Sub. Code 042

Please check that this paper contains
33 Questions and has 10 printed pages

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D.A.V. INSTITUTIONS, CHHATISGARH

SAMPLE PAPER (8) 2023-24

CLASS – XII, SUBJECT – PHYSICS

Time Allowed: 3 Hours **Maximum Marks: 70**

General Instructions:

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

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

(3) All the sections are compulsory.

(4) **Section A** contains sixteen questions, twelve MCQ and four Assertion Reasoning based of one mark each, **Section B** contains five questions of two marks each; **Section C** contains seven questions of three marks each, **Section D** contains two case study based questions of four marks each and **Section E** contains three long answer questions of five marks each.

(5) There is no overall choice. However, an internal choice has been provided in one question in Section B, one question in Section C, one question in each CBQ in Section D and all three question Section E. You have to attempt only one of the choices in such questions.

(6) Use of calculators is not allowed.

(7) You may use the following values of physical constants where ever necessary

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

(ii) $m_e = 9.1 \times 10^{-31}$ Kg

(iii) $h = 6.64 \times 10^{-34}$ Js

(iv) $\mu_0 = 4\pi \times 10^{-7}$ TmA^{-1}

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

(vi) $\epsilon_0 = 8.854 \times 10^{-12}$ $C^2N^{-1}m^{-2}$ (vii) Avogadro's no. = 6.023×10^{23} per gram mole

SECTION – A

Q1. Coulomb meter is the unit of :

(a) electric dipole moment (b) electric field (c) absolute permittivity (d) dielectric constant

Q2. A metallic plate exposed to white light emits electrons. For which of the following colours of light, the stopping potential will be maximum?

(a) blue (b) yellow (c) red (d) violet

Q3.What is the value of minimum force acting between two charges placed at 1m apart from each other ;

(a) Ke^2 (b) Ke (c) Ke/4 (d) Ke/2

Q4.A set of atoms in an excited state decays

(a) in general, to any of the states with lower energy

(b) into a lower state only when excited by an external electric field

(c) all together simultaneously into a lower state.

(d) to emit photons only when they collide

Q5. An electron is moving along positive y-axis in a magnetic field which is parallel to the positive x-axis. In what direction will the magnetic force be acting on the electron?

(a) along –z axis (b) along –x axis (c) along + z axis (d) along x axis

Q6. A galvanometer of resistance 10 ohm gives full scale division when 1 mA current passes through it. The resistance required to convert it into a voltmeter of reading up to 2.5 V is

(a) 2490 ohm (b) 249000 ohm (c) 249 ohm (d) 24.9 ohm

Q7. The relative permeability of a substance X is slightly less than unity and that of substance Y is slightly more than unity, then

(a) X is paramagnetic and Y is ferromagnetic

(b) X is diamagnetic and Y is ferromagnetic

(c) X and Y both are paramagnetic

(d) X is diamagnetic and Y is paramagnetic

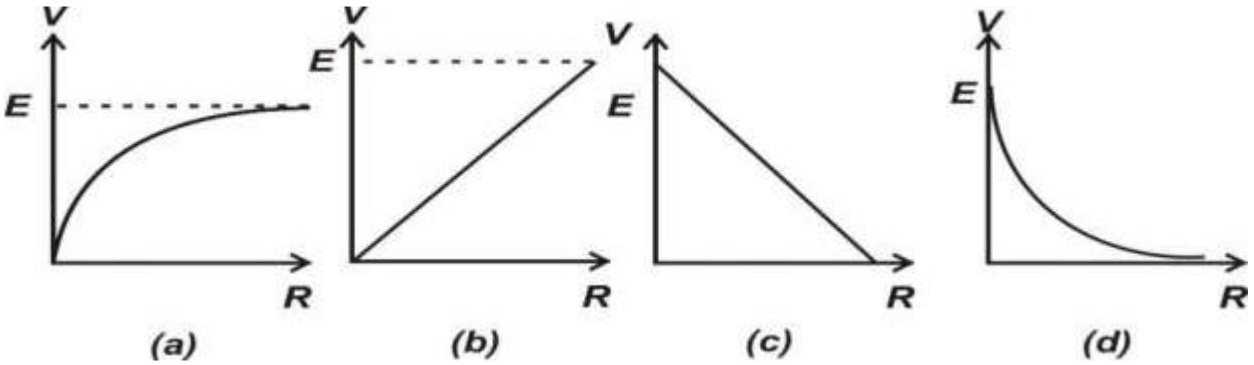
Q8. The magnetic moment of a diamagnetic atom is.

