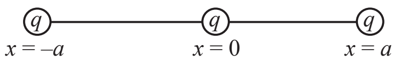
Electrostatic potential and capacitance

(Practice Questions)

Electrostatic Potential Energy

1. Electric potential energy of system of three point charge is zero then find relation between q and. Q

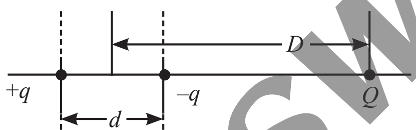
2. Three charges are placed along x-axis at $x = a$, $x = 0$ and $x = a$ as shown in the figure. The potential energy of the system is



(*a*) $-\left(\frac{1}{4\pi\varepsilon_0}\right)\frac{q^2}{a}$ (*b*) $-\left(\frac{1}{4\pi\varepsilon_0}\right)\frac{3q^2}{2a}$

(*c*) $\left[\frac{5q^2}{8\pi\varepsilon a}\right]$ (*d*) $+\left(\frac{1}{4\pi\varepsilon_0}\right)\frac{3q^2}{2a}$

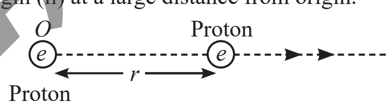
3. A system of three charges are placed as shown in the figure if $D >> d$, the potential energy of the system is best given by



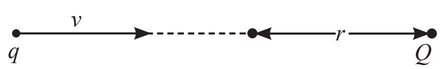
(*a*) $\frac{1}{4\pi\varepsilon_0}\left[-\frac{q^2}{d}-\frac{qQd}{D^2}\right]$ (*b*) $\frac{1}{4\pi\varepsilon_0}\left[+\frac{q^2}{d}+\frac{qQd}{D^2}\right]$

(*c*) $\frac{1}{4\pi\varepsilon_0}\left[-\frac{q^2}{d}-\frac{2qQd}{D^2}\right]$ (*d*) $\frac{1}{4\pi\varepsilon_0}\left[-\frac{q^2}{d}-\frac{qQd}{2D^2}\right]$

4. A proton is fixed at origin. Another proton is released from rest, from a point at a distance r from origin. Taking charge of proton as e and mass as m, find the speed of the proton (i) at a distance $2r$ from origin (ii) at a large distance from origin.



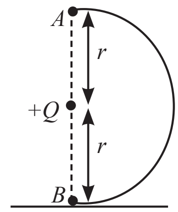
5. The charge q is fired towards another charged particle Q which is fixed, with a speed v. It approaches Q upto a closest distance r and then returns. If q were given a speed $2v$, the closest distance of approach would be



(*a*) r (*b*) $2r$ (*c*) $r/2$ (*d*) $r/4$

6. Calculate the work required to be done to make an arrangement of three particles each having a charge $+q$ such that the particles lie at the vertices of an equilateral triangle of side a, What work will be done by electric field when the particles are shifted away so that the side of triangle becomes $2a$?

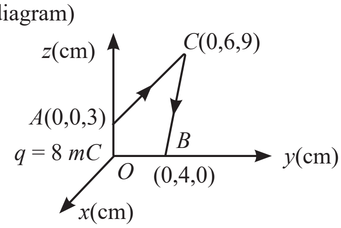
7. The work done in slowly moving an electron of charge e and mass m from A to B along a semicircular path (as shown in the figure) in vertical plane in the field of charge Q is



(*a*) $-2\ mgr$ (*b*) $-Qe/r$

(*c*) $2mgr+\frac{2Qe}{r}$ (*d*) Zero

8. Calculate the work done in taking a charge -2×10^{-9}C from A to B via C (in diagram)



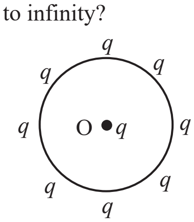
(*a*) 0.2 joule (*b*) 1.2 joule (*c*) 2.2 joule (*d*) zero

9. Two electrons are moving towards each other, each with a velocity of 10^6 m/s. What will be closest distance of approach between them?

(*a*) 1.5×10^{-8} m (*b*) 2.53×10^{-10} m

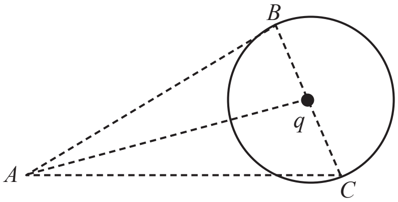
(*c*) 2.53×10^{-6} m (*d*) Zero

10. A point charge q is surrounded by eight identical charges at distance r as shown in figure. How much work is done by the forces of electrostatic repulsion when the point charge at the centre is removed to infinity?



(*a*) Zero (*b*) $\frac{8q^2}{4\pi\varepsilon_0 r}$ (*c*) $\frac{8q}{4\pi\varepsilon_0 r}$ (*d*) $\frac{64q^2}{4\pi\varepsilon_0 r}$

taking a charge q_0 from A to B and W_{AC} represents the work done from A to C, then



(a) $W_{AB} > W_{AC}$ (b) $W_{AB} < W_{AC}$

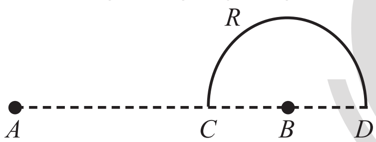
(c) $W_{AB} = W_{AC} = 0$ (d) $W_{AB} = W_{AC} \neq 0$

12. The work which is required to be done to make an arrangement of four particles each having a charge $+q$ such that the particle lie at the four corners of a square of side a is

(a) $(4+\sqrt{2})\frac{kq^2}{a}$ (b) $4\frac{kq^2}{a}$

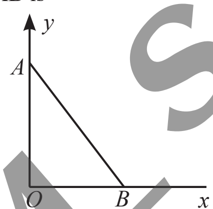
(c) $(2+\sqrt{2})\frac{kq^2}{a}$ (d) $2\frac{kq^2}{a}$

13. Charges +q and -q are placed at points A and B respectively which are a distance $2L$ apart, C is the midpoint between A and B. The work done in moving a charge $+Q$ along the semicircle CRD is



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

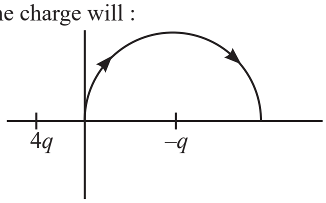
14. As per the diagram a point charge $+q$ is placed at the origin O. Work done in taking another point charge $-Q$ from the point A [coordinates $(0, a)$] to another point B [coordinates $(a, 0)$] along the straight path AB is



(a) Zero (b) $\left(\frac{-qQ}{4\pi\varepsilon_0}\frac{1}{a^2}\right)\cdot\sqrt{2}a$

(c) $\left(\frac{-q}{4\pi\varepsilon_0}\frac{1}{a^2}\right)\cdot\frac{a}{\sqrt{2}}$ (d) $\left(\frac{qQ}{4\pi\varepsilon_0}\frac{1}{a^2}\right)\sqrt{2}a$

15. A two point charges $4q$ and $-q$ are fixed on the x-axis at $x = -d/2$ and $x = d/2$ respectively. If a third point charge 'q' is taken from the origin to $x = d$ along the semicircle as shown in the figure, the energy of the charge will :



(c) Increased by $\frac{q^2}{4\pi\varepsilon_0 d}$ (d) Increased by $\frac{4q^2}{3\pi\varepsilon_0 d}$

16. **Statement I:** Negative of work done in bringing Q charge from infinite to point slowly (without change in kinetic energy) in electric field is called potential energy stored in charge Q.

Statement II: Work done by electrostatic force in bringing Q charge from infinity to point in electric field is called potential energy stored in charge Q.

(a) Statement I is true but Statement II is false

(b) Both Statement I and Statement II are false

(c) Both Statement I and Statement II are true

(d) Statement I is false but Statement II is true

Electric Potential

17. Negative work done by electric force in bringing Unit Positive charge from infinity to the Point in a field is Called electric Potential at that Point.

(a) True (b) False

18. Work done in bringing unit Positive charge slowly from infinity to the Point in electric field is called electric Potential.

(a) True (b) False

19. Change in electric potential energy per unit positive charge is called change in electric potential.

(a) True (b) False

20. Electric Potential energy per unit positive charge is called electric Potential.

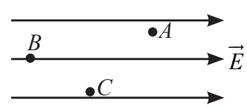
(a) True (b) False

21. Electric potential at distance r away from to +Q change ______ be$\frac{+kQ}{r}$.

(a) Must (b) Must not

(c) May (d) Cannot

22. A, B and C are three points in a uniform electric field. The electric potential is

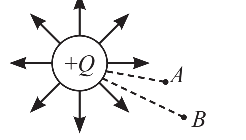
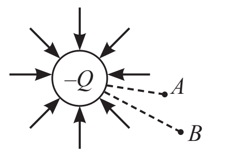
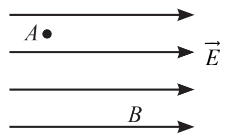
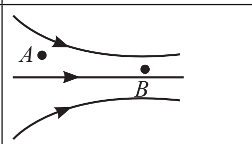


(a) Maximum at B

(b) Maximum at C

(c) Same at all the three points A, B and C

(d) Maximum at A

A.	 	I.	$E_A = E_B, V_A > V_B$
B.	 	II.	$E_A > E_B, V_A > V_B$
C.	 	III.	$E_B > E_A, V_A > V_B$
D.	 	IV.	$E_A > E_B, V_B > V_A$

24. If electric field is zero then electric potential must be zero

(*a*) True (*b*) False

25. If electric field is constant, then potential must be constant

(*a*) True (*b*) False

26. If electric potential constant then electric field must be zero

(*a*) True (*b*) False

27. If potential is constant electric field may be non-zero

(*a*) True (*b*) False

28. If electric field is zero then potential may be non-zero.

(*a*) True (*b*) False

29. Determine the electric field strength vector if the potential of this field depends on *x*, *y* coordinates as $V = 10\,axy$

(*a*) $10a(y\hat{i} + x\hat{j})$ (*b*) $-10a[y\hat{i} + x\hat{j}]$

(*c*) $-a[y\hat{i} + x\hat{j}]$ (*d*) $-10a[x\hat{i} + y\hat{j}]$

30. The electric potential V at a point $P(x, y, z)$ in space is given by $V = 4x^2$ volt. Electric field at a point (1m, 0, 2m) in V/m is

(*a*) 8 along –ve *x*-axis (*b*) 8 along +ve *x*-axis

(*c*) 16 along –ve *x*-axis (*d*) 16 along +ve *x*-axis

31. If electrostatic potential is given as $V = x^2yz + xy^2 + 2zy^2$ find electric field at (1,1,1)

32. **Assertion (A):** Electric potential at a point which is a r distance away from –*Q* charge can be positive potential.

Reason (R): Electric potential is a scalar quantity.

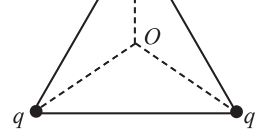
(*a*) Both A and R are true and R is the correct explanation of A.

