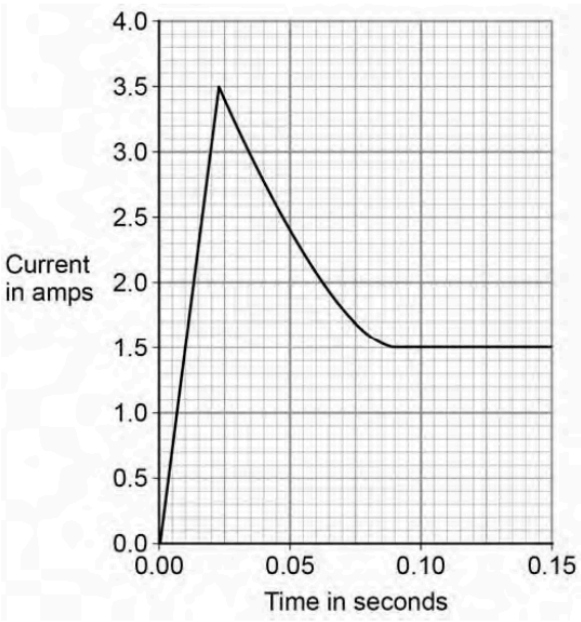
Q1. (2018)

a)

Figure 2 shows how the current through a filament lamp changes after the lamp is switched on.

Figure 2



The normal current through the filament lamp is 1.5 A.

For how many seconds is the current through the filament lamp greater than 1.5 A?

Tick **one** box.

[1 mark]

0.01 s ☐

0.08 s ☐

0.09 s ☐

0.14 s ☐

b)

Why might the filament inside a lamp melt when the lamp is first switched on?

[1 mark]

_____

_____

c)

The lamp is connected to a 24 V power supply. The current through the lamp is 1.5 A.

Calculate the power of the lamp.

Use the equation:

power = potential difference × current

[2 marks]

_____

_____

_____

_____

Power = _____ W

d)

LED lamps are much more efficient than filament lamps.

What does this statement mean?

Tick **one** box.

[1 mark]

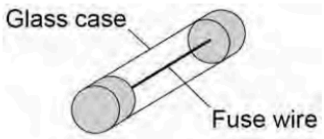
- LED lamps have a similar power output to filament lamps. ☐
- LED lamps waste a smaller proportion of the input energy than filament lamps. ☐
- LED lamps have a higher power input than filament lamps. ☐
- LED lamps waste a larger proportion of the input energy than filament lamps. ☐

Q2. (2018)

a)

Figure 9 shows the structure of a fuse.

Figure 9



Write down the equation that links charge flow, current and time.

[1 mark]

_____

b)

The fuse wire melts when 1.52 coulombs of charge flows through the fuse in 0.40 seconds.

Calculate the current at which the fuse wire melts.

[3 marks]

_____

_____

_____

_____

Current = _____ A

c)

The mass of the fuse wire is 0.00175 kg. The specific latent heat of fusion of the fuse wire is 205 000 J/kg.

Calculate the energy needed to melt the fuse wire.

Use the Physics Equations Sheet.

[2 marks]

_____

_____

_____

_____

Energy = _____ J

Q3. (2018)

a)

Figure 15 shows a student walking on a carpet.

Figure 15

The student becomes negatively charged because of the friction between his socks and the carpet.

Explain why the friction causes the student to become charged.

[2 marks]

b)

Some carpets have thin copper wires running through them. The student is less likely to receive an electric shock after walking on this type of carpet.

Suggest why.

[2 marks]

Q4. (2018)

a)

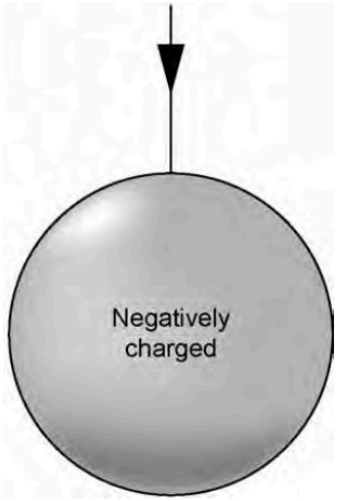
The student's head is represented by the sphere in **Figure 16.**

The student is negatively charged. The arrow shows part of the electric field around the student's head.

Draw **three** more arrows on **Figure 16** to complete the electric field pattern.

[1 mark]

Figure 16



b)

The negatively charged student touches a metal tap and receives an electric shock.

Explain why.

