Examiners' Report
June 2025

GCSE Combined Science 1SC0 2PF

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June 2025

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Introduction

This is paper 3 of combined science at foundation level. It has been examined since 2018. Questions were set to test candidates' knowledge, application and understanding from eight topics in the specification:

- Topic 1 – Key concepts of physics
- Topic 8 – Energy - Forces doing work
- Topic 9 – Forces and their effects
- Topic 10 – Electricity and circuits
- Topic 12 – Magnetism and the motor effect
- Topic 13 – Electromagnetic induction
- Topic 14 – Particle model
- Topic 15 – Forces and matter

It was intended that the examination paper would allow every candidate to show what they knew, understood and were able to do. Within the question paper, a variety of question types were included, such as objective questions, short answer questions worth one or two marks each and longer questions worth three or four marks each. Three questions focused on candidates' knowledge of practical procedures, namely Q02(b), on density measurement, Q04(b)(i) on a cantilever investigation and Q05(b)(ii) on measuring the total height of some stairs. The latter proved to be a touch stone, as to whether candidates could actually think themselves into a very practical situation.

Candidates continued to do well with most calculation questions, although when having to convert quantities into other S.I. units then they struggled a lot more.

This report will provide exemplification of candidates' work, together with tips and/or comments, for a selection of questions. The exemplification will come from responses which highlight successes and pitfalls, with the aim of aiding future teaching of these topics.

Question 1(a)(i)

Most candidates answered this question correctly, with only a small number giving answers of 6, 12 or 144 ohms.

1 (a) Figure 1 shows two lamps in series in a circuit.

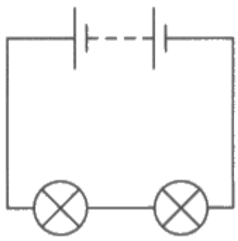

Figure 1

The resistance of each lamp is 12 Ω.

(i) Calculate the total resistance of the lamps in the circuit.

(1)

total resistance of lamps = 24 Ω

ResultsPlus
Examiner Comments

The correct answer, given by most candidates.

1 (a) Figure 1 shows two lamps in series in a circuit.

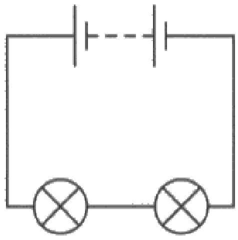

Figure 1

The resistance of each lamp is 12 Ω.

(i) Calculate the total resistance of the lamps in the circuit.

(1)

total resistance of lamps = ...12........ Ω

ResultsPlus
Examiner Comments

A typical incorrect answer.

ResultsPlus
Examiner Tip

Series resistances need to be added to give the total.

Question 1(a)(ii)

Well answered by vast majority of candidates.

(ii) The current in a lamp in Figure 1 is 0.50 A.

The resistance of the lamp is 12 Ω.

Calculate the voltage across this lamp.

Use the equation

$$V = I \times R$$

(2)

V = 0.50 x 12

V = 6

voltage = 6 V

ResultsPlus
Examiner Comments

Full marks, with the straightforward substitution and evaluation.

(ii) The current in a lamp in Figure 1 is 0.50 A.

The resistance of the lamp is 12 Ω.

Calculate the voltage across this lamp.

Use the equation

$$V = I \times R$$

(2)

voltage = 6 V

ResultsPlus
Examiner Comments

The mark scheme says 'award full marks for the correct answer without working'.

ResultsPlus
Examiner Tip

It's nearly always better practice though, to show your working. That way you could get intermediate marks if you mess up the calculation.

(ii) The current in a lamp in Figure 1 is 0.50 A.

The resistance of the lamp is 12 Ω.

Calculate the voltage across this lamp.

Use the equation

$V = I \times R$

pote current resis

$I = \frac{R}{V}$

$I = R \div V$

$I = 12 \div 0.50$

$I = \underline{24}$

$\div\ V\ \div$

$I \times R$

$I = \frac{V}{R}$

(2)

voltage = 24 V

ResultsPlus
Examiner Comments

Wrong, unnecessary rearrangement. Zero marks.

ResultsPlus
Examiner Tip

Don't assume you have got much more to do. All the answer needed was direct substitution into the equation given, multiplying the quantities given.

(ii) The current in a lamp in Figure 1 is 0.50 A.

The resistance of the lamp is 12 Ω.

Calculate the voltage across this lamp.

Use the equation

$$V = I \times R$$

(2)

0.50 x 12 = 8

voltage = 8 V

ResultsPlus
Examiner Comments

Correct substitution, but then an erroneous calculation.

ResultsPlus
Examiner Tip

Just be careful with your calculator, reading off it carefully as well.

Question 1(a)(iii)

This required the substitution of three values in to the energy transfer equation.

Most common answer was 9J – two marks.

Very few candidates did not score on this question.

The majority of candidates did not convert minutes into seconds.

(iii) The voltage across a different lamp is 4.5 V.

The current in this lamp is 0.40 A.

Calculate the energy transferred to the lamp in 5 minutes.

Use the equation

$$E = I \times V \times t$$

(3)

5min = 300 seconds

0.40 × 4.5 × 300 = 540

energy transferred = 540 J

ResultsPlus
Examiner Comments

The correct answer.

ResultsPlus
Examiner Tip

Notice the well communicated working. This maximises the number of intermediate marks that may be given in case of miscalculation.

(iii) The voltage across a different lamp is 4.5 V.

The current in this lamp is 0.40 A.

Calculate the energy transferred to the lamp in 5 minutes.

Use the equation

$$E = I \times V \times t$$

(3)

300 x 4.5 x 0.40

energy transferred = 540 J

ResultsPlus
Examiner Comments

This is the correct answer, with a correct evaluation.

ResultsPlus
Examiner Tip

For the intermediate marks it helps to write down the numbers in the same order as the equation being substituted into.

Here that would be:

V x I x t

4.5 x 0.40 x 300

(iii) The voltage across a different lamp is 4.5 V.

The current in this lamp is 0.40 A.

Calculate the energy transferred to the lamp in 5 minutes.

Use the equation

voltage

$$E = I \times V \times t$$ - time

(3)

energy transferred = 9 J

ResultsPlus
Examiner Comments

Multiplying the three given numbers, without converting the 5 minutes into 300 seconds. This gives two out of three marks.

ResultsPlus
Examiner Tip

't' needs to be in seconds when you use 'VIt'.

Question 1(b)(ii)

This was the most demanding part of Q01.

The association expected is 'more resistance' -> lower current.

However many answers associated increased R with increased I.

Answer such as, 'Currents slow down' were ignored by the mark scheme.

(ii) The resistance of the circuit is increased by adding one resistor to the circuit.

State how increasing the resistance changes the current in the circuit.

(1)

it lowers the current as it resistes the flow from going through

ResultsPlus
Examiner Comments

'Lowers the current' is the same as 'current decreases'. One mark awarded.

(ii) The resistance of the circuit is increased by adding one resistor to the circuit.

State how increasing the resistance changes the current in the circuit.

(1)

It slows the current down

ResultsPlus Examiner Comments

No credit for 'slows the current down'.

ResultsPlus Examiner Tip

Try to get away from every day loose thinking to more exact scientific thinking.

The current decreases.

Electrons may go slower, on average, in a particular direction.

(ii) The resistance of the circuit is increased by adding one resistor to the circuit.

State how increasing the resistance changes the current in the circuit.

(1)

Because it won't be as strong
So it will be less dangerous

ResultsPlus
Examiner Comments

'Won't be so strong' is vague and is not credited.

ResultsPlus
Examiner Tip

In science quantities have exact meanings. That includes 'current' **whose value decreases** when the total resistance in the circuit increases.

(ii) The resistance of the circuit is increased by adding one resistor to the circuit.

State how increasing the resistance changes the current in the circuit.

(1)

Increasing the resistance will also increase the current in the circuit meaning faster rate.

ResultsPlus
Examiner Comments

This response was too often seen.

No marks.

ResultsPlus
Examiner Tip

Running in the air is easier than wading through water, where there is more resistance to motion.

Question 2(b)

Due to a seeming lack of practical knowledge on how to measure density of an irregular object, very few scored full marks. Frequent responses included descriptions of seeing whether the key sinks or floats. Other responses missed out keywords such as 'balance' or just said an incomplete, 'put the key on the balance'. Some responses used the correct method but did not give enough detail to be awarded the marks.

The key (pardon the pun) is to write down a series of clear, unambiguous instructions that may be followed by someone else to accurately determine the density of the key.

(b) A student is asked to find the density of a metal key.

Figure 3 shows a metal key and some apparatus.

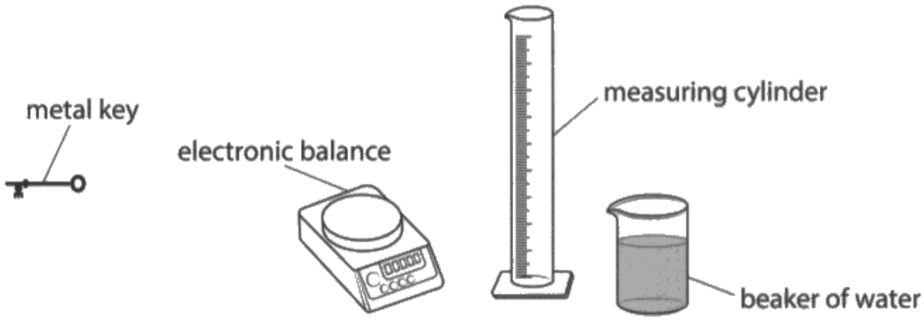

Figure 3

Using the apparatus shown in Figure 3, describe how the student can find the density of the metal key.

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

(4)

The ~~[illegible]~~ volume can be found by pouring water into a ~~[illegible]~~ measuring cylinder at a certain amount. Then place the metal key into the measuring cylinder, the new amount of water should be recorded. Take away ~~[illegible]~~ the starting amount from the new amount = volume. Mass is found by using the electronic balance to weigh the amount of water on it's own, and then again with the key inside the water.

ResultsPlus
Examiner Comments

An excellent, well communicated response, which matches the four marking points very well.

ResultsPlus
Examiner Tip

Make your instructions, in answering 'how to' questions, very clear. Imagine someone trying to follow your instructions...

(b) A student is asked to find the density of a metal key.

Figure 3 shows a metal key and some apparatus.

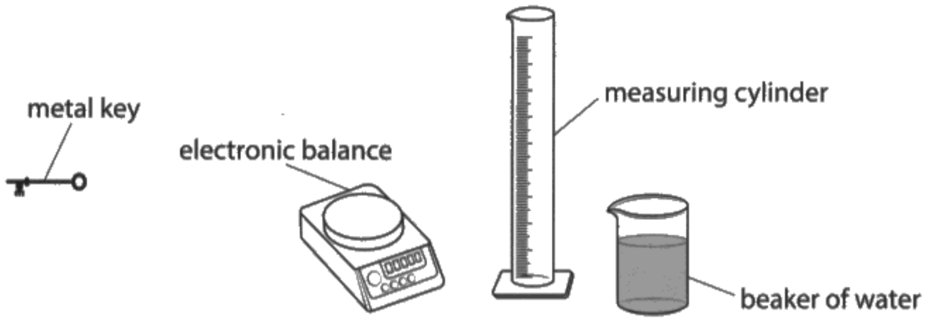

Figure 3

Using the apparatus shown in Figure 3, describe how the student can find the density of the metal key.

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

(4)

Firstly, find the mass of the metal key by using the ~~e~~elecronic balance. Then ~~pour the water from the beaker into the measuring cylinder. After, place the key into the measuring~~ place the beaker of water above the measuring cylinder and put the key into the beaker pushing down to the bottom and measure the amount of water has fell into the measuring cylinder. Finally do the mass ÷ the water in the cylinder.

ResultsPlus
Examiner Comments

This matches the 'alternative method' in the mark scheme.

Marking points 1, 3 and 4 are seen. The candidate is not explicit about filling the beaker (to the brim etc). Mark point 2, therefore, is not there.

(b) A student is asked to find the density of a metal key.

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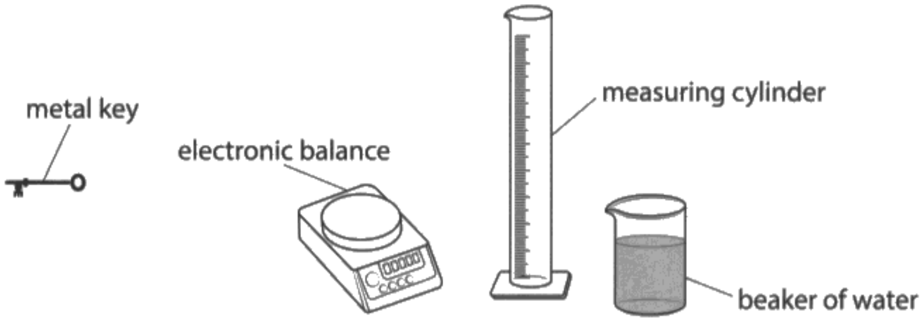

Figure 3

Using the apparatus shown in Figure 3, describe how the student can find the density of the metal key.

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

(4)

The student can find the density by working out the mass, they can do this by placing the metal key onto the electronic balancer. After this you need the volume you can do this by placing the key in the measuring cylinder with the water already in it. Then you see how much the water levels has increased by. Finally you divide the mass by the volume.

ResultsPlus
Examiner Comments

Three marks awarded. It misses an explicit mark point 2 reference – measuring an initial volume of water.

(b) A student is asked to find the density of a metal key.

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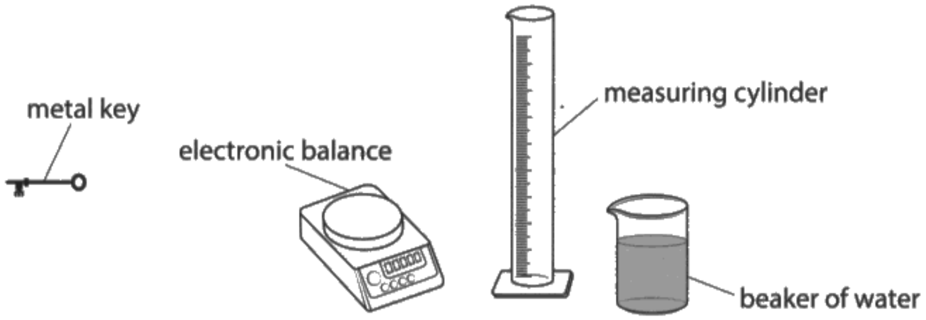

Figure 3

Using the apparatus shown in Figure 3, describe how the student can find the density of the metal key.

