

Name of the Student: \_\_\_\_\_

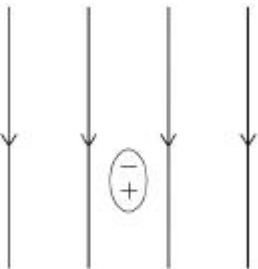
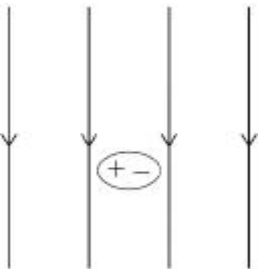
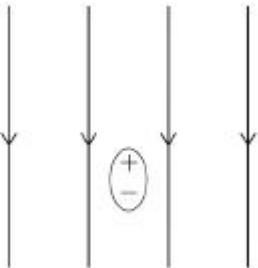
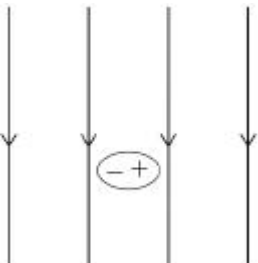
Max. Marks : 20 Marks

Time : 20 Minutes

**Q1.**

A polar molecule is in an external electric field.

Which diagram shows the orientation of the polar molecule?

<b>A</b>		<input type="checkbox"/>
<b>B</b>		<input type="checkbox"/>
<b>C</b>		<input type="checkbox"/>
<b>D</b>		<input type="checkbox"/>

(Total 1 mark)

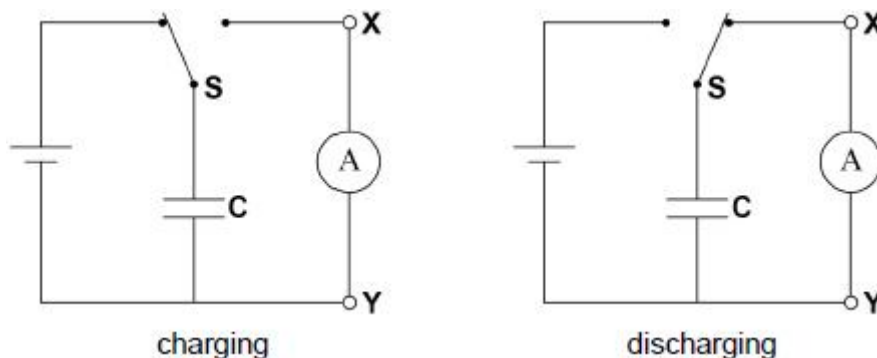
**Q2.**

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	
<b>A</b>	$1.3 \times 10^{-2}$	X to Y	<input type="radio"/>
<b>B</b>	$1.3 \times 10^{-2}$	Y to X	<input type="radio"/>
<b>C</b>	$2.0 \times 10^{-10}$	X to Y	<input type="radio"/>
<b>D</b>	$2.0 \times 10^{-10}$	Y to X	<input type="radio"/>

(Total 1 mark)

**Q3.**

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 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)

**Q4.**

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

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

relative permittivity  $\frac{\epsilon}{3}$ .

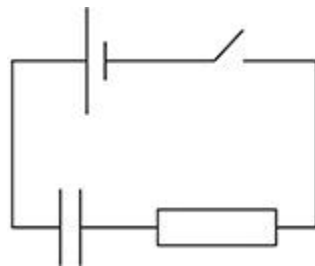
What is the capacitance of Y?

- A  $\frac{C}{27}$
- B  $\frac{C}{9}$
- C  $9C$
- D  $27C$

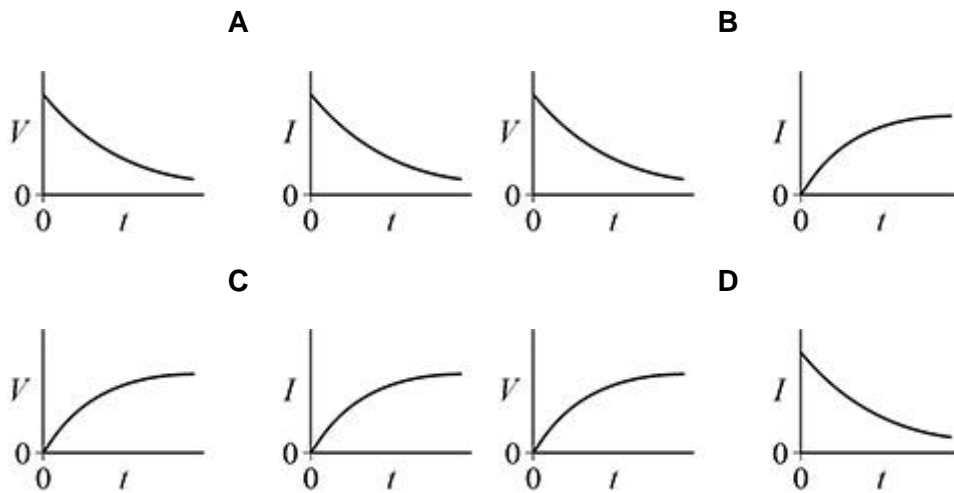
(Total 1 mark)

**Q5.**

The capacitor in the circuit is initially uncharged.  
The switch is closed at time  $t = 0$



Which pair of graphs shows how the potential difference  $V$  across the capacitor and the current  $I$  in the circuit change with time  $t$ ?



- A
- B
- C
- D

(Total 1 mark)

**Q6.**

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

**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.**

An uncharged capacitor is connected to a power supply which supplies a constant current of  $10 \mu\text{A}$ .

After  $100 \text{ ms}$ , the potential difference across the capacitor is  $5.0 \text{ kV}$ .

What is the capacitance of the capacitor?

