clear whether the bits of rocks were the planets, or gravity caused them to clump into planets, so this response was given the lower mark in the level.

Exemplar 2

Draw a labelled diagram of the HD10180 planetary system, **and** describe how the star and its planets may have been formed.



This planetary system could've been produced from a big bang like the one we had. It all started as clouds of dust and rock. Gravity pulled all of this together which caused a big bang. The big bang then created this ~~solar 2 system~~ planetary system. the gravity pulled all this together to create a massive explosion which created these planets.

This is a Level 2 example. The candidate has drawn a clear labelled diagram showing that the planets orbit at different distances. They have confused star formation with the big bang. However, the description of the first stage in the process is correct – a cloud of dust and gas was pulled together by gravity. This is a partial description of the processes and is a Level 2 response. It is clearly communicated and was awarded the higher mark in the level.

Question 4 (b) (i)

(b) Galaxy GN-z11 is one of the most distant galaxies discovered.

The table shows the data on two other galaxies much closer to us.

Galaxy	Distance from us (m)	Receding speed (km/s)
Tadpole galaxy	3.8×10^{24}	9400
Cigar galaxy	1.1×10^{23}	200

(i) What conclusion can you draw between the distance of a galaxy and its speed?

....

.... **[1]**

The majority of candidates said clearly, and correctly, that the further away the galaxy the faster it's speed. One mistake was to give a specific rather than general case, for example, 'The Tadpole galaxy is further away and moves faster'. Low ability candidates re-stated some of the information shown in the table.

Question 4 (b) (ii)

(ii) Write a list of the **three** named galaxies above, in order of increasing red-shift.

....

→

lower red-shift higher red-shift

[2]

The majority of candidates gained 2 marks on this question. Some did not realise the 3rd galaxy was GN-z11, either leaving it blank or suggesting 'Milky Way'.

Question 5 (a)

5 Americium is a radioactive material that emits alpha radiation.

Americium-241, an isotope, is used in many domestic smoke alarms. The radioactive source in the smoke alarm is under a **plastic** case.

Item removed due to third party copyright restrictions

(a) Suggest why the alpha radiation from the source cannot do any harm when you are close to the smoke alarm.

....

.... **[1]**

Many candidates understood that this was because the alpha radiation would not pass through the plastic case. Some candidates knew this but did not gain the mark because they said, for example, 'Because alpha radiation will not pass through paper,' leaving the examiner to deduce that it would not pass through plastic.

Question 5 (b)

(b) Explain how you could use a radiation measuring device in the laboratory to show that the smoke alarm is safe.

....

....

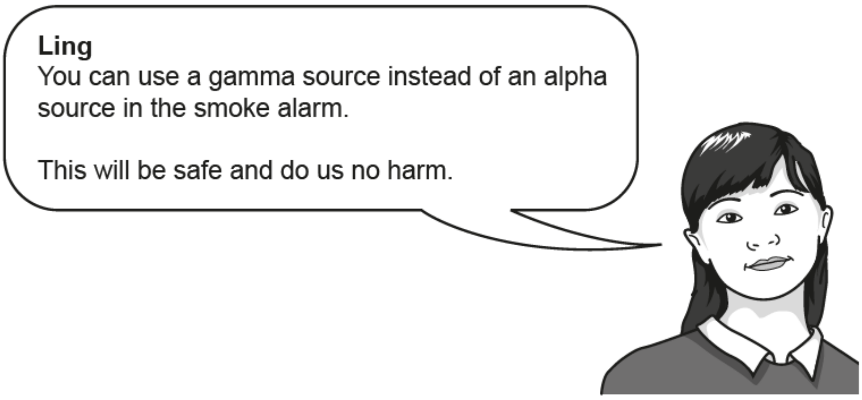
....

.... **[2]**

Most candidates did not give enough detail here. Some wrote a very general statement that repeated the question. Others wrote about a general experiment to measure radiation level, and did not apply it to the alarm. Some low ability candidates did not understand the question and wrote about using smoke to set off the alarm, or see if it would work.

Question 5 (c)

(c) Ling makes the following comment.



Discuss why Ling's suggestion is **not** sensible.

....

....

