



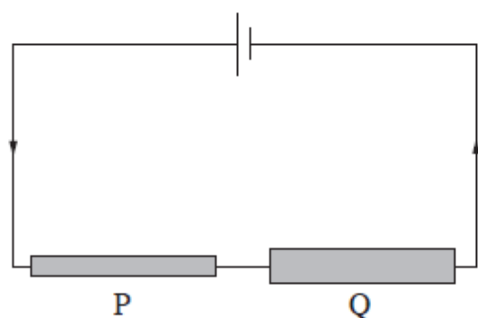
GCE PHYSICS

S21-A420QS

Assessment Resource number 16

Electricity and the Universe Resource G

- (ii) Wires **P** and **Q** are connected to a fixed voltage source. Wire **Q** is made of a different metal from wire **P** and has fewer free electrons per unit volume. [$n_P = 6.4 \times 10^{28} \text{ m}^{-3}$ and $n_Q = 2.0 \times 10^{28} \text{ m}^{-3}$]. The diameter of wire **Q** is twice the diameter of wire **P**.



Determine the ratio $\frac{v_Q}{v_P}$.

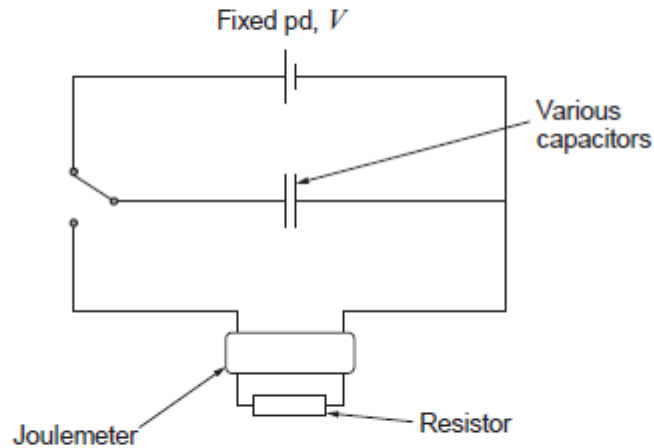
[3]

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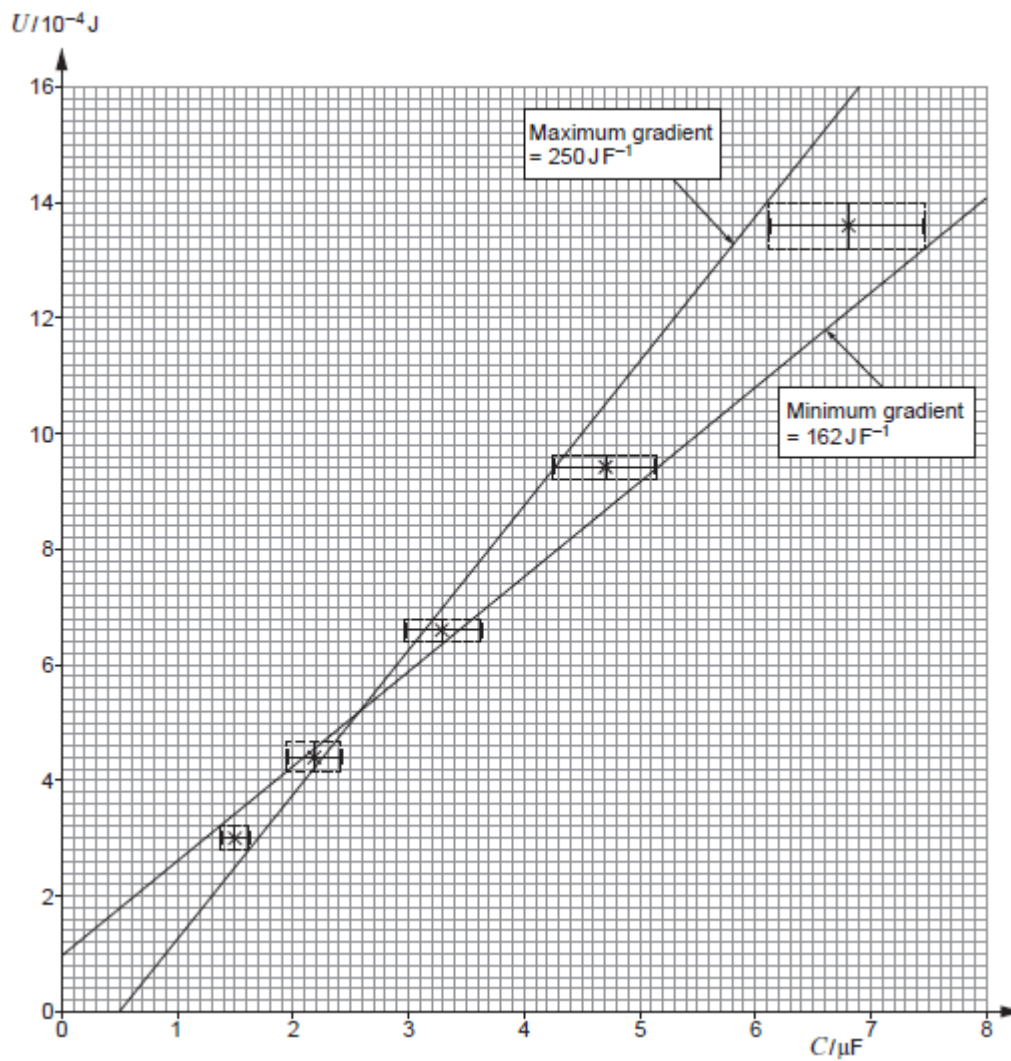
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2. Zack investigates how the energy stored in a capacitor depends on the value of the capacitor, for a fixed potential difference, V .
He is provided with 5 capacitors of differing values.
He uses the following circuit to fully charge each of the capacitors from the fixed pd, V , and then discharges them in turn through a resistor.
The energy transferred is measured using a joulemeter.
He carries out this procedure twice for each capacitor.



Zack plots a graph of mean energy stored, U , against capacitance C .
The graph (on page 6) displays the uncertainties in the mean values of U and C .
Zack uses the **percentage tolerance (uncertainty)** information displayed on each capacitor to draw the error bars on the capacitance axis.
He notes that the percentage tolerance is the same for each capacitor.



- (a) (i) Zack notes that, for all of the capacitors, the joulemeter reading for the first trial was different from the reading for the second trial. Using values from one of the data points, explain how the length of the error bars on the y-axis is related to the readings. [2]

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- (ii) Determine the percentage tolerance of the capacitors. [2]

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- (b) (i) Using the values of the gradients given on the grid and an appropriate equation, determine the maximum and minimum values for V . [3]

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(ii) Hence determine the pd, V , along with its absolute uncertainty. [3]

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(c) Zack's teacher suggests that he should carry out another experiment. Zack decides to discharge the $6.8\mu\text{F}$ capacitor through a $5.6\text{M}\Omega$ resistor. He notes that it took 35 seconds for the pd across the capacitor to drop to 8.0V . Determine whether or not these results are consistent with an initial value of $V = 20.0\text{V}$. [3]

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