KENDRIYA VIDYALAYA IIT KANPUR

PREVIOUS YEAR QUESTION BANK

CLASS XII

PHYSICS

ELECTROSTATICS

1 Mark Questions

1. A point charge is placed at the centre of a hollow conducting sphere of inner radius r and outer radius 2r. Calculate the ratio of the surface charge density of the inner surface to that of the outer surface, Delhi 2020

2. Torque acting on an electric dipole placed in an uniform electric field is maximum what is the angle between the electric field and the dipole moment ? All India 2020

3. Draw the pattern of electric field lines, when a point charge - Q is kept near an uncharged conducting plate. Delhi 2019

4. Draw a pattern of electric field lines due to two positive charges placed a distance d apart. All India 2019

5. Draw the pattern of electric field lines due to an electric dipole. All India 2019

6. Why do the electrostatic field lines not form closed loop? All India 2014, Delhi 2012

7. Two identical balls having same positive charge q coulomb are suspended by two insulating strings of equal length. What would be the effect on the force when a plastic sheet is inserted between the two?

All India 2014

8. Why do the electric field lines never cross each other? All India 2014

9. Why must electrostatic field at the surface of a charged conductor be perpendicular to every point on it? Foreign 2014, Delhi 2012

10. Two point charges q, and q_2 are placed at a distance d apart as shown in the figure. The electric field intensity is zero at the point P on the line joining them as shown. Write two conclusions that you can draw from this. Delhi 2014C

11. Define dipole moment of an electric dipole. Is it a scalar quantity or a vector quantity? Foreign 2012; All india 2011

12. Draw a plot showing the variation of electric field E with distance r due to a point charge q. Delhi 2012

13. A proton is placed in a uniform electric field directed along the positive X-axis. In which direction, will it tend to move? Delhi 2011C

14. In which orientation, a dipole placed in a uniform electric field is in (i) stable equilibrium (ii) unstable equilibrium? Delhi 2011

15. Two point charges having equal charges separated by 1m distance experience a force of 8 N. What will be the force experienced by them, if they are held in water at the same distance? (Given, Kwater=80). All India 2010C

16. A metallic sphere is placed in a uniform electric field as shown in the figure. Which path is followed by electric field lines and why? Foreign 2010

17. Point out whether the following statement is right or wrong.

The mutual forces between two charges do not get affected by the presence of other charges. All India 2010

2 Marks Questions

18. Derive the expression for the torque acting on an electric dipole when it is held in a uniform electric field. Identify the orientation of the dipole in the electric field in which it attains a stable equilibrium. Delhi 2020

19. Derive an expression for the electric field due to a dipole of dipole moment p at a point on its perpendicular bisector. Delhi 2019

20. An electric dipole of length 4 cm when placed with its axis making an angle of 60° with a uniform electric field, experiences a torque of 4√3 N-m. Calculate the potential energy of the dipole, if it has charge ± 8nC. Delhi 2014

21. An electric dipole of length 2 cm when placed with its axis making an angle of 60° with a uniform electric field, experiences a torque of 8/3 N-m. Calculate the potential energy of the dipole if it has charge of ± 4 nC. Delhi 2014

22. An electric dipole of length 1cm when placed with its axis making an angle of 60° with a uniform electric field, experiences a torque of 6√3 N-m. Calculate the potential energy of the dipole, if it has charge ± 2 nC. Delhi 2014

23. An electric dipole is placed in a uniform electric field E with its dipole moment p parallel to the field. Find

(i) the work done in turning the dipole till its dipole moment points in the direction opposite to E. (ii) the orientation of the dipole for which

(ii) the torque acting on it becomes maximum. All India 2014C

24. A small metal sphere carrying a charge +Q is located at the centre of a spherical cavity in a large uncharged metallic spherical shell. Write the charges on the inner and outersurfaces of the shell. Write the expression for the electric field at the point P. Delhi 2014C

25. Point charge (+Q) is kept in the vicinity of an uncharged conducting plate. Sketch electric field lines between the charge and the plate.Foreign 2014

26. Two concentric metallic spherical shells of radii R and 2R are given charge Q and Q_2 respectively. The surface charge densities on the outer surfaces of the shells are equal. Determine the ratio Q:Q2. Foreign 2013

27. Calculate the amount of work done in turning an electric dipole of dipole moment 3×10^{-8} C-m from its position of unstable equilibrium to the position of stable equilibrium in a uniform electric field of intensity 10^3 NC^{-1}. Foreign 2011

28. Plot a graph showing the variation of Coulomb force F versus Vr2, where r is the distance between the two charges of each pair of charges (1 μC, 2 μC) and (1 μC,- 3 μC). Interpret the graphs obtained. All India 2011C

29. Two identical metallic spherical shells A and B having charges + 4 Q and - 10Q are kept a certain distance apart. A third identical uncharged sphere C is first placed in contact with sphere A and then with sphere B, then spheres A and B are brought in contact and then separated. Find the charge on the spheres A and B. All India 2011C

30. A dipole with a dipole moment of magnitude p is in stable equilibrium in an electrostatic field of magnitude E. Find the work done in rotating this dipole to its position of unstable equilibrium. All India 2010C

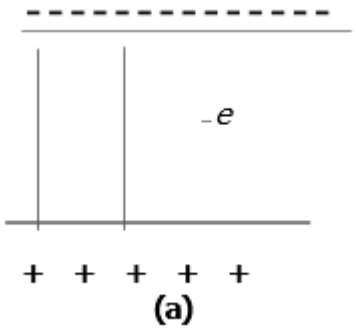
31. A dipole is present in an electrostatic field of magnitude 10^6 NC^{-1}. If the work done in rotating it from its position of stable equilibrium to its position of unstable equilibrium is $2x\ 10^{-23}$ J, then find the magnitude of the dipole moment of this dipole. All India 2010C

32. Deduce the expression for the electric field E at a point r due to a system of two charges q, and q_2 with position vectors r, and r_2 with respect to common origin. Delhi 2010C

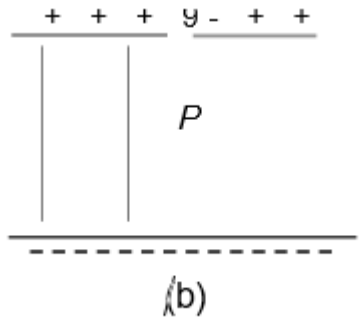
33. An electron falls through a distance of 1.5 cm in a uniform electric field of magnitude

2.0×10^4 N/C (Fig. a)

(i) Calculate the time it takes to fall through this distance starting from rest.



(ii) If the direction of the field is reversed (Fig. b) keeping its magnitude unchanged, calculate the time taken by a proton to fall through this distance starting from rest. 2018C



34. (i) Derive the expression for electric field at a point on the equatorial line of an electric dipole.

34 (ii) Depict the orientation of the dipole in (a) stable, (b) unstable equilibrium in a uniform electric field.

35. (i) Obtain the expression for the torque t experienced by an electric dipole of dipole moment p in a uniform electric field E.

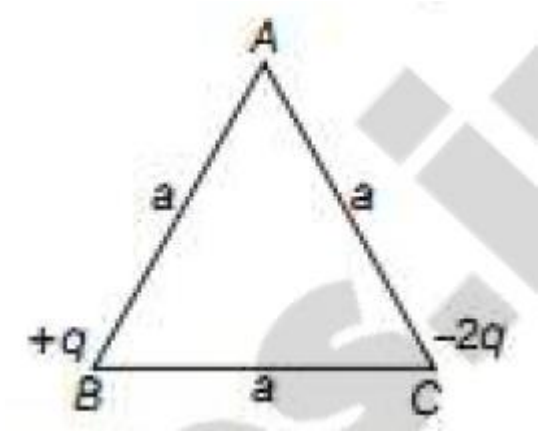
35. (ii)) What will happen, if the field were non-uniform

36. A thin circular ring of radius r is charged uniformly so that its linear charge density becomes k. Derive an expression for the electric field at a point P at a distance x from its centre along the axis of the ring. Hence, prove that at large distances (x» r), the ring behaves as a point charge. Delhi 2016

37. An electric dipole of dipole moment p is placed in a uniform electric field E. Obtain the expression for the torque t experienced by the dipole. Identify two pairs of perpendicular vectors in the expression.

