Sample paper

Time allowed: 3 hours | Max. Marks: 70

General Instructions:

1. All questions are compulsory. There are 37 questions in all.
2. This question paper has four sections: Section A, Section B, Section C and Section D.
3. Section A contains twenty questions of one mark each, Section B contains seven questions of two marks each, Section C contains seven questions of three marks each, and Section D contains three questions of five marks each.
4. There is no overall choice. However, internal choices have been provided in two questions of one mark each, two questions of two marks, one question of three marks and three questions of five marks weightage. You have to attempt only one of the choices in such questions.
5. You may use the following values of physical constants where ever necessary.

$c = 3 \times 10^{8}$ m/s

$h = 6.63 \times 10^{-34}$ Js

$e = 1.6 \times 10^{-19}$ C

$\mu_0 = 4\pi \times 10^{-7}$ T m A^{-1}

$\varepsilon_0 = 8.854 \times 10^{-12}$ $C^2 N^{-1} m^{-2}$

$\frac{1}{4\pi\varepsilon_0} = 9 \times 10^{9}$ N $m^2 C^{-2}$

$m_e = 9.1 \times 10^{-31}$ kg

mass of neutron = 1.675×10^{-27} kg

mass of proton = 1.673×10^{-27} kg

Avogadro's number = 6.023×10^{23} per gram mole

Boltzmann constant = 1.38×10^{-23} JK^{-1}

Sec-A 1 marks

1. Two charges $3x10^{-5}$ and $5x10^{4}$C are placed at a distance 10cm from each other. Find the value of electrostatic force acting between them.
   a) $13.5x10^{11}$N
   b) $40x10^{11}$N
   c) $180x10^{9}$N
   d) $13.5x10^{10}$N
2. When charge is supplied to a conductor, its potential depends upon
   a) The amount of charge
   b) Geometry and size of conductor
   c) Both (a) & (b)
   d) Only on (a)
3. Kirchhoff's II law for the electric network is based on:
   a) Law of conversation of charge
   b) Low of conversation of energy
   c) Low of conversation of angular momentum
   d) Low of conversation of mass

4. In a whetstone's bridge, all the four arms have equal resistance R. if resistance of the galvanometer arm is also R, then equivalent resistance of combination is
   a) R
   b) 2R
   c) R/2
   d) R/4
5. In a certain region of space, electric filled E vector and magnetic filled B vector are perpendicular to each other. An electron enters perpendicularly to both the fields and move undeflected. The velocity of electron is
   a) E/B
   b) B/E
   c) E vector x B vector
   d) E vector. B vector
6. How does the focal length of a convex lens changes if mono chromatic red light is used instead of violet light?
   a) Focal length is increased when red light is used
   b) Focal length is decreases when red light is used
   c) Focal length is remain same when red light is used

d) Not depends on colour of light.

7. the phenomenon of polarization is exhibited by
   a) longitudinal wave
   b) matter wave
   c) transverse wave
   d) mechanical wave

8. which of the following is correct for" Malus Law"
   a) $I=I^2_v \cos^2 \theta$
   b) $I=I_v \cos^2 \theta$
   c) $I=I^2_v \sin^2 \theta$
   d) $I=I_v \tan^{-1} \theta$

9. the theory on the basis of photoelectric effect can be explained:
   a) Corpuscular theory
   b) Wave theory
   c) Electromagnetic theory
   d) Quantum theory

10. When alpha particle sent through a thin gold foil, most of the beam go straight through the foil because
    a) Alpha particles are positively charged
    b) Alpha particles are is more than mass of electron
    c) Most of the part of an atom is empty space
    d) Alpha particles moves with high velocity

11. You can determine the sense of magnetic field lines surrounding a straight current carrying conductor by applying …….rule .

12. S.I. unit of mutual inductance is_____

13. Shorter wave length of an electromagnetic waves……. Energy it carries

14. The minimum energy required by a free electron to just escape from the metal surface is called as----------.

15. The expression _____gives the intensity I of scattered light varying with the Wavelength λ of the incident ray of light.

16. Write the relationship between the size of a nucleus and its mass number (A).

17. How does the energy gap in a semiconductor changes ,when doped with a pentavalent impurity?

18. Name the electromagnetic waves, which(i) maintain the earth's warmth and (ii) are used in aircraft navigation.

19. Two metal A and B have work function 4eV and 10eV respectively. which metal has a higher threshold wavelength?

20. (i) What is the energy of order gap in a semiconductor?

Or

(i)how does the energy gap in semiconductor vary, when doped with a trivalent impurity?

Sec-B 2 marks

21. Using the concept of drift velocity of charge carriers in a conductor, deduce the relationship between current density and resistivity of the conductor.

22. A parallel plate capacitor of capacitance C is charge 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.

23. A proton and a deuteron are accelerated through the same accelerating potential. Which of the two has

(i) Greater value of de-Broglie wavelength associated with it and

(ii) Less momentum?

Give reasons to justify your answer.

24. (i) Write the condition under which light sources can be said to be coherent.

(ii) Why it is necessary to have coherent source in order to produce an interference pattern?

25. (i) Why photoelectric effect cannot be explained on the basis of wave nature of light? give reasons.

(ii)Write the basis features of photon picture of electromagnetic radiation on which Einstein's photoelectric equation is based.

26. Show that the radius of the orbit in hydrogen atom varies as n^2, where n is the principle quantum number of the atom.