(a) much greater than one (b) one (c) between zero and one (d) equal to zero

Q9. Transformation ratio of a step-up transformer is

(a) one (b) more than one (c) less than one (d) infinite

Q10.A cell of emf E and internal resistance r is connected across an external resistor R. The graph showing the variation of P.D. across R



Q11. The energy of an electron in nth orbit of hydrogen atom is En= - 13.6/$n2eV$.The negative sign of energy indicates that

(a) electron is free to move.

(b) electron is bound to the nucleus.

(c) kinetic energy of electron is equal to potential energy of electron.

(d) atom is radiating energy.

Q12. In a Young's double experiment, the path difference at a certain point on the screen between two interfering waves is 1/8th of the wavelength. The ratio of intensity at this point to that at the centre of a bright fringe is close to

(a) 0.80 (b) 0.74 (c) 0.94 (d) 0.85

For Questions 13 to 16, two statement are given one labeled Assertion (A) and other labeled Reason (R). Select the correct answer to these questions from the options as gives below.

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

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

(c) If Assertion is true but Reason is false.

(d) If both Assertion and Reason are false.

Q 13. **ASSERTION (A) :** According to Rutherford's atomic model the path of electron is parabolic.

REASON (R) : Rutherford could not explain the stability of the atom.

Q14. **ASSERTION (A) :** The electrical conductivity of a semiconductor increases on doping.

REASON (R) : Doping always increases the number of electrons in the semiconductor.

Q15. **ASSERTION (A) :** Nuclear force is same between neutron-neutron, proton-proton and neutron –proton.

REASON (R) : nuclear force is charge independent.

Q16. **ASSERTION (A) :** Propagation of light through an optical fibre is due to total internal reflection taking place at the core-cladding interface.

REASON (R) : Refractive index of the material of the cladding of the optical fibre is greater than that of the core.

SECTION – B

Q17. A narrow slit is illuminated by a parallel beam of monochromatic light of wavelength λ equal to 6000A and the angular width of the central maximum in the resulting diffraction pattern is measured . When the slit is next illuminated by light of wavelength 'λ' the angular width decreases by 30%. Calculate the value of the wavelength.

Q18 If the forward voltage in a semiconductor diode is changed from 0.5 V to 2 V then the forward current changes by 1.5 mA. What is the resistance of junction diode.

Q19. Under what conditions does the phenomenon of total internal reflection take place ?

Q20. You are given two converging lenses of focal length 1.25 cm and 5 cm to design a compound microscope .If it is desired to have a magnification of 30, find out the separation between the objective and eye piece.

Q21. Give two differences between electrical resistance and resistivity

OR

State Kirchhoff's loop with an example

SECTION – C

Q22.Two long straight parallel conductors carrying currents I_1 and I_2 are separated by a distance d . If the currents are flowing in the same direction. Show how the magnetic field produced by one is exert an attraction force on other. Obtain the expression for this force and hence define 1 ampere.

Q23. Plot a graph showing the variation of photoelectric current with intensity of light. The work function for the following metals is given.

Na : 2.75 eV and Mo : 4.175 eV.

Which of these will not give photoelectron emission from a radiation of wavelength 3300 A^0 from a laser beam ? What happens if the source of laser beam is brought closer ?

Q24.A given coin has a mass of 3.0 g. Calculate the nuclear energy that would be required to separate all the neutrons and protons from each other. For simplicity assume that the coin is entirely made of $Cu2963$ atoms (of mass 62.92960 u). Given mp = 1.007825u and mn = 1.008665u.

