11 Worksheet

Intermediate level

1 A 30 μF capacitor is connected to a 9.0 V battery.

a Calculate the charge on the capacitor. [2]

b How many excess electrons are there on the negative plate of the capacitor? (Elementary charge $e = 1.6 \times 10^{-19}$ C) [2]

2 The p.d. across a capacitor is 3.0 V and the charge on the capacitor is 150 nC. Determine the charge on the capacitor when the p.d. is:

a 6.0 V [2]

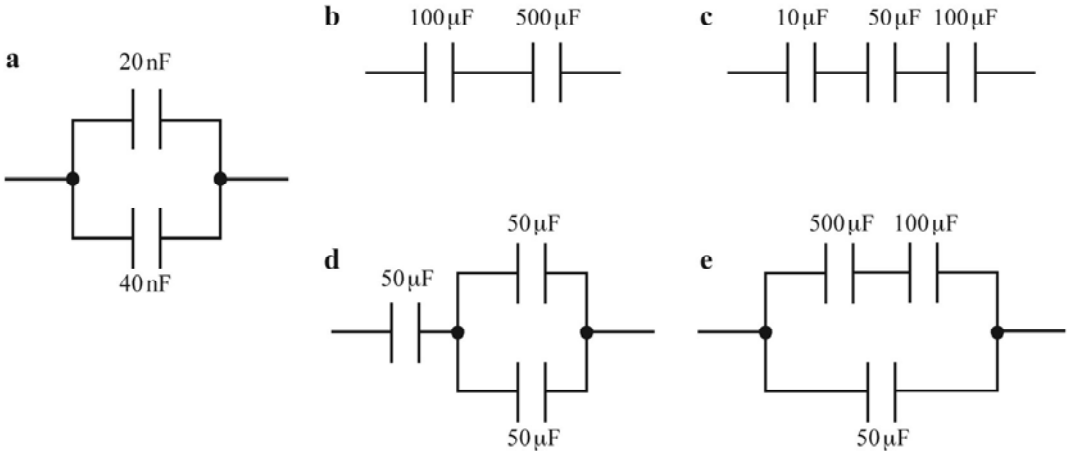
b 9.0 V. [2]

3 A 1000 μF capacitor is charged to a potential difference of 9.0 V.

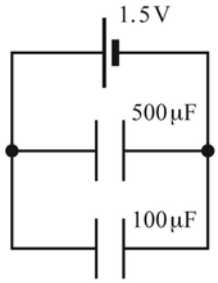
a Calculate the energy stored by the capacitor. [2]

b Determine the energy stored by the capacitor when the p.d. across it is doubled. [2]

4 For each circuit below, determine the total capacitance of the circuit. [14]



5 The diagram shows an electrical circuit.



a Calculate the total capacitance of the two capacitors in parallel. [2]

b What is the potential difference across each capacitor? [1]

c Calculate the total charge stored by the circuit. [2]

d Calculate the total energy stored by the capacitors. [2]

Higher level

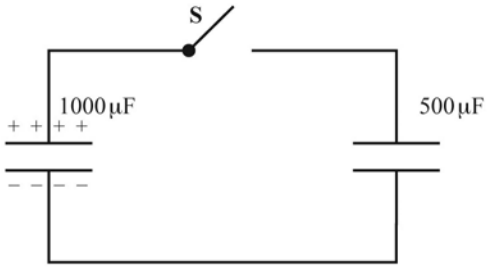
6 A 10 000 μF capacitor is charged to its maximum operating voltage of 32 V. The charged capacitor is discharged through a filament lamp. The flash of light from the lamp lasts for 300 ms.

a Calculate the energy stored by the capacitor. [2]

b Determine the average power dissipated in the filament lamp. [2]

7 The diagram shows a 1000 μF capacitor charged to a p.d. of 12 V.

a Calculate the charge on the 1000 μF capacitor. [2]

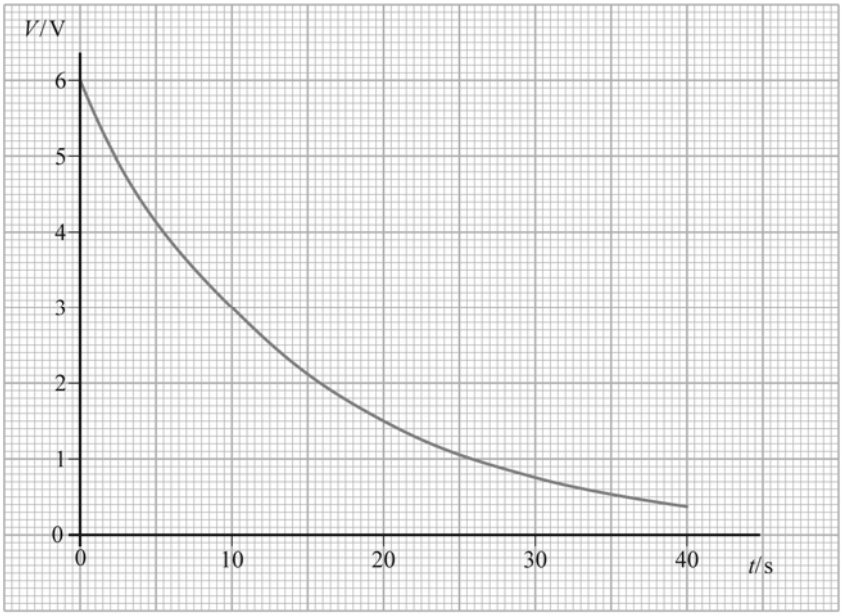


b The 1000 μF capacitor is connected across an uncharged 500 μF capacitor by closing the switch **S**. The charge initially stored by the 1000 μF capacitor is now shared with the 500 μF capacitor.

i Calculate the total capacitance of the capacitors in parallel. [2]

ii Show that the p.d. across each capacitor is 8.0 V. [2]

8 A charged capacitor is connected across a resistor of resistance 100 kΩ. The graph below shows the variation of p.d. V across the capacitor with time t.



Use the graph to determine:

a the initial current in the circuit [2]

b the time constant of the circuit [2]

c the capacitance C of the capacitor. (Hint: use your answer to **b**.) [2]

9 A 220 μF capacitor is charged to a potential difference of 8.0 V and then discharged through a resistor of resistance 1.2 MΩ.

a Determine the time constant τ of the circuit. [2]

b Calculate:

i the initial current in the circuit [2]

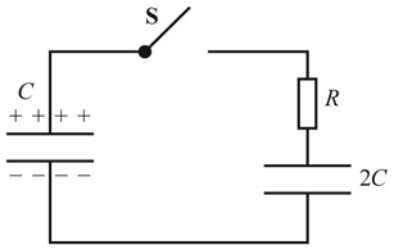
ii the current in the circuit after a time equal to 2τ [2]

iii the p.d. across the capacitor after a time of 50 s. [3]

Extension

10 A 100 μF capacitor is discharged through a resistor of resistance 470 kΩ.
Determine the 'half-life' of this circuit. (The half-life of the circuit is the time taken for the voltage across the capacitor to decrease to 50% of its initial value.) [5]

11 The diagram below shows a charged capacitor of capacitance C. When the switch **S** is closed, this capacitor is connected across the uncharged capacitor of capacitance $2C$.
Calculate the percentage of energy lost as heat in the resistor and explain why the actual resistance of the resistor is irrelevant. [7]



Total: _____ / 70 Score: %

