5 The variation with potential difference V of the charge Q on one of the plates of a capacitor is shown in Fig. 5.1.

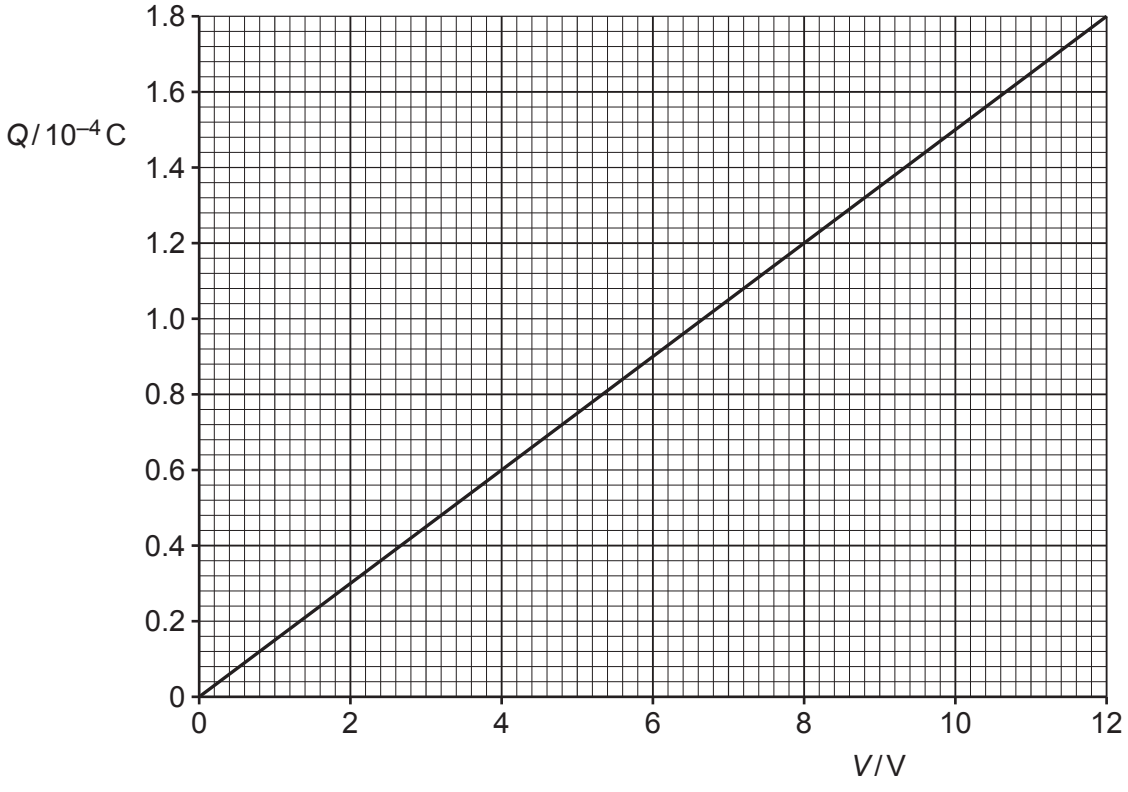

Fig. 5.1

The capacitor is connected to an 8.0 V power supply and two resistors R and S as shown in Fig. 5.2.

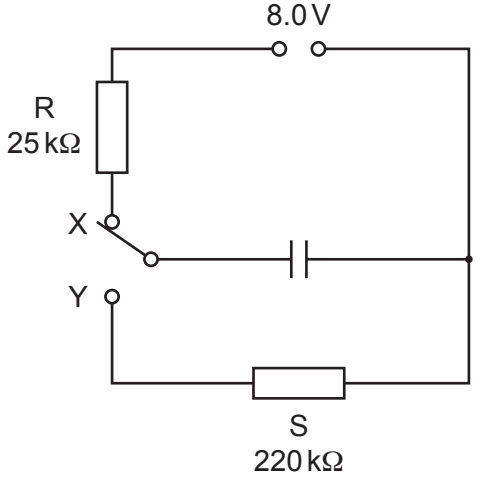

Fig. 5.2

The resistance of R is 25 kΩ and the resistance of S is 220 kΩ.

The switch can be in either position X or position Y.

(a) The switch is in position X so that the capacitor is fully charged.

Calculate the energy E stored in the capacitor.

E = ... J [2]

(b) The switch is now moved to position Y.

(i) Show that the time constant of the discharge circuit is 3.3 s.

[2]

(ii) The fully charged capacitor in **(a)** stores energy E.

Determine the time t taken for the stored energy to decrease from E to $E/9$.

t = ... s [4]

(c) A second identical capacitor is connected in parallel with the first capacitor.

State and explain the change, if any, to the time constant of the discharge circuit.

.....

.....

..... [2]

[Total: 10]