

Multiple Choice Capacitors Paper Questions Jan 2002—Jan 2010 (old spec)

- 7 A capacitor of capacitance C stores an amount of energy E when the p.d. across it is V . Which line, A to D, gives the correct stored energy and p.d. when the charge is increased by 50%.

	energy	p.d.
A	$1.5E$	$1.5V$
B	$2.25E$	$1.5V$
C	$1.5E$	$2.25V$
D	$2.25E$	$2.25V$

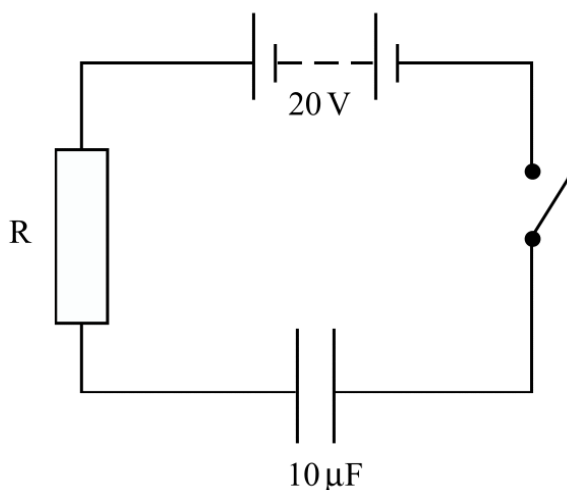
Jun 2002

- 7 A $1\ \mu\text{F}$ capacitor is charged using a constant current of $10\ \mu\text{A}$ for 20 s. What is the energy finally stored by the capacitor?

- A** $2 \times 10^{-3}\ \text{J}$
B $2 \times 10^{-2}\ \text{J}$
C $4 \times 10^{-2}\ \text{J}$
D $4 \times 10^{-1}\ \text{J}$

Jan 2003

8



A capacitor of capacitance $10\ \mu\text{F}$ is fully charged through a resistor R to a p.d. of 20 V using the circuit shown. Which one of the following statements is **incorrect**?

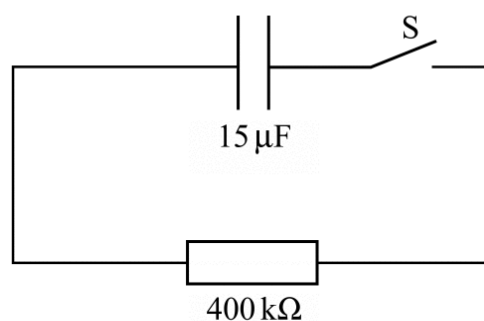
- A** The p.d. across the capacitor is 20 V.
B The p.d. across the resistor is 0 V.
C The energy stored by the capacitor is 2 mJ.
D The total energy taken from the battery during the charging process is 2 mJ.

- 8 A 10 mF capacitor is charged to 10 V and then discharged completely through a small motor. During this process, the motor lifts a weight of mass 0.10 kg. If 10% of the energy stored in the capacitor is used to lift the weight, through what approximate height will the weight be lifted?

- A 0.05 m
 B 0.10 m
 C 0.50 m
 D 1.00 m

Jun 2003

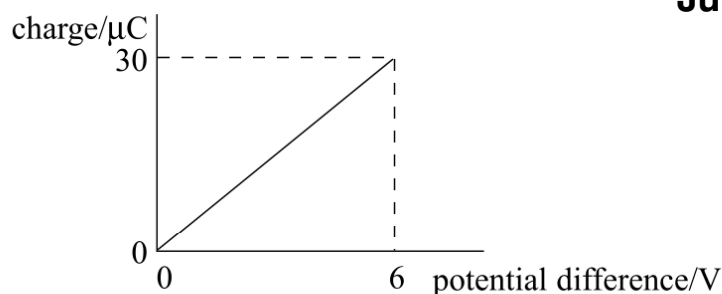
- 9 A capacitor of capacitance $15 \mu\text{F}$ is fully charged and the potential difference across its plates is 8.0 V. It is then connected into the circuit as shown.



The switch S is closed at time $t = 0$. Which one of the following statements is correct?