- A  $2.0 \times 10^{-10} \text{ F}$
- B  $4.0 \times 10^{-10} \text{ F}$
- C  $2.5 \times 10^9 \text{ F}$
- D  $5.0 \times 10^9 \text{ F}$

(Total 1 mark)

**Q9.**

When a parallel-plate capacitor is connected across a battery, the energy stored in the capacitor is  $W$ .

The battery remains connected as the distance between the capacitor plates is halved.

What is the energy now stored in the capacitor?

- A  $0.5W$
- B  $W$
- C  $2W$
- D  $4W$

(Total 1 mark)

### Q10.

A parallel-plate capacitor is made using a sheet of dielectric material between, and in contact with, two plates.

The properties of four sheets of dielectric material are shown.

Which sheet will produce the maximum capacitance?

Sheet	Relative permittivity	Thickness / mm	<input type="checkbox"/>
A	2	0.40	<input type="checkbox"/>
B	3	0.90	<input type="checkbox"/>
C	4	1.0	<input type="checkbox"/>
D	6	1.6	<input type="checkbox"/>

(Total 1 mark)

### Q11.

A  $1.0 \mu\text{F}$  capacitor is charged for 20 s using a constant current of  $10 \mu\text{A}$ .

What is the energy transferred to the capacitor?

- A  $5.0 \times 10^{-3} \text{ J}$
- B  $1.0 \times 10^{-2} \text{ J}$
- C  $2.0 \times 10^{-2} \text{ J}$
- D  $4.0 \times 10^{-2} \text{ J}$

(Total 1 mark)

### Q12.

A parallel-plate capacitor is made by inserting a sheet of dielectric material between two plates. Both plates are in contact with the sheet.

Which relative permittivity and sheet thickness give the greatest capacitance?

	Relative permittivity	Thickness / mm	
A	2	0.40	<input type="checkbox"/>
B	3	0.90	<input type="checkbox"/>
C	4	1.0	<input type="checkbox"/>
D	6	1.6	<input type="checkbox"/>

(Total 1 mark)

**Q13.**

A  $10 \mu\text{F}$  capacitor stores  $4.5 \text{ mJ}$  of energy.  
It then discharges through a  $25 \Omega$  resistor.

What is the maximum current during the discharge of the capacitor?

- A 1.2 A
- B 18 A
- C 30 A
- D 36 A

(Total 1 mark)

**Q14.**

The initial potential difference across a capacitor is  $V_0$ . The capacitor discharges through a circuit of time constant  $T$ . The base of natural logarithms is  $e$ .

What is the potential difference across the capacitor after time  $T$ ?

- A  $\frac{V_0}{2}$
- B  $\frac{V_0}{e}$
- C  $V_0 e$
- D  $V_0 \ln 2$

(Total 1 mark)

**Q15.**

A  $1.0 \mu\text{F}$  capacitor initially stores  $15 \mu\text{C}$  of charge. It then discharges through a  $25 \Omega$  resistor.

What is the maximum current during the discharge of the capacitor?

- A 0.60 mA

- B 1.2 mA
- C 0.60 A
- D 1.2 A

(Total 1 mark)

**Q16.**

An air-filled parallel-plate capacitor is charged from a source of emf. The electric field has a strength  $E$  between the plates. The capacitor is disconnected from the source of emf and the separation between the isolated plates is doubled.

What is the final electric field between the plates?

- A  $2E$
- B  $E$
- C  $\frac{E}{2}$
- D  $\frac{E}{4}$

(Total 1 mark)

**Q17.**

A parallel-plate capacitor has square plates of length  $l$  separated by distance  $d$  and is filled with a dielectric.

A second capacitor has square plates of length  $2l$  separated by distance  $2d$  and has air as its dielectric.

Both capacitors have the same capacitance.

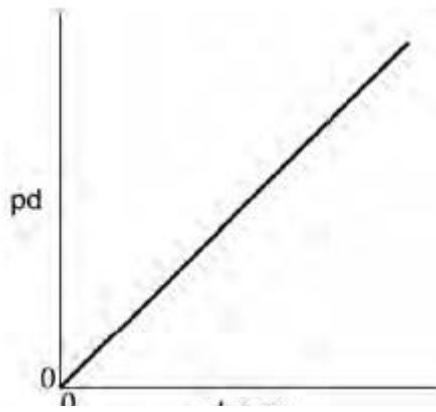
What is the relative permittivity of the dielectric in the first capacitor?

- A  $\frac{1}{2}$
- B 1
- C 2
- D 8

(Total 1 mark)

**Q18.**

The graph shows the variation of potential difference (pd) with charge for a capacitor while it is charging.



Which statement can be deduced from the graph?

- A The charging current is constant.
- B The energy stored in the capacitor increases uniformly with time.
- C The capacitance of the capacitor is constant.
- D The power supply used to charge the capacitor had a constant terminal pd.

(Total 1 mark)

**Q19.**

A parallel-plate capacitor is fully charged and then disconnected from the power supply. A dielectric is then inserted between the plates.

Which row correctly identifies the charge on the plates and the electric field strength between the plates?

	Charge	Electric field strength	
A	Stays the same	Increases	<input type="checkbox"/>
B	Increases	Decreases	<input type="checkbox"/>
C	Increases	Increases	<input type="checkbox"/>
D	Stays the same	Decreases	<input type="checkbox"/>

(Total 1 mark)

**Q20.**

A capacitor of capacitance  $C$  has a charge of  $Q$  stored on the plates. The potential difference between the plates is doubled.

What is the change in the energy stored by the capacitor?

- A  $\frac{Q^2}{2C}$

**B**  $\frac{Q^2}{C}$

**C**  $\frac{3Q^2}{2C}$

**D**  $\frac{2Q^2}{C}$

(Total 1 mark)