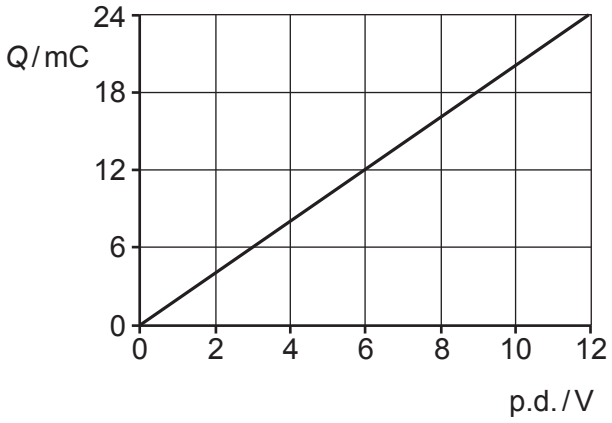
The following information is for use in questions **7** and **8**.

The diagram shows the $Q - V$ graph for a capacitor charged to 12 V.



7 What is the capacitance?

A 2×10^{-3} F

B 144×10^{-3} F

C 288×10^{-3} F

D 500 F

Your answer ☐ **[1]**

8 Which of the following is the energy stored?

A 2×10^{-3} J

B 144×10^{-3} J

C 288×10^{-3} J

D 500 J

Your answer ☐ **[1]**

34 A student makes an iterative model for the decay of charge on a capacitor. The time constant of the circuit is $RC = 10\,\text{s}$.

time lapsed / s t	**charge Q on capacitor / C** Q	**charge ΔQ leaving capacitor in time interval $\Delta t = 1\,\text{s}$ / C** $\Delta Q \approx \frac{Q\Delta t}{RC}$	**charge Q remaining after time interval Δt / C** $Q = (Q - \Delta Q)$
0	5	$\frac{5 \times 1}{10} = 0.5$	$5 - 0.5 = 4.5$
1	4.5		

(a) Complete the numerical values in the two blank cells in the table. **[2]**

(b) (i) Explain the physics behind the approximation in the third column of the table $\Delta Q \approx \frac{Q\Delta t}{RC}$.

.....

.....

.....

..... **[2]**

(ii) State the assumption made in using this approximation and explain how its effect can be made insignificant.

.....

.....

.....

..... **[2]**

2 This question is about charging a capacitor in a circuit with two resistors in series.

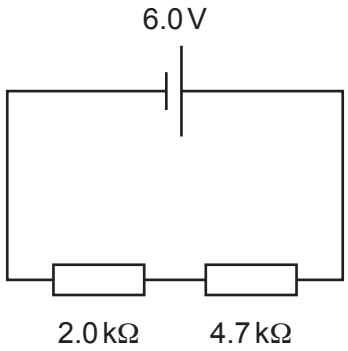


Fig. 2.1

(a) Show that the p.d. across the 4.7 kΩ resistor in the circuit in Fig. 2.1 is about 4 V, assuming that the cell has zero internal resistance.

[2]

(b) A student changes the circuit as shown in Fig. 2.2

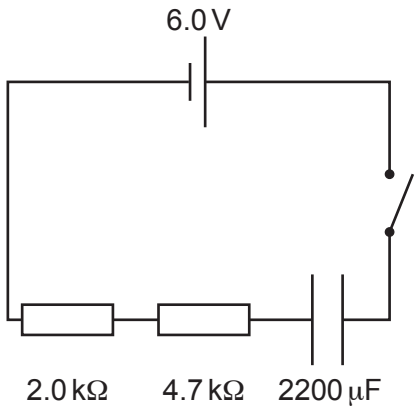


Fig. 2.2

Show that the time constant of the circuit is about 15 s.

[2]

(c) The graph in Fig. 2.3 shows how the p.d. across the capacitor varies with time up to 5*RC.* Add a line to the graph that shows how the p.d. across the **4.7 kΩ resistor** varies with time.

Add another line to show how the p.d. across the **2.0 kΩ resistor** varies with time. Label the lines.

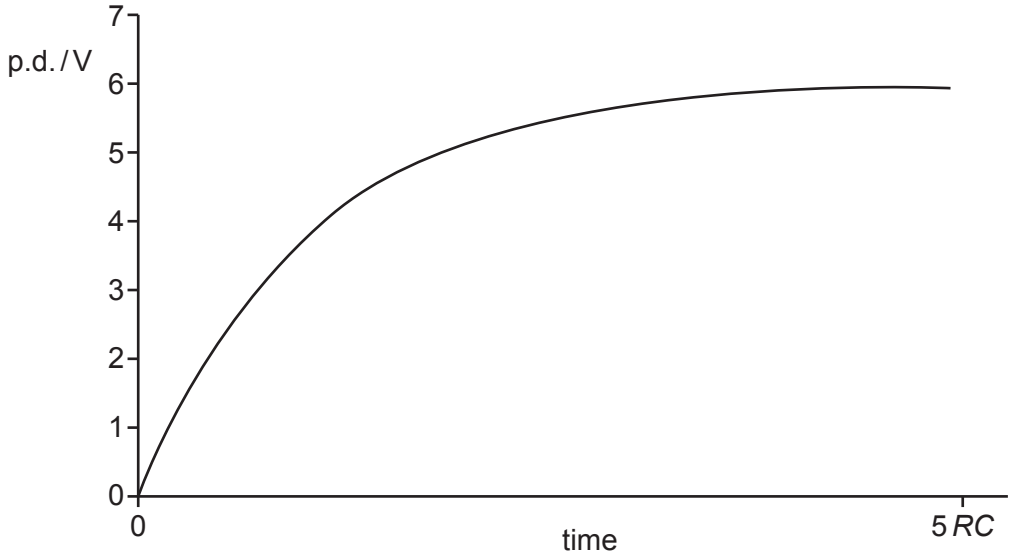


Fig. 2.3

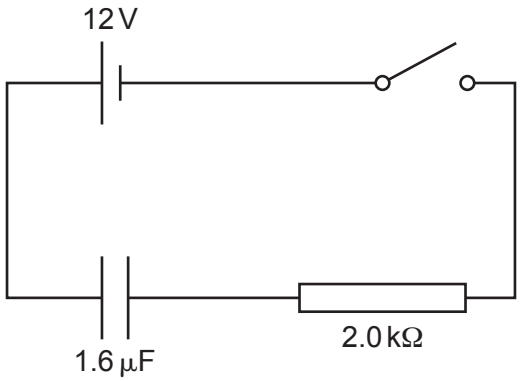
[2]

(d) Calculate the time it takes from the start of the charging for the p.d across the capacitor to reach 5.0 V.

time = ... s **[4]**

The following information is for use in questions **13** and **14**.

An uncharged capacitor and a resistor are connected in this circuit.



	current / mA	p.d. across the capacitor / V	p.d. across the resistor / V
A	0	12	0
B	2	8	4
C	3	6	6
D	6	0	12

13 Which set of values **A** to **D** above, most closely represents the situation immediately after the switch is closed?

Your answer ☐ **[1]**

14 Which set of values **A** to **D** above, most closely represents the situation 3 seconds after the switch is closed?

Your answer ☐ **[1]**