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 pd across it is V. Which line, **A** to **D**, gives the correct stored energy and pd when the charge is increased by 50%.

Jun 2002

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

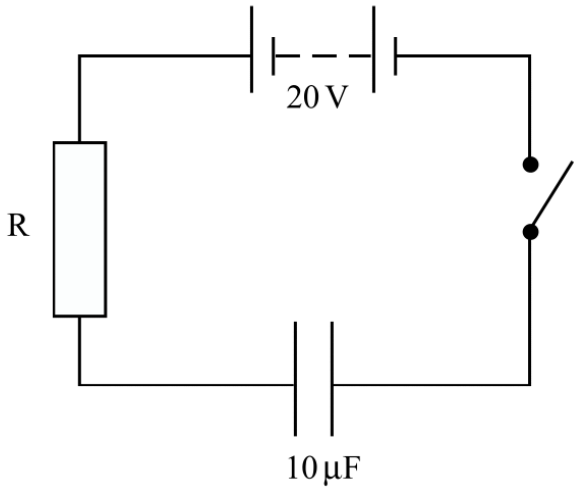
---

7 A 1 μF capacitor is charged using a constant current of 10 μA for 20 s. What is the energy finally stored by the capacitor?

Jan 2003

A 2×10^{-3} J
B 2×10^{-2} J
C 4×10^{-2} J
D 4×10^{-1} J

8



A capacitor of capacitance 10 μF 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**?

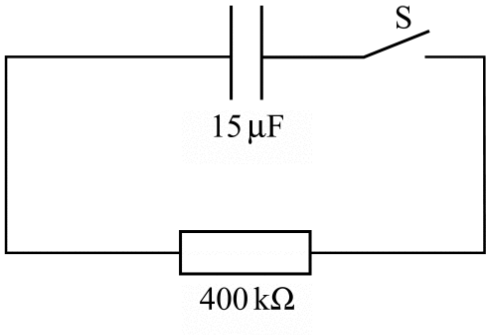
A The p.d. across the capacitor is 20 V.
B The p.d. across the resistor is 0 V.
C The energy stored by the capacitor is 2 mJ.
D The total energy taken from the battery during the charging process is 2 mJ.

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?

Jun 2003

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

9 A capacitor of capacitance 15 μF is fully charged and the potential difference across its plates is 8.0 V. It is then connected into the circuit as shown.

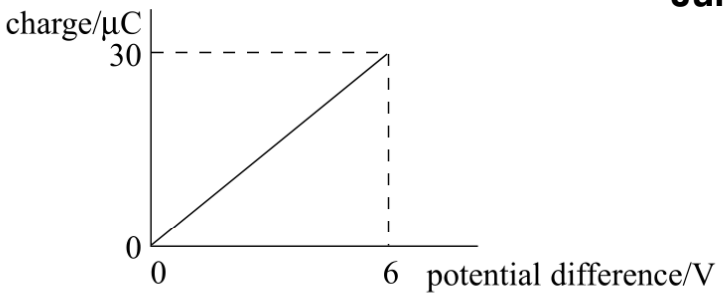


The switch S is closed at time $t = 0$. Which one of the following statements is correct?

A The time constant of the circuit is 6.0 ms.
B The initial charge on the capacitor is 12 μC.
C After a time equal to twice the time constant, the charge remaining on the capacitor is Q_0e^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 μF.
B When the potential difference is 2 V the charge stored is 10 μC.
C When the potential difference is 2 V the energy stored is 10 μJ.
D When the potential difference is 6 V the energy stored is 180 μJ.

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.

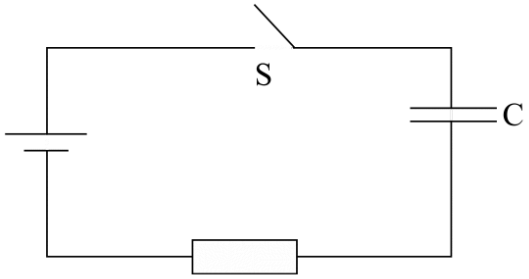
---

6 A 1.0 μF capacitor is charged by means of a **constant** current of 10 μA for 20s. What is the energy finally stored in the capacitor?

Jan 2005

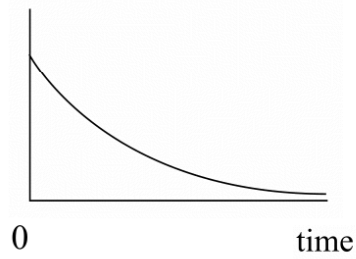
A 4.0×10^{-4} J
B 2.0×10^{-3} J
C 2.0×10^{-2} J
D 4.0×10^{-2} J

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

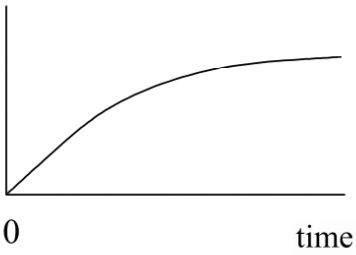


Which line, **A** to **D**, in the table gives a correct pair of graphs showing how the charge and current change with time after S is closed?

graph 1



graph 2



	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 μF capacitor and a 10 μF capacitor are charged so that the potential difference across each of them is the same. The charge stored in the 1000 μF capacitor is Q_1 and the charge stored in the 10 μF 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 μF capacitor is charged so that the voltage across its plates rises at a constant rate from 0 V to 4.0 V in 20 s. What current is being used to charge the capacitor?