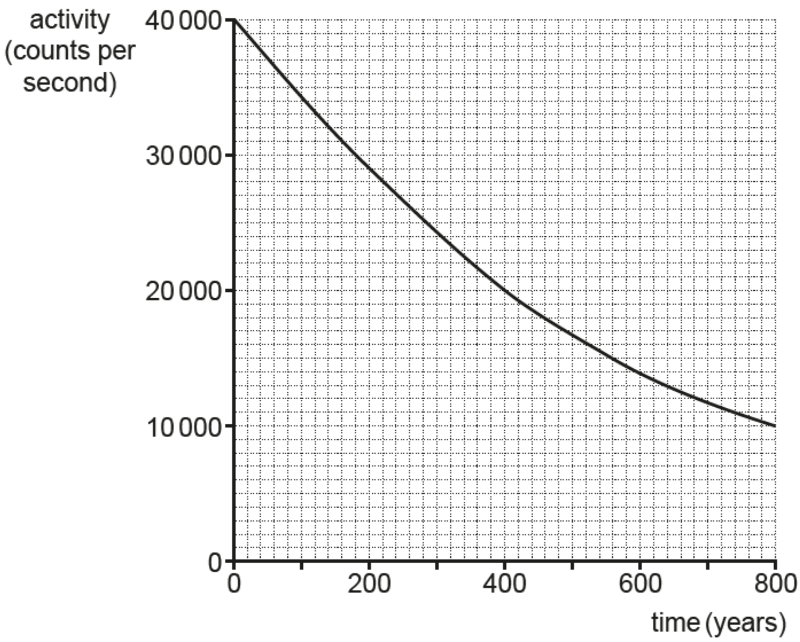
....

.... **[2]**

Candidates knew that this was not a good idea. Many said that the gamma radiation would pass through the plastic and others gave a reason why gamma radiation was harmful, but few made both points. Some of the answers about gamma radiation being harmful were too vague to score, and some said that it was ionising, not recognising that alpha radiation is more ionising.

Question 5 (d) (i)

(d) Ling finds the activity against time graph for a different radioactive alpha source from the Internet.



(i) Use the graph to determine the half-life of the alpha source.

Show your working on the graph.

Half-life = ... years **[2]**

Most of the candidates correctly stated that the half-life was 400 years

Question 5 (d) (ii)

(ii) The initial activity of the source is 40 000 counts per second.

What is the activity of the source after a time equal to 2 half-lives?

Activity = ... counts per second **[3]**

Answers were almost evenly split between the completely correct value of 10 000 counts per second or calculations which were completely wrong.

Question 5 (d) (iii)

(iii) On the graph axes above, sketch a graph for another sample of the alpha source that has an initial activity of 30 000 counts per second.

[3]

This was a difficult curve to draw and a number of candidates did not attempt it. Most candidates who did scored the mark for showing that the curve started at 30 000, but some drew curves which kept the difference in activity the same throughout. A few excellent curves were seen with activities correct at 400 years and 800 years and these usually showed a decreasing difference and scored full marks.

Question 6 (a)

6 A delivery company uses GPS tracker devices to monitor the position and the speed of their vans.

(a) The distance against time graph of one van travelling along a straight road is shown in **Fig. 6.1**.

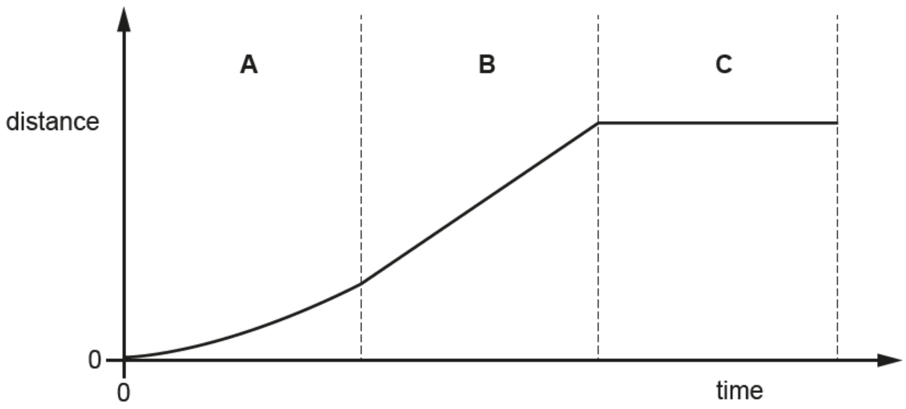


Fig. 6.1

Fig. 6.1 has been divided into three sections **A**, **B**, and **C**.

Complete the table by matching each section, **A**, **B**, or **C**, with the correct type of motion.

