



# Aakash

+ BYJU'S

## Mock Test Paper

for

## CBSE Board Exam.-2024

# PHYSICS

### INSTRUCTIONS FOR CANDIDATES

1. All questions are compulsory.
2. The question paper has five sections and 33 questions. All questions are compulsory.
3. **Section–A** has 16 questions of 1 mark each; **Section–B** has 5 questions of 2 marks each;  
**Section–C** has 7 questions of 3 marks each; **Section–D** has 2 case-based questions of 4 marks each; and  
**Section–E** has 3 questions of 5 marks each.
4. There is no overall choice. However, internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.
5. Wherever necessary, neat and properly labelled diagrams should be drawn.

MM : 70

Time : 180 min.

# Mock Test Paper

## CBSE Board Exam.-2024

### Class-XII

### PHYSICS

Complete Syllabus of Class XII

#### SECTION-A

**Directions (Q1 – Q12).** Select the most appropriate option from those given below for each question.

1. Electric field intensity at the centre of a uniformly charged circular ring of radius  $R$  and linear charge density  $\lambda$  is [1]

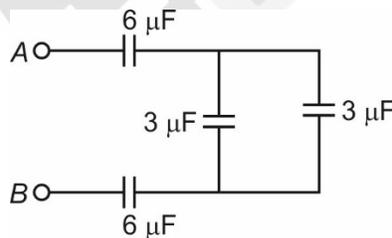
(1)  $\frac{\lambda}{\pi\epsilon_0 R}$

(2) Zero

(3)  $\frac{2\lambda}{\pi\epsilon_0 R}$

(4)  $\frac{\lambda}{4\pi\epsilon_0 R}$

2. The effective capacitance between the points  $A$  and  $B$  as shown in figure is [1]



(1)  $6\ \mu\text{F}$

(2)  $2\ \mu\text{F}$

(3)  $3\ \mu\text{F}$

(4)  $4\ \mu\text{F}$

3. A current carrying coil is subjected to a uniform magnetic field. The coil will orient itself so that its plane becomes [1]

(1) Inclined to  $45^\circ$  to magnetic field

(2) Inclined at any arbitrary angle to the magnetic field

(3) Parallel to the magnetic field

(4) Perpendicular to magnetic field

4. An LCR series circuit is connected to a source of alternating current. At resonance, the applied voltage and current flowing through the circuit will have phase difference of [1]
- (1)  $\frac{\pi}{2}$  (2)  $\pi$   
(3)  $\frac{\pi}{4}$  (4) Zero
5. According to Maxwell's hypothesis, a changing electric field gives rise to [1]
- (1) An emf (2) Conduction current  
(3) Magnetic field (4) Pressure radiant
6. In Young's double slit experiment, minimum is obtained when the phase difference between superimposing waves is (where  $n = 1, 2, 3$ ) [1]
- (1) Zero (2)  $(2n - 1)\pi$   
(3)  $n\pi$  (4)  $(n + 1)\pi$
7. An object is placed at a distance  $2f$  from a convex lens. The image will be [1]
- (1) At one of the foci, virtual and double its size (2) At  $2f$ , real and inverted  
(3) At  $2f$ , virtual and erect (4) At  $f$ , real and inverted
8. Which of the following is not the property of the photons? [1]
- (1) Charge (2) Rest mass  
(3) Momentum (4) Both (1) and (2)
9. If  $R$  is the radius and  $A$  is the mass number of a nucleus, then  $\log R$  versus  $\log A$  graph will be [1]
- (1) A straight line (2) A circle  
(3) An ellipse (4) A parabola
10. Two point charges  $+2 \mu\text{C}$  and  $+6 \mu\text{C}$  repel each other with a force of 12 N. If a charge of  $-4 \mu\text{C}$  is given to each of them, the new force between them is [1]
- (1) 4 N (repulsive) (2) 4 N (attractive)  
(3) 12 N (repulsive) (4) 8 N (attractive)
11. If a positive charge is shifted from a low potential region to a high potential region, the electric potential energy will [1]
- (1) Increase (2) Decrease  
(3) Remain same (4) May increase or decrease
12. When light of wavelength  $4000 \text{ \AA}$  is incident on a photosensitive surface of work function 2.0 eV, the kinetic energy of fastest electron is [1]
- (1) 0.5 eV (2) 1.1 eV  
(3) 2.1 eV (4) 3.1 eV

**Question No. 13 to 16 consist of two** statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below.

- (1) Both (A) and (R) are true and (R) is the correct explanation of (A).  
 (2) Both (A) and (R) are true but (R) is not the correct explanation of (A).  
 (3) (A) is true but (R) is false.  
 (4) Both (A) and (R) are false.
13. **Assertion (A):** Electromagnetic waves can be deflected by magnetic or electric field. [1]  
**Reason (R):** Electromagnetic waves consist of charged particles.
14. **Assertion (A):** Faraday's law of electromagnetic induction is a consequence of conservation of energy. [1]  
**Reason (R):** In a purely resistive AC circuit, the current lags behind the emf in phase.
15. **Assertion (A):** A charge, whether stationary or in motion produces electric field around it. [1]  
**Reason (R):** Moving charge produces electric field as well as magnetic field in surrounding space.
16. **Assertion (A):** If a convex lens is kept in water its convergent power decreases. [1]  
**Reason (R):** Focal length of convex lens in water increases.