27. Distinguish between a metal and an insulator on the basis of energy band diagram.

Sec-c 3marks

28. Answer the following:

(i) Why are the connection between the resistor in a meter bridge made of thick copper strips?

(ii) Why is the generally preferred to obtain the balance point in the middle of the meter bridge wire?

(iii) Which material is used for the meter bridge wire and why?

29. Draw a schematic sketch of the cyclotron. States its working principle. Show that the cyclotron frequency is independent of the velocity of the charge particle.

30. Consider the motion of charged particle of mass m and charge q moving with velocity v in a magnetic field B.

(i) If v is perpendicular to B, then show that it describes a circular path having angular frequency $\omega=qB/m$.

(ii) If the velocity v has a component parallel to the magnetic field B, then trace the path described by the particle. Justify your answer.

31. (i) A plane convex mirrors are known to produce virtual images of the objects. Draw a ray diagram to show, in the case of convex mirrors, virtual object can produce real images.

(ii)Why are convex mirror used as side view mirrors in vehicles?

32.Monochromatic light of wavelength 289 nm is incident from air on a water surface. If μ for water is 1.33, find the wavelength frequency and speed of the reflected light.

(i) A double convex lens is made of a glass of refractive index 1.55 with both faces of the same radius of curvature. Find the radius of curvature required, if the focal length is 20cm.

Or

(i)What is the relation between critical angle and refractive index of a material? (ii) Does critical angle depend on the colour of light? Explain.

33. Write three characteristic properties of nuclear force.

Also draw a plot of potential energy of a pair of a nucleons as function of their separation. Write two conclusion that can be drawn from the graph.

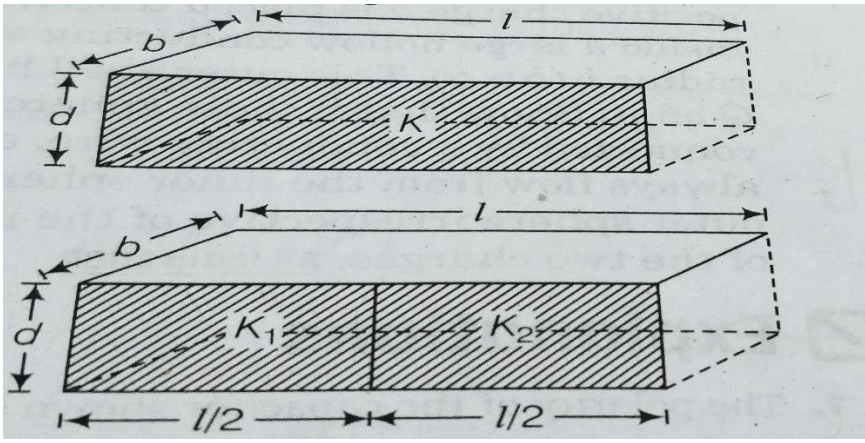
34.(I) Describe the working of light emitting diodes (LEDs).

(II)Which semiconductors are preferred to make LEDs and why?

(III)Give two advantages of using LEDs over conventional incandescent low power lamps.

Sec-D 5marks

35.(i)Obtain the expression for the potential due to an electric dipole of dipole moment P at point x on the axial line.(ii)Two identical capacitors of plate dimensions l x b and plate separation d have dielectric slabs filled in between the space of the plates as shown in figure . Then find the relation between k, k_1 and k_2



Or

(i)If two similar large plates, each of area A having surface charge densities +σ and -σ are separated by a distance d in air, find the expression for ,Fields at points between the two plates and on outer side of the plates. Specify the direction of the field in each case.

(ii)The potential difference between the plates and he capacitance of the capacitor formed.

36.A 2μF capacitor, 100Ω resister and 8H inductor are connected in series with an AC source.

(i)What should be the frequency of the source such that current draw in the circuit is maximum? What is the frequency called?

(ii)If the peak value of emf of the source is 200V, find the maximum current.

(iii)Draw a graph showing variation of amplitude of circuit current with changing frequency of applied voltage in a series L-C-R circuit for two different values of resistance R_1 and R_2 ($R_1 > R_2$).

(Iv)Define the term 'sharpness of Resonance'. Under what condition, does a circuit become more selective?

Or

(i) Explain the meaning of the term mutual inductance. Consider two concentric circular coils, one of the radius r_1 and the other of radius r_2 ($r_1 > r_2$) placed coaxially with centre coinciding with each other. Obtain the expression for the mutual inductance of the arrangements.

(ii) A rectangular coil of area A, having number of turns N is rotated at f revolutions per second in a uniform magnetic field B, the field being perpendicular to the coil.
Prove that the maximum emf induced in the coil is $2\pi fNBA$.

37.Draw a ray diagram to show a working of a compound microscope. Deduce an expression for the total magnification when the final image is formed at the near point .In a compound microscope, an object is placed at a distance of 1.5cm from the objective of focal length 1.25cm. if the eyepiece has a focal length of 5cm and the final Image is formed at the near point. estimate the magnifying power of the microscope.

Or

Using Youngs double slit experiment obtain the conditions for gating bright and dark fringes also derive the expression for the fringe width. Also write the effect on fringe width when(I)Distance between slits increases/decreases(II) Distance between slits and the screen increases/decreases(III) Monochromatic light replaced by white light,(IV) One of slit is closed and (V) entire experimental apparatus is immersed in a liquid