Tick (✓) **one** box in each row.

Type of motion	Section A	Section B	Section C
Stationary			
Constant speed			
Accelerating			

[3]

The large majority scored full marks for this question.

Question 6 (b) (i) and (ii)

(b) The velocity against time graph of another van is shown in **Fig. 6.2**.

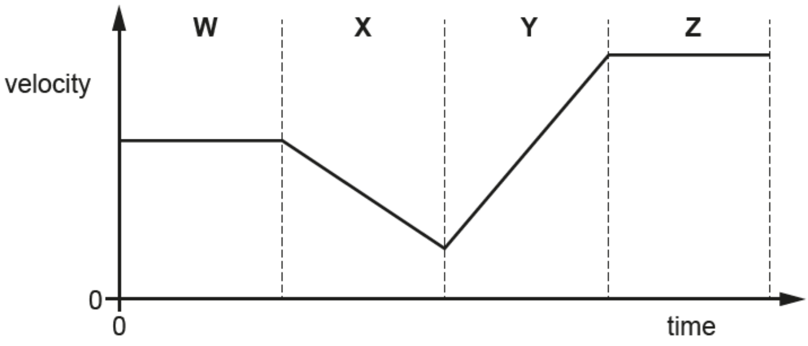


Fig. 6.2

Fig. 6.2 has been divided into four sections **W**, **X**, **Y**, and **Z**.

(i) Identify which section shows the van speeding up.

Explain your answer.

Section: ....

Explanation: ....

.... **[2]**

(ii) Identify which section shows the van slowing down.

Explain your answer.

Section: ....

Explanation: ....

.... **[2]**

The majority gained full marks in 6b(i), but some candidates said, for example, 'The line is going up' or 'The gradient is increasing,' or gave other similar vague or incorrect descriptions of the graph. A similar pattern of answers was seen for 6b(ii).

Question 6 (c)

(c) Data from the GPS tracker device can be used to calculate a van's average acceleration over the entire journey:

- initial speed = 8.5 m/s
- final speed = 36.5 m/s
- time for acceleration = 5.0 s

Use this information to calculate the average **acceleration** of the van.

Use the equation: acceleration = change in speed ÷ time taken

Give the **correct units** for your answer.

Acceleration = ... Units .... **[3]**

Most candidates calculated the acceleration correctly. Very few knew the units for acceleration. The most common answer was m/s.

Question 6 (d) (i)

(d) **(i)** Estimate the mass of the van, in kilograms (kg).

Mass = ... kg **[1]**

Most candidates estimated the mass to be outside the acceptable range of 500 kg to 7500 kg. In most of these cases a mass less than 500 kg was chosen, often less than 100 kg.

Question 6 (d) (ii)

(ii) Estimate the average force acting on the van.

Use your answers from **(c)** and **(d)(i)** to answer the question.

Force = ... N **[3]**

Candidates were allowed to carry forward errors from parts (i) and (ii) so a number scored full marks here. However, this was one of those questions where many candidates deduced that they must either divide or multiply the two numbers. They carried out both calculations and the majority then chose 'divide' for their final answer, scoring zero marks.

Question 7 (a) (i)

7 Nina is investigating electrical circuits in the laboratory.

(a) Nina is looking for a filament lamp for her torch.

Fig. 7.1 shows a filament lamp that may be suitable.

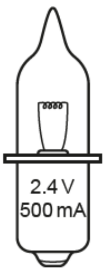
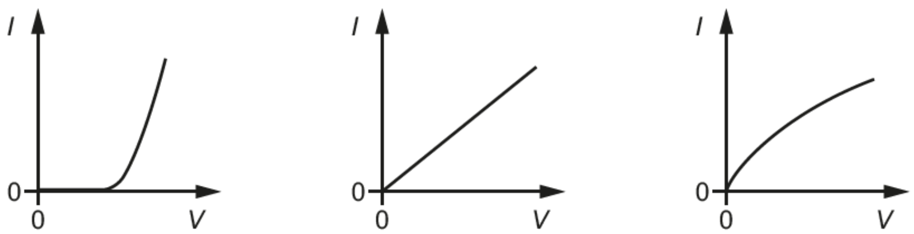


Fig. 7.1

(i) Which current against voltage graph (*I*-*V* characteristic) for a filament lamp is correct?

Put a (ring) around the correct answer.



[1]

The straight line was the most popular choice, but there were plenty of examples of both incorrect answers.

