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PHYSICS

BOOKS - MHTCET PREVIOUS YEAR PAPERS AND PRACTICE PAPERS

ELECTROSTATICS

Example

1. A polythene piece rubbed with wool is found to have negative charge of $3 \times 10^{-7} C$. Estimate the number of electrons transferred.

A. 1.8×10^{15}

B. 1.8×10^{12}

C. 1.2×10^{11}

D. 1.2×10^{10}

Answer: B

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2. Two similarly and equally charged identical metal spheres A and B repel each other with a force of $2 \times 10^{-5} N$. A third identical uncharged sphere C is touched with A and then placed at the midpoint between A and B. Find the net electric force on C.

A. $2 \times 10^{-3} N$

B. $2 \times 10^{-4} N$

C. $2 \times 10^{-5} N$

D. $2 \times 10^{-6} N$

Answer: C

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3. A conducting sphere fo radius 10 cm has an unknown charge. If the electric field 20 cm from the center of the sphere is $1.5 \times 10^3 N/C$ and points radilly inwards, what is the net charge on the sphere ?

A. $2.35 \times 10^{-7} C$

B. $5.38 \times 10^{-11} C$

C. $6.67 \times 10^{-9} C$

D. None of these

Answer: C

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4. If the uniform electric field is $3 \times 10^3 \hat{i} NC^{-1}$, then the flux of this field through a square of 10 cm on a side whose plane is parallel to the y-z- plane gt?

A. $30 Nm^2 C^{-1}$

B. $60 Nm^2 C^{-1}$

C. $15 Nm^2 C^{-1}$

D. $25 Nm^2 C^{-1}$

Answer: A

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5. The electric field in a region is given by $E = a\hat{i} + b\hat{j}$. Hence as and b are constants. Find the net flux passing through a square area of side I parallel to y-z plane.

A. a^2l^2

B. al^2

C. b^2l^2

D. bl^2

Answer: B

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6. A uniformaly charged conducting sphere of diameter 2.4 m has a surface charge density of $80.0\mu Cm^{-2}$. What is the total electric flux leaving the surface of the sphere ?

A. $1.637 \times 10^8 N - m^2 C^{-1}$

B. $1.538 \times 10^8 N - m^2 C^{-1}$

C. $2.383 \times 10\hat{} N - m^2 C^{-1}$

D. $4.356 \times 10^6 N - m^2 C^{-1}$

Answer: A

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7. When 1.0×10^{12} electrons are transferred from one conductor to another, a potential difference of 10 V appears between the conductors. Find the capacitance of this two conductor system.

A. $2.32 \times 10^{-4} F$

B. $1.6 \times 10^{-8} F$

C. $1.2 \times 10^{-6} F$

D. None of these

Answer: B

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8. Two parallel plate air capacitors have their plate areas $100 \text{ and } 500 cm^2$ respectively. If they have the same charge and potential and the distance between the plates of the first capacitor of 0.5 mm, what is the distance between the plates of second capacitor ?

A. 0.25 cm

B. 0.52 cm

C. 0.75 cm

D. 1 cm

Answer: A

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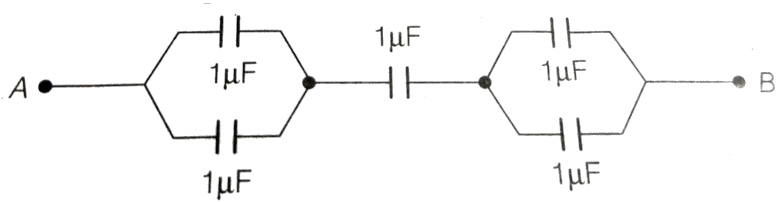
9. The equivalent capacitance between A and B is



A. $2\mu F$

B. $3\mu F$

C. $5\mu F$

D. $0.5\mu F$

Answer: D

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10. A capacitor of capacity $10\mu F$ is subjected to charge by a battery of 10 V. Calculate the energy stored in the capacitor.

A. $2 \times 10^{-7} J$

B. $3 \times 10^{-5} J$

C. $5 \times 10^{-4} J$

D. $8 \times 10^{-6} J$

Answer: C

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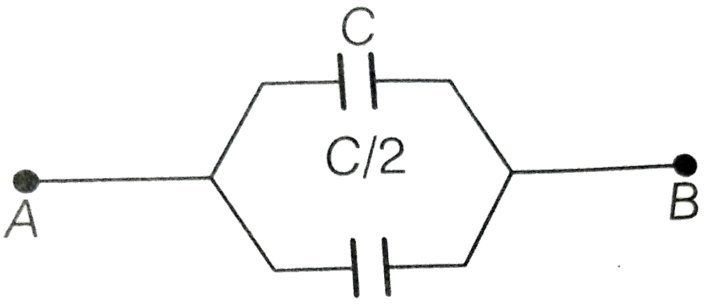
11. Two condenser one of capacity C and other of capacity C/2 are connected to 9 V battery, as shown in figure. The work done in the charging fully both condensers is



A. $1/4CV^2$

B. $2CV^2$

C. $3/4CV^2$

D. $1/2CV^2$

Answer: C

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Practice Exercise Exercise 1 Topical Problems

1. Figure shows the electric field lines around three point charges A, B and C. Which charge has the largest magnitude ?

A. Charge A

B. Charge B

C. Charge A and B

D. Charge C

Answer: D

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2. The electrostatic force of repulsion between two positively charged ions carrying equal charge is $3.7 \times 10^{-9} N$, when they are separated by a distance of 5Å. How much electrons are missing from each ion?

A. 10

B. 8

C. 2

D. 1

Answer: C

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3. In figure two positive charges q_2 and q_3 fixed along the Y-axis, exert a net electric force in the $+x$ direction on a charge q_1 fixed along the X-axis. If a positive charge Q is added at (x, 0), foce on q_1

A. will increase along the positive X-axis

B. will decrease along the positive X-axis

C. will point along the negative X-axis

D. will increase but the direction changes, because of the intersection of Q with q_2 and q_3

Answer: A

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4. If a charge on the body is $1nC$, then how many electrons are present on the body?

A. 1.6×10^{-19}

B. 6.25×10^{9}

C. 6.25×10^{27}

D. 6.25×10^{28}

Answer: B

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5. When 10^{14} electrons are removed from a neutral metal sphere , the charge on it becomes

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6. The electric field in the space between the plates of a discharge tube is $3.24 \times 10^4 NC^{-1}$. If mass of proton is 1.67×10^{-27} kg and its charge is $1.6 \times 10^{-19} C$, the force often the proton in the field is

A. $10.4 \times 10^{-15} N$

B. 2.0×10^{-23}

C. $5.40 \times 10^{-15} N$

D. $5.20 \times 10^{-15} N$

Answer: D

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7. There are two charged identical metal spheres A and B repel each other with a force $3 \times 10^{-5} N$. Another identical uncharged sphere C is touched with A and then placed at the mid-point between A and B. Net force on C is

A. $1 \times 10^{-5} N$

B. $2 \times 10^{-5} N$

C. $1.5 \times 10^{-5} N$

D. $3 \times 10^{-5} N$

Answer: C

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8. Pick out the statement which is incorrect?

A. A negative test charge experiences a force opposite to the direction of the field

B. The tangent drawn to a line of force represents the direction of electric field

C. Field lines never intersect

D. The electric lines forms closed loop

Answer: D

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9. Two spheres carrying charges $+6\mu C$ and $+9\mu C$, separated by a distance d, experiences a force of repulsion F. When a charge of

$-3\mu C$ is given to both the spheres and kept at the same distance as before, the new force of repulsion is

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

B. F

C. $\frac{F}{g}$

D. 3F

Answer: A

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10. The insulation property of air breaks down at $E = 3 \times 10^6 \text{volt}/meter$. The maximum charge that can be given to a sphere of diameter $5m$ is approximately (in coulombs)

A. 3 nC

B. 20 nC

C. 1.5 nC

D. 2 nC

Answer: D

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11. The unit of physical quantity obtained by the line integral of electric field is

A. NC^{-1}

B. Vm^{-1}

C. JC^{-1}

D. $C^2N^{-1}m^{-2}$

Answer: C

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12. The work done in carrying a charge q once round a circle of radius r with a charge Q at the centre is

A. $\frac{qQ}{4\pi\varepsilon_0 a}$

B. $\frac{qQ}{4\pi\varepsilon_0 a^2}$

C. $\frac{q}{4\pi\varepsilon_0 a}$

D. zero

Answer: D

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13. Four charges equal to $-Q$ are placed at the four corners fo a square and a charge q is at its centre, If the system is in equilibrium the value of q si

A. $\frac{-Q}{4}(1+2\sqrt{2})$

B. $\frac{Q}{4}(1+2\sqrt{2})$

C. $\frac{-Q}{2}(1+2\sqrt{2})$

D. $\frac{Q}{2}(1+2\sqrt{2})$

Answer: B

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14. Two small conducting spheres of equal radius have charges $+10\mu C$ and $-20\mu C$ respectively and placed at a distance R from each other. They experience force F_1. If they are brought in

contact and separated to the same distance, they experience force F_2. The ratio of F_1 to F_2 is

A. $1:2$

B. $-8:1$

C. $8:1$

D. $-2:1$

Answer: B

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15. Two positive ions , each carrying a charge q , are separated by a distance d.If F is the force of repulsion between the ions , the number of electrons missing from each ion will be (e being the charge on an electron)

A. $\frac{4\pi\varepsilon_0 Fd^2}{e}$

B. $\sqrt{\frac{4\pi\varepsilon_0 Fe^2}{d^2}}$

C. $\sqrt{\frac{4\pi\varepsilon_0 Fd^2}{e^2}}$

D. $\frac{4\pi\varepsilon_0 Fd^2}{e^2}$

Answer: C

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16. A charged particle of mass 0.003 g is held stationary in space by placing it in a downward direction of electric field of $6 \times 10^4 NC^{-1}$. Then, the magnitude of charge is

A. $5 \times 10^{-4} C$

B. $5 \times 10^{-10} C$

C. $5 \times 10^{-6} C$

D. $5 \times 10^{-9} C$

Answer: B

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17. The work done in carrying an electron from point A to a point B in an electric is 10 MJ. The potential difference $(V_B - V_A)$ is then

A. $+2kV$

B. $-2kV$

C. $+200V$

D. None of these

Answer: D

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18. A charge q is placed at the centre of the line joining two equal charges Q. The system of the three charges will be in equilibrium if q is equal to:

A. $-4Q$

B. $-\frac{Q}{4}$

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

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

Answer: B

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19. A point charge q produces an electric field of magnitude $2NC^{-1}$ at a point distance 0.25 m from it. What is the value of charge ?