- A The time constant of the circuit is 6.0 ms.
 B The initial charge on the capacitor is $12 \mu\text{C}$.
 C After a time equal to twice the time constant, the charge remaining on the capacitor is $Q_0 e^2$, where Q_0 is the charge at time $t = 0$.
 D After a time equal to the time constant, the potential difference across the capacitor is 2.9 V.
- 5 The graph shows how the charge stored by a capacitor varies with the potential difference across it as it is charged from a 6 V battery.

Jun 2004



Which one of the following statements is **not** correct?

- A The capacitance of the capacitor is $5.0 \mu\text{F}$.
 B When the potential difference is 2 V the charge stored is $10 \mu\text{C}$.
 C When the potential difference is 2 V the energy stored is $10 \mu\text{J}$.
 D When the potential difference is 6 V the energy stored is $180 \mu\text{J}$.

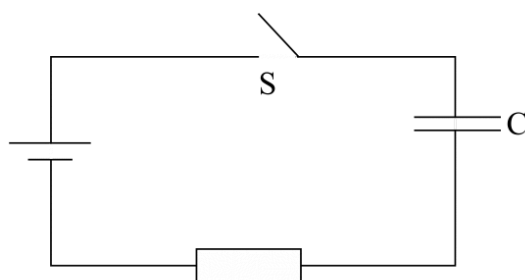
- 6 A capacitor of capacitance C discharges through a resistor of resistance R . Which one of the following statements is **not** true?
- A The time constant will increase if R is increased.
 B The time constant will decrease if C increased.
 C After charging to the same voltage, the initial discharge current will increase if R is decreased.
 D After charging to the same voltage, the initial discharge current will be unaffected if C is increased.

- 6 A $1.0\ \mu\text{F}$ capacitor is charged by means of a **constant** current of $10\ \mu\text{A}$ for 20s. What is the energy finally stored in the capacitor?

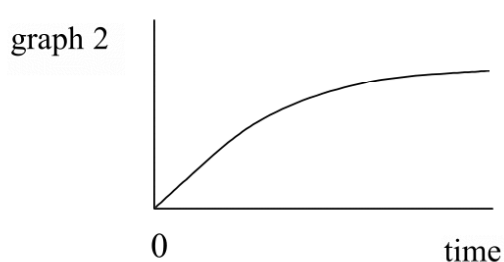
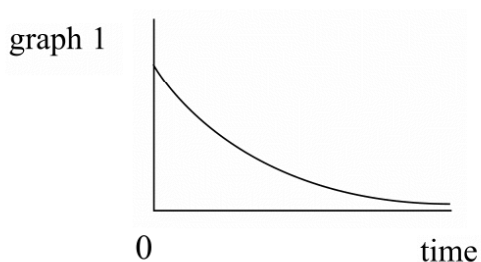
Jan 2005

- A $4.0 \times 10^{-4}\text{J}$
 B $2.0 \times 10^{-3}\text{J}$
 C $2.0 \times 10^{-2}\text{J}$
 D $4.0 \times 10^{-2}\text{J}$

- 7 In the circuit shown, the capacitor C is charged to a potential difference V when the switch S is closed.



Which line, **A** to **D**, in the table gives a correct pair of graphs showing how the charge and current change with time after S is closed?



	charge	current
A	graph 1	graph 1
B	graph 1	graph 2
C	graph 2	graph 2
D	graph 2	graph 1

- 13 A $1000\ \mu\text{F}$ capacitor and a $10\ \mu\text{F}$ capacitor are charged so that the potential difference across each of them is the same. The charge stored in the $1000\ \mu\text{F}$ capacitor is Q_1 and the charge stored in the $10\ \mu\text{F}$ capacitor is Q_2 .

What is the ratio $\frac{Q_1}{Q_2}$?

Jun 2005

- A** 100
B 10
C 1
D $\frac{1}{100}$

- 6 A $400\ \mu\text{F}$ capacitor is charged so that the voltage across its plates rises at a constant rate from $0\ \text{V}$ to $4.0\ \text{V}$ in $20\ \text{s}$. What current is being used to charge the capacitor?

Jan 2006

- A** $5\ \mu\text{A}$
B $20\ \mu\text{A}$
C $40\ \mu\text{A}$
D $80\ \mu\text{A}$

- 7 A $1000\ \mu\text{F}$ capacitor, initially uncharged, is charged by a steady current of $50\ \mu\text{A}$. How long will it take for the potential difference across the capacitor to reach $2.5\ \text{V}$?