(*b*) Both A and R are true but R is NOT the correct explanation of

(*c*) A is true but R is false

(*d*) A is false but R is true

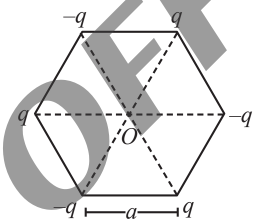
33. Three isolated equal charges are placed at the three corners of an equilateral triangle as shown in figure. The statement which is true for net electric potential *V* and net electric field intensity *E* at the centre of the triangle is



(*a*) $E = 0, V = 0$ (*b*) $V = 0, E \neq 0$

(*c*) $V \neq 0, E = 0$ (*d*) $V \neq 0, E \neq 0$

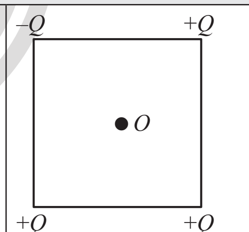
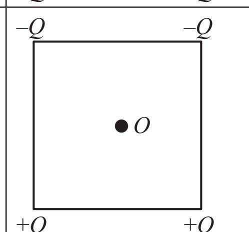
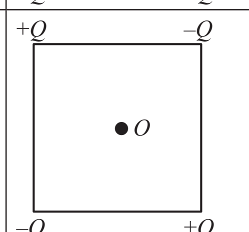
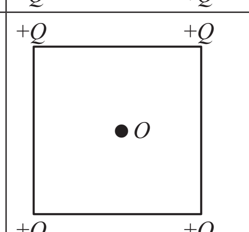
34. Six point charges are placed at the vertices of a regular hexagon of side a as shown. If *E* represents electric field and *V* represents electric potential at 0, then



(*a*) $E = 0$ but $V \neq 0$ (*b*) $E \neq 0$ but $V = 0$

(*c*) $E = 0$ and $V = 0$ (*d*) $E \neq 0$ and $V \neq 0$

35. Match the column I with column II.

Column-I		Column-II	
A.	 	I.	$E = 0, V \neq 0$
B.	 	II.	$E \neq 0, V = 0$
C.	 	III.	$E = 0, V = 0$
D.	 	IV.	$E \neq 0, V \neq 0$

electric field can be zero at that point

(*b*) Net potential of the system at a point can be zero but net electric field can't be zero at that point.

(*c*) Both the net potential and the net electric field cannot be zero at a point.

(*d*) Both the net potential and the net field can be zero at a point.

37. **Statement I:** If potential is non-zero then electric field must be non-zero.

Statement II: If electric field is zero, potential may be zero on non-zero

(*a*) Statement I is true but Statement II is false

(*b*) Both Statement I and Statement II are false

(*c*) Both Statement I and Statement II are true

(*d*) Statement I is false but Statement II is true

38. Two small spheres each carrying a charge q are placed, distance r apart. If one of the spheres is taken around the other in a circular path, the work done will be equal to

(*a*) Force between them × r

(*b*) $\frac{\text{Force between them}}{2\pi r}$

(*c*) Force between them × 2π

(*d*) Zero

39. When a test charge is brought in from infinity along the perpendicular bisector of an electric dipole, to the centre of dipole, then find work done?

(*a*) Positive (*b*) Zero

(*c*) Negative (*d*) None of these

40. If you know $\vec{E}$ at a given point, can you calculate V at that point? If not, what further information do you need?

41. How can you insure that the electric potential in a given region of space will have a constant value?

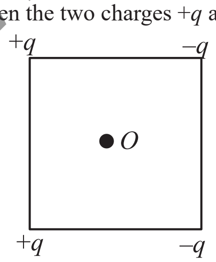
42. An electric charge 10^{-6} μC is placed at origin (0, 0) m of X - Y co-ordinate system. Two points P and Q are situated at $(\sqrt{3}, \sqrt{3})m$ and $(\sqrt{6}, 0)m$ respectively. The potential difference between the points P and Q will be :

(*a*) $\sqrt{3}\,V$ (*b*) $\sqrt{6}\,V$ (*c*) 0 V (*d*) 3 V

43. If 50 joule of work must be done to move an electric charge of 2C from a point, where potential is –10 volt to another point, where potential is V volt, the value of V is

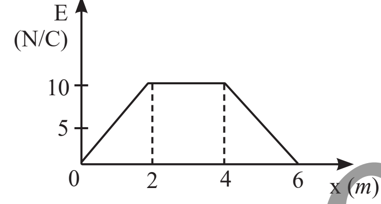
(*a*) 5 V (*b*) –15 V (*c*) + 15 V (*d*) + 10 V

44. Four electric charges +q, + q, –q and –q are placed at the corners of a square of side 2L (see figure). The electric potential at point A, midway between the two charges +q and +q, is



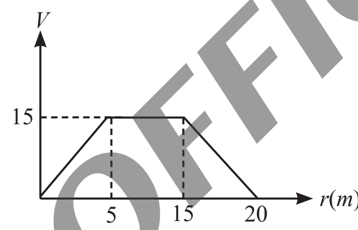
(*a*) Zero (*b*) $\frac{1}{4\pi\varepsilon_0}\frac{2q}{L}(1+\sqrt{5})$

(*c*) $\frac{1}{4\pi\varepsilon_0}\frac{2q}{L}\left(1+\frac{1}{\sqrt{5}}\right)$ (*d*) $\frac{1}{4\pi\varepsilon_0}\frac{2q}{L}\left(1-\frac{1}{\sqrt{5}}\right)$



(*a*) 30V (*b*) 60 V (*c*) 40 V (*d*) 80 V

46. Find electric field at r = 17 m.



(*a*) –3 N/C (*b*) +3 N/C (*c*) 15 N/C (*d*) –15 N/C

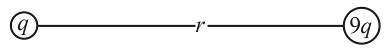
47. A particle A has charge +q and particle B has charge +4q with each of them having the same mass m. When allowed to fall from rest through the same electric potential difference, the ratio of their speeds V_A/V_B will become

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

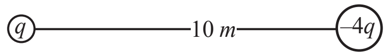
48. Find Potential at origin?

V = ?	q	q	q	q	q	upto
•	•	•	•	•	•	•
(0, 0)	(1, 0)	(2, 0)	(4, 0)	(8, 0)	(16, 0)	Infinity

49. Find potential at a point where electric field is zero?



50. Find potential at a point where electric field is zero



51. Find point where electric potential is zero?

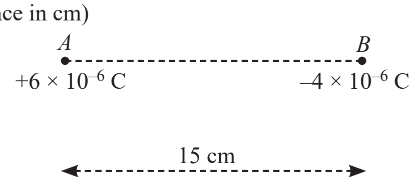
52. A charge Q is placed at each corner of a cube of side a. The potential at the centre of the cube is:

(*a*) $\frac{8Q}{\pi\varepsilon_0 a}$ (*b*) $\frac{4Q}{4\pi\varepsilon_0 a}$

(*c*) $\frac{4Q}{\sqrt{3}\pi\varepsilon_0 a}$ (*d*) $\frac{2Q}{\pi\varepsilon_0 a}$

53. Two point charges –5 μC and +3 μC are placed 64 cm apart. At what points on the line joining the two charges is the electric potential zero. Assume the potential at infinity to be zero.

54. Two charges +6 μC and –4 μC are placed 15 cm apart as shown. At what distance from A to its right, the electrostatic potential is zero (distance in cm)

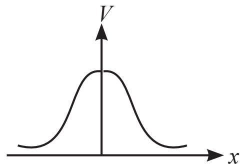


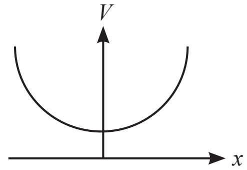
(*a*) 4, 9, 60 (*b*) 9, 45, infinity

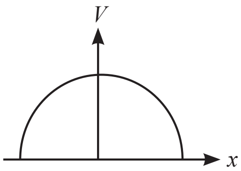
(*c*) 20, 45, infinity (*d*) 9, 15, 45

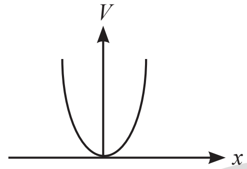
(*c*) $Vn^{2/3}$ (*d*) $Vn^{1/3}$

56. Two identical positive charges are placed on the *y*-axis at $y = -a$ and $y = +a$. The variation of V (electric potential) along *x*-axis is shown by graph

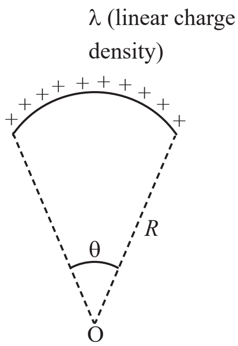
(*a*) 

(*b*) 

(*c*) 

(*d*) 

57. Find potential at '*O*'



58. Two thin wire rings each having a radius *R* are placed at a distance *d* apart with their axes coinciding. The charges on the two rings are $+q$ and $-q$. The potential difference between the centres of the two rings is

(*a*) Zero

(*b*) $\frac{q}{4\pi\varepsilon_0}\left\{\frac{1}{R}-\frac{1}{\sqrt{R^2+d^2}}\right\}$

(*c*) $\frac{qR}{4\pi\varepsilon_0 d^2}$

(*d*) $\frac{q}{2\pi\varepsilon_0}\left\{\frac{1}{R}-\frac{1}{\sqrt{R^2+d^2}}\right\}$

59. A positively charged ring is in $y-z$ plane with its centre at origin. A positive test charge q_0, held at origin is released along *x*-axis, then its speed

(*a*) Increases continuously

(*b*) Decreases continuously

(*c*) First increases then decreases

(*d*) First decreases then increases

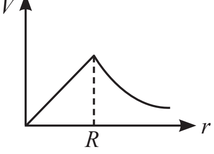
60. Three charged particles having charges q, $-2q$ & q are placed in a line at point $(-a, 0)$, $(0, 0)$ and $(a, 0)$ respectively. The expression for electric potential at $P(r, 0)$ for $r >> a$ is

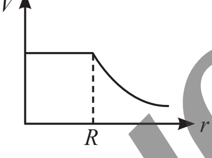
(*a*) $\frac{1}{4\pi\varepsilon_0}\frac{qa^2}{r^4}$

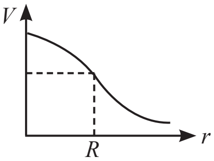
(*b*) $\frac{1}{4\pi\varepsilon_0}\frac{2qa^2}{r^3}$

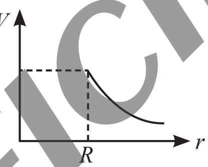
(*c*) $\frac{1}{4\pi\varepsilon_0}\frac{4qa^2}{r^2}$

(*d*) $\frac{1}{4\pi\varepsilon_0}\frac{8qa^2}{r}$

(*a*) 

(*b*) 

(*c*) 

(*d*) 

62. A hollow spherical conductor of radius *r* potential of 100 V at its outer surface. The potential inside the hollow at a distance of *r*/2 from its centre is