### SECTION-B

17. Using Rutherford's model of the atom, derive the expression for the total energy of the electron in hydrogen atom. What is the significance of total negative energy possessed by the electron? [2]
18. Distinguish between a metal and an insulator on the basis of energy band diagrams. [2]
19. Distinguish polar and non-polar dielectric. [2]
20. A lamp is connected in series with a capacitor. Predict your observations when the system is connected first across a dc and then an ac source. What happens in each case if the capacitance of the capacitor is reduced? [2]

OR

Given the resistances of  $1\ \Omega$ ,  $2\ \Omega$  and  $3\ \Omega$ , how will you combine them to get an equivalent resistance of

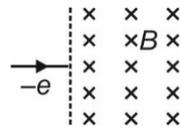
(a)  $\frac{11}{3}\ \Omega$  and (b)  $\frac{11}{5}\ \Omega$ ? [2]

21. Write the expression for the force  $\vec{F}$ , acting on a charged particle of charge ' $q$ ' moving with a velocity  $\vec{v}$  in the presence of both electric field  $\vec{E}$  and magnetic field  $\vec{B}$ . Obtain the condition under which the particle moves undeflected through the fields. [2]

### SECTION-C

22. (a) A cell of emf ' $E$ ' and internal resistance ' $r$ ' is connected across a variable load resistor  $R$ . Draw the plots of the terminal voltage  $V$  versus (i)  $R$  and (ii) the current  $I$ . [2]  
 (b) It is found that when  $R = 4\ \Omega$ , the current is  $1\ \text{A}$  and when  $R$  is increased to  $9\ \Omega$ , the current reduces to  $0.5\ \text{A}$ . Find the values of the emf  $E$  and internal resistance  $r$ . [1]
23. (a) How is the electric field due to a charged parallel plate capacitor affected when a dielectric slab is inserted between the plates fully occupying the intervening region? [1]  
 (b) A slab of material of dielectric constant  $K$  has the same area as the plates of a parallel plate capacitor but has thickness  $\frac{1}{2}d$ , where  $d$  is the separation between the plates. Find the expression for the capacitance when the slab is inserted between the plates. [2]

24. An electron moving horizontally with a velocity of  $4 \times 10^4$  m/s enters a region of uniform magnetic field of  $10^{-5}$  T acting vertically downward as shown in the figure. Draw its trajectory and find out the time it takes to come out of the region of magnetic field. [3]



OR

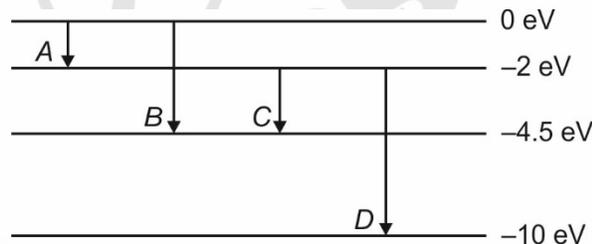
State Lenz's law. Using this law indicate the direction of the current in a closed loop when a bar magnet with north pole is brought close to it. Explain briefly how the direction of the current predicted wrongly results in the violation of the law of conservation of energy. [3]

25. How is a wavefront defined? Using Huygen's construction draw a figure showing the propagation of a plane wave refracting at a plane surface separating two media. Hence verify Snell's law of refraction. [3]
26. Draw  $V-I$  characteristics of a  $p-n$  junction diode. [1]

Answer the questions given below giving reasons.

Why is the current under reverse bias almost independent of the applied potential upto a critical voltage? [2]

27. Monochromatic light of wavelength 589 nm is incident from air on a water surface. If  $\mu$  for water is 1.33, find the wavelength, frequency and speed of the refracted light. [3]
28. (a) The energy levels of a hypothetical atom are shown below. Which of the shown transitions will result in the emission of a photon of wavelength 275 nm? [1]
- (b) Which of these transitions correspond to emission of radiation of (i) maximum and (ii) minimum wavelength?



[2]

## SECTION-D

29. Emf of a cell is the maximum potential difference between two electrodes of the cell when no current is drawn from the cell. Internal resistance is the resistance offered by the electrolyte of a cell when the electric current flows through it. The internal resistance of a cell depends upon the following factors;

- (i) distance between the electrodes
- (ii) nature and temperature of the electrolyte
- (iii) nature of electrodes
- (iv) area of electrodes.

For a freshly prepared cell, the value of internal resistance is generally low and goes on increasing as the cell is put to more and more use. The potential difference between the two electrodes of a cell in a closed circuit is called terminal potential difference and its value is always less than the emf of the cell in a closed circuit. It can be written as  $V = E - Jr$ .