[3 marks]

_____

_____

_____

_____

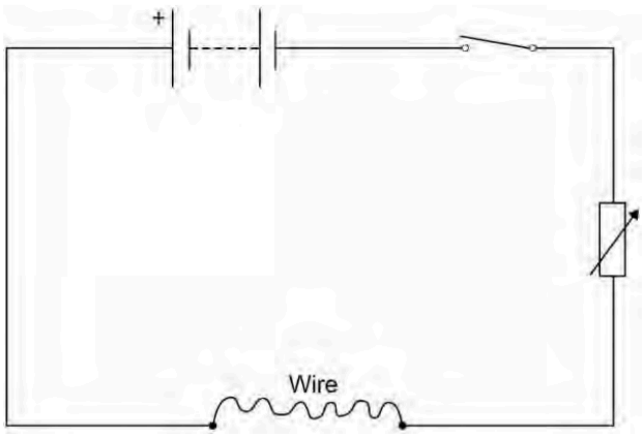
Q5. (2018)

a)

A student investigated how the resistance of a piece of nichrome wire varies with length.

Figure 17 shows part of the circuit the student used.

Figure 17



Complete **Figure 17** by adding an ammeter and a voltmeter.

Use the correct circuit symbols.

[3 marks]

b)

Describe how the student would obtain the data needed for the investigation.

Your answer should include a risk assessment for **one** hazard in the investigation.

[6 marks]

c)

Why would switching off the circuit between readings have improved the accuracy of the student's investigation?

Tick **one** box.

[1 mark]

- The charge flow through the wire would not change. ☐
- The potential difference of the battery would not increase. ☐
- The power output of the battery would not increase. ☐
- The temperature of the wire would not change. ☐

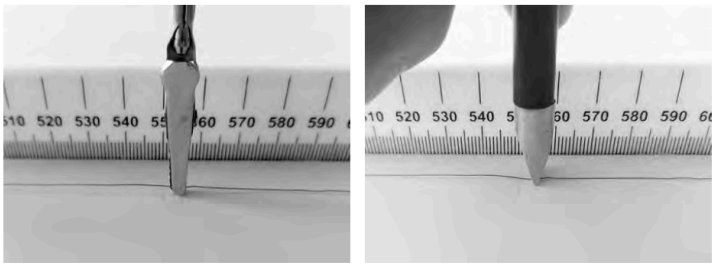
d)

The student used crocodile clips to make connections to the wire.

They could have used a piece of equipment called a 'jockey'.

Figure 18 shows a crocodile clip and a jockey in contact with a wire.

Figure 18



Crocodile clip **Jockey**

How would using the jockey have affected the accuracy and resolution of the student's results compared to using the crocodile clip?

Tick **two** boxes.

[2 marks]

- The accuracy of the student's results would be higher. ☐
- The accuracy of the student's results would be lower. ☐
- The accuracy of the student's results would be the same. ☐
- The resolution of the length measurement would be higher. ☐
- The resolution of the length measurement would be lower. ☐
- The resolution of the length measurement would be the same. ☐

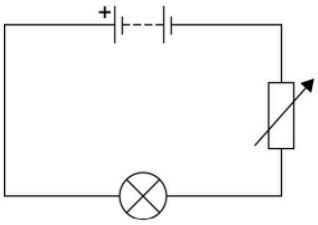
Q6. (2020)

a)

A student investigated how the current in a filament lamp varied with the potential difference across the filament lamp.

Figure 11 shows part of the circuit used.

Figure 11



Complete **Figure 11** by adding an ammeter and a voltmeter.

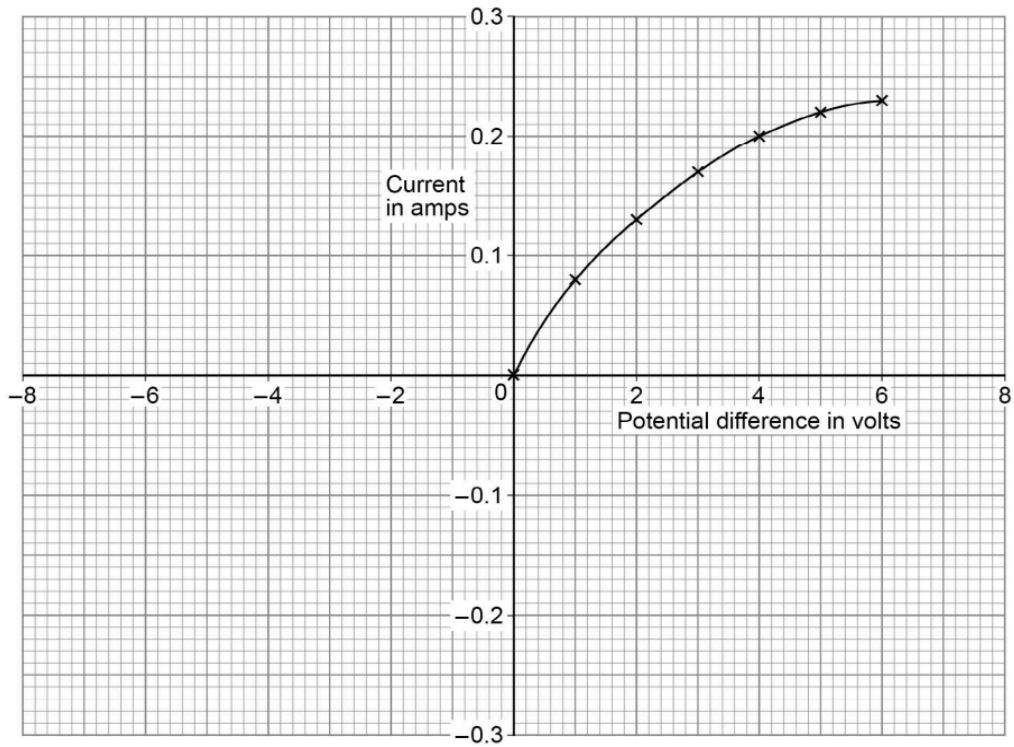
Use the correct circuit symbols.