(*a*) 100 V (*b*) 50 V (*c*) 200 V (*d*) Zero

63. A point dipole $\vec{p} = -p_0\hat{x}$ is kept at the origin. The potential and electric field due to this dipole on the y-axis at a distance d are, respectively. (Take $V = 0$ at infinity)

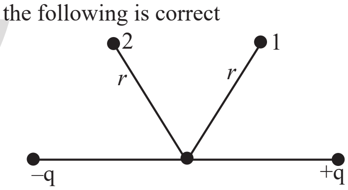
(*a*) $\frac{|\vec{P}|}{4\pi\varepsilon_0 d^2}, \frac{\vec{P}}{4\pi\varepsilon_0 d^3}$

(*b*) $\frac{|\vec{P}|}{4\pi\varepsilon_0 d^2}, \frac{-\vec{P}}{4\pi\varepsilon_0 d^3}$

(*c*) $0, \frac{-\vec{P}}{4\pi\varepsilon_0 d^3}$

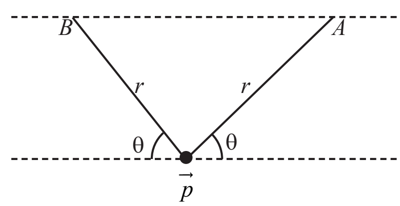
(*d*) $0, \frac{\vec{P}}{4\pi\varepsilon_0 d^3}$

64. Which of the following is correct



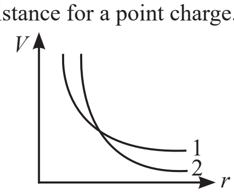
(*a*) $V_1 = V_2$ (*b*) $V_1 > V_2$ (*c*) $V_1 < V_2$ (*d*) Cont say

65. A charge *q* is moved from *A* to *B* in the region of a fixed ideal dipole $\vec{p}$. Find the work done on the charge (Assume gravity free space).



66. **Statement I:** Work done in bringing $+Q$ charge from infinity to the center of dipole along equatorial line is zero.

Statement II: In the given figure, 1 is variation of electric field w.r.t. distance for a point charge while 2 is variation of electric potential w.r.t distance for a point charge.



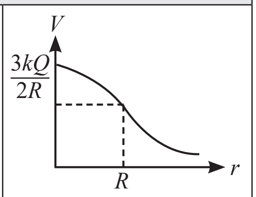
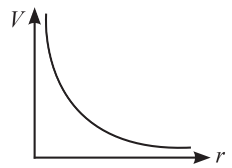
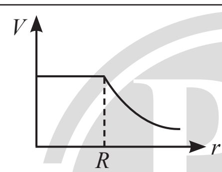
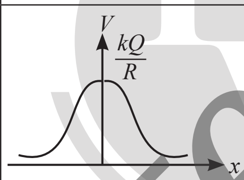
(*a*) Statement I is true but Statement II is false

(*b*) Both Statement I and Statement II are false

(*c*) Both Statement I and Statement II are true

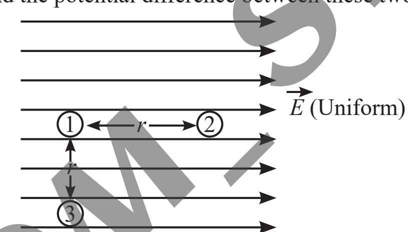
(*d*) Statement I is false but Statement II is true (*a*) R (*b*) $R/2$ (*c*) $4R/3$ (*d*) $R/3$

68. Match the column I with column II.

	Column-I		Column-II
A.	Electric potential due to ring on it's axis	I.	
B.	Electric potential due to solid non-conducting sphere	II.	
C.	Electric potential due to point charge.	III.	
D.	Electric potential due to hollow sphere	IV.	

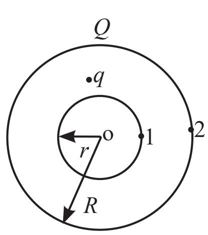
69. A uniformly charged sphere has a total charge Q and radius R. Assume that the potential at the surface of the sphere is zero. Find the electric potential at the center of the sphere.

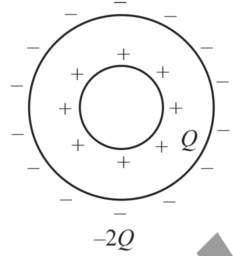
70. In a region of uniform electric field E, two points, 1 and 2, are separated by a distance r. The potential at point 1 is greater than at point 2. Assuming the potential at point 1 is V_1 and at point 2 is V_2, find the potential difference between these two points.



Also, find the potential difference between point 1 and 3.

71. a spherical shell with an inner radius r and outer radius R, carrying a charge Q. The potential at point 1 (on the inner surface) is V_1, and the potential at point 2 (on the outer surface) is V_2. Find the potential difference between the surfaces of the inner and outer spheres.

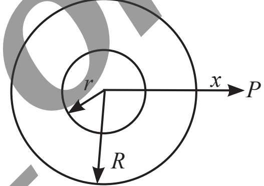




(*a*) Become two times (*b*) Become four times

(*c*) Be halved (*d*) Remain same

73. Two concentric hollow conducting spheres of radius r and R are shown. The charge on outer shell is Q. What charge should be given to inner sphere so that the potential at any point P outside the outer sphere is zero?

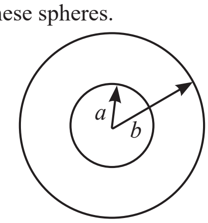


(*a*) $-\frac{Qr}{R}$ (*b*) $-\frac{QR}{r}$

(*c*) $-Q$ (*d*) $-\frac{2QR}{r}$

74. **Assertion (A):** For the given figure, potential difference between surfaces of these concentric hollow sphere only depend on charge present on inner sphere.

Reason (R): Potential due to charge on outer sphere is same at surface of both these spheres.



(*a*) Both A and R are true and Ris the correct explanation of A

(*b*) Both A and R are true but R is NOT the correct explanation of A.

(*c*) A is true but R is false

(*d*) A is false but R is true.

75. A hollow charged metal sphere has radius r. If the potential difference between its surface and a point at a distance $3r$ from the centre is V, then the electric field intensity at distance $3r$ from the centre is

(*a*) $\frac{V}{3r}$ (*b*) $\frac{V}{4r}$ (*c*) $\frac{V}{6r}$ (*d*) $\frac{V}{2r}$

76. A spherical conductor having charge q and radius r is placed at the centre of a spherical shell of radius R and having charge Q ($R > r$). The potential difference between the two is

(*a*) Proportional to Q

(*b*) Proportional to q

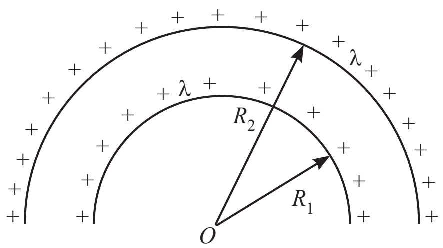
(*c*) Dependent on both Q and q

(*d*) Independent of both Q and q

(*a*) 5 kV (*b*) 50 kV

(*c*) 5 V (*d*) 50 V

78. The electric potential at the centre of two concentric half rings of radii R_1 and R_2, having same linear charge density *A* is:



(*a*) $\frac{\lambda}{2\epsilon_0}$ (*b*) $\frac{\lambda}{\epsilon_0}$

(*c*) $\frac{2\lambda}{\epsilon_0}$ (*d*) $\frac{\lambda}{4\epsilon_0}$

79. If r represents the distance of point from the center of the sphere and *R* represent the radius of sphere, then which of the following statements are incorrect?

I. Electric field for $r > R$ is same as it would be for an equal charge placed at center in case of conducting sphere.

II. Potential for $r > R$ is the same as it would be an equal charge placed at center in case of conducting sphere.

III. Potential for $r < R$ is same as it would be for an equal charge placed at center of sphere in case of uniformly charged solid non-conducting sphere.

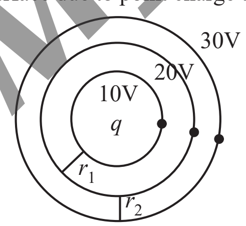
(*a*) Both I and II (*b*) Both I and III

(*c*) Only III (*d*) Both II and III

80. Charge q given to Inner sphere and *Q* on outer concentric sphere they are connect with wire then find final charge on each sphere.

Equipotential Surface

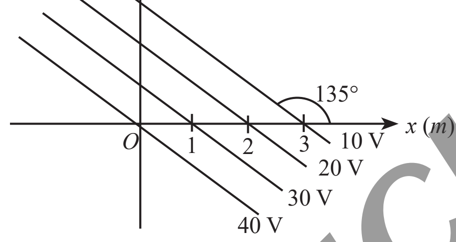
81. Equipotential surface due to point charge then compare r_1 and r_2.



82. An infinite conducting sheet has surface charge density σ. The distance between two equipotential surfaces is *r*. The potential difference between these two surfaces is

(*a*) $\frac{\sigma r}{2\varepsilon_0}$ (*b*) $\frac{\sigma r}{\varepsilon_0}$

(*c*) $\frac{\sigma}{\varepsilon_0 r}$ (*d*) $\frac{\sigma}{2\varepsilon_0 r}$



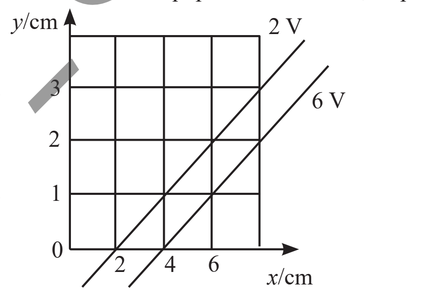
(*a*) $10\sqrt{2}\,V/m$ at 45° with *x*-axis

(*b*) $10\sqrt{2}\,V/m$ at –45° with *x*-axis

(*c*) $\frac{10}{\sqrt{2}}$ V/m at 45° with *x*-axis

(*d*) $10\sqrt{2}\,V/m$ at –45° with *x*-axis

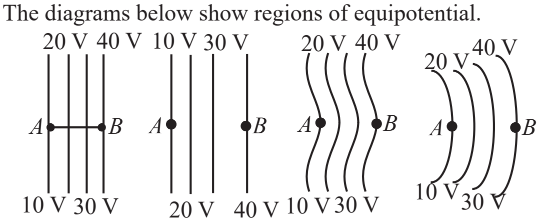
84. Figure shows two equipotential lines in *xy*-plane for an electric field. The *x*-component E_x and *y* component E_y of the electric field in the space between these equipotential lines are, respectively.



(*a*) +150 V/m, –300 V/m (*b*) –150 V/m – 300 V/m

(*c*) –200 V/m, 1400 V/m (*d*) –200V/m,–100V/m

85. The diagrams below show regions of equipotential.



A positive charge is moved from A to B in each diagram.

(*a*) Maximum work is required to move q in figure (c).

(*b*) In all the four cases the work done is the same

(*c*) Minimum work is required to move q in figure (a)

(*d*) Maximum work is required to move q in figure (b).