A. $1.39 \times 10^{-11} C$

B. $1.39 \times 10^{11} C$

C. $13.9 \times 10^{-11} C$

D. $139 \times 10^{11} C$

Answer: A

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20. A hollow metallic sphere of radius 10 cm is given a charge of $3.2 \times 10^{-9} C$. The electric intensity at a point 4 cm from the center is

A. $9 \times 10^{-9} NC^{-1}$

B. $288\ \mathrm{NC}^{-1}$

C. $2.88\ \mathrm{NC}^{-1}$

D. zero

Answer: D

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21. If infinite parallel plane sheet of a metal is charged to charge density σ coulomb per square metre in a medium of dielectric constant K. Intensity of electric field near the metallic surface will be

A. $E = \frac{\sigma}{\varepsilon_0 K}$

B. $E = \frac{K}{3\varepsilon_0}$

C. $E = \frac{\sigma}{2\varepsilon_0 K}$

D. $E = \frac{K}{2\varepsilon_0}$

Answer: C

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22. Three identical charges are fixed at the corners of an equilateral triangle . If the force between any two charges is F, then the net electric force on each will be

A. $\sqrt{2}F$

B. $F\sqrt{3}$

C. 2F

D. 3F

Answer: B

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23. Charge $q_1 = +6.0nC$ is on y-axis at $y = +3cm$ and charge $q_2 = -6.0nC$ is on y-axis at $y = -3cm$. Calculate force on a test charge $q_0 = 2nC$ placed on X-axis at $x = 4cm$.

A. $-51.8\hat{j}\mu N$

B. $+51.8\hat{j}\mu N$

C. $-5.18\hat{j}\mu N$

D. $5.18\hat{j}\mu N$

Answer: A

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24. Two particles of charges $q_1 = +8q$ and $q_2 = -2q$ are placed as shown. At what point away from q_2 on the X-axis, can a

proton be placed so that it is in equilibrium?

A. x = 2L

B. x= 2.5 L

C. x = 3.0 L

D. x = 3.2 L

Answer: A

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25. Figure shows electric field lines in which an electric dipole p is placed as shown in figure. Which of the following statements is correct ?

A. The dipole will not experience any force

B. The dipole will experience a force towards right

C. The dipole will experience a force towards left

D. The dipole will experience a force upwards

Answer: C

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26. Charge q_2 of mass m revolves around a stationary charge q_1 in a circular orbit of radius r. The orbital periodic time of q_2 would be

A. $\left[\frac{4\pi^2 mr^3}{kq_1q_2}\right]^{1/2}$

B. $\left[\frac{kq_1q_2}{4\pi^2 mr^3}\right]^{1/2}$

C. $\left[\frac{4\pi^2 mr^4}{kq_1q_2}\right]^{1/2}$

D. $\left[\frac{4\pi^2 mr^2}{kq_1q_2}\right]^{1/2}$

Answer: A

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27. If 10^{10} electrons are acquired by a body every second, the time required for the body to get a total charge of C will be

A. 2 h

B. 2 days

C. 2 yr

D. 20 yr

Answer: D

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28. The electric potential V at any point x,y,z (all in metre) in space is given by $V = 4x^2$ volt. The electric field at the point $(1m, 0, 2m)$ is .....$\frac{V}{m}$.

A. 8, along negative X-axis

B. 8, along positive X-axis

C. 16, along negative X-axis

D. 16, along positive Z-axis

Answer: A

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29. Among two discs A and B, first have radius 10 cm and charge $10^{-6} - \mu$C and second have radius 30 cm and charge 10^{-5}- C.

When they are touched, charge on both q_A andq_B respectively will, be

A. $q_A = 2.75\mu C, q_B = 3.15\mu C$

B. $q_A = 1.09\mu C, q_B = 1.53\mu C$

C. $q_A = q_B = 5.5\mu C$

D. None of these

Answer: C

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30. A cylinder of radius R and length L is placed in a uniform electric field E parallel to the axis. The total flux for the surface of the cylinder is given by

A. zero

B. $\pi R^2 / E$

C. $2\pi R^2 E$

D. None of the above

Answer: A

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31. q_1, q_2, q_3 and q_4 are point charges located at points as shown in figure and S is the spherical gaussian surface of radius R. Which of the following is true according to the Gauss' theorem?

A. $\oint(E_1 + E_2 + E_3).\, dA = (q_1 + q_2 + q_3)/\varepsilon_0$

B. $\oint(E_1 + E_2 + E_3).\, dA = (q_1 + q_2 + q_3 + q_4)/\varepsilon_0$

C. $\oint(E_1 + E_2 + E_3).\, dA = q_1 + q_2 + q_3/2\varepsilon_0$

D. None of the above

Answer: A

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32. In a region of space, the electric field is given by $\overrightarrow{E} = 8\hat{i} + 4\hat{j} + 3\hat{k}$. The electric flux through a surface of area 100 units in the xy plane is

A. 800 units

B. 300 units

C. 400 units

D. 1500 units

Answer: B

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33. Three identical point charges as shown in figure, are placed at the vertices of an isosceles right angied triangle. Which of the numbered vectors coincides in direction with the electric field at the mid-point M of the hypotenuse?

A. 4

B. 3

C. 2

D. 1

Answer: C

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34. A charge Q is enclosed by a Gaussian spherical surface of radius R. If the radius is doubled, then the outward electric flux will

A. be reduced to half

B. remain the same

C. be doubled

D. increase four times

Answer: B

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35. A charge q is placed at the centre of a cube of side l what is the electric flux passing through two opposite faces of the cube ?

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

B. zero

C. $\frac{6qL^2}{\varepsilon_0}$

D. $\frac{q}{6L^2\varepsilon_0}$

Answer: A

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36. Three infinitely charged sheets are kept parallel to x-y plane having charge densities as shown. Then the value of electric field at P is

A. $\frac{-4\sigma}{\varepsilon_0}\hat{k}$

B. $\frac{4\sigma}{\varepsilon_0}\hat{k}$

C. $\frac{-2\sigma}{\varepsilon_0}\hat{k}$

D. $\frac{2\sigma}{\varepsilon_0}\hat{k}$

Answer: C

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37. In figure $+Q$ charge is located at one of the edge of the cube, then electric flux through cube due to $+Q$ charge is

A. $\frac{+Q}{\varepsilon_0}$

B. $\frac{+Q}{\varepsilon_0}$

C. $\frac{+Q}{4\varepsilon_0}$

D. $\frac{+Q}{8\varepsilon_0}$

Answer: C

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38. A hollow cylinder has a charge q C within it. It ϕ is the electric flux in unit of voltmeter associated with the curved surface B, the flum linked with the plane surface A in unit of V - m will be

A. $\frac{1}{2}\left(\frac{q}{\varepsilon_0}-\phi\right)$

B. $\frac{q}{2\varepsilon_0}$

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

D. $\frac{q}{\varepsilon_0}-\phi$

Answer: A

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39. A charge q is located at the centre of a cube. The electric flux through any face is

A. $\frac{\pi q}{6(4\pi\varepsilon_0)}$

B. $\frac{q}{6(4\pi\varepsilon_0)}$

C. $\frac{2\pi q}{6(4\pi\varepsilon_0)}$

D. $\frac{4\pi q}{6(4\pi\varepsilon_0)}$

Answer: D

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40. A spherical conductor of radius 2 cm is uniformly charged with 3 nC. What is the electric field at a distance of 3 cm from the centre of the sphere?

A. $3 \times 10^6 \mathrm{Vm}^{-1}$

B. $3\mathrm{Vm}^{-1}$

C. $3 \times 10^{4}\mathrm{Vm}^{-1}$

D. $3 \times 10^{-4}\mathrm{Vm}^{-1}$

Answer: C

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41. Five charges $q_!, q_2, q_3, q_4$ and q_5 are fixed at their positions as shown in figure. S is a Gaussian surface.

The Gauss' theorem is given by $\oint E.\, dS = \frac{q}{\varepsilon_0}$

Which of the following statements is correct ?

A. E on the LHS of the above equation will have a contribution from q_1, q_5 and q_3 while q on the RHS will have a

contribution from q_2 and q_4 only

B. E on the LHS of the above equaiton will have a contribution from q_2 and q_3 only

C. E on the LHS of the above equation will have a contribution from all charges, while q on the RHS will have a contribution from q_2 and q_4 only

D. Both E on the LHS and q on the RHS will have contributions from q_2 and q_4 only

Answer: C

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42. Shown below is a distribution of charges. The flux of electric field due to these charges through the surface is

A. $3q/\varepsilon_0$

B. zero

C. $2q/\varepsilon_0$

D. q/ε_0

Answer: B

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43. Two electric dipoles of moment P and $64P$ are placed in opposite direction on a line at a distance of $25cm$. The electric field will be zero at point between the dipoles whose distance from the dipole of moment P is

A. 10 cm

B. 5 cm

C. 8 cm

D. 20 cm

Answer: B

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44. The electric flux of Gaussian surface A that encloses that charged particles in free is

(Given, $q_1 = -14nC, q_2 = 78.85nC, q_3 = -56nC$)

A. $10^3 Nm^2 C^{-1}$

B. $10^3 CN^{-1} C^{-2}$

C. $6.32 \times 10^3 Nm^2 C^{-1}$

D. $6.32 \times 10^3 CN^{-1}m^{-2}$

Answer: A

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45. Figure shows the portions of the infinite parallel non-conducting sheets having the magnitude of the surface charge densities $\sigma_{(+)} = 6.8\mu Cm^2$ and $\sigma_{(-)} = 4.3\mu Cm^2$ for the positively and negatively charged sheets, respectively. Find the electric field E between the sheets.