[3 marks]

b)

Figure 12 shows some of the results.

Figure 12



The student reversed the connections to the power supply and obtained negative values for the current and potential difference.

Draw a line on **Figure 12** to show the relationship between the negative values of current and potential difference.

[2 marks]

c)

Write down the equation which links current (I), potential difference (V) and resistance (R).

[1 mark]

_____

d)

Determine the resistance of the filament lamp when the potential difference across it is 1.0 V.

Use data from **Figure 12**.

[4 marks]

_____

_____

_____

_____

Resistance = _____ Ω

e)

A second student did the same investigation. The ammeter used had a zero error.

What is meant by a zero error?

[1 mark]

_____

_____

Q7. (2021)

a)

When there were three lamps in the circuit the ammeter reading kept changing between 0.35 A and 0.36 A.

What type of error would this lead to?

[1 mark]

Tick (✓) **one** box.

Random error ☐

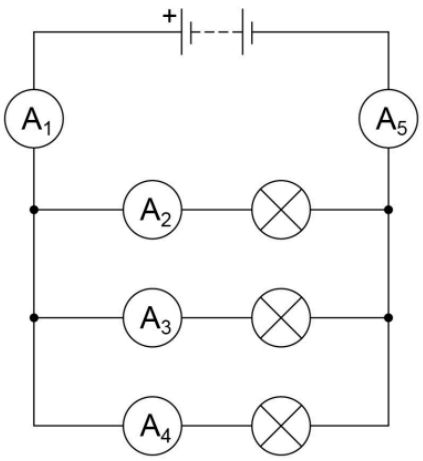
Systematic error ☐

Zero error ☐

b)

Figure 6 shows a circuit with five ammeters and three identical lamps.

Figure 6



Complete **Table 2** to show the readings on ammeters A_2 and A_5.

[2 marks]

Table 2

Ammeter	**A_1**	**A_2**	**A_3**	**A_4**	**A_5**
Current in amps	0.36		0.12	0.12	

c)

The resistance of one lamp is 15 Ω.

The current in the lamp is 0.12 A.

Calculate the power output of the lamp.

Use the equation:

$$\text{power} = (\text{current})^2 \times \text{resistance}$$

[2 marks]

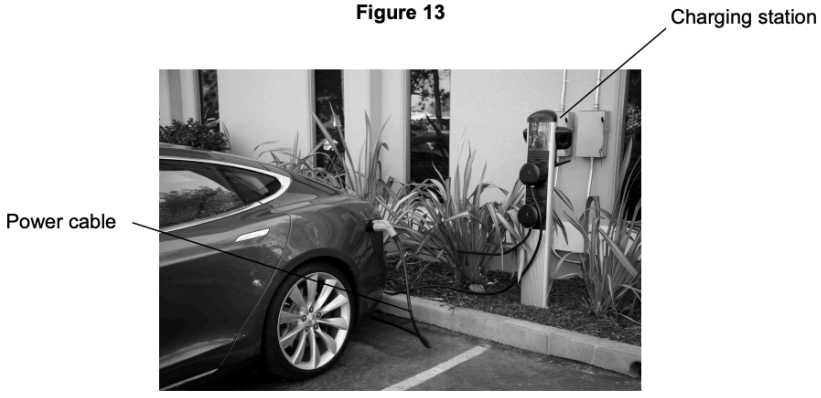
Power = _____ W

Q8. (2021)

a)

Figure 13 shows an electric car being recharged.

Figure 13



The charging station applies a direct potential difference across the battery of the car.

What does 'direct potential difference' mean?

[1 mark]

b)

Which equation links energy transferred (E), power (P) and time (t)?

[1 mark]

Tick (✓) **one** box.

energy transferred = $\frac{\text{power}}{\text{time}}$ ☐

energy transferred = $\frac{\text{time}}{\text{power}}$ ☐

energy transferred = power × time ☐

energy transferred = power^2 × time ☐

c)

The battery in the electric car can store 162 000 000 J of energy.

The charging station has a power output of 7200 W.

Calculate the time taken to fully recharge the battery from zero.

[3 marks]

Time taken = _____ s

d)

Which equation links current (I), potential difference (V) and resistance (R)?

[1 mark]

Tick (✓) **one** box.