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

(4)

To work out the mass you would simply put the metal key on the electronic balance this gives you the mass. Then to find the volume you have a beaker of water then when you add the key into the water find the diffrence in height before and after adding the key then ~~times~~ divide the numbers from both together to get the density.

ResultsPlus
Examiner Comments

Mark points 1 and 4 were awarded here.

The lack of mention of the cylinder prohibits the award of marking points 2 and 3.

(b) A student is asked to find the density of a metal key.

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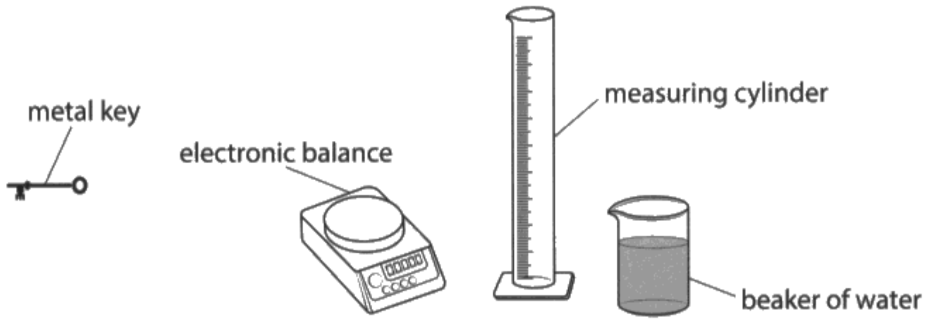

Figure 3

Using the apparatus shown in Figure 3, describe how the student can find the density of the metal key.

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

(4)

fill the measuring cylinder up with water to 10cm.
he should drop the key and see how much the water rises.
Calculate the difference between the start and after measurements.
Mulitply that by the weight of the key which you can
use a scale to find

ResultsPlus
Examiner Comments

The lack of explicit reference to volume or level of water prohibited mark points 2 and 4.

ResultsPlus
Examiner Tip

It is always inportant to spell out **what you are measuring**, with what.

You will not get these marks if you are vague.

(b) A student is asked to find the density of a metal key.

Figure 3 shows a metal key and some apparatus.

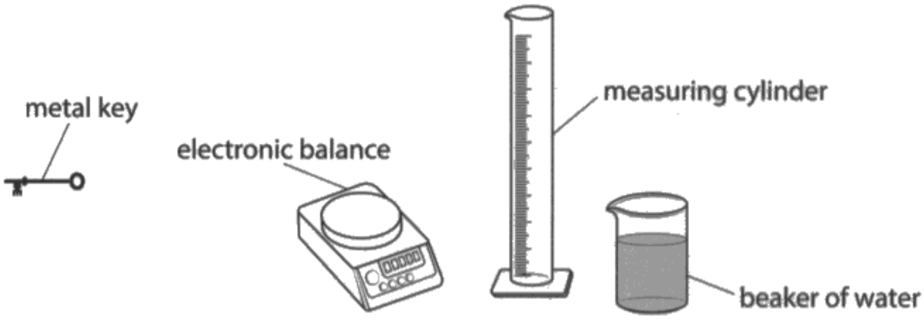

Figure 3

Using the apparatus shown in Figure 3, describe how the student can find the density of the metal key.

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

(4)

The student can find the density of the metal key by finding the volume of the beaker of water. From here, the measuring cylinder will tell you how many ml of water there is. Lastly, you would find the mass of the key by weighing it on the electronic balance. Then, you would divide the mass by the volume to work out the density of the metal key

ResultsPlus
Examiner Comments

This response just gets mark point 1.

Nowhere is a correct **volume of the <u>key</u>** found.

(b) A student is asked to find the density of a metal key.

Figure 3 shows a metal key and some apparatus.

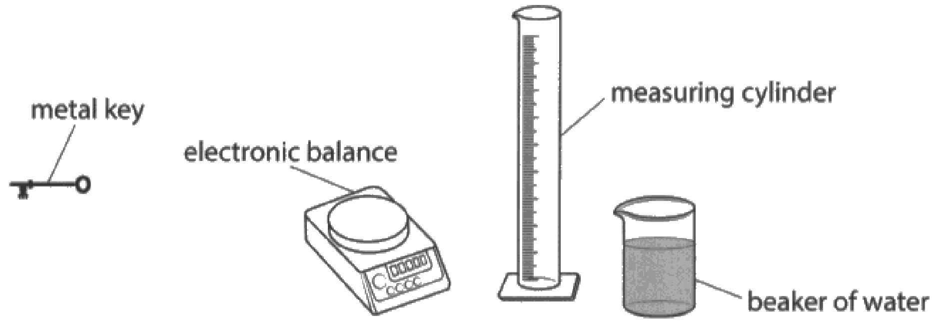

Figure 3

Using the apparatus shown in Figure 3, describe how the student can find the density of the metal key.

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

(4)

They can figure out how much the key weights to find the mass, then por the water into the measuring cylinder and drop the key in, they can watch how long is takes to reach the bottom and see where it lands.

ResultsPlus
Examiner Comments

Just gets a mark for putting the key into the measuring **cylinde**r.

Underline in the mark scheme means **must have**.

No mention of using the balance to find the mass of the key.

(b) A student is asked to find the density of a metal key.

Figure 3 shows a metal key and some apparatus.

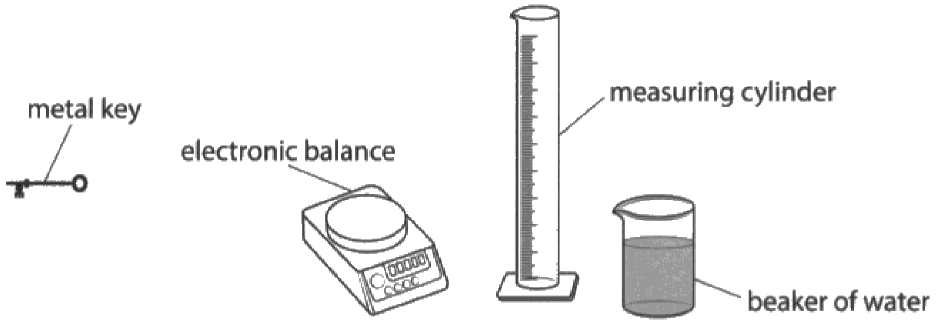

Figure 3

Using the apparatus shown in Figure 3, describe how the student can find the density of the metal key.

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

(4)

Firstly, the student needs to put the experiment together. When that is done, they can then find the mass of the metal key and the volume. When they find these two out, they can divide them and that gives the student the density of the metal key.

ResultsPlus
Examiner Comments

No practical instructions given as to '**how to**'.

Zero marks.

ResultsPlus
Examiner Tip

Spell out exactly **what you will measure, with what**.

Question 2(c)(i)

This was very high scoring. The vast majority of candidates scored two marks.

Candidates had to subtract the two temperatures to find the temperature rise, and then multiply the three quantities in the given equation.

(c) (i) A student heats an aluminium block, as shown in Figure 4.

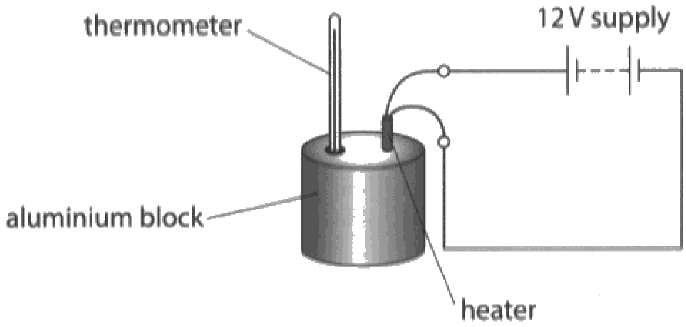

Figure 4

The aluminium block has a mass of 0.96 kg.

The specific heat capacity of aluminium is 920 J / kg °C.

The temperature of the block increases from 18 °C to 35 °C.

Calculate the change in thermal energy of the aluminium block.

Use the equation

change in thermal energy = mass × specific heat capacity × change in temperature

(2)

$\Delta Q = m \times C \times \Delta\theta$

$0{\cdot}96\,kg \times 920\,J/kg°C \times 35° - 18° = 17°$

$0{\cdot}96 \times 920 \times 17 = 15014{\cdot}4$

change in thermal energy = 15014·4 J

ResultsPlus
Examiner Comments

Fully correct.

The candidate spells out the temperature change calculation en route.

(c) (i) A student heats an aluminium block, as shown in Figure 4.

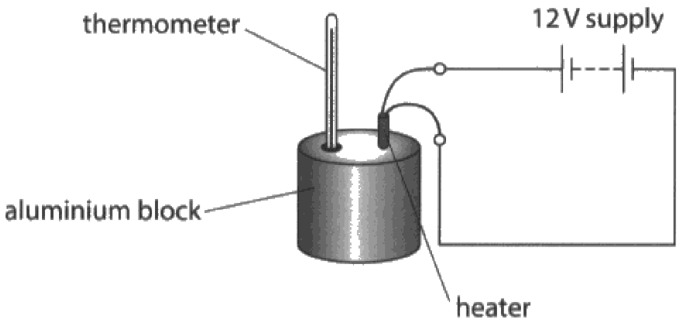

Figure 4

The aluminium block has a mass of 0.96 kg.

The specific heat capacity of aluminium is 920 J/kg °C.

The temperature of the block increases from 18 °C to 35 °C.

Calculate the change in thermal energy of the aluminium block.

Use the equation

change in thermal energy = mass × specific heat capacity × change in temperature

(2)

0.96 × 920 × 17 = 10118.4

35 − 18 = 17

change in thermal energy = 10118.4 J

ResultsPlus Examiner Comments

Correct substitution. Just miscalculates. Thus one mark given.

ResultsPlus Examiner Tip

Use of calculators requires attention to detail and care in doing.

(c) (i) A student heats an aluminium block, as shown in Figure 4.

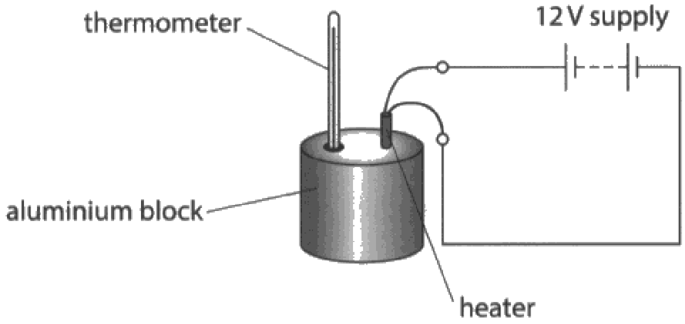

Figure 4

The aluminium block has a mass of 0.96 kg.

The specific heat capacity of aluminium is 920 J / kg °C.

The temperature of the block increases from 18 °C to 35 °C.

Calculate the change in thermal energy of the aluminium block.

Use the equation

0.96 × 920 × 17 °c

change in thermal energy = mass × specific heat capacity × change in temperature

(2)

0.96 × 920 × 17 °c = ~~[illegible]~~ 15,14.4

change in thermal energy = 15,14.4 J

ResultsPlus
Examiner Comments

Substitution mark given.

Then the candidate misses out on the last mark by not putting the '0' in 15**0**14(.4).

Question 2(c)(ii)

Somewhat unexpectedly, ony a minority suggested a sensible practical way of reducing energy loss.

(ii) Suggest **one** way the student could reduce the energy loss from the aluminium block during the experiment.

(1)

he could keep that aluminim block in a close box so that the heat would not come out.

ResultsPlus
Examiner Comments

Mark scheme says 'allow wrap in foil or put in a box'.

(ii) Suggest **one** way the student could reduce the energy loss from the aluminium block during the experiment.

(1)

Insulate the aluminium block to prevent the thermal energy being lost quicker.

ResultsPlus
Examiner Comments

This is the same as 'add insulation'; that was the generic overarching explanation.

(ii) Suggest **one** way the student could reduce the energy loss from the aluminium block during the experiment.

(1)

wrapping the block in tin foil to keep it insulated, no letting heat escape

ResultsPlus
Examiner Comments

'Tin foil' use is explicitly in the mark scheme.

Question 2(c)(iii)

Hardly anyone got this right.

The question is looking for explanations that included ideas about conduction through the aluminium black.

(iii) The thermometer does not show the maximum temperature reached by the aluminium block until some time after the heater is switched off.

Give **one** reason for this.

(1)

takes time for the energy to transfer

ResultsPlus
Examiner Comments

YES, as spelt out in the mark scheme's major marking point here.

(iii) The thermometer does not show the maximum temperature reached by the aluminium block until some time after the heater is switched off.

Give **one** reason for this.

(1)

It takes a while for the thermometer to process the heat

ResultsPlus
Examiner Comments

This is typical of a whole lot of explanations given along these lines.

The key is to focus on the conduction of energy through the metal conductor.

'It takes time for energy to travel through' etc.

A lot wrote about the response of the thermometer in a vague way, like this one.

(iii) The thermometer does not show the maximum temperature reached by the aluminium block until some time after the heater is switched off.

Give **one** reason for this.

(1)

because metal holds heat even after the heater is switched off

ResultsPlus
Examiner Comments

Here is another answer that does not address the real issue at stake.

(iii) The thermometer does not show the maximum temperature reached by the aluminium block until some time after the heater is switched off.

Give **one** reason for this.

(1)

as it needs a bit of time to stop and show an accurate reading. If the heater was still on the thermometer would not stop

(Total for Question 2 = 9 marks)

ResultsPlus
Examiner Comments

The question says '**after the heater is switched off**', so this misses the point.

ResultsPlus
Examiner Tip

Read the question carefully. Some underline key points.

(iii) The thermometer does not show the maximum temperature reached by the aluminium block until some time after the heater is switched off.

Give **one** reason for this.

(1)

the aluminum block is still heating up and takes a while to cool

ResultsPlus
Examiner Comments

This response misses out the explanation's major point about the major process involved – taking time for energy transfer to occur (via conduction).

Question 3(b)

Many candidates did not draw straight or equally spaced lines between the poles.

Some were, however, able to gain at least one mark here for drawing (consistent) arrow(s) on the field line(s).

Arrows that came out of the other ends of the diagram were ignored. They often showed a lack of understanding of the diagram.

(b) Figure 5 shows two magnetic poles facing each other.

There is a uniform magnetic field between the poles.