Q25. The value of ground state energy of hydrogen atom is -13.6 eV.

(i) Find the energy required to move an electron from the ground state to the first excited state of the atom.

(ii) Determine (a) the kinetic energy and (b) orbital radius in the first excited state of the atom.

(Given the value of Bohr radius = 0.53 A^0)

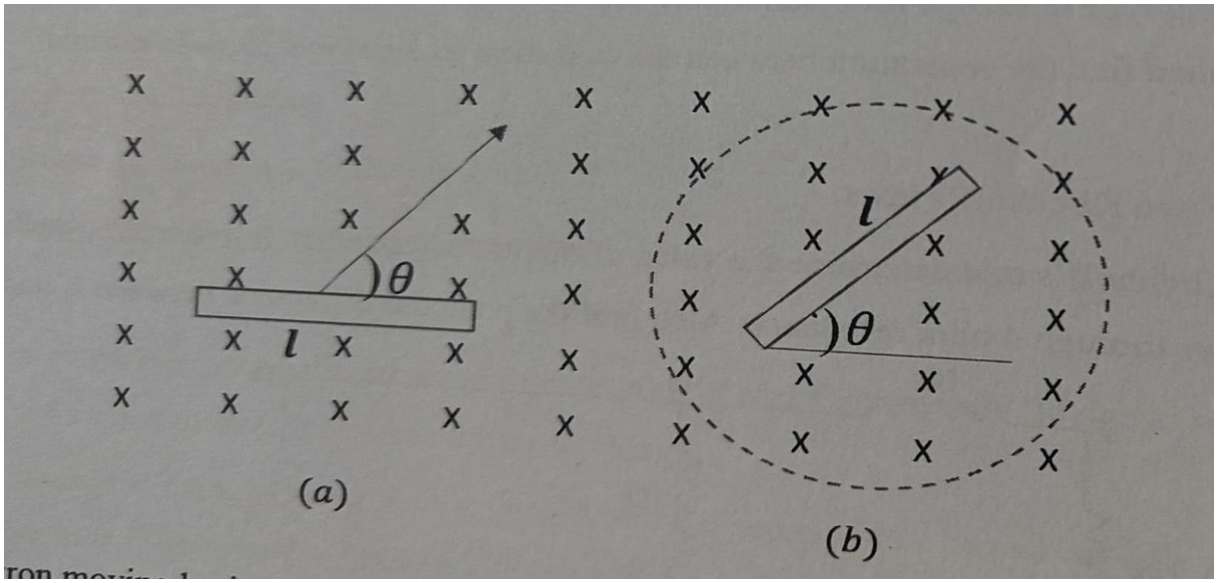
Q26. (i) If f = 0.5 m for a glass lens , What is the power of lens ?

(ii) The radii of curvature of a double covex lens are 10cm and 15cm. Its focal length is 12cm, What is the refractive index of glass?

(iii) A biconvex lens has focal length 2/3 times the radius of curvature of either surface, calculate refractive index of the lens material.