35. Two point charges + q and — 2q are placed at the vertices B and C of an equilateral ABC of side a as given in the figure. Obtain the expression for

(i) the magnitude and
(ii) the direction of the resultant electric field at the vertex A due to these two charges.



39. Define the term electric dipole moment. Is it a scalar or vector? Deduce an

expression for the electric field at a point on the equatorial plane of an electric dipole of length 2a. All India 2013

40. An electric dipole is kept in a uniform electric field. Derive an expression for the

net torque acting on it and write its direction. State the conditions under which the dipole is in
(i) stable equilibrium

(ii) unstable equilibrium. Delhi 2012C

41. Sketch the pattern of electric field lines due to

(i) a conducting sphere having negative charge on it.
(ii) an electric dipole.

5 Marks Questions

42. (i) Derive an expression for the electric field at any point on the equatorial line of an electric dipole.
(ii) Two identical point charges q each are kept 2 m in apart in air. A third
point charge Q of unknown magnitude and sign is placed on the line joining the charges such that the system remains in equilibrium. Find the position and nature of Q.

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43. (i) Derive an expression for the electric field E due to a dipole of length 21 at a point distant r from the center of the dipole on the axial line.

(ii) Draw a graph of E versus r for r » 1_

(iii) If this dipole is kept in a uniform external electric field E0. diagrammatically represent the position of the dipole in stable and unstable equilibrium and write the expressions for the torque acting on the dipole in both the cases.

44. (i) Define torque acting on a dipole of dipole moment p placed in a uniform electric field E. Express it in the vector form and point out the direction along which it acts.

(ii) What happens if the field is non-uniform?

(iii) What would happen if the external field E is increasing (a) parallel to p and (b) anti-parallel to p

1 Mark Questions

1. How does the electric flux due to a point charge enclosed by a spherical Gaussian surface get affected when its radius is increased? Delhi 2016

2. What is the electric flux through a cube of side 1 cm which encloses an electric dipole? All Indio 2015

3. What is the flux due to electric field E = 3x 103iNC-1 through a square of side 10 cm, when it is held normal to E ? All Indio 2015C

4. Two charges of magnitudes —2Q and + Q are located at points (a, 0) and (4a, 0), respectively. What is the electric flux due to these charges through a sphere of

radius 3a with its centre at the origin?

All Indio 2013

5. A charge q is placed at the centre of a cube of side L What is the electric flux passing through each face of the cube?

All Ina, 2010; Foreign 2010

6. Figure shows three point charges, +2q, —q and +3q. Two charges +2q and —q are enclosed within a surface S. What is the electric flux due to this configuration through the surface S?

2 Marks Questions

7. Given a uniform electric field E= 5 x 103 i NC-1. Find the flux of this field through a square of side 10 cm whose plane is parallel to the y-z plane. What would be the flux through the same square if the plane makes an angle of 30° with the X-axis?

8. Given a uniform electric field E= 2 x 103 i - Find the flux of this

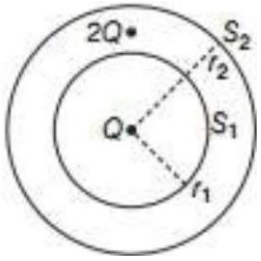
field through a square of side 20 cm whose plane is parallel to the YZ-plane. What would be the flux through the same square if the plane makes an angle of 30° with the X-axis? Foreign 2014

9. Given a uniform electric field E = 4x 103i NC-1. Find the flux of this field through a square of side 5 cm whose plane is parallel to the YZ-plane. What would be the flux through the same square if the plane makes an angle of 30° with the x axis?

10. A sphere SI of radius r1 encloses a net charge Q.

If there is another concentric sphere S2 of radius r2(r, > r1) enclosing charge 2Q.

Find the ratio of the electric flux through S1 and S,. How will the electric flux through sphere SI change if a medium of dielectric constant K is introduced in the space inside S, in place of air?



11. A thin straight infinitely long conducting wire having linear charge density A. is enclosed by a cylindrical surface of radius r and length I, its axis coinciding with the length of the wire. Find the expression for the electric flux through the surface of the cylinder.

12. Show that the electric field at the surface of a charged spherical conducting shell is

given by E = $\frac{\sigma}{\varepsilon_0}\hat{n}$, where σ is the surface charge density and $\hat{n}$

is a unit vector normal to the surface in the outward direction.

13. A spherical conducting shell of inner radius RI and outer radius R2 has a charge Q. A charge q is placed at the centre of the shell.

i) What is the surface charge density on the (a) inner surface, (b) outer surface of the shell?

ii) Write the expression for the electric field at a point to x> R, from the centre of the shell.

14. Consider two hollow concentric spheres Si and S2 enclosing charges 2Q and 4Q respectively as shown in the figure. (i) Find out the ratio of the electric flux through them. (ii) How will the electric flux through the spheres S, change if a medium of dielectric constant Er is introduced in the space inside S1 in place of air? Deduce the necessary expression.

3 Marks Questions

15. State Gauss's law on electrostatics and derive an expression for the electric field due to a long straight thin uniformly charged wire (linear charge density k) at a point lying at a distance r from the wire.

Delhi 2020

16. A hollow conducting sphere of inner radius r1 and outer radius r2 has a charge Q on its surface. A point charge — q is also placed at the centre of the sphere.

(i) What is the surface charge density on the (a) inner and (b) outer surface of the sphere?

(ii) Use Gauss's law of electrostatics to obtain the expression for the electric field at a point lying outside the sphere. ai India 2020

17. (i) An infinitely long thin straight wire has a uniform linear charge density

X. Obtain the expression for the electric field E at a point lying at a distance x from the wire by using Gauss' law.

(ii) Show graphically the variation of this electric field E as a function of distance x from the wire.

18. Two large charged plane sheets of charge densities a and — 2a C/ m2 are arranged

vertically with a separation of d between them. Deduce expressions for the electric field at points (i) to the left of the first sheet (ii) to the right of the second sheet and (iii) between the two sheets.

All India 2019

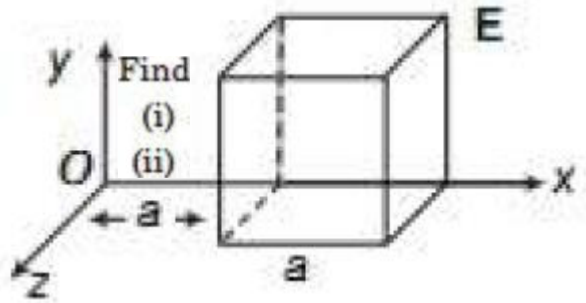
19. A spherical conducting shell of inner radius r1 and outer radius r, has a

charge Q.

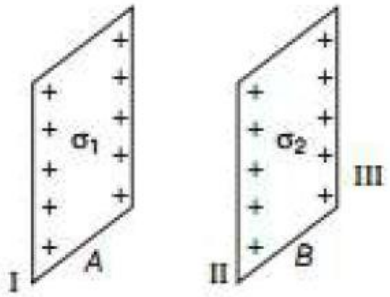
(i) A charge q is placed at the centre of the shell. Find out the surface charge density on the inner and outer surfaces of the shell.

(ii) Is the electric field inside a cavity (with no charge) zero independent of the fact whether the shell is spherical or not? Explain.

20. Define electric flux and write its SI unit. The electric field components in the figure shown are Ex = ax, Ey = 0, Ez= 0, where a = 100N/Cm. Calculate the charge within the cube, assuming a = 0.1 M



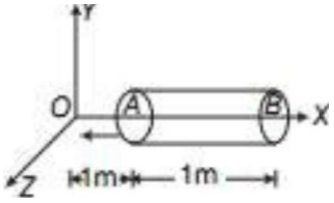
21. Two infinitely large plane thin parallel sheets having surface charge densities al and a2(a1 >a2) are shown in the figure. Write the magnitudes and directions of the net fields in the regions marked II and III.



