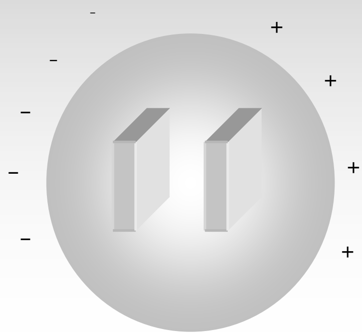
Assignment



Assignment

Charge, Coulombs law, Electric field

Basic Level

1. An electron is moving round the nucleus of a hydrogen atom in a circular orbit of radius *r*. The coulomb force $\vec{F}$ between the two is (Where $K = \frac{1}{4\pi\varepsilon_0}$)

(a) $-K\frac{e^2}{r^3}\hat{r}$ (b) $K\frac{e^2}{r^3}\vec{r}$ (c) $-K\frac{e^2}{r^3}\vec{r}$ (d) $K\frac{e^2}{r^2}\hat{r}$

2. Two point charges $+2C$ and $+6C$ repel each other with a force of 12 *Newtons*. If a charge of $-4C$ is given to each of these charges the force now is **[Kerala PMT 2002; CPMT 1979]**

(a) Zero (b) 4 *N* (attractive) (c) 12 *N* (attractive) (d) 8 *N* (repulsive)

3. Electric field intensity at a point at a distance 60 *cm* from charge is $2\frac{volt}{metre}$ then charge will be

(a) $8\times10^{-11}\,C$ (b) $8\times10^{11}\,C$ (c) $4\times10^{11}\,C$ (d) $4\times10^{-11}\,C$

4. In a uniformly charged spherical shell of radius *r* the electric field is

(a) Zero (b) Non-zero constant (c) Varies with *r* (d) Inversely varies with *r*

5. If σ is the charge per unit area on the surface of a conductor, then the electric field intensity at a point on the surface is

[MP PET 2001; MP PMT 1994]

(a) $\left(\frac{\sigma}{\varepsilon_0}\right)$ normal to surface (b) $\left(\frac{\sigma}{2\varepsilon_0}\right)$ normal to surface

(c) $\left(\frac{\sigma}{\varepsilon_0}\right)$ tangential to surface (d) $\left(\frac{\sigma}{2\varepsilon_0}\right)$ tangential to surface

6. Electric field intensity at a point in between two parallel sheets with like charges of same surface charge densities (σ) is **[MP PMT 2001]**

(a) $\frac{\sigma}{2\varepsilon_0}$ (b) $\frac{\sigma}{\varepsilon_0}$ (c) Zero (d) $\frac{2\sigma}{\varepsilon_0}$

7. The electric field due to cylindrical charge distribution of infinite length at a distance equal to its radius from its surface will be – (λ = linear charge density, *R* = radius of the cylinder)

(a) $\frac{2K\lambda}{R}$ (b) $\frac{K\lambda}{R}$ (c) $\frac{K\lambda}{2R}$ (d) $\frac{3K\lambda}{2R}$

8. There is a solid dielectric sphere of radius 'R' having uniformly distributed charge. What is the relation between electric field 'E' inside the sphere and radius of sphere 'R' is

(a) $E \propto R^{-2}$ (b) $E \propto R^{-1}$ (c) $E \propto \frac{1}{R^3}$ (d) $E \propto R^2$

9. Electric field strength due to a point charge of 5 μC at a distance of 80 cm from the charge is

(a) 8×10^4 N/C (b) 7×10^4 N/C (c) 5×10^4 N/C (d) 4×10^4 N/C

10. One metallic sphere A is given positive charge where as another identical metallic sphere B of exactly same mass as of A is given equal amount of negative charge. Then

(a) Mass of A and mass of B still remain equal (b) Mass of A increases

(c) Mass of B decreases (d) Mass of B increases

11. When 10^{19} electrons are removed from a neutral metal plate, the electric charge on it is **[KCET (E) 1999 Similar to Manipal**

(a) – 1.6 C (b) + 1.6 C (c) 10^{+19} C (d) 10^{-19} C

12. When air is replaced by a dielectric medium of constant k, the maximum force of attraction between two charges separated by a distance

(a) Decreases k times (b) Remains unchanged (c) Increases k times (d) Increases k^{-1} times

13. Two infinite plane parallel sheets separated by a distance d have equal and opposite uniform charge densities σ. Electric field at a point between the sheets is

(a) Zero (b) $\frac{\sigma}{\varepsilon_0}$

(c) $\frac{\sigma}{2\varepsilon_0}$ (d) Depend on the nature of the materials of the spheres

14. A hollow insulated conduction sphere is given a positive charge of 10 μC. What will be the electric field at the centre of the sphere if its radius is 2 *metres*

(a) Zero (b) $5\mu C\ m^{-2}$ (c) 20 $\mu C\ m^{-2}$ (d) 8 $\mu C\ m^{-2}$

15. A body can be negatively charged by **[AIIMS 1998; CPMT 1972]**

(a) Giving excess of electrons to it (b) Removing some electrons from it

(c) Giving some protons to it (d) Removing some neutrons from it

16. Three equal charges are placed on the three corners of a square. If the force between Q_1 and Q_2 is F_{12} and that between Q_1 and Q_3 is F_{13}, then the ratio of magnitudes $\frac{F_{12}}{F_{13}}$

(a) 1/2 (b) 2 (c) $1/\sqrt{2}$ (d) $\sqrt{2}$

17. The magnitude of electric field E in the annular region of a charged cylindrical capacitor

(a) Is same throughout (b) Is higher near the outer cylinder than near the inner cylinder

(c) Varies as $1/r$, where r is the distance from the axis (d) Varies as $1/r^2$, where r is the distance from the axis

18. A glass rod rubbed with silk is used to charge a gold leaf electroscope then charged electroscope is exposed to X-rays for a short period. Then

(a) The divergence of leaves will not be affected (b) The leaves will diverge further

(c) The leaves will collapse (d) The leaves will melt

19. A cube of side b has a charge q at each of its vertices. The electric field due to this charge distribution at the center of this cube will be

[KCET 1994]

(a) q/b^2 (b) $q/2b^2$ (c) $32q/b^2$ (d) Zero

20. The intensity of electric field, due to a uniformly charged infinite cylinder of radius R, at a distance $r(> R)$ from its axis is proportional to

(a) r^2 (b) r^3 (c) $\frac{1}{r}$ (d) $\frac{1}{r^2}$

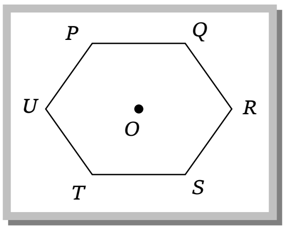
21. Two parallel plates have equal and opposite charge. When the space between them is evacuated, the electric field between the plates is $2 \times 10^5\ V/m$. When the space is filled with dielectric, the electric field becomes $1 \times 10^5\ V/m$. The dielectric constant of the dielectric material

(a) 1/2 (b) 1 (c) 2 (d) 3

Charge, Coulombs law, Electric field

Advance Level

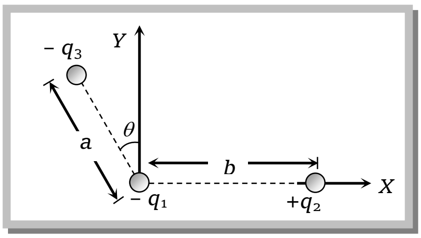
22. Six charges, three positive and ;three negative of equal magnitude are to be placed at the vertices of a regular hexagon such that the electric field at O is double the electric field when only one positive charge of same magnitude is placed at R. Which of the following arrangements of charges is possible for P, Q, R, S, T and U respectively ? **[IIT-JEE (Screening) 2004]**



(a) +, –, +, –, –, + (b) +, –, +, –, +, – (c) +, +, –, +, –, – (d) –, +, +, –, +, –

23. Three charges $-q_1$, $+q_2$ and $-q_3$ are placed as shown in the figure. The X-component of the force on $-q_1$ is proportional to

[AIEEE 2003]



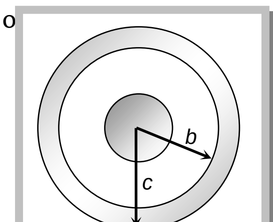
(a) $q_2 / b^2 - (q_3 / a^2)\sin\theta$ (b) $q_2 / b^2 - (q_3 / a^2)\cos\theta$ (c) $q_2 / b^2 + (q_3 / a^2)\sin\theta$ (d) $q_2 / b^2 + (q_3 / a^2)\cos\theta$

24. Two particle of equal mass m and charge q are placed at a distance of 16 cm. They do not experience any force. The value of $\frac{q}{m}$ is

[MP PET 2003]

(a) $4\pi\varepsilon_0 G$ (b) $\sqrt{\frac{\pi\varepsilon_0}{G}}$ (c) $\sqrt{\frac{G}{4\pi\varepsilon_0}}$ (d) $\sqrt{4\pi\varepsilon_0 G}$

25. A solid conducting sphere of radius a has a net positive charge $2Q$. A conducting spherical shell of inner radius b and outer radius c is concentric with the solid sphere and has a net charge $-Q$. The surface charge density on the inner and outer surfaces o[illegible] will be



(a) $-\frac{2Q}{4\pi b^2}, \frac{Q}{4\pi c^2}$ (b) $-\frac{Q}{4\pi b^2}, \frac{Q}{4\pi c^2}$ (c) $0, \frac{Q}{4\pi c^2}$ (d) None of the above

26. Two conducting solid spheres of radii R and $2R$ are given equal charges $(+Q)$ each. When they are connected by a thin conducting wire, the charges get redistributed. The ratio of charge Q_1 on smaller sphere to charge Q_2 on larger sphere becomes **[MP PET 2001]**

(a) $\frac{Q_1}{Q_2} = 1$ (b) $\frac{Q_1}{Q_2} = 2$ (c) $\frac{Q_1}{Q_2} = \frac{1}{2}$ (d) None of these

27. Electric charges of 1 μC, – 1 μC and 2 μC are placed in air at the corners A, B and C respectively of an equilateral triangle ABC having length of each side 10 cm. The resultant force on the charge at C is $\left(\frac{\mu_0}{4\pi} = 10^{-7}\,Hm^{-1}\right)$

(a) 0.9 N (b) 1.8 N (c) 2.7 N (d) 3.6 N

28. A solid metallic sphere has a charge + $3Q$. Concentric with this sphere is a conducting spherical shell having charge – Q. The radius of the sphere is a and that of the spherical shell is $b (b > a)$. What is the electric field at a distance $R(a < R < b)$ from the centre **[MP PMT 1995]**

(a) $\frac{Q}{2\pi\varepsilon_0 R}$ (b) $\frac{3Q}{2\pi\varepsilon_0 R}$ (c) $\frac{3Q}{4\pi\varepsilon_0 R^2}$ (d) $\frac{4Q}{4\pi\varepsilon_0 R^2}$

29. Two copper balls, each weighing 10 g are kept in air 10 cm apart. If one electron from every 10^6 atoms is transferred from one ball to the other, the *coulomb* force between them is (atomic weight of copper is 63.5)

(a) 2.0×10^{10} N (b) 2.0×10^4 N (c) 2.0×10^7 N (d) 2.0×10^6 N

30. A non-conducting solid sphere of radius R is uniformly charged. The magnitude of the electric field due to the sphere at a distance r from its centre

(a) Increases as r increases for $r < R$ (b) Decreases as r increases for $0 < r < \infty$

(c) Decreases as r increases for $R < r < \infty$ (d) In discontinuous at $r = R$

31. Two infinitely long parallel wires having linear charge densities λ_1 and λ_2 respectively are placed at a distance of R *metres*. The force per unit length on either wire will be $\left(k = \frac{1}{4\pi\varepsilon_0}\right)$

(a) $k\frac{2\lambda_1\lambda_2}{R^2}$ (b) $k\frac{2\lambda_1\lambda_2}{R}$ (c) $k\frac{\lambda_1\lambda_2}{R^2}$ (d) $k\frac{\lambda_1\lambda_2}{R}$

32. A point charge of 40 *stat coulomb* is placed 2 cm in front of an earthed metallic plane plate of large size. Then the force of attraction on the point charge is

(a) 100 *dynes* (b) 160 *dynes* (c) 1600 *dynes* (d) 400 *dynes*

33. Two point charges are kept separated by 4 cm of air and 6 cm of a dielectric of relative permittivity 4. The equivalent dielectric separation between them so far their coulombian interaction is conserved is

(a) 10 cm (b) 8 cm (c) 5 cm (d) 16 cm

34. A regular polygon has n sides each of length l. Each corner of the polygon is at a distance r from the centre. Identical charges each equal to q are placed at $(n - 1)$ corners of the polygon. What is the electric field at the centre of the polygon

(a) $\frac{n}{4\pi\varepsilon_0}\frac{q}{r^2}$ (b) $\frac{n}{4\pi\varepsilon_0}\frac{q}{l^2}$ (c) $\frac{1}{4\pi\varepsilon_0}\frac{q}{r^2}$ (d) $\frac{1}{4\pi\varepsilon_0}\frac{q}{l^2}$

35. Two spheres A and B of gold (each of mass 1 *kg.*) are hung from two pans of a sensitive physical balance. If A is given 1 *Faraday* of positive charge and B is given 1 F of negative charge, then to balance the balance we have to put a weight of $(1F = 96500\ C)$

(a) 0.6 μg on the pan of A (b) 0.6 μg on the pan of B

(c) 1.01 *milligram* on the pan of A (d) 1.2 *milligram* on the pan of B

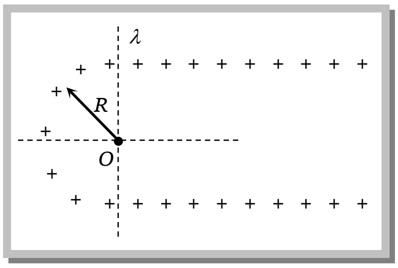
36. A long thin rod lies along the x-axis with one end at the origin. It has a uniform charge density λ *C/m*. Assuming it to infinite in length the electric field point $x = -a$ on the x-axis will

(a) $\frac{\lambda}{\pi\varepsilon_0 a}$ (b) $\frac{\lambda}{2\pi\varepsilon_0 a}$ (c) $\frac{\lambda}{4\pi\varepsilon_0 a}$ (d) $\frac{2\lambda}{\pi\varepsilon_0 a}$

37. The charge on 500 *cc* of water due to protons will be **[RPET 1997]**

(a) $6.0 \times 10^{27}\ C$ (b) $2.67 \times 10^{7}\ C$ (c) $6 \times 10^{23}\ C$ (d) $1.67 \times 10^{23}\ C$

38. In the figure shown, if the linear charge density is λ, then the net electric field at O will be



(a) Zero (b) $\frac{k\lambda}{R}$ (c) $\frac{2k\lambda}{R}$ (d) $\frac{\sqrt{2}\,k\lambda}{R}$

39. A positively charged ball is supported on a rigid insulating stand. We wish to measure the electric field E at a point in the some horizontal level as that of the hanging charge. To do so we put a positive test charge q_0 and measure F/q_0 than E at that point

[CPMT 1990]

(a) $> F/q_0$ (b) $= F/q_0$ (c) $< F/q_0$ (d) Cannot be estimated

40. Two point charges placed at a distances of 20 cm in air repel each other with a certain force. When a dielectric slab of thickness 8 cm and dielectric constant K is introduced between these point charges, force of interaction becomes half of it's previous value. Then K is approximately

(a) 2 (b) 4 (c) $\sqrt{2}$ (d) 1

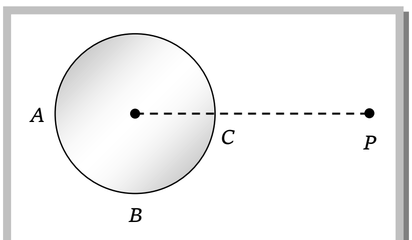
41. A conducting sphere of radius R, and carrying a charge q is joined to a conducting sphere of radius $2R$, and carrying a charge $-2q$. The charge flowing between them will be

(a) $\frac{q}{3}$ (b) $\frac{2q}{3}$ (c) q (d) $\frac{4q}{3}$

Potential, E = – dV/dr, Electric Lines and Work

Basic Level

42. A hollow conducting sphere is placed in an electric field produced by a point charge placed at P as shown in figure. Let V_A, V_B, V_C be the potentials at points A, B and C respectively. Then



(a) $V_C > V_B$ (b) $V_B > V_C$ (c) $V_A > V_B$ (d) $V_A = V_C$

43. A thin spherical conducting shell of radius R has a charge q. Another charge Q is placed at the centre of the shell. The electrostatic potential at a point P a distance $\frac{R}{2}$ from the centre of the shell is

(a) $\frac{(q+Q)}{4\pi\varepsilon_0}\frac{2}{R}$ (b) $\frac{2Q}{4\pi\varepsilon_0 R}$ (c) $\frac{2Q}{4\pi\varepsilon_0 R}-\frac{2q}{4\pi\varepsilon_0 R}$ (d) $\frac{2Q}{4\pi\varepsilon_0 R}+\frac{q}{4\pi\varepsilon_0 R}$

44. A charged oil drop is to be held stationary between two plates separated by a distance of $25\,mm$. If the mass of the drop is $5\times10^{-15}kg$ and the charge on it is $10^{-18}C$, the potential to be applied between the two plates is ($g = 10\ ms^{-2}$)

[Kerala PMT 2002]

(a) $125\ V$ (b) $1250\ V$ (c) $2500\ V$ (d) $450\ V$

45. A hollow conducting sphere of radius R has a charge $(+Q)$ on its surface. What is the electric potential within the sphere at a distance $r=\frac{R}{3}$ from its centre