86. **Assertion (A)**: Work done by electric field on moving a positive charge on an equipotential surface is always zero.

Reason (R): Electric lines of forces are always perpendicular to equipotential surfaces.

In the light of the above statements, choose the most appropriate answer from the options given below :

(*a*) Both (A) and (R) are correct and (R) is the correct explanation of (A)

(*b*) (A) is correct but (R) is not correct

(*c*) Both (A) and (R) are correct but (R) is not the correct explanation of (A)

(*d*) (A) is not correct but (R) is correct

87. Electric fild inside conductor is always zero

(a) True (b) False

88. Electric field inside Isolated conductor is zero where conducting matter is present

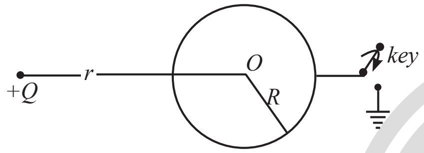
(a) True (b) False

89. **Statement I:** Electrostatic force on q_2 due to q_1 doesn't depend upon medium.

Statement II: Net electrostatic force on q_2 depends upon medium but not on presence of other charges.

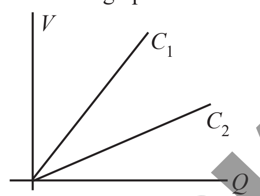
(a) I is true but II is false
(b) I is false but II is true
(c) Both I and II are true but II is not the correct explanation of I
(d) Both I and II are true and II is the correct explanation of I

90. Find final charge on sphere when key is closed?



Capacitance

91. For two capacitor graph between potential and charge is given then which of the following option is correct?

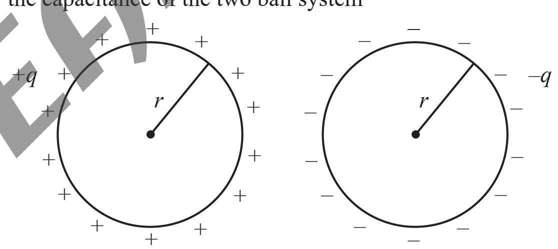


(a) $C_1 = C_2$ (b) $C_1 > C_2$ (c) $C_1 < C_2$ (d) Non of these

Spherical Capacitor

92. What is capacitance of earth?

93. Two similar conducting balls having charges $+q$ and $-q$ are placed at a separation d from each other in air. The radius of each ball is r and the separation between their centres is d ($d >> r$). Calculate the capacitance of the two ball system



(a) $4\pi\varepsilon_0 r$ (b) $2\pi\varepsilon_0 r$

(c) $4\pi\log_e \frac{\varepsilon_0 r}{d}$ (d) $4\pi\log_e \frac{r}{d}$

95. **Assertion (A):** Two metallic)spheres are charged to the same potential. One of them is hollow and another is solid, and both have the same radii. Solid sphere will have lower charge than the hollow one.

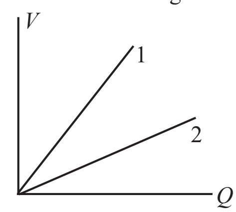
Reason R: Capacitance of metallic spheres depend on the radii of: spheres. In light of the above statements, choose the correct answer from the options given below.

(a) Both A and R are true but R is not the correct explanation of A
(b) Both A and R are true and R is the correct explanation of A
(c) A is false but R is true
(d) A is true but R is false

96. From the given graph of V (potential) v/s charge (Q) for the two sphere 1 and 2 of radius R_1 and R_2, we can conclude that

I. $R_2 > R_1$
II. $R_1 > R_2$
III. 2nd sphere has more capacity to store charge for same potential applied
IV. Both sphere have some capacitance as it doesn't depend upon charge and Potential.

The correct statement from above given statement are



(a) Both I and II (b) Both I and III
(c) Only III (d) Both II and III

97. Capacitance of an isolated conducting sphere of radius R_1 becomes n times when it is enclosed by a concentric conducting sphere of radius R_2 connected to earth. The ratio of their radii $\left(\frac{R_2}{R_1}\right)$ is:

(a) $\frac{n}{n-1}$ (b) $\frac{2n}{2n+1}$

(c) $\frac{n+1}{n}$ (d) $\frac{2n+1}{n}$

Parallel Plate Capacitance

98. The capacitance of a parallel plate capacitor with air as medium is $6\mu F$. With the introduction of a dielectric medium, the capacitance becomes $30\mu F$. The permittivity of the medium is ($\varepsilon_0 = 8.85 \times 10^{-12}\ C^2 N^{-1} m^{-2}$)

(a) $0.44 \times 10^{-13} C^2 N^{-1} m^{-2}$ (b) $1.77 \times 10^{-12} C^2 N^{-1} m^{-2}$
(c) $0.44 \times 10^{-10} C^2 N^{-1} m^{-2}$ (d) $5.00 C^2 N^{-1} m^{-2}$

99. A parallel plate condenser with oil between the plates (dielectric constant of oil $K = 2$) has a capacitance C. If the oil is removed, then capacitance of the capacitor becomes

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

(*a*) independent of the distance between the plates

(*b*) linearly proportional to the distance between the plates

(*c*) proportional to the square root of the distance between the plates

(*d*) inversely proportional to the distance between the plates

101. A parallel plate air capacitor has capacity C, distance of separation between plates is d and potential difference V is applied between the plates. Force of attraction between the plates of the parallel plate air capacitor is

(*a*) $\frac{CV^2}{d}$ (*b*) $\frac{C^2V^2}{2d^2}$ (*c*) $\frac{C^2V^2}{2d}$ (*d*) $\frac{CV^2}{2d}$

102. A force of 10 N acts on a charged particle placed between two plates of a charged capacitor. If one plate of capacitor is removed, then the force acting on that particle will be

(*a*) 5 N (*b*) 10 N (*c*) 20 N (*d*) Zero

103. Statement I: Two plates having surface area a are having charges $+Q$ and are separated by distance d. One plate will experience force of alteration $F = \frac{Q^2}{A\varepsilon_0}$ due to

Statement II: Capacitance of this system doesn't depend upon Q charge present on parallel plates.

(*a*) Statement I is true but Statement II is false

(*b*) Both Statement I and Statement II are false

(*c*) Both Statement I and Statement II are true

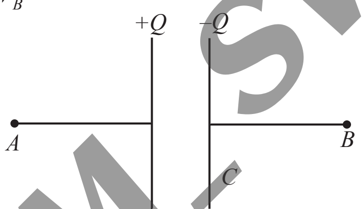
(*d*) Statement I is false but Statement II is true

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

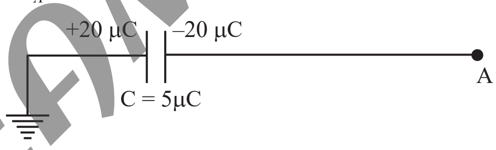
(*a*) increases (*b*) decreases

(*c*) does not change (*d*) becomes zero

105. Find $V_A - V_B$



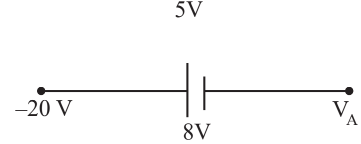
106. Find $V_A = ?$



Battery and Work Done by Battery

107. Find V_B

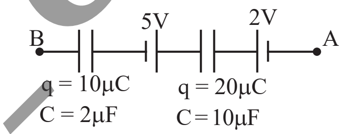
109. Find V_A



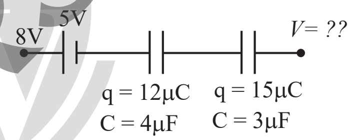
110. Find V

Simple Circuit of Battery and Capacitor

111. In the given circuit Find $V_A - V_B$

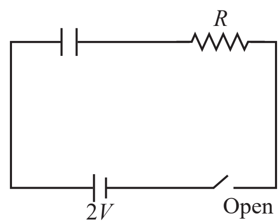


112.



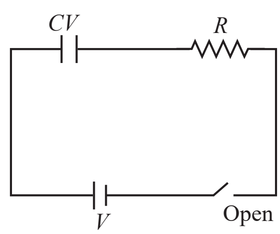
Charging & Discharging of Capacitor

113. In the given circuit, a capacitor C is initially uncharged ($Q = 0$, $V = 0$) and is connected to a 2V battery with an open switch and a resistor R. The circuit is in steady state after the switch is closed

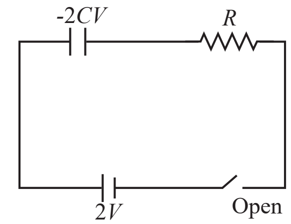


Find final maximum charge on capacitor and energy loss

114. In the circuit a capacitor is initially uncharged and is connected to a battery with e.m.f V and a resistor R via a switch. When the switch is closed, the capacitor starts charging. Find the final maximum charge on the capacitor once the system reaches a steady state and Energy Loss in the circuit.



steady state and Energy Loss in the circuit.



116. If capacitor is initially charged to a certain potential V and is connected to a battery with e.m.f $2V$ and a resistor R. Then Find the final maximum charge on the capacitor and Energy Loss in the circuit.

117. In a metallic conductor, under the effect of applied electric field, the free electrons of the conductor:

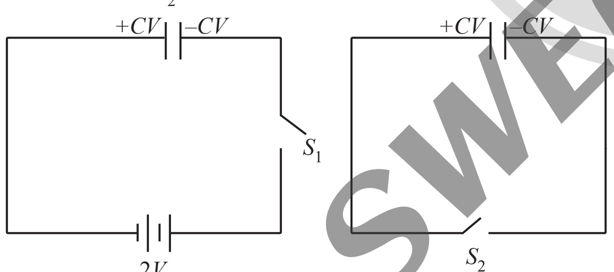
(*a*) Move in the straight line paths in the same direction

(*b*) Move with the uniform velocity throughout from lower potential to higher potential

(*c*) Drift from higher potential to lower potential

(*d*) Move in the curved paths from lower potential to higher potential

118. For the given two figures (a) and (b) energy lost in form of heat when switch S_1 is closed is x times as compared to Energy lost when switch S_2 is closed find value of x



(*a*) 0 (*b*) 1 (*c*) 3 (*d*) 9

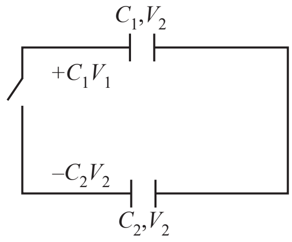
Connection of Two Capacitor

119. Two capacitor is connected with same Polarity

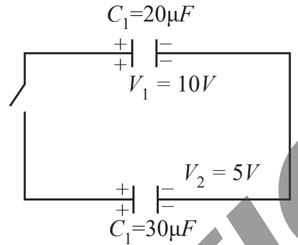
(i) Find Common Potential

(ii) Final charge on each capacitor

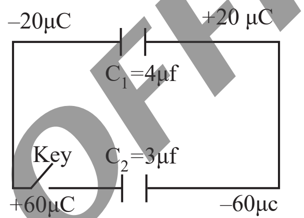
(iv) Energy loss



(iii) Total loss in energy.