A. $6.3 \times 10^5 \mathrm{NC}^{-1}$ towards right

B. $6.3 \times 10^5 \mathrm{NC}^{-1}$ towards left

C. $1.14 \times 10^{-5} \mathrm{NC}^{-1}$ towards right

D. $1.14 \times 10^5 \mathrm{NC}^{-1}$ towards left

Answer: C

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46. The electric flux through a chlosed surface area S enclosing charge Q is ϕ. If the surface area is doubled, then the flux is

A. 2ϕ

B. $\phi/2$

C. $\phi/4$

D. ϕ

Answer: D

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47. For a given surface the Gauss's law is stated as $\oint \vec{E} \cdot d\vec{A} = 0$. From this we can conclude that

A. E is necessarily zero on the surface

B. E is perpendicular to the surface at every point.

C. The total flux through the surface is zero

D. The flux is only going out ot the surface

Answer: A

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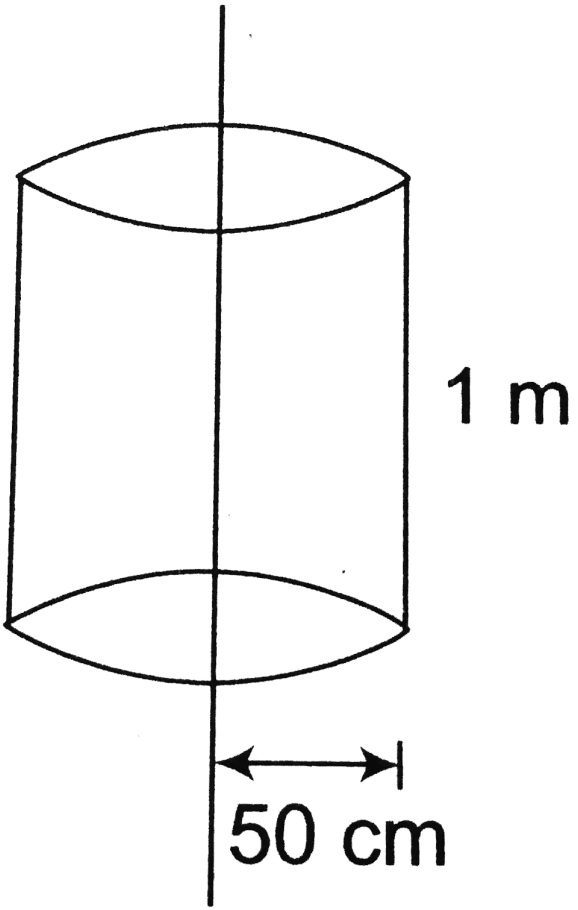
48. Electric charge is uniformly distributed along a along straight wire of radius $1mm$. The charge per centimeter length of the wire is Q coulomb. Another cyclindrical surface of radius $50cm$ and length $1m$ symmetrically enclose the wire ask shown in figure. The

total electric flux passing through the cyclindrical surface is



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

B. $\frac{100Q}{\varepsilon_0}$

C. $\frac{10Q}{\pi\varepsilon_0}$

D. $\frac{100Q}{\pi\varepsilon_0}$

Answer: B

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49. The inward and outward electric flux for a closed surface unit of $N - m^2/C$ are respectively 8×10^3 and 4×10^3. Then the total charge inside the surface is [where $\varepsilon_0 =$ permittivity constant]

A. $4 \times 10^3 C$

B. $-4 \times 10^3 C$

C. $\left(\frac{-4 \times 10^3}{\varepsilon}\right) C$

D. $-4 \times 10^3 \varepsilon_0 C$

Answer: D

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50. The electric charges are distributed in a small volume. The flux of the electric field through a spherica surface of radius 10 cm surrounding the total charge is $20V - m$. The flux over a concentric sphere of radius 20 cm will be

A. 20 V-m

B. 25 V-m

C. 40 V-m

D. 200 V-m

Answer: A

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51. If the electric field given by $\left(5\hat{i}+4\hat{j}+9\hat{k}\right)$, then the electric flux through a surface of area 20 unit lying in the yz- plane will be

A. 100 unit

B. 80 unit

C. 180 unit

D. 20 unit

Answer: A

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52. Two capacitors having capacitances C_1 and C_2 are charged with 120 V and 200 V batteries respectively. When they are connected in parallel now, it is found that the potential on each one of them is zero. Then,

A. $5C_1 = 3C_2$

B. $3C_1 = 5C_2$

C. $3C_1 \pm 5C_2 = 0$

D. $9C_1 = 4C_2$

Answer: C

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53. A parallel plate capacitor is charged and then isolated. The effect of increasing the plate separation on charge, potential and capacitance respectively are

A. constant, decrease, increase

B. constant, decrease, decrease

C. constant, increase, decrease

D. increase, decrease, decrease

Answer: C

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54. Conducting sphere of radius R_1 is covered by concentric sphere of radius R_2. Capacity of this combination is proportional to

A. $\frac{R_2 - R_1}{R_1 R_2}$

B. $\frac{R_2 + R_1}{R_1 R_2}$

C. $\frac{R_1 R_2}{R_1 + R_2}$

D. $\frac{R_1 R_2}{R_2 - R_1}$

Answer: D

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55. The amount of work done in increasing the voltage across the plates of capacitor from 5 V to 10 V is W. The work done in increasing it from 10 V to 15 V will be

A. 0.6 W

B. 1 W

C. 1.25 W

D. 1.67 W

Answer: D

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56. A parallel-plate capacitor is connected to a battery. A metal sheet of negligible thickness is placed between the plates. The

sheet remains parallel to the plates of the capacitor.

A. Equal and opposite charge will appear in the forces of metal sheet

B. Capacity remain same

C. Potential difference between the plates will increase

D. Battery supplies more charge

Answer: B

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57. A parallel plate air capacitor consists of two circular plates of diameter $8cm$. At what distance should the plates be held so as to have the same capacitance as that of a sphere of a diameter $20cm$?

A. $4 \times 10^{-3} m$

B. $1 \times 10^{-3} cm$

C. $1 \times 10^{-2} cm$

D. $1 \times 10^{-3} m$

Answer: D

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58. A parallel plate capacitor is made by stacking n equally spaced plates connected alternatively. If the capacitance between any two adjacent plates is 'C' then the resultant capacitance is

A. nm

B. n/m

C. nn^2

D. $(n-1)x$

Answer: D

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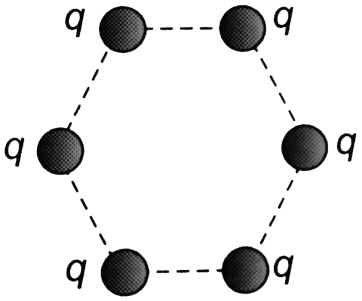
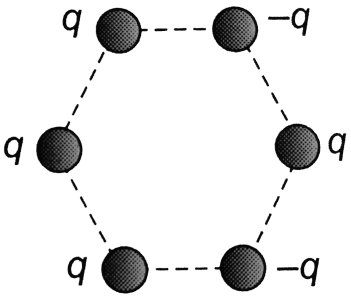
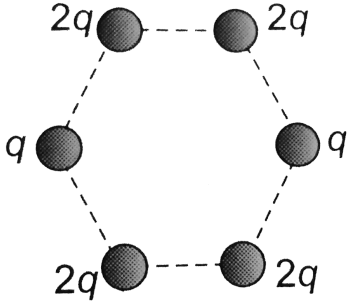
59. Figure below show regular hexagons with charges at the vertices. In which of the following cases the electric field at the centre is not zero



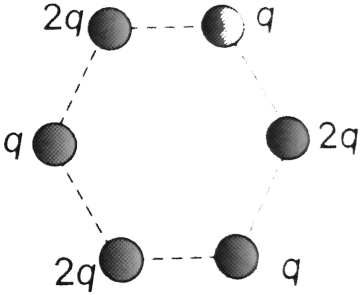
Case (1)



Case (2)



Case (3)



Case (4)

A.

B.

C.

D.

Answer: A

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60. A parallel plate condenser has a unifrom electric field $E(V/m)$ in the space between the plates. If the distance between the plates is $d(m)$ and area of each plate is $A\left(m^2\right)$ the energy (joule) stored in the condenser is

A. $\frac{1}{2}\varepsilon_0 E^2$

B. $\varepsilon_0 EAd$

C. $\frac{1}{2}\varepsilon_0 E^2 Ad$

D. $E^2 Ad/\varepsilon_0$

Answer: C

Watch Video Solution

61. A parallel plate condenser is charged by connected it to a battery. The battery is disconnected and a glass slab is introduced between the plates. Then

A. charge and potential difference

B. charge and capacitance

C. capacitance and potential difference

D. energy stored and potential difference

Answer: D

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62. A capacitor or capacitance C_1 is charge to a potential V and then connected in parallel to an uncharged capacitor of

capacitance C_2. The fianl potential difference across each capacitor will be

A. $\frac{C_1 V}{C_1 + C_2}$

B. $\frac{C_2 V}{C_1 + C_2}$

C. $1 + \frac{C_2}{C_1}$

D. $1 - \frac{C_2}{C_1}$

Answer: A

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63. How many $1\mu F$ capacitors must be connected in parallel to store a charge of 1 C with a potential of 110 V across the capacitors?

A. 990

B. 900

C. 9090

D. 909

Answer: C

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64. The $500\mu F$ capacitor is charged at a steady rate of $100\mu C/s$. The potential difference across the capacitor will be 10 V after an interval of

A. 5 s

B. 10 s

C. 50 s

D. 100 s

Answer: C

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65. A parallel plate air capacitor of capacitance C is connected to a cell of $emFV$ and then disconnected from it. A dielectric slab of dielectric constant K, which can just fill the air gap of the capacitor, is now inserted in it. Which of the following is incorrect ?