22. A hollow cylindrical box of length 1 m and area of cross -section 25 cm2 is placed in a three-dimensional coordinate system as shown in the figure. The electric field in the region is given by E. 50 xi, where E is in NC-1 and x is in metre.

i) net flux through the cylinder.

ii) charge enclosed by the cylinder.

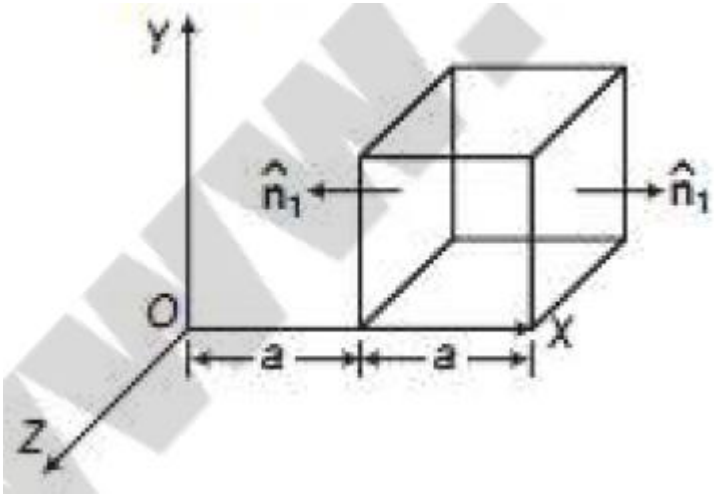


Delhi 2013

23. (i) State Gauss's law.

(ii) A thin straight infintely long conducting wire of linear charge density ;. is enclosed by a cylindrical surface of radius r and length I. Its axis coinciding with the length of the wire. Obtain the expression for the electric field indicating its direction at a point on the surface of the cylinder.

24. State Gauss' law in electrostatics. A cube with each side a is kept in an electric field given by E. Cxî as shown in the figure, where C is a positive dimensional constant. Find out



i) The electric flux through the cube.

ii) The net charge inside the cube.

25. Using Gauss' law obtain the expression for the electric field due to uniformly charged spherical shell of radius R at a point outside the shell. Draw a graph showing the variation of electric field with r, for r > R and r < R.

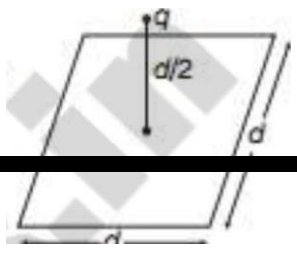
5 Marks Questions

26. (i) Define electric flux. Is it a scalar or a vector quantity?

A point charge q is at a distance of d/2 directly above the centre of a square of side d as shown in the figure. Use Gauss' law to

obtain the expression for the electric flux through the square.

(ii) If the point charge is now moved to a distance d from the centre of the square and the side of the square is doubled, explain how the electric flux will be affected.



27. (i) Use Gauss' law to derive the expression for the electric field (E) due to a straight uniformly charged infinite line of charge density C/m.

(ii) Draw a graph to show the variation of E with perpendicular distance r from the line of charge.

(iii) Find the work done in bringing a charge q from perpendicular distance r1 to r2(r2> r1). CBSE 2018

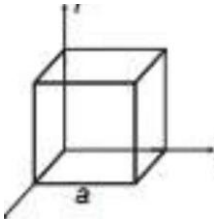
28. (i) Use Gauss' theorem to find the electric field due to a uniformly charged infinitely large plane thin sheet with surface charge density cf.

(ii) An infinitely large thin plane sheet has a uniform surface charge density -s-o. Obtain the expression for the amount of work done in bringing a point charge q from infinity to a point of distant r in front of the charged plane sheet. All Indio 2017

(i)29. An electric dipole of dipole moment p

consists of point charges +q and —q separated by a distance 2a apart. Deduce the expression for the electric field E due to the dipole at a distance x from the centre of the dipole on its axial line in terms of the dipole moment p . Hence, show that in the limitx»a,E --o 2 p/(4xe3).

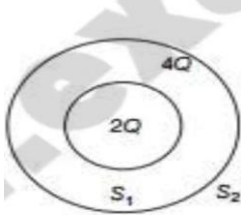
(ii) Given the electric field in the region E= 2x1, find the net electric flux through the cube and the charge enclosed by it.



30. (i) Define electric flux. Write its SI unit. Gauss' law in electrostatics is true for any closed surface, no matter what its shape or size is. Justify this statement with the help of a suitable example.
(ii) Use Gauss' law to prove that the electric field inside a uniformly charged spherical shell is zero

31. (i) Deduce the expression for the torque acting on a dipole of dipole moment p in the presence of uniform electric field E.

(iii) Consider two hollow concentric spheres Si and S2 enclosing charges 2Q and 4Q respectively as shown in the figure (a) find out the ratio of the electric flux through them. (b) How will the electric flux through the sphere S1 changes if a medium of dielectric L is introduced in the space inside S1 in place of air? Deduce the necessary expression?

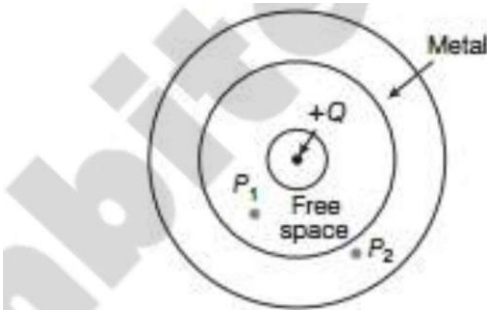


32. Using Gauss' law, deduce the expression for the electric field due to a uniformly charged spherical conducting shell of radius R at a point
(i) outside the shell (ii) inside the shell. Plot a graph showing variation of electric field as a function of r > R and r < R. (r being the distance from the centre of the shell)

33. (i) Define electric flux. Write its SI unit.

(ii) A small metal sphere carrying charge

Q is located at the centre of a spherical cavity inside a large uncharged metallic spherical shell as shown in the figure.Use Gauss' law to find the expressions for the electric field at points Pi and P,.



34. Define electric flux. Write its SI unit. SE 2021 (Te

Using Gauss' law prove that the electric field at a point due to a uniformly charged infinite plane sheet is independent of distance from it.

How is the field directed if the sheet is

(a) positively charged?

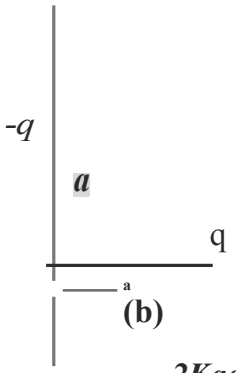
(b) negatively charged? Delhi 2012

35. (i) State Gauss' law. Use it to deduce the expression for the electric field due to a uniformly charged thin spherical shell at points

(a) inside the shell and

(b) outside the shell.

(ii) Two identical metallic spheres A and B having charges + 4Q and — 10Q are kept a certain distance apart. A third identical uncharged sphere C is first placed in contact with sphere A and then with sphere B. Then, spheres A and B are brought in contact and then separated. Find the charges on the spheres A and B



$\frac{2Kqqo}{a^2}$

(d) $\frac{1\ Kqq_0}{n}$

42

Multiple Choice Questions (MCQs)

1. An object has charge of 1 C and gains 5.0 x 1018 electrons. The net charge on the object becomes

(a) -0.80 C (b) + 0_80 C

)+ 1_80 C (d) + 0.20C

2. In an experiment, three microscopic latex spheres are sprayed into a chamber and became charged with charges + 3e, + Se and - 3e, respectively. All the three spheres came in contact simultaneously for a moment and got separated. Which one of the following are possible values for the final charge on the spheres?