121. Find loss in energy when key is closed?



122. A capacitor of capacitance 'C_1' is charged unto potential 'V' and is then disconnected from the battery. It is then connected to uncharged capacitor, in parallel, whose capacitance is 'C_2'. The potential difference across each capacitor is_____.

(*a*) $\frac{C_1+C_2}{C_2V}$ (*b*) $\frac{C_2V}{C_1+C_2}$

(*c*) $\frac{C_1+C_2}{C_1V}$ (*d*) $\frac{C_1V}{C_1+C_2}$

123. There are two identical capacitors, first one is uncharged and filled with dielectric of constant k while other one is changed to potential v having air between it's plates. If two capacitors are joined end to end, the common potential will be

(*a*) $\frac{V}{K-1}$ (*b*) $\frac{KV}{K+1}$

(*c*) $\frac{KV}{K-1}$ (*d*) $\frac{V}{k+1}$

124. A capacitor is charged with a battery and energy stored is U. After disconnecting battery another capacitor is of same capacity is connected in parallel with it. Then energy stored in each capacitor is:

(*a*) U/2 (*b*) U/4 (*c*) 4U (*d*) 2U

125. A capacitor is charged by a battery. The battery is removed and another identical uncharged capacitor is connected in parallel. The total electrostatic energy of resulting system:

(*a*) Increase by a factor of 2

(*b*) Increase by a factor of 4

(*c*) Decreases by a factor of 2

(*d*) Remains the same

126. An uncharged parallel plate capacitor having a dielectric of constant K is connected to a similar air cored parallel capacitor charged to a potential V. The two capacitors share charges and the common potential is V'. The dielectric constant K is

(*a*) $\frac{V'-V}{V'+V}$ (*b*) $\frac{V'-V}{V'}$

(*c*) $\frac{V'-V}{V}$ (*d*) $\frac{V-V'}{V'}$

them becomes 20 V. The capacitance of the second capacitor is:

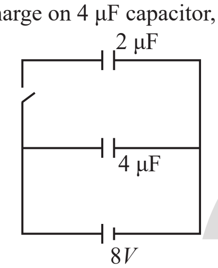
(*a*) 15 µF (*b*) 20 µF (*c*) 10 µF (*d*) 30 µF

128. Two capacitors of capacitances C and $2C$ are charged to potential differences V and $2V$, respectively. These are then connected in parallel in such a manner that the positive terminal of one is connected to the negative terminal of the other. (The final energy of this configuration is:)

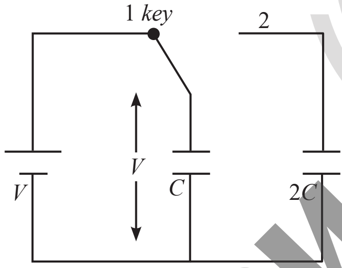
(*a*) $\frac{3}{2}CV^2$ (*b*) $\frac{9}{2}CV^2$ (*c*) $\frac{25}{6}CV^2$ (*d*) 0

129. A 600 pF capacitor is charged by 200 V supply. It is then disconnected form the supply and is connected to another uncharged 600 pF capacitor. Electrostatic energy lost in the process is______µJ.

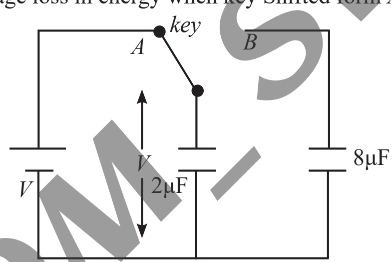
130. Find total change in charge on 4 µF capacitor, when Key is closet



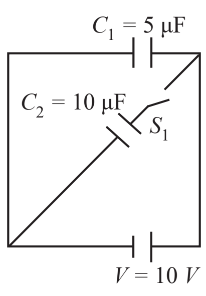
131. Find percentage loss in energy when Key is shifted from (1) to (2) after large time.



132. Percentage loss in energy when key Shifted form A to B

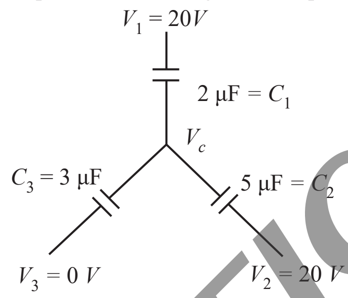


133. If Q_1 is charge on C_1 before switch S_1 is closed and Q_2 is charge on C_1 after closing the switch S_1. Find $Q_1 - Q_2$.



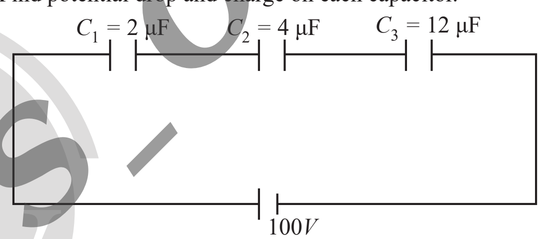
(*a*) 0 (*b*) 1 (*c*) 3 (*d*) 9

134. Find common potential and charge on each plate.

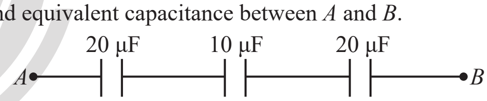


Series & Parallel Combination of Capacitor

135. Find potential drop and charge on each capacitor.

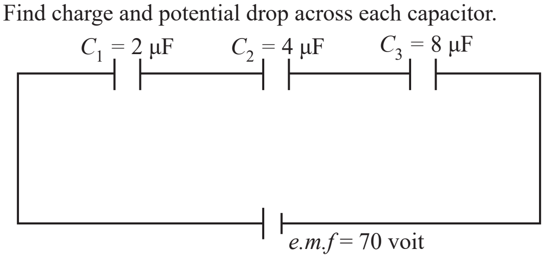


136. Find equivalent capacitance between A and B.

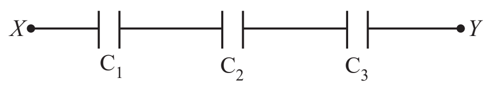


137. n capacitor of equal capacitance 'C' connected in series then find equivalent capacitance.

138. Find charge and potential drop across each capacitor.

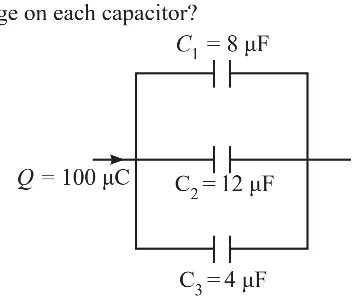


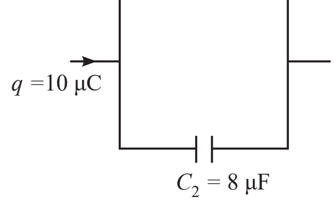
139. In the circuit below C_1 = 20 µF, C_2 = 40 µF and C_3 = 50 µF and C_3 = 50 µF. If no capacitor can sustain more than 50V, then maximum potential difference between X and Y is



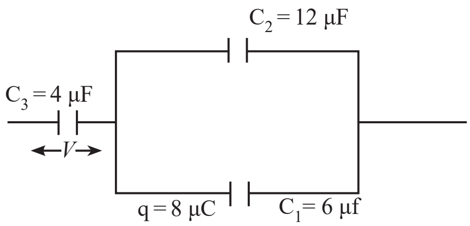
(*a*) 95 V (*b*) 150 V (*c*) 75 V (*d*) 65 V

140. Find charge on each capacitor?

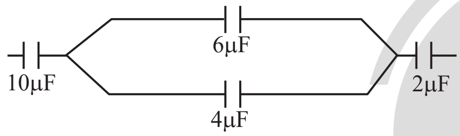




142. Charge on 6 μF is 8 μC then find potential drop across 4 μF.

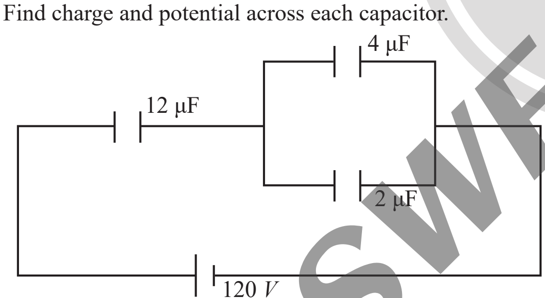


143. In the figure shown below, the charge on the left plate of the 10 μF capacitor is –30 μC. The charge on the right plate of the 6 μF capacitor is

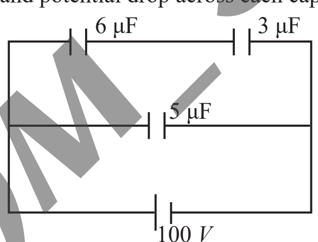


(*a*) + 18 μC (*b*) –12 μC
(*c*) +12 μC (*d*) –18 μC

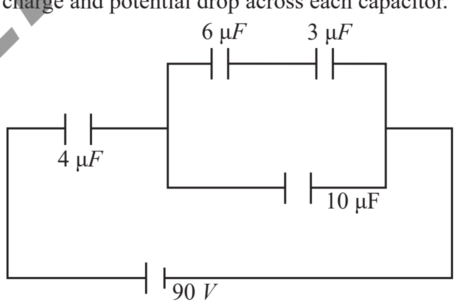
144. Find charge and potential across each capacitor.

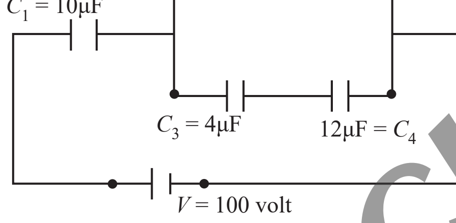


145. Find charge and potential drop across each capacitor.

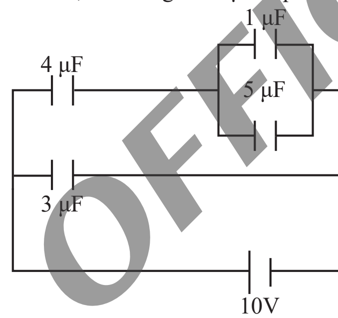


146. Find charge and potential drop across each capacitor.



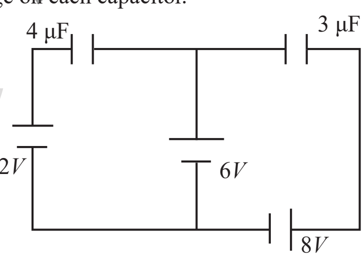


148. In the given circuit, the charge on 4μF capacitor will be:

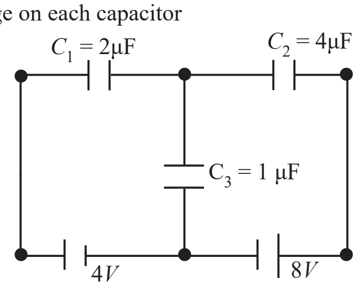


(*a*) 13.4 μC (*b*) 24 μC
(*c*) 9.6 μC (*d*) 5.4 μC

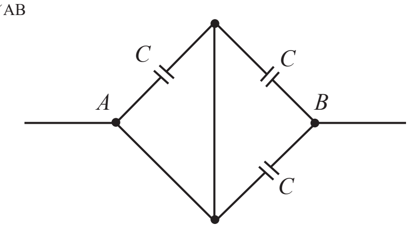
149. Find charge on each capacitor.