Jan 2006

A 5 μA
B 20 μA
C 40 μA
D 80 μA

---

7 A 1000 μF capacitor, initially uncharged, is charged by a steady current of 50 μA. How long will it take for the potential difference across the capacitor to reach 2.5 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 μF is charged to 30 kV. If the bank of capacitors could be discharged completely in 5.0 ms what would be the mean power delivered?

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

---

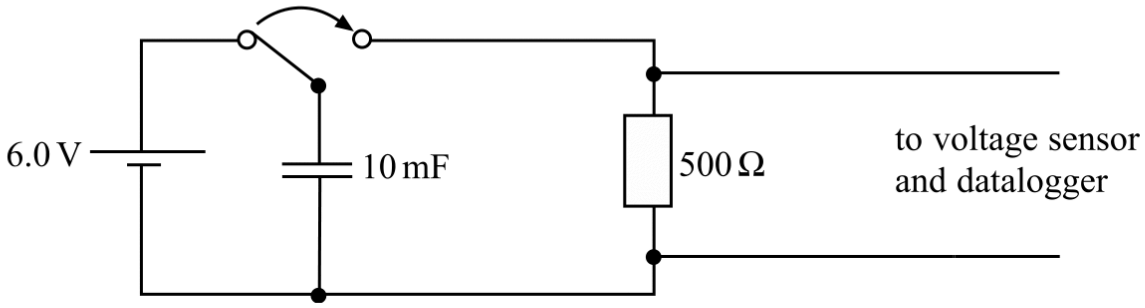
6 How many of the following four equations correctly represent the energy E stored by a capacitor of capacitance C when it is charged to a pd V and its charge is Q?

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

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

(i) pd and time in capacitor discharge,
(ii) electric field strength and distance in a radial field, and
(iii) 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

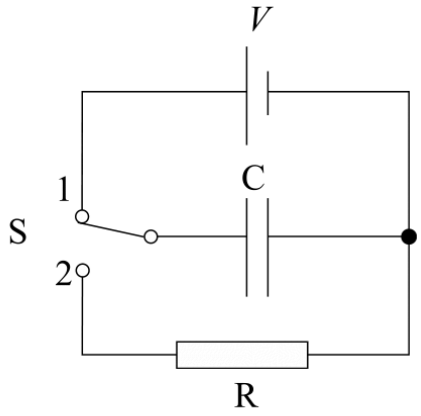
---

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

A 0.50 V
B 1.0 V
C 2.0 V
D 4.0 V

9



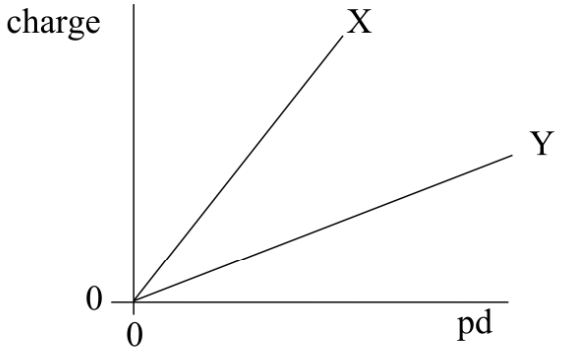
Switch S in the circuit is held in position 1, so that the capacitor C becomes fully charged to a pd V and stores energy E. The switch is then moved quickly to position 2, allowing C to discharge through the fixed resistor R. It takes 36 ms for the pd across C to fall to $\frac{V}{2}$. After the switch 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

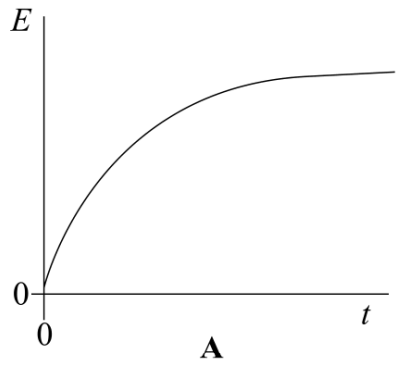


Which one of the following statements is correct?

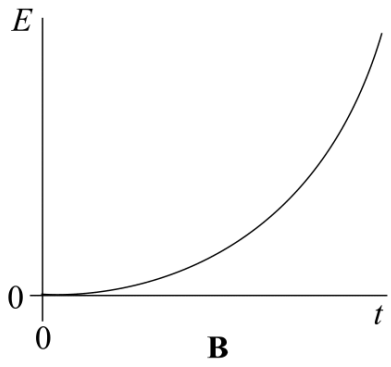
A The capacitance of X is equal to that of Y.
B The capacitance of Y is greater than that of X.
C The capacitance of Y is less than that of X.
D The capacitances of both X and Y are increasing.