$I = V \times R$ ☐

$I = V^2 \times R$ ☐

$R = I \times V$ ☐

$V = I \times R$ ☐

e)

The potential difference across the battery is 480 V.

There is a current of 15 A in the circuit connecting the battery to the motor of the electric car.

Calculate the resistance of the motor.

[3 marks]

Resistance = _____ Ω

f)

Different charging systems use different electrical currents.

- Charging system **A** has a current of 13 A.
- Charging system **B** has a current of 26 A.
- The potential difference of both charging systems is 230 V.

How does the time taken to recharge a battery using charging system **A** compare with the time taken using charging system **B**?

[1 mark]

Tick (✓) **one** box.

Time taken using system **A** is half the time of system **B** ☐

Time taken using system **A** is the same as system **B** ☐

Time taken using system **A** is double the time of system **B** ☐

Q9. (2021)

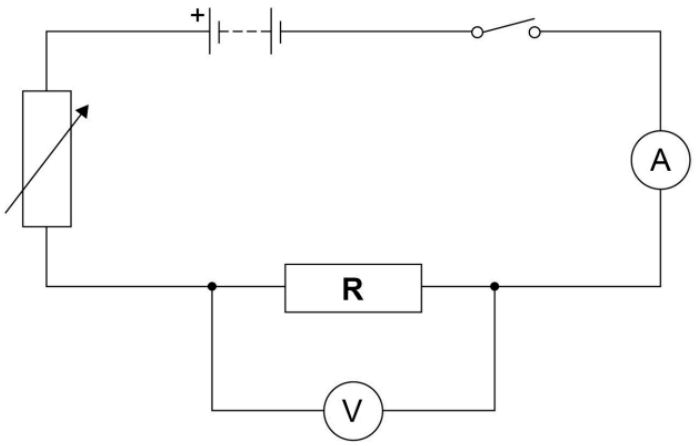
a)

Student **A** investigated how the current in resistor **R** at constant temperature varied with the potential difference across the resistor.

Student **A** recorded both positive and negative values of current.

Figure 14 shows the circuit Student **A** used.

Figure 14



Describe a method that Student **A** could use for this investigation.

[6 marks]

b)

Student **B** repeated the investigation.

During Student **B**'s investigation the temperature of resistor **R** increased.

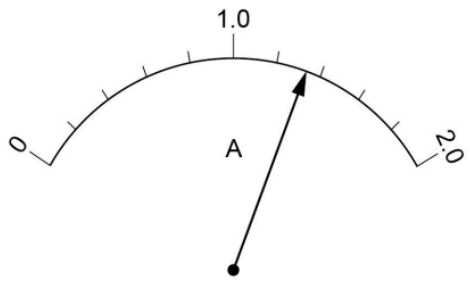
Explain how the increased temperature of resistor **R** would have affected Student **B**'s results.

[2 marks]

c)

Figure 15 shows the scale on a moving coil ammeter at one time in the investigation.

Figure 15



What is the resolution of the moving coil ammeter?

[1 mark]

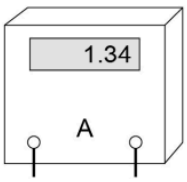
Resolution = _____ A

d)

Student **B** replaced the moving coil ammeter with a digital ammeter.

Figure 16 shows the reading on the digital ammeter.

Figure 16



The digital ammeter has a higher resolution than the moving coil ammeter.

Give **one** other reason why it would have been better to use the digital ammeter throughout this investigation.

[1 mark]

_____

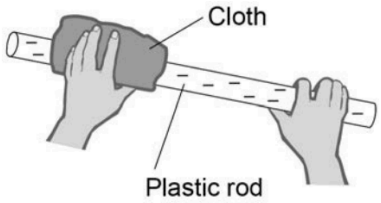
Q10. (2022)

a)

Figure 3 shows a plastic rod being rubbed with a cloth.

The plastic rod becomes negatively charged.

Figure 3



Complete the sentences.

Choose answers from the box.

Each answer may be used once, more than once or not at all.

[2 marks]

electrons	**neutrons**	**protons**

The plastic rod becomes charged because it gains _____ .

The cloth also becomes charged because it loses _____ .

b)

What charge is left on the cloth?

[1 mark]

Tick (✓) **one** box.

A negative charge ☐

A neutral charge ☐

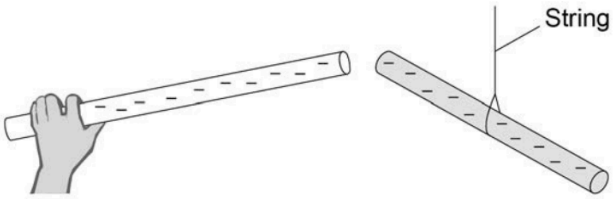
A positive charge ☐

c)

The negatively charged plastic rod is put near another negatively charged plastic rod that is hanging from a string.

Figure 4 shows the two rods.

Figure 4



What force is exerted on the two rods?

Tick (✓) **one** box.

Give a reason for your answer.

