PHYSICS

BOOKS - BITSAT GUIDE

ELECTRIC CAPACITOR

Practice Exercise

1. In which form of the following, the energy is stored in the capacitor?

A. Charge

B. Magnetic field

C. Capacitance

D. Electric potential energy

Answer: D

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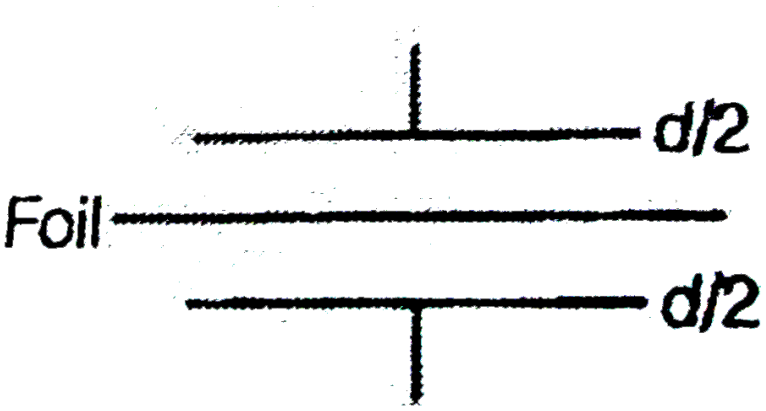
2. A sheet of aluminium foil of negligible thickness is placed between the plates of a capacitor of capacitance C as shown in the

figure, the capacitance of capacitor becomes



A. 2C

B. C

C. $\frac{C}{2}$

D. zero

Answer: B

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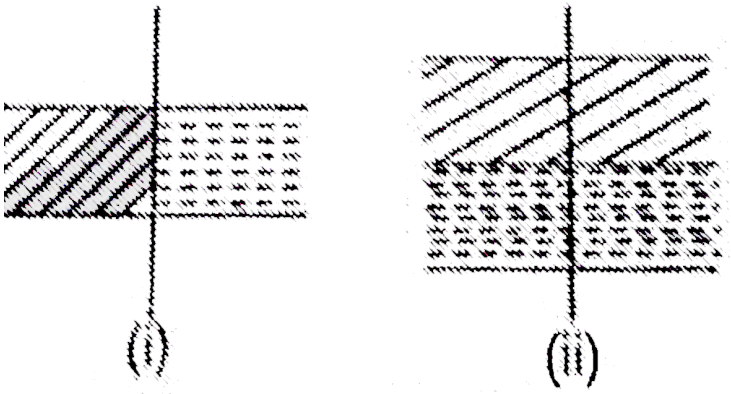
3. Calculate the ratio of capacitance of two capacitors of same dimension of same dimensions but of different values K and $\frac{K}{4}$ arranged in two ways as shown in Fig. (i) and (ii).



A. $5:2$

B. $25:16$

C. $5:4$

D. $2:5$

Answer: B

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4. A conducting sphere of radius 10 cm is given a charge of $+2 \times 10^{-8} C$. What will be its potential?

A. $0.03kV$

B. $0.9kV$

C. $1.8kV$

D. $3.6kV$

Answer: C

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5. If n identical drops of mercury are combined to form a bigger drop then find the capacity of

bigger drop, if capacity of each drop of mercury is C.