(a) Zero (b) $\frac{1}{4\pi\varepsilon_0}\frac{Q}{r}$ (c) $\frac{1}{4\pi\varepsilon_0}\frac{Q}{R}$ (d) $\frac{1}{4\pi\varepsilon_0}\frac{Q}{r^2}$

46. A cube of a metal is given a positive charge Q. For the above system, which of the following statements is true**[MP PET**

(a) Electric potential at the surface of the cube is zero (b) Electric potential within the cube is zero

(c) Electric field is normal to the surface of the cube (d) Electric field varies within the cube

47. Two spheres A and B of radius 'a' and 'b' respectively are at same electric potential. The ratio of the surface charge densities of A and B is

(a) $\frac{a}{b}$ (b) $\frac{b}{a}$ (c) $\frac{a^2}{b^2}$ (d) $\frac{b^2}{a^2}$

48. Electric potential at equatorial point of a small dipole with dipole moment p (At r, distance from the dipole) is

[MP PMT 2001; Similar to MP PMT 1996 & CPMT 1982]

(a) Zero (b) $\frac{p}{4\pi\varepsilon_0 r^2}$ (c) $\frac{p}{4\pi\varepsilon_0 r^3}$ (d) $\frac{2p}{4\pi\varepsilon_0 r^3}$

49. The radius of a soap bubble whose potential is 16 V is doubled. The new potential of the bubble will be

(a) 2 V (b) 4 V (c) 8 V (d) 16 V

50. A unit charge is taken from one point to another over an equipotential surface. Work done in this process will be

[CBSE 2000; CPMT 1997; KCET 1994]

(a) Zero (b) Positive (c) Negative (d) Optimum

51. The displacement o a charge Q in the electric field $E = e_1 i + e_2 j + e_3 k$ is $r = ai + bj$. The work done is

[EAMCET (Eng) 2000]

(a) $Q(ae_1 + be_2)$ (b) $Q\sqrt{(ae_1)^2 + (be_2)^2}$ (c) $Q(e_1 + e_2)\sqrt{a^2 + b^2}$ (d) $Q(\sqrt{e_1^2 + e_2^2})(a + b)$

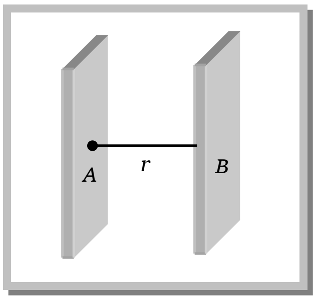
52. Two electric charges 12 μC and – 6 μC are placed 20 cm apart in air. There will be a point P on the line joining these charges and outside the region between them, at which the electric potential is zero. The distance of P from – 6 μC charge is **[EAMCET (E) 2000]**

(a) 0.10 m (b) 0.15 m (c) 0.20 m (d) 0.25 m

53. Two charges of 4 μC each are placed at the corners A and B of an equilateral triangle of side length 0.2 m in air. The electric potential at C is $\left(\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9 \frac{N - m^2}{C^2}\right)$ **[EAMCET (Med.) 2000]**

(a) 9×10^4 V (b) 18×10^4 V (c) 36×10^4 V (d) 36×10^4 V

54. The figure given below shows two parallel equipotential surfaces A and B kept at a small distance r from each other A point charge of – q *coul* is taken from the surface A to B. The amount of net work W done will be given by **[RPET 1999; CPMT 1986]**



(a) $W = -\frac{1}{4\pi\varepsilon_0}\left(\frac{q}{r}\right)$ (b) $W = -\frac{1}{4\pi\varepsilon_0}\left(\frac{q}{r^2}\right)$ (c) $W = \frac{1}{4\pi\varepsilon_0}\left(\frac{q}{r^2}\right)$ (d) Zero

55. Two metal spheres of radii R_1 and R_2 are charged to the same potential. The ratio of charges on the spheres is

[KCET (E) 1999]

(a) $\sqrt{R_1} : \sqrt{R_2}$ (b) $R_1 : R_2$ (c) $R_1^2 : R_2^2$ (d) $R_1^3 : R_2^3$

56. Electric charges of + 10μC, +5μC, – 3μC and + 8μC are placed at the corners of a square of side $\sqrt{2}\,m$. The potential at the centre of the square is

(a) 1.8 V (b) 1.8×10^6 V (c) 1.8×10^5 V (d) 1.8×10^4 V

57. An electron enters between two horizontal plates separated by 2 mm and having a p.d. of 1000 V. The force on electron is

[JIPMER 1999]

(a) 8×10^{-12} N (b) 8×10^{-14} N (c) 8×10^9 N (d) 8×10^{14} N

58. Two unlike charges of magnitude q are separated by a distance 2d. The potential at a point midway between them is

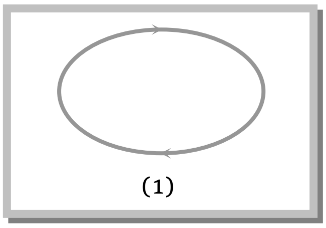
[JIPMER 1999]

(a) Zero (b) $\frac{1}{4\pi\varepsilon_0}$ (c) $\frac{1}{4\pi\varepsilon_0}.\frac{q}{d}$ (d) $\frac{1}{4\pi\varepsilon_0}.\frac{2q}{d^2}$

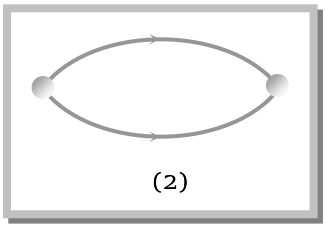
59. A hollow metal sphere of radius 5 *cm* is charged such that the potential on its surface is 10 *V*. The potential at a distance of 2 *cm* from the centre of the sphere

(a) Zero (b) 10 *V* (c) 4 *V* (d) 10/3 *V*

60. Below figures (1) and (2) represent lines of force. Which is correct statement **[MP PET 1995]**



(1)



(2)

(a) Figure (1) represents magnetic lines of force (b) Figure (2) represents magnetic lines of force

(c) Figure (1) represents electric line of force (d) Both (1) and (2) represent magnetic line of force

61. At a certain distance from a point charge the electric field is 500 *V/m* and the potential is 3000 *V*. What is this distance **[MP PMT 1995]**

(a) 6 *m* (b) 12 *m* (c) 36 *m* (d) 144 *m*

62. Two plates are 2 *cm* apart, a potential difference of 10 *volt* is applied between them, the electric field between the plates is

[MP PET 1994]

(a) 20 *N/C* (b) 500 *N/C* (c) 5 *N/C* (d) 250 *N/C*

63. Charges $+\frac{10}{3}\times 10^{-9}$ are placed at each of the four corners of a square of side 8 *cm*. The potential at the intersection of the diagonals is

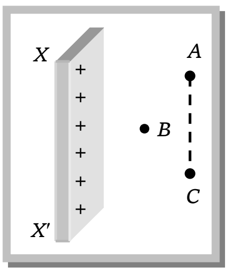
(a) $150\sqrt{2}$ *volt* (b) $1500\sqrt{2}$ *volt* (c) $900\sqrt{2}$ *volt* (d) 900 *volt*

64. Three charges $2q$, $-q$, $-q$ are located at the vertices of an equilateral triangle. At the centre of the triangle

(a) The field is zero but potential is non-zero (b) The field is non-zero but potential is zero

(c) Both field and potential are zero (d) Both field and potential are non-zero

65. The potential due to a infinite line charge XX' at point A is 20 *V* and at point B is 50 *V*. Point A and C are situated on equipotential surface then the work done in carrying an electron from

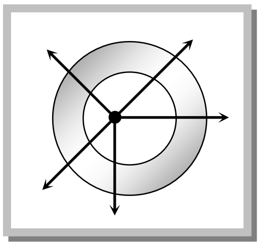
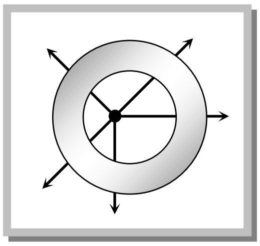
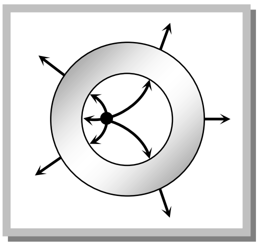
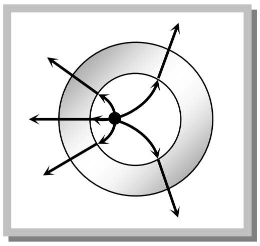


(a) A to B is 30 eV (b) B to C is 30 eV (c) A to C is – 30 eV (d) A to B and from B to C is 30 eV

Potential, E = – dV/dr, Electric Lines and Work

Advance Level

66. A metallic shell has a point charge 'q' kept inside its cavity. Which one of the following diagrams correctly represents the electric lines of forces

(a)  (b)  (c)  (d) 

67. Electric potential at any point is $V = -5x + 3y + \sqrt{15}z$, then the magnitude of the electric field is

(a) $3\sqrt{2}$ (b) $4\sqrt{2}$ (c) $5\sqrt{2}$ (d) 7

68. Two concentric spheres of radii R and r have similar charges with equal surface densities (σ). What is the electric potential at their common centre ?

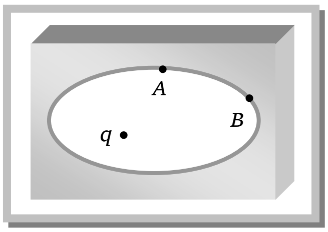
(a) $\frac{\sigma}{\varepsilon_0}$ (b) $\frac{R\sigma}{r\varepsilon_0}$ (c) $\frac{\sigma}{\varepsilon_0}(R+r)$ (d) $\frac{\sigma}{\varepsilon_0}(R-r)$

69. A uniform electric field pointing in positive x-direction exists in a region. Let A be the origin, B be the point on the x-axis at x = +1 cm and C be the point on the y-axis at y = +1 cm. Then the potentials at the points A, B and C satisfy

[IIT Screening 2001]

(a) $V_A < V_B$ (b) $V_A > V_B$ (c) $V_A < V_C$ (d) $V_A > V_C$

70. An ellipsoidal cavity is carved within a perfect conductor. A positive charge q is placed at the centre of the cavity. The points A and B are on the cavity surface as shown in the figure. Then



(a) Electric field near A in the cavity = Electric field near B in the cavity (b) Charge density at A = Charge density at B

(c) Potential at A = Potential at B (d) Total electric field flux through the surface of the cavity is q/ε_0

71. The radius of a hollow metallic sphere is r. If the p.d. between its surface and a point at distance 3r from its centre is V, then the intensity of electrical field at a distance of 3r from its centre will be

(a) $V/6r$ (b) $V/4r$ (c) $V/3r$ (d) $V/2r$

72. In Millikan's oil drop experiment an oil drop carrying a charge Q is held stationary by a potential difference 2400 V between the plates. To keep a drop of half the radius stationary the potential difference had to be made 600 V. What is the charge on the second drop

[MP PET 1997]

(a) $\frac{Q}{4}$ (b) $\frac{Q}{2}$ (c) Q (d) $\frac{3Q}{2}$

73. A non-conducting ring of radius 0.5 m carries a total charge of 1.11×10^{-10} C distributed non-uniformly on its circumference producing an electric field E everywhere in space. The value of the line integral $\int_{l=\infty}^{l=0} -E.dl$ (l = 0 being centre of the ring) in *volt* is

[IIT 1997 Cancelled]

(a) + 2 (b) – 1 (c) – 2 (d) Zero

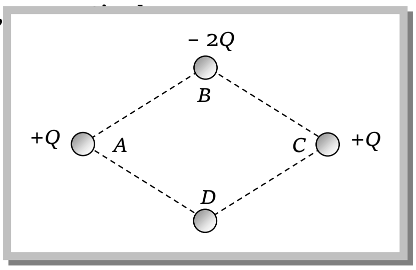
74. A sphere of radius r is placed concentrically inside a hollow sphere of radius R. The bigger and smaller spheres are given charges Q and q respectively and are insulated. The potential difference between the two spheres depends on **[RPET 1996]**

(a) Only charge q (b) Only charge Q (c) Both q and Q (d) Not on q and Q

75. Four equal charges q are held fixed at (0, R), (0, – R), (R, R) and (R, – R) respectively of a (x, y) co-ordinate system. The work done in moving a charge Q from point A (R, 0) to origin (0, 0) is

(a) Zero (b) $\frac{qQ}{4\pi\varepsilon_0}\frac{\sqrt{2}-1}{\sqrt{2}R}$ (c) $\frac{2qQ}{\pi\varepsilon_0}\frac{\sqrt{2}}{R}$ (d) $\frac{qQ}{4\pi\varepsilon_0}\frac{\sqrt{2}+1}{\sqrt{2}R}$

76. Consider a parallelogram $ABCD$, with angle at B is 120°. A charge + Q placed at corner A produces field E and potential V at corner D. If we now added charges – 2Q and + Q at corners B and C respectively, the magnitude of field and potential at D will become,



(a) E and 0 (b) 0 and V (c) $E\sqrt{2}$ and $\frac{V}{\sqrt{2}}$ (d) $\frac{E}{\sqrt{2}}$ and $\frac{V}{\sqrt{2}}$

77. The intensity of electric field in a region of space is represented by $E = \frac{100}{x^2} V/m$. The potential difference between the points x = 10 m and x = 20 m will be

(a) 15 m (b) 10 V (c) 5 V (d) 1 V

78. Two points A and B lying on Y-axis at distances 12.3 cm and 12.5 cm from the origin. The potentials at these points are 56 V and 54.8 V respectively, then the component of force on a charge of 4 μC placed at A along Y-axis will be

(a) 0.12 N (b) 48×10^{-3} N (c) 24×10^{-4} N (d) 96×10^{-2} N

79. When two uncharged metal balls of radius 0.09 mm each collide, one electron is transferred between them. The potential difference between them would be

(a) 16 μV (b) 16 pV (c) 32 μV (d) 32 pV

80. An electric field of 100 Vm^{-1} exists along x-axis. The potential difference between a point A (– 1m, 0) and B(+3m, 0) is

(a) 200 V (b) – 200 V (c) 400 V (d) – 400 V

81. The potential in an electric field has the form $V = a(x^2 + y^2 + z^2)$. The modulus of the electric field at a point (z, y, z) is

(a) $2a(x^2+y^2+z^2)^{3/2}$ (b) $2a\sqrt{x^2+y^2+z^2}$ (c) $a\sqrt{x^2+y^2+z^2}$ (d) $\dfrac{2a}{\sqrt{x^2+y^2+z^2}}$

82. Electric potential is given by $V = 6x - 8xy^2 - 8y + 6yz - 4x^2$. Then electric force acting on 2 *coulomb* point charge placed on origin will be **[RPET 1999, 97]**

(a) 2N (b) 6N (c) 8N (d) 20N

83. An electric line of force in the xy plane is given by equation $x^2 + y^2 = 1$. A particle with unit positive charge, initially at rest at the point $x = 1$, $y = 0$ in the xy plane

(a) Not move at all (b) Will move along straight line

(c) Will move along the circular line of force (d) Information is insufficient to draw any conclusion

84. An electric field $\vec{E} = 50\hat{i} + 75\hat{j}\, N/C$ exists in a certain region of space. Presuming the potential at the origin to be zero, the potential at point P (1 m, 2m) will be

(a) 100 V (b) – 100 V (c) 200 V (d) – 200 V

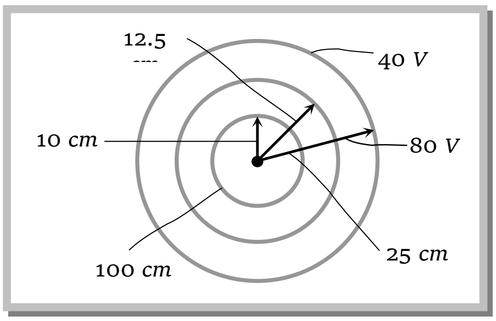
85. Electric potential in an electric filed is given as $V = \dfrac{K}{r}$, (K being constant), if position vector $\vec{r} = 2\hat{i} + 3\hat{j} + 6\hat{k}$, then electric field will be

(a) $\left(2\hat{i}+3\hat{j}+6\hat{k}\right)\dfrac{K}{243}$ (b) $\left(2\hat{i}+3\hat{j}+6\hat{k}\right)\dfrac{K}{343}$ (c) $\dfrac{K}{243}\left(3\hat{i}+2\hat{j}+6\hat{k}\right)$ (d) $\dfrac{K}{343}\left(6\hat{i}+2\hat{j}+3\hat{k}\right)$

86. Two points are at distances a and b (a < b) from a long string of charge per unit length λ. The potential difference between the points is proportional to

(a) b/a (b) b^2/a^2 (c) $\sqrt{b/a}$ (d) ln (b/a)

87. Some spherical equipotential surfaces are shown in the figure. The values of the potentials are 100 V, 80 V, 40 V on surfaces of radii 10 cm, 12.5 cm and 25 cm. The electric field at a distance r from the common centre is



(a) $\dfrac{20}{r^2}$ (b) $\dfrac{10}{r^3}$ (c) $\dfrac{20}{r^3}$ (d) $\dfrac{10}{r^2}$

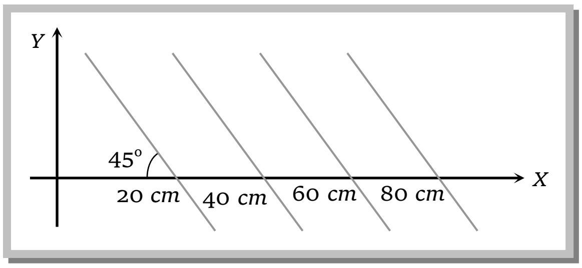
88. An arc of radius r carries charge. The linear density of charge is λ and the are subtends a angle $\dfrac{\pi}{3}$ at the centre. What is electric potential at the centre