[2 marks]

A force of attraction ☐

A force of repulsion ☐

There is no force ☐

Reason _____

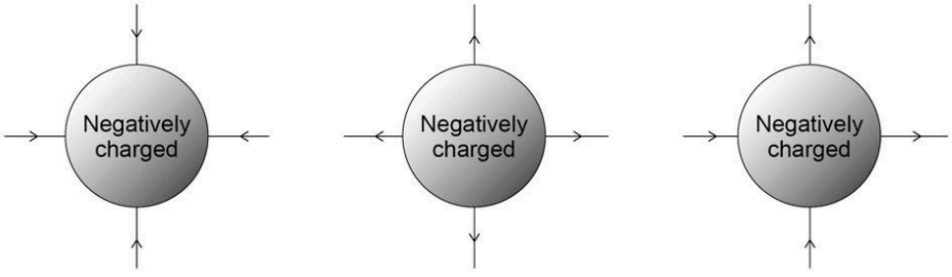
Q11.(2022)

There is an electric field around any charged object.

Which diagram shows the electric field pattern around a negatively charged sphere?

[1 mark]

Tick (✓) **one** box.



☐ ☐ ☐

Q12.(2022)

In which position do two charged spheres experience the greatest electrostatic force?

[1 mark]

Tick (✓) **one** box.

A Negatively charged Negatively charged ☐

B Negatively charged Negatively charged ☐

C Negatively charged Negatively charged ☐

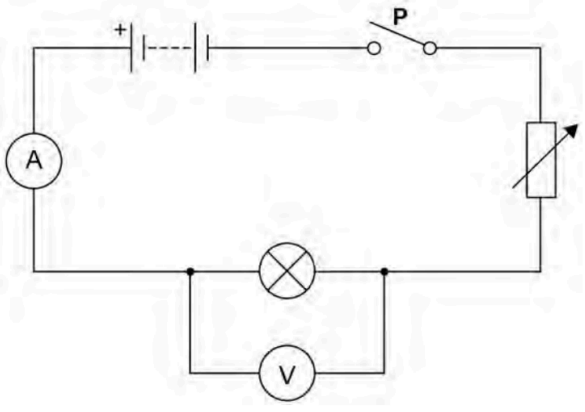
Q13.(2023)

a)

A student investigated how the current in a filament lamp varies with the potential difference across the lamp.

Figure 1 shows the circuit used.

Figure 1



What is component **P**?

[1 mark]

b)

Complete the sentences.

Choose answers from the box.

[2 marks]

charge	**current**	**energy**	**potential difference**	**power**

The ammeter in the circuit measures _____ .

The voltmeter in the circuit measures _____ .

c)

How will **increasing** the resistance of the variable resistor in **Figure 1** affect each of the following quantities?

[3 marks]

Tick (✓) **one** box in **each** row.

Quantity	**Decreases**	**Stays the same**	**Increases**
Current in the circuit			
Potential difference across the lamp			
Total resistance of the circuit			

d)

A charge flow of 15 coulombs passed through the filament lamp in a time of 60 seconds.

Calculate the current in the lamp.

Use the equation:

$$\text{current} = \frac{\text{charge flow}}{\text{time}}$$

[2 marks]

_____

_____

_____

Current = _____ A

e)

When the current in the filament lamp is 0.12 A, the potential difference across the lamp is 6.0 V.

Calculate the resistance of the filament lamp.

Use the equation:

$$\text{resistance} = \frac{\text{potential difference}}{\text{current}}$$

[2 marks]

Resistance = _____ Ω

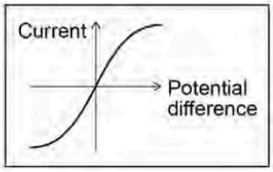
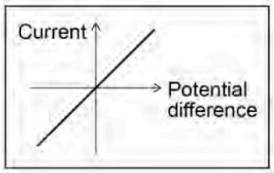
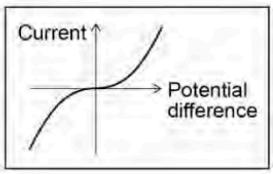
f)

The student repeated the investigation after replacing the lamp with a resistor at constant temperature and then a diode.

The student plotted a graph for each component.

Draw **one** line from each component to its graph.

[2 marks]

Component	Graph
Diode	
Filament lamp	
Resistor	

g)

Figure 2 shows an ammeter.

The ammeter is **not** connected to a circuit.

Figure 2

What type of error does the ammeter display?

[1 mark]

Tick (✓) **one** box.

A positive error ☐

A random error ☐

A zero error ☐

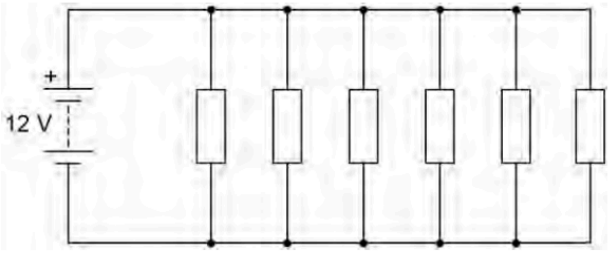
Q14.(2023)

a)

Figure 14 shows an electrical circuit used to heat the windscreen of a car.