A. The potential difference between the plates decreases K times

B. The energy stored in the capacitor decreases K times

C. The change in energy is $\frac{1}{2}C_0V^2(K-1)$

D. The change is energy is $\frac{1}{2}C_0V^2\left(\frac{1}{K}-1\right)$

Answer: D

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66. The radii of the inner and outer spheres of a condenser are 9 cm and 10 m respectively. If the dielectric constant of the medium between the two sphere is 6 and charge on the inner sphere is $18 \times 10^{-9} C$, then the potential of inner sphere will be, if the other sphere is earthed

A. 180 V

B. 30 V

C. 18 V

D. 90 V

Answer: B

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67. An unchanged capacitor with a solid dielectric is connected to a similar air capacitor charged to a potential of V_0.. If the common potential after sharing of charges becomes V, then the dielectric constant of the dielectric must be

A. V_0 / V

B. $\frac{V}{V_0}$

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

D. $\frac{(V_0 - V)}{V_0}$

Answer: C

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68. Two insulated metal spheres of raddi 10 cm and 15 cm charged to a potential of 150 V and 100 V respectively, are connected by means of a metallic wire. What is the charge on the first sphere?

A. 2 esu

B. 4 esu

C. 6 esu

D. 8 esu

Answer: B

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69. The mean electric energy density between the plates of a charged capacitor is (here $q =$ charge on the capacitor and $A =$ area o fthe capacitor plate)

A. $\frac{q^2}{2\varepsilon_0 A^2}$

B. $\frac{q}{2\varepsilon_0 A^2}$

C. $\frac{q^2}{2\varepsilon_0 A}$

D. None of these

Answer: A

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70. A $10\mu F$ capacitor is charged to a potential difference of $50V$ and is connected to another uncharged capacitor in parallel. Now the common potential difference becomes 20 volt. The capacitance of second capacitor is

A. $10\mu F$

B. $20\mu F$

C. $30\mu F$

D. $15\mu F$

Answer: D

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71. n small drops of same size are charged to V volts each .If they coalesce to from a single large drop, then its potential will be -

A. Vn

B. Vn^{-1}

C. $Vn^{1/3}$

D. $Vn^{2/3}$

Answer: D

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72. Potential energy of two equal negative point charges $2\mu C$ each held 1 m apart in air is

A. 2 J

B. 2 eV

C. 4 J

D. 0.036 J

Answer: D

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

A. $16 \times 10^{-32} J$

B. $31 \times 10^{-26} J$

C. $4 \times 10^{-10} J$

D. $32 \times 10^{-32} J$

Answer: D

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74. The capacitance of a parallel plate capacitor with air as medium is $3\mu F$. With the introduction of a dielectric medium between the plates, the capacitance becomes $15\mu F$. The permittivity of the medium is

A. $5C^2N^{-1}m^{-2}$

B. $15C^2N^{-1}m^{-2}$

C. $0.44 \times 10^{-10} C^2 N^{-1} m^{-2}$

D. $8.845 \times 10^{-11} C^2 N^{-1} m^{-2}$

Answer: C

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75. Energies stored in capacitor and dissipated during charging a capacitor bear a ratio

A. $1:1$

B. $1:2$

C. $1:1/2$

D. $2:1$

Answer: a

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76. A copper plate of thickness b is placed inside a parallel plate capacitor of plate distance d and area A, as shwon 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. infinity

Answer: C

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77. In 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. 2.5 V, 7.5 V

B. 2 V, 8 V

C. 7.5 V, 2.5 V

D. 8 V, 2 V

Answer: C

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

D. 3C

Answer: B

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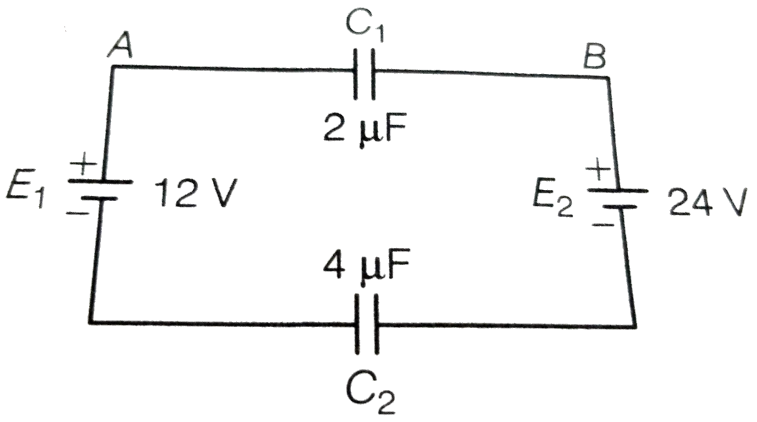
79. Two capacitors C_1 and C_2 are connected in a circuit as shown in figure. The potential difference $(V_A - V_B)$ is



A. 8 V

B. $-8V$

C. 12 V

D. $-12V$

Answer: B

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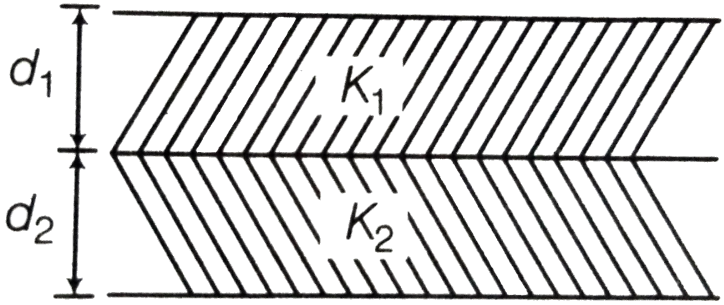
80. A parallel plate capacitor is made of two dielectric block in series. One of the blocks has thickness d_1 and dielectric constant

K_1 and the other has thickness d_2 and dielectric constant K_2 as shown in figure. This arrangement can be thought as a dielectric slab of thickness $d(= d_1 + d_2)$ and effective dielectric constant K. The K is equal to



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

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

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

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

Answer: C

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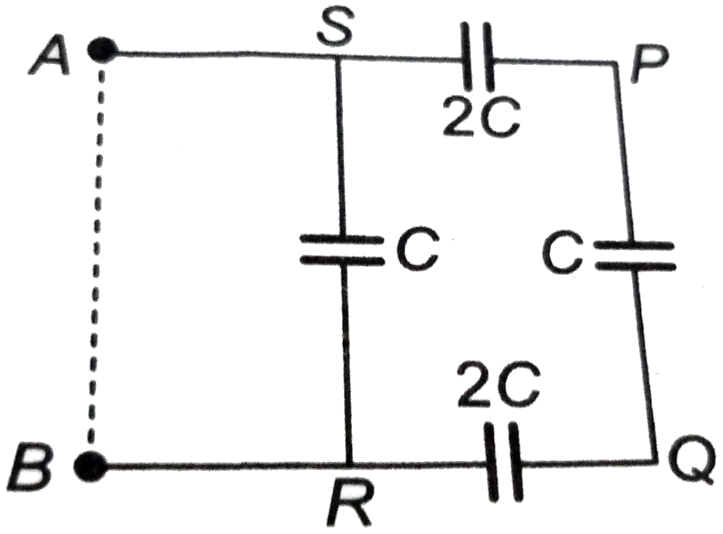
81. In the circuit shown, a potential difference of 90 V is appllied across AB. The potential difference between the points P and Q is



A. 15 V

B. 30 V

C. 45 V

D. 60 V

Answer: C

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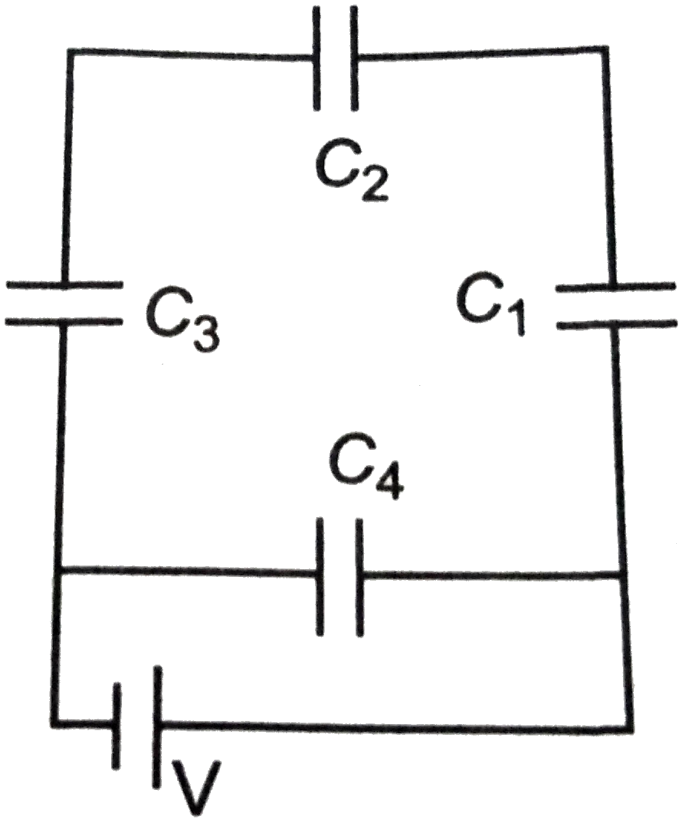
82. A network of four capacitors of capacities equal to $C_1 = C, C_2 = 2C, C_2 = 3C$ and $C_4 = 4C$ are connected to a battery as shown in the figure.



