

## Investigating charging and discharging capacitors

### Introduction

This practical activity supports the theory on charging and discharging capacitors.

### Aim

- To observe the pattern of charging and discharging a capacitor.
- To take measurements to allow confirmation of exponential formulae learned.

### Intended class time

- 60 to 90 minutes

### Links to Specification

#### Physics A

- 6.1.1(a) capacitance:  $C = \frac{Q}{V}$ ; the unit farad
- 6.1.1(b) charging and discharging of a capacitor or capacitor plates with reference to the flow of electrons
- 6.1.1(c)(i) analysis of circuits containing capacitors, including resistors
- 6.1.3(a)(i) charging and discharging capacitor through a resistor
- 6.1.3(a)(ii) techniques and procedures to investigate the charge and the discharge of a capacitor using both meters and data-loggers
- 6.1.3(b) time constant of a capacitor–resistor circuit:  $\tau = RC$
- 6.1.3(c) equations of the form  $x = x_0 e^{-\frac{t}{\tau}}$  and  $x = x_0 (1 - e^{-\frac{t}{\tau}})$  for capacitor-resistor circuits
- 6.1.3(e) exponential decay graph; constant-ratio property of such a graph.

#### Physics B

- 5.1.1(a)(i) capacitance as the ratio  $C = \frac{Q}{V}$
- 5.1.1(a)(ii) the exponential form of the decay of charge on a capacitor as due to the rate of removal of charge being proportional to the charge remaining  $\frac{dQ}{dt} = -\frac{Q}{RC}$
- 5.1.1(b)(i) for a capacitor; the term: time constant  $\tau$
- 5.1.1(c)(i) solving equations of the form  $\frac{dN}{dt} = -\lambda N$  by iterative numerical or graphical methods.
- 5.1.1(c)(ii) calculating time constant  $\lambda$  of a capacitor circuit from data:  $\tau = RC$ ;  $Q = Q_0 e^{-\frac{t}{RC}}$

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**R Sandford**



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