A. $n^{1/3}C$

B. $n^{2/3}C$

C. $n^{1/4}$ C

D. nC

Answer: A

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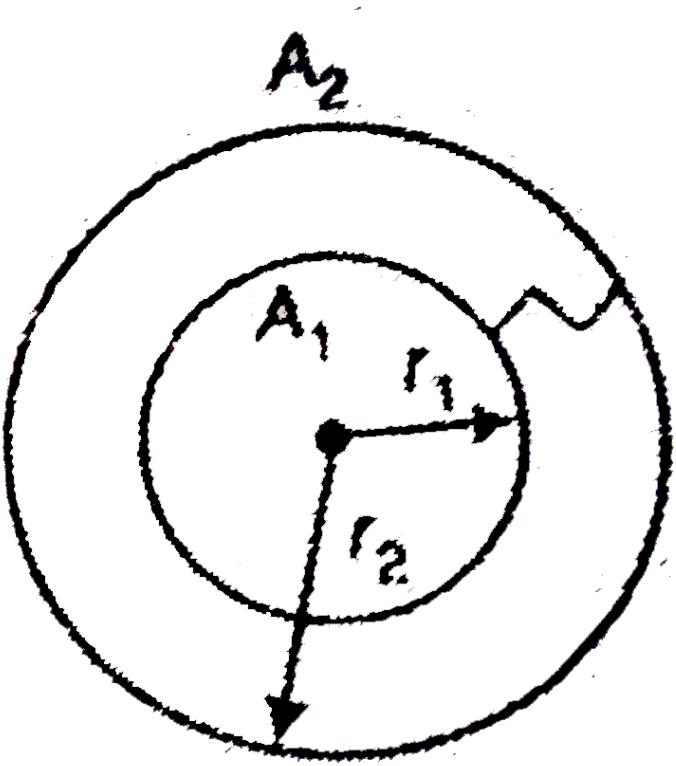
6. Two spherical conductors A_1 and A_2 of radii r_1 and r_2 are placed concentrically in air. The two are connected by a copper wire as shown in figure. Then, the equivalent capacitance of

the system is



A. $\frac{4\pi\varepsilon_0 K r_1 r_2}{r_2 - r_1}$

B. $4\pi\varepsilon_0(r_2 + r_1)$

C. $4\pi\varepsilon_0 r_2$

D. $4\pi\varepsilon_0 r_1$

Answer: C

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7. Calculate amount of charge flow, when a conducting sphere of radius R and carrying a charge Q, is joined to an uncharged conducting sphere of radius 2R.

A. $\frac{Q}{4}$

B. $\frac{Q}{3}$

C. $\frac{Q}{2}$

D. $\frac{2Q}{3}$

Answer: D

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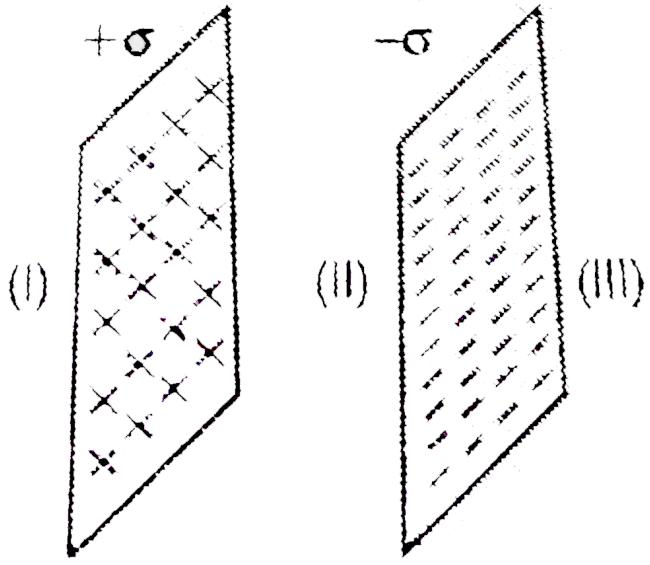
8. Find the electric field in region II as shown in figure.



A. zero

B. $\frac{\sigma}{4\pi\varepsilon_0}$

C. $\frac{\sigma}{\varepsilon_0}$

D. Infinite

Answer: C

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9. Two capacitors A and B having capacitances $10\mu f$ and $20\mu F$ are connected in series with a 12 V battery. The ratio of the charge on A and B is

A. $0.5:1$

B. $1:1$

C. $2:1$

D. $2:4$

Answer: B

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10. A 6×10^{-4} F parallel plate air capacitor is connected to a 500 V battery. When air is replaced by another dielectric material, 7.5×10^{-4}C charge flows into the capacitor. The value of the dielectric constant of the material is

A. 1.5

B. 2.0

C. 1.0025

D. 3.5

Answer: C

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11. The 90 pF capacitor is connected to a 12 V battery. How many electrons a transferred from one plate to another?

