

# CBSE Sample Paper 15

## Class XII Exam 2022-23

### Physics

Time: 3 Hours

Max. Marks: 70

#### General Instructions:

1. There are 35 questions in all. All questions are compulsory.
2. This question paper has five sections: Section A, Section B, Section C, Section D and Section E. All the sections are compulsory.
3. Section A contains eighteen MCQ of 1 mark each, Section B contains seven questions of two marks each, Section C contains five questions of three marks each, section D contains three long questions of five marks each and Section E contains two case study based questions of 4 marks each.
4. There is no overall choice. However, an internal choice has been provided in section B, C, D and E. You have to attempt only one of the choices in such questions.
5. Use of calculators is not allowed.

### SECTION-A

- 1.** Two charged spheres separated by a distance  $d$  exert some force  $F$  on each other. If they are immersed in a liquid of dielectric constant 4, then what is the force exerted, if all other conditions are same?  
(a)  $2F$  (b)  $4F$  (c)  $\frac{F}{2}$  (d)  $\frac{F}{4}$
- 2.** The electrostatic energy stored in a capacitor is  
(a)  $\frac{1}{2}QV$  (b)  $\frac{1}{QV}$  (c)  $\frac{2}{QV}$  (d)  $QV$
- 3.** If the length of a conductor is halved, then its conductance will be  
(a) halved (b) doubled (c) quadrupled (d) unchanged
- 4.** A proton is moving in a space with constant velocity in an electric field  $E$  and magnetic field  $B$ . The angle between electric field and magnetic field should be  
(a)  $0^\circ$  (b)  $30^\circ$  (c)  $45^\circ$  (d)  $90^\circ$
- 5.** At the magnetic poles of the earth, a compass needle will be  
(a) vertical (b) horizontal  
(c) inclined at  $10^\circ$  with the vertical (d) inclined at  $45^\circ$  with the horizontal
- 6.** In a  $p-n$  junction diode, the holes are due to  
(a) protons (b) neutrons (c) extra electrons (d) missing of electrons
- 7.** The electrical resistance of a healthy man is  
(a)  $50,000 \Omega$  (b)  $10,000 \Omega$  (c)  $1,000 \Omega$  (d)  $10 \Omega$

8. Two coils are placed close to each other. The mutual inductance of the pair of coils depends upon

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- (a) currents in the coils
- (b) materials of the wires of the coils
- (c) relative position and orientation of the coils
- (d) rates at which the currents are changing in the coils

9. Reactance of a capacitor of capacitance  $C$  for an alternating current of frequency  $\frac{400}{\pi}$  Hz is  $25 \Omega$ . The value of  $C$  is

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- (a)  $25 \mu\text{F}$
- (b)  $50 \mu\text{F}$
- (c)  $75 \mu\text{F}$
- (d)  $100 \mu\text{F}$

10. Which of the following electromagnetic waves have the smallest wavelength?

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- (a)  $\gamma$ -rays
- (b) X-rays
- (c) UV waves
- (d) infra-red rays

11. When two converging lenses of same focal  $f$  are placed in contact, the focal length of the combination is

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- (a)  $f$
- (b)  $2f$
- (c)  $\frac{f}{2}$
- (d)  $3f$

12. The ratio of no. of turns of primary coil to secondary coil in a transformer is 2:3. If a cell of 6 V is connected across the primary coil, then voltage across the secondary coil will be

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- (a) 3 V
- (b) 6 V
- (c) 9 V
- (d) 12 V

13. Mass of a photon of frequency  $\nu$  is given by

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- (a)  $m = \frac{h}{\lambda}$
- (b)  $m = \frac{h\nu}{c}$
- (c)  $m = \frac{h\nu}{c^2}$
- (d)  $m = \frac{h\nu}{c}$

14. In some substances, charge can flow at ordinary temperature, but not at very low temperatures. These substances are called

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- (a) conductors
- (b) insulators
- (c) dielectrics
- (d) semiconductors

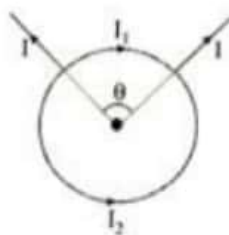
15. The energy produced in the sun is due to

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- (a) fission reaction
- (b) fusion reaction
- (c) chemical reaction
- (d) motion of electrons and ions

16. **Assertion :** The magnetic field at the centre of the circular coil in the following figure due to the currents  $I_1$  and  $I_2$  is zero.

