PHYSICSHOLIDAY HOME WORK

1.Two charges of magnitudes –20 and + O 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 India 2013]

2.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 India 2010; Foreign 2010]

Figure shows three-pointcharges, + 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?   [Delhi 2010]
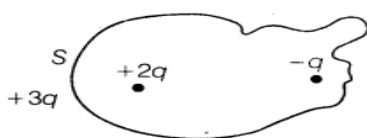

3.If the radius of the Gaussian surface enclosing a charge is halved, how does the electric flux through the Gaussian surface change? [All India 2009,2008]

4.Given a   uniform electric held E =5 x 103 i N/C, find the flux of this held through a square of 10 cm on a side 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?   [Delhi 2014]

5.Given a   uniform   electric   held E =2 x 103 i N/C, find the flux of this held 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?   [Delhi 2014, HOTS]

6.Given a   uniform   electric field E = 4 x 103 i N/C. Find the flux of this field through a square of 5 cm on a side 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?   [Delhi 2014, HOTS]

7.A sphere S1 of radius q enclosed a net charge Q. If there is another concentric sphere S2 of radius r2(r2 > q) enclosing charge 20, and the ratio of the electric flux through S1 and S2. How will the electric flux through sphere S1 change if a medium of dielectric constant K is introduced in the space inside S2 in place of air? [All India 2014]
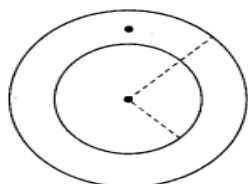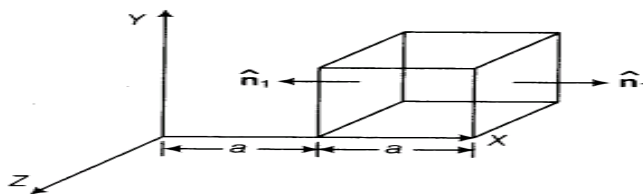

8.A hollow cylindrical box of lenght 1 m and area of cross-section 25 cm2 is placed in a three-dimensional coordinate system as shown in the figure.

The electric field in the region is given by $E = 50\, x\hat{i}$, where E is in NC^{-1} and x is in metre.

Find
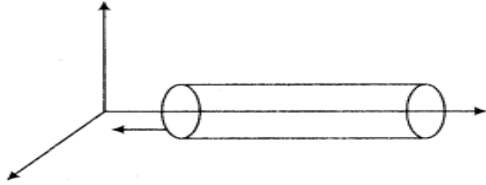
9. Define electric flux. Write its SI unit, (ii) The electric field components due to a charge inside the cube of side 0.1 m are shown below.

$$E_x = \alpha\, x,$$

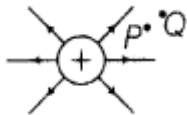where, $\alpha = 500$ N/C-m,

$E_y = 0, E_z = 0$

Calculate

(a) the flux through the cube and

(b) the charge inside the cube.

[All India 2008]

10. The figure shows the field lines of a positive charge. Is the work done by the field is moving a small positive charge from Q to P positive or negative? [Foreign 2014]

11. For any charge configuration, equipotential surface through a point is a normal to the electric field. Justify. [Delhi 2014]

12. A-point charge Q is placed at point O as shown in the figure. Is the potential difference (VA − VB) positive, negative or zero if Q is (i) positive (ii) negative
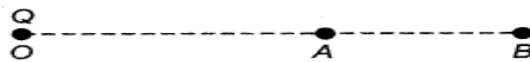
[All India 2011]

13. Two-point charges q1 and q2 are located at q and r2, respectively in an external electric field E. Obtain the expression for the total work done in assembling this configuration. [Delhi 2014 C]

14. Two charges of 5 nC and − 2 nC are placed at points (5 cm, 0, 0) and (23 cm, 0, 0) in the region of space, where there is no other external field. Calculate the electrostatic potential energy of this charge system.[Delhi 2008 C]

15. The following graph shows the variation of charge Q with voltage V for two capacitors K and L In which capacitor is more electrostatic energy stored?
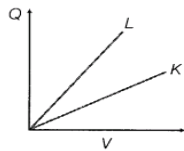
16. Find the charge on the capacitor as Shown in the circuit. [Foreign 2014]
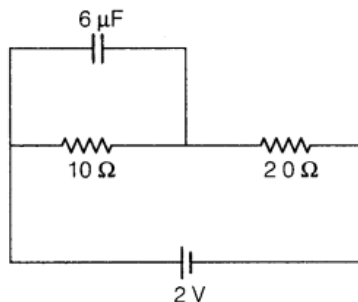
17. Two identical parallel plate (air) capacitors C1 and C2 have capacitance C each. The space between their plates is now filled with dielectrics as shown in the figure. If the two capacitors still have equal capacitance, they obtain the relation between dielectric constants K, K1 andK2.[Foreign 2011]
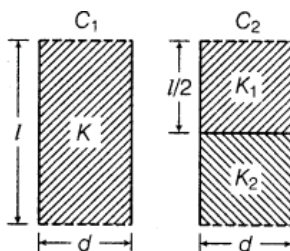
18. A capacitor of 200 pF is charged by a 300 V battery. The battery is then disconnected and the charged capacitor is connected to another uncharged capacitor of 100 pF. Calculate the difference between the final energy stored in the combined system and the initial energy stored in the single capacitor. [Foreign 2012]

19. 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

(i) the capacitances of the capacitor,

(ii) potential difference between the plates and

(iii) the energy stored in the capacitors be affected? Justify your answer in each case. [Delhi 2010]