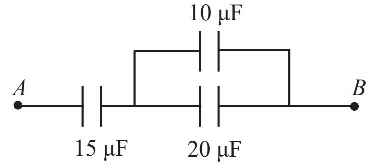
150. find charge on each capacitor

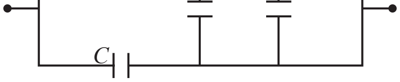


151. Find C_{AB}



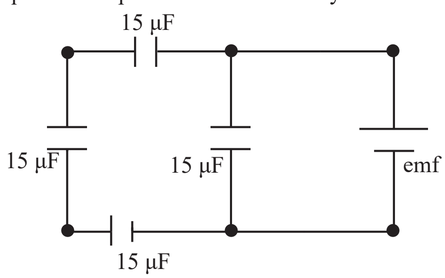
152. In the arrangement shown, find the equivalent capacitance between *A* and B.





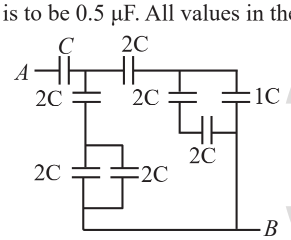
(*a*) $\frac{C}{2}$ (*b*) 4C (*c*) $\frac{5}{3}C$ (*d*) 2C

154. Find equivalent capacitance across battery.



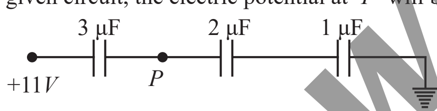
(*a*) 5 μF (*b*) 10 μF (*c*) 15 μF (*d*) 20 μF

155. In the circuit shown, find C if the effective capacitance of the whole circuit is to be 0.5 μF. All values in the circuit are in μF.

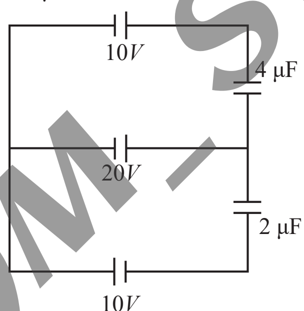


(*a*) $\frac{7}{11}\mu$ F (*b*) 4 μf (*c*) $\frac{6}{5}\mu$ F (*d*) $\frac{7}{10}\mu F$

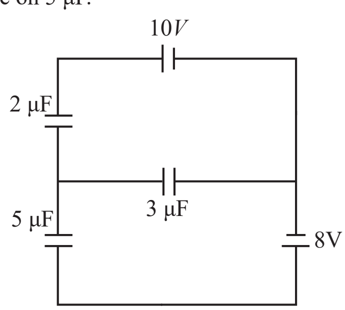
156. In the given circuit, the electric potential at 'P' will be

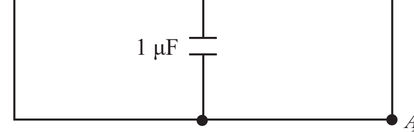


157. Find charge on 4 μF.

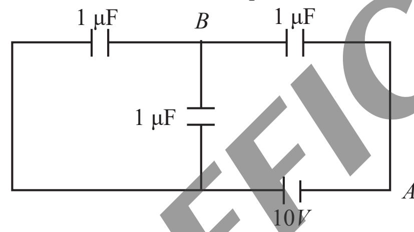


158. Find charge on 5 μF.

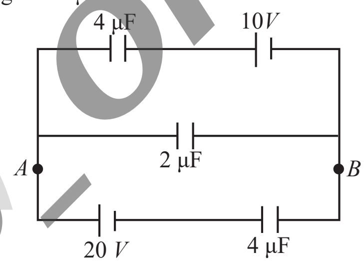




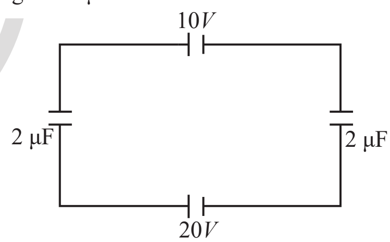
160. If potential at A is 10 V then find potential at B.



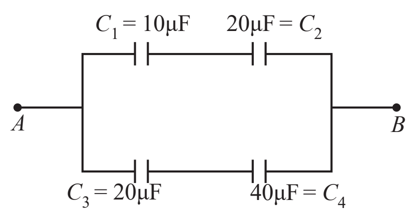
161. Find charge on 2 μF



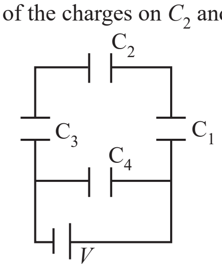
162. Find charge on 2 μF



163. If charge on C_1 is 10 μF then find potential difference between A and B.

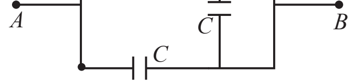


164. A network of four capacitors of capacity equal to $C_1 = C$, $C_2 = 2C$, $C_3 = 3C$ and $C_4 = 4C$ are connected to a battery as shown in the figure. The ratio of the charges on C_2 and C_4 is

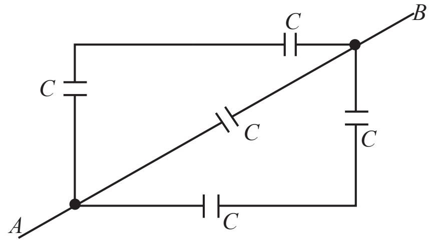


(*a*) $\frac{22}{3}$ (*b*) $\frac{3}{22}$

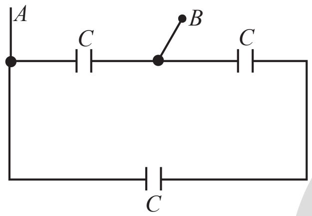
(*c*) $\frac{7}{4}$ (*d*) $\frac{4}{7}$



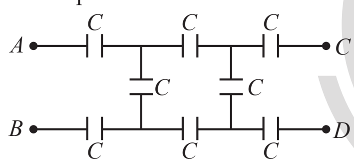
166. Find equivalent capacitance



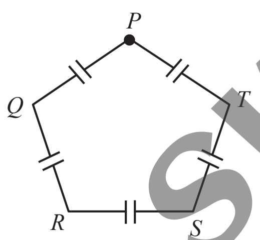
167. Find equivalent capacitance between A & B



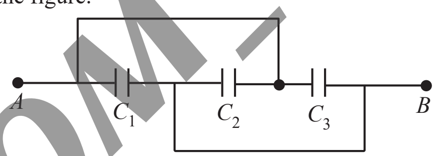
168. Find equivalent capacitance between A & B.



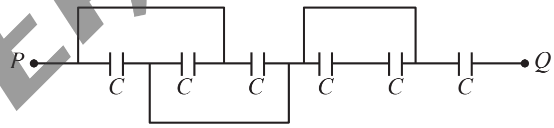
169. Find C_{PQ}/C_{PR} = ??



170. Find the equivalent capacitance of the combination between *A* and *B* in the figure.

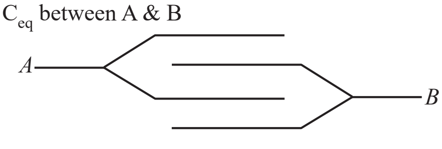


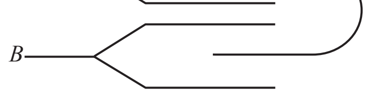
171. For the following circuit the equivalent capacitance *P* and *Q* is



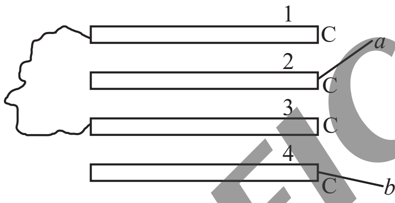
(*a*) 6 C (*b*) 4 C (*c*) $\frac{3C}{2}$ (*d*) $\frac{3C}{4}$

172. Find C_{eq} between A & B





174. Capacitance between *a* and *b*.



175. Effective capacitance of parallel combination of two capacitors C_1 and C_2 is 10 μF. When these capacitors are individually connected to a voltage source of 1 *V*, the energy stored in the capacitor C_2 is 4 times that of C_1. If these capacitors are connected in series, their effective capacitance will be:

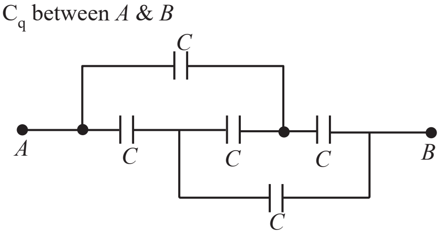
(*a*) 4.2 μF (*b*) 88.4 μF (*c*) 1.6 μF (*d*) 0.32 μF

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

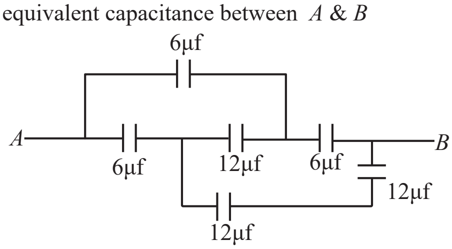
(*a*) $\frac{16C_1}{n_1 n_2}$ (*b*) $\frac{2C_1}{n_1 n_2}$ (*c*) $16\frac{n_2}{n_1}C_1$ (*d*) $2\frac{n_2}{n_1}C_1$

Wheatstone Bridge

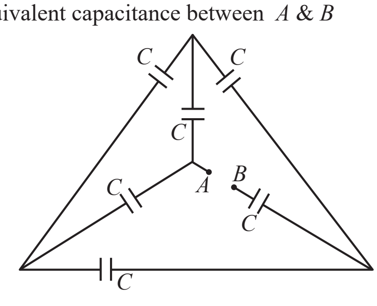
177. Find C_q between *A* & *B*

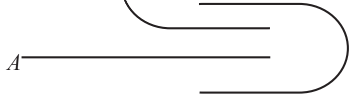


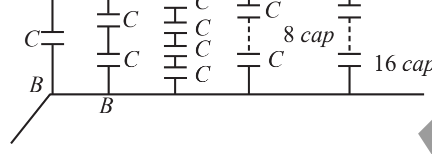
178. Find equivalent capacitance between *A* & *B*



179. Find equivalent capacitance between *A* & *B*

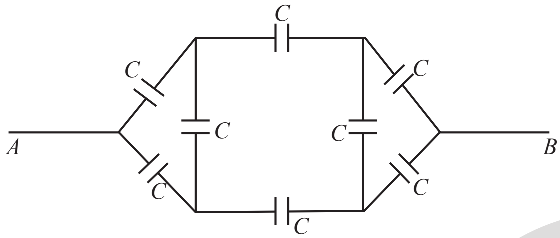




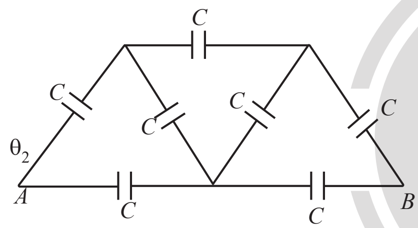


Symmetric circuit

181. Symmetric circuit

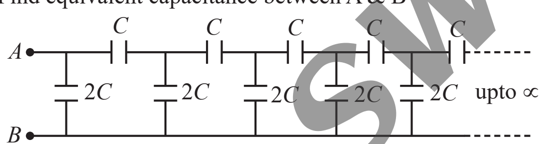


182. Symmetric circuit



Ladder network

183. Find equivalent capacitance between A & B



(*a*) $(\sqrt{3}+1)$ C (*b*) $(\sqrt{3}-1)$ C

(*c*) $(\sqrt{5}+1)$ C (*d*) 3C

184. **Assertion (A):** Resultant capacitance of the given ladder system must be less than C.

