Class: XII Session: 2020-2021

Subject: Physics

Sample Question Paper (Theory)

Maximum Marks: 70 Marks | Time Allowed: 3 hours

General Instructions:

(1) All questions are compulsory. There are 33 questions in all.

(2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E.

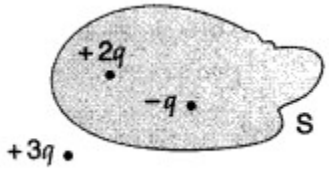
(3) Section A contains ten very short answer questions and four assertion reasoning MCQs of 1 mark each, Section B has two case based questions of 4 marks each, Section C contains nine short answer questions of 2 marks each, Section D contains five short answer questions of 3 marks each and Section E contains three long answer questions of 5 marks each.

(4) There is no overall choice. However internal choice is provided. You have to attempt only one of the choices in such questions.

Section –A

All questions are compulsory. In case of Internal choices attempt any one of them.

1. Figure shows three point charges, +2q, -q and + 3q. What is the electric flux due to this configuration through the surface 'S' ? (1)



2. Name the physical quantity whose S.I. unit is JC^{-1}. Is it a scalar or a vector quantity? (1)

3. Who discovered magnetic effect of current? (1)

4. What is the angle of dip at magnetic equator? (1)

5. Which law of conservation is obeyed by Lenz's law? (1)

6. Which electromagnetic radiation has least wavelength? (1)

7. Which phenomenon is utilised in an optical fibre? (1)

8. When light from a source goes from one medium to another the quality that remains unchanged is frequency or wavelength? (1)

9. The stopping potential in a certain experiment is 1.5 V. What is the maximum kinetic energy of photo electrons emitted? (1)

10. State Bohr's quantization condition for defining stationery orbits. (1)

For question numbers 11, 12, 13 and 14, 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) Both A and R are true and R is the correct explanation of A.

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

c) A is true but R is false.

d) A is false and R is also false.

11. Assertion: Electric charges quantized. (1)

Reason : Charge less than 1nC is not possible in nature

12. Assertion: If a proton and an electron are placed in the same uniform electric field they experience force of equal magnitudes. (1)

Reason: Electric force on a test charge is independent of its mass.

13. Assertion: The Coulomb force is the dominant force in nature. (1)

Reason: The Coulomb force is weaker than the gravitational force.

14. Assertion: The electric field at any point inside a uniformly charged thin spherical shell is zero. (1)

Reason: Entire charge given to the thin spherical shell lies only on its outer surface and there is no charge present inside the shell.

Section B

Questions 15 and 16 are Case Study based questions and are compulsory.

15. An electric dipole is a system consisting of the two equal and opposite point charges separated by a small and finite distance.

If dipole movement of this system is **p** and it is placed in a uniform electric field **E**.

1. Write the expression of torque experienced by a dipole. (1)
2. Identify two pairs of perpendicular vectors in the expression. (1)
3. Show diagrammatically the orientation of the dipole in the field for which the torque is
   a) Maximum
   OR (1)
   Half the maximum value
   b) Zero (1)

16. A compound microscope consists of two convex lenses – One acts as a magnifying lens and is known as an objective and the other lens is called an eye piece. The two lenses worked independently.

Objective lens produces a magnified image of a tiny object O. This image is further magnified by the eye piece and final image is seen at least distance of distinct vision.

1. What type of image is produced by an objective? (1)
2. Where would the first image have to be produced by the objective relative to the eye piece such that the second magnified image is produced on the same side of the eye piece as the first image? (First image distance is ue from the eye piece) (1)
3. If we have two microscopes with a similar set of combination of lenses (i.e for each fo = 1.25 cm ; fe= *6.0 cm*), the magnification produced by first microscope is higher than the second one. What might be the reason? (2)

Section -C

All questions are compulsory. In case of internal choices attempt any one.