Draw field lines, on Figure 5, to show the uniform part of the magnetic field. At least one line must have an arrow on it to indicate the direction of the magnetic field.

(2)

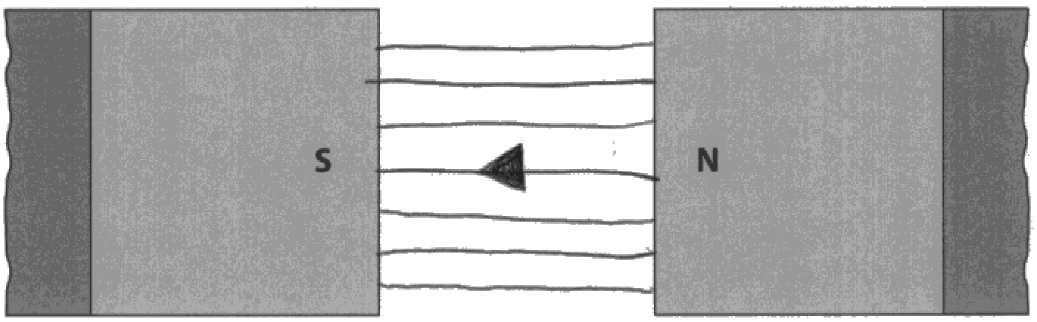

Figure 5

ResultsPlus Examiner Comments

Requisite number of straight lines (at least 3), first mark, with an arrow to the left, second mark.

(b) Figure 5 shows two magnetic poles facing each other.

There is a uniform magnetic field between the poles.

Draw field lines, on Figure 5, to show the uniform part of the magnetic field. At least one line must have an arrow on it to indicate the direction of the magnetic field.

(2)

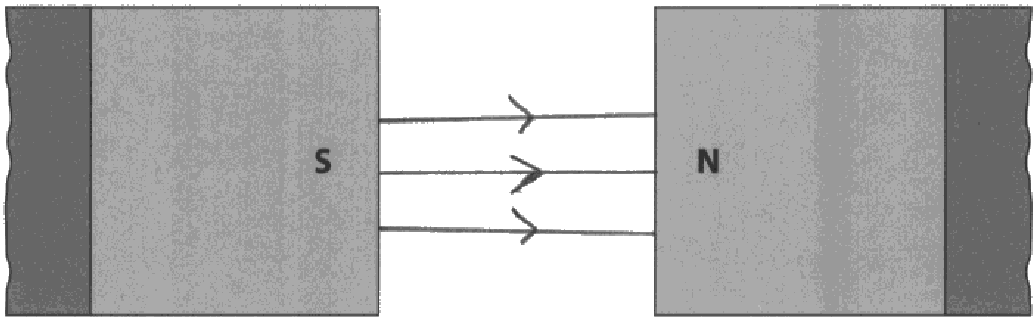

Figure 5

ResultsPlus
Examiner Comments

Three straight lines, mark given. The arrows are in the wrong direction though.

ResultsPlus
Examiner Tip

Magnetic field lines always go fron N to S, by convention.

(b) Figure 5 shows two magnetic poles facing each other.

There is a uniform magnetic field between the poles.

Draw field lines, on Figure 5, to show the uniform part of the magnetic field. At least one line must have an arrow on it to indicate the direction of the magnetic field.

(2)

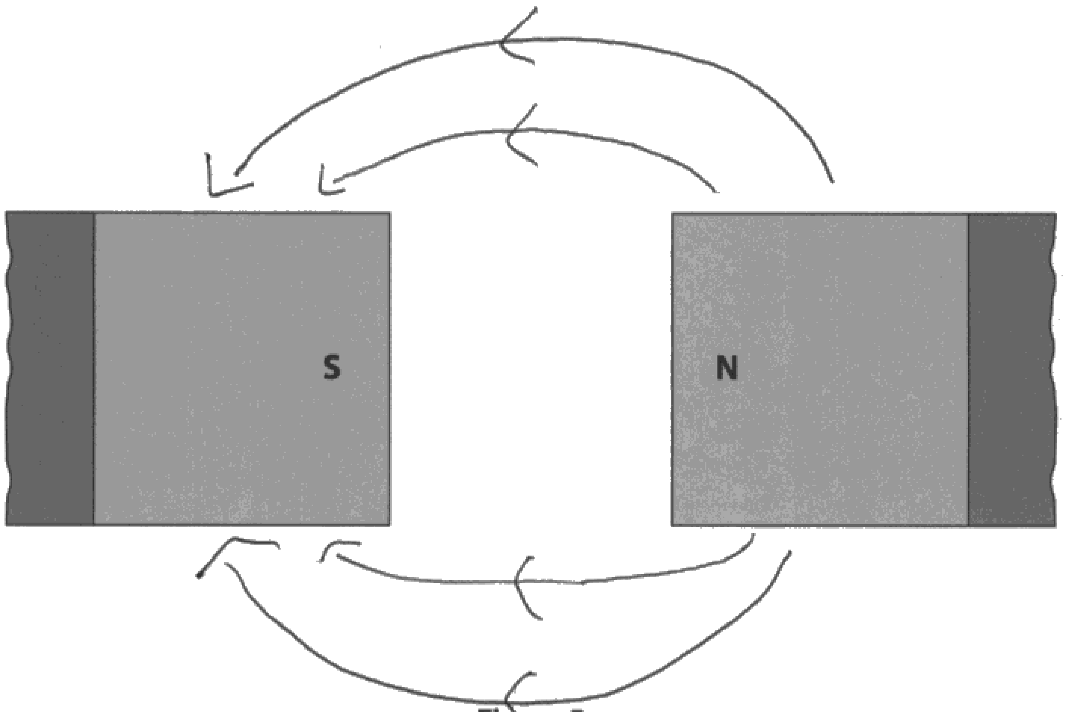

Figure 5

ResultsPlus
Examiner Comments

One mark given for (consistent) direction of lines.

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There is a uniform magnetic field between the poles.

Draw field lines, on Figure 5, to show the uniform part of the magnetic field. At least one line must have an arrow on it to indicate the direction of the magnetic field.

(2)

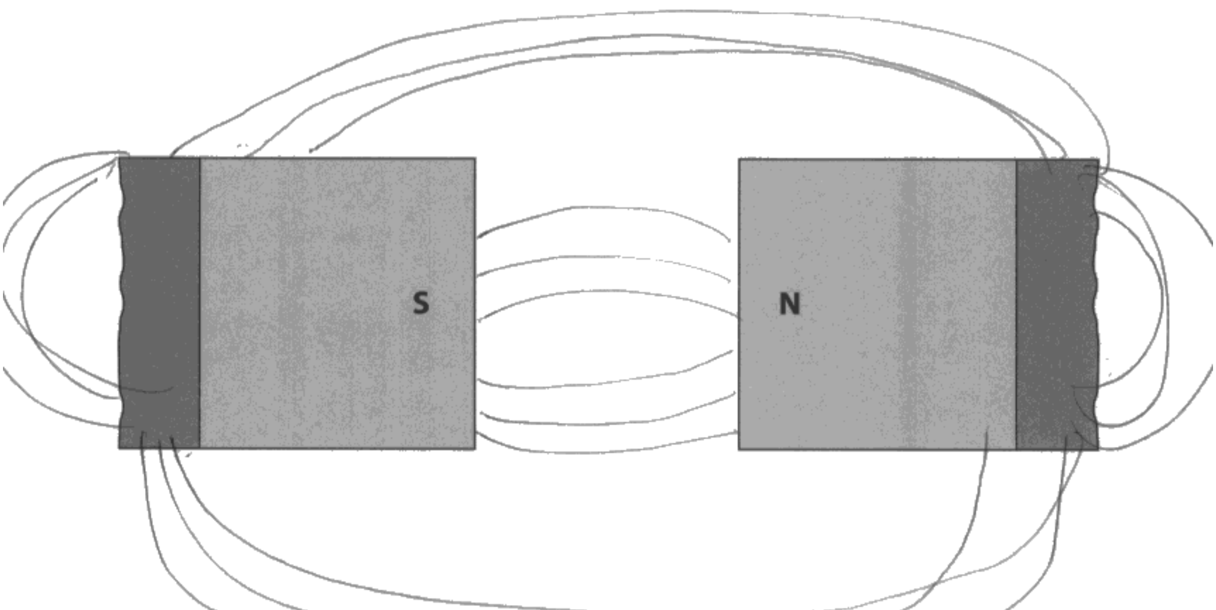


Figure 5

ResultsPlus
Examiner Comments

No credit. Curved lines are ignored in the context of this question.

ResultsPlus
Examiner Tip

If the field is uniform then straight parallel lines are needed to show that.

(b) Figure 5 shows two magnetic poles facing each other.

There is a uniform magnetic field between the poles.

Draw field lines, on Figure 5, to show the uniform part of the magnetic field. At least one line must have an arrow on it to indicate the direction of the magnetic field.

(2)

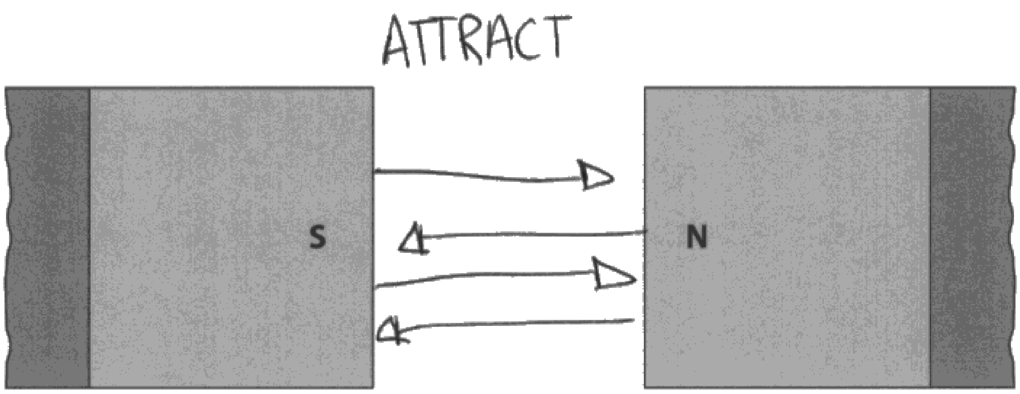


Figure 5

ResultsPlus
Examiner Comments

Roughly parallel straight lines are accepted for the first mark.

Consistent arrow directions are needed for the secong mark.

These show contradictions.

Question 3(c)(i-ii)

A majority of candidates got the mark for (i), the drawing of an 'X' within acceptable limits.

Few scored in (ii), with only a very few having the two components needed in the explanation:

1. field is strongest (there)
2. shown by field lines being closer together (there).

(c) Figure 6 shows the magnetic field around a bar magnet.

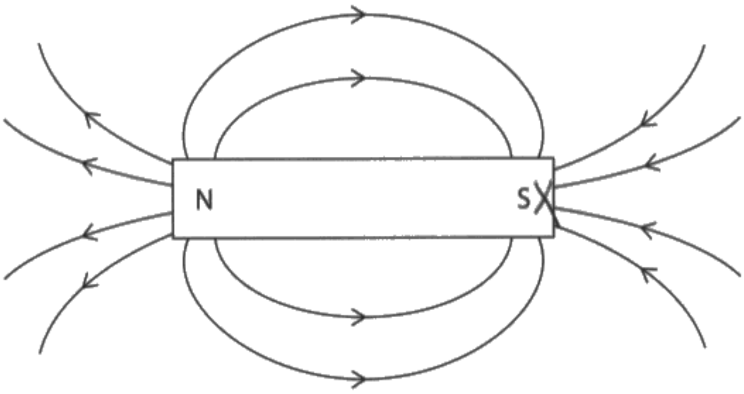


Figure 6

Iron filings are sprinkled onto the magnet.

(i) On Figure 6, draw an X where most of the iron filings will stick.

(1)

(ii) Explain why most of the iron filings will stick to the point you have labelled with an X.

(2)

thats where most of the magnetism is as the feild lines are coming towards it which means the iron fillings will stick to it easier as there is more ~~magnet~~ electromagnetic strength in that part.

ResultsPlus
Examiner Comments

Correct positioning (i) with the two components of the linked explanation (ii).

ResultsPlus
Examiner Tip

How close the field lines are to each other goes with the strength of the field.

(c) Figure 6 shows the magnetic field around a bar magnet.

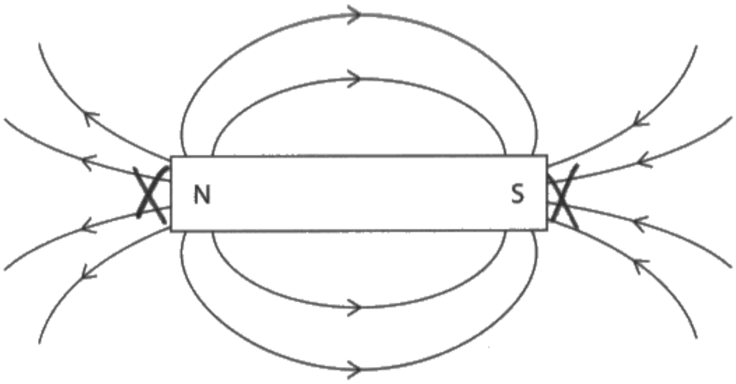


Figure 6

Iron filings are sprinkled onto the magnet.

(i) On Figure 6, draw an X where most of the iron filings will stick.

(1)

(ii) Explain why most of the iron filings will stick to the point you have labelled with an X.

(2)

Becauses since the field lines are closer, the magnetic field is much stronger.

ResultsPlus
Examiner Comments

Full marks given.

Positioning (i) one mark.

(ii) comments associating stronger (one mark) with field lines being closer (one mark).

ResultsPlus
Examiner Tip

Match the number of points you make with the number of marks you see.

(c) Figure 6 shows the magnetic field around a bar magnet.

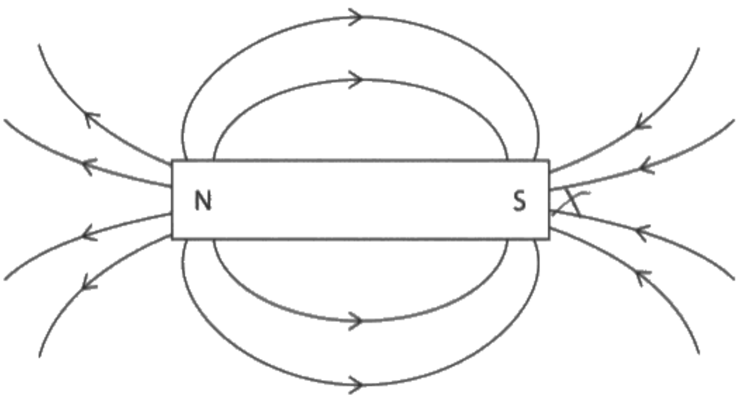


Figure 6

Iron filings are sprinkled onto the magnet.