Question 7 (a) (ii)

(ii) Calculate the amount of charge flowing through the filament lamp when it is used for 60 s.

Use the equation: charge = current × time

Charge = ... C **[3]**

Candidates found this calculation difficult. Many scored 2 marks but either did not convert milliamps to amps, or did so incorrectly. A large number used 2.4 V somewhere in their calculation. A common incorrect answer was 2.4 × 60 = 144 C.

Question 7 (a) (iii)

(iii) The base of the filament lamp has '2.4 V, 500 mA' stamped on it.

Calculate the power of the filament lamp at 2.4 V.

Power = ... W **[3]**

This calculation was also difficult and again some candidates forgot to convert the current to amps. To award marks examiners must be able to see the calculation. A few candidates wrote only '1200' which could not be awarded any marks.

Question 7 (b)

(b) Nina connects up the following circuit using two identical filament lamps.

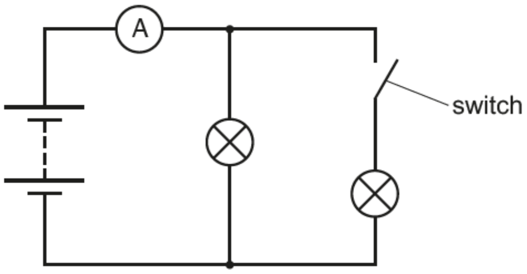


Fig. 7.2

The switch is currently open.

Explain what happens to the ammeter reading when the switch is then **closed**.

....

....

....

.... **[2]**

Many candidates knew the reading would increase, but many thought this was because there would not be any current until the switch was closed. Some said that the circuit was now complete, not recognising that there was a complete circuit already. Few said that both lamps would each have an identical current doubling the ammeter reading.

Question 7 (c) (i)

(c) (i) What is the name of the electrical component that conducts current in **only one** direction?

Tick (✓) **one** box.

Diode ☐

Lamp ☐

Light-Dependent Resistor (LDR) ☐

Thermistor ☐

[1]

The diode was not well known, but was the most common answer. LDR was a popular choice, but there were also a number of responses for lamp and a few for thermistor.

Question 7 (c) (ii)

(ii) Draw an electrical symbol for your answer to **(c)(i)**.

[1]

Of the candidates that chose the diode, most could not draw the symbol accurately. A number of answers showed that they had some idea of what it looked like, but could not remember enough to score a mark. The lamp and the LDR seemed to be better known and a number of candidates were credited for an error carried forward.

Question 8 (a) (i)

8 This question is about gears and levers.

(a) A wristwatch with its back cover removed is shown in **Fig. 8.1**.

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Fig. 8.1

You can see some of the gears inside the wristwatch.

Two gears **Q** and **R** are shown in **Fig. 8.2**.

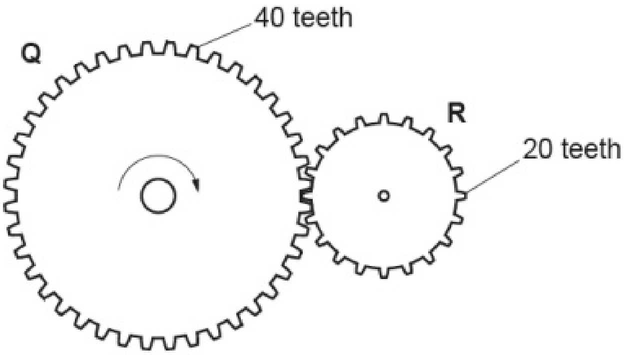

Fig. 8.2

The gear **Q** has 40 teeth and gear **R** has 20 teeth. Both gears have the same size teeth.

The gear **Q** moves in a clockwise direction.

Gear **Q** rotates at 6 revolutions per minute.

(i) On **Fig. 8.2**, show the direction of rotation of gear **R**. **[1]**

This question, and questions 9 and 10 are material that is also on the higher tier exam paper. Most candidates drew an anticlockwise arrow. Some candidates did not answer this part.

	AfL **Answers on diagrams**	Candidates often miss parts of questions which require them to mark or annotate a diagram, rather than writing an answer in blank space. Encourage them to read the text for instructions rather than scanning for answer space to identify where there is a command word, such as complete or show, both here and in question 10(b).

Question 8 (a) (ii)

(ii) How many revolutions are completed by gear **R** in one minute?