Reason (R): Capacitance in series combination must be less than the smallest capacitance.

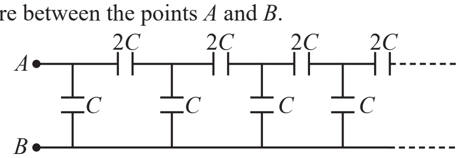
(*a*) Both (A) and (R) are correct and (R) is the correct explanation of (A)

(*b*) (A) is correct but (R) is not correct

(*c*) Both (A) and (R) are correct but (R) is not the correct explanation of (A)

(*d*) (A) is not correct but (R) is correct

185. Find the equivalent capacitance of the infinite ladder shown in the figure between the points *A* and *B*.



Dielectric inside Capacitor

187. A capacitor with plate separation *d* is charged to *v* volts. The battery and a dielectric slab of thickness *d*/2 and dielectric constant ' 2 ' is inserted between plates. The potential difference across its terminal become

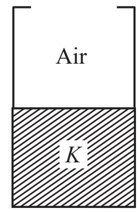
(*a*) V (*b*) $2V$ (*c*) $\frac{4V}{3}$ (*d*) $\frac{3V}{4}$

188. A parallel plate capacitor has plate area 40 cm^2 and plate separation 2 mm. The space between the plates is filled with a dielectric medium of thickness 1 mm and dielectric constant 5 . The new capacitance of the system is:

(*a*) $24\varepsilon_0$F (*b*) $\frac{3}{10}\varepsilon_0$ F (*c*) $\frac{10}{3}\varepsilon_0$ F (*d*) $10\varepsilon_0$F

Dielectric in Series and Parallel Combination

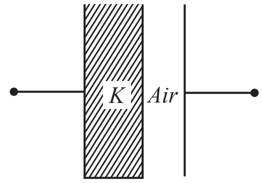
189. A parallel plate air capacitor has capacitance *C*. Now half of the space is filled with a dielectric material with dielectric Constant *K* as shown in figure. The new capacitance is *C*. Then



(*a*) $C' = \frac{C}{2}[1+K]$ (*b*) $C' = C[1+K]$

(*c*) $C' = C\left[1+\frac{K}{2}\right]$ (*d*) $C' = C\left[\frac{1}{2}+K\right]$

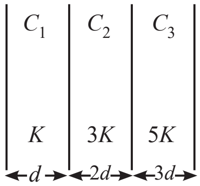
190. A parallel plate air capacitor has capacitance C. Half of space between the plates is filled with dielectric of dielectric constant K as shown in figure. The new capacitance is *C*'. Then



(*a*) $C' = C\left[\frac{K}{K+1}\right]$ (*b*) $C' = C\left[\frac{2K}{K+1}\right]$

(*c*) $C' = \frac{2C}{K+1}$ (*d*) $C' = C\left[1+\frac{K}{2}\right]$

area of plate = A)



(*a*) $\frac{15}{34}\frac{K\varepsilon_0 A}{d}$ (*b*) $\frac{15}{6}\frac{K\varepsilon_0 A}{d}$

(*c*) $\frac{25}{6}\frac{K\varepsilon_0 A}{d}$ (*d*) $\frac{9}{6}\frac{K\varepsilon_0 A}{d}$

192. An air filled parallel plate condenser has a capacity of 2 pF . The separation of the plates is doubled and the space between the plates is filled with wax. If the capacity is increased to 6 pF , the dielectric constant of wax is

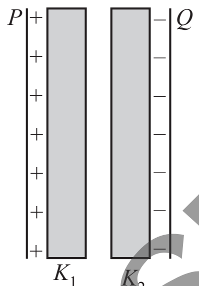
(*a*) 2 (*b*) 3 (*c*) 4 (*d*) 6

193. A parallel plate capacitor after charging is kept connected to a battery and the plates are pulled apart with the help of insulating handles. Now which of the following quantities will decrease?

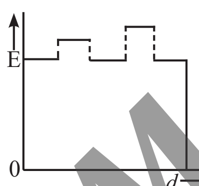
(*a*) Charge (*b*) Capacitance

(*c*) Energy stored (*d*) All of these

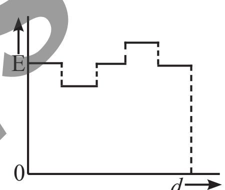
194. Two thin dielectric slabs of dielectric constants K_1 and K_2 $(K_1 < K_2)$ are inserted between plates of a parallel plate capacitor, as shown in the figure. The variation of electric field E between the plates with distance d as measured from plate P is correctly shown by



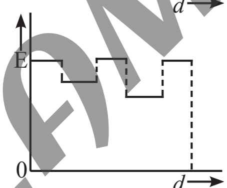
(*a*)



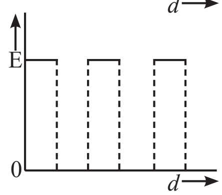
(*b*)



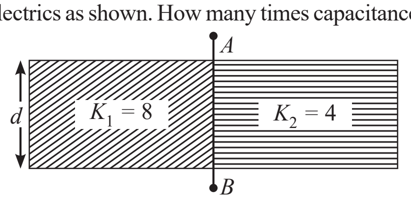
(*c*)



(*d*)



195. A capacitor having capacitance 1μF with air is filled half-half with two dielectrics as shown. How many times capacitance will become?

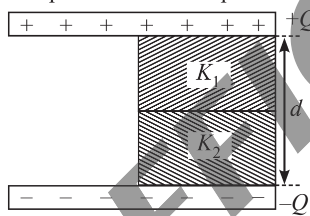


(*a*) 12 (*b*) 6 (*c*) 8/3 (*d*) 3

additional charge that flows into the capacitor from the battery is

(*a*) 2 μC (*b*) 3 μC (*c*) 5 μC (*d*) 10 μC

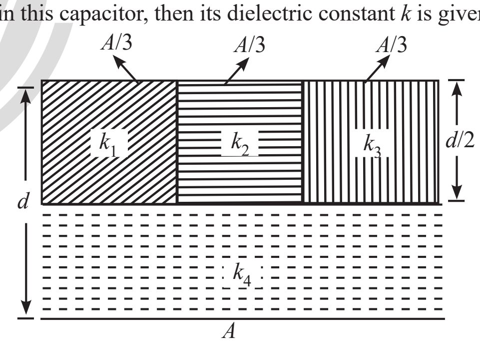
197. A parallel-plate capacitor with plate area A has separation d between the plates. Two dielectric slabs of dielectric constant K_1 and K_2 of same area $\frac{A}{2}$ and thickness $\frac{d}{2}$ are inserted in the space between the plates. The capacitance of the capacitor will be given by:



(*a*) $\frac{\varepsilon_0 A}{d}\left(\frac{1}{2}+\frac{K_1+K_2}{K_1 K_2}\right)$ (*b*) $\frac{\varepsilon_0 A}{d}\left(\frac{1}{2}+\frac{2(K_1+K_2)}{K_1 K_2}\right)$

(*c*) $\frac{\varepsilon_0 A}{d}\left(\frac{1}{2}+\frac{K_1 K_2}{K_1+K_2}\right)$ (*d*) $\frac{\varepsilon_0 A}{d}\left(\frac{1}{2}+\frac{K_1 K_2}{2(K_1+K_2)}\right)$

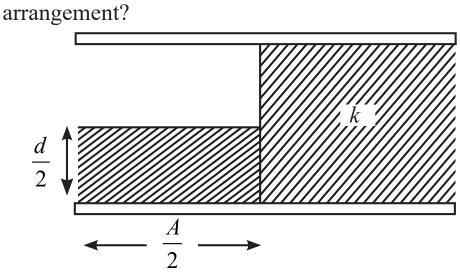
198. A parallel-plate capacitor of area A, plate separation d and capacitance C is filled with four dielectric materials having dielectric constants k_1, k_2, k_3 and k_4 as shown in the figure below. If a single dielectric material is to be used to have the same capacitance C in this capacitor, then its dielectric constant k is given by



(*a*) $k = k_1 + k_2 + k_3 + 3k_4$ (*b*) $k = \frac{2}{3}(k_1 + k_2 + k_3) + 2k_4$

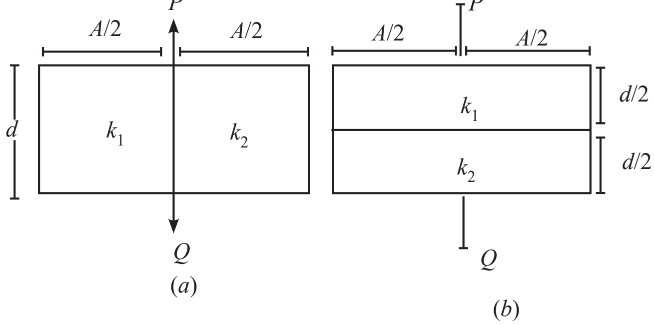
(*c*) $\frac{2}{k} = \frac{3}{k_1 + k_2 + k_3} + \frac{1}{k_4}$ (*d*) $\frac{1}{k} = \frac{1}{k_1} + \frac{1}{k_2} + \frac{1}{k_3} + \frac{1}{2k_4}$

199. A parallel plate capacitor with plate area A and plate separation d , is filled with a dielectric slab as shown. What is the capacitance of the arrangement?