(i) On Figure 6, draw an X where most of the iron filings will stick.

(1)

(ii) Explain why most of the iron filings will stick to the point you have labelled with an X.

(2)

because ~~S~~ the South Side is pulling and the north is ~~pu~~ repelling

ResultsPlus
Examiner Comments

Positioning mark only.

ResultsPlus
Examiner Tip

Iron filings show the shape of the field.

The strength of the field is the same at either end, N or S.

(c) Figure 6 shows the magnetic field around a bar magnet.

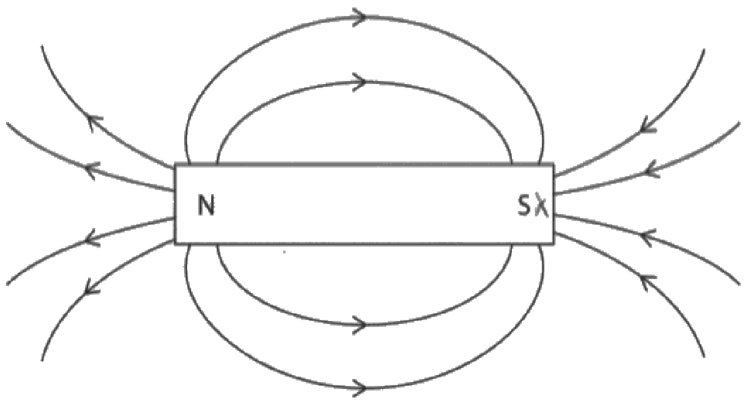


Figure 6

Iron filings are sprinkled onto the magnet.

(i) On Figure 6, draw an X where most of the iron filings will stick.

(1)

(ii) Explain why most of the iron filings will stick to the point you have labelled with an X.

(2)

As it will be attracted to a Pole and it is the South Pole as that is the "Pull Side"

ResultsPlus
Examiner Comments

Missing the point about the strength of the field.

ResultsPlus
Examiner Tip

Iron filings are equally pulled to the south and north poles.

One side does not push them away, nor the other side attract them.

Question 3(d)(i)

Most candidates did not get to grips with what this question was asking for.

When marks were awarded it was mostly for stating firstly that the needle always points to the north.

The second mark was for associating this with the force involved. A mark was given for that, or an equivalent statement about the pull of the earth's magnetic field.

(d) One use of a magnet is in a plotting compass.

(i) Explain how a plotting compass can be used to show that the Earth has a magnetic field.

(2)

Because the plotting compass always points at the North pole, that means that its attracted to the South pole on earth.

ResultsPlus
Examiner Comments

This matches mark point 1 and 2 extremely well, as mapped out in the additional guidance.

ResultsPlus
Examiner Tip

Look for the two marks here □ two ideas.

1. Compass always pointing in the same direction – often simply 'north' will do.
2. Comes from a force caused by the Earth's magnetism / magnetic field. That force may be expressed as a pull or an attraction (to an opposite pole).

The candidate gets these two parts very well.

(d) One use of a magnet is in a plotting compass.

(i) Explain how a plotting compass can be used to show that the Earth has a magnetic field.

(2)

the arrow on a plotting compass always faces north
showing how the earths magnetic field
pulls the arrow to the north.

ResultsPlus
Examiner Comments

This candidate identifies the pulling aspect of the Earth's magnetic field for the second mark.

(d) One use of a magnet is in a plotting compass.

(i) Explain how a plotting compass can be used to show that the Earth has a magnetic field.

(2)

A plotting compass can be used to show that the Earth has a magnetic field is because it always points to the north! and ~~so~~ the pointer ~~[illegible]~~ in the compass is metal so it has a magnet - i.e. attraction to ~~the~~ a north.

ResultsPlus
Examiner Comments

The attraction aspect, for the second mark, is seen again.

Candidates express what the attraction is to in various ways.

We accept to the north pole or to the south pole at the north pole!

The mark scheme, in additional guidance, allows for such naming.

Question 3(d)(ii)

Many appropriate answers were seen here. Permanent magnets are to be found in many modern devices.

'Compass' was an obvious answer, given that the question had been talking about such earlier.

'Mobile phones' was a frequently seen answer, as was 'fridges'.

'MRI scanners' were accepted. Web searches reveal which devices **may** include permanent magnets. The list is very far reaching.

Four acceptable answers are cited below, with one 'bar magnet' which the mark scheme excluded; the question asked for **a device** that **uses** a permanent magnet.

(ii) State the name of a device that uses a permanent magnet.

(1)

MRI machine Scanner

ResultsPlus Examiner Comments

There are some scanners which do use permanent magnets.

ResultsPlus Examiner Tip

Web search this to check.

(ii) State the name of a device that uses a permanent magnet.

(1)

Compass

ResultsPlus
Examiner Comments

One mark.

(ii) State the name of a device that uses a permanent magnet.

(1)

Car engine

ResultsPlus
Examiner Comments

Crucial components in electrical motors.

(ii) State the name of a device that uses a permanent magnet.

(1)

fridge magnet

ResultsPlus
Examiner Comments

One mark.

(ii) State the name of a device that uses a permanent magnet.

(1)

Bar magnet.

ResultsPlus
Examiner Comments

A bar magnet is a permanent magnet.

It cannot be said to be a device that uses a permanent magnet.

Question 4(b)(i)

This was a challenging question for candidates.

It did produce a decent spread of marks, but very few obtained four marks.

Quite a number of candidates did not apply themselves to answering the practical basis in '**how** could you investigate'. They often went off into hypothetical conjecture, 'If you added more weights than the distance 'd' would increase'.

What was needed was a clear sequence of steps to be taken. These were spelt out in the mark scheme:

(any four out of these five points would gain the marks)

1. measure initial d / distance / height (1)
2. change weight (1)
3. measure new d / distance / height (1)
4. repeat / continue (changing weight and measuring d) (1)
5. plot a graph (d against weight) (1)

Hardly anyone proposed plotting an appropriate graph.

(b) Figure 7 shows what happens when weights are added to the end of a wooden strip.

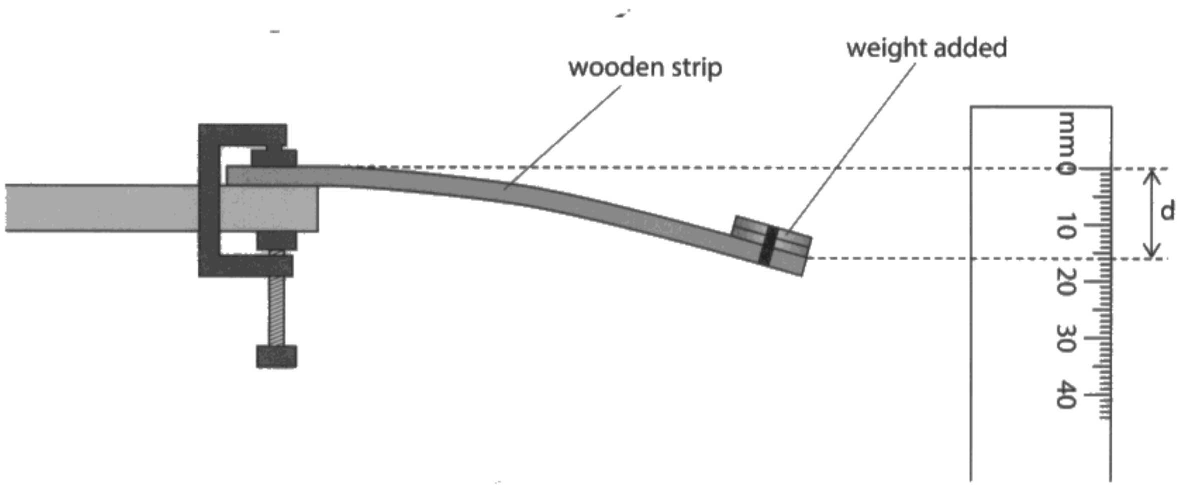


Figure 7

(Source: https://www.schoolphysics.co.uk/age16-19/Mechanics/Simple%20harmonic%20 motion/text/Vibrating_cantilever/index.html)

The end of the strip of wood moves down by a distance, d, as shown in Figure 7.

(i) Describe how a student could investigate how the distance, d, depends on the weight added to the wooden strip.

(4)

A student could investigate how the distance depends on the weight added to the wooden strip by setting the ruler at 0mm and aligning it with the wooden strip. You will then add weights and gradually increase the mass of the weights and measure the distance it has moved down.

ResultsPlus
Examiner Comments

This succinct answer gains all four marks:

- mp1 an initial measurement of distance is spelt out, using the ruler
- mp2 adding weight(s) is clear
- mp3 measuring distance moved down is clear
- mp4 repetition is spelt out – 'gradually increases the mass of the weights', measuring distance.

(b) Figure 7 shows what happens when weights are added to the end of a wooden strip.

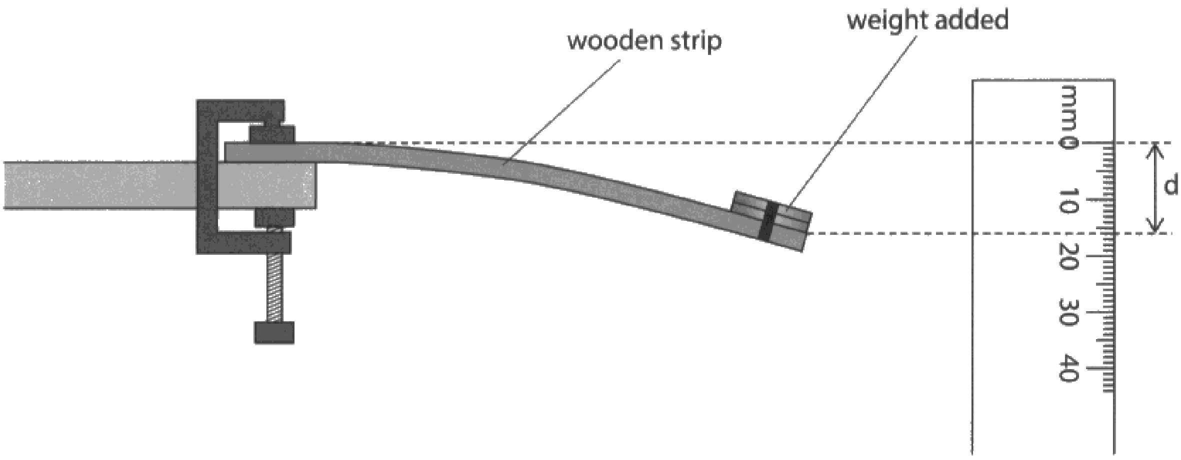


Figure 7

(Source: https://www.schoolphysics.co.uk/age16-19/Mechanics/Simple%20harmonic%20 motion/text/Vibrating_cantilever/index.html)

The end of the strip of wood moves down by a distance, d, as shown in Figure 7.

(i) Describe how a student could investigate how the distance, d, depends on the weight added to the wooden strip.

(4)

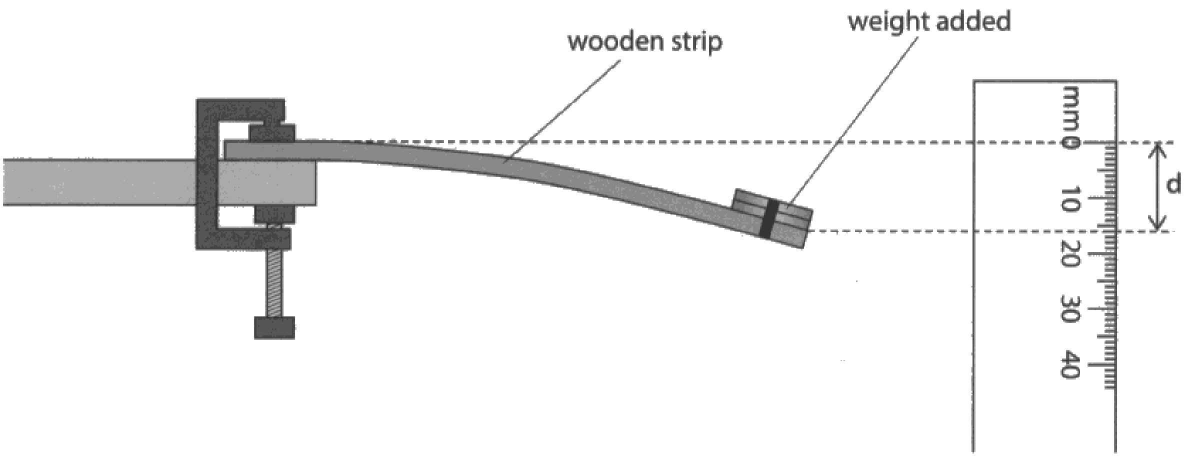
The student could put the wooden strip into a clamp stand and hold or place a ruler vertically onto a stand at the end of the wooden strip. The student can then measure the distance on the wooden strip with no weight added ~~After~~ at zero. The student can then use a different amount of added weight each time to find the different distances moved with more or less ~~of~~ weight

ResultsPlus
Examiner Comments

All four mark points are matched here:

1. measurement of distance with no weight added
2. add weight
3. measure distance again
4. adding **different amount of weights each time** does add up to the required repetition of measurements idea. ('to get the different distance ... ').

(b) Figure 7 shows what happens when weights are added to the end of a wooden strip.



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The end of the strip of wood moves down by a distance, d, as shown in Figure 7.

(i) Describe how a student could investigate how the distance, d, depends on the weight added to the wooden strip.

(4)

The student could put more weight onto the wooden strip to measure how much further down the wood will bend and put less weight on to see how much it bends. This would show that the more weight added will show the amount the wood bends.

ResultsPlus
Examiner Comments

This is a typical answer that scored some marks.

They were awarded one mark for matching mark point 2, and one for measuring a new distance, mp3, although this mark could have been made clearer.

In an investigative context, a sequence of changing weights and measuring 'd' again is not seen clearly, so mp4 could not be awarded.

(b) Figure 7 shows what happens when weights are added to the end of a wooden strip.