17. Three capacitors of capacitances 2pF, 3pF and 4pF are connected in parallel.
(a) What is the total capacitance of the combination? ½
(b) Determine the charge on each capacitor if the combination is connected to 100 V supply. 1½

18. An ammeter of resistance 0.80 Ohm can measure current up to 1 A. What must be the value of shunt resistance to enable the ammeter to measure current up to 5.0A? (1)

What is the combined resistance of Ammeter and shunt. (1)

OR

A straight wire of length L carrying a current I stays suspended horizontally in midair in a region where there is a uniform magnetic field **B.** The linear mass density of the wire is λ. Obtain the magnitude and direction of this magnetic field. (2)

19. Define magnetic declination. Deduce the relation connecting angle of dip and horizontal component of Earth's magnetic field at a place. (2)

OR

(a) The horizontal component of earth's magnetic field at a place is $1/\sqrt{3}$ times its vertical component there. Find the value of angle of dip at that place. (1)

(b) What is the ratio of horizontal component to the total magnetic field of the Earth at that place? (1)

20. The flux linked with a large circular coil , of radius R is 0.5 x10^-3 Wb when a current of 0.5 A flows through a small neighboring coil of radius r.

(a)Calculate the mutual inductance for the given pair of coils. (1)

(b) If the current through the small coil suddenly falls to zero, what would be its effect in the larger coil ? (1)

21. Mono chromatic light of wave length 589 nm is incident from air on water surface. If refractive index of water is 1.33, Find

(a) Frequency of the refracted light. (1)

(b) Wave length of refracted light. (1)

22. Define wavefront. (1)

Use Huygen's principle to show propagation of wavefront from the instant $t_1=0$ to a later time $t_2 = t$. (1)

23. Laser light of wavelength 630 nm incident on a pair of slits produces an interference pattern in which the bright fringes are separated by 8.1 mm. A second light produces an interference pattern in which the fringes are separated by 7.2 mm. Calculate the wavelength of the second light. (2)

24. With the help of a diagram, show the biasing of a light emitting diode (LED).Give its two advantages over conventional incandescent lamps. (2)

Or

Draw a circuit diagram to show biasing of a solar cell. Draw its characteristic curve. (2)

25. Draw a labelled diagram of full wave rectifier. Show input and output wave forms. (2)

Section-D

All questions are compulsory. In case of internal choices, attempt any one.

26. Derive an expression for the resistivity of a good conductor in terms of the relaxation time of electrons. (3)

27. Draw a labelled schematic diagram of an a.c generator. Write its principle, working and show tsshat induced emf is sinusoidal in nature. (3)

OR

Define term mutual inductance between the two coils. Obtain the expression for mutual inductance of a pair of long coaxial solenoid each of length l and radii r1 and r2 (r2 > r1). Total number of turns in two solenoids are N1 and N2 respectively. (3)

28. An electron and a photon, each has a wavelength of 1.00 nm. Find

(a) Their momentum (1)

(b) Energy of the photon (1)

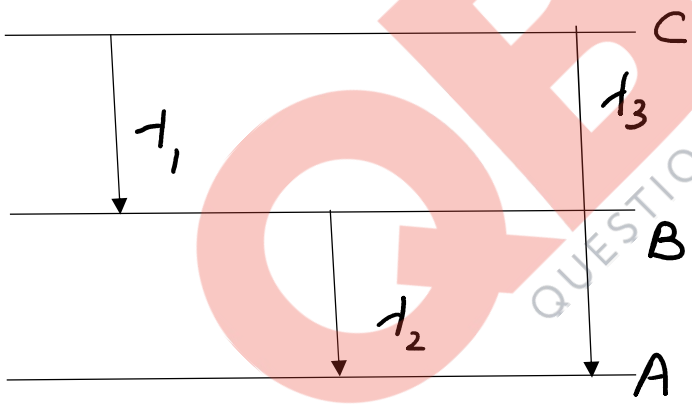
(c) Kinetic energy of electron (1)

OR

The threshold frequency for a certain metal is 3.3 x 10^14 Hertz. If light of frequency 8.2x10^14 Hz is incident on the metal, predict the cut off voltage for the photoelectric emission. (3)

29. (a) Using de- Broglie hypothesis, explain Bohr's second postulate of quantization of energy level in a hydrogen atom. (3)

(b) Find the relation between the three wave lengths λ_1, λ_2 & λ_3 from the energy level diagram shown here. (2)



30. Two nuclei have mass numbers in the ratio 1:8.

(a) What is the ratio of their nuclear radii? (1 $\frac{1}{2}$)

(b) Assuming nuclei to be spherical in shape, how does the surface area of a nucleus of mass number A_1 compare with that of a nucleus of mass number A_2 ? (1$\frac{1}{2}$)

Section C

All questions are compulsory. In case of internal choices, attempt any one.