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?

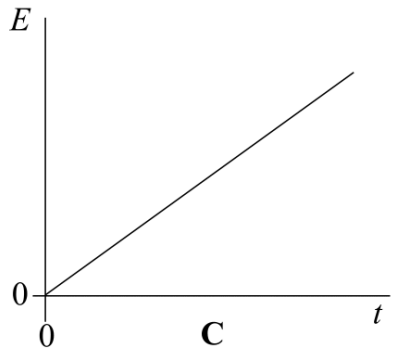
Jun 2008



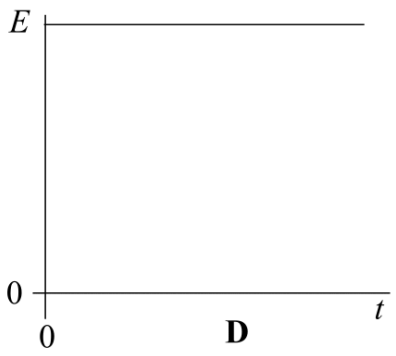
A



B



C



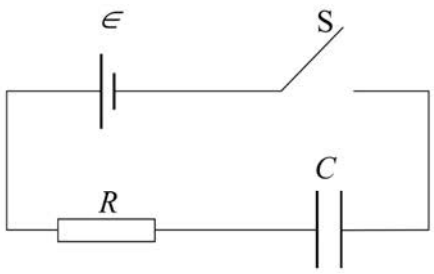
D

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 $\in$ 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

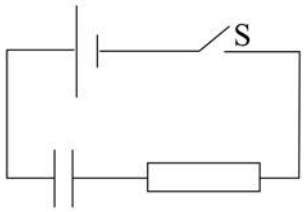
A $\in$ and R.
B $\in$ and C.
C C and R.
D C alone.

7 A heart defibrillator used on a patient contains a 64 μF 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?

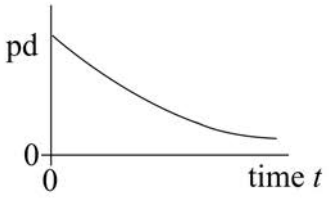
Jun 2009

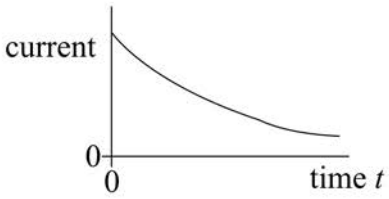
A 2.6×10^{-10} A
B 1.6 A
C 16 A
D 3.9×10^{4} A

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?

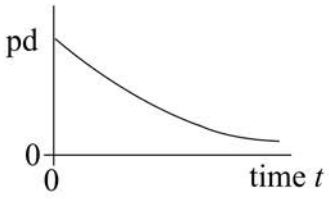


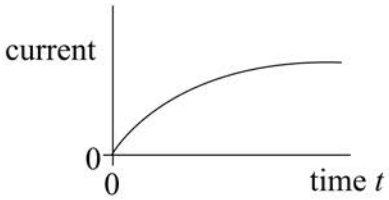
A



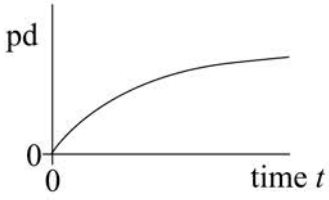


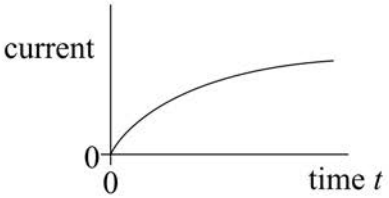
B



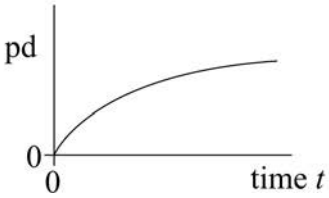


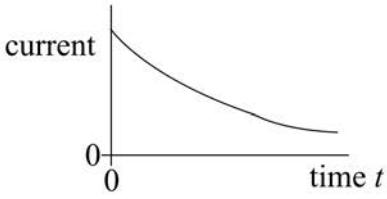
C





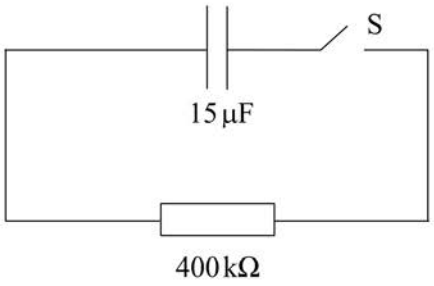
D





8 A capacitor of capacitance 15 μF is fully charged and the potential difference across its plates is 8.0 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?

A The time constant of the circuit is 6.0 ms.
B The initial charge on the capacitor is 12 μC.
C After a time equal to twice the time constant, the charge remaining on the capacitor is Q_0e^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.