Jun 2006

- A** 20 s
B 50 s
C 100 s
D 400 s

- 8 In experiments to pass a very high current through a gas, a bank of capacitors of total capacitance $50\ \mu\text{F}$ is charged to $30\ \text{kV}$. If the bank of capacitors could be discharged completely in $5.0\ \text{ms}$ what would be the mean power delivered?

- A** 22 kW
B 110 kW
C 4.5 MW
D 9.0 MW

- 6 How many of the following four equations correctly represent the energy E stored by a capacitor of capacitance C when it is charged to a pd V and its charge is Q ?

$$E = \frac{1}{2} \frac{Q^2}{C}$$

$$E = \frac{1}{2} \frac{C}{V^2}$$

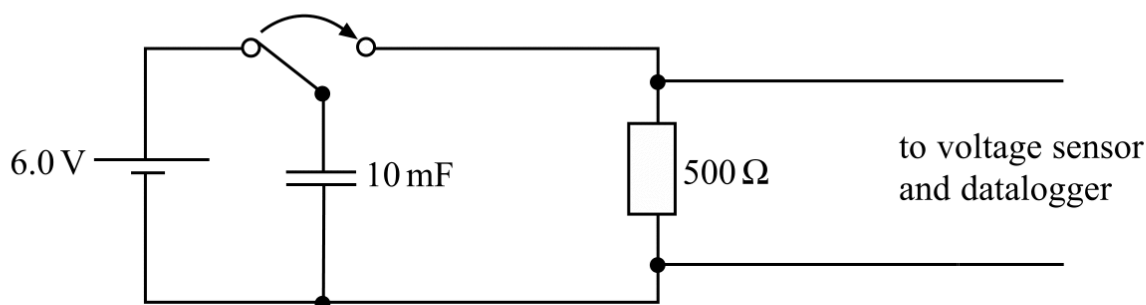
$$E = \frac{1}{2} QC$$

$$E = \frac{1}{2} CV^2$$

Jan 2007

- A** one
B two
C three
D four

- 7 A voltage sensor and a datalogger are used to record the discharge of a 10 mF capacitor in series with a 500 Ω resistor from an initial pd of 6.0 V. The datalogger is capable of recording 1000 readings in 10 s. Which line, **A** to **D**, in the table gives the pd and the number of readings made after a time equal to the time constant of the discharge circuit?



	potential difference/V	number of readings
A	2.2	50
B	3.8	50
C	2.2	500
D	3.8	500

- 8 The relationship between two physical quantities may be inverse, inverse square or exponential. Which line, **A** to **D**, in the table shows correct relationships for
- pd and time in capacitor discharge,
 - electric field strength and distance in a radial field, and
 - gravitational potential and distance in a radial field?

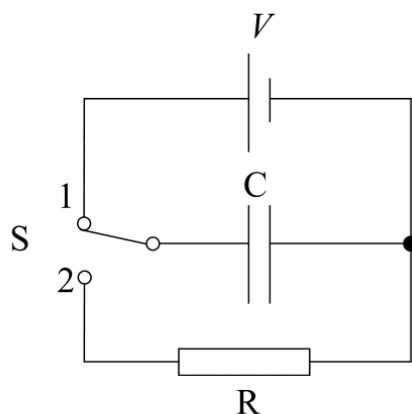
	(i) capacitor discharge	(ii) electric field strength	(iii) gravitational potential
A	exponential	inverse	inverse square
B	inverse	inverse square	exponential
C	inverse square	exponential	inverse
D	exponential	inverse square	inverse

- 8 A capacitor of capacitance 2500 μF is charged by a **constant** current of 200 μA . What is the pd across the capacitor 25 s after starting to charge?

Jun 2007

- 0.50 V
- 1.0 V
- 2.0 V
- 4.0 V

9

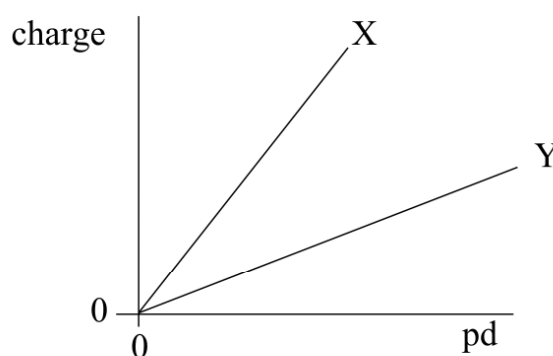


Switch S in the circuit is held in position 1, so that the capacitor C becomes fully charged to a pd V and stores energy E . The switch is then moved quickly to position 2, allowing C to discharge through the fixed resistor R. It takes 36 ms for the pd across C to fall to $\frac{V}{2}$. After the switch has been moved to position 2, how long does it take before the energy stored by C has fallen to $\frac{E}{16}$?