Each resistor in the circuit represents a heating element.

Figure 14



The 12 V battery supplies direct potential difference.

What is meant by 'direct potential difference'?

[1 mark]

b)

Which equation links charge flow (Q), energy (E) and potential difference (V)?

[1 mark]

Tick (✓) **one** box.

$E = \frac{V}{Q}$ ☐

$E = QV$ ☐

$E = \frac{Q}{V}$ ☐

$E = \frac{V^2}{Q}$ ☐

c)

Calculate the charge flow through the 12 V battery when the battery transfers 5010 J of energy.

[3 marks]

Charge flow = _____ C

Q14.d)(2023)

Ice forms on the windscreen at a temperature of 0 °C.

The electrical circuit transfers 5010 J of energy to the ice.

A mass of 0.015 kg of ice melts.

Calculate the specific latent heat of fusion of water.

Use the Physics Equations Sheet.

[3 marks]

Specific latent heat of fusion of water = _____ J/kg

e)

The electrical circuit was left switched on while the ice changed from a solid to a liquid and increased in temperature to 5 °C.

Explain the changes in the arrangement **and** movement of the particles as the ice melted and the temperature increased to 5 °C.

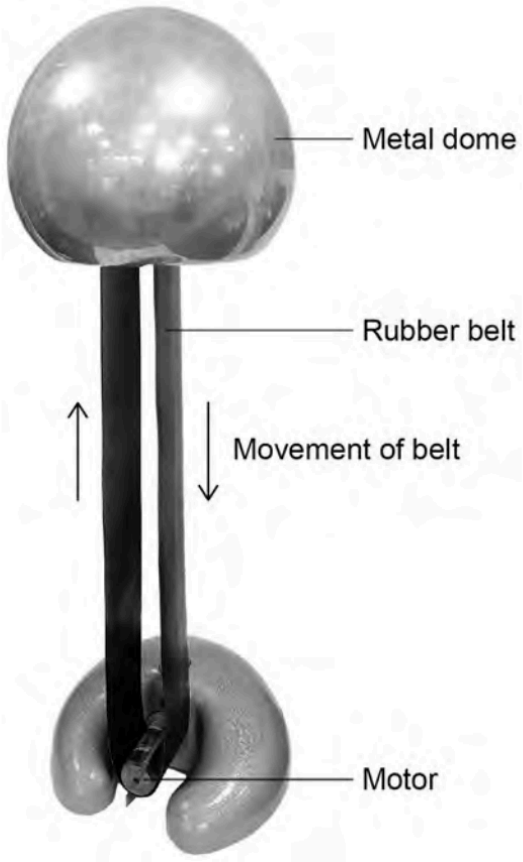
[6 marks]

Q15. (2024)

a)

Figure 1 shows a static electricity generator.

Figure 1



The rubber belt is turned by a motor.

As the rubber belt moves, charge is transferred from the rubber belt to the metal dome.

Figure 2 shows a student touching the metal dome of the static electricity generator.

The dome is negatively charged.

Figure 2

Complete the sentence.

Choose the answer from the box.

[1 mark]

negative	**neutral**	**positive**

When the student touches the negatively charged metal dome the student's hair

gains a _____ charge.

b)

Complete the sentence.

Choose the answer from the box.

[1 mark]

attraction	**gravity**	**repulsion**

The hair on the student's head stands up because the strands of hair experience

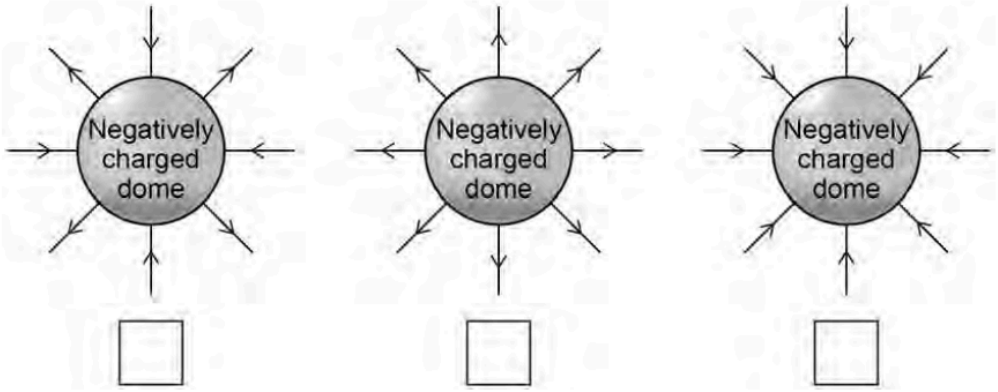
forces of _____.

c)

Which of the following diagrams shows the electric field pattern around the negatively charged metal dome?