(a) + 5e, - + 5e (b) + 6e, + 6e, - 7e

(c)+ 4e, + 3_5e, + 5.5e (d)+ 5e, - 8e, + 7e

3. Four objects W, X, Y and Z each with charge + q are held fixed at four points of a square of side d as shown in the figure_ Objects X and Z are on the mid-points of the sides of the square. The

electrostatic force exerted by object W on object X is F, then the magnitude of the force exerted by object W on Z is

(a) $\frac{F}{7}$ (b) $\frac{F}{5}$ (c) $\frac{F}{3}$ (d) $\frac{F}{2}$

6. 4. A square sheet of side a is lying parallel to XY-plane at z = a. The electric field in the region is E = cz2k. The electric flux through the sheet is

(a) a^4c (b) $\frac{1}{3}a^3c$

(c) $\frac{1}{3}a^4c$ (d) 0

7. The electric flux through a closed Gaussian surface depends upon Delhi 2020

(a) net charge enclosed and permittivity of the medium

(b) net charge enclosed, permittivity of the medium and the size of the Gaussian surface

(c) net charge enclosed only

(d) permittivity of the medium only

8. An electric dipole of dipole moment p is placed in a uniform external electric field E. Then the

(a) torque experienced by the dipole is E x p

(b) torque is maximum, if p is perpendicular to E

(c) potential energy is maximum, if p is parallel to E

9. An electric dipole placed in a non-uniform electric field experiences

(a) both a torque and a net force

(b) only a force but no torque

(c) only a torque but no net force

(d) no torque and no net force

10. An electric dipole is placed in a uniform electric field with the dipole axis making an angle 6 with the direction of the electric field. The orientation of the dipole for stable equilibrium is

(a) 6 —it (b) 3

(c) 0 (d) 9

11. The electric dipole moment of an electron and a proton 4.3 nm apart is

(a) 6.88x 10-11 C-m (b) 2.56x 10-29C2/m

(c) 3.72 x (d) 1.1x 10-46 Cl'm

12. What is the nature of Gaussian surface involved in Gauss' law of electrostatics?

(a) Scalar (b) Electrical

(c) Magnetic (d) Vector

13. In a region, the intensity of an electric field is given by E = (2i + 3j+ k)NC-1. The electric flux through a surface S = 10 i m2 in the region is

(a) 5 N-m'C-1 (b) 10 N-m2 C-1

(c) 15 N-m2 (d) 20 N-m2 C-1

Assertion-Reason Questions

Directions (Q. Nos. 16.22) In the following questions, two statements are given- one labelled

Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below

(a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion_

(b) If both Assertion and Reason are correct but Reason is not the correct explanation of Assertion.

(c) If Assertion is correct but Reason is incorrect.

(d) If both Assertion and Reason are incorrect.

Assertion (A) A negative charge in an electric field moves along the direction of the electric field.

Reason (R) On a negative charge the force acts in the direction of the electric

field. ME 2021(Term-11

15. Assertion When charges are shared between any two bodies, then no charge is really lost but some loss of energy does Occur.

Reason Some energy disappears in the form of heat, sparking, etc.

16. Assertion The coulomb force is the dominating force in the universe.

Reason The coulomb force is weaker than the gravitational force.

17. Assertion At the centre of the line joining two equal and opposite charges, E = 0.

Reason At the centre of the line joining

two equal and similar charge, E x 0.

18. Assertion If a dipole is enclosed by a surface, then according to Gauss's law, electric flux linked with it will be zero.

Reason The charge enclosed by a surface is zero.

19. Assertion In a region, where uniform electric field exists, the net charge within volume of any size is zero.

Reason The electric flux within any closed surface in region of uniform electric field is zero.

20. Assertion With the help of Gauss's theorem, we can find electric field at any point.

Reason Gauss's theorem cannot be applied for any type of charge distribution.

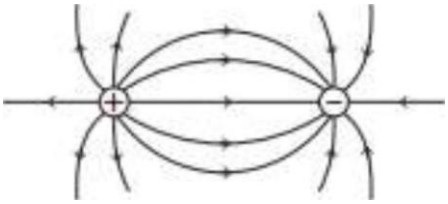
Case Based Questions

Directions (Q.Nos_ 23.24 I These questions are case study based questions. Attempt any 4 sub-parts from each question. Each question carries I mark.

21. Electric Charge

Electric charge is an intrinsic property of elementary particles like electrons, protons, etc. Due to charge on elementary particles, attraction or repulsion force occurs between them. There are two types of charges; one is positive and other is negative.

Electric lines of forces for pair of two unlike charges are shown below



Electric field lines do not pass through a conductor.

(i) Charge on a body which carries 40 excess electrons is

(a) 6.4 x 10-18 C
(b) - 6.4 x 10-1g C
(c) 6.4 x 10-19 C
(d) —6.4 x 10-19 C

(ii) Which of the following charge does not exist on any type of charged body?

(a) 32 x 10-19 C (b) 6.4 x 10-19C

(c) 9.6 x 10-2° C (d) 9.6 x 10-18 C

(iii) A body is negatively charged, it implies that

(a) there is negative as well as positive charge in the body but the positive charge is more than negative charge
(b) there is negative as well as positive charge in the body but the negative charge is more than positive charge
(c) there is only negative charge in the body
(d) None of the above

(iv) Electric lines of forces

(a) intersect at positive charge to each other
(b) intersect at negative charge to each other
(c) do not intersect each other
(d) are not responsible for attraction for two unlike charges

(v) Two charges are repel to each other, if

(a) one charge is positive and other is negative
(b) Both charges are positive
(c) Both charges are negative
(d) Both (b) and (c)

22. Faraday Cage

A Faraday cage or Faraday shield is an enclosure made of a conducting material. According to electrostatics of a conductor, we know that fields within the conductor cancel out with any external fields, hence electric field within the enclosure is zero. These Faraday cages act as big hollow conductors in which we can put the things to shield them from electrical fields. Any electrical shocks, the cage receives, pass harmlessly around the outside of the cage.

(i) Which type of materials can be used to make a Faraday cage?

(a) Insulators
(b) Semiconductors
(c) Metallic conductors
(d) All of the above

(ii) Examples of a real world Faraday cage is

(a) plastic box (b) lightning rod

(c) metallic rod(d) car (iii) An isolated point charge — q is placed inside the Faraday cage. Its surface must have charge equal to

(a) — q (b)+ q (c) — 2q (d) 0

(iv) A point charge of 1C is placed at the centre of Faraday cage in the shape of cube with surface of 5 cm edge.

The number of electric field lines passing through the cube normally will be

(a) Ll x 108 N-m2/C leaving the surface
(b) 1.1x 108 N-m2/C entering the surface
(c)9 x 109 N-m2/C leaving the surface
(d) 9 x 109 N-m2/C entering the surface

(v) What is the electrical force inside a Faraday cage, when it is struck by lightning?

(a) The same as the lightning
(b) Half that of the lightning
(c) A quarter of the lightning
(d) Zero

23. ... A proton released from rest in an electric field will start moving towards a region of .....potential in the field_AH Indio 2020

24. The work done in moving a charge particle between two points in a uniform electric field does not depend on the path followed by the particle. Why?All Indio 2020

25. Draw equipotential surfaces for an electric dipole. Delhi 2019

26. Draw the equipotential surfaces due to an isolated point charge. Delhi 2019

27. Does the charge given to a metallic sphere depend on whether it is hollow or solid? Give reason for your answer. Delhi 2017

28. A point charge + Q is placed at point 0 as

shown in the figure. Is the potential difference (V4 - V5) positive, negative or zero?

29. A charge q is moved from a point A above a dipole of dipole moment p to a point B below the dipole in equatorial plane without acceleration. Find the work done in this process?

30. Why are electric field lines perpendicular at a point on an equipotential surface of a conductor?

31. Two point charges q and —2q are kept d distance apart. Find the location of point relative to charge q at which potential due to this system of charges is zero.

32. The figure shows the field lines of a positive charge. Is the work done by the field in moving a small positive charge from Q to P positive or negative?

33. For any charge configuration the equipotential surface through a point is a normal to the electric field. Justify. Delhi 2014

34. What is the geometrical shape of equipotential surfaces due to a single isolated charge? Delhi 2013. All Indio 2010 C

35. What is the amount of work done in moving a point charge around a circular arc of radius r at the centre of which another point charge is located? All Indio 2013C

36. Two charges 24C and —211C are placed at
points A and B at 5 cm apart. Depict an equipotential surface of the system.

Delhi 2013C

37. Why electrostatic potential is constant throughout the volume of the conductor and has the same value as on its surface?