The ratio of the charges C_2 and C_4 is

A. $\frac{22}{3}$

B. $\frac{3}{22}$

C. $\frac{7}{4}$

D. $\frac{4}{7}$

Answer: B

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83. A series combination of n_1 capacitors, each of value C_1, is charged by a source of potential difference $4V$. When another parallel combination of n_2 capacitors, each of value C_2, is charged by a source of potential difference V, it has same (total) energy stored in it, as the first combination has. the value of C_2, in terms of C_1, is then

A. $\frac{2C_1}{n_1 n_2}$

B. $16\frac{n_1}{n_2}C_1$

C. $2\frac{n_2}{n_1}C_1$

D. $\frac{16C_1}{n_1n_2}$

Answer: D

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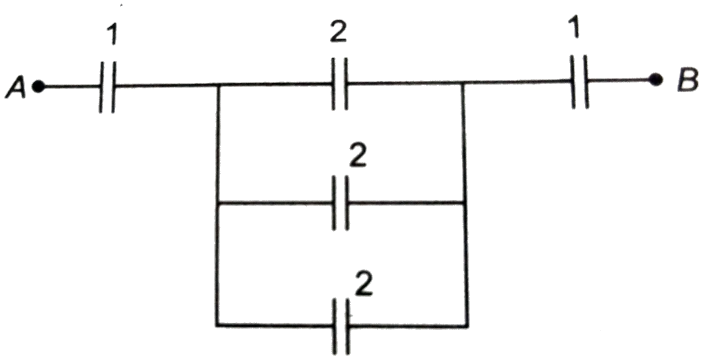
84. In the connections shown in the adjoining figure, the equivalent capacity between points A and B will be



A. $\frac{13}{6}$

B. $\frac{6}{13}$

C. 6

D. 13

Answer: A

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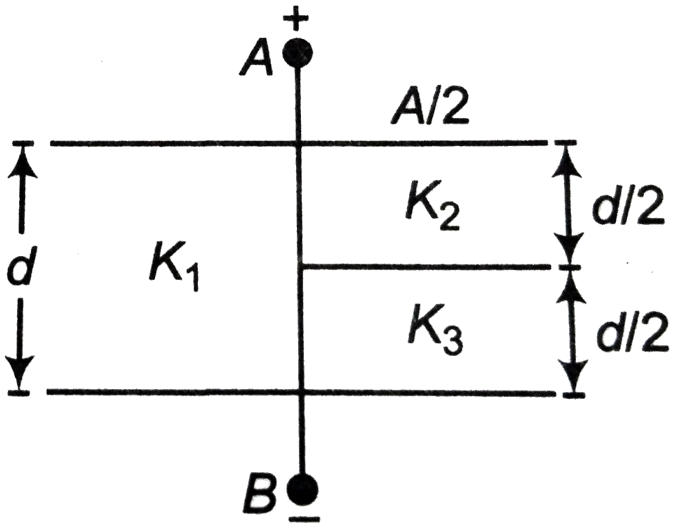
85. Parallel plate capacitor is constructed using three different dielectric materials as shown in the figure.

The parallel plates, across with a potential difference is applied of area A metre^2 and separated by a distance d metre. The

capacitance across A and B is



A. $\frac{\varepsilon_0 A}{d}\left[\frac{K_1}{2}+\frac{K_2K_3}{K_2+K_3}\right]$

B. $\frac{\varepsilon_0 A}{d}\left[\frac{K_1}{2}+\frac{K_2+K_3}{K_2K_3}\right]$

C. $\frac{\varepsilon_0 A}{d}\left[\frac{2}{K_1}+\frac{K_2K_3}{K_2+K_3}\right]$

D. $\frac{\varepsilon_0 A}{d}\left[\frac{2}{K_1}+\frac{K_2+K_3}{K_1K_3}\right]$

Answer: A

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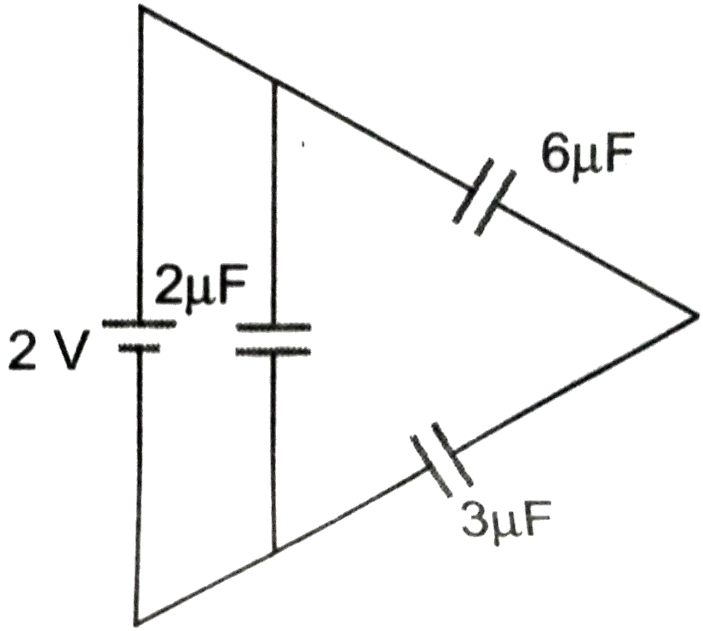
86. The total energy stored in the condenser system shown in the figure will be



A. $2\mu J$

B. $4\mu J$

C. $8\mu J$

D. $16\mu J$

Answer: C

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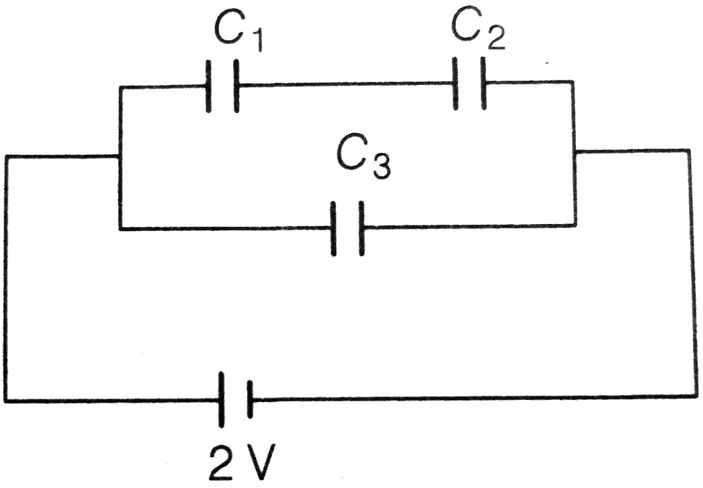
87. Two capacitor $C_1 = 2\mu F$ and $C_2 = 6\mu F$ are in series order connected is parallel to a third capacitor $C_3 = 4\mu F$. This combination is connected to 2 V battery. In charging these capacitor energy consumed by the battery is



A. $2 \times 10^{-6} J$

B. $11 \times 10^{6} J$

C. $\frac{32}{3} \times 10^{-6} J$

D. $\frac{16}{3} \times 10^{-6} J$

Answer: B

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Practice Exercise Exercise 2 Miscellaneous Problems

1. In $1g$ of a solid, there are 5×10^{21} atoms. If one electrons is removed from each of 0.01% atoms of the solid, find the charge gained by the solid (given that electronic charge is $1.6 \times 10^{19} C$).

A. $+0.08C$

B. $+0.8C$

C. $-0.08C$

D. $-0.8C$

Answer: A

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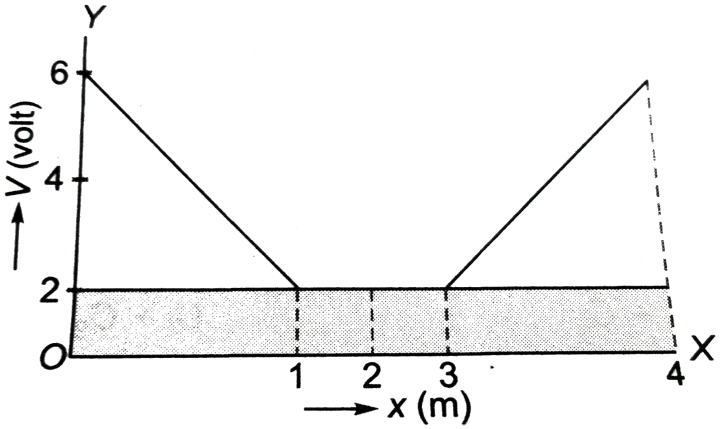
2. The variation of electric potential with distance from a fixed point is shown in the figure. What is the value of electric filed at x = 2 m?



A. Zero

B. $6/2$

C. $6/1$

D. $6/3$

Answer: A

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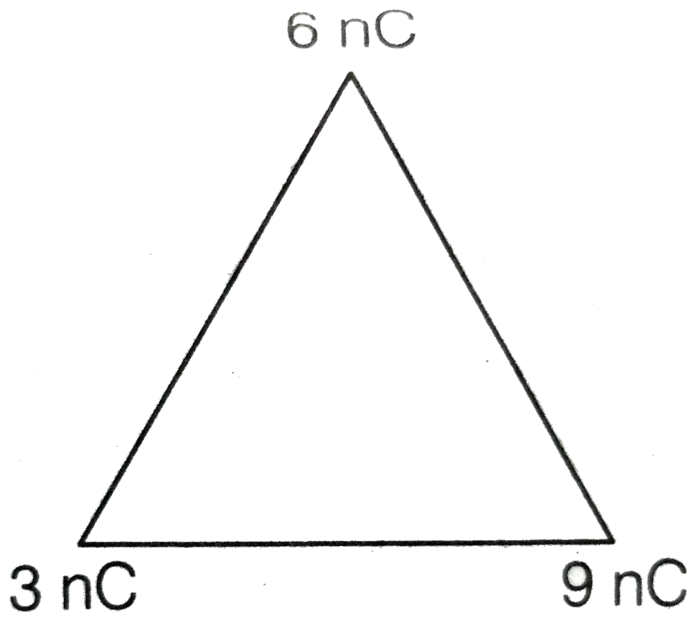
3. Three point charges 3nC, 6nC and 6nC are placed at the corners of an equilateral triangle of side 0.1 m. The potential energy of the system is



A. 9910 J

B. $8.91\mu J$

C. $99100J$

D. $89100J$

Answer: B

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4. 100 capacitors each having a capacity of $10\mu F$ are connected in parallel and are charged by a potential difference of $100kV$. The energy stored in the capacitors and the cost of charging them, if electrical energy costs 108 paise per kWh, will be

A. 10^7 and 300 paise

B. $5 \times 10^6 J$ and 300 paise

C. $5 \times 10^6 J$ and 150 paise

D. $10^7 J$ and 750 paise

Answer: C

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5. The electric field in a certain region is acting radially outwards and is given by $E = Ar$. A charge contained in a sphere of radius $'a'$ centred at the origin of the field, will given by

A. $4\pi\varepsilon_0 Aa^2$

B. $A\varepsilon_0 a^2$

C. $A\pi\varepsilon_0 Aa^3$

D. $\varepsilon_0 Aa^3$

Answer: C

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6. A large insulated sphere of radius r charged with Q units of electricity is placed in contact with a small insulated uncharged sphere of radius r' and is then separated. The charge on the smaller sphere will now be.