(a) $\frac{\lambda}{4\varepsilon_0}$ (b) $\frac{\lambda}{8\varepsilon_0}$ (c) $\frac{\lambda}{12\varepsilon_0}$ (d) $\frac{\lambda}{16\varepsilon_0}$

89. A wire is bent in the form of a regular hexagon of side *a* and a total charge *Q* is distributed uniformly over it. One side of the hexagon is removed. The electric field due to the remaining sides at the centre of the hexagon is

(a) $\frac{Q}{12\sqrt{3}\pi\varepsilon_0 a^2}$ (b) $\frac{Q}{16\sqrt{3}\pi\varepsilon_0 a^2}$ (c) $\frac{Q}{8\sqrt{2}\pi\varepsilon_0 a^2}$ (d) $\frac{Q}{8\sqrt{2}\varepsilon_0 a^2}$

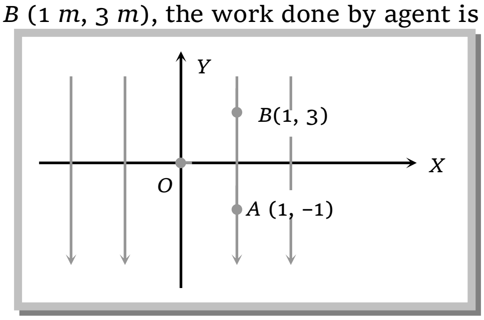
90. Some equipotential plane parallel surfaces are shown in the figure. The planes are inclined to *x*-axis by 45° and the distance from one plane to another plane along *X*-axis is 20 *cm*. The electric field is



(a) 177 Vm^{-1} at angle 135° with *X*-axis (b) 125 Vm^{-1} at angle 45° to the *X*-axis

(c) 177 Vm^{-1} at angle 45° to the *X*-axis (b) 125 Vm^{-1} at angle 135° to the *X*-axis

91. An electric field of strength 50 $V\,m^{-1}$ exists along the negative direction of *Y*–axis. If 1 μC of positive charge is shifted from a point *A* (1 *m*, –1 *m*) to *B* (1 *m*, 3 *m*), the work done by agent is



(a) 0 (b) – 0.2 *mJ* (c) + 0.2 *mJ* (d) + 0.8 *mJ*

92. A radioactive source in the form of a metal sphere of radius 10^{-2} *m*, emits beta particles at the rate of 5×10^{10} particles per *sec*. The source is electrically insulated. How long will it take for it's potential to be raised by 2 *volts*, assuming 40% of the emitted beta particles escape the source

(a) 700 *sec* (b) 700 *milli sec* (c) 700 μ *sec* (d) 700 *n sec*

Equilibrium, Motion of Charge, *Neutral Point and*

Basic Level

93. A bullet of mass 2*g* is having a charge of 2μC. Through what potential difference must it be accelerated, starting from rest, to acquire a speed of 10 *m/s* ?

(a) 50 *kV* (b) 5 *V* (c) 50 *V* (d) 5 *kV*

94. Three point charges are placed at the corners of an equilateral triangle. Assuming only electrostatic forces are acting **[KCET 2002]**

(a) The system can never be in equilibrium

(b) The system will be in equilibrium if the charge rotate about the centre of the triangle

(c) The system will be in equilibrium if the charges have different magnitudes and different signs

(d) The system will be in equilibrium if the charges have the same magnitudes but different signs

95. The distance between charges 5×10^{-11} C and -2.7×10^{-11} C is 0.2 m. The distance at which a third charge should be placed from -2.7×10^{-11} C charge in order that it will not experience any force along the line joining the two charges is **[Kerala PET 2002]**

(a) 0.44 m (b) 0.65 m (c) 0.556 m (d) 0.350

96. If 3 charges are placed at the vertices of equilateral triangle of charge 'q' each. What is the net potential energy, if the side of equilateral Δ is l cm

(a) $\frac{1}{4\pi\varepsilon_0}\frac{q^2}{l}$ (b) $\frac{1}{4\pi\varepsilon_0}\frac{2q^2}{l}$ **(c)** $\frac{1}{4\pi\varepsilon_0}\frac{3q^2}{l}$ (d) $\frac{1}{4\pi\varepsilon_0}\frac{4q^2}{l}$

97. A charged particle of mass 0.003 gm is held stationary in space by placing it in a downward direction of electric field of 6×10^4 N/C. Then the magnitude of the charge is

(a) 5×10^{-4} C (b) 5×10^{-10} C (c) -18×10^{-6} C (d) -5×10^{-9} C

98. Cathode rays travelling from east to west enter into region of electric field directed towards north to south in the plane of paper. The deflection of cathode rays is towards

(a) East (b) South (c) West (d) North

99. An electron and a proton are kept in a uniform electric field. The ratio of their acceleration will be

(a) Unity (b) Zero (c) $\frac{m_p}{m_e}$ (d) $\frac{m_e}{m_p}$

100. A drop of 10^{-6} kg water carries 10^{-6} C charge. What electric field should be applied to balance its weight (assume g = 10 m/s^2)

[MP PET 2002]

(a) 10 V/m upward (b) 10 V/m downward (c) 0.1 V/m downward (d) 0.1 V/m upward

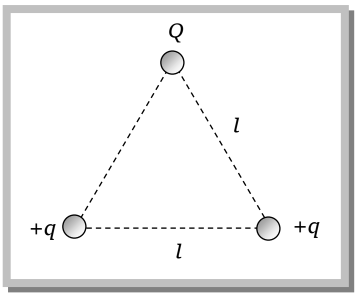
101. If identical charges ($-q$) are placed at each corner of a cube of side b, then electric potential energy of charge ($+q$) which is placed at centre of the cube will be

(a) $\frac{8\sqrt{2}q^2}{4\pi\varepsilon_0 b}$ (b) $\frac{-8\sqrt{2}q^2}{\pi\varepsilon_0 b}$ (c) $\frac{-4\sqrt{2}q^2}{\pi\varepsilon_0 b}$ (d) $\frac{-4q^2}{\sqrt{3}\pi\varepsilon_0 b}$

102. Two point charges + 9e and + e are at 16 cm away from each other. Where should another charge q be placed between them so that the system remains in equilibrium

(a) 24 cm from + 9e (b) 12 cm from + 9e (c) 24 cm from + e (d) 12 cm from + e

103. Three charges Q, $+q$ and $+q$ are placed at the vertices of an equilateral triangle of side l as shown in the figure. If the net electric energy of the system is zero, then Q is equal to



(a) $-\frac{q}{2}$ (b) $-q$ (c) $+q$ (d) Zero

104. The acceleration of an electron in an electric field of magnitude 50 V/cm, if e/m value of the electron is 1.76×10^{11} C/kg is

[CPMT 2001]

(a) 8.8×10^{14} m/sec^2 (b) 6.2×10^{13} m/sec^2 (c) 5.4×10^{12} m/sec^2 (d) Zero

105. A simple pendulum has a metal bob, which is negatively charged. If it is allowed to oscillate above a positively charged metallic plate, then its time period will

(a) Increases (b) Decreases (c) Become zero (d) Remain the same

106. A particle of mass '*m*' and charge '*q*' is accelerated through a potential difference of *V volt*, its energy will be **[MP PET**

(a) qV (b) mqV (c) $\left(\frac{q}{m}\right)V$ (d) $\frac{q}{mV}$

107. Consider two point charges of equal magnitude and opposite sign separated by certain distance. The neutral point due to them **[KCET (E) 2001]**

(a) Does not exist

(b) Will be in mid way between them

(c) Lies on the perpendicular bisector of the line joining the two

(d) Will be closer to the negative charge

108. The dimension of $(1/2).\varepsilon_0 E^2$ (ε_0 : permittivity of free space; E : electric field) is **[IIT Screening 2000]**

(a) MLT^{-1} (b) ML^2T^{-2} (c) $ML^{-1}T^{-2}$ (d) ML^2T^{-1}

109. In a uniform electric field a charge of 3 *C* experiences a force of 3000 *N*. The p.d. between two points 1 *cm* apart along the electric lines of force will be

(a) 10 *V* (b) 30 *V* (c) 100 *V* (d) 300 *V*

110. An electron enters an electric field with its velocity in the direction of the electric lines of force. Then

(a) The path of the electron will be a circle (b) The path of the electron will be a parabola

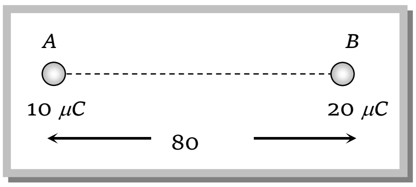
(c) The velocity of the electron will decrease (d) The velocity of the electron will increase

111. An electron of mass *m* and charge *e* is accelerated from rest through a p.d. *V* in vacuum. The final speed of the electron will be

[MP PMT 2000]

(a) $V\sqrt{e/m}$ (b) $\sqrt{eV/m}$ (c) $\sqrt{2eV/m}$ (d) $2eV/m$

112. In the figure distance of the point from *A*, where the electric field is zero is **[RPMT 2000]**



(a) 20 *cm* (b) 10 *cm* (c) 33 *cm* (d) None of these

113. Two metal pieces having a potential difference of 800 *V* are 0.02 *m* apart horizontally. A particle of mass 1.96×10^{-15} *kg* is suspended in equilibrium between the plates. If *e* is the elementary charge, then charge on the particle is **[MP PET 1999]**

(a) *e* (b) 3*e* (c) 6*e* (d) 8*e*

114. A sphere of radius 1 *cm* has potential of 8000 *V*, then energy density near its surface will be

(a) $64 \times 10^5\ J/m^3$ (b) $8 \times 10^3\ J/m^3$ (c) $32\ J/m^3$ (d) $2.83\ J/m^3$

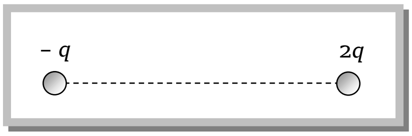
115. A particle of mass *m* and charge *q* is placed at rest in a uniform electric field *E* and then released. The kinetic energy attained by the particle after moving a distance *y* is

(a) qEy^2 (b) qE^2y (c) qEy (d) q^2Ey

116. Two equal charges q are placed at a distance of 2 a and a third charge – $2q$ is placed at the midpoint. The potential energy of the system is

(a) $\frac{q^2}{8\pi\varepsilon_0 a}$ (b) $\frac{6q^2}{8\pi\varepsilon_0 a}$ (c) $-\frac{7q^2}{8\pi\varepsilon_0 a}$ (d) $\frac{9q^2}{8\pi\varepsilon_0 a}$

117. In the diagram shown electric field intensity will be zero at a distance



(a) Between – q and $+2q$ charges (b) Towards $+2q$ on the line drawn

(c) Away from the line towards $2q$ (d) Away from the line towards – q

118. If an electron has an initial velocity in a direction different from that of an electric field, the path of the electron is **[CPMT 1982]**

(a) A straight line (b) A circle (c) An ellipse (d) A parabola

119. Three charges $4q$, Q and q are in a straight line in the position of 0, $l/2$ and l respectively. The resultant force on q will be zero. If Q =

[CPMT 1980]

(a) – q (b) – 2 q (c) $-\frac{q}{2}$ (d) 4 q

120. A pendulum bob of mass 80 mg and carrying a charge of 2×10^{-8} C is at rest in a horizontal uniform electric field of 20,000 V/m. The tension in the thread of the pendulum is

(a) 2.2×10^{-4} N (b) 4.4×10^{-4} N (c) 8.8×10^{-4} N (d) 17.6×10^{-4} N

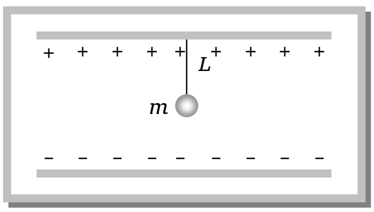
Equilibrium, Motion of Charge, *Neutral Point and*

Advance Level

121. An electron moving with the speed 5×10^6 per sec is shooted parallel to the electric field of intensity 1×10^3 N/C. Field is responsible for the retardation of motion of electron. Now evaluate the distance travelled by the electron before coming to rest for an instant (mass of $e = 9 \times 10^{-31}$ Kg. charge $= 1.6 \times 10^{-19}$ C)

(a) 7 m (b) 0.7 mm (c) 7 cm (d) 0.7 cm

122. A small sphere carrying a charge 'q' is hanging in between two parallel plates by a string of length L. Time period of pendulum is T_0. When parallel plates are charged, the time period changes to T. The ratio T/T_0 is equal to **[UPSEAT 2003]**



(a) $\left(\frac{g+\frac{qE}{m}}{g}\right)^{1/2}$ (b) $\left(\frac{g}{g+\frac{qE}{m}}\right)^{3/2}$ (c) $\left(\frac{g}{g+\frac{qE}{m}}\right)^{1/2}$ (d) None of these

123. Two equal point charges are fixed at $x = -a$ and $x = +a$ on the x-axis. Another point charge Q is placed at the origin. The change in the electrical potential energy of Q, when it is displaced by a small distance x along the x-axis, is approximately proportional to

[IIT Screening 2002]

(a) x (b) x^2 (c) x^3 (d) $1/x$

124. An elementary particle of mass m and charge $+e$ is projected with velocity v towards a much more massive particle of charge Ze, where $Z > 0$. What is the closest possible approach of the incident particle

(a) $Ze^2/2\pi\varepsilon_0 mv^2$ (b) $Ze^2/4\pi\varepsilon_0 mr_n$ (c) $Ze^2/8\pi\varepsilon_0 r_n$ (d) $-Ze^2/8\pi\varepsilon_0 r_n$

125. A ball of mass 1 g and charge 10^{-8} C moves from a point A. Where potential is 600 *volt* to the point B where potential is zero. Velocity of the ball at the point B is 20 cm/s. The velocity of the ball at the point A will be

(a) 22.8 cm/s (b) 228 cm/s (c) 16.8 m/s (d) 168 m/s

126. An electron of mass m_e initially at rest moves through a certain distance in a uniform electric field in time t_1. A proton of mass m_p also initially at rest takes time t_2 to move through an equal distance in this uniform electric field. Neglecting the effect of gravity, the ratio of t_2/t_1 is nearly equal to

(a) 1 (b) $(m_p/m_e)^{1/2}$ (c) $(m_e/m_p)^{1/2}$ (d) 1836

127. Point charges $+4q$, $-q$ and $+4q$ are kept on the x-axis at points $x = 0$, $x = a$ and $x = 2a$ respectively, then **[CBSE 1992]**

(a) Only $-q$ is in stable equilibrium (b) None of the charges are in equilibrium

(c) All the charges are in unstable equilibrium (d) All the charges are in stable equilibrium

128. A mass $m = 20$ g has a charge $q = 3.0$ mC. It moves with a velocity of 20 m/s and enters a region of electric field of 80 N/C in the same direction as the velocity of the mass. The velocity of the mass after 3 *seconds* in this region is

(a) 80 m/s (b) 56 m/s (c) 44 m/s (d) 40 m/s

129. An electron moves round a circular path of radius 0.1 m about an infinite linear charge of density +1 $\mu C/m$. The speed of the electron will be

(a) 5.6×10^3 m/s (b) 2.8×10^5 m/s (c) 5.6×10^7 m/s (d) 2.8×10^7 m/s

130. An electron falls through a distance of 8 cm in a uniform electric field of 10^5 N/C. The time taken by the electron in falling will be

(a) 3×10^{-6} s (b) 3×10^{-7} s (c) 3×10^{-8} s (d) 3×10^{-9} s

131. Two particles, each of mass 10 g and having charge of 1μC are in equilibrium on a horizontal table at a distance of 50 cm. The coefficient of friction between the particles and the table is

(a) 0.18 (b) 0.54 (c) 0.36 (d) 0.72

132. A small ball of mass (36 π)μ *gm* has a charge of 10^{-8} *C* on it. It is suspended by a thread from a vertical charged metal plate. In equilibrium the thread makes an angle of 45° with the plate. If $g = 10\ m/s^2$, then the charge density on the plate is

(a) $10^{-9}\ C/m^2$ (b) $10^{-8}\ C/m^{-2}$ (c) $10^{-7}\ C/m^2$ (d) $10^{-6}\ C/m^2$

133. A charged plate has charge density of $2 \times 10^{-6}\ C/m^2$. The initial distance of an electron which is moving towards plate, cannot strike the plate, if it is having energy of 200 *eV*

(a) 1.77 *mm* (b) 3.51 *mm* (c) 1/77 *cm* (d) 3.51 *cm*

134. A piece of cloud having area $25 \times 10^6\ m^2$ and electric potential of 10^5 *volts*. If the height of cloud is 0.75 *km*, then energy of electric field between earth and cloud will be

(a) 250 *J* (b) 750 *J* (c) 1225 *J* (d) 1475 *J*

135. 10 μ*C* charge is uniformly distributed over a thin ring of radius 1*m*. A particle (mass = 0.9 *gram* , charge 1 μ c) is placed on the axis of ring. It is displaced towards centre of ring, then time period of oscillations of particle

(a) 0.6 *sec* (b) 0.2 *sec* (c) 0.3 *sec* (d) 0.4 *sec*

136. Two identical particles of same mass are having same magnitude of charge *Q*. One particle is initially at rest on a frictionless horizontal plane and the other particle is projected directly towards the first particle from a very large distance with a velocity *v*. The distance of closest approach of the particle will be

(a) $\frac{1}{4\pi\varepsilon_0}\frac{4Q^2}{mv^2}$ (b) $\frac{1}{4\pi\varepsilon_0}\frac{2Q^2}{mv^2}$ (c) $\frac{1}{4\pi\varepsilon_0}\frac{Q^2}{m^2v^2}$ (d) $\frac{1}{4\pi\varepsilon_0}\frac{4Q^2}{m^2v^2}$

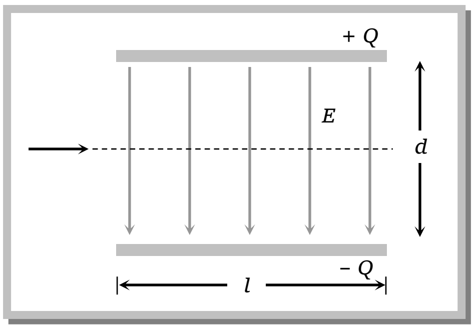
137. A very small sphere of mass 80 *gm* having a charge *Q* is held at a height 9*m* velocity above the centre of a fixed conducting sphere of radius 1*m*, carrying an equal charge *Q*, when released is falls until it is repelled just before it comes in contact with the sphere. What will be the charge *Q* ($g = 9.8\ m/s^2$)

(a) 28 *mC* (b) 28 μC (c) 28 *C* (d) None of these

138. A thin conducting ring of radius *r* has an electric charge + *Q*, if a point charge *q* is placed at the centre of the ring, then tension of the wire of ring will be

(a) $\frac{Qq}{8\pi\varepsilon_0 r^2}$ (b) $\frac{Qq}{4\pi\varepsilon_0 r^2}$ (c) $\frac{Qq}{8\pi^2\varepsilon_0 r^2}$ (d) $\frac{Qq}{4\pi^2\varepsilon_0 r^2}$

139. A particle of specific charge (*q*/*m*) enters into uniform electric field *E* along the centre line, with velocity *v*. After how much time it will collide with one of the plate (figure)



(a) $\frac{d}{V}$ (b) $\frac{d}{2V}$ (c) $\sqrt{\frac{md}{qE}}$ (d) $\sqrt{\frac{2md}{qE}}$

140. A dust particle of radius 5×10^{-7} m lies in an electric field of 6.28×10^5 V/m. The surrounding medium is air whose coefficient of viscosity is 1.6×10^{-5} $N\text{-}s/m^2$. If the particle moves with a horizontal uniform velocity of 0.02 m/s, the number of electrons on it is

(a) 10 (b) 20 (c) 30 (d) 40

141. A drop of water of mass 18×10^{-3} gm falls from a hole of the bottom of a charged conducting sphere of radius 20 cm, carrying with it a charge of 10^{-9} C and leaving a uniformly distributed charge of 2.5×10^{-6} C on the sphere. The speed of drop after it had fallen by 30 cm, will be

(a) 3.67 m/s (b) 4.62 m/s (c) 1.61 m/s (d) 3.06 m/s

142. How should three charge q, $2q$ and $8q$ be arranged on a 9 cm long line such that the potential energy of the system is minimum ?