20. A system of capacitors connected as shown in the figure has a total energy of 160 mJ stored in it. Obtain the value of the equivalent capacitance of this system and the value of Z. [All India 2009 c]
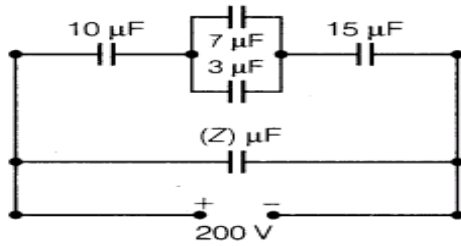
21. The two plates of a parallel plate capacitor are 4 mm apart. A slab of dielectric constant 3 and thickness 3 mm is introduced between the plates with its faces parallel to them. The distance between the plates is so adjusted that the capacitance of the capacitor becomes (2/3) rd. of its original value. What is the new distance between the plates? [All India 2008 C]

22. Two identical slabs, of a given metal, are joined together, in two different ways, as shown in figures

(a) and (b). What is the ratio of the resistances of these two combinations? [Delhi 2010 c]


(a)   (b)
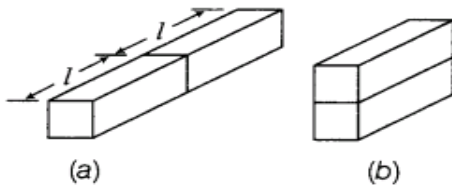
23. Two conducting wires X and Y of same diameter but different materials are joined in series across a battery. If the number density of electrons in X is twice than that in Y, then find the ratio of drift velocity of electrons in the two wires. [All India 2010]

24. Write an expression for the resistivity of a metallic conductor showing its variation over a limited range of temperatures. [Delhi 2008 C]

25. In a meter bridge, two unknown resistances R and S when connected in the two gaps, give a null point at 40 cm from one end. What is the ratio of R and S? [Delhi 2010]

26. Use Kirchhoff's rules to determine the value of the current flowing in the circuit shown in the figure.
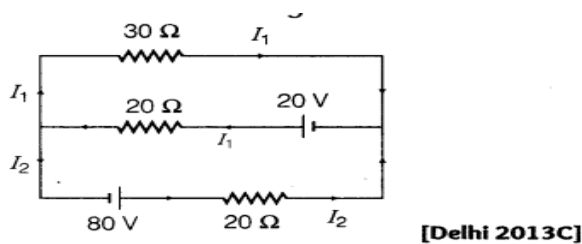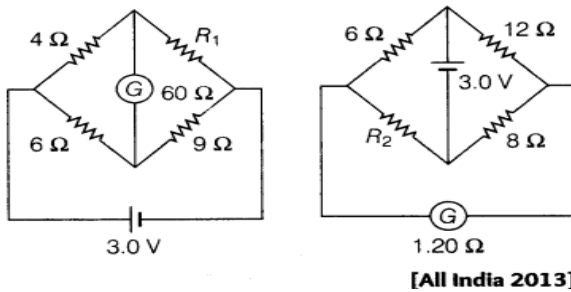

[Delhi 2013C]

27. Calculate the current drawn from the battery in the given network

$R_5 = 2\ \Omega$

$R_1 = 1\ \Omega$ $R_2 = 5\ \Omega$ $R_3 = 4\ \Omega$

$R_4 = 2\ \Omega$

$+\ 4\ V\ -$

[All India 2009]
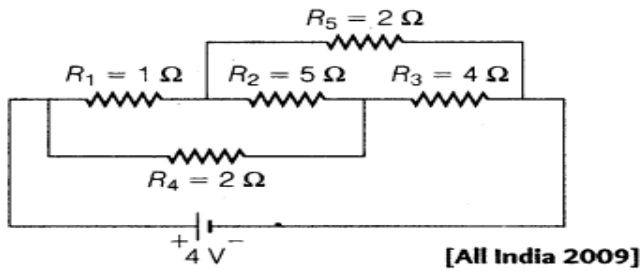
28. Define the current sensitivity of a galvanometer. Write its SI unit. Figure shows two circuits each having a galvanometer and a battery of 3 When the galvanometer in each arrangement do not show any deflection, obtain the ratio R1 /R2.

$4\ \Omega$ R_1

G $60\ \Omega$

$6\ \Omega$ $9\ \Omega$

$3.0\ V$

$6\ \Omega$ $12\ \Omega$

$3.0\ V$

R_2 $8\ \Omega$

G

$1.20\ \Omega$

[All India 2013]

29. 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?

$6\ V$ $0.2\ A$ B $5\ \Omega$ C

$10\ \Omega$

$15\ \Omega$ $30\ \Omega$ $5\ \Omega$

$2\ V$

$0.2\ A$ R A D

[All India 2012]
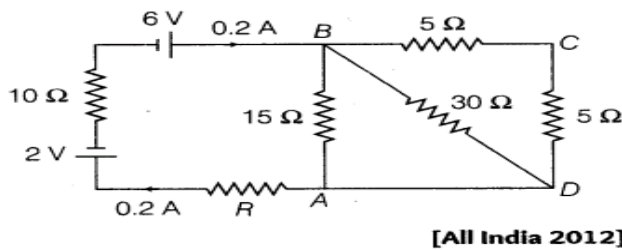
30. State Kirchhoff's rules. Use these rules to write the expressions for the currents I1 I2 and I3 in the circuit diagram shown in figure below.

I_1 $E_1 = 2\ V$ $r_1 = 4\ \Omega$

I_2 $E_2 = 1\ V$ $r_2 = 3\ \Omega$

I_3 $E_3 = 4\ V$ $r_3 = 2\ \Omega$

[All India 2010]