A. 1.1×10^9

B. 6.7×10^9

C. 4×10^{19}

D. 5×10^{19}

Answer: B

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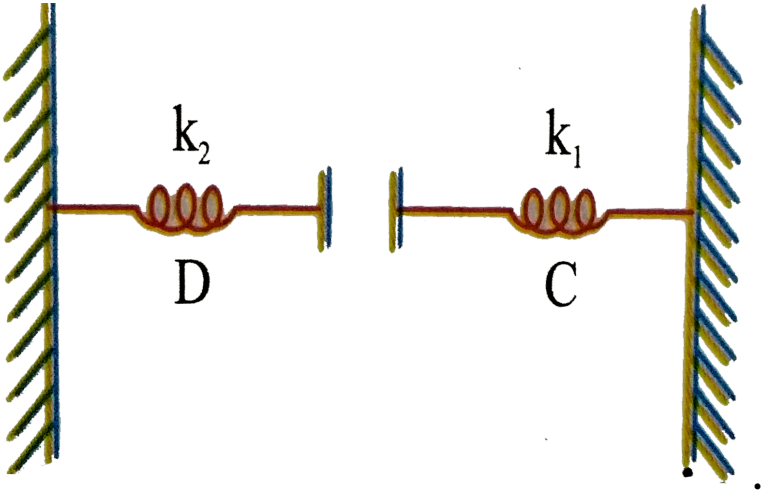
12. In the given figure the capacitor of plate area A is charged upto charge q. The ratio of elongations (neglect force gravity) in springs

C and D at equilibrium position is.



A. $\frac{k_1}{k_2}$

B. $\frac{k_2}{k_1}$

C. $k_1 k_2$

D. None of these

Answer: B

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13. A potential difference of 500 V is applied across a paralle plate capacitor. The separation between the plates is $2 \times 10^{-3} m$. The plates of the capacitor are vertical. An electron is projected vertically upwards between the plates with a velocity of $10^5 m/a$ and it moves undeflected between the plates. The magnetic field acting perpendicular to the electric field has magnitude of

A. $1.5Wb/m^2$

B. $2.0Wb/m^2$

C. $2.5Wb/m^2$

D. $3.0Wb/m^2$

Answer: C

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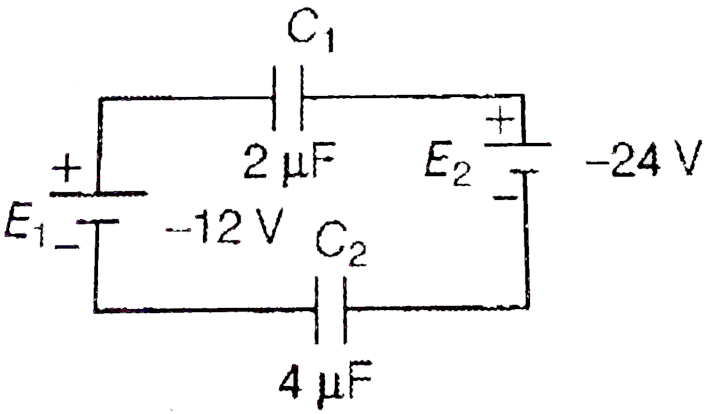
14. Two capacitors C_1 and C_2 are connected in a circuit as shown in figure. The potential

difference $(V_A - V_B)$ is



A. $8V$

B. $-8V$

C. $12V$

D. $12V$

Answer: B

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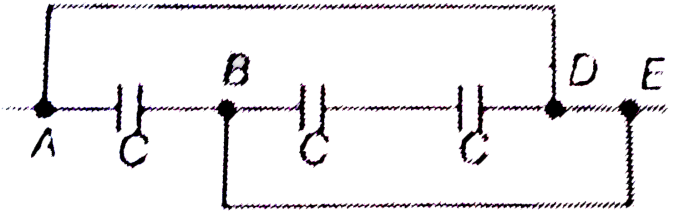
15. In the given figure, the equivalent capacitance between A and B is



