BK BIRLA CENTRE FOR EDUCATION

SARALA BIRLA GROUP OF SCHOOLS
SENIOR SECONDARY CO-ED DAY CUM BOYS' RESIDENTIAL SCHOOL

PRE BOARD - 1 EXAMINATION 2024-25

Class : XII
Date : 18/11/2024
Admission No.:

Duration: 3 Hrs
Max. Marks: 70
Roll No.:

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.
(5) Section B contains five questions of two marks each.
(6) Section C contains seven questions of three marks each.
(7) Section D contains two case study-based questions of four marks each.
(8) Section E contains three long answer questions of five marks each.
(9) 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 questions in Section E. You have to attempt only one of the choices in such questions.
(10) Use of calculators is not allowed.
(11) 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) $e = 1.6 \times 10^{-19}$ C (iv) $\mu_0 = 4\pi \times 10\text{-}7$ TmA^{-1}
(v) $m_p = 1.67 \times 10^{-27}$ kg (vi) $m_n = 1.675 \times 10^{-27}$ kg (vii) h = 6.63 x10-34 Js
(vii) $\varepsilon_0 = 8.854 \times 10^{-12}$ $C^2N^{-1}m^{-2}$ (viii) Avogadro's number = 6.023×10^{23}per gram mole

SECTION-A

1. V/m is the unit of _____ 1
(a) Electric field intensity (b) Electric flux (c) Electric potential (d) Charge
2. The electric potential on the axis of an electric dipole at a distance 'r from its centre is V. Then the potential at a point at the same distance on its equatorial line will be 1
(a) 2V (b) -V (c) V/2 (d) Zero
3. The total flux through the faces of the cube with side of length 'a' if a charge ''q is placed at corner A of the cube is: 1
(a) $q/4\varepsilon_0$ (b) $q/2\varepsilon_0$ (c) $q/8\varepsilon_0$ (d) q/ε_0
4. If copper wire is stretched to make its radius decrease by 0.1%, then the percentage change in its resistance is approximately 1
(a)–0.4% (b) +0.8% (c) +0.4% (d) +0.2%
5. Two concentric and coplanar circular loops P and Q have their radii in the ratio 2:3. Loop Q carries a current 9 A in the anticlockwise direction. For the magnetic field to be zero at the common centre, loop P must carry 1
(a) 3A in clockwise direction (b) 9A in clockwise direction
(c) 6 A in anti-clockwise direction (d) 6 A in the clockwise direction.

6. In a series LCR circuit, the voltage across the resistance, capacitance and inductance is 10 V each. If the capacitance is short circuited the voltage across the inductance will be: 1
   (a) 10 V (b) $10\sqrt{2}$ V (c) $10/\sqrt{2}$ V (d) 20 V
7. Electromagnetic waves travelling in a medium having relative permeability $\mu_r = 1.3$ and relative permittivity $\varepsilon_r = 2.14$. The speed of electromagnetic waves in medium must be: 1
   (a) 1.8×10^8 ms^{-1} (b) 1.8×10^4 ms^{-1} (c) 1.8×10^6 ms^{-1} (d) 1.8×10^2 ms^{-1}
8. Which of the following statement is NOT true about the properties of electromagnetic waves? 1
   (a) These waves do not require any material medium for their propagation
   (b) Both electric and magnetic field vectors attain the maxima and minima at the same time
   (c) The energy in electromagnetic wave is divided equally between electric and magnetic fields
   (d) Both electric and magnetic field vectors are parallel to each other
9. Two lens of power -15 D and +5 D are placed in contact co-axially. The focal length of equivalent lens is: 1
   (a) -10 cm (b) -20 cm (c) +10 cm (d) None
10. In a Young's double slit experiment, the path difference at a certain point on the screen between two interfering waves is 1/8 th of the wavelength. The ratio of intensity at this point to that at the centre of a bright fringe is close to 1
    (a) 0.80 (b) 0.74 (c) 0.94 (d) 0.85
11. The Rutherford α-particle experiment shows that most of the α-particles pass through almost un-scattered while some are scattered through large angles. What information does it lead to? 1
    (a) Atoms are hollow.
    (b)The whole mass of the atom is concentrated in a small centre called nucleus
    (c) Nucleus is positively charged
    (d) All of the above
12. In semiconductors, at room temperature 1
    (a) the conduction band is completely empty
    (b) the valence band is partially empty and the conduction band is partially filled
    (c) the valence band is completely filled and the conduction band is partially filled
    (d) the valence band is completely filled