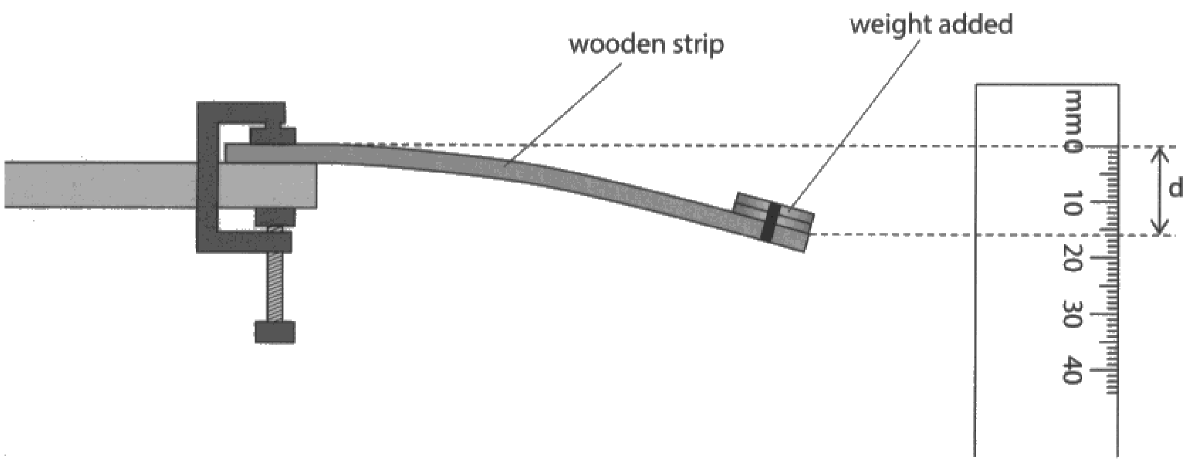

Figure 7

(Source: https://www.schoolphysics.co.uk/age16-19/Mechanics/Simple%20harmonic%20 motion/text/Vibrating_cantilever/index.html)

The end of the strip of wood moves down by a distance, d, as shown in Figure 7.

(i) Describe how a student could investigate how the distance, d, depends on the weight added to the wooden strip.

(4)

Because they could add more weight wich would result in the ruler bending more so it would be further down the ruler.

ResultsPlus Examiner Comments

Only mp2 is awarded.

The repetition element is not spelt out.

The measurements of 'd' are not made clear.

(b) Figure 7 shows what happens when weights are added to the end of a wooden strip.

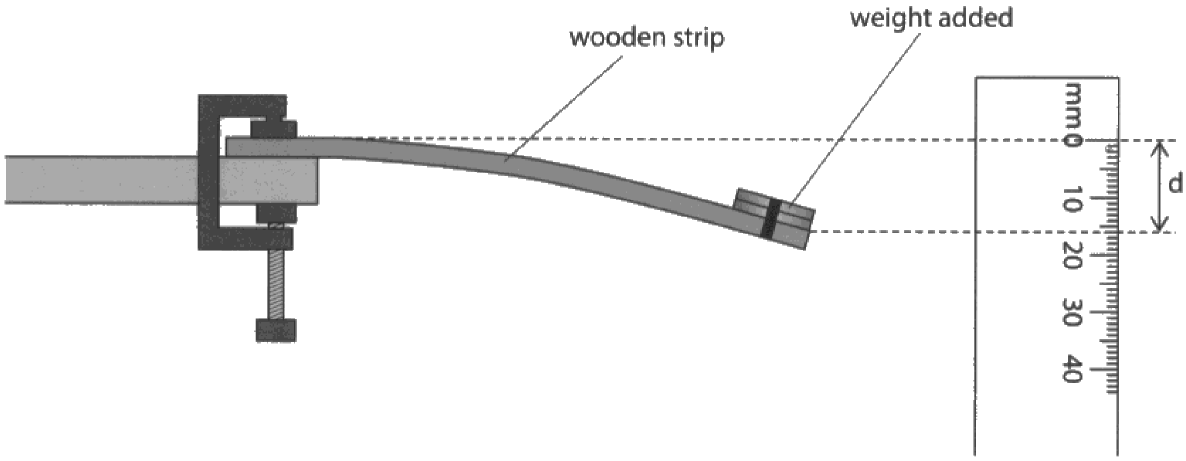

Figure 7

(Source: https://www.schoolphysics.co.uk/age16-19/Mechanics/Simple%20harmonic%20 motion/text/Vibrating_cantilever/index.html)

The end of the strip of wood moves down by a distance, d, as shown in Figure 7.

(i) Describe how a student could investigate how the distance, d, depends on the weight added to the wooden strip.

(4)

As the more the weight ~~#~~ is increased the wooden strip would get lower and lower making the measure-ment become higher and higher ~~and well as this~~ and as well as this it also depends on if damage to the wooden strip takes place.

ResultsPlus
Examiner Comments

This is an example of a candidate who deals with this investigation hypothetically.

They gain no marks – practical steps to be undertaken are not spelt out.

ResultsPlus
Examiner Tip

With practical 'How would you...?' questions you must stick to describing practical steps of what you would do, in a logical sequence.

Question 4(b)(ii)

Candidates were asked to nominate another variable that could be investigated.

This was well answered by a majority of candidates.

The strips themselves could be changed in some way, or you could vary the length of strip that was free to bend.

(ii) A student conducts a second experiment with the same equipment where they decide to keep the size of the weight constant.

State another variable, other than the weights added, that would affect the distance, d.

(1)

How long the wooden strip is

ResultsPlus
Examiner Comments

Length of the strip was, perhaps, the most obvious variable to test next.

(ii) A student conducts a second experiment with the same equipment where they decide to keep the size of the weight constant.

State another variable, other than the weights added, that would affect the distance, d.

(1)

the material that the strip is made of

ResultsPlus
Examiner Comments

'Material of the strip' is one alternative variable given in the additional guidance of the mark scheme.

(ii) A student conducts a second experiment with the same equipment where they decide to keep the size of the weight constant.

State another variable, other than the weights added, that would affect the distance, d.

(1)

~~length~~ thickness of the Strip.

ResultsPlus
Examiner Comments

Thickness of the strip is another clearly possible practical variable to change.

(ii) A student conducts a second experiment with the same equipment where they decide to keep the size of the weight constant.

State another variable, other than the weights added, that would affect the distance, d.

(1)

the type of wooden strip used

ResultsPlus
Examiner Comments

One mark.

(ii) A student conducts a second experiment with the same equipment where they decide to keep the size of the weight constant.

State another variable, other than the weights added, that would affect the distance, d.

(1)

~~equi~~ moving equipment can be affect the distance d

ResultsPlus
Examiner Comments

This idea is too vague. No credit was given.

Question 4(c)(i)

A straightforward calculation of spring constant was asked for, with the equation given.

There was an added hurdle to leap over with the extension being given in cm when the answer required it per metre.

(c) (i) Figure 8 shows a spring stretched by some weights.

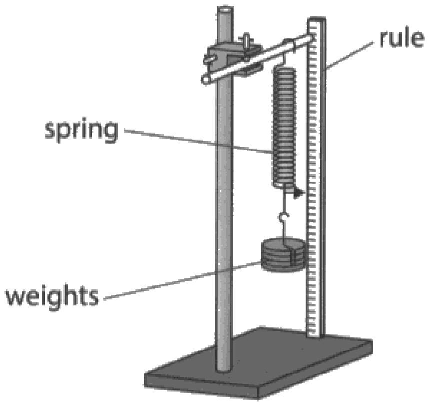

Figure 8

The extension of the spring is 6.2 cm when a weight of 2 N is added.

Calculate the spring constant, *k*, of the spring.

Use the equation

$$k = \frac{F}{x}$$

(2)

~~$\frac{2}{6.2} = 0.323$~~

$\frac{2}{0.062}$

$= 32.26.$

spring constant, *k* = 32.26. N/m

ResultsPlus
Examiner Comments

This candidate arrives at the correct evaluation with a correct conversion of cm to m.

ResultsPlus
Examiner Tip

Watch out for the need for unit conversions.

Extension is given in cm, but the answer is required in newtons per **metre**.

(c) (i) Figure 8 shows a spring stretched by some weights.

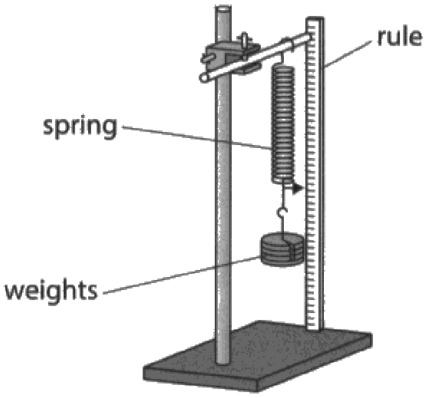

Figure 8

The extension of the spring is 6.2 cm when a weight of 2 N is added.

Calculate the spring constant, k, of the spring.

Use the equation

$$k = \frac{F}{x}$$

$\frac{2}{6.2} = 0.32$

(2)

spring constant, k = 0.32 N/m

ResultsPlus
Examiner Comments

Many more candidates got one mark in this question compared with the few who got two marks.

The reason was taking the numbers at face value and neglecting to convert cm ▯ metres.

(c) (i) Figure 8 shows a spring stretched by some weights.

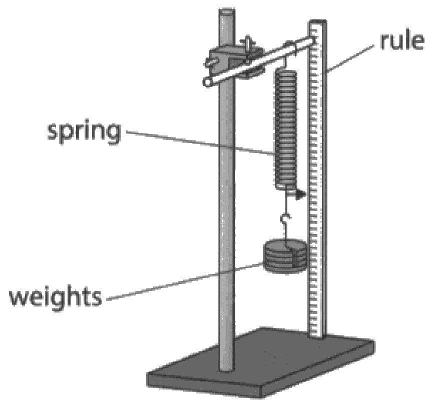

Figure 8

The extension of the spring is 6.2 cm when a weight of 2 N is added.

Calculate the spring constant, k, of the spring.

Use the equation

$$k = \frac{F}{x}$$

(2)

$6.2 \div 2 = 3.1$

spring constant, k = 3.1 N/m

ResultsPlus
Examiner Comments

Unfortunately many candidates inverted the calculation, leaving 'x' in cm.

This is why the mark scheme says ' ignore 3.1 (from 6.2/2)'.

Question 4(c)(ii)

Calculation of ½ k x^2 was needed. With x = 0.06m that needed to calculate 0.06^2.

(ii) Work is done when a spring is stretched.

A different spring has a spring constant of 25 N / m.

The spring is stretched by 0.06 m.

Calculate the energy transferred by stretching the spring.

Use the equation

$$E = \frac{1}{2} \times k \times x^2$$

energy transferred in streching = 0.5 x Spring constant x (exteation)^2

(2)

$0.5 \times 25 \times (0.06)^2$

$= 0.045$

energy transferred = 0.045 J

ResultsPlus
Examiner Comments

Well spelt out with the correct outcome.

ResultsPlus
Examiner Tip

Care is needed with calculator work, especially here, when entering 0.06^2.

(ii) Work is done when a spring is stretched.

A different spring has a spring constant of 25 N / m.

The spring is stretched by 0.06 m.

Calculate the energy transferred by stretching the spring.

Use the equation

$$E = \frac{1}{2} \times k \times x^2$$

(2)

$\frac{1}{2} \times 25 \times 0.6^2 = 4.50$

energy transferred = 4.50 J

ResultsPlus Examiner Comments

This gets one mark, with the mark scheme saying '0.045 to any other power of ten scores one mark'.

(ii) Work is done when a spring is stretched.

A different spring has a spring constant of 25 N / m.

The spring is stretched by 0.06 m.

Calculate the energy transferred by stretching the spring.

Use the equation

$$E = \frac{1}{2} \times k \times x^2$$

(2)

$\frac{1}{2} \times 0.06 \times 25^2 = 18.75$

energy transferred = 18.75 J

ResultsPlus
Examiner Comments

A number of candidates wrongly substituted k with 0.06 and x with 25.

Once you have got it wrong there, no marks are due.

Question 5(a)(iii)

Hardly any candidates gave a correct answer with this question.

The question said:

The actual velocity at the end of the runway is less than the expected velocity as calculated in part (ii).*

Suggest one way to reduce the difference between the actual velocity and the expected velocity.

The reason for * needed realising. Friction and air resistance reduce the velocity of the trolley. That needed counteracting by a proposed measure.

Many candidates said things like 'repeat readings', which would not give any improvement.

(iii) The light gate, shown in Figure 9, is used to determine the actual velocity of the trolley at the end of the runway.

The actual velocity at the end of the runway is less than the expected velocity as calculated in part (ii).

Suggest **one** way to reduce the difference between the actual velocity and the expected velocity.

(1)

reduce the air resistance. Make the trolley streamlined

ResultsPlus Examiner Comments

This solution is one of the possible answers. It is given in additional guidance in the mark scheme.

ResultsPlus Examiner Tip

The whole context of a question needs thinking about, to see what it is getting at.

(iii) The light gate, shown in Figure 9, is used to determine the actual velocity of the trolley at the end of the runway.

The actual velocity at the end of the runway is less than the expected velocity as calculated in part (ii).

Suggest **one** way to reduce the difference between the actual velocity and the expected velocity.

(1)

make the ramp higher so the trolley travels at a faster rate.

ResultsPlus
Examiner Comments

This is taken as equivalent to 'make runway steeper' as given in the mark scheme.

(iii) The light gate, shown in Figure 9, is used to determine the actual velocity of the trolley at the end of the runway.

The actual velocity at the end of the runway is less than the expected velocity as calculated in part (ii).

Suggest **one** way to reduce the difference between the actual velocity and the expected velocity.

(1)

put oil to grease the trolley, so it moved faster.

ResultsPlus
Examiner Comments

This is the primary expected answer, as given in the mark scheme.

(iii) The light gate, shown in Figure 9, is used to determine the actual velocity of the trolley at the end of the runway.

The actual velocity at the end of the runway is less than the expected velocity as calculated in part (ii).

Suggest **one** way to reduce the difference between the actual velocity and the expected velocity.

(1)

~~Make the ramp steeper~~ Make the runway steeper.

ResultsPlus
Examiner Comments

An additional guidance spelt out answer.

(iii) The light gate, shown in Figure 9, is used to determine the actual velocity of the trolley at the end of the runway.

The actual velocity at the end of the runway is less than the expected velocity as calculated in part (ii).

Suggest **one** way to reduce the difference between the actual velocity and the expected velocity.

(1)

By increasing the mass of the trolley could reduce the difference between the actual velocity and expected velocity.