A. $Q(r + r')$

B. $Q(r - r')$

C. $\frac{Q}{r' + r}$

D. $\frac{Qr'}{r' + r}$

Answer: D

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7. A charge of magnitude Q is divided into two parts q and $(Q-q)$ such that the two parts exert maximum force on each other. Calculate the ratio Q/q.

A. Q

B. $\frac{3Q}{4}$

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

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

Answer: C

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8. An infinite line charge produces a field of $9 \times 10^{-4} N \quad C^{-1}$ at a distance of 2 cm. calculate the linear charge density.

A. $10^{-3} Cm^2$

B. $10^{-4}Cm^2$

C. $10^{-5}Cm^2$

D. $10^{-7}Cm^2$

Answer: D

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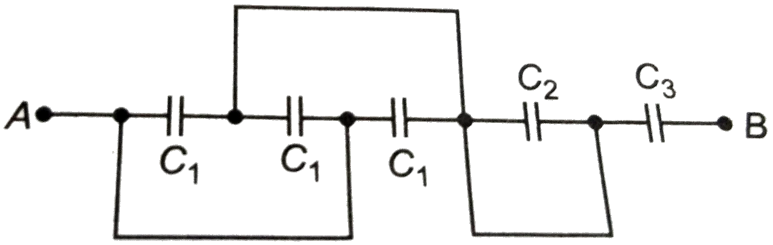
9. A circuit is shown in figure for which $C_1 = (3 \pm 0.011)\mu F, C_2 = (5 \pm 0.01)\mu F$ and $C_3 = (1 \pm 0.01)\mu F$.

If C is the equivalent capacitance across AB, then C is given by



A. $(0.9 \pm 0.114)\mu F$

B. $(0.9 \pm 0.01)\mu F$

C. $(0.9\mu 0.023)\mu F$

D. $(0.9\mu 0.09)\mu F$

Answer: C

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10. Charges $+2Q$ and $-Q$ are placed as shown in figure. The point at which electric field intensity is zero, will be

A. Somewhere between $-Q$ and $+2Q$

B. somewher on the left of $-Q$

C. somewhere on the right of $+2Q$

D. somewhere on the right bisector of line joining $-q$ and $+2Q$

Answer: B

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11. The electric field at the centre of a square having equal charge q at each of the coner (side of square a)

A. $\frac{8kq}{a^2}$

B. $\frac{2kq}{a^2}$

C. zero

D. $\frac{4kq}{\left(a/\sqrt{2}\right)^2}$

Answer: C

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12. Two point charge $-q$ and $+q/2$ are situated at the origin and the point $(a, 0, 0)$ respectively. The point along the X-axis where the electic field Vanishes is

A. $x = \frac{\sqrt{2}a}{\sqrt{2}-1}$

B. $X = \sqrt{2}a - \sqrt{2} - 1$

C. $x = \left(\sqrt{2}-1\right)\sqrt{2}a$

D. None of these

Answer: A

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13. A ball of mass 1 kg carrying a charge $10^{-8}C$ moves from a point A at potential 600 V to a point B at zero potential. The change in its kinetic energy is

A. $-6 \times 10^{-6}\text{erg}$

B. $-6 \times 10^{-6}J$

C. $6 \times 10^{-6}J$

D. $6 \times 10^{-6}\text{erg}$

Answer: C

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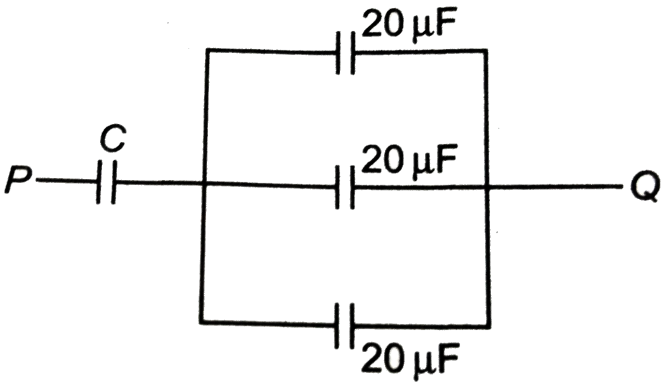
14. If the equivalent capacitance between points P and Q of the combination of the capacitors hown in figure below is $30\mu F$, the

capacitor C is



A. $60\mu F$

B. $30\mu F$

C. $10\mu F$

D. $5\mu F$

Answer: A

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15. An electric field is given by $E = \left(y\hat{i} + x\hat{j}\right)NC^{-1}$. The work done in moving a 1C charge from $r_A = \left(2\hat{i} + 2\hat{j}\right)m$ to $r_B = \left(4\hat{i} + 2\hat{j}\right)m$ is

A. 2y

B. 3y

C. zero

D. infinity

Answer: A

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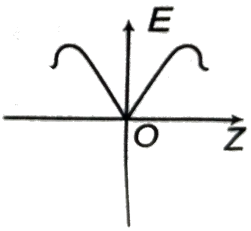
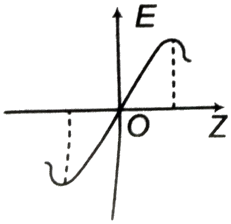
16. A circular ring carries a uniformly distributed positive charge and lies in the xy plane with center at the origin of the

cooredinate system. If at a point (0,0,z) the electric field is E, then which of the following graphs is correct?

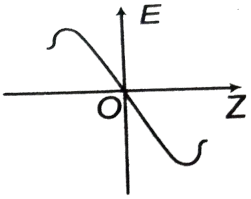
A.



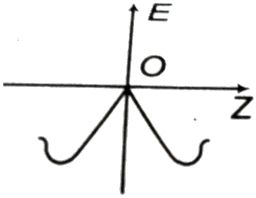
B.



C.



D.



Answer: B

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17. A conducting sphere of radius 5 cm has an unknown charge. The electric field at 10 cm from the centre of the sphere is $1.8 \times 10^3 NC^{-1}$ and points radially inward. What is the net charge on the sphere?

A. $1.8nC$

B. $2nC$

C. $1nC$

D. $1.5nC$

Answer: B

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18. Charge Q is given by the displacement $r = a\hat{i} + b\hat{j}$ in an electrif field $E = E_1\hat{i} + E_2\hat{j}$. The work done is

A. $Q((E_1a) + (E_2b))$

B. $Q\sqrt{(E_1a)^2 + (E_2b)^2}$

C. $Q(E_1 + E_2)\sqrt{a^2 + b^2}$

D. $Q\left(\sqrt{E_1^2 + E_2^2}\right)\sqrt{a^2 + b^2}$

Answer: A

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19. If the electric flux entering and leaving an enclosed surface respectively is ϕ_1 and ϕ_2, the electric charge inside the surface will be

A. $\frac{\phi_2 - \phi_1}{\varepsilon_0}$

B. $\frac{\phi_1 + \phi_2}{\varepsilon_0}$

C. $\frac{\phi_1 - \phi_2}{\varepsilon_0}$

D. $\varepsilon_0(\phi_1 + \phi_2)$

Answer: D

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20. The capacitance of a capacitor between$4/3$ times its original value if a dielectric slab of thickness $t = d/2$ is inserted between the plates (d is the separation between the plates). What is the dielectric consant of the slab?

A. 6

B. 8

C. 2

D. 4

Answer: C

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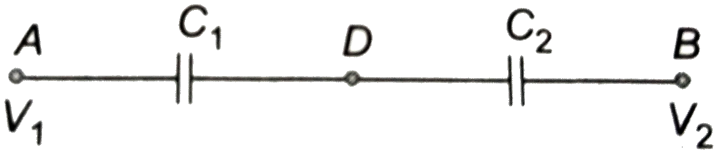
21. Two condensers C_1 and C_2 in a circuit are joined as shown in the figure. The potential of point A is V_1 and that of B is V_2. The potential of point D will be



A. $\frac{1}{2}(V_1 + V_2)$

B. $\frac{C_1V_2 + C_2V_1}{C_1 + C_2}$

C. $\frac{C_1V_1 + C_2V_2}{C_1 + C_2}$

D. $\frac{C_2V_1 - C_1V_2}{C_1 + C_2}$

Answer: B

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22. Two charges placed in air repel each other by a force of $10^{-4}N$. When oil is introduced between the charges, then the force becomes $2.5 \times 10^{-5}N$

The dielectric constant of oil is

A. 2.5

B. 0.25

C. 2

D. 4

Answer: D

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23. Five balls numbered 1,2,3,4,and 5 are suspended using separated threads. The balls (1,2),(2,4) and (4,1) show electrostatic attraction while balls (2,3) and (4,5) show repulsion. Therefore, ball 1 must be

A. positively charged

B. negatively charged

C. neutral

D. None of the above

Answer: D

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24. The angle between the dipole moment and electric field at any point on the equatorial plane is

A. 180°

B. 0°

C. 45°

D. 90°

Answer: A

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25. The electric field at point (30, 30, 0) due to a charge $0.008\mu C$ at origin will be (coordinates are in cm)

A. $8000NC^{-1}$

B. $4000\left(\hat{i}+\hat{j}\right)NC^{-1}$

C. $200\sqrt{2}\left(\hat{i}+\hat{j}\right)NC^{-1}$

D. $400\sqrt{2}\left(\hat{i}+\hat{j}\right)NC^{-1}$

Answer: C

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26. The electric field strength due to a circular loop of charge of radius R are uniform linear density of charge λ, at its centre is proportonal to

A. λR

B. λ / R

C. λ / R^2

D. None of these

Answer: D

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27. A 400 pF capacitor, charged by a 100 volt d.c supply is disconnected from the supply and connected to another uncharged 400 pF capacitor. Calculate the loss of energy.