Delhi 2012

38. Why the potential inside a hollow spherical charged conductor is constant and has the same value as on its surface? Foreign 2012

39. Why there is no work done in moving a charge from one point to another on an equipotential surface? Foreign 2012

40. A hollow metal sphere of radius 5 cm is charged such that potential on its surface is 10V. What is the potential at the centre of the sphere? All Indio 2011

41. Can two equipotential surfaces intersect each other? Justify your answer. Delhi 2011C

42. Draw equipotential surfaces due to a single point charge. All Indio 2011C

43. Name the physical quantity whose SI unit is JC-1. Is it a scalar or a vector quantity?

44. Write two important characteristics of equipotential surface.

45. The magnitude of electric field (in NC-1)

46. in a region varies with the distance r (in cm) as

47. = 10r+ 5

48. By how much does the electric potential increase in moving from point at r = 1 m to a point at r = 10 m? Delhi 2020

49. 25. (i) Draw equipotential surfaces corresponding to the electric field

50. that uniformly increases in magnitude along with the

51. z- directions.

52. (ii) Two charges —q and +q are located at points (0, 0, —a) and (0, 0, a). What is the electrostatic potential at the points (0, 0, z) and (x, y, 0)? Delhi 2019

53. 26. (i) Draw the equipotential surfaces due to an electric dipole.

54. (ii) Derive an expression for the electric field due to a dipole of dipole moment p at a point on its perpendicular bisector. Delhi 2019

55. 27. Two point charges q1 and q2 are located at r1 and r, respectively in an external electric field E. Obtain the expression for the total work done in assembling this configuration. Delhi 2014C

56. 28. Two closely spaced equipotential surfaces A and B with potentials V and V+5V, (where SV is the change in V) are kept Si

57. distance apart as shown in the figure. Deduce the relation between the electric field and the potential gradient between them. Write the two important conclusions concerning the relation

58. between the electric field and electric potential. Delhi 2014C

59. Calculate the amount of work done to dissociate a system of three charges, two of 141C and one of —4u.0 placed on the vertices of an equilateral triangle of side 10 cm.

60. A test charge q is moved without acceleration from A to C along the path from A to B and then from B to C in electric field E as shown in the figure.

(i) Calculate the potential difference, between A and C.

(ii) At which point (of the two) the electric potential is more and why?

(iii) Draw a plot showing the variation of (i) electric field (E) and (ii) electric potential (V) with distance r due to a point charge Q.

61. Two uniformly large parallel thin plates having charge densities + a and — a are kept in the XZ- plane at a distance d apart. Sketch an equipotential surface due to electric field between the plates. If a particle of mass ni and charge — q remains stationary between the plates. What is the magnitude and direction of this field? Delhi 2011

62. Two point charges 3 uC and —3 pC are placed at points A and B at 5 cm apart.

(i) Draw the equipotential surfaces of the system.

(ii) Why do equipotential surfaces get close to each other near the point charge? All India 2011C

63. Two charged conducting spheres of radii r1

and r, connected to each other by a wire. Find the ratio of electric fields at the surfaces of the two spheres. Delhi 2011C

64. A dipole with its charge —q and +q located

at the points (0,—b, 0) and (0, + b ,0) is present in a uniform electric field E. The equipotential surfaces of this field are planes parallel to the YZ-plane.

(i) What is the direction of the electric field E?

(ii) How much torque would the dipole experience in this field?

65. Find out the expression for the potential energy of a system of three charges q1 , q,, and q3 located at r1 , r,, and r, with respect to the common origin 0. Delhi 2010C

3 Marks Questions

66. (i) Two point charges + Q1 and - Q2 are placed at r distance apart. Obtain the expression for the amount of work done to place a third charge Q3 at the mid-point of the line joining the two charges.

(ii) At what distance from charge + Qi on the line joining the two charges (in terms of Q1, Q2 and r) will this work done be zero? Delhi 2020

67. (i) Draw the equipotential surfaces corresponding to a uniform electric field in the z-direction.

(iii) Derive an expression for the electric potential at any point along the axial line of an electric dipole.

(iv) (i) Derive the expression for the electric potential due to an electric dipole at a point on its axial line.

(ii) Depict the equipotential surfaces due to an electric dipole. Delhi 2 017

(v) Define an equipotential surface. Draw equipotential surfaces in case of a single point charge in a constant electric field in

z-direction. Why the equipotential surfaces about a single charge are not equidistant?

Can electric field exist tangential to an equipotential surface? Give reason. All India 2016

Depict the equipotential surfaces for a system of two identical positive point charges placed at a distance d apart.

(vi) Deduce the expression for the potential energy of a system of two point charges q1 and q 2 brought from infinity to the points with positions r1 and r, respectively in presence of external electric field E.

44. Two point charges q and -q are located at points (0,0,-a) and (0,0,a) respectively.

(i) Find the electrostatic potential at (0,0, z) and (x, y,0).

(ii) How much work is done in moving a small test charge from the point (5,0,0) to (-7,0,0) along the X-axis?

How would your answer change if the path of the test charge between the same points is not along the X-axis but along any other random path?

(i) (u

(iv) If the above point charges are now placed in the same external electric field E, what would be the potential system in its orientation of unstable equilibrium?

positions in a uniform energy of the charge

Justify your answer in each case.

(iii)

43. (i)

1. Why does current in steady state not flow in a capacitor battery? However, momentary current does flow during charging capacitor. Explain. All India 2017

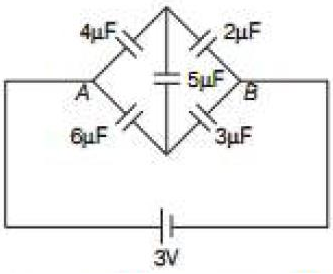
connected across a or discharging of the

The given graph shows the variation of charge q versus potential capacitors C1and C2. Both the capacitors have same plate separation greater than that C1. Which line (A or B) corresponds to C'1 and

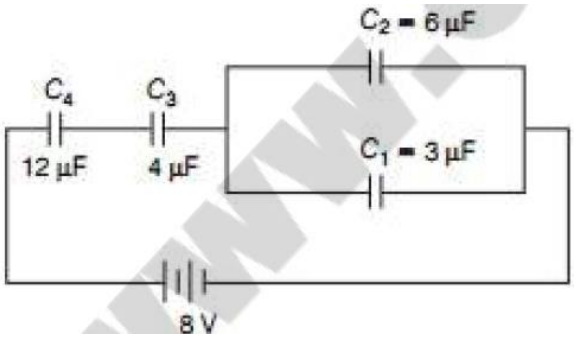
(ii)

difference V for two but plate area of c2 is why?

1. Define the dielectric constant of a medium. What is its unit?
2. Distinguish between a dielectric and a conductor.
3. Obtain the expression for the energy stored in a capacitor connected across a DC battery. Hence, define energy density of the capacitor.
4. . Find the total charge stored in the network of capacitors connected between A and B as shown in figure below.



5. In a network, four capacitors C1,C,,C3 and C4 are connected as shown in the figure.



   a. Find the net capacitance of the circuit.
   b. If the charge on the capacitor C1 is 6 gC, then (a) calculate the charge on the capacitors C3 and C4 (b) net energy stored in the capacitors C3 and C4 connected in series.

6. 10. A parallel plate capacitor of capacitance C is charged to a potential V It is then connected to another uncharged capacitor having the same capacitance. Find out the ratio of the energy stored in the combined system to that stored initially in the single capacitor. All Indio 2014

7. 11. Two parallel plate capacitors of capacitances C1 and C, such that Cl = 2C, are connected across a battery of V volt as shown in the figure. Initially, the key (k) is kept closed to fully charge the capacitors.