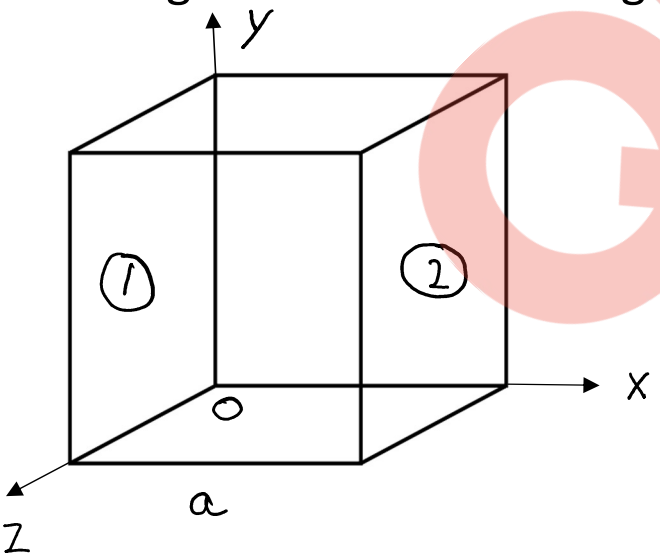
31.

(a)An electric dipole of dipole moment **p** consists of point charge +q and –q separated by a distance '2a'apart.Deduce the expression for electric field **E** due to **short** dipole on its axial line in terms of dipole moment **p**.

(3)

(b) Given the electric field in the region $\mathbf{E}=2x\hat{i}$ (refer to fig below),Find the net electric flux

through the cube and charge enclosed by cube. (2)



OR

(a) State Gauss's law. Using this law obtain the expression for electric field due to an infinitely long straight conductor of linear charge density λ. (3)

(b) A wire AB of length L has linear charge density $\lambda = kx$ where x is measured from the end A of the wire. The wire is enclosed by a Gaussian hollow surface. Find the expression for the electric flux through the surface. (2)

32.

(a) Draw a labelled diagram of step down transformer. (1)

(b) State the principle of its working. (1)

(c) Dedue the turn ratio in terms of voltages and currents. (1)

(d) How much current is drawn by the primary of the transformer connected to 220 V supply when it delivers power to 100 V-550 W refrigerator? (2)

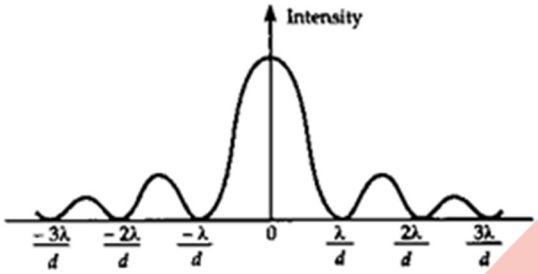
OR

Derive an expression for the impedance of series LCR circuit connected to an a.c supply of variable frequency. (3)

Plot a graph showing variation of current with frequency of the applied voltage. (1)

Explain briefly how the phenomenon of resonance in the circuit can be used in the tuning mechanism of a radio or T.V set. (1)

33. when the plane wavefront of wavelength λ is incident on a narrow slit,
an intensity distribution pattern of the form shown is observed on a screen suitably kept behind the slit.



(a) Name the phenomenon observed. (1)

(b) Why is there significant fall in intensity of the secondary maxima in compared to central maxima? (2)

(c) When the width of the slit is made double the original width,how is size of central width affectd? (2)

OR

(a)Describe briefly how a diffraction pattern is obtained on a screen due to single narrow slit illuminated by a monochromatic source of light. Hence obtain the condition for the angular width of secondary maxima and secondary minima. (3)

(b) Two wavelengths of sodium lights of 590 nm and 596 nm are used in turn to study the diffraction taking place at a single slit of aperture

2 x 10^-6 m. The distance between the slit and the screen is 1.5 m. Calculate the separation between the positions of first maxima of the diffraction pattern obtained in the two cases. (2)