Number of revolutions = ... per minute **[2]**

Most candidates successfully calculated 12 revolutions per minute. The most common error was an answer of 3 revolutions per minute.

Question 8 (b)

(b) The lid of a can of paint has a lip which makes it easier to open, using a lever.

The diagram below shows a screwdriver placed under the lip.

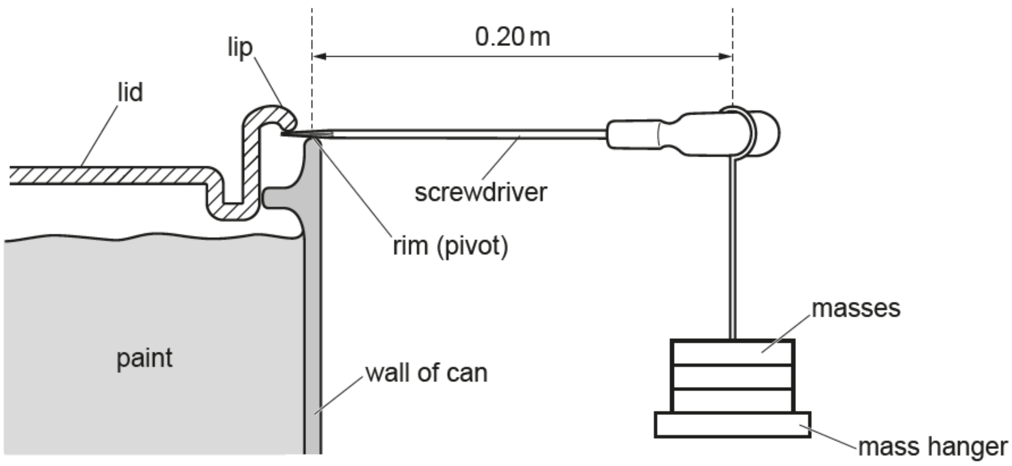

Fig. 8.3

In an experiment, masses are added to the mass hanger to open the lid.

The mass hanger hangs at a distance of 0.20 m from the rim (pivot) of the can.

A total weight of 32 N of the hanging masses opens the lid.

Calculate the moment of this force.

Moment = ... Nm **[3]**

Most candidates gained full marks here. There were some candidates who could not decide whether to multiply or divide. They did both calculations and then selected one as the final answer. Those who chose incorrectly scored no marks. Candidates leaving both calculations, even if mathematically correct, would not receive any credit.

Question 9

9* Kai is doing experiments in the laboratory to determine the density of the two different liquids, **E** and **F**.

He uses a measuring cylinder placed on a balance.

He then pours different volumes of liquid **E** into the measuring cylinder, and records the balance reading, as shown in **Fig. 9.1**. The balance reading is equal to the total mass of the measuring cylinder and the liquid.

He then empties the measuring cylinder, and repeats the same procedure with liquid **F**.

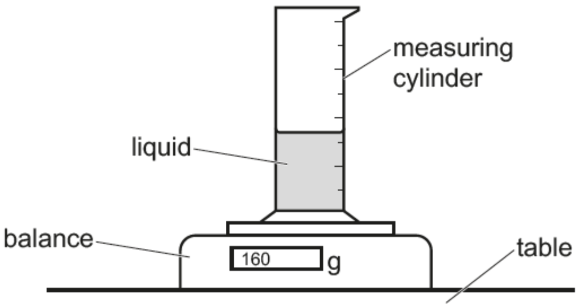

Fig. 9.1

Kai's results are shown in **Fig. 9.2**.