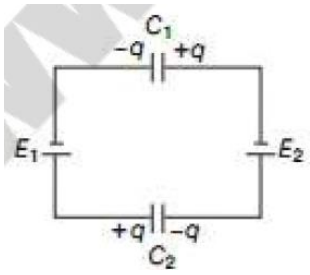
8. Two parallel plate capacitors of capacitances C1and C, such that C1 = C,/ 2 are connected across a battery of V volts as shown in the figure. Initially, the key (k) is kept closed to fully charge the capacitors. The key is now thrown open and a dielectric slab of dielectric constant K is inserted in the two capacitors to completely fill the gap between the plates. Find the ratio of
   (i) the net capacitance and
   (ii) the energies stored in the combination before and after the introduction of the dielectric slab.

9. A slab of material of dielectric constant K has the same area as that of the plates of a parallel plate capacitor, but has the thickness d/2. Where, d is the separation between the plates. Find out the

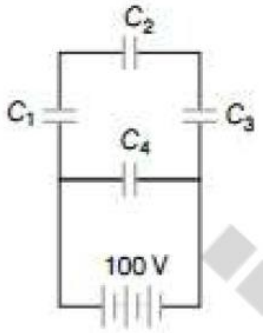
expression for its capacitance when the

slab is inserted between the plates of the capacitor. Delhi 2013

10. Determine the potential difference across the plates of the capacitor C1 of the network shown in the figure below. (assume, E,> E)



11. A network of four capacitors each of capacitance 15μF is connected across a battery of 100 V as shown in the figure. Find the (i) net capacitance and (ii) the charge on the capacitor c4.



Two capacitors of 1 ;IF capacitance are

connected to a battery of 6 V. Initially switch S is closed. After sometime S is left open and dielectric slab of dielectric constant K = 3 are inserted to fill completely the space between the plates of the two capacitors. How will the (i) charge and

12. (ii) potential difference between the plates of the capacitors be affected after the slabs are inserted?

13. Net capacitance of three identical capacitors in series is 1 What will be their net capacitance if connected in parallel?

Find the ratio of energy stored in these two configurations if both are connected to the same source. All Indio 2011

14. Figure shows two identical capacitors C,
15. and C, each of 2RF capacitance connected to a battery of 5 V. Initially, switch S is closed. After sometime, S is left open and dielectric slabs of dielectric constant K = 5 are inserted to fill completely the space between the plates of the two capacitors. How will the (i) charge and (ii) potential difference between the plates of the capacitors be affected after the slabs are inserted?

16. What is the area of the plates of 2F parallel plate capacitor having separation between the plates is 0.5 cm?

17. A 2004F parallel plate capacitor

having plate separation of 5 mm is charged by a 100 V DC source. It remains connected to the source. Using an insulated handle, the distance between the plates is doubled and a dielectric slab of thickness 5 mm and dielectric constant 10 is introduced between the plates. Explain with reason, how the

(i) capacitance (ii) electric field between the plates (iii) energy density of the capacitor will change?

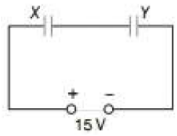
18. A 12 pF capacitor is connected to a 50 V battery. How much electrostatic energy is stored in the capacitor? If another capacitor of 6 pF is connected in series with it with the same battery connected across the combination, find the charge stored and potential difference across each capacitor.

19. Two parallel plate capacitors X and Y have the same area of plates and same separation between them, X has air between the plates while Y contains a dielectric medium of Er = 4_

(i) Calculate the capacitance of each capacitor if equivalent capacitance of the combination is 411F.

(ii) Calculate the potential difference between the plates of X and Y.

(iii) Estimate the ratio of electrostatic energy stored in X and Y.



20. Find the ratio of the potential differences that must be applied across the parallel and series combination of two capacitors Cl and C2 with their capacitances in the ratio 1 : 2 so that the energy stored in these two cases becomes the same.

0

15V

21. Two capacitors of unknown capacitances C1 and C2 are connected first in series and then in parallel across a battery of 100 V. If the energy stored in the two combinations is 0.045J and 0.25 J respectively, then determine the value of Cl and C,. Also, calculate the charge on each capacitor in parallel combination.

22. (i) Obtain the expression for the energy stored per unit volume in a charged parallel plate capacitor.

)ii)The electric field inside a parallel plate capacitor is E. Find the amount of work done in moving a charge q over a closed rectangular loop.

23. (i) Derive the expression for the capacitance of a parallel plate capacitor having plate area A and plate separation d.

(ii) Two charged spherical conductors of radii R1 and R., when connected by a conducting plate respectively. Find the ratio of their surface charge densities in terms of their radii.

24. In a parallel plate capacitor with air between the plates each plate has an area of 6 x 10-3m- and the separation between the plate is 3 mm.

(i) Calculate the capacitance of the capacitor.

(ii) If this capacitor is connected to 100 V supply, what would be the charge on each plate?

(iii) How would charge on the plates be affected if a 3 mm thick mica sheet of = 6 is inserted between the plates while the same voltage supply remains connected?

25. A capacitor of unknown capacitance is connected across a battery of V volt. The charge stored in it is 360gC . When potential across the capacitor is reduced by 120 V, the charge stored in it becomes 120 gC.

Calculate

(i) the potential V and the unknown capacitance C.

(ii) the charge stored in the capacitor if the voltage applied had increased by 120 V.

26. A capacitor of 200 pF is charged by a 300 V battery. The battery is then disconnected and the charged capacitor is connected to another uncharged capacitor of 100 pF. Calculate the difference between the final energy stored in the combined system and the initial energy stored in the single capacitor.

27. A parallel plate capacitor is charged by a battery. After sometime, the battery is disconnected and a dielectric slab with its thickness equal to the plate separation is inserted between the plates. How will

    a. the capacitances of the capacitor
    b. potential difference between the plates
    c. the energy stored in the capacitors be affected? Justify your answer in each case.

28. A parallel plate capacitor each with plate area A and separation d is charged to a potential difference V. The battery used to charge it remains connected. A dielectric slab of thickness d and dielectric constant K is now placed between the plates. What change if any will take place in

    a. charge on plates?
    b. electric field intensity between the plates?
    c. capacitance of the capacitor? Justify your answer in each case

29. A parallel plate capacitor is charged to a potential difference V by a DC source. The capacitor is then disconnected from the source. If the distance between the plates is doubled. State with reason, how the following will change? Delhi 2010

(i) Electric field between the plates

(ii) Capacitance

Energy stored in the capacitor.

30. Show that the capacitance of a spherical conductor is 4rrE0 times the radius of the spherical conductor.
31. Find the ratio of the potential differences that must be applied across the parallel and the series combination of two identical capacitors so that the energy stored in the two cases becomes the same.
32. (i) How is the electric field due to a charged parallel plate capacitor affected when a dielectric slab is inserted between the plates fully occupying the intervening region?

    (ii) A slab of material of dielectric constant K has the same area as the plates of a parallel plate capacitor but has thickness d, where d is the separation between the plates. Find the expression for the capacitance when the slab is inserted between the plates.

33. (i) Plot a graph comparing the variation of potential V and electric field E due to a point charge Q as a function of distance R from the point charge.
    (ii) Find the ratio of the potential differences that must be applied across the parallel and the series combination of two capacitors CI and C2 with their capacitances in the ratio 1 : 2 so that the energy stored in the two cases becomes the same.
34. (i) Describe briefly the process of transferring the charge between the two plates of a parallel plate capacitor when connected to a battery. Derive an expression for the energy stored in a capacitor.

    (iii) A parallel plate capacitor is charged by a battery to a potential difference V. It is disconnected from battery and then connected to another uncharged capacitor of the same capacitance. Calculate the ratio of the energy stored in the combination to the initial energy on the single capacitor

35. A capacitor of capacitance C1 is charged to a potential V1 while another capacitor of capacitance C2 is charged to a potential

difference 172. The capacitors are now disconnected from their respective charging batteries and connected in parallel to each other.

Find the total energy stored in the two capacitors before they are connected.

Find the total energy stored in the parallel combination of the two capacitors.
Explain the reason for the difference of energy in parallel combination in comparison to the total energy before they are connected

36. (i) If two similar large plates each of area A having surface charge densities +a and —a are separated by a distance d in

air, then find the expression for

(a) field at points between the two plates and on outer side of the plates. Specify the direction of the field in each case.