[1 mark]

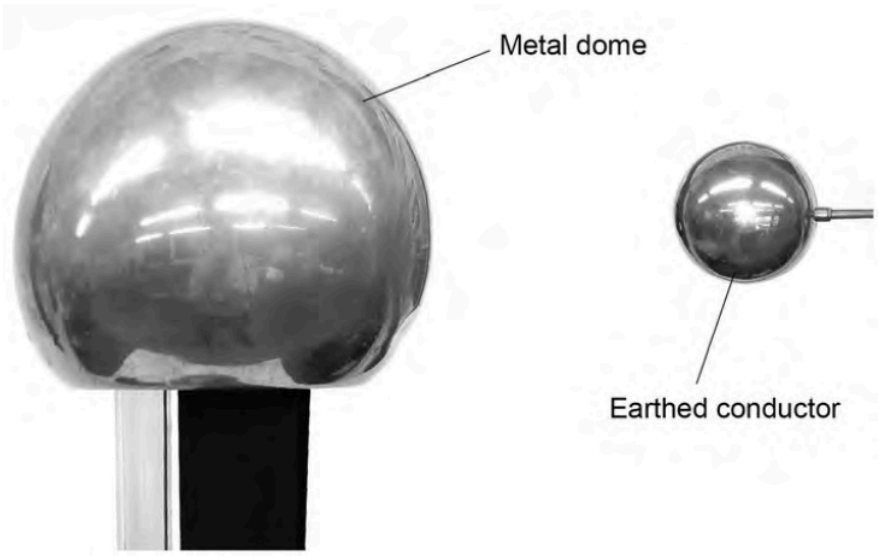
Tick (✓) **one** box.



d)

Figure 3 shows the negatively charged metal dome and an earthed conductor.

Figure 3



The air between the dome and the earthed conductor is an insulator.

Complete the sentence.

Choose the answer from the box.

[1 mark]

efficiency	**resistance**	**temperature**

The air between the dome and the earthed conductor has

a high _____.

e)

The earthed conductor is moved closer to the metal dome.

A spark jumps from the dome to the earthed conductor.

Complete the sentence.

Choose the answer from the box.

[1 mark]

earthed	**ionised**	**neutral**

The spark jumps because the air around the charged dome has

become _____.

f)

Which particles are transferred when the spark jumps from the negatively charged metal dome to the earthed conductor?

[1 mark]

Tick (✓) **one** box.

Electrons ☐

Neutrons ☐

Protons ☐

g)

The potential difference between the metal dome and earth is 300 000 V.

When the spark jumps there is a charge flow of 0.000 002 C.

Calculate the energy transferred by the spark.

Use the equation:

energy transferred = charge flow × potential difference

[2 marks]

_____

_____

_____

Energy transferred = _____ J

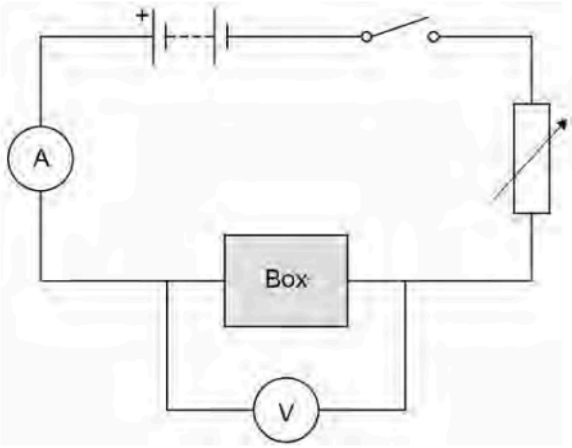
Q16. (2024)

a)

A student had an unknown electrical component inside a sealed box.

Figure 14 shows the circuit the student used to identify the component.

Figure 14



The student varied the potential difference across the component and measured the current in the component.

Table 3 shows the results when the potential difference across the component was 6.0 V.

Table 3

Potential difference in volts	**Current in amps**			
	1st reading	2nd reading	3rd reading	**Mean**
6.0	0.26	0.21	0.25	**X**

Calculate value **X** in **Table 3**.

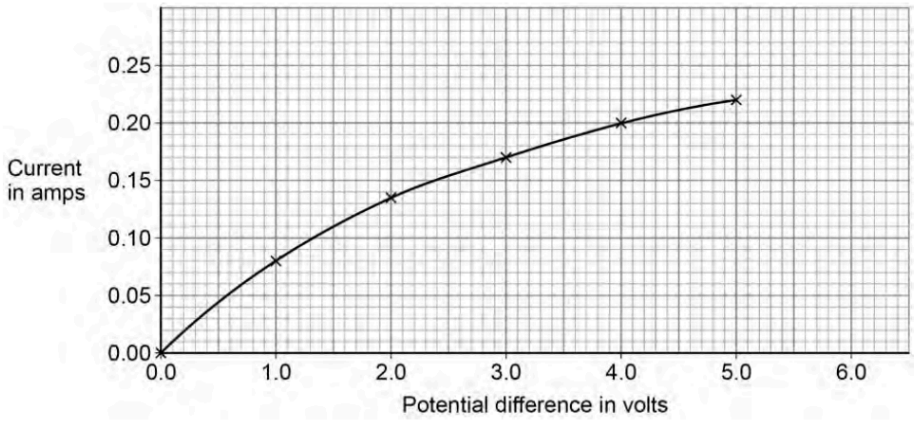
[2 marks]

X = _____ A

b)

Figure 15 shows the results.