ResultsPlus
Examiner Comments

This is not on the mark scheme; it would not assist.

Question 5(a)(i-ii)

For Q05(a)(i) most candidates were awarded one mark for seeing 4.1 as spelt out in the additional guidance.

10 x 26

A lack of conversion from 26 cm to 0.26m thwarted many.

This question was a 'show that' question, which many candidates found very challenging.

For Q05(a)(ii) many candidates scored two out of the three marks available.

This was due to failing to take the square root once they had evaluated v^2.

5 (a) A student places a trolley at the top of a runway, as shown in Figure 9.

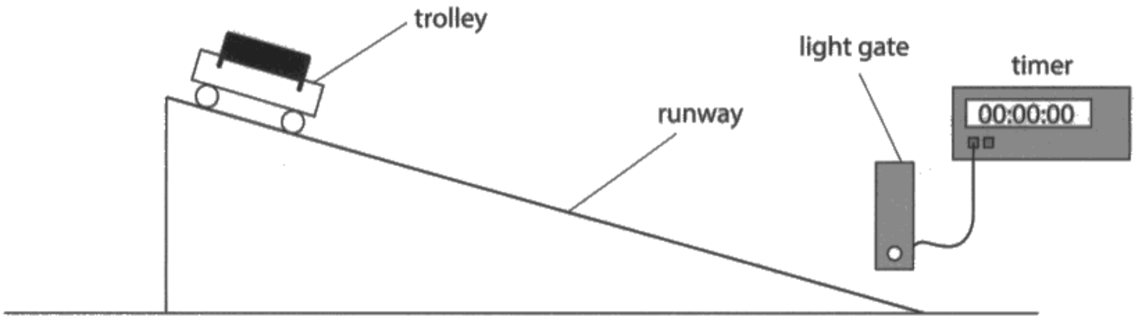

Figure 9

The student had to lift the trolley through a height of 26 cm to put it at the top of the runway.

The gravitational potential energy, ΔGPE, of the trolley increases by 4.1 J when lifted to the top of the runway.

The gravitational field strength, g, = 10 N/kg.

(i) Show that the mass of the trolley is about 1.6 kg.

Use the equation

$$m = \frac{\Delta GPE}{g \times \Delta h}$$

height is measured in M

↳ 0.26 M

(2)

~~4.1 / 10 × 26~~

↓

Therefore the equation would be

$$\frac{4.1}{10 \times 0.26}$$

↳ this equals: 1.576923kg

↳ this then shows the mass is about 1.6 kg

(ii) The student releases the trolley and the trolley moves down the runway.

The student assumes that all the extra gravitational potential energy, ΔGPE, stored at the top of the runway is transferred to kinetic energy at the end of the runway.

Calculate the expected value of the velocity of the trolley at the end of the runway.

Use the equation

$\rightarrow 2.4.1$

$$v^2 = \frac{2 \times \Delta GPE}{m}$$

$\rightarrow 1.57692\dot{3}\dot{0}$

(3)

$\frac{2 \times 4.1}{1.57692\dot{3}\dot{0}} = 5.2$ $\sqrt{5.2} = 2.2803508$

expected velocity = 2.28 m/s

ResultsPlus
Examiner Comments

Full marks for (i) and (ii).

Well set out for the show that question, converting 26cm to 0.26m clearly. Part (ii) carried out the calculation all the way to getting the square root at the end.

ResultsPlus
Examiner Tip

This answer, for both parts, would be really useful for taking as a great example of best practice.

5 (a) A student places a trolley at the top of a runway, as shown in Figure 9.

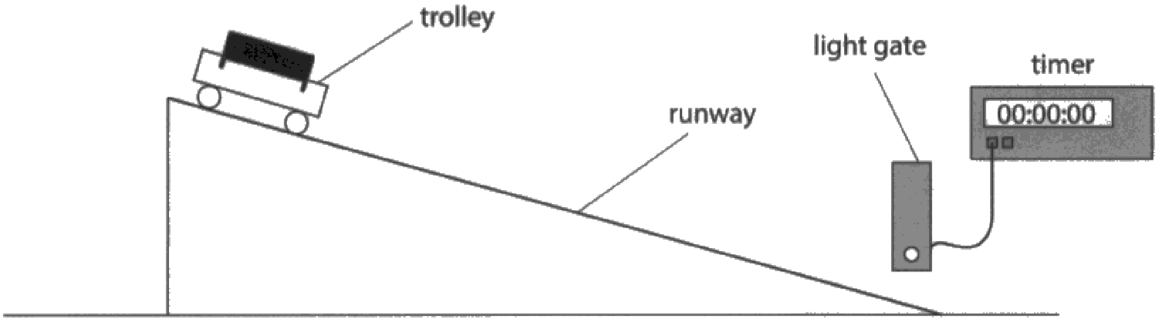

Figure 9

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The gravitational field strength, g, = 10 N/kg.

(i) Show that the mass of the trolley is about 1.6 kg.

Use the equation

$$m = \frac{\Delta GPE}{g \times \Delta h}$$

(2)

$$\text{mass} = \frac{4.1}{10 \times 26} =$$

Change to m

$$\frac{4.1}{10 \times 0.26} = 1.576\ldots\ldots$$

1.6 (1dp)

(ii) The student releases the trolley and the trolley moves down the runway.

The student assumes that all the extra gravitational potential energy, ΔGPE, stored at the top of the runway is transferred to kinetic energy at the end of the runway.

Calculate the expected value of the velocity of the trolley at the end of the runway.

Use the equation

$$v^2 = \frac{2 \times \Delta GPE}{m}$$

(3)

$$\text{velocity}^2 = \frac{2 \times 4.1}{1.6} = 5.125$$

5.1

expected velocity = 5.1 m/s

ResultsPlus Examiner Comments

Part (i) is flawlessly done, full marks.

Part (ii) fails to take the square root at the end, a common fault.

ResultsPlus Examiner Tip

If you find out 'v^2', to get 'v' by itself you have to take the square root on your calculator.

5 (a) A student places a trolley at the top of a runway, as shown in Figure 9.

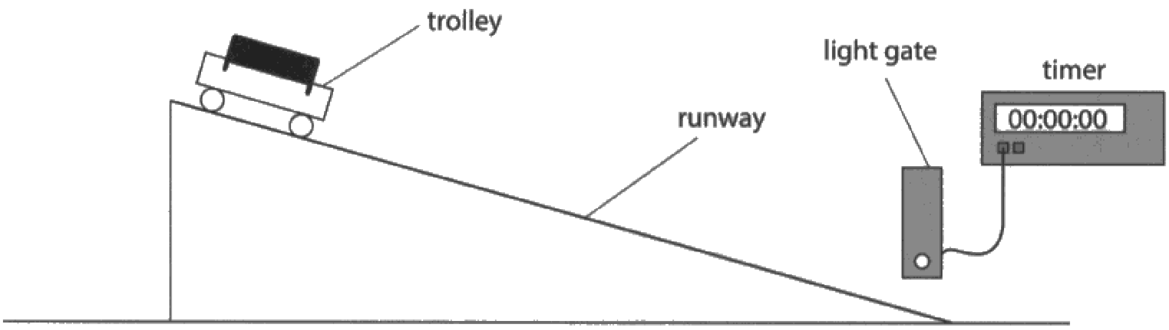

Figure 9

The student had to lift the trolley through a height of 26 cm to put it at the top of the runway.

The gravitational potential energy, ΔGPE, of the trolley increases by 4.1 J when lifted to the top of the runway.

The gravitational field strength, g, = 10 N/kg.

(i) Show that the mass of the trolley is about 1.6 kg.

Use the equation

$$m = \frac{\Delta GPE}{g \times \Delta h}$$

(2)

$$\frac{4.1}{10 \times 26} \times 100 = \frac{410}{10 \times 26}$$

$$= 1.57$$

$$= 1.6 \text{ kg}$$

(ii) The student releases the trolley and the trolley moves down the runway.

The student assumes that all the extra gravitational potential energy, ΔGPE, stored at the top of the runway is transferred to kinetic energy at the end of the runway.

Calculate the expected value of the velocity of the trolley at the end of the runway.

Use the equation

$$v^2 = \frac{2 \times \Delta GPE}{m}$$

$\frac{2 \times 410}{1.6}$

(3)

$= 512.5$

expected velocity = 513 m/s

ResultsPlus
Examiner Comments

This gets one mark for using (m =) 4.1 10 x 26

There is not a straightforward convincing conversion of cm □ metres. Rather the candidate seems to bodge the answer, using 410 in the numerator to arrive at the expected answer.

Conjuring, with numbers like that, will never receive full credit.

For part (ii) this is a wrong substitution of the GPE.

Any ecf needed to use any incorrect value of 'm' as the error carried forward.

5 (a) A student places a trolley at the top of a runway, as shown in Figure 9.

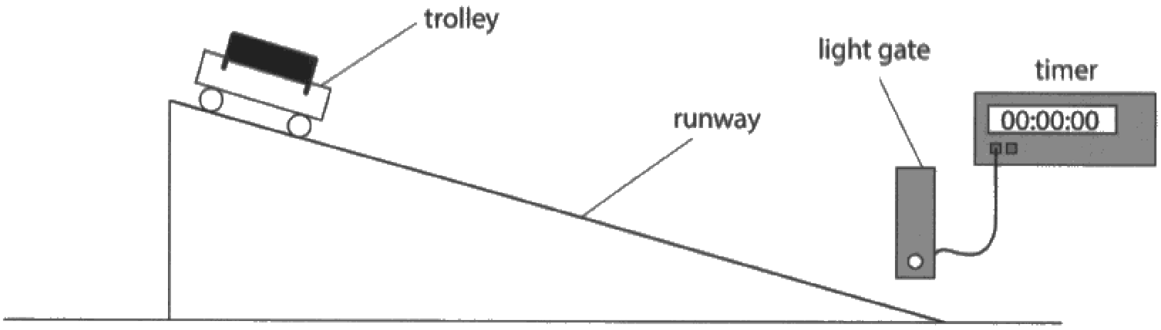

Figure 9

The student had to lift the trolley through a height of 26 cm to put it at the top of the runway.

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The gravitational field strength, g, = 10 N/kg.

(i) Show that the mass of the trolley is about 1.6 kg.

Use the equation

$$m = \frac{\Delta GPE}{g \times \Delta h}$$

(2)

$$\frac{4.1}{10 \times 26} = 0.015769230$$

$$= 1.57$$

$$= 1.6$$

(ii) The student releases the trolley and the trolley moves down the runway.

The student assumes that all the extra gravitational potential energy, ΔGPE, stored at the top of the runway is transferred to kinetic energy at the end of the runway.

Calculate the expected value of the velocity of the trolley at the end of the runway.

Use the equation

$$v^2 = \frac{2 \times \Delta GPE}{m}$$

(3)

$2 \times 4.1 = 8.2$

$\frac{8.2}{1.6} = 5.125$

expected velocity = 5.125 m/s

ResultsPlus
Examiner Comments

(i) got one mark for 4.1 10 x 26 as per the additional guidance.

Part (ii) got two marks for calculating v^2.

Question 5(b)(i)

To substitute in the equation given the candidate required the conversion of mass of student to weight of student.

Unfortunately most candidates missed this and so missed out on most if not all marks.

If they went from 48 Kg to 480 N and gave the answer to two significant figures, as the question asked, then they got full marks.

(b) (i) A different student finds out how much power can be generated by running up some stairs in a measured amount of time.

The following quantities are measured:

mass of student = 48 kg

total height of stairs = 2.9 m

time to run up stairs = 3.4 s

Calculate the power the student generated.

Give the answer to 2 significant figures (2 s.f.).

Use the equation

$$\text{power} = \frac{\text{weight of student} \times \text{height of stairs}}{\text{time to run up stairs}}$$

(3)

weight = 48 x 10 = 480

$$\frac{480 \times 2.9}{3.4}$$

= 409.41176...

= 410

power = 410 W

ResultsPlus
Examiner Comments

This is a clear exemplary calculation, following the introduction's explanation.

This is worth studying and emulating.

ResultsPlus
Examiner Tip

1. Mass and weight are different in physics. This is learning from key stage 2 onwards.
2. Note what the question asks for. Here it asks for 2 significant figures.

(b) (i) A different student finds out how much power can be generated by running up some stairs in a measured amount of time.

The following quantities are measured:

mass of student = 48 kg

total height of stairs = 2.9 m

time to run up stairs = 3.4 s

Calculate the power the student generated.

Give the answer to 2 significant figures (2 s.f.).

Use the equation

$$\text{power} = \frac{\text{weight of student} \times \text{height of stairs}}{\text{time to run up stairs}}$$

(3)

$48 \times 10 = 480$

$$\frac{480 \times 2.9}{3.4} = 409.411...$$

power = 409.5 W

ResultsPlus
Examiner Comments

This does a pretty good job.

They just miss off the rounding to 2 s.f. at the end.

Hence two marks.

(b) (i) A different student finds out how much power can be generated by running up some stairs in a measured amount of time.

The following quantities are measured:

mass of student = 48 kg

total height of stairs = 2.9 m

time to run up stairs = 3.4 s

Calculate the power the student generated.

Give the answer to 2 significant figures (2 s.f.).

Use the equation

$$\text{power} = \frac{\text{weight of student} \times \text{height of stairs}}{\text{time to run up stairs}}$$

(3)

$$\text{Power} = \frac{48 \times 2.9}{3.4}$$

$$= 40.9411764 7$$

power = 41 W

ResultsPlus
Examiner Comments

This was a typical response for a good number of candidates.

Having a flawed initial calculation, only the last s.f. mark is available to them.

(b) (i) A different student finds out how much power can be generated by running up some stairs in a measured amount of time.

The following quantities are measured:

mass of student = 48 kg

total height of stairs = 2.9 m

time to run up stairs = 3.4 s

Calculate the power the student generated.

Give the answer to 2 significant figures (2 s.f.).

Use the equation

$$\text{power} = \frac{\text{weight of student} \times \text{height of stairs}}{\text{time to run up stairs}}$$

(3)

$$\frac{48 \times 2.9}{3.4}$$

$= 48 \times 2.9 = 139.2$

$$\frac{139.2}{3.4} = 12.0415 2249$$

$= 12$

power = 12 W

ResultsPlus Examiner Comments

The mark scheme, in additional guidance, says:

accept the result of any **calculation** to 2s.f. for this mark.

If their calculation is shown, even with a calculator slip in it like this, then the s.f. mark may be awarded here.

It is this skill, of rounding to 2 significant figures, that is being tested in the final mark.

