

Capacitance – A2 Physics P2

1. No.3(3.3_3.4)

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An isolated solid conducting sphere is initially uncharged. Electrons are then transferred to the sphere.

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The sphere acts as a capacitor because it stores charge at an electric potential.

Show that the capacitance of the sphere is approximately $1 \times 10^{-11} \text{ F}$.

[3 marks]

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Electrons leak away from the sphere with time and the amount of energy stored by the sphere decreases. At one instant, the magnitude of the electric potential of the sphere has fallen to $1.0 \times 10^6 \text{ V}$.

Calculate, for this instant, the change in the energy stored by the sphere.

[3 marks]

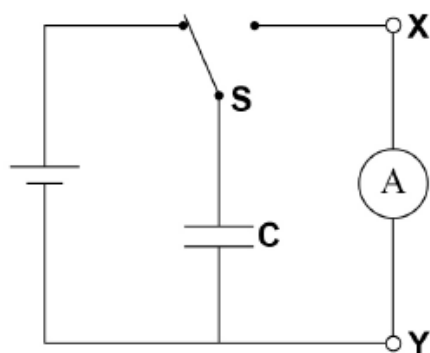
change in energy = _____ J

2. No.17

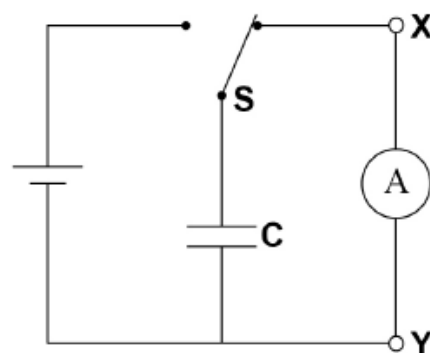
A switch **S** allows capacitor **C** to be completely charged by a cell and then completely discharged through an ammeter.

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.



charging



discharging

What are the magnitude and direction of the average conventional current in the ammeter?
[1 mark]

	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

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3. No.18

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

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?

[1 mark]

A T is $15\ \text{ms}$.

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B Q_0 is $12\ \mu\text{C}$.

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C After a time T the pd across the capacitor is $1.5\ \text{V}$.

☐

D After a time $2T$ the charge on the capacitor is $Q_0 e^2$.

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4. No.19

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?

[1 mark]

A $\frac{C}{27}$

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B $\frac{C}{9}$

☐

C $9C$

☐

D $27C$

☐

5. No.20

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?

[1 mark]

A $0.5E$ ☐B E ☐C $2E$ ☐D $4E$ ☐

6. No.21

A fully charged capacitor of capacitance 2.0 mF discharges through a $15 \text{ k}\Omega$ resistor.

What fraction of the stored energy remains after 1.0 minute?

[1 mark]

A $\frac{1}{4}$ ☐B $\frac{1}{e^2}$ ☐C $\frac{1}{16}$ ☐D $\frac{1}{e^4}$ ☐