Figure 15



Calculate the power of the component when the potential difference across the component is 3.0 V.

Use **Figure 15** and the equation:

power = potential difference × current

[3 marks]

Power = _____ W

c)

Complete the sentence.

Choose the answer from the box.

[1 mark]

decreases	**stays the same**	**increases**

As the potential difference across the component increases, the gradient of the graph _____.

d)

What is the component in the sealed box?

[1 mark]

Tick (✓) **one** box.

Diode	☐
Filament lamp	☐
Resistor at constant temperature	☐

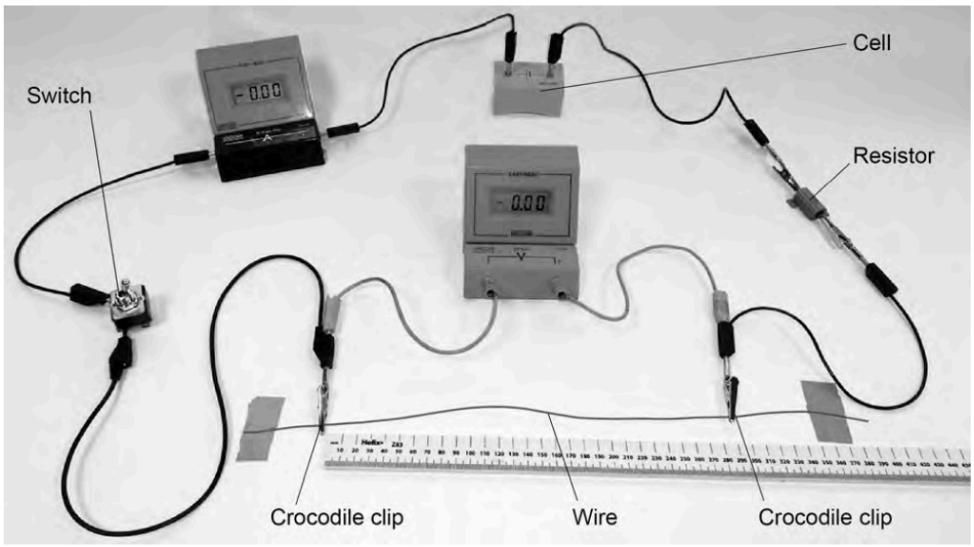
Q17. (2024)

a)

A student investigated how the length of a wire affects the resistance of the wire at constant temperature.

Figure 18 shows the circuit used.

Figure 18



The student plotted a graph of resistance against the length of wire.

Describe a method the student could have used to collect the data needed to plot the graph.

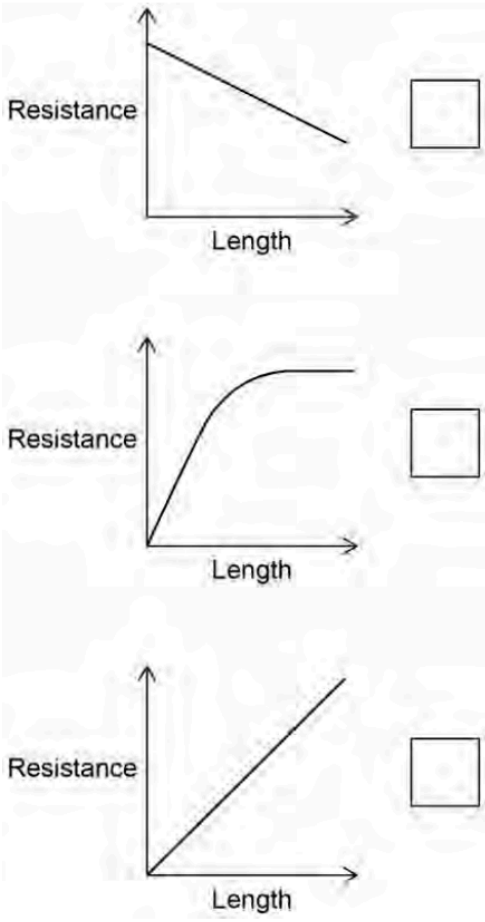
[6 marks]

b)

Which graph shows the relationship between the resistance of a wire at constant temperature and its length?

[1 mark]

Tick (✓) **one** box.



c)

The student used a cell that had a potential difference of 1.50 V.

Explain why the cell was **not** an electrical hazard to the student in the investigation.

[2 marks]

_____

_____