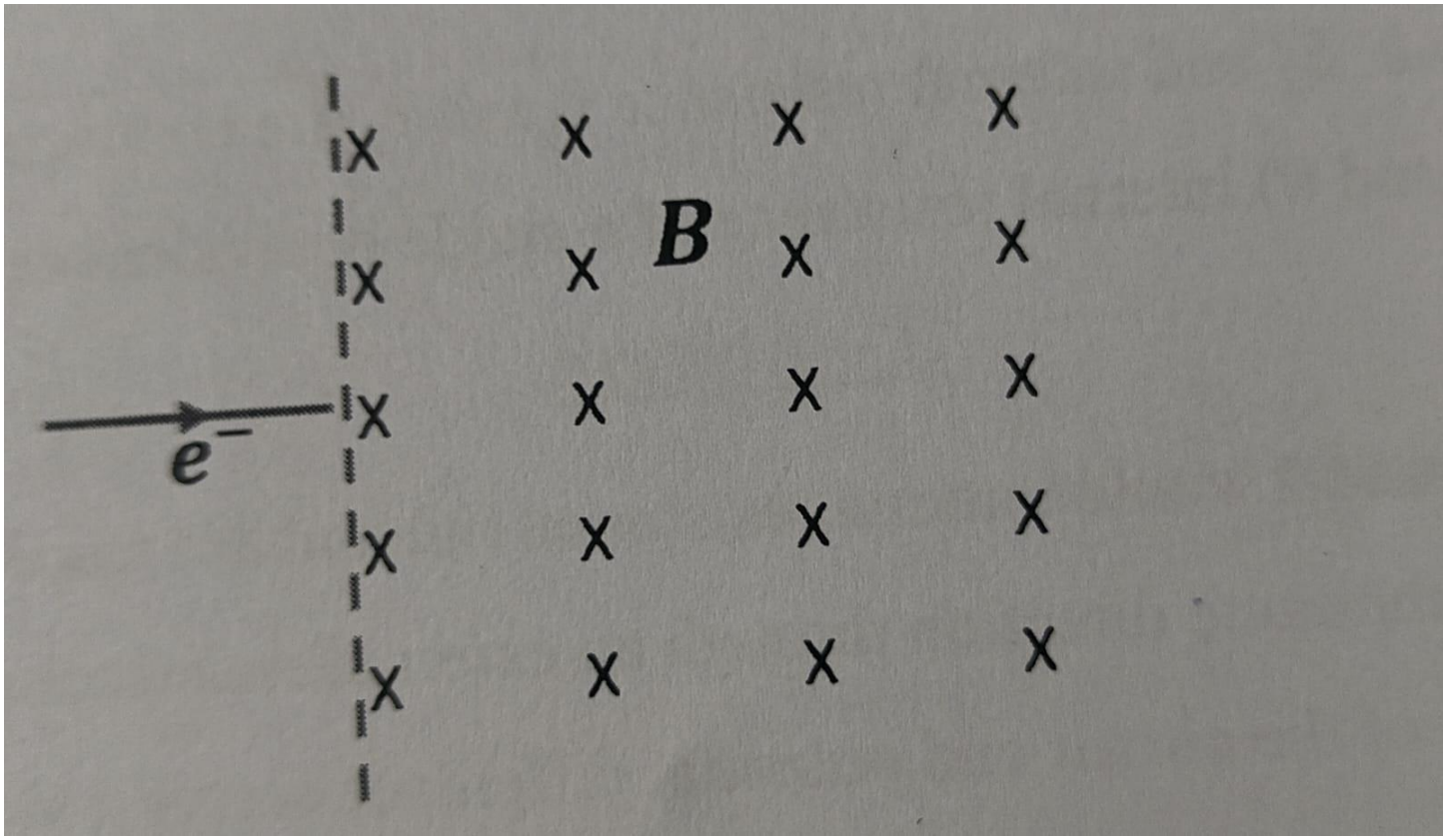
Q27. An inductor, capacitor and resistor is connected in series with an A.C source (i) find the expression for impedance (ii) draw phasor diagram (iii) write the condition for resonance of LCR circuit.

Q28.Calculate the rate at which the flux linked with the generated area changes with time when a rod of length l is (i) translated (ii) rotated clockwise in a uniform magnetic field of induction B as shown in figure.



OR

An electronmoving horizontally with a velocity of $4 \times 10^{4} ms^{-1}$ enters a region of uniform magnetic field of $10^{-5}T$ acting vertically downward as shown in the figure. Draw its trajectory and find out the time takes to come out of the region of magnetic field .



SECTION – D

CASE STUDY BASED QUESTIONS

Read the following paragraph and answer the question that follow :

Q29. Modern train are based on maglev technology in which trains are magnetically levitated, which runs its EDS maglev system. There are coils on both sides of wheels. Due to motion of the train, current induces in the coil of track which levitate it. This is in accordance with Lenz's law. If train lowers down then due to Lenz's law, repulsive force increase due to which train gets uplifted and if it goes much higher then there is a net downward force due to gravity. The advantage of Maglev trains in that there is no friction between the train and the track, thereby reducing power consumption and enabling the train to attain very high speeds. Disadvantage of Maglev train is that as it slows down, the electromagnetic forces decreases and it becomes difficult to keep it levitated and as it moves forward according to Lenz's law there is an electromagnetic drag force.