ResultsPlus Examiner Tip

Be careful to show your calculations if you want to get intermediate marks.

No working shown, no chance of other marks if you slip up on the way.

Question 5(b)(ii)

This was a good test of practical know-how.

It would not be very practical, or easily feasible, to place a ruler, mark off the top and then proceed to add the next interval etc. Think about being on the stairs and trying to do that.

These are what the two marking points were awarded for:

- First measure the height of a single step.
- Secondly multiply by the number of steps.

(ii) Explain how the total height of the stairs can be found using a 50 cm ruler.

(2)

measuring the height of a Single Step the multiplying the height by the number of stairs.

ResultsPlus
Examiner Comments

This matches the two mark scheme points very well.

Examiners did not mind whether the rise was called a step or a stair.

The same idea was communicated.

(ii) Explain how the total height of the stairs can be found using a 50 cm ruler.

(2)

Measure the height of 1 stair and then multiply the height of 1 stair by the total number of stairs

ResultsPlus
Examiner Comments

Well spelt out. Very well explained.

Both marks awarded.

ResultsPlus
Examiner Tip

This would work.

Imagine yourself into the situation.

(In practice the vast majority of stairs have steps of equal heights.)

(ii) Explain how the total height of the stairs can be found using a 50 cm ruler.

(2)

~~By counting from 50cm~~ Start to measure it from the ground and use your finger tip to know where to place the ruler after.

ResultsPlus
Examiner Comments

This is the impractical solution, talked of in the introduction to this question.

No marks given.

(ii) Explain how the total height of the stairs can be found using a 50 cm ruler.

(2)

By stacking the rules on top then couting how many rulers it is and ~~then~~ multiply that by 50.

ResultsPlus
Examiner Comments

Another impractical solution; no marks given.

Question 6(a)

Candidates were expected to recall the frequency of the mains domestic electricity supply as 50 Hz.

This is specified on p72 of the Combined Science specification.

Hardly anyone scored this mark. The most common wrong number given was to give the mains voltage number of 230.

Question 6(b)

This was a very high scoring question enabling scoring here for candidates who had struggled earlier on.

All the candidate had to do was multiply the two given numbers together.

(b) The mains supply to the television is 230 V.

The current supplied to the television is 0.53 A.

Calculate the power input to the television.

Use the equation

$$P = I \times V$$

(2)

$230 \times 0.53 = 121.9$

power = 121.9 W

ResultsPlus
Examiner Comments

This was the most common, correct answer given.

All two marks awarded.

ResultsPlus
Examiner Tip

Never give up as you come towards the end of a question paper.

You may still gain vital marks.

(b) The mains supply to the television is 230 V.

The current supplied to the television is 0.53 A.

Calculate the power input to the television.

Use the equation

$$P = I \times V$$

(2)

$0.53 \times 230 = 121.9$

122

power = 122 W

ResultsPlus
Examiner Comments

This was equally acceptable for two marks.

The mark scheme said:

'accept values that round down to 120 to 2s.f. e.g. 121.9 or 122'.

(b) The mains supply to the television is 230V.

The current supplied to the television is 0.53 A.

Calculate the power input to the television.

Use the equation

$$P = I \times V$$

(2)

230 X 0.53 = 727.40

power = 727.40 W

ResultsPlus
Examiner Comments

This gains one mark for the substitution. Unfortunately they then miscalculate.

Question 6(c)(ii)

The question looked for the fuse melts (or blows or breaks) for mark point 1.

Mark point 2 generously awarded the second mark for any from, '*allow switches off {charge flow / circuit / TV / appliance / supply / electricity / voltage / power / energy}*'.

Unfortunately we had many answers that could not be credited, talking of exploding fuses or plugs, or talking about fires being set off.

(ii) A 3 A fuse is used in the plug.

Explain what happens if a fault causes the current to rise to more than 3 A.

(2)

If current increases more than 3A The fuse melts because it has a capacity to let 3A current flow only but if increases it melts breaking the circuit and stopping flow of current through circuit.

ResultsPlus
Examiner Comments

This is a comprehensive accurate answer, explaining everything clearly, and matching the two marking points.

ResultsPlus
Examiner Tip

This level of understanding is worth aiming for.

(ii) A 3 A fuse is used in the plug.

Explain what happens if a fault causes the current to rise to more than 3 A.

(2)

If the current rises to more than 3A, the fuse will blow in order to prevent short cuts from being made.

ResultsPlus
Examiner Comments

Fuse blowing gets the first marking point.

The 'prevents short cuts being made' is not worthy of the second marking point.

(ii) A 3 A fuse is used in the plug.

Explain what happens if a fault causes the current to rise to more than 3 A.

(2)

The fuse would cause sparks and pop, the plug would no longer work as it has blew up.

ResultsPlus
Examiner Comments

'Would **cause** sparks and would pop' not close enough to **the fuse melts**.

No marks.

(ii) A 3 A fuse is used in the plug.

Explain what happens if a fault causes the current to rise to more than 3 A.

(2)

~~There will t~~ This could become ~~an to~~ a hazard as an overload of electrical current could create severe casualties such as a potential fire hazard; ~~henceforth the creation~~

ResultsPlus
Examiner Comments

This is not **explaining what happens** (to the 3A fuse etc.).

It is one of many examples, in the majority, of candidates going off into catastrophes of various descriptions.

ResultsPlus
Examiner Tip

In science / physics questions we look for answers that contain the science / physics that you have learnt.

Focus on these.

(ii) A 3 A fuse is used in the plug.

Explain what happens if a fault causes the current to rise to more than 3 A.

(2)

If the current increases above 3A
the the wires inside the fuse will
break which will turn off the device
until you renew the fuse

ResultsPlus
Examiner Comments

Mark point 1 for 'wires inside the fuse will break'.

Second mark for 'will turn off the device'. That is equivalent to the mark scheme's 'switches off appliance'.

ResultsPlus
Examiner Tip

Allowance is made for various ways of saying the same thing, by expert markers.

Question 6(c)(iii)

Another safety device was asked for (in addition to the fuse of Q06(c)(ii)).

The earth wire/pin was the most common answer given to get the mark, followed by circuit breaker.

Some candidates, somewhat predictably, went for 'wear gloves / goggles'.

Answers about safety devices should always be given in the context of what's being asked for. Generic safety devices, often do not match the context.

(iii) A fuse is a safety device.

State **one** other safety device that can be used in domestic electrical wiring.

(1)

~~Cover~~ earth wire

ResultsPlus
Examiner Comments

The most common, correct answer is seen here.

(iii) A fuse is a safety device.

State **one** other safety device that can be used in domestic electrical wiring.

(1)

A plastic cover around the wires that is soft to protect but also allow them to bend.

ResultsPlus
Examiner Comments

There were lots of correct answers associated with (electrical) insulation. This was one of them.

(iii) A fuse is a safety device.

State **one** other safety device that can be used in domestic electrical wiring.

(1)

electrical tape

ResultsPlus
Examiner Comments

This is a common way of providing electrical insulation in homes.

(iii) A fuse is a safety device.

State **one** other safety device that can be used in domestic electrical wiring.

(1)

~~A cable box~~ A fuse box

ResultsPlus
Examiner Comments

The mark scheme excludes 'fuse box'.

One **other** safety device was asked for.

The earlier part already featured fuses.

(iii) A fuse is a safety device.

State **one** other safety device that can be used in domestic electrical wiring.

(1)

~~non-conducting gloves.~~

Saftey goggles

ResultsPlus
Examiner Comments

Zero marks.

ResultsPlus
Examiner Tip

Please avoid try-to-catch-all general safety devices.

In the context of **domestic** situations, everybody does not need to go around with goggles on.

(iii) A fuse is a safety device.

State **one** other safety device that can be used in domestic electrical wiring.

(1)

Switches

ResultsPlus
Examiner Comments

Switches are not devices principally aimed at safety.

Question 6(d)

There was a good spread of marks in this question but very few indeed achieved level 3 marks. For that to occur two thresholds had to be passed, **typically** with:

1. The principle of step up transformer for transformer A and step down for transformer B being established, with some explanation, however limited.
2. The idea of a current decrease leading to decreased energy losses in the overhead transmission lines.

Common misconceptions included the idea that transformers change power and transformers store electricity until it is needed.

*(d) Figure 10 is a diagram showing a part of the National Grid, used to supply electrical power to homes.

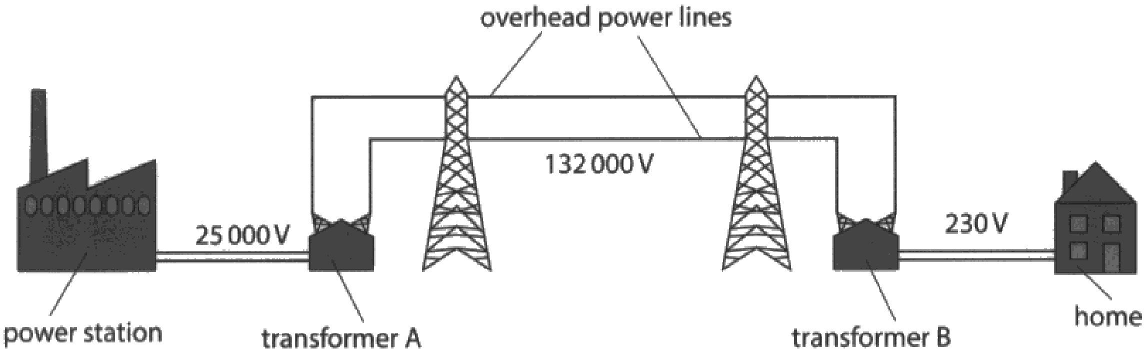

Figure 10

Using information from Figure 10, explain how electrical power is distributed from power stations to homes.

Your answer should refer to

- the role of the transformers
- the different voltages
- how energy losses are reduced

(6)

Answer lines for this question are on page 23.

- Power stations produce a large amount of current
- Transformer A (a step up transformer) increases the voltage which then decreases the current
- Transformer B (a step down transformer) reduces the voltage down to a safer and usable 230V for homes.

Power stations have tons of current ~~~~ so if this went straight into the grid, a huge amount of energy would be lost as heat due to the resistance,
- Transformer A reduces the power lost due to heating in the cables.

ResultsPlus Examiner Comments

This is a very succinct level 3 explanation, involving talking effectively about the role of the transformers and linking reduced current with reduced power losses in the cables.

Full six marks deserved.

ResultsPlus Examiner Tip

The answer does not have to fill every line in the answer space given if it contains the clear principles via which the system works.

The role of current in producing heating in wires is a key one here.

*(d) Figure 10 is a diagram showing a part of the National Grid, used to supply electrical power to homes.

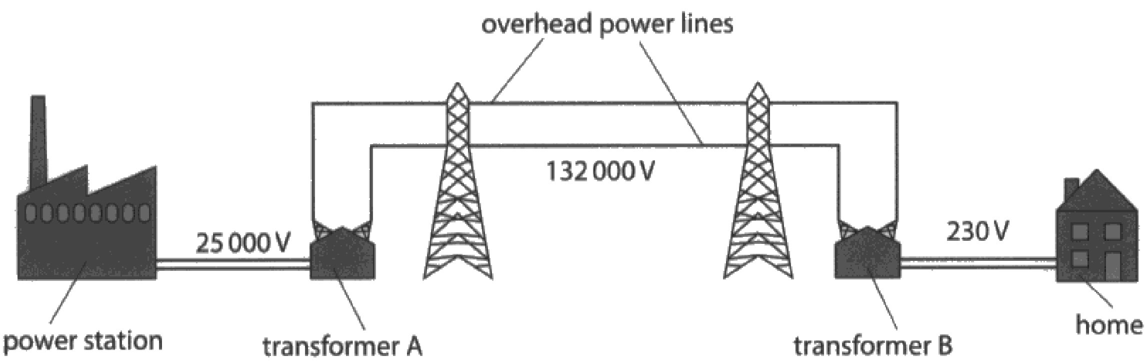

Figure 10

Using information from Figure 10, explain how electrical power is distributed from power stations to homes.

Your answer should refer to

$\frac{6}{6}$ pls

- the role of the transformers
- the different voltages
- how energy losses are reduced

(6)

Answer lines for this question are on page 23.

~~Transformers increase~~ The step up transformer increases the voltage to overhead power lines therefore decreases current. This is because that much current going to overhead power lines would be dangerous and would cause alot of energy to be lost so this is more efficient. The stepdown transformers decrease the voltage from 132 000 V down to the normal 230V. If that much voltage reached a home it could cause a power surge and destroy most appliances as they are mostly capped to 230 V. From power station is 25000V. step up converts to 132000V in lines and stepdown 230 V for homes.

ResultsPlus
Examiner Comments

The key issue of reducing current, after the first transformer, is well focused on.

In doing so they acknowledge how the voltage changes, quoting evidence from the diagram.

They go on, in sequence, to explain why the voltage must be subsequently lowered before being sent into homes.

That is valid in the context of their argument.

Too many other candidates focused on that latter aspect to the exclusion of most else. That tended to limit them to a level 2 mark at best.

*(d) Figure 10 is a diagram showing a part of the National Grid, used to supply electrical power to homes.

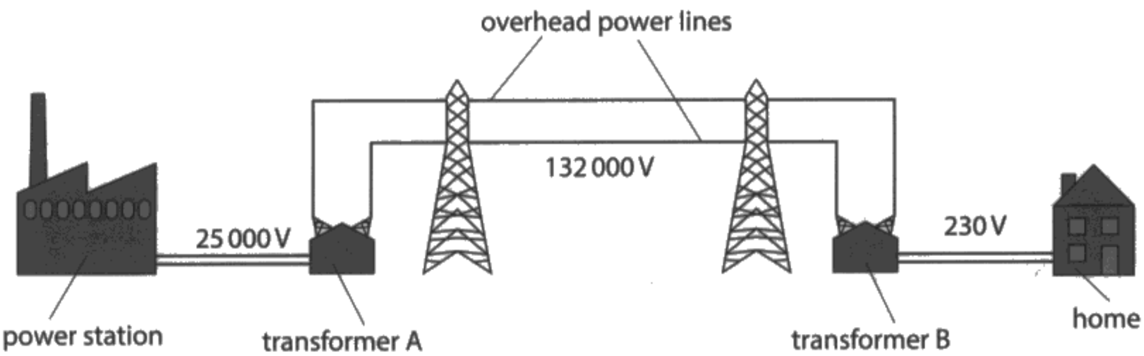

Figure 10

Using information from Figure 10, explain how electrical power is distributed from power stations to homes.

