

OCR

A Level

A Level Physics

Capacitors

Name:



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Total Marks: /30



1. George wishes to explore the rules for multiple capacitors. To do this, he constructs a circuit using three: C_1 is connected in series with C_2 ; these are both connected in parallel with C_3 . All are connected to a 6 V power supply. $C_1 = 10 \mu F$, $C_2 = 20 \mu F$ and $C_3 = 50 \mu F$.

Total for Question 1: 13

- (a) Explain in terms of the flow of electrons how a potential difference is built up across a capacitor. [3]

- (b) Outline a different experiment George could perform to confirm the rule for capacitance in series circuits. Include a circuit diagram. [3]



(c) Calculate the following for George's circuit.

i. The total capacitance of the circuit.

[3]

ii. The reading on a voltmeter placed across capacitor 1.

[3]

iii. The reading on a voltmeter placed across capacitor 2.

[1]



2.

Total for Question 2: 6

(a) What is represented by the area underneath a graph of the potential difference across a resistor against the charge stored by it? [1]

(b) From the equation $W = \frac{1}{2}QV$, derive two other equations for the energy stored in capacitor. One should not include the term V and one should not include the term Q . [3]

(c) State the effect of each of the following on the energy stored by a capacitor. [2]

i. Doubling the potential difference across it.

ii. Halving the capacitance.



3. Ella charges a $50\ \mu\text{F}$ capacitor using a $6\ \text{V}$ power supply. She then discharges it through a resistor of resistance R (connected in parallel).

Total for Question 3: 11

- (a) Outline an experiment that Ella could perform to demonstrate the discharge characteristics of a capacitor when it is discharging through a resistor. Include a circuit diagram. [3]

- (b) After $10\ \text{s}$, the charge has reduced by $99\ \mu\text{C}$ from its initial value of $300\ \mu\text{C}$. Calculate R . [2]

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(c) Calculate the current in the circuit 2τ after the switch has been turned on.

[2]

(d) Once it has completely discharged, Ella recharges the capacitor using the same 6 V power supply. Calculate the potential difference across the capacitor after 5 s.

[2]



- (e) Sketch, on a single set of axes, the variation of V_C , V_R and V_0 with time during charging. V_C , V_R and V_0 are the potential differences across the capacitor, the resistor and the power supply respectively.

[2]

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