(1) What is the advantage of this system?

(a) No friction, hence no power consumption (c) Gravitational force is zero

(b) No electric power is used (d) Electrostatic force draws the train

(2) What is the disadvantages of this system

(a) Train experiences and upward force according to Lenz's law (c) Retardation

(b) Friction force creates a drag on the train (d) By Lenz's law the train experiences a drag

(3) Which force causes the train to elevate up?

(a) Electromagnetic force (c) Time varying electric field

(b) Magnetic force (d) Induced electric field

(4) What does MAGLEV stands for?

(a) Magnetic Leviation (c) Moving Awesome Gravity Levitation Elemental vacuum

(b) Magnetic Levitation (d) Magic Levels

Q30. Lightening during a thunder storm

•lightning is due to charges produced by friction during a thunder storm.

•It seems that the air currents move upward while the water droplets move downward. These vigorous movements cause separation of charges. By a process, not yet completely understood, the positive charges collect near the upper edges of the clouds and the negative charges accumulate near the lower edges. This is the cause of accumulation of positive charges near the ground. When the magnitude of the accumulated charges becomes very large, the air, normally a poor conductor of electricity, is no longer able to resist their flow. Negative and positive charges create streaks of bright light and sound. We see streaks as lightning. The process is called an electric discharge.

•A moving thunderstorm also gathers positive charge on the ground As the differences in charges continue to increase, positive charge collects on tall objects such as trees, houses, and telephone poles—and even people.

•The negatively charged lower part of the clouds induces the positive charge on the ground. When the clouds are closer or the charge is very high 'a channel develops'. The subsequent electrical transfer in the channel is lightning.

(1) Clouds gain electrical charges due to friction, which is between

(a) Air and clouds

(b) Between Raindrops

(c) Ground and the clouds

(d) Air and heavy raindrops

(2) Lightening strikes tall buildings, tall trees as

(a) positive charge builds up on the ground

(b) Electrons flow from negative to positive

(c) The top of the buildings, tall trees acquire positive charge

(d) Charge has to flow to the ground.

(3) If your hair stands up during a storm this is because

(a) Positive charge travels from the ground towards the cloud

(b) Negative charge travels from cloud to the ground

(c) Your positively charged hair are attracted by the clouds.

(d) Your body is charged

(4) If no shelter is available and you are in an open field,

(a) run to be under a trees.

(b) Run to the middle of the field .

(c) lie on the ground.

(d) squat low on the ground. Place your hands on your knees with your head between the hands

.SECTION – E

Q31.(a) State the principle of ac generator.

(b) Explain with the help of a well labelled diagram, its working and obtain the expression for the emf generated in the coil.

(c) Is it possible to generate emf without rotating the coil? Explain

OR

(a) Define a wave front.

(b) Draw the diagram to show the shape of plane wave front as they pass through (i) a thin prism and (ii) a thin convex lens. State the nature of refracted wave front.

(c) Verify Snell's law of refraction using Huygens's principle

Q32. What is diffraction of light ? Draw and discuss the graph showing the variation of intensity with angle in a single slit diffraction experiment. What will be the effect on the width of the central bright fringe in the diffraction pattern of a single slit if:

(a) the width of the slit is decreased?

(b) the monochromatic source of light is replaced by a source of white light ?

OR

(a) Derive the formula for refraction at concave refracting surface when the object lies in the rarer medium.

(b) What happens to the focal length of the lens when it is immersed in water.

Q33.Derive an expression for the torque experienced by an electric dipole placed in a uniform electric field. What is the net force acting on this electric dipole? How the torque and net force affected when the same dipole is placed in non-uniform electric field ?

OR

(a) Define electric flux. Write its S.I. unit.

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

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