(a) q at a distance of 3 cm from $2q$ (b) q at a distance of 5 cm from $2q$

(c) $2q$ at a distance of 7 cm from q (d) $2q$ at a distance of 9 cm from q

143. A proton and an α-particle are situated at r distance apart. At very large distance apart when released, the kinetic energy of proton will be

(a) $\frac{2ke^2}{r}$ (b) $\frac{8}{5}\frac{ke^2}{r}$ (c) $\frac{ke^2}{r}$ (d) $\frac{8ke^2}{r}$

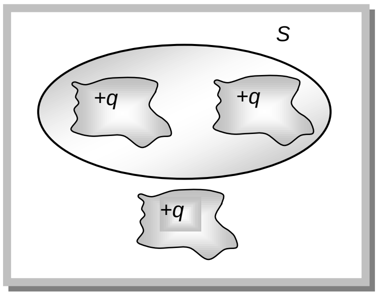
Electric dipole, Flux and Gauss's Law

Basic Level

144. An electric dipole has the magnitude of its charge as q and its dipole moment is p. It is placed in a uniform electric field E. If its dipole moment is along the direction of the field, the force on it and its potential energy are respectively **[CBSE 2004]**

(a) $q.E$ and $p.E$ (b) Zero and minimum (c) $q.E$ and maximum (d) $2q.E$ and minimum

145. Shown below is a distribution of charges. The flux of electric field due to these charges through the surface S is **[AIIM**



(a) $3q/\varepsilon_0$ (b) $2q/\varepsilon_0$ (c) q/ε_0 (d) Zero

146. A charge q is located at the centre of a cube. The electric flux through any face is **[CBSE 2003]**

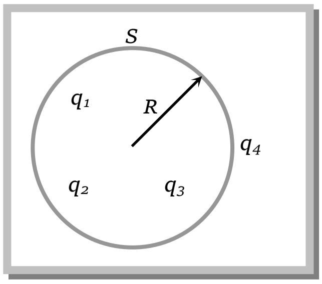
(a) $\frac{4\pi q}{6(4\pi\varepsilon_0)}$ (b) $\frac{\pi q}{6(4\pi\varepsilon_0)}$ (c) $\frac{q}{6(4\pi\varepsilon_0)}$ (d) $\frac{2\pi q}{6(4\pi\varepsilon_0)}$

147. 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

[AIEEE 2003]

(a) $(\phi_1 + \phi_2)\varepsilon_0$ (b) $(\phi_2 - \phi_1)\varepsilon_0$ (c) $(\phi_1 + \phi_2)/\varepsilon_0$ (d) $(\phi_2 - \phi_1)/\varepsilon_0$

148. q_1, q_2, q_3 and q_4 are point charges located at points as shown in the figure and S is a spherical Gaussian surface of radius R. Which of the following is true according to the Gauss's law



(a) $\oint_s (\vec{E}_1 + \vec{E}_2 + \vec{E}_3).d\vec{A} = \frac{q_1 + q_2 + q_3}{2\varepsilon_0}$

(b) $\oint_s (\vec{E}_1 + \vec{E}_2 + \vec{E}_3).d\vec{A} = \frac{(q_1 + q_2 + q_3)}{\varepsilon_0}$

(c) $\oint_s (\vec{E}_1 + \vec{E}_2 + \vec{E}_3).d\vec{A} = \frac{(q_1 + q_2 + q_3 + q_4)}{\varepsilon_0}$

(d) None of the above

149. The distance between H^+ and Cl^- ions in HCl molecule is 1.28Å. What will be the potential due to this dipole at a distance of 12Å on the axis of dipole

(a) 0.13 V (b) 1.3 V (c) 13 V (d) 130 V

150. The potential at a point due to an electric dipole will be maximum and minimum when the angles between the axis of the dipole and the line joining the point to the dipole are respectively

(a) 90° and 180° (b) 0° and 90° (c) 90° and 0° (d) 0° and 180°

151. When an electric dipole $\vec{p}$ is placed in a uniform electric field $\vec{E}$ then at what angle between $\vec{P}$ and $\vec{E}$ the value of torque will be maximum

(a) 90° (b) 0° (c) 180° (d) 45°

152. According to Gauss's theorem, electric field of an infinitely long straight wire is proportional to

(a) r (b) $\frac{1}{r^2}$ (c) $\frac{1}{r^3}$ (d) $\frac{1}{r}$

153. The electric field at a distance 'r' from an electric dipole is proportional to **[MP PET 2000; MP PMT 1993]**

(a) $1/r$ (b) $1/r^2$ (c) $1/r^3$ (d) r^2

154. Water is an excellent solvent because its molecules are **[MP PMT 1999]**

(a) Neutral (b) Highly polar (c) Non-polar (d) Anodes

155. An electric dipole is placed in an electric field generated by a point charge **[MP PMT 1999]**

(a) The net electric force on the dipole must be zero (b) The net electric force on the dipole may be zero

(c) The torque on the dipole due to the field must be zero (d) The torque on the dipole due to the field may be zero

156. Eight dipoles of charges of magnitude e are placed inside a cube. The total electric flux coming out of the cube will be

[MP PMT/PET 1998]

(a) $\frac{8e}{\varepsilon_0}$ (b) $\frac{16e}{\varepsilon_0}$ (c) $\frac{e}{\varepsilon_0}$ (d) Zero

157. A cube of side l is placed in a uniform field E, where $E = E\hat{i}$. The net electric flux through the cube is

(a) Zero (b) l^2E (c) $4l^2E$ (d) $6l^2E$

158. The distance between a proton and electron both having a charge 1.6×10^{-19} *coulomb*, of a hydrogen atom is 10^{-10} *metre*. The value of intensity of electric field produced on electrons due to proton will be

(a) 2.304×10^{-10} N/C (b) 14.4 V/m (c) 16 V/m (d) 1.44×10^{11} N/C

159. The electric field at a point on equatorial line of a dipole and direction of the dipole **[MP PET 1995]**

(a) Will be parallel (b) Will be in opposite direction (c) Will be perpendicular (d)

160. For a given surface the Gauss's law is stated as $\oint E.ds = 0$. 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 of the surface

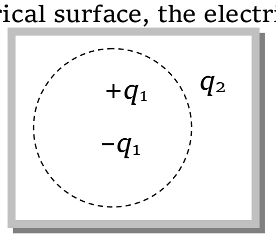
161. An electric dipole when place in a uniform electric field E will have minimum potential energy, if the positive direction of dipole moment makes the following angle with E

(a) π (b) $\pi/2$ (c) Zero (d) $3\pi/2$

Electric dipole, Flux and Gauss's Law

Advance Level

162. Consider the charge configuration and a spherical Gaussian surface as shown in the figure. When calculating the flux of the electric field over the spherical surface, the electric field will be due to



(a) q_2 (b) Only the positive charges (c) All the charges (d)

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

(a) 5 cm (b) $\frac{25}{9}$ cm (c) 10 cm (d) $\frac{4}{13}$ cm

164. Two point charges $+q$ and $-q$ are held fixed at $(-d, 0)$ and $(d, 0)$ respectively of a (X, Y) co-ordinate system. Then **[IIT 1995]**

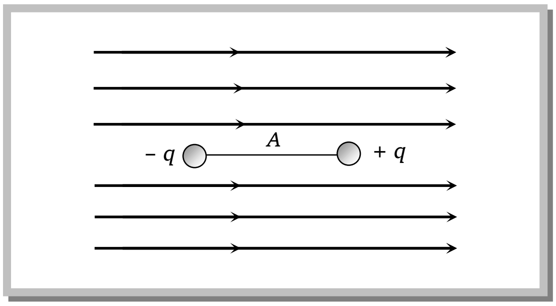
(a) E at all points on the Y-axis is along $\hat{i}$

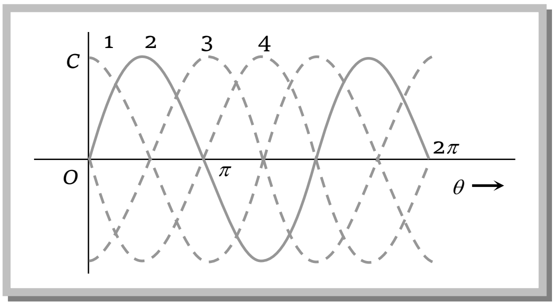
(b) The electric field E at all points on the X-axis has the same direction

(c) Dipole moment is $2qd$ directed along $\hat{i}$

(d) Work has to be done in bringing a test charges from infinity to the origin

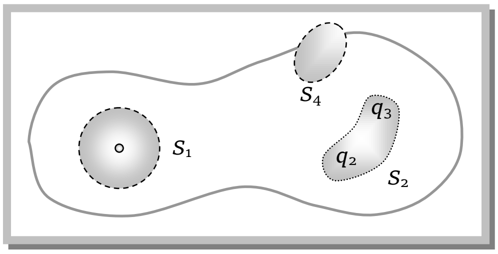
165. The electric dipole is situated in an electric field as shown in adjacent figure. The dipole and the electric field are both in the plane of the paper. The dipole is rotated about an axis perpendicular the plane of the paper about its axis at a point A in anti-clockwise direction. If the angle of rotation is measured with respect to the direction of the electric field, then the torque for different values of the angle of rotation 'θ' will be represented in fig. given below by the **[CPMT 1986]**





(a) Curve (1) (b) Curve (2) (c) Curve (3) (d) Curve (4)

166. As shown in the figure $q_1 = 1\mu c$, $q_2 = 2\mu c$ and $q_3 = -3\ \mu c$ and S_1, S_2, S_3 and S_4 are four closed surfaces. The values of electric flux coming out of the surfaces S_1 and S_2 will respectively be



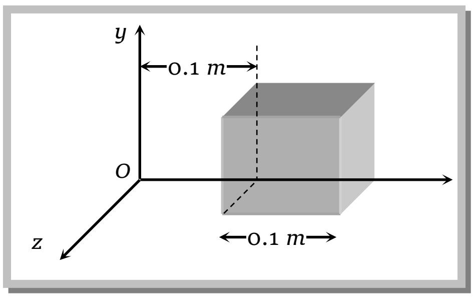
(a) Zero, 1.113×10^{-5} V/m

(b) 1.13×10^5 V-m and zero

(c) 1.13×10^5 V-m and -1.13×10^5 V-m

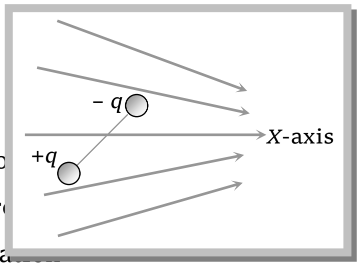
(d) -1.13×10^5 V-m and 1.13×10^5 V-m

167. What will be the charge present inside a cube which produces electric field $E_x = 600\ x^{1/2}$, $E_y = 0$, $E_z = 0$



(a) 600 μC (b) 60 μC (c) 7 $\mu\mu C$ (d) 6 $\mu\mu C$

168. There exists a non-uniform electric field along x-axis as shown in figure. The field increases at a uniform rate along positive x-axis. A dipole is placed inside the field as shown. For the dipole which one of the following statement is correct



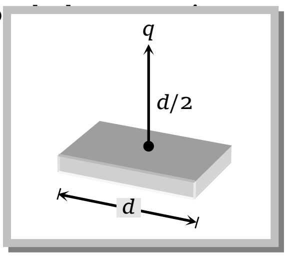
(a) Dipole moves along positive x-axis and undergoes a clockwise rotation

(b) Dipole moves along negative x-axis after undergoing a clockwise rotatio

(c) Dipole moves along positive x-axis after under going an anticlockwise r

(d) Dipole moves along negative x-axis and undergoes an anticlockwise rota

169. A point charge $+q$ is at a distance $d/2$ from a square surface of side d and is directly above the centre of the square as shown in fig. The electric flux thro



(a) $q/\pi\varepsilon_0$ (b) $q/6\varepsilon_0$ (c) q/ε_0 (d) Zero

Capacitance and Capacitor

Basic Level

170. A parallel plate capacitor carries a charge q. The distance between the plates is doubled by application of a force. The work done by the force is

(a) Zero (b) $\frac{q^2}{C}$ (c) $\frac{q^2}{2C}$ (d) $\frac{q^2}{4C}$

171. A parallel plate capacitor of capacity C_0 is charged to a potential V_0

(i) The energy stored in the capacitor when the battery is disconnected and the separation is doubled E_1

(ii) The energy stored in the capacitor when the charging battery is kept connected and the separation between the capacitor plates is doubled is E_2. Then E_1/E_2 value is

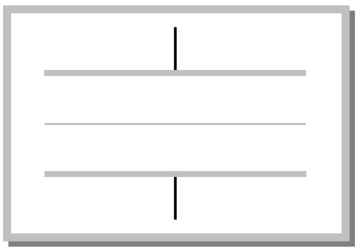
(a) 4 (b) 3/2 (c) 2 (d) ½

172. Capacitance of a parallel plate capacitor becomes 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). The dielectric constant of the slab is **[Karnataka CET 2003]**

(a) 8 (b) 4 (c) 6 (d) 2

173. As shown in the figure, a very thin sheet of aluminium in placed in between the plates of the condenser. Then the capacity

[AIEEE 2003]



(a) Will increase (b) Will decrease (c) Remains unchanged (d) May increase or decrease

174. 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} *joule* (b) 16×10^{-32} *joule* (c) 3.1×10^{-26} *joule* (d) 4×10^{-10} *joule*

175. What fraction of the energy drawn from the charging battery is stored in a capacitor ?

(a) 100% (b) 75% (c) 50% (d) 25%

176. Capacitance (in *F*) of a spherical conductor with radius $1\,m$ is

(a) 1.1×10^{-10} (b) 10^{-6} (c) 9×10^{-9} (d) 10^{-5}

177. Work done by an external agent in separating the parallel plate capacitor is **[AIEEE 2002]**

(a) CV (b) $\frac{1}{2}C^2V$ (c) $\frac{1}{2}CV^2$ (d) None of these

178. A parallel plate capacitor has an electric field of $10^5\,V/m$ between the plates. If the charge on the capacitor plate is $1\mu C$, the force on each capacitor plate is

(a) 0.5 *N* (b) 0.05 *N* (c) 0.005 *N* (d) None of these

179. A conducting sphere of radius $10\,cm$ is charged $10\,\mu C$. Another uncharged sphere of radius $20\,cm$ is allowed to touch it for some time. After that if the spheres are separated, then surface density of charges on the spheres will be in the ratio of

[AIIMS 2002]

(a) 1 : 4 (b) 1 : 3 (c) 2 : 1 (d) 1 : 1

180. If the distance between parallel plates of a capacitor is halved and dielectric constant is doubled then the capacitance

[CBSE 2002; BHU 2001]

(a) Decreases two times (b) Increases two times (c) Increases four times (d) Remain the same

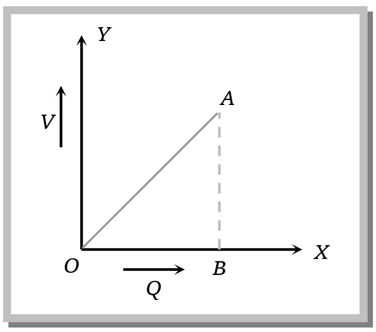
181. *N* identical spherical drops are charged to the same potential V. They are combine to form a bigger drop. The potential of the big drop will be

