

CBSE EXAMINATION PAPER-2024

PHYSICS

(Solved)

Time allowed : 3 hours

Maximum Marks : 41

General Instructions :

Read the following instructions carefully and follow them :

- i. This question paper contains **21 questions**. All questions are **compulsory**.
- ii. This question paper is divided into **4 sections**.
- iii. **Section A** – questions number **1 to 11** are multiple choice questions Each question carries **1 marks**.
- iv. **Section B** – questions number **12 to 15** are very short answer Each question carries **2 marks**.
- v. **Section C** – questions number **16 to 19** are short answer Each question carries **3 marks**.
- vi. **Section D** – questions number **20 to 21** 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.

A thin plastic rod is bent into a circular ring of radius R . It is uniformly charged with charge density λ . The magnitude of the electric field at its centre is:

[1 Marks]

(A) $\lambda/2\epsilon_0 R$

(B) $\lambda/4\epsilon_0 R$

(C) Zero

(D) $\lambda/4\pi\epsilon_0 R$

Question 2.

A loop carrying a current I clockwise is placed in x - y plane, in a uniform magnetic field directed along z -axis. The tendency of the loop will be to:

[1 Marks]

(A) move along y -axis

(B) shrink

(C) expand

(D) move along x -axis

Question 3.

A galvanometer of resistance G ohm is converted into an ammeter of range 0 to I A. If the current through the galvanometer is 0.1% of I A, the resistance of the ammeter is :

[1 Marks]

(A) $G/999\Omega$

(B) $G/1000\Omega$

(C) $G/100.1\Omega$

(D) $G/1001\Omega$

Question 4.

The reactance of a capacitor of capacitance C connected to an ac source of frequency ω is ' X '. If the capacitance of the capacitor is doubled and the frequency of the source is tripled, the reactance will become :

[1 Marks]

(A) $X/6$

(B) $2/3X$

(C) $6X$

(D) $3/2X$

Question 5.

Ge is doped with As. Due to doping,

[1 Marks]

(A) the structure of Ge lattice is distorted.

(B) the number of conduction electrons decreases.

(C) the number of conduction electrons increases.

(D) the number of holes increases.

Question 6.

Two beams, A and B whose photon energies are 3.3 eV and 11.3 eV respectively, illuminate a metallic surface (work function 2.3 eV) successively. The ratio of maximum speed of electrons emitted due to beam A to that due to beam B is :

[1 Marks]

(A) 3

(B) $1/3$

(C) $1/9$

(D) 9

Question 7.

The waves associated with a moving electron and a moving proton have the same wavelength . It implies that they have the same

[1 Marks]

(A) momentum

(B) angular momentum

(C) speed

(D) energy

Question 8.

Assertion (A) : In photoelectric effect, the kinetic energy of the emitted photoelectrons increases with increase in the intensity of the incident light.

Reason (R) : Photoelectric current depends on the wavelength of the incident light.

[1 Marks]

(A) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).

(B) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

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

(D) Assertion (A) is false and Reason (R) is also false.

(E) Assertion (A) is false and Reason (R) is true..

Question 9.

Assertion (A) : The mutual inductance between two coils is maximum when the coils are wound on each other.

Reason (R) : The flux linkage between two coils is maximum when they are wound on each other.

[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) : Two long parallel wires, freely suspended and connected in series to a battery, move apart.

Reason (R) : Two wires carrying current in opposite directions repel each other.

[1 Marks]

(A) Assertion (A) is false and Reason (R) is also false.

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

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

(D) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

Question 11.

Assertion (A) : Plane and convex mirrors cannot produce real images under any circumstance.

Reason (R) : A virtual image cannot serve as an object to produce a real image.

[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 true, but Reason (R) is false.

(C) Assertion (A) is false and Reason (R) is also false.

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

Section B

Question 12.

Monochromatic light of frequency 5.0×10^{14} Hz passes from air into a medium of refractive index 1.5. Find the wavelength of the light (i) reflected and (ii) refracted at the interface of the two media.

[2 Marks]

Question 13.

An object is placed 30 cm in front of a concave mirror of radius of curvature 40 cm. Find the

(i) position of the image formed and

(ii) magnification of the image.

[2 Marks]

Question 14.

Plot a graph showing the variation of current with voltage for the material GaAs. On the graph, mark the region where :

- a) resistance is negative, and
- b) Ohm's law is obeyed.

[2 Marks]

Question 15.

A plano-convex lens of focal length 16 cm is made of a material of refractive index 1.4. Calculate the radius of the curved surface of the lens.

[2 Marks]

Section C

Question 16.

- a) The wavelength of the electromagnetic wave is often correlated with the characteristic size of the system that radiates. Give two examples to justify this statement.
- b) (i) Long distance radio broadcasts use short-wave bands. Why ?
- (ii) Optical and radio telescopes are built on the ground, but X-ray astronomy is possible only from satellites orbiting the Earth. Why ?

[3 Marks]

Question 17.

Write the drawbacks of Rutherford's atomic model. How did Bohr remove them? Show that different orbits in Bohr's atom are not equally spaced.

[3 Marks]

Question 18.

- (a) State any two properties of a nucleus.
- (b) Why is the density of a nucleus much more than that of an atom ?

(c) Show that the density of the nuclear matter is the same for all nuclei.

[3 Marks]

Question 19.

What is a Wheatstone bridge ? Obtain the necessary conditions under which the Wheatstone bridge is balanced.

[3 Marks]

Section D

Question 20.

(i) Draw a labelled diagram of a step-up transformer and describe its working principle. Explain any three causes for energy losses in a real transformer.

(ii) A step-up transformer converts a low voltage into high voltage. Does it violate the principle of conservation of energy ? Explain.

(iii) A step-up transformer has 200 and 3000 turns in its primary and secondary coils respectively. The input voltage given to the primary coil is 90 V. Calculate :

- The output voltage across the secondary coil
- The current in the primary coil if the current in the secondary coil is 2.0 A.

[5 Marks]

Question 21.

(i) State Huygens' principle. A plane wave is incident at an angle i on a reflecting surface. Construct the corresponding reflected wavefront. Using this diagram, prove that the angle of reflection is equal to the angle of incidence.

(ii) What are the coherent sources of light ? Can two independent sodium lamps act like coherent sources ? Explain.

(iii) A beam of light consisting of a known wavelength 520 nm and an unknown wavelength λ , used in Young's double slit experiment produces two interference patterns such that the fourth bright fringe of unknown wavelength coincides with the fifth bright fringe of known wavelength. Find the value of λ .

[5 Marks]