A. $3C$

B. $\frac{C}{3}$

C. $\frac{3}{2C}$

D. infinity

Answer: D

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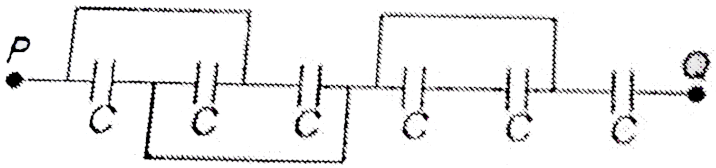
16. For the circuit, the equivalent capacitance between P and Q is



A. $6C$

B. $4C$

C. $\frac{3C}{2}$

D. $\frac{6C}{11}$

Answer: D

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17. A parallel plate capacitor is connected to a battery of constant emf. Let the electric field at a given point between the plate be E_0, when there is no medium between the plates. The new electric field at the point, If a medium

of dielectric constant A is intoduced between them, is

A. $\frac{E_0}{4}$

B. $\frac{E_0}{2}$

C. E_0

D. $4E_0$

Answer: C

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18. Force acting upon charged particle kept between the plates of a charged condenser is F. If one of the plates of the condenser is removed, force acting on the same particle will become.

A. 0

B. $\frac{F}{2}$

C. F

D. $2F$

Answer: B

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19. A parallel plate capacitor has two layers of dielectrons as shown in figure. This capacitor is connected across a battery, then the ratio of potential difference across the dielectric layers is

A. $\frac{4}{3}$

B. $\frac{1}{2}$

C. $\frac{1}{3}$

D. $\frac{3}{2}$

Answer: D

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20. A parallel plate capacitor of plate area A and plate separation d is charged to potential difference V and then the battery is disconnected. A slab of dielectric constant K is then inserted between the plates of the capacitor so as to fill the space between the

plates. If Q, E and W denote respectively, the magnitude of charge on each plate, the electric field between the plates (after the slab is inserted), and work done on the system, in question, in the process of inserting the slab, then

A. $Q = \varepsilon_0 \frac{AV}{d}$

B. $W = \varepsilon_0 \frac{AV^2}{2d}\left(1 - \frac{1}{K}\right)$

C. $C = \frac{V}{Kd}$

D. All of these

Answer: B

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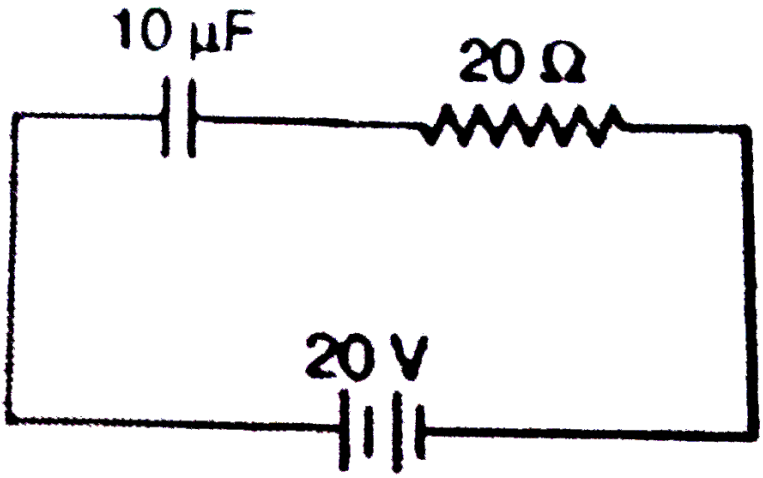
21. A capacitor of capacitance $10\mu F$ is charged by connecting through a resistance of $20Omga$ and battery of 20 V. What is the energy supplied by the battery?



