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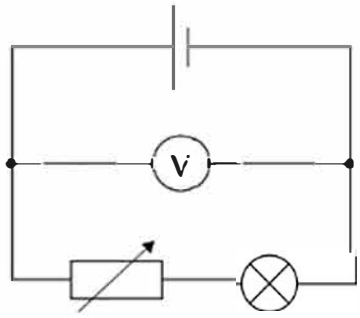
0 7 **Figure 9** shows a practical circuit in which a variable resistor is used to control the brightness of a lamp. The voltmeter reading is monitored as the variable resistor is adjusted to make the lamp brighter.

Figure 9



0 7 . 1 Explain why the reading on the voltmeter decreases as the brightness of the lamp increases.

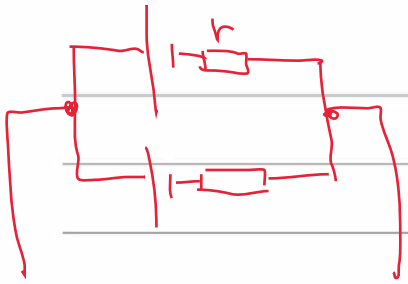
[2 marks]

As the brightness of the bulb increases the current in the circuit increases. This means that the I through the internal resistance also increases and then from V=IR this means that the lost voltage across r must also increase. Therefore the terminal pd as measured by the voltmeter descreases

0 7 . 2 The variable resistor is adjusted so that the lamp is at its brightest. The reading V_1 on the voltmeter is noted. A second identical cell is then connected in parallel with the cell in **Figure 9**. The new reading V_2 on the voltmeter is noted.

Explain why V_2 is greater than V_1.

[2 marks]



Terminal pd is increasing - this is because we have two internal resistors connected in parallel so their combined resistance decreases meaning that the value of the lost voltage v=Ir also decreases.

4

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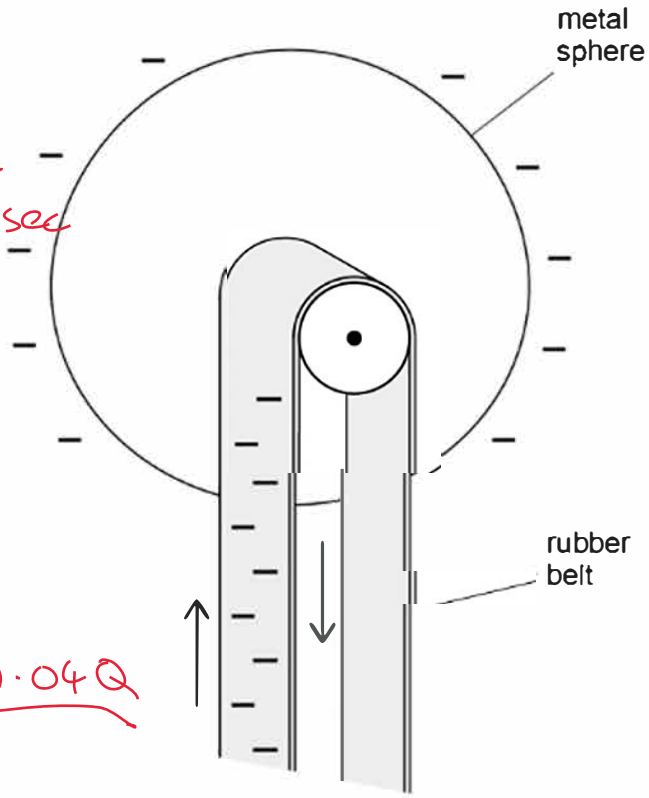
2 1 A rubber belt in an electrostatic machine has a width of 0.1 m and moves with speed 0.4 m s^{-1}.

Each square metre of the belt carries a charge Q coulomb. The charge is removed and transferred to a metal sphere.



Area of belt moving up in 1sec
$= 0.4 \times 0.1 =$
$0.04\ m^2$

Charge is $0.04Q$

What is the charge collected by the sphere each second?

[1 mark]

A $0.016Q$ ○

B $0.04Q$ ○

C $0.25Q$ ○

D $4Q$ ○

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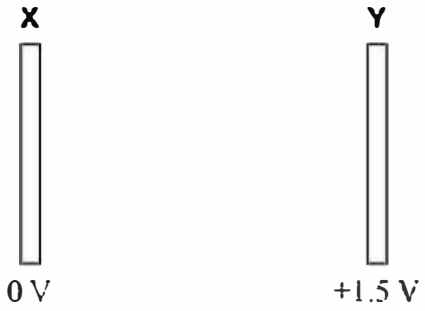
2 2 Charged plates **X** and **Y** have a potential difference 1.5 V between them.



Which particle gains 3.0 eV of kinetic energy when moving from **Y** to **X**?

[1 mark]

A proton ○

B positron ○

C electron ○

D alpha particle ○

1eV is the energy gained by 1e of charge as it accel through1v. We have 1.5V so each e of charge gains 1.5eV. Since there are 3eV this must mean we have a particle with a double charge

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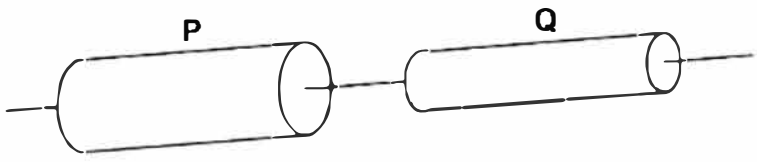
2 5 Two cylindrical wires **P** and **Q** are of equal length and made of the same material. The diameter of **P** is greater than that of **Q**.

P and **Q** are connected in series and the ends of this arrangement are connected to a power supply.



Which two quantities are the same for **P** and **Q**?

[1 mark]

A	potential difference across wire	resistivity	○
B	resistivity ✓	current ✓	✗
C	current	resistance	○
D	resistance	potential difference across wire	○

Turn over for the next question

same material therefore same resistivity
connected in parallel so same I

Turn over ▶

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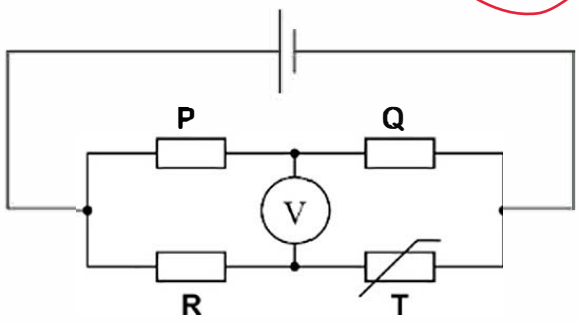
2 6 In the circuit below, the initial voltmeter reading is zero.



The temperature of the negative temperature coefficient thermistor **T** is then increased.

Which change to the circuit could restore the voltmeter reading to zero?

[1 mark]

A Decreasing the resistance of **R**. ☐

B Increasing the resistance of **R**. ☐

C Decreasing the resistance of **P**. ☐

D Increasing the resistance of **Q**. ☐

2 7 An electric motor lifts a load of weight W through a vertical height h in time t. The potential difference across the motor is V and the current through it is I.

What is the efficiency of the motor?

[1 mark]

A $\frac{Wht}{VI}$ ☐

B $\frac{VI}{Wht}$ ☐

C $\frac{Wh}{VIt}$ ☐

D $\frac{VIt}{Wh}$ ☐