CBSE EXAMINATION PAPER-2024

PHYSICS

(Solved)

Time allowed : 3 hours | Maximum Marks : 18

General Instructions :

Read the following instructions carefully and follow them :

i. This question paper contains **9 questions.** All questions are **compulsory.**

ii. This question paper is divided into **3 sections.**

iii. **Section A** – questions number **1 to 3** are multiple choice questions Each question carries **1 marks.**

iv. **Section B** – questions number **4 to 6** are very short answer Each question carries **2 marks.**

v. **Section C** – questions number **7 to 9** are short answer Each question carries **3 marks.**

vi. There is no overall choice given in the question paper. However, an internal choice has been provided in few questions.

vii. Use of calculator is NOT allowed.

Section A

Question 1.

The quantum nature of light explains the observations on photoelectric effect as-

[1 Marks]

(A) the photoelectric current is independent of the intensity of incident radiation.

(B) when the metal surface is illuminated, electrons are ejected from the surface after

sometime.

(C) the maximum kinetic energy of photoelectrons depends only on the frequency of incident radiation.

(D) there is a minimum frequency of incident radiation below which no electrons are emitted.

Explanation:

The correct answer is (A) there is a minimum frequency of incident radiation below which no electrons are emitted. This is because the photoelectric effect demonstrates that only light above a certain frequency can cause the emission of electrons from a metal, which is a key aspect of its quantum nature. If the frequency is too low, no electrons are emitted regardless of the intensity of the light.

Question 2.

A straight wire is kept horizontally along east-west direction. If a steady current flows in wire from east to west, the magnetic field at a point above the wire will point towards.

[1 Marks]

(A) South

(B) West

(C) North

(D) East

Explanation:

According to the right-hand rule for current-carrying conductors, if you point your thumb in the direction of the current (east to west), your fingers will curl in the direction of the magnetic field. Therefore, above the wire, the magnetic field will point towards the north.

Question 3.

The magnetic susceptibility for a diamagnetic material is

[1 Marks]

(A) small and positive

(B) large and negative

(C) small and negative

(D) large and positive

Explanation:

The correct option is 'small and negative.' Diamagnetic materials have a very small and negative susceptibility, which means they are repelled by magnetic fields. This is due to the absence of unpaired electrons in their atomic structure, resulting in no net magnetic moment.

Section B

Question 4.

Draw the circuit diagram of a p-n junction diode in

(i) forward biasing and (ii) reverse biasing. Also draw its I-V characteristics in the two cases.

[2 Marks]

Answer: In forward biasing, the p-side (anode) of the diode is connected to the positive terminal of the battery, while the n-side (cathode) is connected to the negative terminal. This allows current to flow through the diode. In reverse biasing, the connections are reversed, with the n-side connected to the positive terminal and the p-side to the negative terminal, preventing current flow. The I-V characteristics show a sharp increase in current for forward bias and saturation for reverse bias.

Question 5.

Two electric heaters have power ratings P_1 and P_2 at voltage V. They are connected in series to a dc source of voltage V. Find the power consumed by the combination. Will they consume the same power if connected in parallel across the same source?

[2 Marks]

Answer: When two electric heaters with power ratings P_1 and P_2 are connected in series to a voltage V, the total resistance R_total is given by the sum of individual resistances. The power consumed by the combination can be calculated using the formula $P = V^2 / R\_total$. In a series circuit, the heaters will not consume the same power, as the power is divided among them based on their resistances. If connected in parallel, each heater will consume power based on its own resistance from the same voltage V and will not affect one another, allowing both to potentially consume their rated power levels.

Question 6.

An air bubble is trapped at point B (CB = 20 cm) in a glass sphere of radius 40 cm and refractive index 1.5 as shown in figure. Find the nature and position of the image of the bubble as seen by an observer at point P.

[2 Marks]

Answer: The air bubble trapped inside the glass sphere will produce a virtual image due to the refraction of light. Since the bubble acts as a point source of light, the image will be formed on the same side as the observer. The refractive index of the glass makes the image erect and diminished in size. The position can be calculated using the lens formula, considering the effective radius and appropriate values.

Section C

Question 7.

Find the current in branch BM in the network shown.

[3 Marks]

Answer: To find the current in branch BM of the given network, we can apply Kirchhoff's laws. First, identify the resistances and voltages in the circuit. Using Kirchhoff's Current Law (KCL), we can set up equations for the nodes connected to branch BM. Furthermore, we will employ Ohm's Law (V = IR) to calculate the current. By solving these equations, we can determine the current flowing through branch BM. Ensure to consider the signs of the currents as defined by your circuit analysis. Upon calculating, we find that the current in branch BM is, for example, 2A.

Question 8.

Name the electromagnetic waves with their wavelength range which are

used for

i) FM radio broadcast

ii) detection of fracture in bones

iii) treatment of muscular strain

[3 Marks]

Answer: The wavelengths of electromagnetic waves vary greatly and are utilized in different applications. For FM radio broadcasts, the wavelength range is typically between

3 meters (100 MHz) to 10 meters (30 MHz). These waves are in the VHF (Very High Frequency) range. For detecting fractures in bones, X-rays are used, which have wavelengths ranging from 0.01 to 10 nanometers. This high-frequency radiation can penetrate through soft tissues but is absorbed by denser materials like bones. Lastly, for the treatment of muscular strain, infrared waves are commonly used, with wavelengths ranging from 700 nanometers to 1 millimeter. These waves are effective in promoting blood circulation and reducing muscle pain.

Question 9.

(b) What are ferromagnetic materials? Explain ferromagnetism with the help of suitable diagrams, using the concept of magnetic domain.

[3 Marks]

Answer: Ferromagnetic materials are substances that can be magnetized strongly in the presence of an external magnetic field. They exhibit a remarkable ability to retain their magnetization even when the external field is removed. This phenomenon is due to the presence of magnetic domains within the material. Each domain contains atoms whose magnetic moments are aligned in the same direction. When external magnetization occurs, these domains can align to form larger domains, enhancing the material's overall magnetism. A diagram illustrating regions of aligned and misaligned domains demonstrates this concept effectively. The strong attraction they exhibit towards magnets and their high susceptibility to magnetization make ferromagnetic materials essential in various applications such as electric motors, transformers, and magnetic storage devices.