11.3 Capacitance

Question Paper

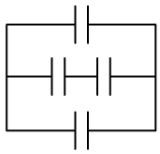
Course	DP IB Physics
Section	11. Electromagnetic Induction (HL only)
Topic	11.3 Capacitance
Difficulty	Medium

To be used by all students preparing for DP IB Physics HL
Students of other boards may also find this useful

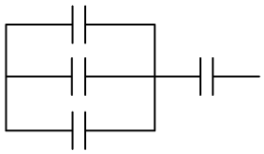
Question 1

Four capacitors, each one with a capacitance C, are connected such that their combined capacitance is 0.75C. How are they connected?

A



B



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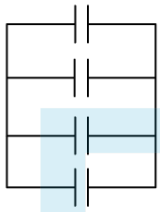


D

[1 mark]

Question 2

Energy stored in between the plates of parallel plate capacitor of area A with a permittivity of the dielectric between the plates ε, electric field strength E and separated by distance d is given by

A. $\frac{1}{2}\varepsilon\frac{d}{E^2A}$

B. $\frac{1}{2}\varepsilon E^2\frac{A}{d}$

C. $\frac{1}{2}\varepsilon AE^2d$

D. $\frac{1}{2}\frac{Ad}{\varepsilon E^2}$

[1 mark]

Question 3

The capacitance of a pixel of a CCD is 6.4 pF. A pulse of light is incident on the pixel and as a result, 10^6 electrons are ejected from the pixel. The magnitude of the change in potential of the pixel is

A. 4 V

B. 0.4 V

C. 0.25 V

D. 0.025 V

[1 mark]

Question 4

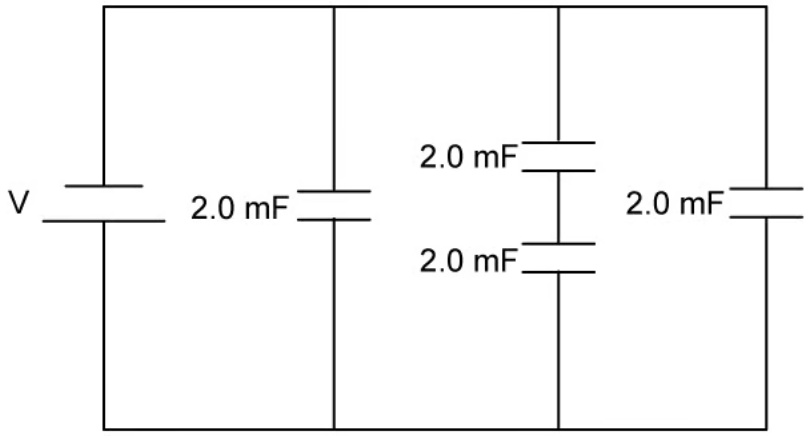
A parallel-plate capacitor is connected to a cell of constant emf. The separation between the plates is doubled without disconnecting the cell. What are the changes in the energy stored in the capacitor, the magnitude of the capacitance of the capacitor and the charge stored on the plates?

	Energy Stored	Capacitance	Charge
A.	Doubles	Halves	Halves
B.	Halves	Halves	Halves
C.	Doubles	Doubles	Doubles
D.	Halves	Halves	Doubles

[1 mark]

Question 5

The circuit below shows 4 capacitors each with capacitance 2.0 mF.



The total energy stored in the circuit is 100 J. What is the value of *V*?

A. 5.0 kV

B. 5.0 V

C. 0.2 kV

D. 2.0 kV

[1 mark]

Question 6

A capacitor is charged by a constant current of 5.0 μA for 2 minutes. As a result, the potential difference across the capacitor increases by 10 V.

What is the capacitance of the capacitor?

A. 60 μF

B. 600 μF

C. 10 μC

D. 1 μC

[1 mark]

Question 7

Four capacitors of same capacitance are connected in parallel. When they are connected to a cell, a total charge of 2.4 μC is accumulated on them. After discharging, they are connected in series and then charged by the same cell.

What is the total charge stored on the capacitors after charging in series?