Your answer should refer to

- the role of the transformers
- the different voltages
- how energy losses are reduced

Step up - increases voltage ~~voltage~~ current + decrease current

Step down - decreases voltage - increase current

230v

(6)

Answer lines for this question are on page 23.

- The power station produces a high amount of current that can't be transferred straight to homes as it would lead to heat transfer and energy loss
- ~~A~~ Goes to a step up transformer which increases the voltage from 25,000v to 132,000v which decreases the current, reducing energy loss as less ~~curren~~ current is wasted through thermal energy transfer
- Goes through the overhead powerlines to the step down transformer which decreases voltage to 230v, suitable ~~of~~ amount to go to homes.

ResultsPlus
Examiner Comments

This third example of a six-marker is even more succinct and to the point than was example 1.

Another example of a level 3, six mark answer, not needing to be long-winded to make the necessary points.

ResultsPlus
Examiner Tip

The three examples are all worth seeing as best practice.

They may be compared by candidates to see which one of these they think is the pick of the bunch.

*(d) Figure 10 is a diagram showing a part of the National Grid, used to supply electrical power to homes.

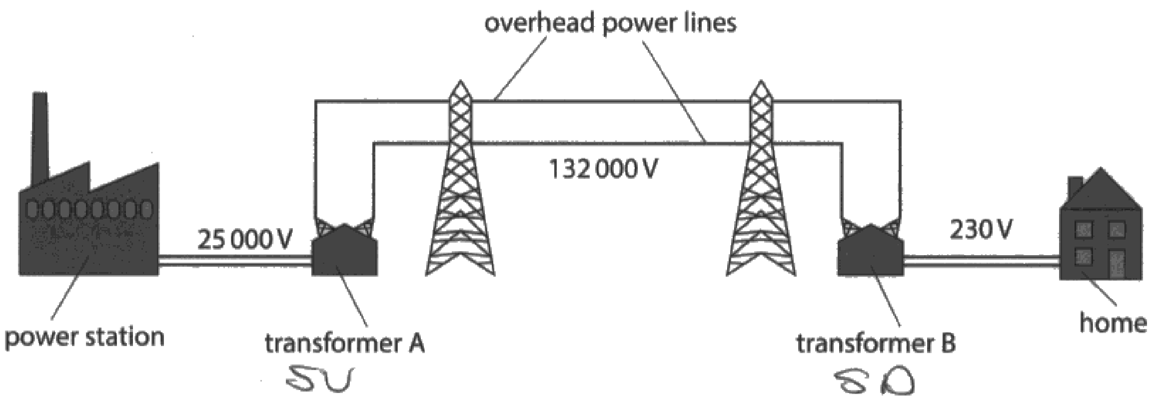

Figure 10

Using information from Figure 10, explain how electrical power is distributed from power stations to homes.

Your answer should refer to

- the role of the transformers
- the different voltages
- how energy losses are reduced

(6)

Answer lines for this question are on page 23.

The power station sends the voltages to the step up transformers which have more primary coils then secondary coils. It then sends off the voltages to over head power lines which is distributed between itself. They then send off the voltage to the step down transformers which carry more secondary coils then primary coils. That transformer sends the ~~vo~~ ~~vo~~ voltages to the homes of people to use.

The role of a transformer is to distribute voltages through apliences such as charders for electronic devices.

ResultsPlus
Examiner Comments

This candidate achieves a good level 2.

The transformers are expertly described, including extra detail about their construction, in terms of coils.

The third component of the answer asked for in the stem of the question asks for 'how energy losses are reduced'. This is not really delved into, unfortunately, limiting the attainment below level 3.

ResultsPlus
Examiner Tip

Look for 'deal-breakers' as you study six-mark questions.

What would that be in this question, to access level three?

*(d) Figure 10 is a diagram showing a part of the National Grid, used to supply electrical power to homes.

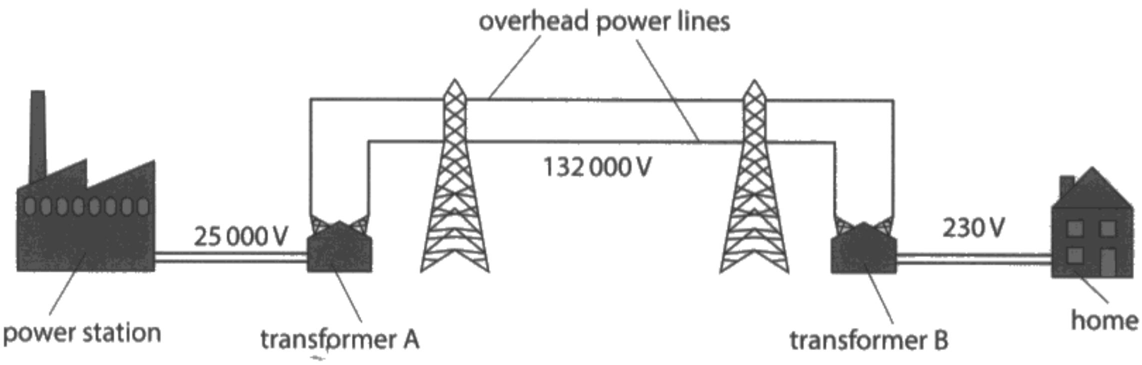

Figure 10

Using information from Figure 10, explain how electrical power is distributed from power stations to homes.

Your answer should refer to

- the role of the transformers
- the different voltages
- how energy losses are reduced

(6)

Answer lines for this question are on page 23.

• The two different transformers used are step up transformers and step down transformers.
• at the overhead powerlines is wear the most voltage is conducted
• transformer B (step down) reduces the voltage (increase resistance) to houses so a safe amount is distributed that is needed.
• ~~Pow~~ places line power stations use step up tranformers before supplying the national grid of power lines
• houses recieve less for ~~safte~~ safety through the step down tranformers, recieving voltage distributed from live wires on over head power lines which supply across the whole country.
• step up transformers ensure energy isnt lost
• overhead wires have a lot of voltage due to the individual wire voltage combined.

(Total for Question 6 = 13 marks)

TOTAL FOR PAPER = 60 MARKS

ResultsPlus
Examiner Comments

This is one of the answers, intimated earlier, which although it gives a good account of step up and step down transformers, goes on with a restricted argument about making voltages acceptable for the domestic part of the system.

They miss out on the key issue of current linked to heating in wires and power losses.

Limited to level 2.

Four marks.

*(d) Figure 10 is a diagram showing a part of the National Grid, used to supply electrical power to homes.

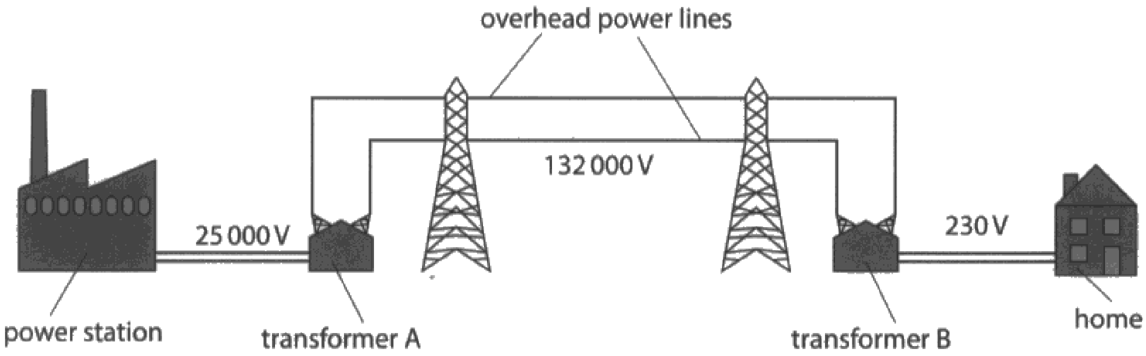

Figure 10

Using information from Figure 10, explain how electrical power is distributed from power stations to homes.

Your answer should refer to

- the role of the transformers
- the different voltages
- how energy losses are reduced

(6)

Answer lines for this question are on page 23.

• Power Stations Send voltage to transformer A.
• Transformer A than carries them through the overhead powerlines which also carries a lot of voltage.
• Than from the overhead powr lines it will travel to transformer B.
• Transformer B will suply 230V to homes.
• Power Stations hold 25,000V which is sent to transformer A.
• transformer A to B goes through power lines which have an increased amount of voltage.
• Than from transformer B to the home the energy is reduced.

ResultsPlus
Examiner Comments

This is a limited description of the various steps of the process shown in Figure 10.

There is no effective explanatory content.

Level 1 is appropriate.

Two marks.

*(d) Figure 10 is a diagram showing a part of the National Grid, used to supply electrical power to homes.

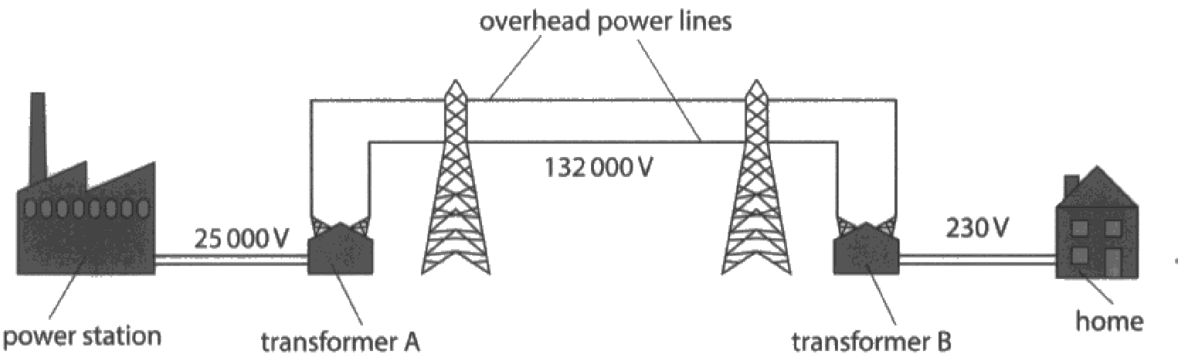

Figure 10

Using information from Figure 10, explain how electrical power is distributed from power stations to homes.

Your answer should refer to

- the role of the transformers
- the different voltages
- how energy losses are reduced

(6)

Answer lines for this question are on page 23.

Power stations first directly send all power*[2] to transformer A, transformer A is usually a well insulated and protected building which can handle the power. Then, power is directed to the over head power lines*[1] - these helping to quickly ~~tran~~ transport the power to another location - this location being transformer B. Transformer B is also usually a well insulated and protected building which ~~can~~ can easily ~~han~~ handle the power. Once outside of transformer B - a small quantities of the power, usually in bunches of 230V - are dished out to the houses ~~equaller~~ equally. This ~~process~~ process is ~~constantt~~ consistant.

*[1], 132,000 volts as an estimation

*[2], usually around 25,000 each round,

ResultsPlus Examiner Comments

This response does not go beyond level 1.

It is similar to the previous answer with some added repeated ideas about 'well insulated and protected buildings'. The submission concludes with the doling out of lots of 230V to homes.

It does not really exhibit any scientific explanation to what is going on.

Level 1.

Two marks.

*(d) Figure 10 is a diagram showing a part of the National Grid, used to supply electrical power to homes.

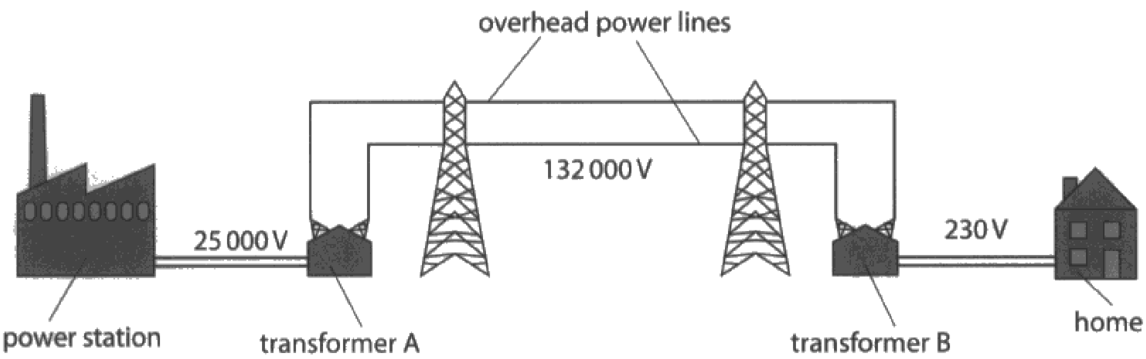

Figure 10

Using information from Figure 10, explain how electrical power is distributed from power stations to homes.

Your answer should refer to

- the role of the transformers
- the different voltages
- how energy losses are reduced

(6)

Answer lines for this question are on page 23.

The power goes trough a step up transformer which increases the voltage but reduces the current. Then it goes to a step down ~~Cont~~ transformer which reduses the voltage but increases the current so that it is safer for consumers.

ResultsPlus
Examiner Comments

This is a level 2 answer.

It is quite brief, including associating increasing the voltage with a decrease in current beyond the first transformer.

It is not then linked to the key heating-in-wires principle, leading to power losses.

Level 2.

Four marks.

Paper Summary

Overall this exam gave ample opportunity for candidates to display their knowledge and understanding at grades 1-5.

Candidates have continued to do well with most calculation questions and these often formed a substantial part of candidates' accrued marks.

The assessment of practical skills showed some jeopardy. Q02(b), on measuring density, did not achieve high scoring outcomes very often. Likewise for Q04(b)(i), when many candidates showed a tendency to speak hypothetically rather than practically, based upon lab experiences. Q05(b)(ii) also caused difficulty for many. The way of measuring Dh when running up stairs to find power, is to measure the height of one step then x number of steps (counted). If candidates had had experience of this in school science labs, it surely would have yielded more attainment.

Successful candidates were:

- well-acquainted with the content of the specification
- skilled as a result of having been engaged with practical work during their course
- competent in quantitative work, especially in using equations
- well-focused in their comprehension of the question-at-hand
- willing to apply physics principles to the novel situations presented to them.

Less successful candidates:

- had gaps in their conceptual knowledge of the topics of this paper
- had gaps in their procedural knowledge, relating to their practical work
- misread and / or misunderstood the symbols used in equations
- did not focus sufficiently on what the question was asking
- found difficulty in applying their knowledge to new situations.

Grade boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link: https://qualifications.pearson.com/en/support/support-topics/results-certification/grade-boundaries.html

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