- (i) The terminal potential difference of two electrodes of a cell is equal to emf of the cell when [1]
- (1)  $I \neq 0$
  - (2)  $I = 0$
  - (3) Both (1) and (2)
  - (4) Neither (1) nor (2)

(ii) A cell of emf  $E$  and internal resistance  $r$  gives a current of 0.5 A with an external resistance of  $12\Omega$  and a current of 0.25 A with an external resistance of  $25\Omega$ . What is the value of the internal resistance of the cell? [1]

- (1)  $5\Omega$  (2)  $1\Omega$   
(3)  $7\Omega$  (4)  $3\Omega$

(iii) Choose the wrong statement. [1]

- (1) Potential difference across the terminals of a cell in a closed circuit is always less than it.  
(2) Internal resistance of a cell decrease with the decrease in temperature of the electrolyte.  
(3) Potential difference versus current graph for a cell is a straight line with a -ve slope.  
(4) Terminal potential difference of the cell when it is being charged is given as  $V = E + Ir$ .

(iv) An external resistance  $R$  is connected to a cell of internal resistance  $r$ , the maximum current flows in the external resistance, when [1]

- (1)  $R = r$  (2)  $R < r$   
(3)  $R > r$  (4)  $R = Ir$

30. We delved into the principles of light propagation, reflection, and refraction. We particularly emphasized the law of reflection, which states that the angle of incidence equals the angle of reflection. Another significant topic we explored is Snell's law, or the law of refraction, which relates the angle of incidence and the angle of refraction to the ratio of the velocities of light in the two media. This law forms the basis for understanding phenomena such as the bending of light as it passes from one medium to another and the operation of optical instruments like lenses and prisms. The lens formula,  $1/f = 1/v - 1/u$ , is a critical tool for understanding image formation in convex and concave lenses.

i. What does the law of reflection state? [1]

- (1) The angle of incidence is half the angle of reflection.  
(2) The angle of incidence is twice the angle of reflection.  
(3) The angle of incidence equals the angle of reflection.  
(4) The angle of incidence is unrelated to the angle of reflection.

ii. What does Snell's law, or the law of refraction, relate to? [1]

- (1) The angle of incidence and the angle of reflection.  
(2) The angle of incidence and the angle of refraction.  
(3) The velocity of light and the angle of incidence.  
(4) The velocity of light and the angle of reflection.

iii. How does light behave when it passes from one medium to another? [1]

- (1) It accelerates.  
(2) It decelerates.  
(3) It may bends.  
(4) It does not change its path.

iv. Which formula is used for understanding image formation in lenses? [1]

- (1)  $1/f = 1/v + 1/u$   
(2)  $1/f = 1/v - 1/u$   
(3)  $f = v/u$   
(4)  $f = u/v$

## SECTION-E

31. (a) Draw a ray diagram showing image formation in a compound microscope. Define the term 'limit of resolution' and name the factors on which it depends. How is it related to resolving power of a microscope? [2]
- (b) Suggest two ways by which the resolving power of a microscope can be increased. [1]
- (c) 'A telescope resolves whereas a microscope magnifies'. Justify this statement. [2]

OR

How is the working of a telescope different from that of a microscope? [2]

The focal lengths of the objective and eyepiece of a microscope are 1.25 cm and 5 cm respectively. Find the position of the object relative to the objective in order to obtain an angular magnification of 30 in normal adjustment. [3]

32. Using Rydberg formula, calculate the wavelength of the spectral lines of the first member of the Lyman series and of the Balmer series. [5]

OR

Using Bohr's postulates, derive the expression for the total energy of the electron in the stationary states of the hydrogen atom. [5]

33. (a) Why cannot two independent monochromatic sources produce sustained interference pattern? [1]
- (b) Deduce, with the help of Young's arrangement to produce interference pattern, an expression for the fringe width. [4]

OR

Write, using Biot-Savart law, the expression for the magnetic field  $\vec{B}$  due to an element  $\vec{dl}$  carrying current  $I$  at a distance  $\vec{r}$  from it in a vector form. [5]

Hence derive the expression for the magnetic field due to current carrying loop of radius  $R$  at a point  $P$  distant  $x$  from its centre along the axis of the loop.

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# CBSE Class XII Board Exam Result 2023

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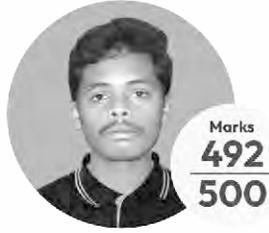
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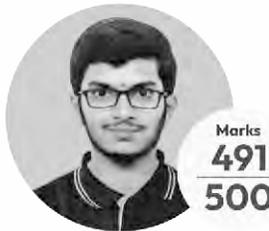
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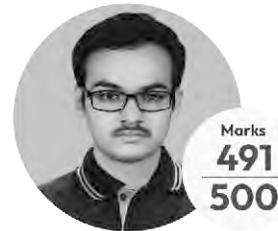
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