AQA Physics A-level

RP09 - Charging and Discharging Capacitors

Practical Flashcards

What must always be checked when using an electrolytic capacitor in a circuit?

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The electrolytic capacitor is a polarised component and so must be connected with the correct polarity in the circuit. If connected incorrectly, it can overheat and become a safety hazard.

What equation is used to calculate the time constant of a resistor-capacitor circuit?

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Time Constant = Resistance x Capacitance

$\tau = RC$

What information does the time constant tell us?

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The time constant tells us how long it takes for the capacitor to charge to 63% of its full capacity, as well as how long it takes for it to discharge to 37% of its full capacity.

What device is used to measure the potential difference across a capacitor and how should be connected?

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A voltmeter should be connected in parallel across the ends of the capacitor.

What equation shows how the potential difference across a capacitor varies with time as it discharges?

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$$V = V_0 e^{\frac{-t}{RC}}$$

Where V_0 is the initial pd across the capacitor.

What is the advantage of taking logarithms before plotting an exponential relationship?

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Taking logarithms allows the exponential relationship to be more easily confirmed when plotted as it allows the graph to be matched to the equation of a straight line. This also means that the desired variables can be more easily obtained.

What graph can be plotted to confirm the exponential decay of a capacitor's potential difference as it discharges?

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A graph of $\ln(V/V_0)$ against t can be plotted. This should form a straight line graph.

When plotting a discharge graph of $\ln(V/V_0)$ against t, how can the capacitor's time constant be obtained?

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The graph will have an equation of

$$\ln(V) = \ln(V_0) - t/RC$$

and so the time constant (RC) is given by -1/gradient

What is the benefit of doing a trial discharge before carrying out this experiment in full?

What is the benefit of doing a trial discharge before carrying out this experiment in full?

A trial discharge with your chosen values of R and C allows you to choose a suitable time interval to take recordings at, depending on how quickly the capacitor discharges.

State the equation that shows how the potential difference across a capacitor varies with time as it charges.

State the equation that shows how the potential difference across a capacitor varies with time as it charges.

$$V = V_0\left(1 - e^{\frac{-t}{RC}}\right)$$

Where V_0 is the pd across the fully-charged capacitor.