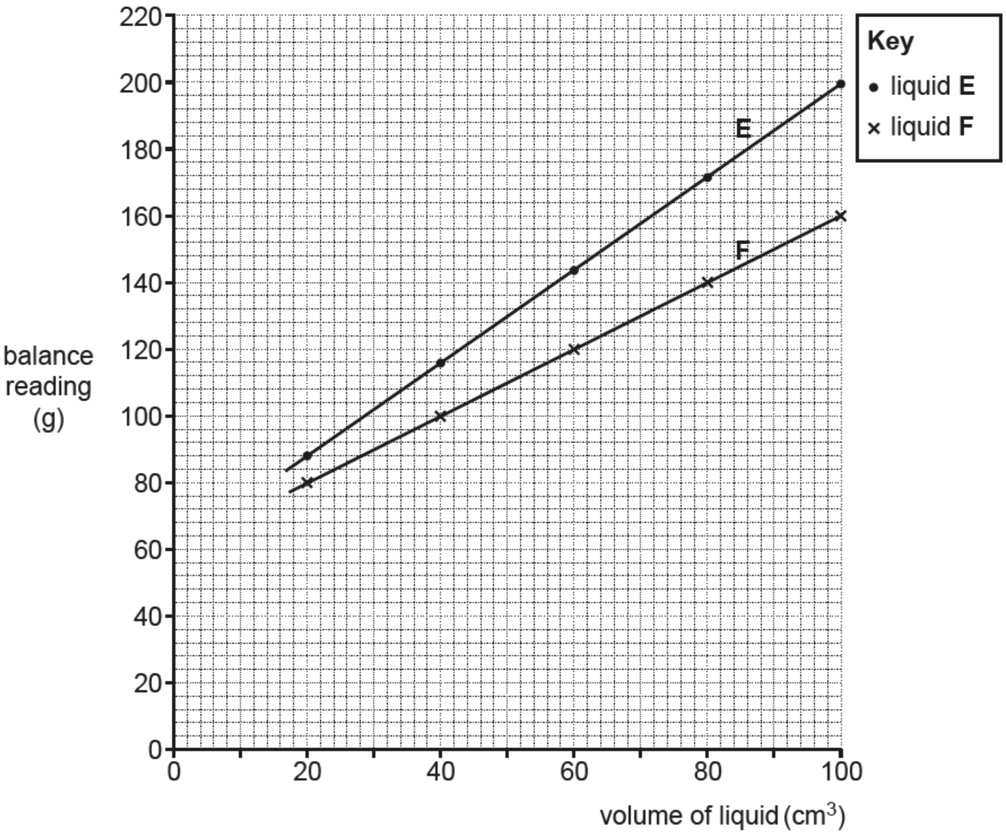

Fig. 9.2

Compare the density of the liquids **E** and **F**.

Your answer should include calculations and a detailed analysis of **Fig. 9.2**.

Use the equation: density = mass ÷ volume

....

....

....

....

....

.... **[6]**

This question, requiring extrapolation and interpretation of the intercept, was difficult for all candidates, including those taking the higher tier exam. Most foundation candidates made a good attempt at interpreting the graph, including several calculations in their answer. They scored level 2. Very few level 3 responses were seen.

Exemplar 3

Compare the density of the liquids **E** and **F**.

Your answer should include calculations and a detailed analysis of **Fig. 9.2**.

Use the equation: density = mass ÷ volume

Balance reading = equal to the total mass of the measuring cylinder and the liquid

E → mass = 200g, volume = 100cm³

F → mass = 160g, volume = 100cm³

E density = 200 ÷ 100 = 2 g/cm³

F density = 160 ÷ 100 = 1.6g/cm³

Figure 9.2 shows firstly that liquid E is a denser liquid than liquid F, as the same amount of it (100cm³) weighs more / gives a higher balance reading (100cm³ of liquid E ~~gm~~ weighs 200g with the measuring cylinder, whereas liquid F: 100cm³ ~~with the~~ weighs only 160g with the measuring cylinder) Calculating the density of the liquids using density = mass ÷ volume shows us that the density of liquid ~~E~~ E is 2 g/cm³, and the density of liquid F is lower at 1.6 g/cm³.

This exemplar is a Level 2 response. The candidate has attempted to use the equation to calculate density with the mass of the liquid and cylinder and the volume of the liquid. Although they have stated that the mass includes the cylinder, they have not realised they need to calculate the mass of the liquid. A correct calculation would be a Level 3 response. They have stated that the Density of E is greater than the density of F and this evaluation, together with the attempted calculation is a Level 2 response. The communication is clear so the mark at the top of the level was awarded.

Exemplar 4

liquid F has a lower balance reading against balance E because liquid E is more dense than liquid F, liquid E has a balance reading of 200 and liquid F has a balance reading of 160, this is proof that liquid E is more concentrated than liquid F.

A Level 1 response. This candidate has not made any attempt at a calculation. They have evaluated the information to state that the density of E is greater than F. This is sufficient for Level 1 and has been given the mark at the top of the level.

Question 10 (a)

10 Lyla and Alex are investigating two identical light-dependent resistors (LDRs). A torch is used as a light source by Lyla, and Alex decides to use a table lamp.

Each light source is placed above the LDR.

