

CBSE EXAMINATION PAPER-2024

PHYSICS

(Solved)

Time allowed : 3 hours

Maximum Marks : 40

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 12** are multiple choice questions Each question carries **1 marks**.
- iv. **Section B** – questions number **13 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.

Electrons drift with speed v_d in a conductor with potential difference V across its ends. If V is reduced to $V/2$, their drift speed will become:

[1 Marks]

(A) $2v_d$

(B) v_d

(C) $4v_d$

(D) $v_d/2$

Question 2.

A wire of length 4.4 m is bent around in the shape of a circular loop and carries a current of 1.0 A. The magnetic moment of the loop will be:

[1 Marks]

(A) 3.5 Am^2

(B) 0.7 Am^2

(C) 1.54 Am^2

(D) 2.10 Am^2

Question 3.

Which of the following quantity/quantities remains same in primary and secondary coils of an ideal transformer?

Current, Voltage, Power, Magnetic flux

[1 Marks]

(A) Current only

(B) Power only

(C) Magnetic flux and Power both

(D) Voltage only

Question 4.

A resistor and an ideal inductor are connected in series to a $100\sqrt{2} \text{ V}$, 50 Hz ac source. When a voltmeter is connected across the resistor or the inductor, it shows the same reading. The reading of the voltmeter is:

[1 Marks]

(A) $50\sqrt{2} \text{ V}$

(B) 50 V

(C) $100\sqrt{2}$ V

(D) 100 V

Question 5. Electromagnetic waves with wavelength 10 nm are called:

[1 Marks]

(A) Infrared waves

(B) Ultraviolet rays

(C) Gamma rays

(D) X-rays

Question 6. The work function for a photosensitive surface is 3.315 eV. The cut-off wavelength for photoemission of electrons from this surface is:

[1 Marks]

(A) 150 nm

(B) 200 nm

(C) 500 nm

(D) 375 nm

Question 7.

An alpha particle approaches a gold nucleus in the Geiger-Marsden experiment with kinetic energy K . It momentarily stops at a distance d from the nucleus and reverses its direction. Then d is proportional to:

[1 Marks]

(A) $1/K^{1/2}$

(B) K

(C) $K^{1/2}$

(D) $1/K$

Question 8. An n-type semiconducting Si is obtained by doping intrinsic Si with:

[1 Marks]

(A) B

(B) In

(C) P

(D) Al

Question 9. When a p-n junction diode is subjected to reverse biasing:

[1 Marks]

(A) the barrier height decreases and the depletion region widens.

(B) the barrier height increases and the depletion region widens.

(C) the barrier height decreases and the depletion region shrinks.

(D) the barrier height increases and the depletion region shrinks.

Question 10.

Assertion (A): Photoelectric current increases with an increase in intensity of incident radiation, for a given frequency of incident radiation and the accelerating potential.

Reason (R): Increase in the intensity of incident radiation results in an increase in the number of photoelectrons emitted per second and hence an increase in the photocurrent.

[1 Marks]

(A) Both Assertion (A) and Reason (R) are false.

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

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

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

Question 11.

Assertion (A): Lenz's law is a consequence of the law of conservation of energy.

Reason (R): There is no power loss in an ideal inductor.

[1 Marks]

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct

explanation of the Assertion (A).

(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 false.

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

Question 12.

Assertion (A): The magnifying power of a compound microscope is negative.

Reason (R): The final image formed is erect with respect to the object.

[1 Marks]

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

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

Section B

Question 13. A convex lens ($n = 1.52$) has a focal length of 15.0 cm in air. Find its focal length when it is immersed in liquid of refractive index 1.65. What will be the nature of the lens?

[2 Marks]

Question 14. How does the energy gap of an intrinsic semiconductor effectively change when doped with a (a) trivalent impurity, and (b) pentavalent impurity? Justify your answer in each case.

[2 Marks]

Question 15.

What is the effect on the interference pattern in Young's double-slit experiment when (i) the source slit is moved closer to the plane of the slits, and (ii) the separation between the two slits is increased? Justify your answers.

[2 Marks]

Section C

Question 16. The figure shows a circuit with three ideal batteries. Find the magnitude and direction of currents in the branches AG, BF and CD.

[3 Marks]

Question 17.

Two long, straight, parallel conductors carry steady currents in opposite directions. Explain the nature of the force of interaction between them. Obtain an expression for the magnitude of the force between the two conductors. Hence define one ampere.

[3 Marks]

Question 18.

The de Broglie wavelength λ as a function of $1/\sqrt{K}$, for two particles of masses m_1 and m_2 are shown in the figure. Here, K is the energy of the moving particles.

- (a) What does the slope of a line represent ?
- (b) Which of the two particles is heavier ?
- (c) Is this graph also valid for a photon ?

Justify your answer in each case.

[3 Marks]

Question 19. With the help of a circuit diagram, explain the working of a p-n junction diode as a full wave rectifier. Draw its input and output waveforms.

[3 Marks]

Section D

Question 20.

- (i) Give any two differences between the interference pattern obtained in Young's double-slit experiment and a diffraction pattern due to a single slit.
- (ii) Draw an intensity distribution graph in case of a double-slit interference pattern.
- (iii) In Young's double-slit experiment using monochromatic light of wavelength λ , the intensity of light at a point on the screen, where path difference is λ , is K units. Find the

intensity of light at a point on the screen where the path difference is $\lambda/6$.

[5 Marks]

Question 21.

(i) Draw a labelled ray diagram of a compound microscope showing image formation at least distance of distinct vision. Derive an expression for its magnifying power.

(ii) A telescope consists of two lenses of focal length 100 cm and 5 cm. Find the magnifying power when the final image is formed at infinity.

[5 Marks]

Prepzy