A. $\frac{192}{5}$ mC

B. $\frac{192}{5}$ μC

C. $\frac{3}{20}$ mC

D. $\frac{3}{20}$ μC

[1 mark]

Question 8

Three capacitors are connected in series with capacitances 6 μF, 3 μF and 4 μF respectively.

What is the combined capacitance of these capacitors?

A. 13 μF

B. $\frac{4}{3}$ μF

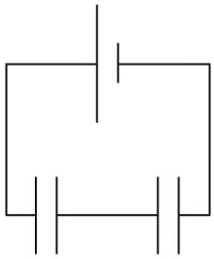
C. $\frac{3}{4}$ μF

D. $\frac{1}{13}$ μF

[1 mark]

Question 9

Two capacitors of different capacitance are connected in series to a source of emf with negligible internal resistance.



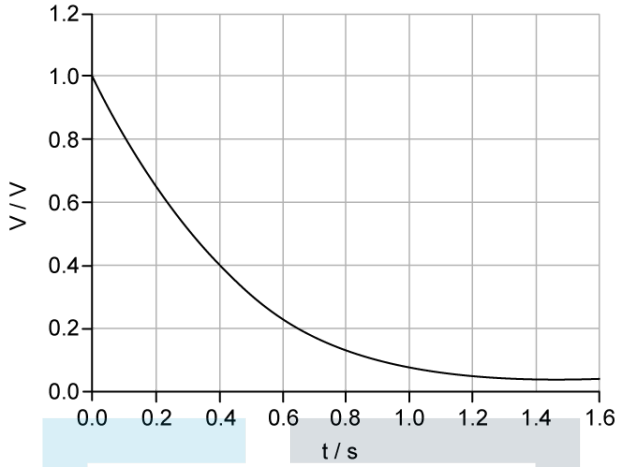
What is correct about the potential difference across each capacitor and the charge on each capacitor?

	Potential Difference	Charge
A.	Depends on the capacitance	Depends on the capacitance
B.	Same	Same
C.	Same	Depends on the capacitance
D.	Depends on the capacitance	Same

[1 mark]

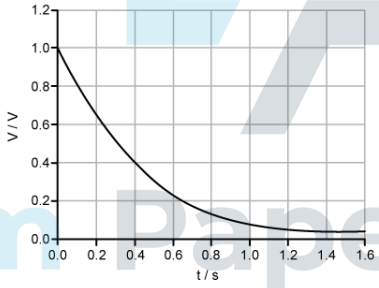
Question 10

A capacitor of capacitance *C* discharges through a resistor of resistance *R*. The graph shows the variation with time *t* of the voltage *V* across the capacitor.



The capacitor is changed to one of value $\frac{C}{2}$ and the resistor is changed to one of value $\frac{R}{2}$. Which graph shows the variation with *t* of *V* when the new combination is discharged?

A



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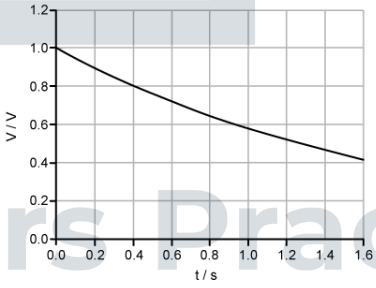

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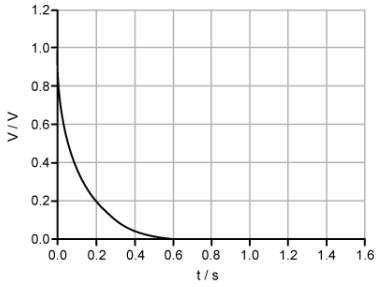

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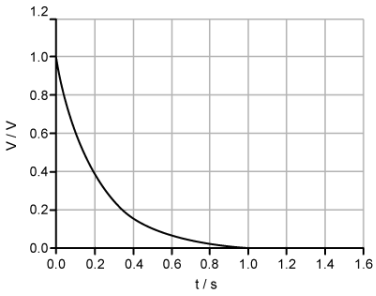

[1 mark]