CBSE EXAMINATION PAPER-2024

PHYSICS

(Solved)

Time allowed : 3 hours | Maximum Marks : 39

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 20** are short answer Each question carries **3 marks.**

vi. **Section D** – questions number **21 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 1.

A battery supplies 0.9 A current through a 2 Ω resistor and 0.3 A current through a 7 Ω resistor when connected one by one. The internal resistance of the battery is:

[1 Marks]

(A) 2 Ω

(B) 1 Ω

(C) 0.5 Ω

(D) 1.2 Ω

Question 2.

A particle of mass m and charge q describes a circular path of radius R in a magnetic field. If its mass and charge were 2m and q/2 respectively, the radius of its path would be:

[1 Marks]

(A) 4R

(B) 2R

(C) R/2

(D) R/4

Question 3. Which of the following pairs is that of paramagnetic materials?

[1 Marks]

(A) Sodium and Calcium

(B) Copper and Aluminium

(C) Nickel and Cobalt

(D) Lead and Iron

Question 4.

A galvanometer of resistance 50 Ω is converted into a voltmeter of range (0 - 2V) using a resistor of 1.0 kΩ. If it is to be converted into a voltmeter of range (0 - 10 V), the resistance required will be:

[1 Marks]

(A) 5.4 kΩ

(B) 4.8 kΩ

(C) 5.2 kΩ

(D) 5.0 kΩ

Question 5. The electromagnetic waves used to purify water are:

[1 Marks]

(A) Infrared rays

(B) Ultraviolet rays

(C) X-rays

(D) Gamma rays

Question 6.

The energy of an electron in the ground state of hydrogen atom is —13.6 eV. The kinetic and potential energy of the electron in the first excited state will be

[1 Marks]

(A) -13.6 eV, 27.2 eV

(B) -6.8 eV, 13.6 eV

(C) 6.8 eV, —3.4 eV

(D) 3.4 eV, -6.8 eV

Question 7.

The potential energy between two nucleons inside a nucleus is minimum at a distance of about

[1 Marks]

(A) 2.8 fm

(B) 1.6 fm

(C) 0.8 fm

(D) 2.0 fm

Question 8.

Assertion (A) : Equal amount of positive and negative charges are distributed uniformly on two halves of a thin circular ring as shown in figure. The resultant electric field at the centre O of the ring is along OC.

Reason (R) : It is so because the net potential at O is not zero.

[1 Marks]

(A) If both Assertion (A) and Reason (R) are true and Reason (R) is correct explanation of Assertion (A)

(B) If both Assertion (A) and Reason (R) are true and Reason (R) is not the correct explanation of Assertion (A).

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

(D) If both Assertion (A) and Reason (R) are false.

Question 9.

Assertion (A) : The energy of a charged particle moving in a magnetic field does not change.

Reason (R) : It is because the work done by the magnetic force on the charge moving in a magnetic field is zero.

[1 Marks]

(A) If both Assertion (A) and Reason (R) are true and Reason (R) is correct explanation of Assertion (A).

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

(C) If both Assertion (A) and Reason (R) are true and Reason (R) is not the correct explanation of Assertion (A).

(D) If both Assertion (A) and Reason (R) are false.

Question 10.

Assertion (A) : In a Young's double-slit experiment, interference pattern is not observed when two coherent sources are infinitely close to each other.

Reason (R) : The fringe width is proportional to the separation between the two sources.

[1 Marks]

(A) If both Assertion (A) and Reason (R) are true and Reason (R) is correct explanation of Assertion (A).

(B) If both Assertion (A) and Reason (R) are true and Reason (R) is not the correct explanation of Assertion (A).

(C) If both Assertion (A) and Reason (R) are false.

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

Question 11.

Assertion (A) : An alpha particle is moving towards a gold nucleus. The impact parameter is maximum for the scattering angle of 180°.

Reason (R) =: The impact parameter in an alpha particle scattering experiment does not depend upon the atomic number of the target nucleus.

[1 Marks]

(A) If both Assertion (A) and Reason (R) are true and Reason (R) is not the correct explanation of Assertion (A).

(B) If both Assertion (A) and Reason (R) are true and Reason (R) is correct explanation of Assertion (A).

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

(D) If both Assertion (A) and Reason (R) are false.

Section B

Question 12.

a) Four point charges of 1 μC, -2 μC, 1 μC, and 2 μC are placed at the corners A, B, C, and D respectively, of a square of side 30 cm. Find the net force acting on a charge of 4 μC placed at the centre of the square.

[2 Marks]

Question 13. A telescope has an objective lens of focal length 150 cm and an eyepiece of focal length 5 cm. Calculate its magnifying power in normal adjustment and the distance of the image formed by the objective.

[2 Marks]

Question 14.

a) Two energy levels of an electron in a hydrogen atom are separated by 2.55 eV. Find the wavelength of radiation emitted when the electron makes transition from the higher energy level to the lower energy level.

b) In which series of hydrogen spectrum this line shall fall?

[2 Marks]

Question 15. The earth revolves around the sun in an orbit of radius 1.5×10^{11} m with orbital speed 30 km/s. Find the quantum number that characterizes its revolution using Bohr's model in this case (mass of earth = 6.0×10^{24} kg).

[2 Marks]

Section C

Question 16.

a) Write Einstein's photoelectric equation. How did Millikan prove the validity of this equation?

b) Explain the existence of threshold frequency of incident radiation for photoelectric emission from a given surface.

[3 Marks]

Question 17.

a) (i) State Lenz's Law. In a closed circuit, the induced current opposes the change in magnetic flux that produced it as per the law of conservation of energy. Justify.

(ii) A metal rod of length 2 m is rotated with a frequency of 60 rev/s about an axis passing through its centre and perpendicular to its length. A uniform magnetic field of 2 T perpendicular to its plane of rotation is switched on in the region. Calculate the emf induced between the centre and the end of the rod.

[3 Marks]

Question 18.

a) Name the parts of the electromagnetic spectrum which are (i) also known as 'heat waves' and (ii) absorbed by the ozone layer in the atmosphere.

b) Write briefly one method each, of the production and detection of these radiations.

[3 Marks]

Question 19.

a) Explain the characteristics of a pn junction diode that makes it suitable for its use as a rectifier.

b) With the help of a circuit diagram, explain the working of a full wave rectifier.

[3 Marks]

Question 20.

Explain the following, giving reasons:

a) A doped semiconductor is electrically neutral.

b) In a p-n junction under equilibrium, there is no net current.

c) In a diode, the reverse current is practically not dependent on the applied voltage.

[3 Marks]

Section D

Question 21.

(a) (i) You are given three circuit elements X, Y and Z. They are connected one by one across a given ac source. It is found that V and I are in phase for element X. V leads I by (π/4) for element Y while I leads V by (π/4) for element Z. Identify elements X, Y and Z.

(ii) Establish the expression for impedance of circuit when elements X, Y and Z are connected in series to an ac source. Show the variation of current in the circuit with the frequency of the applied ac source.

(iii) In a series LCR circuit, obtain the conditions under which (i) impedance is minimum and (ii) wattless current flows in the circuit.

[5 Marks]