

Q1.

An air-filled parallel-plate capacitor and a resistor are connected in series across the terminals of a battery.

The plates of the capacitor are then moved further apart.

This change results in

- A** a decrease in the potential difference across the capacitor plates
- B** a decrease in the charge held on the capacitor plates
- C** an increase in the energy stored on the capacitor
- D** an increase in the capacitance of the capacitor

☐☐☐☐

(Total 1 mark)

Q2.

Which is equal to ϵ_0 ?

- A** the relative permittivity of a vacuum
- B** the charge stored on a capacitor consisting of two parallel plates of area 1 m^2 separated by 1 m when the potential difference between the plates is 1 V
- C** the work done when moving a 2 C charge from infinity to a distance of $\pi \text{ m}$ from the centre of a metal sphere that carries 2 C of charge
- D** the charge on a metal sphere which experiences a force of 1 N when its centre is placed 1 m from the centre of a metal sphere that carries 1 C of charge

☐☐☐☐

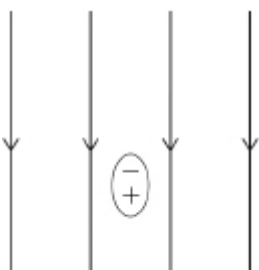
(Total 1 mark)

Q3.

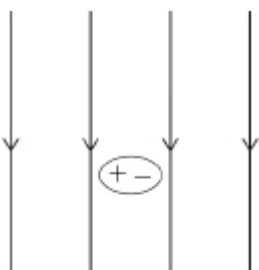
A polar molecule is in an external electric field.

Which diagram shows the orientation of the polar molecule?

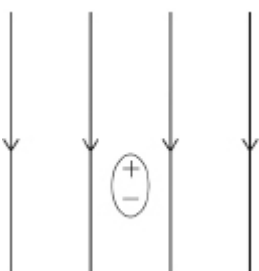
A



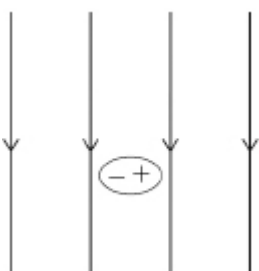
B



C



D



Each diagram (A, B, C, D) includes a box to the right for the answer, each containing a small circle.

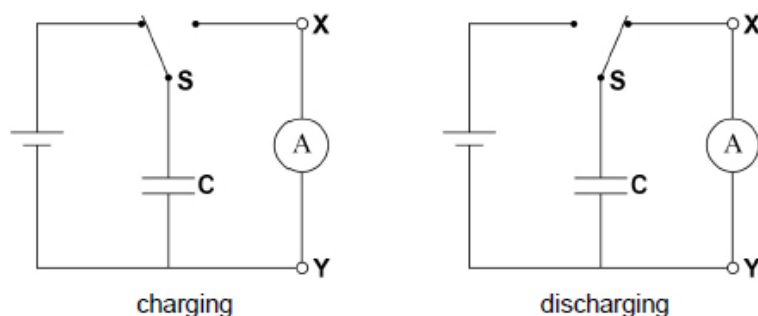
(Total 1 mark)

Q4.

A switch **S** allows capacitor **C** to be completely charged by a cell and then completely discharged through an ammeter.

The emf of the cell is 4.0 V and it has negligible internal resistance.

The capacitance of **C** is $0.40 \mu\text{F}$ and there are 8000 charge–discharge cycles every second.



What are the magnitude and direction of the average conventional current in the ammeter?

	Magnitude of current / A	Direction of current	
A	1.3×10^{-2}	X to Y	☐
B	1.3×10^{-2}	Y to X	☐
C	2.0×10^{-10}	X to Y	☐
D	2.0×10^{-10}	Y to X	☐

(Total 1 mark)

Q5.

A $30 \mu\text{F}$ capacitor is charged by connecting it to a battery of emf 4.0 V.

The initial charge on the capacitor is Q_0 .

The capacitor is then discharged through a $500 \text{ k}\Omega$ resistor.

The time constant for the circuit is T .

Which is correct?

- A** T is 15 ms. ☐
- B** Q_0 is $12 \mu\text{C}$. ☐
- C** After a time T the pd across the capacitor is 1.5 V. ☐
- D** After a time $2T$ the charge on the capacitor is $Q_0 e^2$. ☐

(Total 1 mark)

Q6.

Capacitor **X** of capacitance C has square plates of side length l and separation d and is made with a dielectric of relative permittivity ϵ .

Capacitor **Y** has square plates of side length $3l$ and separation $\frac{d}{3}$ and is made with a dielectric of relative permittivity $\frac{\epsilon}{3}$.

What is the capacitance of **Y**?

A $\frac{C}{27}$ ☐

B $\frac{C}{9}$ ☐

C $9C$ ☐

D $27C$ ☐

(Total 1 mark)

Q7.

A parallel plate capacitor is connected across a battery and the energy stored in the capacitor is E .

Without disconnecting the battery, the separation of the plates is halved.

What is the energy now stored in the capacitor?

A $0.5E$ ☐

B E ☐

C $2E$ ☐

D $4E$ ☐

(Total 1 mark)

Q8.

A fully charged capacitor of capacitance 2.0 mF discharges through a 15 k Ω resistor.

What fraction of the stored energy remains after 1.0 minute?

A $\frac{1}{4}$ ☐

B $\frac{1}{e^2}$ ☐

C $\frac{1}{16}$ ☐

D $\frac{1}{e^4}$ ☐

(Total 1 mark)