A. Less than 2 mJ

B. Equal to 2 mJ

C. More than 2 mJ

D. Cannot be predicted

Answer: C

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22. A capacitor of capacitance C is charged to a potential difference V_0. The charged battery is disconnected and the capacitor is connected

to a capacitor of unknown capacitance C_x. The potential difference across the combination is V. The value of C_x should be

A. $\frac{C(V_0 - V)}{V}$

B. $\frac{C(V - V_0)}{V}$

C. $\frac{CV}{V_0}$

D. $\frac{CV_0}{V}$

Answer: A

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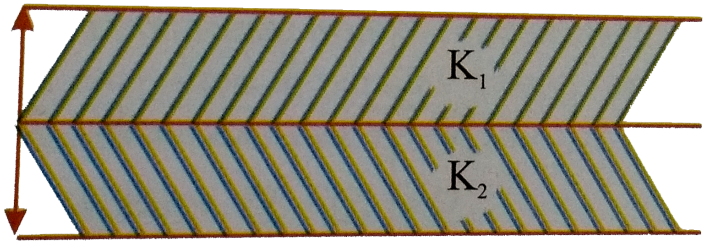
23. A parallel plate capacitor is made of two dielectric blocks in series. One of the blocks has thickness d_1 and dielectric constant K_1 and the other has thickness d_2 and dielectric constant K_2 as shown in figure. This arrangement can be through as a dielectric slab of thickness $d(=d_1+d_2)$ and effective dielectric constant K. The K is.



A. $\dfrac{K_1d_1+K_2d_2}{d_1+d_2}$

B. $\frac{K_1 d_1 + K_2 d_2}{K_1 + K_2}$

C. $\frac{K_1 K_2 (d_1 + d_2)}{K_1 d_1 + K_2 d_2}$

D. $\frac{2K_1 K_2}{K_1 + K_2}$

Answer: C

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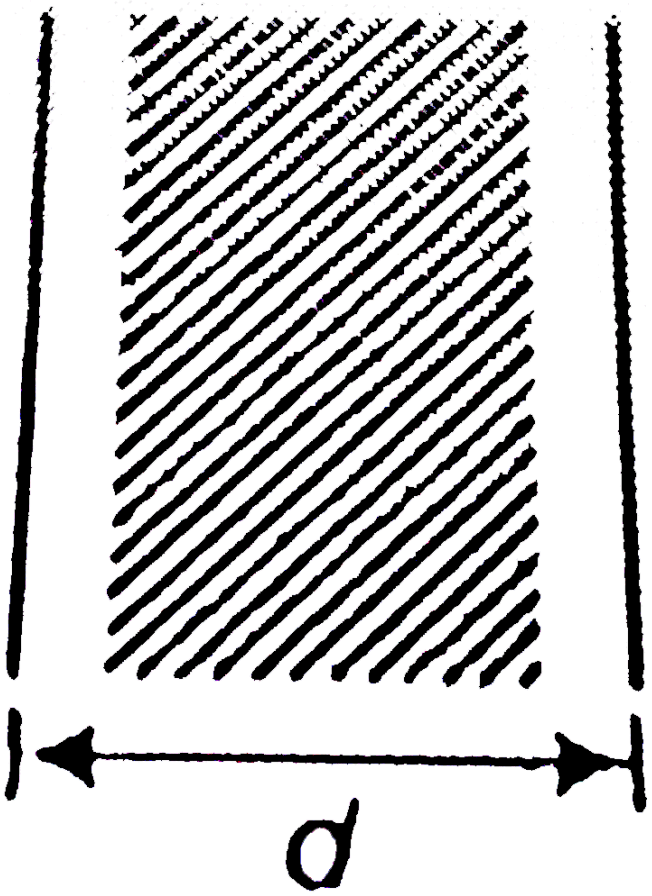
24. A copper plate of thickness b is placed inside a parallel plate capacitor of plate distance d and area A as shown in figure. The