(a) $VN^{1/3}$ (b) $VN^{2/3}$ (c) V (d) VN

182. A capacitor is used to store 24 *watt* hour of energy at 1200 volt. What should be the capacitance of the capacitor **[KCET 2001]**

(a) $120\,mF$ (b) $120\,\mu F$ (c) $12\,\mu F$ (d) $24\,mF$

183. Change *Q* on a capacitor varies with voltage *V* as shown in the figure, where *Q* is taken along the *X*-axis and *V* along the *Y*-axis. The area of triangle *OAB* represents



(a) Capacitance (b) Capacitive reactance

(c) Magnetic field between the plates (d) Energy stored in the capacitor

184. A solid conducting sphere of radius R_1 is surrounded by another concentric hollow conducting sphere or radius R_2. The capacitance of this assembly is proportional to

(a) $\frac{R_2 - R_1}{R_1 R_2}$ (b) $\frac{R_2 + R_1}{R_1 R_2}$ (c) $\frac{R_1 R_2}{R_2 + R_1}$ (d) $\frac{R_1 R_2}{R_2 - R_1}$

185. A condenser having a capacity 2.0 *microfarad* is charged to 200 volts and then the plates of the capacitor are connected to a resistance wire. The heat produced in joules will be

(a) 4×10^4 *Joule* (b) 4×10^{10} *Joule* (c) 4×10^{-2} *Joule* (d) 2×10^{-2} *Joule*

186. A metallic sheet is inserted between plates parallel to the plates of a parallel plate capacitor. The capacitance of the capacitor

[REE 2000]

(a) Increases

(b) Is independent of the position of the sheet

(c) Is maximum when the metal sheet is in the middle

(d) Is maximum when the metal sheet touches one of the capacitor plates

187. The capacity of parallel plate condenser depends on **[MP PMT 2000; CPMT 1974]**

(a) The type of metal used (b) The thickness of plates

(c) The potential applied across the plates (d) The separation between the plates

188. A variable condenser is permanently connected to a $100V$ battery. If the capacity is changed from $2\mu F$ to $10\mu F$, then change in energy is equal to

(a) 2×10^{-2} J (b) 2.5×10^{-2} J (c) 3.5×10^{-2} J (d) 4×10^{-2} J

189. The capacity of a parallel plate capacitor with no dielectric substance but with a separation of 0.4 *cm* is $2\mu F$. The separation is reduced to half and it is filled with a dielectric substance of value 2.8. The final capacity of the capacitor is **[CBSE 2000]**

(a) $11.2\mu F$ (b) $15.6\mu F$ (c) $19.2\mu F$ (d) $22.4\mu F$

190. The capacity o a condenser is 4×10^{-6} *farad* and its potential is 100 *volt*. The energy released on discharging it fully will be

[MP PMT 2000; AFMC 1998; AIIMS 1984, 80 Similar to MP PET 1999]

(a) 0.02 *joule* (b) 0.04 *joule* (c) 0.025 *joule* (d) 0.05 *joule*

191. When we touch the terminals of a high voltage capacitor, even after a high voltage has been cut off, then the capacitor has a tendency to

(a) Restore energy (b) Discharge energy (c) Affect dangerously (d) Both (b) and (c)

192. A parallel plate air capacitor is charged to a potential difference of V. After disconnecting the battery, distance between the plates of the capacitor is increased using an insulating handle. As a result, the potential difference between the plates

[KCET (E) 1999; KCET (M) 1999]

(a) Decreases (b) Increases (c) Becomes zero (d) Does not change

193. A 10 *pF* capacitor is connected to a $50V$ battery. How much electrostatic energy is stored in the capacitor ?

[KCET (E) 1999; KCET (M) 1999 Similar to AFMC 2000, MP PMT 2000, MP PET 1994 and CPMT 1978]

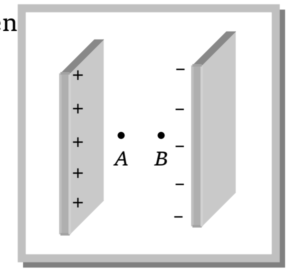
(a) $1.25 \times 10^{-8} J$ (b) $2.5 \times 10^{-7} J$ (c) $3.5 \times 10^{-5} J$ (d) $4.5 \times 10^{-2} J$

194. When a dielectric material is introduced between the plates of a charged condenser, the electric field between the plates

[Pb. PMT 1999]

(a) Decreases (b) Increases (c) Remain constant (d) First 'b' then 'a'

195. Two protons A and B are placed in space between plates of a parallel plate capacitor charged upto V volts (see fig.) Forces on protons are F_A and F_B, then



(a) $F_A > F_B$ (b) $F_A < F_B$ (c) $F_A = F_B$ (d) Nothing can be said

196. A condenser is charged and then battery is removed. A dielectric plate is put between the plates of condenser, then correct statement is

[RPET 1998]

(a) Q constant, V and U decrease (b) Q constant, V increases, U decreases

(c) Q increases, V decreases, U increases (d) None of these

197. 1000 small water drops each of radius r and charge q coalesce together to form one spherical drop. The potential of the big drop is larger than that of the smaller drop by a factor of

[CPMT 1997, 91; MP PMT 1996; NCERT 1984 Similar to CPMT 1989, 83, MP PMT 1994, 89 & MP PET 1997, 92]

(a) 1000 (b) 100 (c) 10 (d) 1

198. Two metal spheres of radii $1cm$ and $2cm$ are given charges of $10^{-2}C$ and $5\times10^{-2}C$ respectively. If both spheres are joined by a metal wire, then the final charge on the smaller spheres will be

(a) $2\times10^{-2}C$ (b) $4\times10^{2}C$ (c) $3\times10^{-2}C$ (d) $4\times10^{-2}C$

199. A condenser is charged and then battery is removed. A dielectric plate is put between the plates of condenser, then correct statement is

[RPET 1998]

(a) Q constant, V and U decrease (b) Q constant, V increases, U decreases

(c) Q increases, V decreases, U increases (d) None of these

200. 1000 small water drops each of radius r and charge q coalesce together to form one spherical drop. The potential of the big drop is larger than that of the smaller drop by a factor of

[CPMT 1997, 91; MP PMT 1996; NCERT 1984 Similar to CPMT 1989, 83, MP PMT 1994, 89 & MP PET 1997, 92]

(a) 1000 (b) 100 (c) 10 (d) 1

201. Two metal spheres of radii $1cm$ and $2cm$ are given charges of $10^{-2}C$ and $5\times10^{-2}C$ respectively. If both spheres are joined by a metal wire, then the final charge on the smaller spheres will be

(a) $2\times10^{-2}C$ (b) $4\times10^{2}C$ (c) $3\times10^{-2}C$ (d) $4\times10^{-2}C$

202. A capacitor of capacity C has charge Q and stored energy is W. If the charge is increased to $2Q$, the stored energy will be

[MP PET 1990]

(a) $2W$ (b) $W/2$ (c) $4W$ (d) $W/4$

203. 64 drops each having the capacity C and potential V are combined to form a big drop. If the charge on the small drop is q, then the charge on the big drop will be

(a) $2q$ (b) $4q$ (c) $16q$ (d) $64q$

204. The capacity of a parallel plate condenser is 5 μF. When a glass plate is placed between the plates of the conductor, its potential becomes $1/8^{th}$ of the original value. The value of dielectric constant will be

[MP PMT 1985 Similar to CPMT 1990, 88, 85, 82, 72, MP PET 1994, KCET 1994, MP PMT 1993 and NCERT 1990]

(a) 1.6 (b) 5 (c) 8 (d) 40

205. Which one statement is correct ? A parallel plate air condenser is connected with a battery. Its charge, potential, electric field and energy are Q_0, V_0, E_0 and U_0 respectively. In order to fill the complete space between the plates a dielectric slab is inserted, the battery is still connected. Now the corresponding values Q, V, E and U are in relation with the initially stated as **[IIT 1985]**

(a) $Q > Q_0$ (b) $V > V_0$ (c) $E > E_0$ (d) $U > U_0$

206. The capacity of a parallel plate air capacitor is 10 μF and it is given a charge 40 μC. the electrical energy stored in the capacitor in *ergs* is

(a) 80×10^6 (b) 800 (c) 8000 (d) 20000

207. There is an air filled 1 pF parallel plate capacitor. When the plate separation is doubled and the space is filled with wax, the capacitance increases to 2 pF. The dielectric constant of wax is

(a) 2 (b) 4 (c) 6 (d) 8

208. A parallel plate capacitor is charged and the charging battery is then disconnected. If the plates of the capacitor are moved further apart by means of insulating handles, then **[MP PMT 1996; Manipal MEE 1995; MP PET 1992; IIT 1887]**

(a) The charge on the capacitor increases

(b) The voltage across the plates decreases

(c) The capacitance increases

(d) The electrostatics energy stored in the capacitor increases

209. An air capacitor is connected to a battery. The effect of filling the space between the plates with a dielectric is to increase

[MP PMT 1995]

(a) The charge and the potential difference (b) The potential difference and the electric field

(c) The electric field and the capacitance (d) The charge and the capacitance

210. Between the plates of a parallel plate condenser there is 1 *mm* thick paper of dielectric constant 4. It is charged at 100 *volt*. The electric field in *volt*/*metre* between the plates of the capacitor is

(a) 100 (b) 100000 (c) 25000 (d) 400000

211. A capacitor is kept connected to the battery and a dielectric slab is inserted between the plates. During this process

[MP PMT 1994]

(a) No work is done

(b) Work is done at the cost of the energy already stored in the capacitor before the slab is inserted

(c) Work is done at the cost of the battery

(d) Work is done at the cost of both the capacitor and the battery

212. A capacitor with air as the dielectric is charged to a potential of 100 *volts*. If the space between the plates is now filled with a dielectric of dielectric constant 10, the potential difference between the plates will be

(a) 1000 *volts* (b) 100 *volts* (c) 10 *volts* (d) Zero

213. The distance between the circular plates of a parallel plate condenser 40 *mm* in diameter, in order to have same capacity as a sphere of radius 1 *metre* is

(a) 0.01 *mm* (b) 0.1 *mm* (c) 1.0 *mm* (d) 10 *mm*

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

(a) 0 (b) $F/2$ (c) F (d) $2F$

215. Two metallic charged spheres whose radii are 20 *cm* and 10 *cm* respectively, have each 150 *micro-coulomb* positive charge. The common potential after they are connected by a conducting wire is

(a) 9×10^6 *volts* (b) 4.5×10^6 *volts* (c) 1.8×10^7 *volts* (d) 13.5×10^6 *volt*

216. A capacitor of capacity C is connected with a battery of potential V in parallel. The distance between its plates is reduced to half at once, assuming that the charge remains the same. Then to charge to capacitance upto the potential V again, the energy given by the battery will be

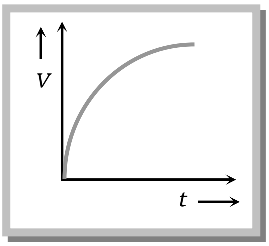
(a) $CV^2/4$ (b) $CV^2/2$ (c) $3CV^2/4$ (d) CV^2

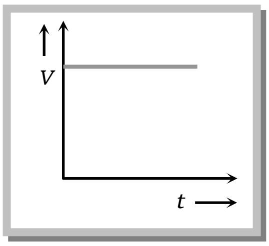
Capacitance and Capacitor

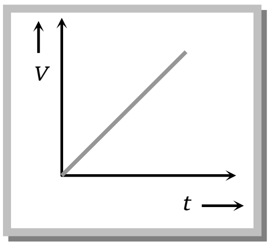
Advance Level

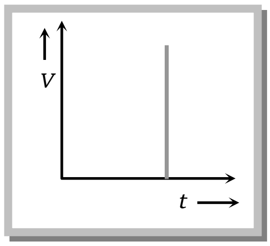
217. If on charging a capacitor current is kept constant then the variation of potential V of the capacitor with time t is shown as

[MP PET 2003]

(a)


(b)


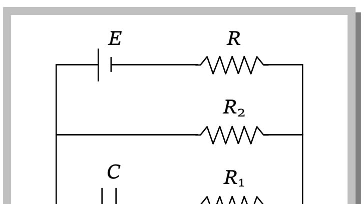
(c)


(d)


218. Two capacitors of capacitance 2 and $3\mu F$ are joined in series. Outer plate first capacitor is at 1000 *volt* and outer plate of second capacitor is earthed (grounded). Now the potential on inner plate of each capacitor will be **[MP PMT 2003]**

(a) 700 *Volt* (b) 200 *Volt* (c) 600 *Volt* (d) 400 *Volt*

219. In the given figure each plate of capacitance C has partial value of charge **[MP PMT 2003]**



(a) CE (b) $\frac{CER_1}{R_2 - R}$ (c) $\frac{CER_2}{R_2 + R}$ (d) $\frac{CER_1}{R_1 - R}$

220. A parallel plate capacitor has plate area A and separation d. It is charged to a potential difference V_0. The charging battery is disconnected and the plates are pulled apart to three times the initial separation. The work required to separate the plates is

[Kerala PET 2002]

(a) $\frac{3\varepsilon_0 AV_0^2}{d}$ (b) $\frac{\varepsilon_0 AV_0^2}{2d}$ (c) $\frac{\varepsilon_0 AV_0^2}{3d}$ (d) $\frac{\varepsilon_0 AV_0^2}{d}$

221. A charged 100μF capacitor is discharged through a 10 $k\Omega$ resistor. The ratio $\frac{\text{Charge on the capacitor after 1 second}}{\text{Original charge on the capacitor}}$ is

(a) $(1 - 1/e)$ (b) ln 2 (c) $(1 - \ln 2)$ (d) $1/e$

222. The area of the plates of a parallel plate capacitor is A and the distance between the plates is 10 mm. There are two dielectric sheets in it, one of dielectric constant 10 and thickness 6 mm and the other of dielectric constant 5 and thickness 4 mm. The capacity of the condenser is

(a) $\frac{12}{35}\varepsilon_0 A$ (b) $\frac{2}{3}\varepsilon_0 A$ (c) $\frac{5000}{7}\varepsilon_0 A$ (d) 1500 $\varepsilon_0 A$

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

(a) 5 sec (b) 20 sec (c) 25 sec (d) 50 sec

224. The space between the plates of a parallel plate capacitor is filled completely with a dielectric substance having dielectric constant 4 and thickness 3 mm. The distance between the plates in now increased by inserting a second sheet of thickness 5 mm and dielectric constant K. If the capacitance of the capacitor so formed is one-half of the original capacitance, the value of K is

(a) 10/3 (b) 20/3 (c) 5/3 (d) 15/3

225. A capacitor of capacitance 160 μF is charged to a potential difference of 200 V and then connected across a discharge tube, which conducts until the potential difference across it has fallen to 100 V. The energy dissipated in the tube is

(a) 6.4 J (b) 4.8 J (c) 3.2 J (d) 2.4 J

226. A 0.1 μF capacitor filled completely with a dielectric and it is charged until the p.d. between the plates becomes 25 V. Then the charge is shared with a similar capacitor which has air as dielectric. The potential difference falls to 15 V. The dielectric constant of the first capacitor is

(a) 2.5 (b) 1.5 (c) 7.5 (d) 5.5

227. A parallel plate capacitor of plate area A and plate separation d is charged to potential V and then the battery is disconnected. A slab of dielectric constant K is then inserted between the plates of the capacitors 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 the process of inserting the slab, then state incorrect relation from the following **[IIT-JEE 1991; MP PET 1997]**

(a) $Q = \frac{\varepsilon_0 AV}{d}$ (b) $W = \frac{\varepsilon_0 AV^2}{2Kd}$ (c) $E = \frac{V}{Kd}$ (d) $W = \frac{\varepsilon_0 AV^2}{2d}\left(\frac{1}{K} - 1\right)$

228. A dielectric slab of thickness d is inserted in a parallel plate capacitor whose negative plate is at $x = 0$ and positive plate is at $x = 3d$. The slab is equidistant from the plates. The capacitor is given some charge. As x goes from 0 to $3d$ **[IIT 1998]**

(a) The magnitude of the electric field remains the same

(b) The direction of the electric field remains the same

(c) The electric potential increases continuously

(d) The electric potential increases at first, then decreases and again increases

229. A capacitor of capacitance C_0 is charged to a potential V_0 and then isolated. A small capacitor C is then charged from C_0, discharged and charged again; the process being repeated n times. Due to this, potential of the larger capacitor is decreased to V. Value of C is

(a) $C_0\left[\frac{V_0}{V}\right]^{1/n}$ (b) $C\left[\left(\frac{V_0}{V}\right)^{1/n}-1\right]$ (c) $C\left[\left(\frac{V}{V_0}\right)-1\right]^n$ (d) $C\left[\left(\frac{V}{V_0}\right)^n+1\right]$

Grouping of Capacitors

Basic Level

230. Three capacitors each of capacity $4\mu F$ are to be connected in such a way that the effective capacitance is $6\ \mu F$. This can be done by **[CBSE 2003]**

(a) Connecting them in parallel (b) Connecting two in series and one in parallel

(c) Connecting two in parallel and one in series (d) Connecting all of them in series

231. A 0.2 μF capacitor is charged to 600 V. After removing it from battery it is connected to another capacitor of $1\mu F$ in parallel. The voltage on the capacitor will become

(a) 300 V (b) 600 V (c) 100 V (d) 120 V

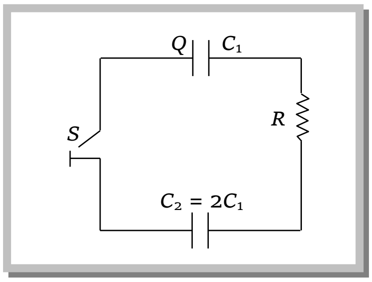
232. Two identical capacitors, have the same capacitance C. One of them is charged to potential V_1 and the other to V_2. The negative ends of the capacitors are connected together. When the positive ends are also connected, the decrease in energy of the combined system is **[IIT Screening 2002]**