(b) the potential difference between the plates.

(c) the capacitance of the capacitor so formed.

(ii) Two metallic spheres of radii R and 2R are charged so that both of these have same surface charge density a. If they are connected to each other with a conducting wire. In which direction will the charge flow and why?

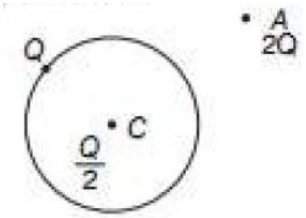
37. (i) Explain using suitable diagrams, the difference in the behaviour of a

(a) conductor and

(b) dielectric in the presence of external electric field_ Define the terms polarisation of a dielectric and write its relation with susceptibility.

(ii) A thin metallic spherical shell of radius R carries a charge Q on its surface. A point charge Q12 is placed at its centre C and an other charge

+ 2Q is placed outside the shell at a distance x from the centre as shown in the figure.



Find

(i) the force on the charge at the centre of shell and at the point A.

(ii) the electric flux through the shell.

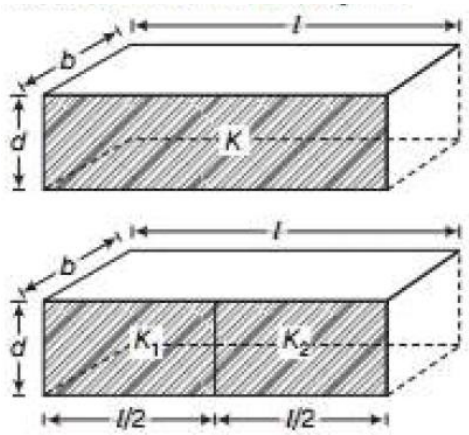
38.

a. Derive the expression for the energy density of the electric field in a parallel plate capacitor.

b. A fully charged parallel plate capacitor is connected across an uncharged identical capacitor. Show that the energy stored in the combination is less than the energy stored initially in the single capacitor.

39. . (i) Obtain the expression for the potential due to an electric dipole of dipole moment p at a point r on the axial line.

Two identical capacitors of plate dimensions 1 x b and plate separation d have dielectric slabs filled in between the space of the plates as shown in the figure.



40. (i) A parallel plate capacitor is charged by a battery to a potential difference V.

The battery is disconnected and a dielectric slab is inserted to completely fill the space between the plates.

How will

a. its capacitance
b. electric field between the plates and
c. energy stored in the capacitor be affected? Justify your answer giving necessary mathematical expressions for each case.

(ii) (a) Draw the electric field lines due to a conducting sphere.

(b) Draw the electric field lines due to a dipole.

41. (x, y, z) is given by V = 3x2, where x is in The electric potential V at any point

metres and V in volts_ The electric field at

the point (1, 0, 2) is

(a) 6 Vim along -X-axis
(b) 6 Vim along .-X-axis
(c) 1.5 V/m along —X-axis
(d) 1.5 Vim along + X-axis

42. A + 3.0 nC charge Q is initially at a distance of ri = 10 cm from a + 5.0 nC charge q fixed at the origin. The charge Q is moved away from q to a new position at r2 = 15 cm. In this process the work done by the field is VISE 2021 (Term-0

(a) 129 x 10-5 J (b) 3,6 x 10U J
(c) —45 x 10-7J (d) 4.5 x 10-7J

43. Two charges 14 gC and - 4µC are placed at (- 12 cm, 0, 0) and (12 cm, 0, 0) in an external electric field E = (-;-,), where

r`

B = 1.2 x 106 N/cm2 and r is in metres.

The electrostatic potential energy of the configuration is CBSE 2021 (Term-II

(a) 97.9 J (h) 102.1 J

(c) 2.1 J (d) - 97.9 J

44. Equipotentials at a large distance from a collection of charges whose total sum is not zero are CBSE 2021 (Term-11

a. spheres
b. planes
c. ellipsoids
d. paraboloids

45. A hollow metal sphere of radius 10 cm is charged such that the potential on its surface becomes 80 V. The potential at the centre of the sphere is

(a) 80 V (b) 800 V (c) 8 V (d) zero

46. Which of the following is not true?

a. For a point charge the electrostatic potential varies as 1/r
b. For a dipole the potential depends on the position vector and dipole moment vector
c. The electric dipole potential varies as lir at large distance
d. For a point charge the electrostatic field varies as lir

47. Define the term drift velocity of charge carriers in a conductor and write its relationship with the current flowing through it. Delhi 2014

48. Define the term electrical conductivity of a metallic wire. Write its SI unit. Delhi 2014

49. Show variation of resistivity of Si with temperature in graph. Delhi 2014,12

50. Define the term mobility of charge carriers in a conductor. Write its SI unit. Delhi 2014

51. How does one explain increase in resistivity of a metal with increase of temperature ? An India 2014C

52. Write a relation between current and drift velocity of electrons in a conductor. Use this relation to explain how the resistance of a conductor changes with the rise in temperature? All Indio 2013

53. Two materials Si and Cu are cooled from 300 K to 60 K. What will be the effect on their resistivity? Foreign 2013

54. A conductor of length / is connected to a DC source of potential difference V. If the length of the conductor is tripled by gradually stretching it keeping V constant, how will drift speed of electrons be affected ? Foreign 2012

55. When electrons drift in a metal from lower to higher potential, does it mean that all the free electrons of the metal are moving in the same direction? Delhi 2012

56. Show on a graph the variation of resistivity with temperature for a typical semiconductor. Delhi 2012

57. Define resistivity of a conductor. Write its SI unit.

58. Using the concept of drift velocity of charge carriers in a conductor deduce the relationship between current density and resistivity of the conductor. Delhi 2015C

59. Estimate the average drift speed of conduction electrons in a copper wire of cross-sectional area LO x 10 m2 earning a current of 1.5 A. Assume that the density of conduction electrons to be

60. 9 x 1026m-3

61. Draw a plot showing the variation of resistivity of a (i) conductor and (ii) semiconductor with the increase in temperature. How does one explain this behaviour in terms of number density of charge carriers and the relaxation time?

62. Derive an expression for the current density of a conductor in terms of the drift speed of electrons. Foreign 2014

63. Define mobility of a charge carrier. Write the relation expressing mobility in terms of relaxation time. Give its SI unit.

All India 2013C

64. Plot a graph showing temperature dependence of resistivity for a typical semiconductor. How is this behaviour explained? Delhi 2011

65. Show on a plot the variation of resistivity of (i) a conductor and (ii) a typical semiconductor as a function of temperature.

Using the expression for the resistivity in terms of the number density and relaxation time between the collisions explain how resistivity in the case of a conductor increases while it decreases in a semiconductor with the rise of temperature.

66. (i) Define the term conductivity of a metallic wire. Write its SI unit.

(ii) Using the concept of free electrons in a conductor derive the expression for the conductivity of a wire in terms of number density and relaxation time. Hence, obtain the relation between current density and the applied electric field E.

67. Define the term of drift velocity.

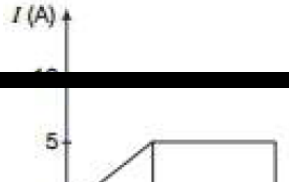
(i) On the basis of electron drift derive an expression for resistivity of a conductor in terms of number density of free electrons and relaxation time. On what factors does resistivity of a conductor depend?

(ii) Why alloys like Constantan and Manganin are used for making standard resistors?

68. Find the relation between drift velocity and relaxation time of charge carriers in a conductor. A conductor of length L is connected to a DC source of emf E. If the length of the conductor is tripled by stretching it keeping E constant then, explain how its drift velocity would be affected. Delhi 2015

69. (i) Deduce the relation between current I flowing through a conductor and drift velocity vg, of the electrons.

(ii) Figure shows a plot of current I flowing through the cross-section of a wire versus the time t. Use the plot to find the charge flowing in 10s through the wire.