capacitance of capacitor is



A. $\frac{A\varepsilon_0}{d}$

B. $\frac{A\varepsilon_0}{b}$

C. $\frac{A\varepsilon_0}{d-b}$

D. ∞

Answer: D

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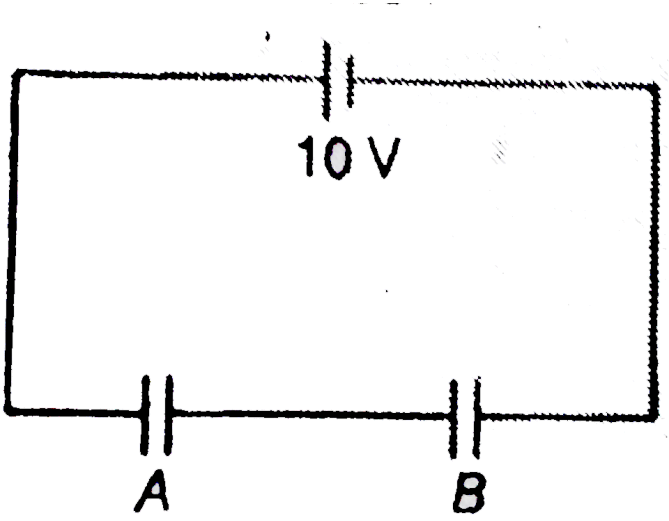
25. For the circuit shown below, capacitors A and B have identical geometry, but a material of dielectric constant 3 is present between the plates of B. The potential difference across A

and B are respectively



A. $2.5V, 7.5V$

B. $2V, 8V$

C. $7.5V, 2.5V$

D. $8V, 2V$

Answer: A

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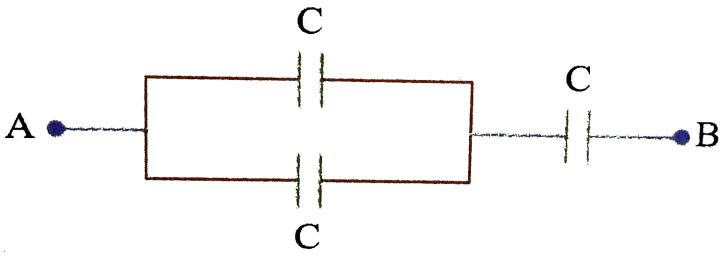
26. In the net work three identical capacitors are connected as shown. Each of them can withstand to a maximum $100V$ potential difference. What is the maximum voltage that can be applied across A and B so that no capacitor gets spoiled.



A. $150V$

B. $120V$

C. $180V$

D. $0.200V$

Answer: B

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27. Calculate the work done against the electric force, if the separation of the

capacitor of area S is increased from x_1 to x_2.

Assume charge q on the capacitor is constant.

A. $W = \frac{q^2}{\varepsilon_0 S}(x_2 - x_1)$

B. $W = \frac{q}{\varepsilon_0 S}(x_2 - x_1)$

C. $W = \frac{q^2}{2\varepsilon_0 S}(x_2 - x_1)$

D. $W = \frac{q^2}{4\varepsilon_0 S}(x_2 - x_1)$

Answer: C

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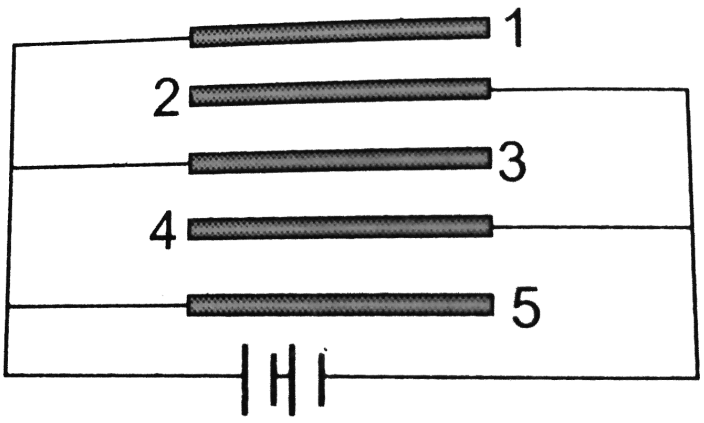
28. Five identical plates are connected across a battery as follows : If the charge on plate 1 be $+q$, then the charges on the plates $2, 3, 4$ and 5 are