(a) $\frac{1}{4}C(V_1^2 - V_2^2)$ (b) $\frac{1}{4}C(V_1^2 + V_2^2)$ (c) $\frac{1}{4}C(V_1 - V_2)^2$ (d) $\frac{1}{4}C(V_1 + V_2)^2$

233. If there are n-capacitors in parallel connected to V volt source, then the energy stored is equal to

(a) CV (b) $\frac{1}{2}nCV^2$ (c) CV^2 (d) $\frac{1}{2n}CV^2$

234. Two capacitors C_1 and $C_2 = 2C_1$ are connected in a circuit with a switch between them as shown in the figure. Initially the switch is open and C_1 holds charge Q. The switch is closed. At steady state, the charge on each capacitor will be **[Orissa JEE 2002]**



(a) $Q, 2Q$ (b) $Q/3, 2Q/3$ (c) $3Q/2, 3Q$ (d) $2Q/3, 4Q/3$

235. Two capacitors of $1\mu F$ and $2\mu F$ are connected in series, the resultant capacitance will be

(a) $4\mu F$ (b) $\frac{2}{3}\mu F$ (c) $\frac{3}{2}\mu F$ (d) $3\mu F$

236. A capacitor of $10\,\mu F$ charged up to 250 volts is connected in parallel with another capacitor of $5\mu F$ charged up to 100 volts. The common potential is

(a) 500 V (b) 400 V (c) 300 V (d) 200 V

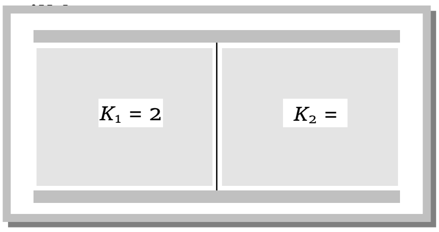
237. A body of capacity $4\mu F$ is charged to $80V$ and another body of capacity $6\mu F$ is charged to $30V$. When they are connected the energy lost by $4\mu F$ capacitor is

(a) 1. 8 mJ (b) 4.6 mJ (c) 3.2 mJ (d) 2.5 mJ

238. A $20F$ capacitor is charged to $5V$ and isolated. It is then connected in parallel with an uncharged $30F$ capacitor. The decrease in the energy of the system will be

(a) 25 J (b) 200 J (c) 125 J (d) 150 J

239. Capacitance of an air filled parallel plate capacitor is 10 μF. If two dielectric medium are filled as shown in figure then equivalent capacitance



(a) 30 μF (b) 15 μF (c) 5 μF (d) 10 μF

240. Three capacitors of capacitance $3\mu F$, $10\mu F$ and 15 μF are connected in series to a voltage source of 100 V. The charge on 15 μF is

[CPMT 2001; AIIMS 2000; Pb PMT 1999; Similar to RPMT 1999, 2000 and MP PMT 2000]

(a) 25 μC (b) 100 μC (c) 200 μC (d) 280 μC

241. A parallel plate capacitor has capacitance C. If it is equally filled with parallel layers of materials of dielectric constant K_1 and K_2 its capacity becomes C_1. The ratio of C_1 to C is

(a) $K_1 + K_2$ (b) $\frac{K_1K_2}{K_1 - K_2}$ (c) $\frac{K_1 + K_2}{K_1K_2}$ (d) $\frac{2K_1K_2}{K_1 + K_2}$

242. A capacitor of capacity C_1, is charged by connecting it across a battery of e.m.f. V_0. The battery is then removed and the capacitor is connected in parallel with an uncharged capacitor of capacity C_2. The potential difference across this combination is **[MP PET 2000]**

(a) $\frac{C_2}{C_1 + C_2}.V_0$ (b) $\frac{C_1}{C_1 + C_2}.V_0$ (c) $\frac{C_1 + C_2}{C_2}.V_0$ (d) $\frac{C_1 + C_2}{C_1}.V_0$

243. Two capacitors with capacitances C_1 and C_2 are charged to potentials V_1 and V_2 respectively. When they are connected in parallel, the ratio of their respective charges is

(a) $\frac{V_1^2}{V_2^2}$ (b) $\frac{V_1}{V_2}$ (c) $\frac{C_1^2}{C_2^2}$ (d) $\frac{C_1}{C_2}$

244. Two condensers of capacity 0.3 μF and 0.6 μF respectively are connected in series. The combination is connected across a potential of 6 *volts*. The ratio of energies stored by the condensers will be

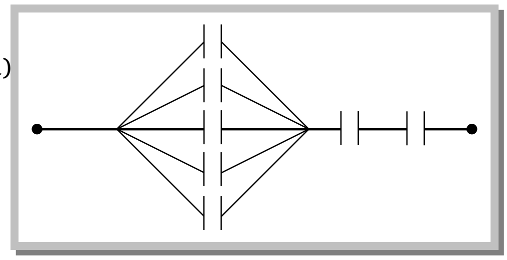
(a) $\frac{1}{2}$ (b) 2 (c) $\frac{1}{4}$ (d) 4

245. Three capacitors of capacitances 3 μF are connected once in series and another time in parallel. The ratio of equivalent capacitance in the two cases $\left(\frac{C_s}{C_p}\right)$ will be

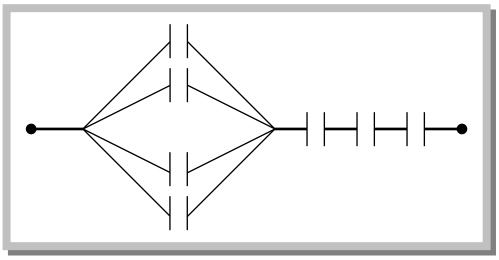
(a) 1 : 9 (b) 9 : 1 (c) 1 : 1 (d) 1 : 3

246. Seven capacitors each of capacity $2\mu F$ are to be so connected to have a total capacity $\frac{10}{11}\mu F$. Which will be the necessary figure as shown ?

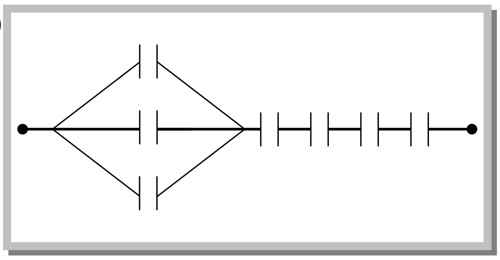
(a)



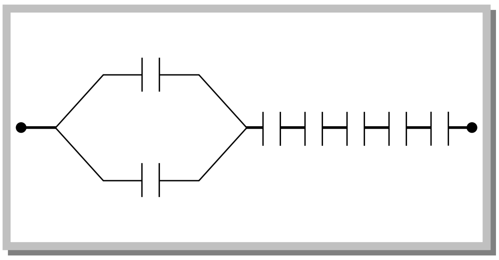
(b)



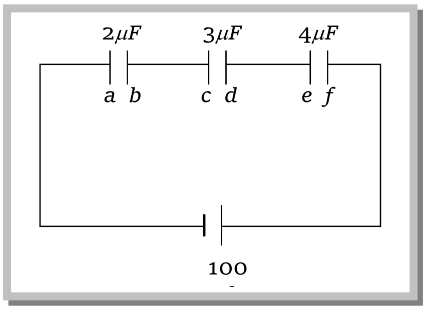
(c)



(d)



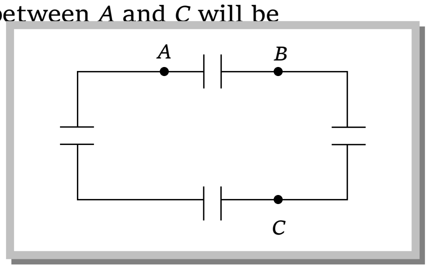
247. Three capacitors are connected to d.c. source of 100 *volts* as shown in the adjoining figure. If the charge accumulated on plates of C_1, C_2 and C_3 are q_a, q_b, q_c, q_d, q_e and q_f respectively, then



(a) $q_b + q_d + q_f = \frac{100}{9}$ *coulombs* (b) $q_b + q_d + q_f = 0$

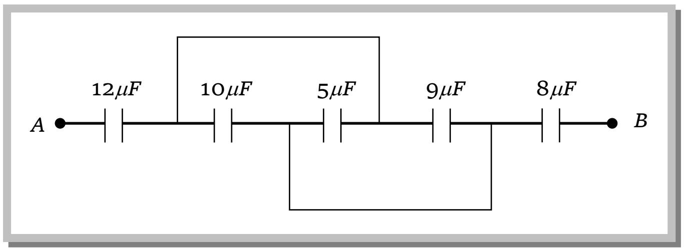
(c) $q_a + q_c + q_e = 50$ *coulombs* (d) $q_b = q_d = q_f$

248. Four capacitors of each of capacity $3\mu F$ are connected as shown in the adjoining figure. The ratio of equivalent capacitance between A and B and between A and C will be



(a) 4 : 3 (b) 3 : 4 (c) 2 : 3 (d) 3 : 2

249. The capacities and connected of five capacitors are shown in the adjoining figure. The potential difference between the points A and B is 60 *volts*. Then the equivalent capacity between A and B and the charge on 5 μF capacitance will be respectively



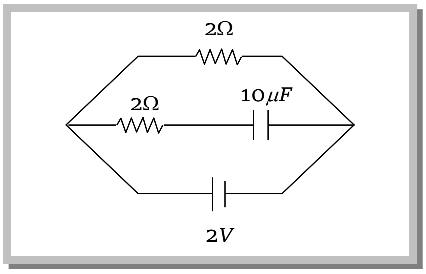
(a) 44 μF; 300 μC (b) 16 μF; 150 μC (c) 15 μF; 200 μC (d) 4 μF; 50μC

250. Three identical capacitors are combined differently. For the same voltage to each combination, the one that stores the greatest energy is

(a) Two in parallel and the third in series with it (b) Three in series

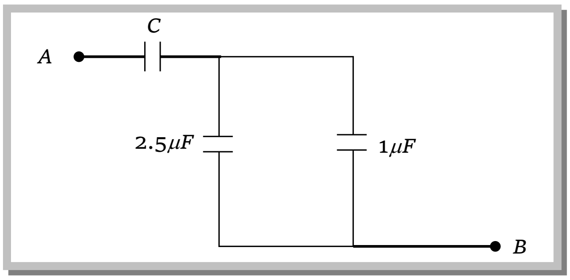
(c) Three in parallel (d) Two in series and third in parallel with it

251. The charge on a capacitor of capacitance 10 μF connected as shown in the figure is **[AMU 1995]**



(a) 20 μC (b) 15 μC (c) 10 μC (d) Zero

252. The equivalent capacitance between A and B in the figure is 1 μF. Then the value of capacitance C is



(a) 1.4 μF (b) 2.5 μF (c) 3.5 μF (d) 1.2 μF

253. A condenser of capacity C_1 is charged to a potential V_0. The electrostatic energy stored in it is U_0. It is connected to another uncharged condenser of capacity C_2 in parallel. The energy dissipated in the process is

(a) $\frac{C_2}{C_1+C_2}U_0$ (b) $\frac{C_1}{C_1+C_2}U_0$ (c) $\left(\frac{C_1-C_2}{C_1+C_2}\right)U_0$ (d) $\frac{C_1C_2}{2(C_1+C_2)}U_0$

254. Minimum number of capacitors of 2 μF capacitance each required to obtain a capacitor of 5 μF will be

(a) Three (b) Four (c) Five (d) Six

255. 2 μF capacitance has p.d. across its two terminals 200 *volts*. It is disconnected with battery and then another uncharged capacitance is connected in parallel to it, then p.d. becomes 20 *volts*. Then the capacity of another capacitance will be

[CPMT 1991 Similar to MP PET 1999, 92]

(a) 2 μF (b) 4 μF (c) 18 μF (d) 16 μF

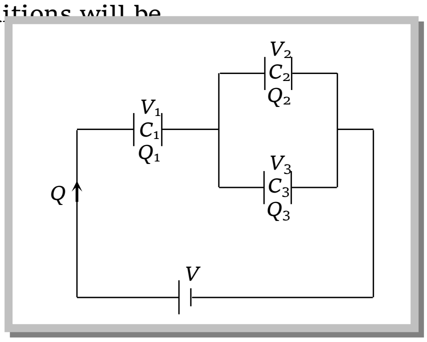
256. Two capacitors each of capacity 2 μF are connected in parallel. This system is connected in series with a third capacitance of 12 μF capacity. The equivalent capacity of the system will be

(a) 16 μF (b) 13 μF (c) 4 μF (d) 3 μF

257. A 4 μF condenser is connected in parallel to another condenser of 8 μF. Both the condensers are then connected in series with a 12 μF condenser and charged to 20 *volts*. The charge on the plate of 4 μF condenser is

(a) 3.3 μC (b) 40 μC (c) 80 μC (d) 240 μC

258. In the diagram below are shown three capacitors C_1, C_2 and C_3 joined to battery. With symbols having their usual meanings, the correct conditions will be



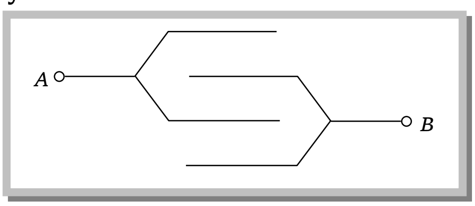
(a) $Q_1 = Q_2 = Q_3$ and $V_1 = V_2 = V_3 + V$ (b) $Q_1 = Q_2 + Q_3$ and $V = V_1 + V_2 + V_3$

(c) $Q_1 = Q_2 + Q_3$ and $V = V_1 + V_2$ (d) $Q_3 = Q_2$ and $V_2 = V_3$

Grouping of Capacitors

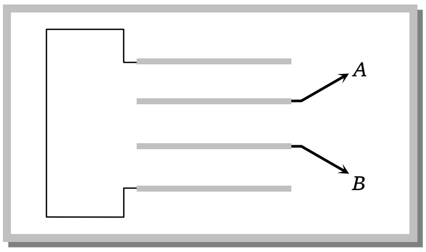
Advance Level

259. If four plates each of area A are arranged according to the given diagram with distance d between neighboring plates then the capacitance of the system between A and B will be



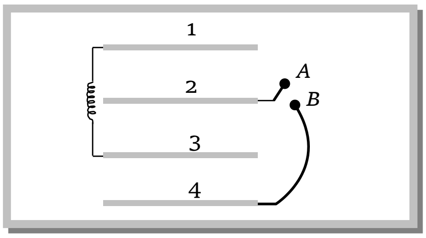
(a) $\frac{4\varepsilon_0 A}{d}$ (b) $\frac{3\varepsilon_0 A}{d}$ (c) $\frac{2\varepsilon_0 A}{d}$ (d) $\frac{\varepsilon_0 A}{d}$

260. Four metallic plates, each with a surface area of one side A are placed at a distance d from each other. The plates are connected as shown in the figure. Then the capacitance of the system between A and B is



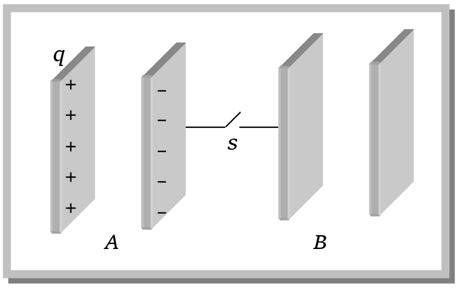
(a) $\frac{3\varepsilon_0 A}{d}$ (b) $\frac{2\varepsilon_0 A}{d}$ (c) $\frac{2}{3}.\frac{\varepsilon_0 A}{d}$ (d) $\frac{3}{2}.\frac{\varepsilon_0 A}{d}$

261. The equivalent capacity between A and B in the adjoining figure will be



(a) $\frac{\varepsilon_0 A}{d}$ (b) $\frac{3}{2}\frac{\varepsilon_0 A}{d}$ (c) $\frac{2\varepsilon_0 A}{d}$ (d) $\frac{2\varepsilon_0 A}{3d}$

262. Consider the situation shown in the figure. The capacitor A has a charge q on it whereas B is uncharged. The charged appearing on the capacitor B a long time after the switch is closed is

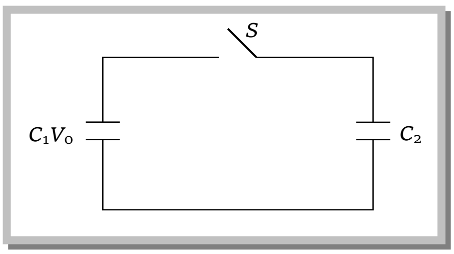


(a) Zero (b) $q/2$ (c) q (d) $2q$

263. Two capacitors of capacitances $3\mu F$ and $6\mu F$ are charged to a potential of $12V$ each. They are now connected to each other, with the positive plate of each joined to the negative plate of the other. The potential difference across each will be **[KCET 2002]**

(a) $6V$ (b) $4V$ (c) $3V$ (d) Zero

264. A capacitor of capacity C_1 is charged to the potential of V_0. ON disconnecting with the battery, it is connected with a capacitor of capacity C_2 as shown in the adjoining figure. The ratio of energies before and after the connection of switch S will be

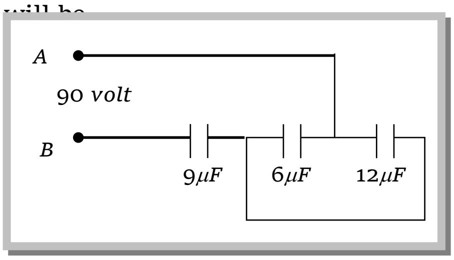


(a) $(C_1 + C_2)/C_1$ (b) $C_1/(C_1 + C_2)$ (c) C_1C_2 (d) C_1/C_2

265. The two metallic plate of radius r are placed at a distance d apart and its capacity is C. If a plate of radius $r/2$ and thickness d of dielectric constant 6 is placed between the plates of the condenser, then its capacity will be