    For Questions 13 to 16, two statements are given –one labelled Assertion (A) and other labelled Reason (R). Select the correct answer to these questions from the options as given below.
    (a) If both Assertion and Reason are true and Reason is 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

13. Assertion: Energy of incident photons increases with increase in frequency and as a result photoelectric current increase. 1
    Reason: Photoelectric saturation current increases with the increase in frequency of incident light.
14. Assertion: The magnetic field produced by a current carrying solenoid is independent of its length and cross-sectional area. 1
    Reason: The magnetic field inside the solenoid is uniform.
15. Assertion: The frequency of radiation emitted or absorbed by an atom is related to the difference in energy between two energy levels. 1
    Reason: The energy of the photon emitted or absorbed is equal to the difference in energy between the two levels.
16. Assertion: Energy is released when heavy nuclei undergo fission or light nuclei undergo fusion. 1
    Reason: For heavy nuclei, binding energy per nucleon increases with increasing Z while for light nuclei it decreases with increasing Z.

Section-B (2 X 5)

17. A silver wire has a resistance of 2.1 Ω, at 27.5°C and a resistance of 2.7 Ω at 100°C. Determine the temperature coefficient of resistivity of silver. 2
18. Explain the working of moving coil galvanometer. 2
19. A beam of light converges at a point P. Now a lens is placed in the path of the convergent beam 12 cm from P. At what point does the beam converge if the lens is a convex lens of focal length 20 cm. 2

    OR

    A small telescope has an objective lens of focal length 144 cm and an eyepiece of focal length 6.0 cm. What is the magnifying power of the telescope? What is the separation between the objective and the eyepiece? 2
20. An α-particle and a proton are accelerated from rest by the same potential. Find the ratio of their de-Broglie wavelengths. 2
21. In a hydrogen atom, find the wavelength of the spectrum when an electron jumps from 3^{rd} orbit to 1^{st} orbit. 2

Section-C (3 X7)

22. Derive an expression for the energy of a parallel plate capacitor with air present between the two plates. 3
23. Using Gauss' law in electrostatics, derive an expression for the electric field due to a uniformly changed Spherical shell (i) At a point outside the shell, (ii) At a point at the surface of the shell and (iii) At a point inside the shell. 3

24. Two straight parallel current carrying conductors are kept at a distance r from each other in air. The direction for current in both the conductors is the same. Find the magnitude and direction of the force between them. Hence define one ampere. 3

25. Identify the part of the electromagnetic spectrum which: 3
    (a) is used in radar system, (b) is used for sterilisation, (c) is used for studying crystal structure. Write any one method of the production and detection of each of the above radiations.

26. How does the angle of minimum deviation of a glass prism of refractive index 1.5 change, if it is immersed in a liquid of refractive index 1.33? 3

27. (a) What do you understand by reverse biasing of p-n junction diode? (1+2)
    (b) Draw the circuit diagram to obtain characteristic curve of p-n junction diode in reverse biasing.

28. Explain the working of p-n junction diode as full wave rectifier. 3

Section-D

29. Case Study: Read the following paragraph and answer the questions. (1+1+1+1)

FORCE ON A CHARGE IN ELECTRIC AND MAGNETIC FIELD

A point charge q (moving with a velocity v and located at 'r' at a given time (t) in the presence of both the electric field E and magnetic field B. The force on an electric charge q due to both of them can be written as $\mathbf{F} = q\,[\mathbf{E} + \mathbf{v} \times \mathbf{B}] = \mathbf{F_e} + \mathbf{F_m}$. It is called the 'Lorentz force'.

