

# CBSE EXAMINATION PAPER-2024

## PHYSICS

(Solved)

Time allowed : 3 hours

Maximum Marks : 36

### General Instructions :

Read the following instructions carefully and follow them :

- i. This question paper contains **19 questions**. All questions are **compulsory**.
- ii. This question paper is divided into **4 sections**.
- iii. **Section A** – questions number **1 to 10** are multiple choice questions Each question carries **1 marks**.
- iv. **Section B** – questions number **11 to 13** are very short answer Each question carries **2 marks**.
- v. **Section C** – questions number **14 to 18** are short answer Each question carries **3 marks**.
- vi. **Section D** – questions number **19 to 19** are long answer Each question carries **5 marks**.
- vii. There is no overall choice given in the question paper. However, an internal choice has been provided in few questions.
- viii. Use of calculator is NOT allowed.

## Section A

### Question I.

Consider a group of charges  $q_1, q_2, q_3, \dots$  such that  $\sum q \neq 0$ . Then equipotentials at a large distance, due to this group are approximately :

[1 Marks]

(A) Spherical surface

(B) Paraboloidal surface

(C) Plane

(D) Ellipsoidal surface

### Question 2.

A circular loop of wire, carrying a current 'I' is lying in xy plane with its centre coinciding with the origin. It is subjected to a uniform magnetic field pointing along +z-axis. The loop will:

[1 Marks]

(A) remain stationary

(B) move along z-axis

(C) move along y-axis

(D) move along x-axis

### Question 3.

The current in a coil of 15 mH increases uniformly from zero to 4 A in 0.004 s. The emf induced in the coil will be:

[1 Marks]

(A) 15.0 V

(B) 12.5 V

(C) 17.5 V

(D) 22.5 V

### Question 4.

Consider a solenoid of length  $l$  and area of cross-section  $A$  with fixed number of turns. The self-inductance of the solenoid will increase if:

[1 Marks]

(A) both  $l$  and  $A$  are decreased

(B)  $l$  is decreased and  $A$  is increased

(C) both I and A are increased

(D) I is increased and A is decreased

**Question 5.** Which one of the following has the highest frequency?

[1 Marks]

(A) Infrared rays

(B) Gamma rays

(C) Radio waves

(D) Microwaves

**Question 6.**

A proton and an alpha particle having equal velocities approach a target nucleus. They come momentarily to rest and then reverse their directions. The ratio of the distance of closest approach of the proton to that of the alpha particle will be:

[1 Marks]

(A) 4

(B)  $1/2$

(C)  $1/4$

(D) 2

**Question 7.** An electron makes a transition from  $n = 2$  level to  $n = 1$  level in the Bohr model of a hydrogen atom. Its period of revolution:

[1 Marks]

(A) increases by 87.5%

(B) decreases by 87.5%

(C) increases by 43.75%

(D) decreases by 43.75%

**Question 8.**

Assertion (A): In a semiconductor, the electrons in the conduction band have lesser energy than those in the valence band.

Reason (R): Donor energy level is just above the valence band in a semiconductor.

[1 Marks]

- (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
- (B) Assertion (A) is false and Reason (R) is also false.
- (C) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
- (D) Assertion (A) is true, but Reason (R) is false.

### Question 9.

Assertion (A): Photoelectric effect demonstrates the particle nature of light.

Reason (R): Photoelectric current is proportional to frequency of incident radiation.

[1 Marks]

- (A) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
- (B) Assertion (A) is false and Reason (R) is also false.
- (C) Assertion (A) is true, but Reason (R) is false.
- (D) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

### Question 10.

Assertion (A): A convex lens, when immersed in a liquid, disappears.

Reason (R): The refractive indices of the material of the lens and the liquid are equal.

[1 Marks]

- (A) Assertion (A) is false and Reason (R) is also false.
- (B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
- (C) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

(D) Assertion (A) is true, but Reason (R) is false.

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## Section B

### Question 11.

The magnifying power of an astronomical telescope is 24. In normal adjustment, distance between its two lenses is 150 cm. Find the focal length of the objective lens.

[2 Marks]

### Question 12.

Explain the following :

a) For a simple microscope, the angular size of the object equals the angular size of the image. Yet it offers magnification.

b) Both plane and convex mirrors produce virtual images of objects. Can they produce real images under some circumstances ?

[2 Marks]

### Question 13.

Draw the circuit diagram of a Wheatstone bridge. Obtain the condition when no current flows through the galvanometer in it.

[2 Marks]

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## Section C

**Question 14.** Determine the current in branches AB, AC and BC of the network shown in figure.

[3 Marks]

**Question 15.** Two long straight parallel conductors carrying currents exert a force on each other. Why? Derive an expression for the force per unit length between two long straight parallel conductors carrying currents in opposite directions. Explain the nature of the force between these conductors.

[3 Marks]

### Question 16.

A sinusoidal voltage is applied to an electric circuit containing a circuit element 'X' in which the current leads the voltage by  $\pi/2$

- (a) Identify the circuit element 'X' in the circuit.
- (b) Write the formula for its reactance.
- (c) Show graphically the variation of this reactance with frequency of ac voltage.
- (d) Explain the behaviour of this element when it is used in (i) an ac circuit, and (ii) a dc circuit.

[3 Marks]

### Question 17.

Draw the circuit diagrams for obtaining the V-I characteristics of a p-n junction diode. Explain briefly the salient features of the V-I characteristics in (i) forward biasing, and (ii) reverse biasing.

[3 Marks]

### Question 18.

On the basis of energy band diagrams, distinguish between (i) an insulator, (ii) a semiconductor, and (iii) a conductor.

[3 Marks]

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## Section D

### Question 19.

(i) A charge + Q is placed on a thin conducting spherical shell of radius R. Use Gauss's theorem to derive an expression for the electric field at a point lying (i) inside and (ii) outside the shell.

(ii) Show that the electric field for same charge density ( $\sigma$ ) is twice in case of a conducting plate or surface than in a nonconducting sheet.

[5 Marks]

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