70. Define relaxation time of the free electrons drifting in a conductor. How it is related to the drift velocity of free electrons? Use this relation to deduce the expression for the electrical resistivity of the material.

71. (i) Derive the relation between current density J and potential difference V across a current carrying conductor of length 1, area of cross-section A and the number density n of free electrons.

(ii) Estimate the average drift speed of conduction electrons in a copper wire of cross-sectional area 1.0 x 10-7 m2 carrying a current of 1.5 A. [Assume that the number density of conduction electrons is 9 x 1028 m-3 J

72. (i) Derive an expression for drift velocity of electrons in a conductor. Hence, deduce Ohm's law.

(ii) A wire whose cross-sectional area is increasing linearly from its one end to the other is connected across a battery of potential difference V volt. Which of

the following quantities remain constant in the wire?

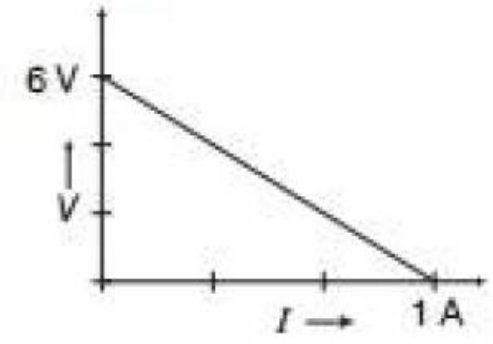
(a) Drift speed

(b) Current density

(c) Electric current

Electric field Justify your answer

73. . The plot of the variation of potential difference across a combination of three identical cells in series versus current is shown below. What is the emf and internal resistance of each



cell?

74. The emf of a cell is always greater than its terminal voltage. Why? Give reason.

Delhi 2013

75. A cell of emf E and internal resistance r draws a current I. Write the relation between terminal voltage V in terms of E,

I and r.

76. Two cells of emfs 1.5 V and 2.0 V having internal resistances 0.2 LI and 0.3 respectively are connected in parallel. Calculate the emf and internal resistance of the equivalent cell.

77. A cell of emf E and internal resistance r is connected across a variable resistor R. Plot a graph showing the variation of

14. A battery of emf E and internal resistance r when connected across an external resistance of 12 LI produces a current of 0.5 A. When connected across a resistance of 25 f2 it produces a current of 0.25 A. Determine (i) the emf and (ii) the internal resistance of the cell_ All India 2013C

15. A cell of emf E and internal resistance r is connected to two external resistances R1 and R, and a perfect ammeter_ The current in the circuit is measured in four different situations

(i) Without any external resistance in the circuit

(ii) With resistance Rionly

(iii) With R1 and R2 in series combination

(iv) With R1 and R2 in parallel combination

The currents measured in the four cases are 0.42 A, 1.05 A, 1.4 A and 4.2 A, but not necessarily in that order. Identify the currents corresponding to the four cases mentioned above. Delhi 2012

. A battery of emf 10 V and internal resistance 3 LI is connected to a resistor. If the current in the circuit is 0.5 A ,then find

(i) the resistance of the resistor.
(ii) the terminal voltage of the battery.

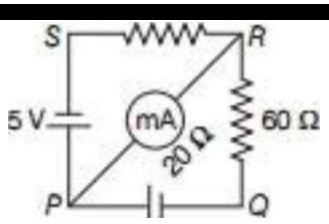
Delhi 2012C

17. The network PQRS as shown in the circuit diagram has the batteries of 4 V and

5 V and negligible internal resistance. A milliammeter of 20 S2 resistance is

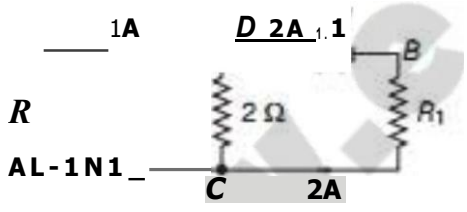
connected between P and R. Calculate the reading in the milliammeter. All India 2012C

200 11



4V

18. In the given circuit assuming point A to be at zero potential use Kirchhoff s rules to determine the potential at point B.



All Indio 2011

19. Using Kirchhoff's rules in the given circuit, determine All India 2011

0.5 A 3 V 2 S2

A ----IF-0.AM- g

1. V 2 i2 F

vvvvv.

(i) the current I, in the arm EF and
(ii) the voltage drop across the unknown resistor R.

20. A straight line plot showing the terminal potential difference (E) of a cell as a function of current (1) drawn from it is shown

in the figure_ 1. 0.28 A

Using this plot, determine

ow&--

E

(i) the emf and
(ii) internal resistance of the cell.

***E* .1 4 V**

Delhi 2011C

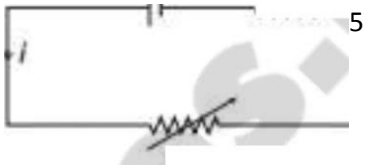
21. Two cells of emf 2E and E and internal resistances 2r and r respectively are connected in parallel. Obtain the expressions for the equivalent emf and the

internal resistance of the combination _

All India 2010C

22. Three cells of emf ——— E,2E and 5E having internal resistances r, `6r and 3r, variable resistance R as shown in the figure. Find the expression for the current. Plot a graph for variation of current with R. All India 2010C

E, *r* 5E, 3r *2E,* 2r



Current in circuit, i — $\frac{}{R+r}$

Two cells of emfs El and E,, and internal resistances r1 and r, respectively are connected in parallel. Obtain expressions for the equivalent

(i) resistance and
(ii) emf of the combination 2018C

25. Using Kirchhoffs rules calculate the potential difference between Band D in the circuit diagram as shown in the figure.

A _____ 2 V (2 8

26. A cell of emf E and internal resistance r is connected across a variable load resistor R. Draw the plots of the terminal voltage V versus (i) resistance R and
(ii) current I.

It is found that when R = 4 i2 the current is 1 A and when R is increased to 9 0 the current reduces to 0.5 A. Find the values of the emf E and internal resistance r_

All India 2015

27. Using Kirchhoffs rules, determine the value of unknown resistance R in the circuit, so that no current flows through 4 it resistance. Also, find the potential difference between points A and D.

Delhi 2012

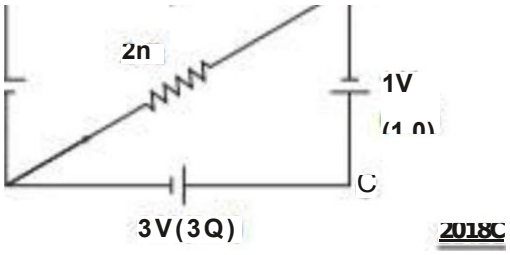
28. Calculate the value of the resistance R in the circuit shown in the figure, so that the current in the circuit is 0.2A. What would be the potential difference between points

A and B? All India 2012

(i) State Kirchhoff s rules.

(ii) A battery of 10 V and negligible internal

resistance is connected across the diagonally opposite corners of a cubical network consisting of 12 resistors each of 1 £1 resistance. Use Kirchhoffs rules to determine. All Indio 2010



2018C

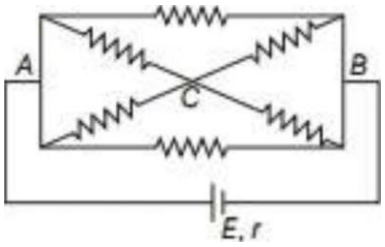
(a) the equivalent resistance of the network and

(b) the total current in the network.

(i) State the two Kirchhoffs laws. Explain briefly, how these rules are justified?

(ii) The current is drawn from a cell of emf E and internal resistance r connected to the network of resistors each of resistance r as shown in the figure. Obtain the expression for (a) the current draws from the cell and

(b) the power consumed in the network. Delhi 2017



they are connected (i) in series and (ii) in parallel across a supply V, find the power dissipated in the two combinations in terms of P1 and P,. Delhi 2019

1. Two electric bulbs P and Q have their resistances in the ratio of 1 : 2. They are connected in series across a battery. Find the ratio of the power dissipation in these bulbs.2018
2. Use Kirchhoff's rules to obtain the balance conditions in a Wheatstone bridge. All India 2015