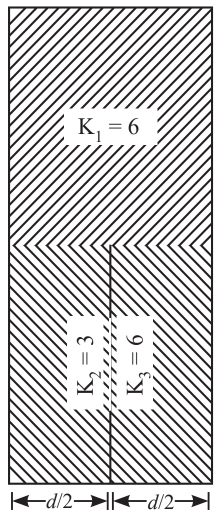
(*a*) $\left(\frac{k+1}{2}\right)\frac{\varepsilon_0 A}{d}$ (*b*) $\frac{3}{2}\frac{k\varepsilon_0 A}{2}$

(*c*) $\frac{4}{3}\frac{k\varepsilon_0 A}{d}$ (*d*) $\frac{k(k+3)}{2(k+1)}\frac{\varepsilon_0 A}{d}$

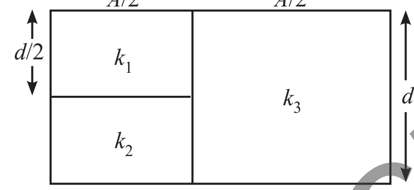


(*a*) 1 : 1 (*b*) 2 : 3 (*c*) 9 : 3 (*d*) 25 : 24

201. Three different dielectrics are filled in a parallel plate capacitor as shown. What should be the dielectric constant of a material, which when fully filled between the plates produces same capacitance?



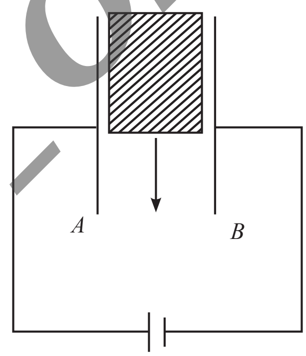
(*a*) 4 (*b*) 6 (*c*) 5 (*d*) 9



(*a*) $\frac{2\varepsilon_0 A}{d}\left[\frac{1}{k_1}+\frac{1}{k_2}+\frac{1}{k_3}\right]$ (*b*) $\frac{\varepsilon_0 A}{d}\left[\frac{1}{k_1}+\frac{1}{k_2}+\frac{1}{k_3}\right]$

(*c*) $\frac{2\varepsilon_0 A}{d}\left[k_1+k_2+k_3\right]$ (*d*) None of these

203. An insulator plate is passed through the plates of a capacitor. Then current outside the capacitor.



(*a*) First flows from A to B and then from B to A

(*b*) First flows from B to A and then from A to B

(*c*) Always flows from B to A

(*d*) Always flows from A to B

1. **Statement I:** The Capacitance of a capacitor does not depend on . the shape of the plates.

   Statement II: The Capacitance of a capacitor does depend upon the charges on the plates.

2. **Statement I:** If A dielectric slab is inserted between the plates of a isolated charged capacitor. The potential difference between the plates will remain the same.

   Statement II: The charge on the capacitor is Q and the magnitude of induced charge on each surface of the dielectric slab inserted between the plates of capacitor is Q'. Then Q must be smaller than Q.

3. **Statement I:** If the Separation between the plates of charged parallel plate capacitor is increased then Energy density between the plates will change.

   Statement II: A parallel plate is connected to a battery when a metal sheet of negligible thickness is inserted parallely between the plates, Then capacitance will increase.

4. **Statement I:** A capacitor of capacitance C is charged to potential V. The flux of the electric field through a closed surface enclosing the capacitor will be zero.

   Statement II: Two metal plates having charges Q, –Q face each other at some separation & are dipped into an oil Tank. If oil is pumped out, the Electric field Between the plates will decrease.

5. **Statement I:** Two capacitors each having capacitance C and breakdown voltage V are Joined in series. The capacitance & Breakdown voltage of combination will be $\frac{C}{2}$ and 2V Respectively.

   Statement II: If above given two capacitors are connected in parallel instead of connecting in series, then capacitance & Breakdown voltage of Combination will be 2C and $\frac{V}{2}$ Respectively.

1. $q = -2Q$ **2.** (*c*) **3.** (*a*) **4.** (i) $\sqrt{\frac{Ke^2}{mr}}$ (ii) $\sqrt{\frac{2Ke^2}{mr}}$ **5.** (*d*) **6.** $\frac{3Kq^2}{2a}$ **7.** (*a*) **8.** (*b*) **9.** (*b*)

10. (*b*) **11.** (*d*) **12.** (*a*) **13.** (*a*) **14.** (*a*) **15.** (*d*) **16.** (*b*) **17.** (*a*) **18.** (*a*) **19.** (*a*)

20. (*a*) **21.** (*c*) **22.** (*a*) **23.** A - II, B-IV, C–I, D–III **24.** (*b*) **25.** (*b*) **26.** (*a*) **27.** (*b*) **28.** (*a*)

29. (*b*) **30.** (*a*) **31.** $7\hat{j}$ **32.** (*b*) **33.** (*c*) **34.** (*c*) **35.** A–IV, B–II, C–III, D–I **36.** (*a*) **37.** (*d*)

38. (*d*) **39.** (*b*) **40.** No, we need reference point because V depends on reference point **41.** If E = O **42.** (*c*)

43. (*c*) **44.** (*d*) **45.** (*a*) **46.** (*b*) **47.** (*a*) **48.** $\frac{q}{2\pi\varepsilon_0}$ **49.** $\frac{16kq}{3r}$ **50.** $\frac{-kq}{10}$ **51.** 2m **52.** (*c*)

53. 96 cm From +3 μC **54.** (*b*) **55.** (*c*) **56.** (*a*) **57.** Kλθ **58.** (*d*) **59.** (*a*) **60.** (*b*) **61.** (*b*)

62. (*a*) **63.** (*c*) **64.** (*b*) **65.** $W = -\frac{2KP\cos\theta.q}{r^2}$ **66.** (*a*) **67.** (*d*) **68.** A-IV, B-I, C-II, D-III **69.** $\frac{KQ}{2R}$

70. $V_1 - V_2 = Er$, $V_1 - V_3 = 0$ **71.** $Kq\left[\frac{1}{r} - \frac{1}{R}\right]$ **72.** (*a*) **73.** (*c*) **74.** (*a*) **75.** (*c*) **76.** (*b*)

77. (*b*) **78.** (*a*) **79.** (*c*) **80.** Charge on inner sphere = 0, charge on outer sphere = $q + Q$ **81.** $r_1 < r_2$ **82.** (*b*)

83. (*a*) **84.** (*c*) **85.** (*b*) **86.** (*a*) **87.** (*b*) **88.** (*a*) **89.** (*a*) **90.** $-\frac{QR}{r}$ **91.** (*c*)

92. 711×10^{-6} F **93.** (*b*) **94.** (*b*) **95.** (*c*) **96.** (*b*) **97.** (*a*) **98.** (*c*) **99.** (*d*) **100.** (*a*)

101. (*d*) **102.** (*a*) **103.** (*d*) **104.** (*a*) **105.** $\frac{Q}{C}$ **106.** – 4 V **107.** 13 V **108.** 15 V **109.** 28 V **110.** 12 V

111. 10 V **112.** 5 V **113.** $q_{max} = 2CV, 2CV^2$ **114.** $q_{max} = +CV$, $U_{loss} = 1/2\, CV^2$ **115.** $q_{max} = 0$, $U_{loss} = 0$

116. $q_{max} = CV, U_{loss} = \frac{1}{2}CV^2$ **117.** (*d*) **118.** (*d*)

119. (i) $\frac{C_1V_1 + C_2V_2}{C_1 + C_2}$, (ii) $Q_1 = C_1\left[\frac{C_1V_1 + C_2V_2}{C_1 + C_2}\right]$, (iii) $\frac{1}{2}\frac{C_1C_2}{C_1 + C_2}(V_1 - V_2)^2, Q_2 = C_2\left[\frac{C_1V_1 + C_2V_2}{C_1 + C_2}\right]$

120. (i) 7V, (ii) $(q_1)_{final} = 140\mu C$, $(q_2)_{final} = 210\mu C$, (iii)1150μJ **121.** 535.7 μf **122.** (*d*) **123.** (*d*) **124.** (*b*)

125. (*c*) **126.** (*d*) **127.** (*a*) **128.** (*a*) **129.** 6 **130.** (0) **131.** 66.66% **132.** 80% **133.** (*a*)

134. $V_c = 19V$, charge on $C_1 = 2\mu C$, Charge on $C_2 = 55\mu C$, Charge on $C_3 = 57\mu C$

135. $(Q)_{all\ capacitor} = 12\ \mu C$, $V_1 = 60\ V$, $V_2 = 30\ V$, $V_3 = 10\ V$ **136.** 5μF **137.** $C_{eq} = \frac{c}{n}$

138. Q = 80 μC, $V_1 = 40\ V$, $V_2 = 20\ V$, $V_3 = 10\ V$ **139.** (*a*) **140.** $q_1 = \frac{100}{3}\mu C, q_2 = 50\mu C, q_3 = \frac{50}{3}\mu C$

141. $Q_1 = \frac{30}{7}\mu C, Q_2 = \frac{40}{7}\mu C$ **142.** 6 V **143.** (*a*)

144. $q_{12\mu F} = 480\ \mu C$, $V_{12\mu F} = 40$ V, $q_{4\mu F} = 320\ \mu C$, $V_{4\mu F} = 80$ V, $q_{2\mu F} = 160\mu C$, $V_{2\mu F} = 80$ V **145.** $q_{6\mu F} = q_{3\mu F} = 200\mu C$, $q_{5\mu F} = 50\mu C$

146. $q_{6\mu F} = 45\ \mu C$, $V_{6\mu F} = 7.5$ V, $q_{3\mu F} = 45\ \mu C$, $V_{3\mu F} = 15$ V, $q_{4\mu F} = 270\ \mu C$, $V_{4\mu F} = 67.5$ V, $q_{10\mu F} = 225\ \mu C$, $V_{10\mu F} = 22.5$ V **147.** $\frac{50}{4}$ volt

153. (*d*) 154. (*d*) 155. (*a*) 156. $V_P = 9V$ 157. $q_{4\mu F} = 40\mu C$ 158. 10 μC 159. $V_A = 50$ V 160. $V_B = \frac{50}{3}V$

161. $q_{2\mu F} = 24\mu C$ 162. 10 μC 163. $V_A - V_B = \frac{3}{2}V$ 164. (*b*) 165. 2C 166. 2C 167. $\frac{3C}{2}$ 168. $\frac{4C}{11}$

169. $\frac{3}{2}$ 170. $C_1 + C_2 + C_3$ 171. (*d*) 172. 3C 173. $C_{AB} = 2C$ 174. $\frac{2C}{3}$ 175. (*c*) 176. (*a*)

177. C 178. 6μF 179. $\frac{C}{2}$ 180. $C = \frac{A\varepsilon_0}{d}$ 181. $\frac{2C}{3}$ 182. $\frac{7C}{8}$ 183. (*b*) 184. (*a*) 185. 2C

186. 2C 87. (*d*) 188. (*c*) 189. (*a*) 190. (*b*) 191. (*a*) 192. (*d*) 193. (*d*) 194. (*c*) 195. (*b*)

196. (*c*) 197. (*c*) 198. (*c*) 199. (*d*) 200. (*d*) 201. (*c*) 202. (*d*) 203. (*b*)

MR* CORNER

1. I. False, II. True
2. I. False, II. False
3. Both are false
4. Both are True
5. I. True, II. False