FREE REVISION PACK

Charging & Discharging Capacitors

AQA A-level Physics · 7408 · Specification 3.7.4.4

Easy | Medium | Multiple choice · past-paper questions

6	6	≈ 10 min
QUESTIONS	TOTAL MARKS	SUGGESTED TIME*

Contents

Q	LEVEL	FOCUS	SOURCE	MARKS
1	Easy	Fraction of energy left after two time constants	AQA June 2022 · A-level Paper 2 · Q21	1 mark
2	Easy	Maximum discharge current	AQA June 2019 · A-level Paper 2 · Q21	1 mark
3	Easy	Fraction of charge left after 4.8 s	AQA June 2017 · A-level Paper 2 · Q21	1 mark
4	Medium	Maximum current from the stored energy	AQA November 2020 · A-level Paper 2 · Q22	1 mark
5	Medium	V and I graphs while charging	AQA November 2021 · A-level Paper 2 · Q20	1 mark
6	Medium	Resistance needed for a constant charging current	AQA June 2025 · A-level Paper 2 · Q18	1 mark

Key ideas to have ready

- Time constant RC: the time for the charge (or pd or current) in a discharge to fall to 1/e ≈ 37% of its starting value.
- Discharge: $Q = Q_0 e^{-t/RC}$, and V and I fall the same way. The energy stored $\propto Q^2$, so it falls as $e^{-2t/RC}$.
- The current is largest at the start of a discharge: $I_0 = V_0 / R$.
- Charging through a resistor: V_C rises towards the emf while the current falls towards zero. $V_C + V_R$ = emf at every moment.

How to use this pack

1. The questions are grouped into levels (Easy and Medium). Work through them in order, and check your answers at the end of each level before moving on.
2. Every question is multiple choice with one correct answer. Write down your working anyway; that is how you find mistakes.
3. The separate mark scheme uses the same numbers and explains every answer.

Levels are based on how students did in AQA's examiner reports where that information exists, plus our own difficulty rating. *About 1.5 minutes per question.

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Easy

Definitions and one-step ideas. Most students get these right.

Questions 1–3

Only **one** answer per question is allowed. For each question, completely fill in the circle alongside the appropriate answer.

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1 A fully charged capacitor of capacitance $2.0\ \text{mF}$ discharges through a $15\ \text{k}\Omega$ resistor.

What fraction of the stored energy remains after 1.0 minute?

[1 mark]

A $\frac{1}{4}$ ⬭

B $\frac{1}{e^2}$ ⬭

C $\frac{1}{16}$ ⬭

D $\frac{1}{e^4}$ ⬭

AQA June 2019 · A-level Paper 2 · Q21

2 A $1.0\ \mu\text{F}$ capacitor initially stores $15\ \mu\text{C}$ of charge. It then discharges through a $25\ \Omega$ resistor.

What is the maximum current during the discharge of the capacitor?

[1 mark]

A $0.60\ \text{mA}$ ⬭

B $1.2\ \text{mA}$ ⬭

C $0.60\ \text{A}$ ⬭

D $1.2\ \text{A}$ ⬭

AQA June 2017 · A-level Paper 2 · Q21

3 A capacitor of capacitance $120\ \mu\text{F}$ is charged and then discharged through a $20\ \text{k}\Omega$ resistor.

What fraction of the original charge remains on the capacitor $4.8\ \text{s}$ after the discharge begins?

[1 mark]

A 0.14 ⬭

B 0.37 ⬭

C 0.63 ⬭

D 0.86 ⬭

Medium

Two or three steps. Roughly a third to a half of students get these right.

Questions 4–6

AQA November 2020 · A-level Paper 2 · Q22

4 A $10\ \mu F$ capacitor stores $4.5\ mJ$ of energy.
It then discharges through a $25\ \Omega$ resistor.

What is the maximum current during the discharge of the capacitor?

[1 mark]

A $1.2\ A$ ⬭

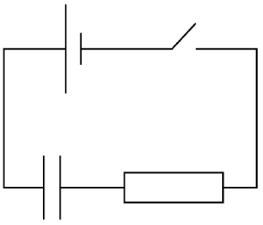
B $18\ A$ ⬭

C $30\ A$ ⬭

D $36\ A$ ⬭

AQA November 2021 · A-level Paper 2 · Q20

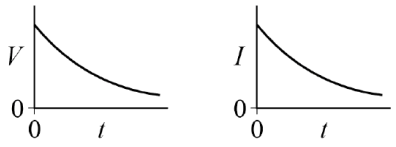
5 The capacitor in the circuit is initially uncharged.
The switch is closed at time $t = 0$



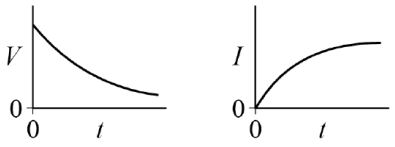
Which pair of graphs shows how the potential difference V across the capacitor and the current I in the circuit change with time t?

[1 mark]

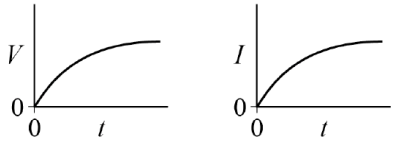
A



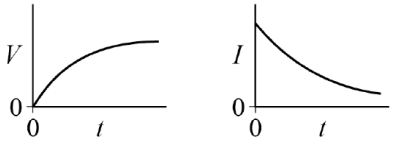
B



C

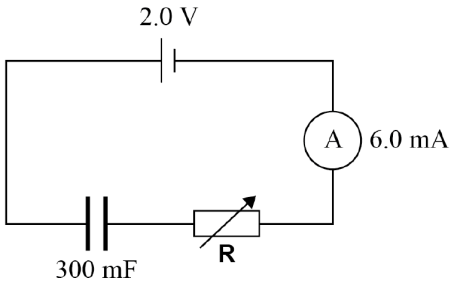


D



AQA June 2025 · A-level Paper 2 · Q18

6 A capacitor is initially uncharged and is then charged using a constant current. This is achieved by reducing the resistance of a variable resistor **R** as the charge on the capacitor increases.



The capacitor has a capacitance of $300\ \text{mF}$ and is fully charged in a time $t = 100\ \text{s}$.
The cell has an emf of $2.0\ \text{V}$ and negligible internal resistance.
The charging current is $6.0\ \text{mA}$.

What is the resistance of **R** at $t = 30\ \text{s}$?

[1 mark]

A $58\ \Omega$ ⬭

B $100\ \Omega$ ⬭

C $233\ \Omega$ ⬭

D $333\ \Omega$ ⬭

End of questions. Check your answers with the matching mark scheme. More free packs and 1-to-1 tuition:
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