A. $-q, +q, -q, +q$

B. $-2q, +2q, -2q, +q$

C. $-q, +2q, -2q, +q$

D. None of these

Answer: B

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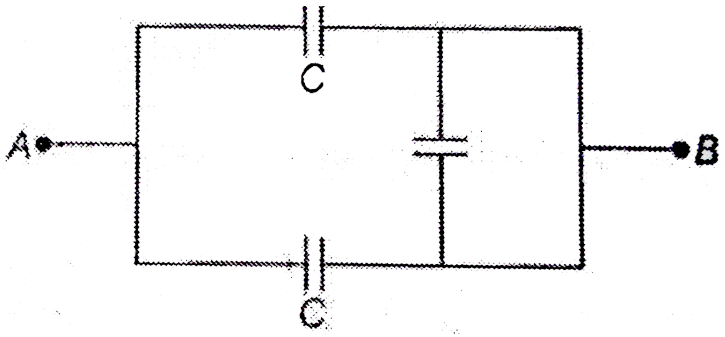
29. The equivalent capacitance of the combination of three capacitors each of capacitance C between A and B as shown in

figure is



A. C

B. $2C$

C. $C/2$

D. $3C$

Answer: B

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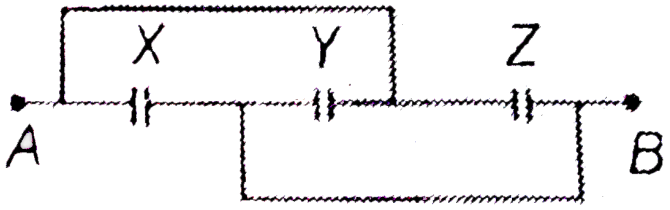
1. Three capacitors $X = 1\mu F, Y = 2\mu F$ and $Z = 3\mu F$ are connected as shown in figure, then the equivalent capacitance between points A and B is



A. $6\mu F$

B. $12\mu F$

C. $3\mu F$

D. None of these

Answer: A

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2. A capacitor of capacity $0.1\mu F$ connected in series to a resistor of $10M\Omega$ is charged to a certain potential and then made to discharge through resistor. The time in which the

potential will take to fall to half its original value is (Given, $\log_{10} 2 = 0.3010$)

A. $2s$

B. $0.693s$

C. $0.5s$

D. $1.0s$

Answer: B

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3. The work done in placing a charge of 8×10^{-18} coulomb on a condenser of capacity 100 micro-farad is

A. 32×10^{-32}J

B. 16×10^{-32}J

C. 3.1×10^{-26}J

D. 4×10^{-10}J

Answer: A

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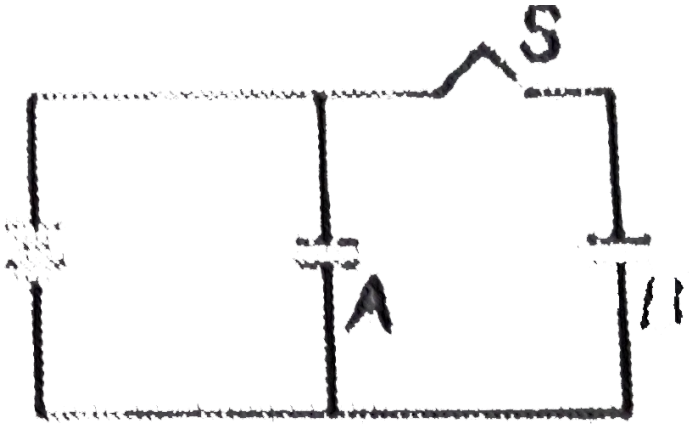
4. Two identical air filled parallel plate capacitors are charged to the same potential in the manner shown by closing the switch S. If now the switch S is opened and the space between the plates is filled with a dielectric of relative permittivity ε_t, then



A. the potential difference as well as charge on each capacitor goes up by a factor ε_r

B. the potential difference as well as the charge on each capacitor goes down by a factor ε_r

C. the potential difference across A remains constant and the charge on B remains unchanged

D. the potential difference across B remains constant, while the charge on A remains unchanged

Answer: C

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5. Which of the following is discontinuous across a charged conducting surface?

A. Electric potential

B. Electric intensity

C. Both electric potential and intensity

D. None of the above

Answer: B

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6. Capacitance of a capacitor made by a thin metal foil is $2\mu F$. If the foil is foilded with paper of thickness 0.15 mm, dielectric constant

of paper is 2.5 and width of paper is 400 mm, the length of foil will be

A. 0.34 m

B. 1.33 m

C. 13.4 m

D. 33.9 m

Answer: D

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