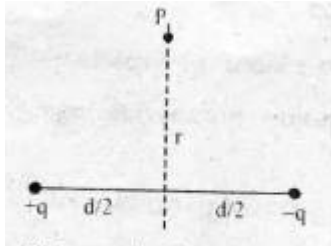1. Two equal and opposite charges placed in air is as shown in figure:
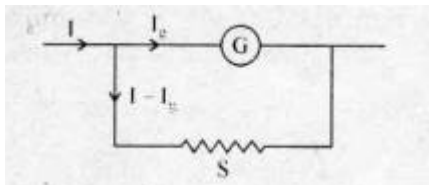

a. Redraw the figure and show the direction of the dipole moment (P), direction of the resultant electric field (E) at P.

b. Write an equation to find out the electric field at P.

2. What do you mean by drift velocity? Write a relation between drift velocity and electric current.

3. A galvanometer is connected as shown in the picture below:

a. This combination can be used as _____(voltmeter/ rheostat/ ammeter)

b. Derive an expression to find the value of resistance S.

4. The block diagram below shows the general form of a Communicative system
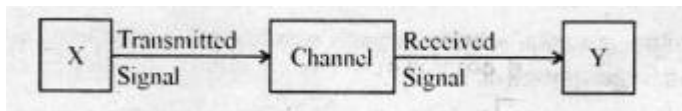
a. Identify the blocks X and Y

b. What is the difference between attenuation and amplification?

5. 5.a Name the part of the electromagnetic spectrum:

a. used in radar systems

b. Produced by bombarding a metal target by a high speed electron

5.b Electromagnetic waves are produced by_____
(charges at rest/ charges in uniform motion/ charges in accelerated motion)

5.c. Why only microwaves are used in microwave ovens?

6. Two thin convex lenses of focal length f_1 and f_2 are placed in contact:

a.   If the object is at principal axis, draw Ray diagram of the image formation by this combination of lenses

b.   Obtain a general expression for effective focal length of the combination in terms of f_1 and f_2
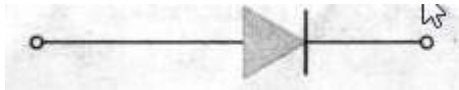
7. (a) Derive an expression for self-inductance of a solenoid

   (b) What do you mean by eddy current? Write any two applications of it.

8. (a) Name the different series of line observed in a hydrogen spectrum
   (b) Draw energy level diagram of hydrogen atom

9. Symbol of a diode is given below:

a.   The diode is a _____ (rectifier diode/ photo diode/ zener diode)

   b. Draw the VI characteristics of the above diode

   c. A zener diode with V_Z= 6.0V is used for voltage regulation. The current through the load is to be 4.0mA and that through the zener diode is 20mA. If the unregulated output is 10.0V, what is the value of the series resistor R.

   d. What is the fundamental frequency of the ripple in a full wave rectifier circuit operating from 50Hz mains?

10. Two spheres enclose charges as shown in the diagram below:
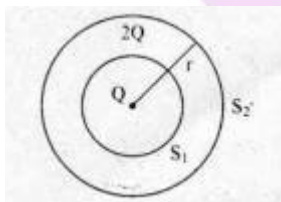
a.   Derive an expression of electric field intensity at any point on the surface S_2
b.   What is the ratio of the electric flux through S_1 and S_2.

11. (a) Choose the wrong option:

 (i) Volt= Weber/ second   (ii) Weber = Henry X Ampere

(iii) Joule= Henry X Ampere²   (iv) Volt=Weber x Second

(b) The current in a coil of self- inductance 0.1 H varies from 2A to 5A in a time of 1ms. Find the induced emf across the coil.

12. (a) Sound waves do not exhibit_____

 (i) Interference   (ii) diffraction   (iii) Polarisation   (iv) reflection

(b)Describe Young's double slit experiment to determine the bandwidth of the interference   pattern

<div align="center">Or</div>

a.   The intensity of scattered light in Rayleigh scattering is proportional to
_____

    b. Explain the diffraction pattern obtained due to a single slit and represent graphically the variation of intensity with angle of diffraction

    13. Choose the appropriate values for x-rays from the below table:

Wavelength	Frequency
1mm	3×10^{17} Hz
1m	3×10^{8} Hz
1 nm	3×10^{21} Hz

    14. (a) Define half-life period of a radioactive nucleus. Write down the relation connecting half-life period and mean life.

        (b) Define 1 amu. Calculate its energy equivalent to MeV.

    15. Write down the truth table of a NOR gate.

16. (a) The work function of a metal is 6 eV. If two photons each have energy 4 eV strike with the metal surface.

 (i) will the emission be possible?   (ii) why?

    (b) The waves associated with the matter is called matter waves. Let e and pbe the de-Broglie wavelengths associated with electron and proton respectively. If they are accelerated by the same potential, then

(i) $\lambda e > \lambda p$ (ii) $\lambda p > \lambda e$ (iii) $\lambda p = \lambda e$ (iv) $^{-}\lambda e = \dfrac{1}{\lambda p}$

17. (a) The core of the transformer has the following properties:

 (i) Core is laminated   (ii) hysteresis loop is narrow

 Explain the significance of each property

    (b) What is the significance of each property?

18. (a) List out any two limitations of Bohr atom model.

        (b) According to de-Broglie's explanation of Bohr's second postulate of quantization, the standing particle wave on a circular orbit for n=4 is given by:

(i) $2\pi r_n = 4/\lambda$

(ii) $\dfrac{2\pi}{\lambda} = 4r_n$

(iii) $2\pi r_n = 4\lambda$

(iv) $\dfrac{\lambda}{2\pi} = 4r_n$

19. (a) What do you mean by Q value of a nuclear reaction?
    (b) Write down the expressions for Q value in the case of -decay
    (c) Two nuclei have mass numbers in the ratio 1:64. What is the ratio of their nuclear radii?

20. (a) State Gauss Law for Magnetism
    (b) How this differs from Gauss law for electrostatics?
    (c)Why is the difference in the two cases?