- A 51 ms
- B 72 ms
- C 432 ms
- D 576 ms

- 8 The graph shows how the charge stored by each of two capacitors, X and Y, increases as the pd across them increases.

Jan 2008

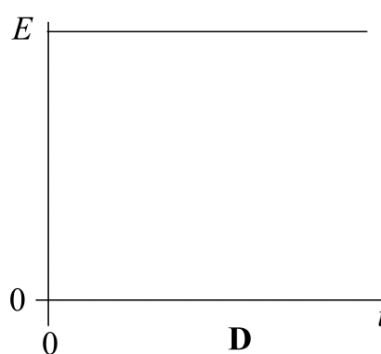
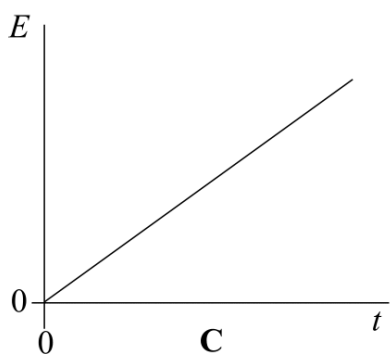
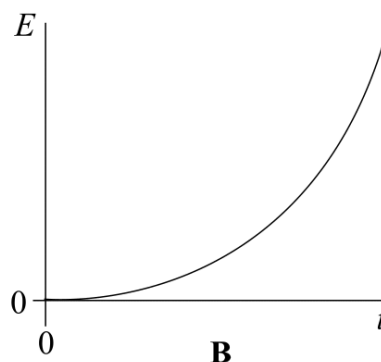
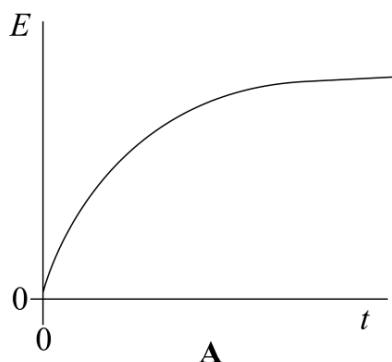


Which one of the following statements is correct?

- A The capacitance of X is equal to that of Y.
- B The capacitance of Y is greater than that of X.
- C The capacitance of Y is less than that of X.
- D The capacitances of both X and Y are increasing.

- 6 An uncharged capacitor of fixed capacitance is connected in series with a switch and battery. The switch is closed at time $t = 0$. Which graph, **A** to **D**, shows how the energy, E , stored by the capacitor, changes with time, t , after the switch is closed?

Jun 2008

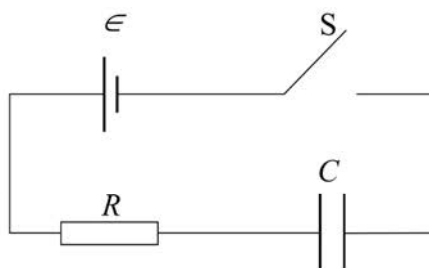


- 7 The voltage across a capacitor falls from 10 V to 5 V in 48 ms as it discharges through a resistor. What is the time constant of the circuit?

- A** 24 ms
- B** 33 ms
- C** 69 ms
- D** 96 ms

6

Jan 2009



When switch S is closed, the capacitor of capacitance C begins to charge from the cell of emf ϵ through the resistor of resistance R . The initial current in the circuit is I .