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**Reason :**  $I_1 = I_2$  implies that the fields due to the current  $I_1$  and  $I_2$  will be balanced.

- (a) Both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.
- (c) Assertion is correct but Reason is incorrect.
- (d) Assertion is incorrect but Reason is correct.

17. **Assertion :** The ferromagnetic substance do not obey Curie's law.

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**Reason :** At Curie point a ferromagnetic substance start behaving as a paramagnetic substance.

- (a) Both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.
- (c) Assertion is correct but Reason is incorrect.
- (d) Assertion is incorrect but Reason is correct.

18. **Assertion :** Long distance power transmission is done at high voltage.

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**Reason :** At high voltage supply power losses are less.

- (a) Both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
- (b) Both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.
- (c) Assertion is correct but Reason is incorrect.
- (d) Assertion is incorrect but Reason is correct.

## SECTION-B

19. Write the expression, in a vector form, for the Lorentz magnetic force  $\vec{F}$  due to a charge moving with velocity  $\vec{v}$  in a magnetic field  $\vec{B}$ . What is the direction of the magnetic force ?

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20. Why cannot two magnetic lines of forces due to a bar magnet cross each other?

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21. Find the wavelength of electromagnetic waves of frequency  $6 \times 10^{12}$  Hz in free space. Give its two applications.

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**OR**

Define intensity of an electromagnetic wave..

22. The focal length of a equiconvex lens is equal to the radius of curvature of either face. What is the value of refractive index of the material of the lens ?

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23. Light from two coherent sources is reaching the screen. If the path difference at a point on the screen for the yellow light be  $\frac{3\lambda}{2}$ , then what will be the colour of the fringe at that point?

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**OR**

What will be the effect of interference fringes if red light is replaced by blue light ?

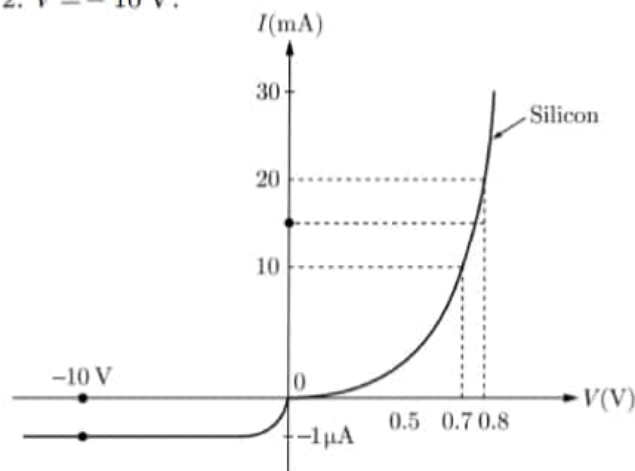
24. Atomic radius of first orbit of hydrogen atom is  $0.53 \text{ \AA}$ . What is the radius of its fifth orbit?

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25. The  $V-I$  characteristic of a silicon diode is as shown in the figure. Calculate the resistance of the diode at

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1.  $I = 15 \text{ mA}$ ,
2.  $V = -10 \text{ V}$ .



## SECTION-C

26. What is polarization of charge? With the help of a diagram show why the electric field between the plates of capacitor reduces on introducing a dielectric slab. Define the dielectric constant on the basis of these fields.

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27. When an ideal capacitor is charged AC by a DC battery, no current flows. However, when an AC source is used, the current flows continuously. How does one explain this, based on the concept of displacement current?

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28. How does a combination of lenses affect the size, position and nature of the image?

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**OR**

Use mirror equation to show that convex mirror always produces a virtual image independent of the location of the object.

29. State the important properties of neutrons.

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**OR**

Answer the following:

1. Why is the binding energy per nucleon found to be constant for nuclei in the range of mass number  $A$  lying between 30 and 170?
2. When a heavy nucleus with mass number  $A = 240$  breaks into two nuclei,  $A = 120$ , energy is released in the process.

30. Draw the circuit diagram of a full-wave rectifier using  $p-n$  junction diode. Explain its working and show the output input waveforms.