(i) If the charge q is moving under a field, the force acting on the charge depends on the magnitude of field as well as the velocity of the charge particle, what kind of field is the charge moving in? 1

(a) Electric field (b) Magnetic field
(c) Both electric and magnetic field perpendicular to each other (d) None of these

(ii) The magnetic force acting on the charge 'q' placed in a magnetic field will vanish if 1

(a) if v is small (b) If v is perpendicular to B (c) If v is parallel to B (d) None of these

(iii) If an electron of charge '-e' is moving along + X direction and magnetic field is along + Z direction, then the magnetic force acting on the electron will be along 1

(a) + X axis (b) - X axis (c) - Y axis (d) + Y axis

(iv)The vectors which are perpendicular to each other in the relation for magnetic force acting on a charge particle are 1

(a) **F** and **v** (b) **F** and **B** (c) **v** and **B** (d) All of these

Or

(iv) A particle moves in a region having a uniform magnetic field and a parallel, uniform electric field. At some instant, the velocity of the particle is perpendicular to the field direction. The path of the particle will be 1

(a) A straight line (b) A circle
(c) A helix with uniform pitch (d) A helix with non-uniform pitch

30. Case study:

Read the following paragraph and answer the questions. (1+1+1+1)

Lenard observed that when ultraviolet radiations were allowed to fall on the emitter plate of an evacuated glass tube, enclosing two electrodes (metal plates), and current started flowing in the circuit connecting the plates. As soon as the ultraviolet radiations were stopped, the current flow also stopped. These observations proved that it was ultraviolet radiations, falling on the emitter plate, that ejected some charged particles from the emitter and the positive plate attracted them.

(i) Alkali metals like Li, Na, K and Cs show photo electric effect with visible light but metals like Zn, Cd and Mg respond to ultraviolet light, because… 1

(a) Frequency of visible light is more than that for ultraviolet light
(b) Frequency of visible light is less than that for ultraviolet light I
(c) Frequency of visible light is same for ultraviolet light
(d) Stopping potential for visible light is more than that for ultraviolet light

(ii) We do not observe the phenomenon of photoelectric effect with non-metals, because … 1

(a)For non-metals the work function is high
(b) Work function is low I
(c) Work function can't be calculated
(d) For non-metals, threshold frequency is low

(iii) The effect of increase in intensity on photoelectric current is… 1

(a)Photoelectric current increases (b) Decreases
(c) No change (d) Varies with the square of intensity

(iv) The factor on which the stopping potential depends … 1

(a)Work function (b) Frequency (c) Current (d) Energy of photon

Or

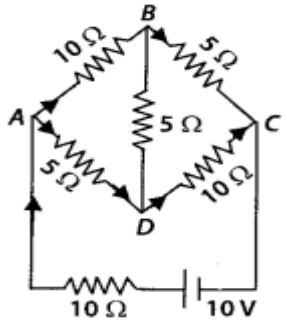
(iv) How does the maximum K.E of the electrons emitted vary with the work function of metal? 1

(a) It doesn't depend on work function (b) It decreases as the work function increases
(c) It increases as the work function increases (d) Its value is doubled with the work function

Section-E

31. (a) State and explain balanced wheat stone bridge. 2

(b) Determine the current in each branch of the network shown in figure. 3



Or

(a) Define resistance of a conductor also write factors on which resistance of a resistor depends. 2
(b) What is the need of combination of resistors. Explain all types of combinations in brief. 3

32 (a) Use Huygen's principle to verify the laws of reflection. 2
(b) A beam of light consisting of two wavelengths, 650 nm and 520 nm, is used to obtain interference fringes in a Young's double-slit experiment. Distance between two slits is 2mm and screen is placed at distance 1.2 m from the plane of slits.
(i) Find the distance of the third bright fringe on the screen from the central maximum for wavelength 650 nm. 1
(ii) What is the least distance from the central maximum where the bright fringes due to both the wavelengths coincide? 2

OR

(a) Draw a schematic diagram of refraction at spherical surface and using it find the relation between object distance, image distance and refractive indices in terms of radius of curvature. 3
(b) Double-convex lenses are to be manufactured from a glass of refractive index 1.55, with both faces of the same radius of curvature. What is the radius of curvature required if the focal length is to be 20 cm? 2

33 (a) Draw the phasor diagram for a series LRC circuit connected to an AC source. Using the phasor diagram, derive the expression for the impedance of the circuit and phase difference between V and I. 3
(b) A coil of inductance 0.50 H and resistance 100 Ω is connected to a 240 V. 50 Hz ac supply.
(i) What is the maximum current in the coil? 1
(ii) What is the time lag between the voltage maximum and the current maximum? 1

OR

(a) Find the expression for motional e.m.f developed in a conductor of length 'L' rotated in uniform magnetic field 'B' with angular velocity 'ω'. 2
(b) With the help of suitable diagram state working principle and explain working of a step-up transformer. 3

----------ALL THE BEST----------