The time taken for the current to decrease to $\frac{I}{2}$ is determined by the value(s) of

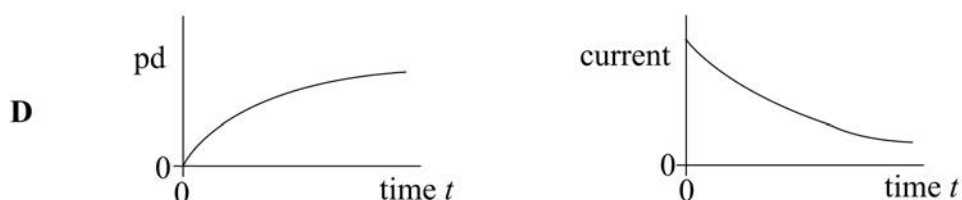
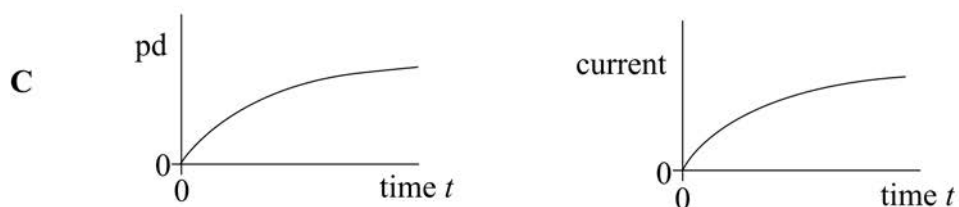
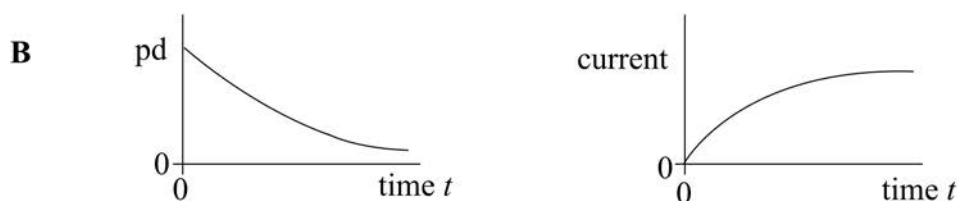
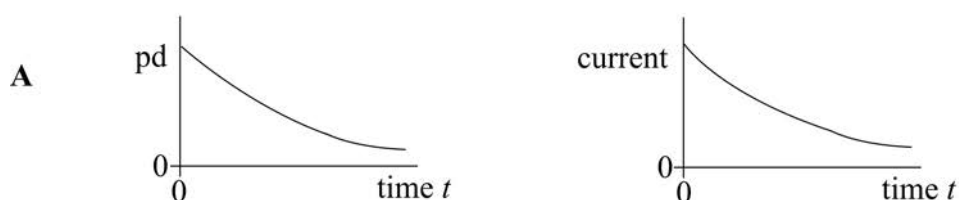
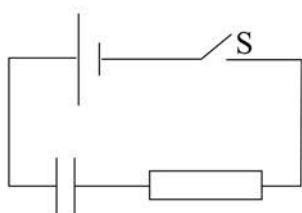
- A** ϵ and R .
- B** ϵ and C .
- C** C and R .
- D** C alone.

- 7 A heart defibrillator used on a patient contains a $64 \mu\text{F}$ capacitor which is charged using a 2500 V supply.
What is the average current through the patient's body if the capacitor is fully discharged in 10 ms ?

Jun 2009

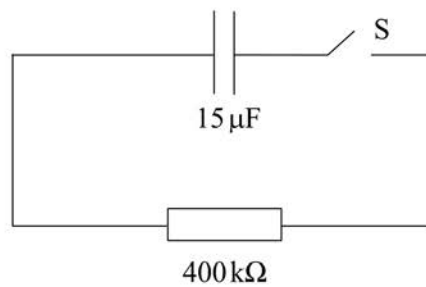
- A** $2.6 \times 10^{-10} \text{ A}$
B 1.6 A
C 16 A
D $3.9 \times 10^4 \text{ A}$

- 8 The capacitor in the circuit is initially uncharged. The switch S is closed at time $t = 0$.
Which pair of graphs, **A** to **D**, correctly shows how the pd across the capacitor and the current in the circuit change with time?



- 8 A capacitor of capacitance $15\ \mu\text{F}$ is fully charged and the potential difference across its plates is $8.0\ \text{V}$. It is then connected into the circuit as shown.

Jan 2010



The switch S is closed at time $t = 0$. Which one of the following statements is correct?

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- B The initial charge on the capacitor is $12\ \mu\text{C}$.
- C After a time equal to twice the time constant, the charge remaining on the capacitor is $Q_0 e^{-2}$, where Q_0 is the charge at time $t = 0$.
- D After a time equal to the time constant, the potential difference across the capacitor is $2.9\ \text{V}$.