(a) $7C/2$ (b) $3C/7$ (c) $7C/3$ (d) $9C/4$

266. The capacity of the capacitors are shown in the adjoining fig. The equivalent capacitance between the points A and B and the charge on the 6 μF will be



(a) 27 μF; 540 μC (b) 15 μF; 270 μC (c) 6 μF; 180 μC (d) 15 μF; 90 μC

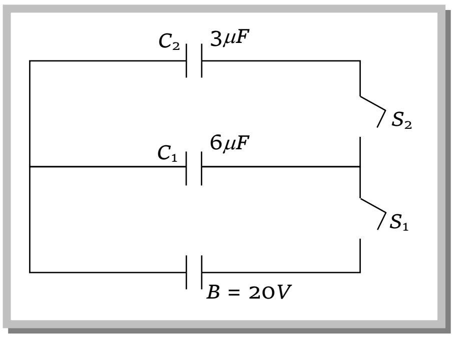
267. A parallel plate capacitor of capacitance C is connected to a battery and is charged to a potential difference V. Another capacitor of capacitance 2C is connected to another battery and is charged to potential difference $2V$. The charging batteries are now disconnected and the capacitors are connected in parallel to each other in such a way that the positive terminal of one is connected to the negative terminal of the other. The final energy of the configuration is **[IIT-JEE 1995]**

(a) Zero (b) $\frac{25CV^2}{6}$ (c) $\frac{3CV^2}{2}$ (d) $\frac{9CV^2}{2}$

268. Two identical parallel plate capacitors are connected in series to a battery of 100 V. A dielectric slab of dielectric constant 4.0 is inserted between the plates of second capacitor. The potential difference across the capacitor will now be respectively **[MP PMT 1992]**

(a) 50 V, 50 V (b) 80 V, 20 V (c) 20 V, 80 V (d) 75 V, 25 V

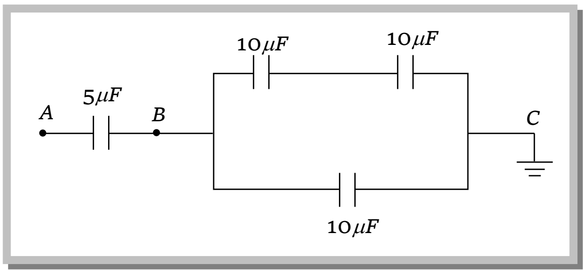
269. In the circuit shown here $C_1 = 6\mu F$, $C_2 = 3\ \mu F$ and battery $B = 20\ V$. The switch S_1 is first closed. It is then opened and afterwards S_2 is closed. What is the charge finally on C_2



(a) 120 μC (b) 80 μC (c) 40 μC (d) 20 μC

270. In the give circuit if point C is connected to the earth and a potential of + 2000 V is given to the point A, the potential at B is

[MP PET 1997]



(a) 1500 V (b) 1000 V (c) 500 V (d) 400 V

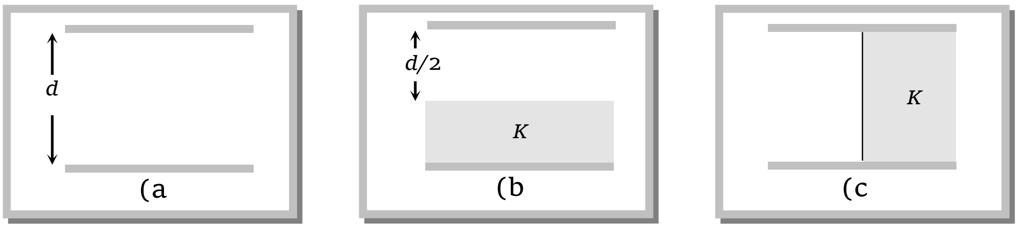
271. A 10 μF capacitor and a 20 μF capacitor are connected in series across a 200 V supply line. The charged capacitors are then disconnected from the line and reconnected with their positive plates together and negative plates together and no external voltage is applied. What is the potential difference across each capacitor

(a) $\frac{800}{9}V$ (b) $\frac{800}{3}V$ (c) 400 V (d) 200 V

272. An uncharged 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) $\frac{V_0}{V}$ (b) $\frac{V}{V_0}$ (c) $\frac{(V_0 - V)}{V}$ (d) $\frac{(V_0 - V)}{V_0}$

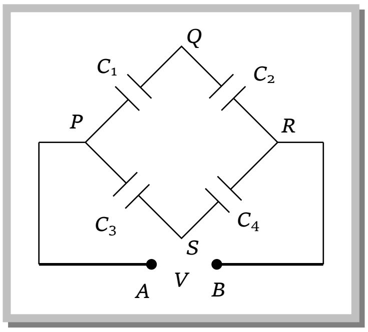
273. The capacitance of a parallel plate condenser is C_1 (fig. a). A dielectric of dielectric constant K is inserted as shown in figure (b) and (c). If C_2 and C_3 are the capacitances in figure (b) and (c), then



(a) Both C_2 and $C_3 > C_1$ (b) $C_3 > C_1$ but $C_2 < C_1$

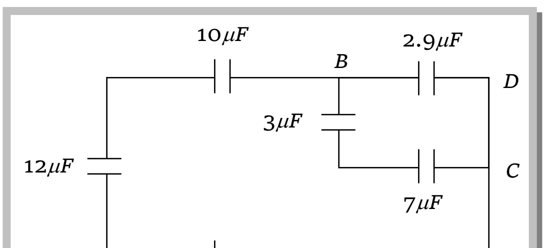
(c) Both C_2 and $C_3 < C_1$ (d) $C_1 = C_2 = C_3$

274. The potential difference between the points Q and S of the given circuit is



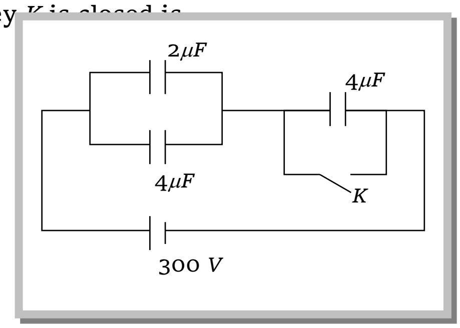
(a) $\frac{(C_2 - C_1)}{C_1}V$ (b) $\frac{(C_4 - C_3)}{C_3}V$ (c) $\frac{(C_2C_3 - C_1C_4)V}{(C_1 + C_2 + C_3 + C_4)}$ (d) $\frac{(C_4C_1 - C_2C_3)V}{(C_1 + C_2)(C_3 + C_4)}$

275. Five capacitors are connected as shown in the diagram. If the p.d. between A and B is 22 V, the emf of the cell is



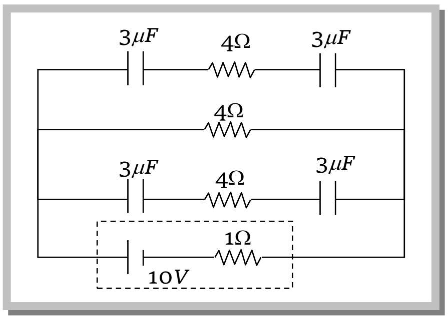
(a) 26 V (b) 42 V (c) 38 V (d) 46 V

276. In the circuit shown in the figure the amount of charge that will flow through any section of the connecting wires to the battery when the key K is closed is



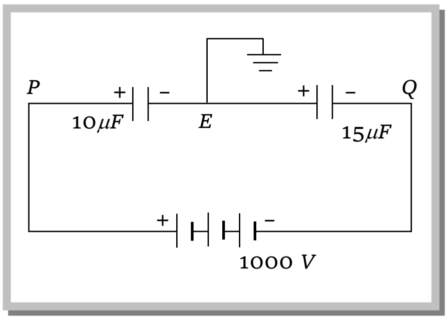
(a) 800μC (b) 1800μC (c) 1200μC (d) 1600μC

277. In the following figure, the charge on each condenser in the steady state will be



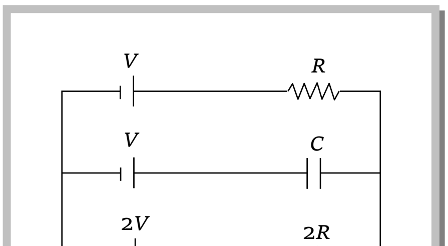
(a) 3μC (b) 6 μC (c) 9μC (d) 12μC

278. The figure shows a circuit with E as the earthing of the common plate. The potentials at P and Q are



(a) 0V, – 1000 V (b) 1000 V, 0 V (c) + 600 V, – 400 V (d) + 400 V, – 600 V

279. In the given circuit, with steady current, the potential drop across the capacitor must be



(a) V (b) $\frac{V}{2}$ (c) $\frac{V}{3}$ (d) $\frac{2V}{3}$

280. A parallel plate capacitor is charged to a potential difference of $50V$. It is discharged through a resistance. After 1 second, the potential difference between plates becomes $40V$. Then

(a) Fraction of stored energy after 1 second is 16/25 (b) P.d. between the plates after 2 seconds will be $32V$

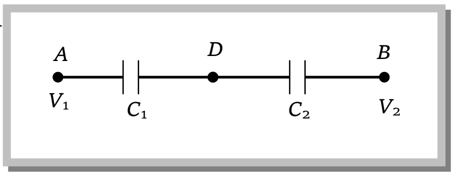
(c) P.d. between the plates after 2 seconds will be $20V$ (d) Fraction of stored energy after 1 second is $\frac{4}{5}$

281. The equivalent capacitance of three capacitors of capacitance C_1, C_2 and C_3 connected in parallel is 12 units and the product $C_1C_2C_3 = 48$. When the capacitors C_1 and C_2 are connected in parallel the equivalent capacitance is 6 units. Then the capacitance are

[KCET 1999]

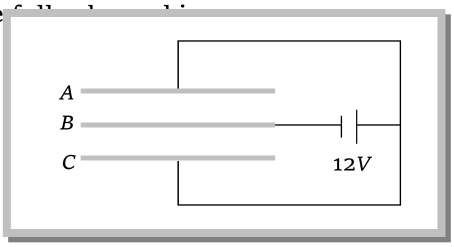
(a) 1.5, 2.5, 8 (b) 2,3,7 (c) 2,4,6 (d) 1,5,6

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



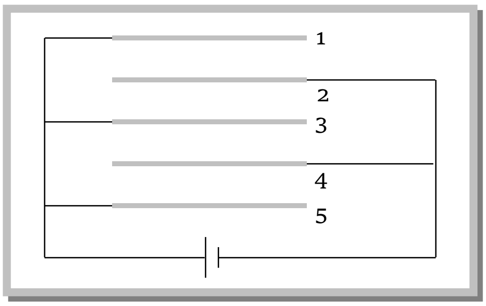
(a) $\frac{1}{2}(V_1 + V_2)$ (b) $\frac{C_2V_1 + C_1V_2}{C_1 + C_2}$ (c) $\frac{C_1V_1 + C_2V_2}{C_1 + C_2}$ (d) $\frac{C_2V_1 - C_1V_2}{C_1 + C_2}$

283. Three plates A, B, C each of area 50 cm^2 have separation 3 mm between A and B and 3 mm between B and C. The energy stored when the plates are



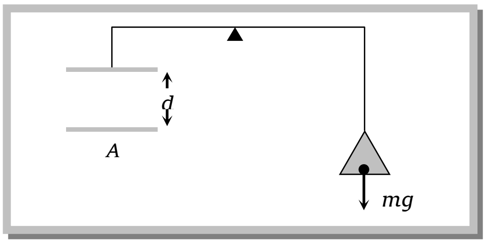
(a) $1.6 \times 10^{-9}\,J$ (b) $2.1 \times 10^{-9}\,J$ (c) $5 \times 10^{-9}\,J$ (d) $7 \times 10^{-9}\,N$

284. 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



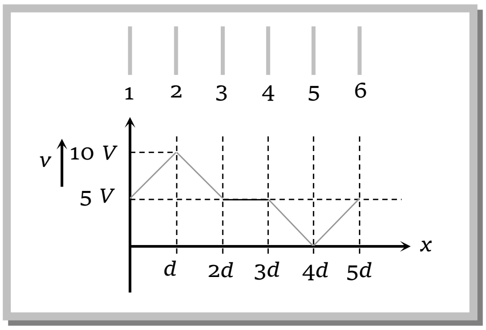
(a) $-q, +q, -q, +q$ (b) $-2q, +2q, -2q, +q$ (c) $-q, +2q, -2q, +q$ (d) None of the above

285. One plate of a parallel plate capacitor is suspended from a beam of a physical balance as shown in the figure. The area of each plate is 625 cm^2 and the distance between these plates is 5 mm. If an additional mass 0.04 gm is placed in the other pan of the balance, then the potential difference required between the plates to keep it in equilibrium will be



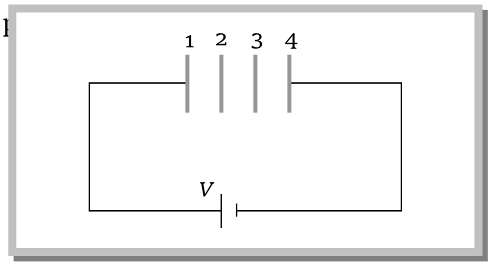
(a) 150 V (b) 188 V (c) 225 V (d) 310 V

286. The V versus x plot for six identical metal plates of cross-sectional area A is as shown. What will be the equivalent capacitance between 2 and 5 (The plates are placed with a separation d)



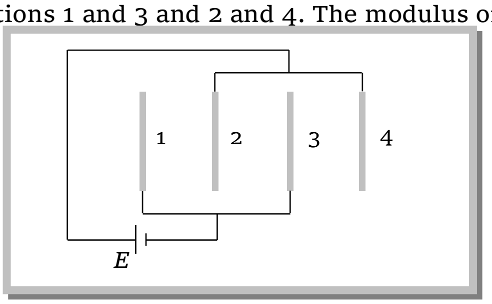
(a) $\frac{2\varepsilon_0 A}{d}$ (b) $\frac{\varepsilon_0 A}{d}$ (c) $\frac{3\varepsilon_0 A}{d}$ (d) $\frac{4\varepsilon_0 A}{d}$

287. Two parallel metal plates are inserted at equal distances into a parallel plate capacitor as shown in the figure. Plates 1 and 4 are connected to a battery of emf ε. With reference to the positive plate of the battery at zero potential, the potential of other p



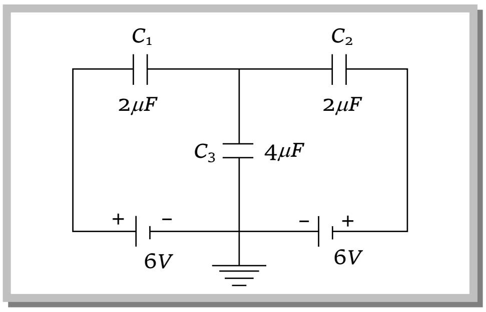
(a) 0, V, V, V (b) $0, \frac{V}{2}, \frac{V}{3}, V$ (c) $0, \frac{V}{3}, \frac{2V}{3}, V$ (d) 0, 0, 0, 0

288. Four plates, each of area A and each side are placed parallel to each other at a distance d. A battery is connected between the combinations 1 and 3 and 2 and 4. The modulus of charge on each plate is



(a) $\frac{2\varepsilon_0 A}{d}E$ (b) $\frac{3\varepsilon_0 A}{d}E$ (c) $\frac{2\varepsilon_0 A}{3d}E$ (d) $\frac{\varepsilon_0 A}{d}E$

289. Three capacitors are connected as shown in figure. Then the charge on C_1 is

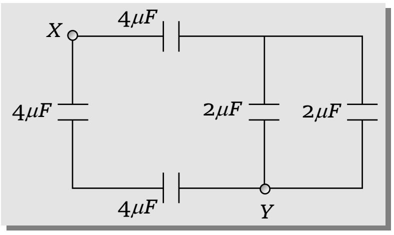


(a) 6 μC (b) 12 μC (c) 18 μC (d) 24 μC

Practice Networks (Find equivalent capacitance between X and Y)