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## SECTION-D

**31.** 1. State Gauss theorem.

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2. Apply this to obtain the expression for the electric field intensity at a point due to an infinitely long, thin, uniformly charged straight wire.

**OR**

Two spherical conductors of radii 4 cm and 5 cm are charged to the same potential. If  $\sigma_1$  and  $\sigma_2$  be the respective values of the surface density of charge on both the conductors, What is the ratio of  $\frac{\sigma_1}{\sigma_2}$  ?

**32.** Two long straight parallel conductors carrying steady currents  $I_1$  and  $I_2$  are separated by a distance  $r$ . Explain briefly, with the help of a suitable diagram, how the magnetic field due to one conductor acts on the other. Hence deduce the expression for the force acting between the two conductors. Mention the nature of the force.

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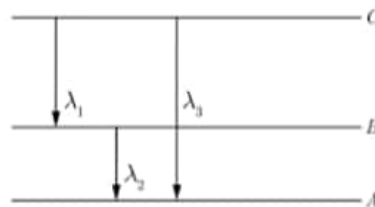
**OR**

1. Explain principle and working of a moving coil galvanometer. Derive an expression for current sensitivity.
2. Compare between moving coil galvanometer and moving magnet galvanometer.

**33.** 1. State Bohr's quantization condition for defining stationary orbits. How does the Broglie hypothesis, explain the stationary orbits?

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2. Find the relation between the three wavelengths  $\lambda_1$ ,  $\lambda_2$  and  $\lambda_3$  from the energy level diagram shown below.



**OR**

1. The radius of the innermost electron orbit of a hydrogen atom is  $5.3 \times 10^{-11}$  m. Calculate its radius in  $n = 3$  orbit.
2. The total energy of an electron in the first excited state of the hydrogen atom, is  $-3.4$  eV. Find out its (a) kinetic energy and (b) potential energy in this state.

## SECTION-E

**34.** An astronomical telescope is an optical instrument which is used for observing distinct images of heavenly bodies like stars, planets etc. It consists of two lenses. In normal adjustment of telescope, the final image is formed at infinity. Magnifying power of an astronomical telescope in normal adjustment is defined as the ratio of the angle subtended at the eye by the angle

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subtended at the eye by the final image to the angle subtended at the eye, by the object directly, when the final image and the object both lie at infinite distance from the eye. It is given by,  $m = \frac{f_o}{f_e}$ . To increase magnifying power of an astronomical telescope in normal adjustment, focal length of objective lens should be large and focal length of eye lens should be small.

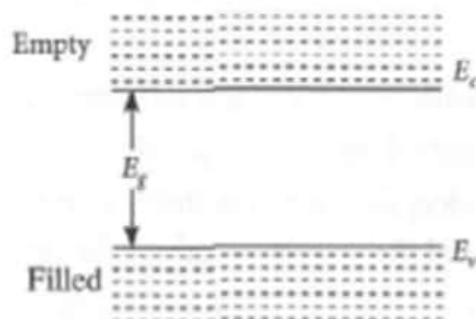
- (i) What is the condition for the focal lengths of objective lens and eye-piece, for large magnifying power of astronomical telescope.
- (ii) An astronomical telescope of magnifying power 7 consists of the two thin lenses 40 cm apart, in normal adjustment. Find the focal lengths of the lenses.
- (iii) An astronomical telescope has a magnifying power of 10. In normal adjustment, distance between the objective and eye piece is 22 cm. Find the focal length of objective lens.

**OR**

- (iv) A telescope has large diameter of the objective. Then its resolving power is high or low? Explain.

- 35.** From Bohr atomic model, we know that the electrons have well defined energy levels in an isolated atom. But due to interatomic interactions in a crystal, the electrons of the outer shells are forced to have energies different from those in isolated atoms. Each energy level splits into a number of energy levels forming a continuous band. The gap between top of valence band and bottom of the conduction band in which no allowed energy levels for electrons can exist is called energy gap.

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- (i) What is the value of energy band gap in an insulator?
- (ii) What is the order of separation between conduction and valence band in a semiconductor.
- (iii) Carbon, silicon and germanium have four valence electrons each. At room temperature what about the number of free electrons for conduction in all three

**OR**

- (iv) According to band theory, conductors, insulators and semiconductors, which among of them has smallest forbidden gap?

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