The resistance of the LDR is determined for different numbers of identical sheets of tracing paper placed on the LDR, as shown in **Fig. 10.1**.

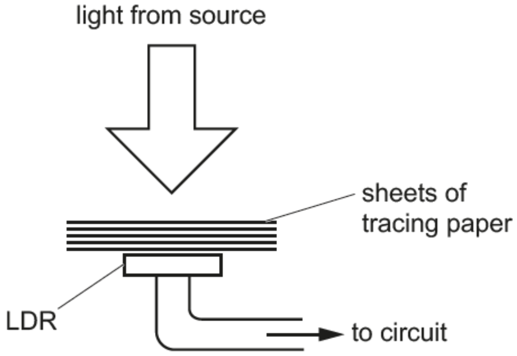

Fig. 10.1

Lyla's and Alex's results are shown in **Fig. 10.2**.

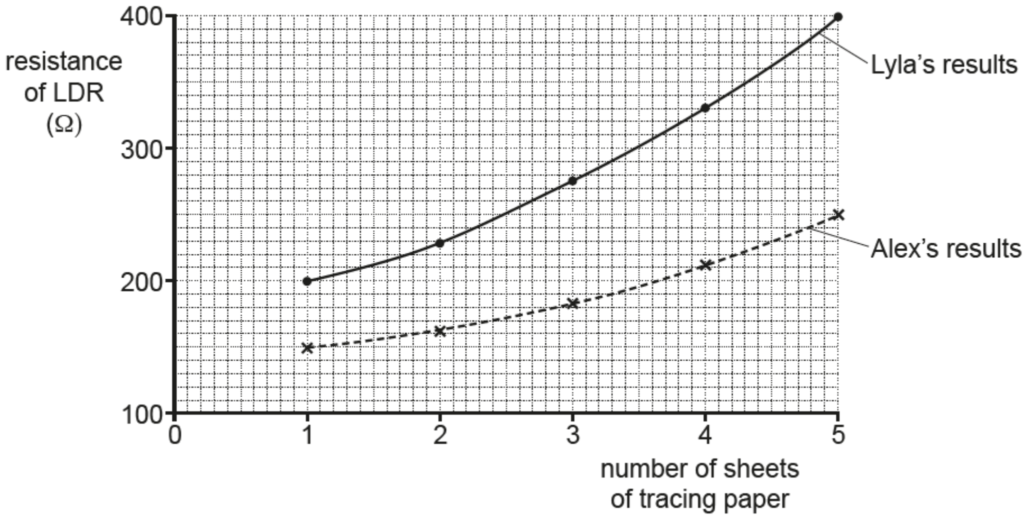

Fig. 10.2

(a) Use **Fig. 10.2** to explain how the **light intensity** affects the resistance of the LDR.

....

....

....

.... **[2]**

Some higher ability candidates scored 2 marks here, but many candidates did not say that increasing the number of sheets of paper decreased the intensity, and scored only 1 mark for increasing light intensity decreased resistance. A common answer was that increasing the paper increased the resistance. Some lower ability candidates did not use the graph to answer this question, they wrote general statements about light intensity and resistance. Some candidates wrongly deduced that increasing light intensity increased resistance.

Question 10 (b)

(b) The LDR is connected to a cell, an **ammeter** and a **voltmeter**.

The meter readings from the ammeter and voltmeter are used to determine the resistance of the LDR.

Complete **Fig. 10.3** to show the likely circuit connected by Lyla and Alex.

Fig. 10.3

[2]

Many candidates did not add to the circuit diagram. A common answer showed the ammeter and voltmeter both in series. The ammeter and voltmeter symbols do not have horizontal lines through them, and examiners often could not award a mark because of these incorrect symbols.

Question 10 (c) (i) and (ii)

(c) Lyla and Alex worked in different parts of the laboratory to conduct their investigations.

Both used identical sheets of tracing paper and identical LDRs but their results were different.

(i) Suggest **one** thing that must be kept the same to get identical results.

....

.... **[1]**

(ii) Suggest **one** improvement that needs to be made to get identical results.

....

.... **[1]**

Answers to both c(i) and c(ii) showed that candidates understood the importance of having the same light source and the same ambient light. A few said that the distance between the LDR and the light source should be kept the same. A number of different, sensible ways to keep ambient light the same were suggested. Many others suggested identical LDRs and sheets of tracing paper, which were already stated in the question. A few said, 'Keep the experiment the same' which was too vague to be awarded any marks.

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