Basic Level

1. **[Karnataka CET 2003]**



(a) $3\,\mu F$

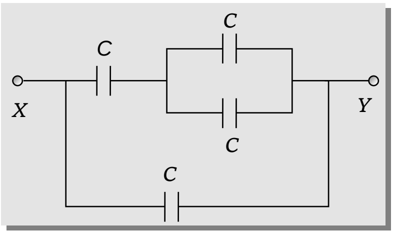
(b) $2\,\mu F$

(c) $4\,\mu F$

(d) $8\,\mu F$

Solution

2. **[MP PET 2003]**



(a) $\frac{5}{8}C$

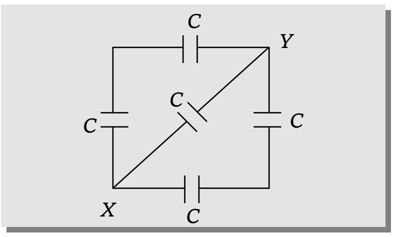
(b) $\frac{3}{5}C$

(c) $\frac{5}{3}C$

(d) C

Solution

3. **[MP PET 2003]**



(a) $2C$

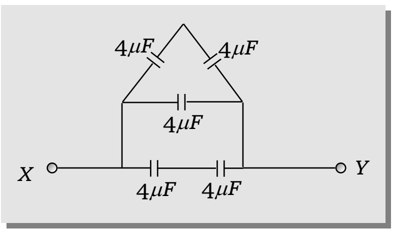
(b) $C/5$

(c) $5C$

(d) $C/2$

Solution

4. **[DCE 2001]**



(a) $8\mu F$

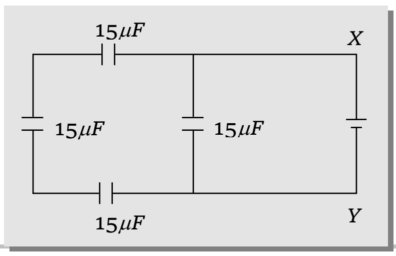
(b) $6\mu F$

(c) $268\ \mu F$

(d) $\frac{10}{38}\ \mu F$

Solution

5. **[DCE 2000 Similar to MP PMT 1992 and MP PET 1983]**



(a) $15\mu F$

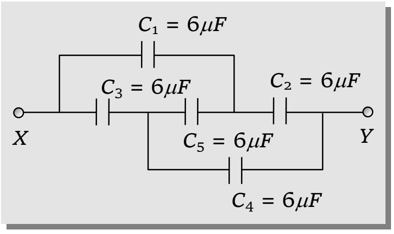
(b) $20\mu F$

(c) $25\mu F$

(d) $30\mu F$

Solution

6. **[CBSE 1999]**



(a) 24 μF

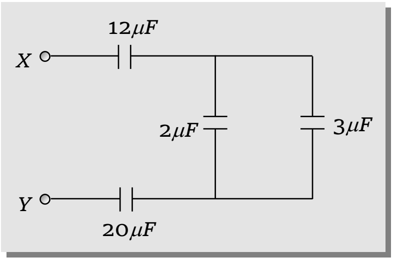
(b) 18 μF

(c) 12 μF

(d) 6 μF

Solution

7. **[MP PET /PMT 1988]**



(a) 47 μF

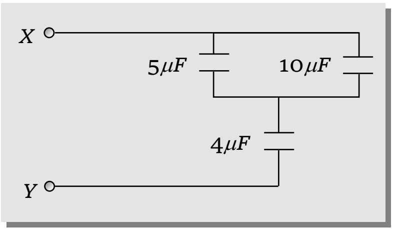
(b) 3 μF

(c) 60 μF

(d) 10 μF

Solution

8. **[Pb PMT 1999]**



(a) 2.2 μF

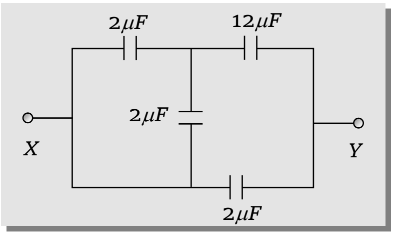
(b) 3.2 μF

(c) 1.2 μF

(d) 4.7 μF

Solution

9. **[MP PET 1996]**



(a) $28/9\mu F$

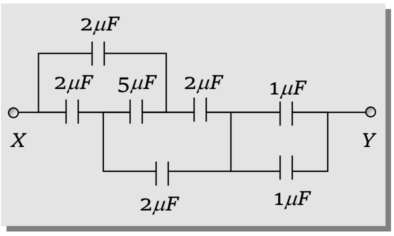
(b) $4\mu F$

(c) $5\mu F$

(d) $18\mu F$

Solution

10. **[MP PET 1997]**



(a) $\frac{1}{2}\mu F$

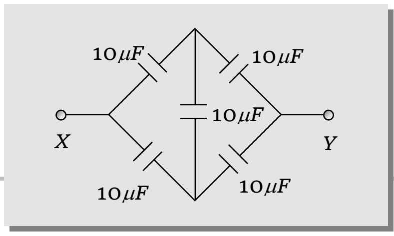
(b) 1 μF

(c) 2 μF

(d) 1.33 μF

Solution

11. **[MP PMT 1999; CPMT 1986, 88]**



(a) 40 μF

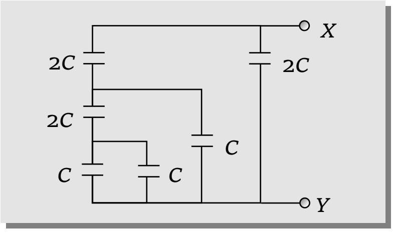
(b) 20 μF

(c) 30 μF

(d) 10 μF

Solution

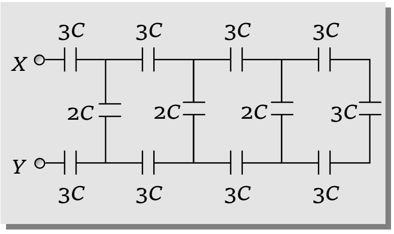
12. **[RPET 1997]**



(a) $3C$
(b) $2C$
(c) C
(d) $\frac{C}{3}$

Solution

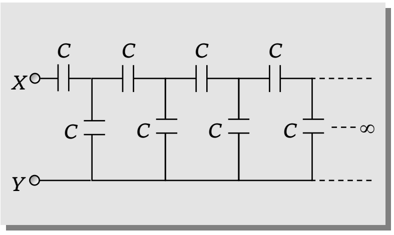
13.



(a) C
(b) $9\ C$
(c) $0.86\ C$
(d) $5.0\ C$

Solution

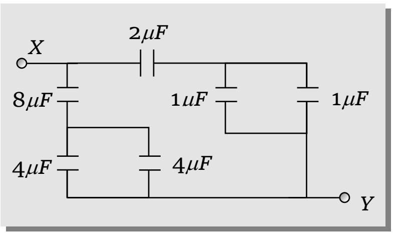
14.



(a) Zero
(b) Infinite
(c) $0.62\ C$
(d) $1.62\ C$

Solution

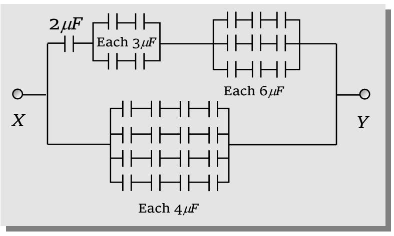
15.



(a) $10\ \mu F$
(b) $20\ \mu F$
(c) $5\ \mu F$
(d) $2.5\ \mu F$

Solution

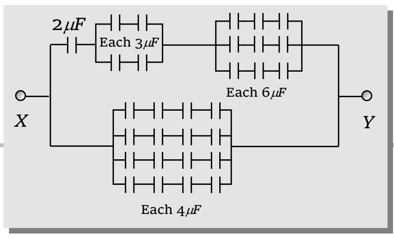
16.



(a) $3\mu F$
(b) $4\mu F$
(c) $5\mu F$
(d) $6\mu F$

Solution

17.



(a) $3\ \mu F$
(b) $6\ \mu F$
(c) $1.5\ \mu F$

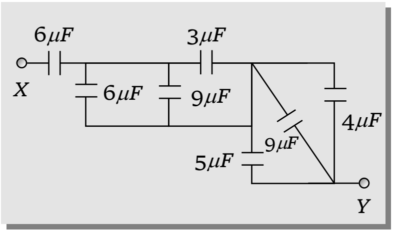
Solution

(d) 9 μF

Practice Networks (Find equivalent capacitance between X and Y)

Advance Level

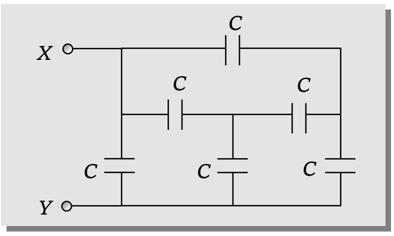
18.



(a) 3.6 μF
(b) 6 μF
(c) 1.5 μF
(d) 9 μF

Solution

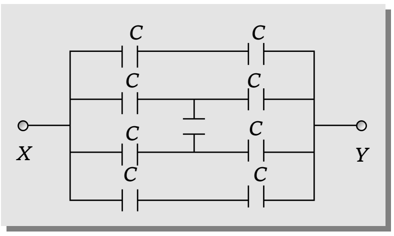
19.



(a) $C/2$
(b) C
(c) $2C$
(d) $6C$

Solution

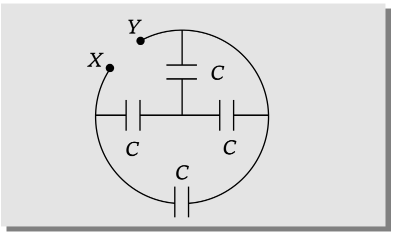
20.



(a) C
(b) $C/2$
(c) $2C$
(d) $3C$

Solution

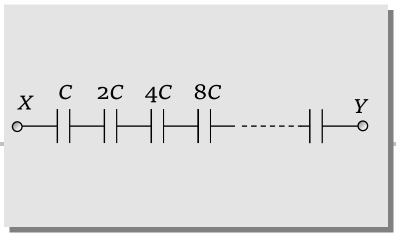
21.



(a) $\frac{5}{3}C$
(b) $\frac{2}{3}C$
(c) C
(d) $2C$

Solution

22.

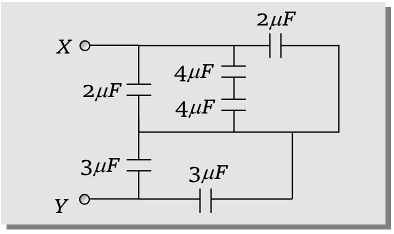


(a) C
(b) $C/2$
(c) $2C$

Solution

(d) ∞

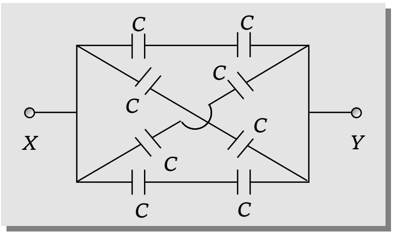
23.



(a) $17/6\mu F$
(b) $12/17\mu F$
(c) $6/5\ \mu F$
(d) $3\ \mu F$

Solution

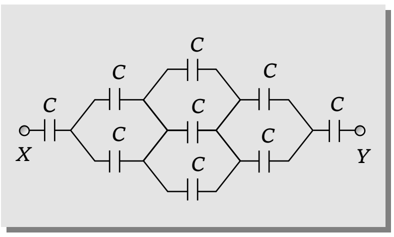
24.



(a) C
(b) $2C$
(c) $3C$
(d) $4C$

Solution

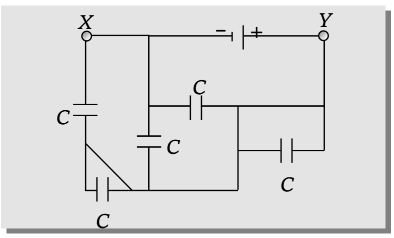
25.



(a) $C/10$
(b) $10C/3$
(c) $3C/10$
(d) $9C$

Solution

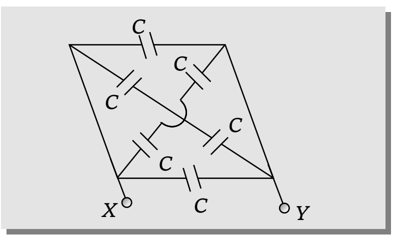
26.



(a) C
(b) $5C$
(c) $2C$
(d) $3C$

Solution

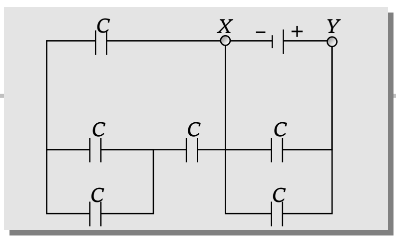
27.



(a) C
(b) $2C$
(c) $3C$
(d) $4C$

Solution

28.

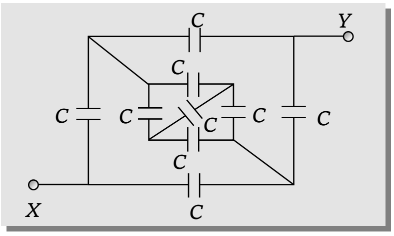


(a) $6C$
(b) $5C$

Solution

(c) $3C$
(d) $2C$

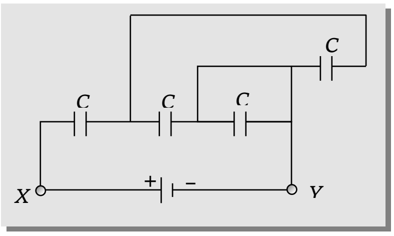
29.



(a) C
(b) $4C$
(c) $6C$
(d) 0

Solution

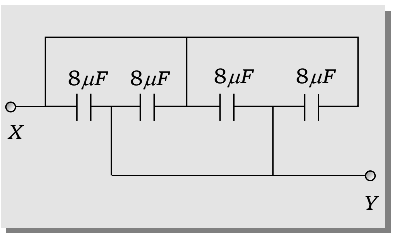
30.



(a) C
(b) $2C$
(c) $3C$
(d) $2C/3$

Solution

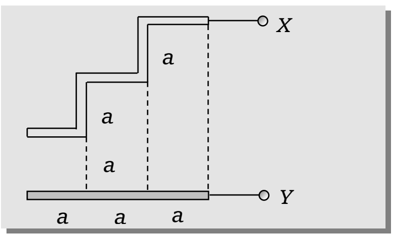
31.



(a) 32 μF
(b) 2 μF
(c) 8 μF
(d) 16 μF

Solution

32.



(a) $\dfrac{10\varepsilon_0 A}{5a}$

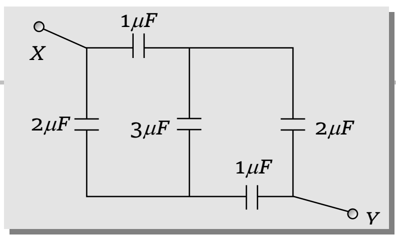
(b) $\dfrac{9\varepsilon_0 A}{7a}$

(c) $\dfrac{11\varepsilon_0 A}{8a}$

(d) $\dfrac{12\varepsilon_0 A}{18a}$

Solution

33.



(a) $\dfrac{19}{56}\ \mu F$

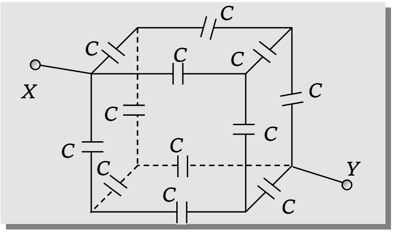
Solution

(b) $\frac{64}{11}\,\mu F$

(c) $\frac{56}{11}\,\mu F$

(d) $\frac{9}{37}\,\mu F$

34.



(a) $\frac{5}{6}C$

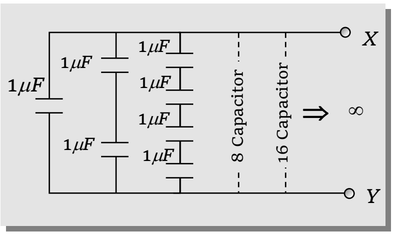
(b) $\frac{C}{6}$

(c) $\frac{C}{5}$

(d) $\frac{6C}{5}$

Solution

35. **[EAMCET 1990]**



(a) $1\ \mu F$

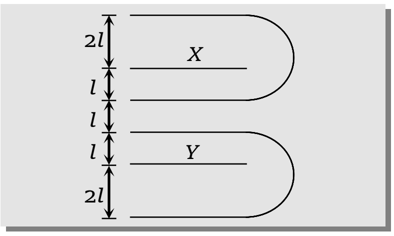
(b) $2\ \mu F$

(c) $\frac{1}{2}\,\mu F$

(d) ∞

Solution

36.



(a) $\frac{3C}{7}$

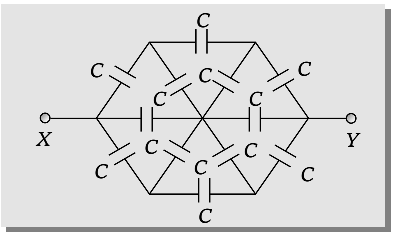
(b) $\frac{7C}{3}$

(c) $5C$

(d) $2C$

Solution

37.



(a) $\frac{4C}{5}$

(b) $\frac{5C}{4}$

(c) $12\ C$

(d) $\frac{C}{12}$

Solution

***

Answer Sheet

Assignment (Basic & Advance Level)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
c	b	a	a	a	c	b	c	b	d	b	a	b	a	a	b	c	c	d	c
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
c	d	c	d	a	c	b	c	c	a, c	b	d	b	c	c	c	b	a	a	b
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
d	d	d	b	c	c	b	a	c	a	a	c	c	d	b	c	b	a	b	a
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
a	b	b	b	a	c	d	c	b	c, d	a	b	a	a	c	a	c	c	c	c
81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
b	d	c	d	b	d	d	c	a	c	c	c	a	a	c	c	b	d	c	a
101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
d	b	a	a	b	a	a	c	a	c	c	c	b	d	c	c	d	d	a	c
121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140
c	c	c	a	a	b	c	b	c	d	c	a	a	d	a	a	b	c	c	c
141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160
a	a	b	b	b	a	b	b	a	b	a	d	c	b	d	d	a	d	b	c
161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
c	c	a	a	b	c	c	c	b	c	a	d	c	b	c	a	c	b	c	c
181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
b	a	d	d	c	a, b	d	d	a	a	d	b	a	a	c	a	b	a	a	b
201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220
a	c	d	c	d	b	d	d	d	b	d	c	b	d	a	d	a	d	c	d
221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240
d	c	d	b	d	b	b	b, c	b	b	c	c	b	b	b	d	a	d	a	c
241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260
d	b	d	b	a	a	d	a	d	c	a	a	a	b	c	d	b	c	b	d
261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280
d	a	b	a	d	c	c	b	c	c	a	c	a	d	d	b	d	c	c	a
281	282	283	284	285	286	287	288	289											
c	c	b	b	b	b	c	d	a											

Assignment (Practice Networks)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
c	c	a	a	b	d	b	b	c	b	d	a	a	c	c	c	a	a	c	c
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37			
a	b	d	b	c	d	c	d	a	d	a	c	d	d	b	a	b			