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QUESTION WORKBOOK

Capacitors and energy stored

Capacitance · Year 13

AQA 3.7.4.1, 3.7.4.2, 3.7.4.3 · CIE 19.1, 19.2 · OCR A 6.1.1, 6.1.2, 6.2.3

10 questions · 30 marks

NAVY SCREEN EDITION

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SECTION A · Warm-up

A1 Define capacitance and state its unit. [2]

A2 A capacitor stores 6.0×10^{-3} C when the potential difference across it is 12 V. Calculate its capacitance. [2]

A3 State the three equivalent equations for the energy stored in a capacitor. [2]

SECTION B · Standard

B1 A 100 μF capacitor is charged to 20 V. Calculate (a) the charge stored and (b) the energy stored. [3]

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B2 A capacitor holds a charge of 5.0×10^{-3} C at a potential difference of 8.0 V. Calculate the energy stored using $E = \frac{1}{2}QV$. [3]

B3 A parallel-plate capacitor has plates of area 0.020 m^2 separated by 1.0 mm of vacuum. Calculate its capacitance ($\varepsilon_0 = 8.85 \times 10^{-12}$ F m^{-1}). [4]

B4 A 470 µF capacitor is charged to 9.0 V. Calculate the charge and the energy stored. [3]

SECTION C · Stretch

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C1 The parallel-plate capacitor above (177 pF in vacuum) is filled with a dielectric of relative permittivity 4.0. Calculate its new capacitance, and state the effect on the energy stored at a fixed voltage. [4]

C2 A 220 µF capacitor stores a charge of 3.3×10^{-3} C. Calculate (a) the energy stored using $E = \tfrac{1}{2}Q^2/C$ and (b) the potential difference across it. [4]

C3 Explain how a polar dielectric between the plates increases the capacitance. [3]

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