A-LEVEL PHYSICS • EXERCISE SHEET

19.1 Capacitors and capacitance

Name: _____ Class: _____ Date: _____ **Total: 12 marks**

Objective

Build the skills to answer exam questions on **capacitance** —$C = Q/V$ and combining capacitors.

You must be able to:

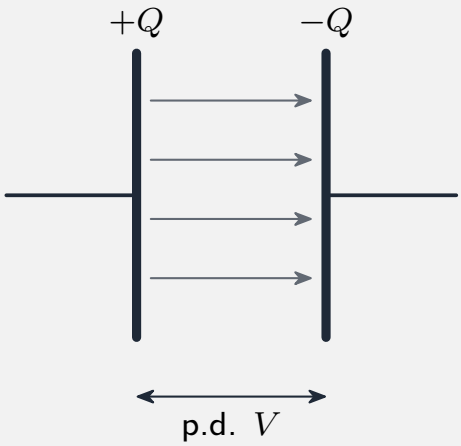
- define **capacitance** and use $C = Q/V$
- combine capacitors in **series** and **parallel**

1 Worked examples

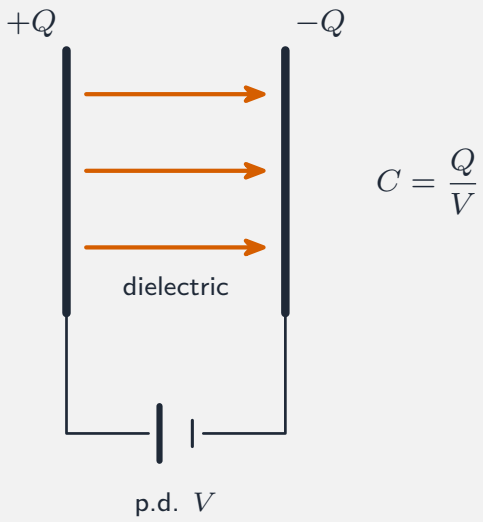
Study these first. Each one shows the method for a question type used later —follow the steps and you can do the Practice and Exam-style questions yourself.

Capacitance

A **capacitor** stores charge: $+Q$ on one plate, $-Q$ on the other, with p.d. V across the gap:



$$C = Q/V$$



$$C = \frac{Q}{V}$$

A parallel-plate capacitor

$$C = \frac{Q}{V} \quad \text{(farad, F = C V}^{-1}\text{)}.$$

■ **Combining capacitors (opposite to resistors)**

- **parallel:** $C = C_1 + C_2 + \dots$
- **series:** $\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} + \dots$

2 Practice

Now apply the methods above.

2.1 Define **capacitance**. [1]

2.2 State the **unit** of capacitance. [1]

2.3 A capacitor holds 60 μC of charge at 12 V. Find its **capacitance**. [2]

2.4 Write the formula for capacitors in **parallel**. [1]

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3 Exam-style questions

3.1 The unit of capacitance is the: [1]

- **A** coulomb
- **B** farad
- **C** volt
- **D** ohm

3.2 A 100 μF capacitor is charged to 9.0 V. Calculate the **charge** stored. [2]

3.3 A 4.0 μF and a 2.0 μF capacitor are connected in **series**. Calculate the combined capacitance. [3]

3.4 Write the formula for capacitors in **series**. [1]

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4 Go further

You are now ready for the real exam questions on this subtopic. Open the **19.1 Capacitors and capacitance** past-paper sheet in the Library, or try these in **Practice mode**:

- 9702/41 N25 —Q6 (capacitance, structured)
- 9702/43 N25 —Q6 (capacitors, combining)
- 9702/42 J25 —Q7 (capacitance from a graph)
- 9702/44 J25 —Q5 (C = Q/V)

- 9702/42 M25 —Q5 (capacitor circuit)

Solutions

2.1 The **charge stored per unit potential difference** ($C = Q/V$).

2.2 The **farad** (F).

2.3 $C = Q/V = (60 \times 10^{-6})/12 = 5.0\ \mu\text{F}$.

2.4 $C = C_1 + C_2 + \ldots$.

3.1 **B** —farad.

3.2 $Q = CV = (100 \times 10^{-6})(9.0) = 9.0 \times 10^{-4}$ C.

3.3 $\dfrac{1}{C} = \dfrac{1}{4.0} + \dfrac{1}{2.0} = \dfrac{3}{4.0}$; $C = 1.3\ \mu\text{F}$.

3.4 $\dfrac{1}{C} = \dfrac{1}{C_1} + \dfrac{1}{C_2} + \ldots$.