A. $10^{-5}J$

B. $10^{-6}J$

C. $10^{-7}J$

D. $10^{-4}J$

Answer: B

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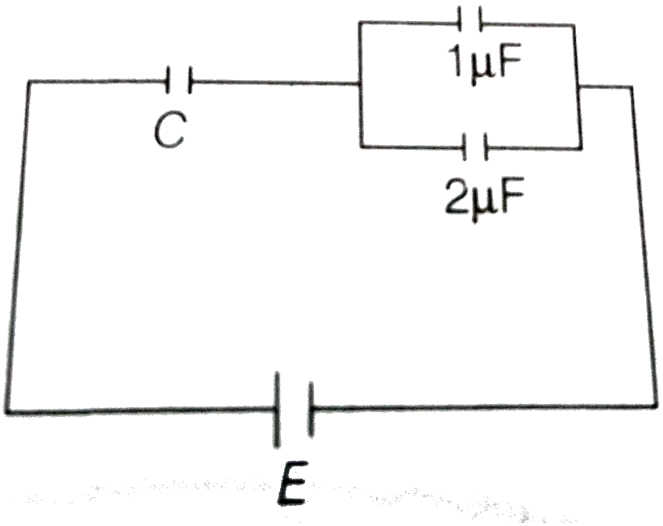
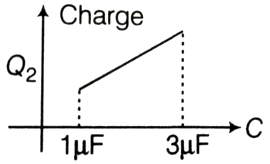
28. In the given circuit, charge Q_2 on the $2\mu F$ capacitor changes as C is varied from $1\mu F$ to $3\mu F$. Q_2 as a function of C is given

property by (figures are drawn schematically and are not to scale)



A.



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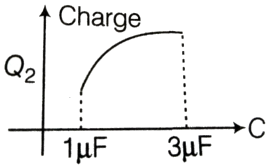

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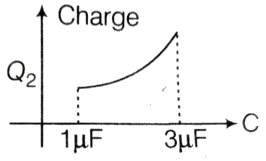

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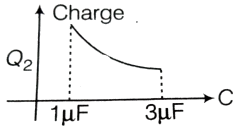

Answer: C

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29. Two capacitors of capacitance C are connected in series. If one of them is filled with dielectric substance K, what is the effective capacitance?

A. $\frac{KC}{(1+K)}$

B. $C(K+1)$

C. $\frac{2KC}{1+K}$

D. None of the above

Answer: A

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30. Two positive point charges of 12 and 5 microcoulombs, are placed 10 cm apart in air. The work needed to bring them 4 cm closer is

A. 2.4 J

B. 3.6 J

C. 1.6 J

D. 6.0 J

Answer: B

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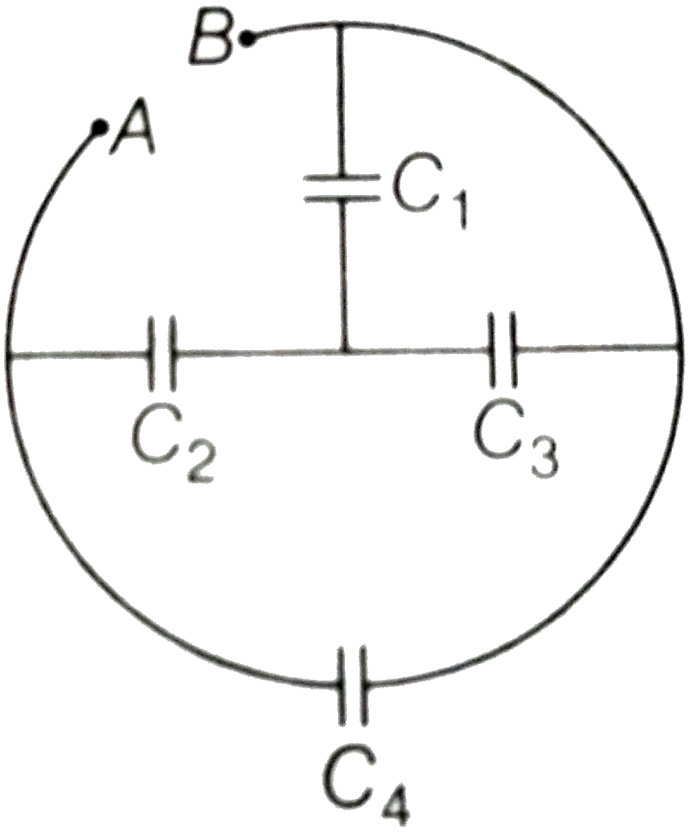
31. In the arrangement of capacitors shown in the figure, each capacitor is of $9\mu F$, then the equivalent capacitance between the

point A and B is



A. $9\mu F$

B. $18\mu F$

C. $4.5\mu F$

D. $15\mu F$

Answer: D

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32. The enrgy of a charged capacitor is U. Another identical capacitor is connected parallel to the first capacitor, after disconnecting the battery. The total energy of the system of these capacitors will be

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

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

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

D. $\frac{2U}{4}$

Answer: B

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33. Two identical parallel plate capacitors are placed in series and connected to a constant voltage source of V_0 volt. If one of the capacitors is completely immersed in a liquid with dielectric constant K, the potential difference between the plates of the other capacitor will change to -

A. $\frac{K}{K+1}V$

B. $\frac{K+1}{K}$

C. $\frac{2K}{K+1}$

D. $\frac{K+1}{2K}V$

Answer: A

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34. How many $6\mu F, 200V$ condensers are needed to make a condenser of $18\mu F, 600?$

A. 9

B. 18

C. 3

D. 27

Answer: D

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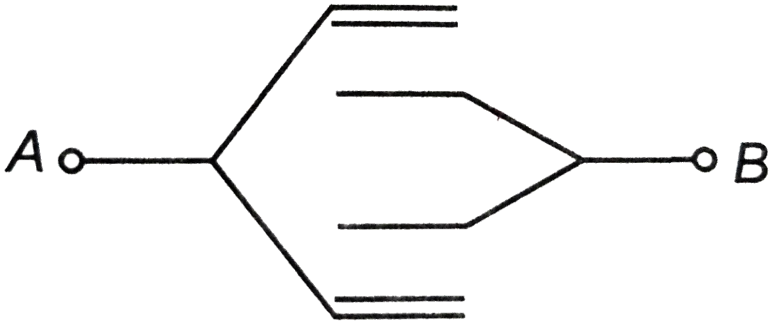
35. Four plates of equal area A are separated by equal distance d and are arranged as shown in the figure. The equivalent capacity



A. $\frac{2\varepsilon_0 A}{d}$

B. $\frac{3\varepsilon_0 A}{d}$

C. $\frac{3\varepsilon_0 A}{2d}$

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

Answer: A

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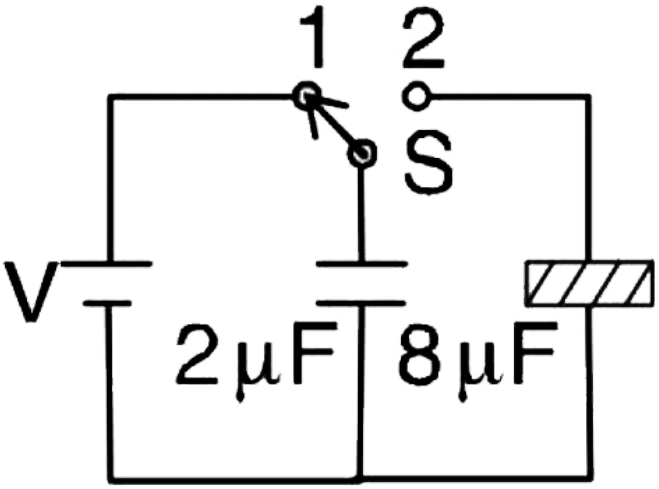
36. A $2\mu F$ capacitor is charged as shown in the figure. The percentage of its stored energy disispated after the switch S is

turned to poistion 2 is



A. 0 %

B. 20 %

C. 75 %

D. 80 %

Answer: D

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37. The capacitance of an isolated conducting sphere of radius R is proportional to

A. R^{-1}

B. R^2

C. R^{-2}

D. R

Answer: D

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38. Three capacitors $3\mu F, 6\mu F$ and $6\mu F$ are connected in series to a source of 120 V. The potential difference, energy stored and charge of a parallel plate capacitor respectively. The quantities

that increase when a dielectric slab is introduced between the plates without disconnecting the battery are

A. 24

B. 30

C. 40

D. 60

Answer: D

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39. C, V, U and Q are capacitance, potential difference, energy stored and charge of parallel plate capacitor respectively. The quantities that increase when a dielectric slab is introduced between the plates without disconnecting the battery are

A. V and C

B. V and U

C. U and Q

D. V and Q

Answer: C

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40. If dielectric is inserted in charged capacitor (battery removed), then quantity that remains constant is

A. capacitance

B. potential

C. intensity

D. charge

Answer: D

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41. A capacitor of capacitance $10\mu F$ charged to 100V is connected to an uncharged capacitor. The effective potential now is 40 V. The capacitance on uncharged capacitor is

A. $12\mu F$

B. $15\mu F$

C. $25\mu F$

D. $30\mu F$

Answer: B

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42. A parallel plate capacitor is made of two circular plates separated by a distance 5mm and with a dielectric of dielectric constant 2.2 between them. When the electric field in the dielectric is $3 \times 10^4 V/m$ the charge density of the positive plate will be close to:

A. $6 \times 10^{-7} Cm^{-2}$

B. $3 \times 10^{-7} \mathrm{Cm}^{-2}$

C. $3 \times 10^4 \mathrm{Cm}^{-2}$

D. $6 \times 10^4 \mathrm{Cm}^{-2}$

Answer: A

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43. Two capacitors of $10pF$ and $20pF$ are connected to 200 V and 100 V sources, respectively. If they are connected by the wire, then

what is the common potential of the capacitors?

A. 133.3 V

B. 150 V

C. 300 V

D. 400 V

Answer: A

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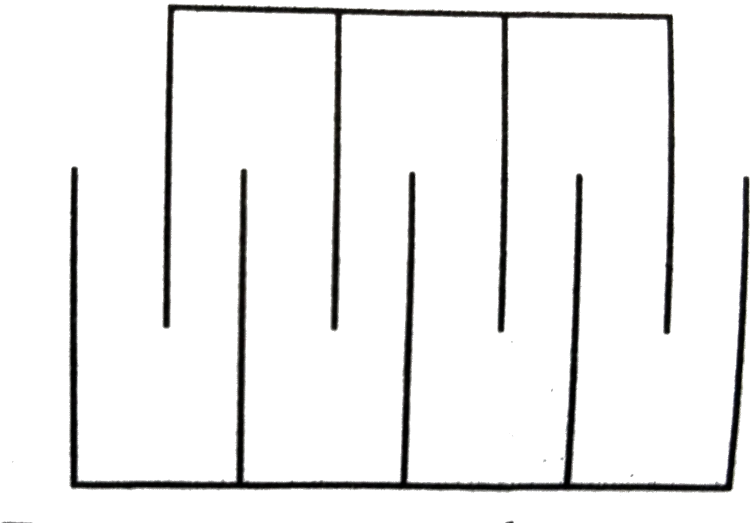
44. A gang capacitor is formed by interlocking a number of plates as shown in figure. The distance between the consecutive places is 0.885 cm and the overlapping area of the plates is $5cm^2$. The

capacity of the unit is



A. 1.06 pF

B. 4 pF

C. 6.36 pF

D. 12.72 pF

Answer: B

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45. The equivalent capacitance of the combination of the capacitors is :

A. $3.20\mu F$

B. $7.80\mu F$

C. $3.90\mu F$

D. $2.16\mu F$

Answer: A

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46. The radii of two concentric spherical conducting shells are r_1 and $r_2 (> r_1)$. The change on the oute shell is q. The charge on the inner shell which is connected to the earth is

A. $\frac{-r_2}{r_1}$

B. zero

C. $\frac{-r_1}{r_2}q$

D. $-q$

Answer: C

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47. A parallel plate capacitor is located horizontally such that one of the plates is submerged in liquid while the other is above the liquid surface. When plates are charged, the level of liquid.

A. rises

B. falls

C. remains unchanged

D. may rise of fall depending on the amount of a charge

Answer: A

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Mht Cet Corner

1. Three parallel plate air capacitors are connected in parallel. Each capacitor has plate area $\frac{A}{3}$ and the separation between the plates is d, 2d and 3d respectively. The equivalent capacity of combination is (ε_0 = absolute permittivity of free space)

A. $\frac{7\varepsilon_0 A}{18d}$

B. $\frac{1\varepsilon_0 A}{18d}$

C. $\frac{13\varepsilon_0 A}{18d}$

D. $\frac{17\varepsilon_0 A}{18d}$

Answer: B

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2. Two identical parallel plate air capacitors are connected in series to a battery of emf V. If one of the capacitor is completely filled with dielectric material of constant K, then potential difference of the other capacitor will become

A. $\frac{K}{V(K+1)}$

B. $\frac{KV}{K+1}$

C. $\frac{K-1}{KV}$

D. $\frac{V}{K(K+1)}$

Answer: B

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3. The differeence in the effective capacity of two similar capacitor when joined in series and then in paralllel is 6 μ F the capacity of each capacitor is

A. $2\mu F$

B. $4\mu F$

C. $8\mu F$

D. $16\mu F$

Answer: B

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4. The electric field intensity at point near and outside the surface of a charged conductor of any shape is E_1 the electric field intensity due to uniformly charged infinite thin plane sheet is E_2 the relation between E_1 and E_2 is

A. $2E_1 = E_2$

B. $E_1 = E_2$

C. $E_1 = 2E_2$

D. $E_1 = 4E_2$

Answer: C

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5. Two concentric spheres kept in air have radii R and r. They have similar charge and equal surface charge density σ. The electrical

potential at their common centre is (where, $\varepsilon_0 =$ permittivity of free space)

A. $\frac{\sigma(R+r)}{\varepsilon_0}$

B. $\frac{\sigma(R-r)}{\varepsilon_0}$

C. $\frac{\sigma(R+r)}{2\varepsilon_0}$

D. $\frac{\sigma(R+r)}{4\varepsilon_0}$

Answer: A

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6. Two charges of equal magnitude q are placed in air at a distance 2a apart and third charge $-2q$ is placed at mid-point . The potential energy of the system is $(\varepsilon_0$ = permittivity of free space)

A. $-\frac{q^2}{8\pi\varepsilon_0 a}$

B. $-\frac{3q^2}{8\pi\varepsilon_0 a}$

C. $-\frac{5p^2}{8\pi\varepsilon_0 a}$

D. $-\frac{7q^2}{8\pi\varepsilon_0 a}$

Answer: D

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7. Three particles, each having a charge of $10\mu C$ are placed at the coners of an equilateral triangle of side $10cm$. The electrostatic potential energy of the system is (Given $\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9 N - m^2 / C^2$)

A. zero

B. ∞

C. 27 J

D. 100 J

Answer: C

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8. Energy per unit volume for a capacitor having area A and separation d kept at potential diffeence V is given by : -

A. $\frac{1}{2}\varepsilon_0\frac{V^2}{d^2}$

B. $\frac{1}{2\varepsilon_0}\frac{V^2}{d^2}$

C. $\frac{1}{2}CV^2$

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

Answer: A

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9. If the distance between the plates of a parallel plate capacitor of capacity $10\mu F$ is doubled, then new capacity will be

A. $5\mu F$

B. $20\mu F$

C. $10\mu F$

D. $15\mu F$

Answer: A

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10. The electric intensity of outside a charged sphere of radius R at a distance $r(r > R)$ is

A. $\frac{\sigma R^2}{\varepsilon_0 r^2}$

B. $\frac{\sigma r^2}{\varepsilon_0 R^2}$

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

D. $\frac{\sigma R}{\varepsilon_0 r}$

Answer: A

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11. In a parallel plate capacitor , the capacity increases if

A. area of the plate is decreased

B. distance between the plates increases

C. area of the plate is increased

D. dielectric constant decrease

Answer: C

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12. The energy required to charge a parallel plate condenser of plate separtion d and plate area of cross-section A such that the unifom field between the plates is E is

A. $\frac{1}{2}\varepsilon_0 E^2 / Ad$

B. $\varepsilon_0 E^2 / Ad$

C. $\varepsilon_0 E^2 Ad$

D. $\frac{1}{2}\varepsilon_0 E^2 Ad$

Answer: C

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13. A charge Q is situated at the corner of a cube the electric flux passed through all the six faces of the cube is :

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

B. $\frac{q}{3\varepsilon_0}$

C. $\frac{q}{6\varepsilon_0}$

D. $\frac{q}{8\varepsilon_0}$

Answer: D

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14. In bringing an electron towards another electron, the electrostatic potential energy of the system

A. decreases

B. increases

C. remains same

D. becomes zero

Answer: B

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15. A parallel plate condenser with oil (dielectric constant 2) between the plates has capacitance C. If oil is removed, the capacitance of capacitor becomes

A. $\sqrt{2C}$

B. 2C

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

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

Answer: D

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16. Unit of electric flux is

A. Vm

B. N-m/C

C. V/m

D. C/N-m

Answer: A

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17. Two point charges $+3\mu C$ and $+8\mu C$ repel each other with a force of $40N$. If a charge of $-5\mu C$ is added to each of them, then the force between them will become

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18. An infinite line charge produce a field of $7.182 \times 10^8 NC^{-1}$ at a distance of 2 cm. The linear charge density is

A. $7.27 \times 10^{-4} Cm^{-1}$

B. $7.98 \times 10^{-4} Cm^{-1}$

C. $7.11 \times 10^{-4} Cm^{-1}$

D. $7.04 \times 10^{-4} Cm^{-1}$

Answer: B

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19. An electron experiences a force equal to its weight, when placed in an electric field. The intensity of the field will be

A. $1.7 \times 10^{-11} N/C$

B. $5.0 \times 10^{-11} N/C$

C. $5.5 \times 10^{-11} N/C$

D. $56 N/C$

Answer: C

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20. If the distance between the plates of parallel plate capacitor is halved and the dielectric constant of dielectric is doubled, then its capacity will

A. increased by 16 times

B. increases by 4 times

C. increase by 2 times

D. reamin the same

Answer: B

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21. A particle of mass m and charge q is placed at rest in a uniform electric field E and then released, the kinetic energy attained by the particle after moving a distance y will be

A. q^2Ey

B. qEy

C. aE^2y

D. qEy^2

Answer: B

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22. A condenser has a capacity $2\mu F$ and is charged to a voltage of 50 V. The energy stored is

A. $25 \times 10^5 J$

B. 25 J

C. $25 \times 10 \ \ \text{erg}$

D. $25 \times 10^3 \ \ \text{erg}$

Answer: D

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23. Two electrons are separated by a distance of 1Å. What is the Coulomb force between them?

A. $2.3 \times 10^{-8} N$

B. $4.6 \times 10^{-8} N$

C. $1.5 \times 10^{-8} N$

D. None of these

Answer: A

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24. If $4 \times 10^{20} eV$ energy is required to move a charge of 0.25 coulomb between two points. Then what will be the potential difference between them ?

A. 178 V

B. 256 V

C. 356 V

D. None of these

Answer: B

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25. A capacitor of $20\mu F$ is charged to 500 volts and connected in parallel ith another capacitor of $10\mu F$ and charged to 200 volts. The common potential is

A. 400 V

B. 200 V

C. 100 V

D. 50 V

Answer: A

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26. The capacitance between the points A and B in the given circuit will be

A. $1\mu F$

B. $2\mu F$

C. $3\mu F$

D. $4\mu F$

Answer: A

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27. A parallel plate capacitor with air between plates (dielectric constant K =2) has a capacitance C. If the air is removed, then capacitance of the capacitor is

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

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

C. $\sqrt{2}C$

D. 2C

Answer: B

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28. A 700 pF capacitor is charged by a 50 V battery. The electrostatic energy stored it is

A. $17.0 \times 10^{-8} J$

B. $13.6 \times 10^{-9} J$

C. $9.5 \times 10^{-9} J$

D. $8.7 \times 10^{-7} J$

Answer: D

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29. In the given figure, three capacitors each of capacitance 6 pF are connected in series. The total capacitances of the combination becomes

A. $2 \times 10^{-12} F$

B. $3 \times 10^{-12} F$

C. $6 \times 10^{-12} F$

D. 9×10^{-12}

Answer: A

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