

CLASS: XI
MODEL QUESTION PAPER (HPBoSE) 2024-25
SUBJECT PHYSICS (THEORY)

MAXIMUM MARKS: 60

TIME ALLOWED:- 3HOURS

GENERAL INSTRUCTIONS:

- (1) There are 27 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.
- (3) All the sections are compulsory.
- (4) Section A contains twelve MCQ's and Assertion Reasoning based questions of 1 mark each, Section B contains four questions of two marks each, Section C contains seven questions of three marks each, Section D contains one case study based questions of four marks and Section E contains three long answer questions of five marks each.
- (5) There is no overall choice. However, an internal choice has been provided in one question in Section B, one question in Section C, one question in each CBQ in Section D and all three questions in Section E. You have to attempt only one of the choices in such questions.
- (6) Use of calculators is not allowed.

SECTION-A (MULTIPLE CHOICE QUESTIONS)

- 1. How many significant figures are in the number 0.00456?**
 - a) 2
 - b) 3
 - c) 4
 - d) 5
- 2. A car travels a distance of 150 m in 5 seconds. What is its average speed?**
 - a) 20 m/s
 - b) 30 m/s
 - c) 25 m/s
 - d) 15 m/s
- 3. The horizontal range of a projectile is maximum, when the angle of projection is:**
 - a) 30°
 - b) 45°
 - c) 60°
 - d) 90°
- 4. According to Newton's second law of motion, which of the following is correct?**
 - a) Force is equal to mass times velocity.
 - b) Force is equal to mass times acceleration.
 - c) Force is equal to mass times distance.
 - d) Force is equal to velocity divided by mass.
- 5. If a force of 10 N moves an object 5 m in the direction of the force, how much work is done?**
 - a) 10 J
 - b) 50 J
 - c) 5 J
 - d) 25 J
- 6. The specific heat capacity of water is approximately**
 - a) 1 J/kg·K

- b) 4.18 J/kg·K
c) 2 J/kg·K
d) 3.5 J/kg·K
7. According to the first law of thermodynamics, which of the following is correct?
a) Energy can be created.
b) Energy can be destroyed.
c) Energy can change forms but cannot be created or destroyed.
d) Energy is always lost.
8. In an ideal gas, the average kinetic energy of a gas molecule is directly proportional to
a) Pressure
b) Volume
c) Temperature
d) Density
9. The time period of a simple pendulum is independent of
a) Mass of the bob
b) Length of the pendulum
c) Acceleration due to gravity
d) Amplitude of oscillation
10. What is the distance between two consecutive crests or troughs in a wave called?
a) Amplitude
b) Wavelength
c) Frequency
d) Period
11. Assertion (A) : The speed of sound in air is affected by temperature.
Reason (R) : Sound travels faster in warmer air because molecules move more quickly at higher temperatures.
a) Both A and R are true, and R is the correct explanation for A.
b) Both A and R are true, but R is not the correct explanation for A.
c) A is true, but R is false.
d) A is false, but R is true.
12. Assertion(A) : The pressure in a fluid at rest increases with depth.
Reason (R) : The weight of the fluid above exerts pressure downward, causing an increase in pressure with depth.
a) Both A and R are true, and R is the correct explanation for A.
b) Both A and R are true, but R is not the correct explanation for A.
c) A is true, but R is false.
d) A is false, but R is true.

SECTION-B (VERY SHORT ANSWER QUESTIONS)

13. Using dimensional analysis, show that the following equation is dimensionally correct.

$$m = \frac{m_0}{\sqrt{\left(1 - \frac{v^2}{c^2}\right)}}$$

where m_0 is the rest mass of particle, v is the velocity of light in medium and c is the velocity of light in vacuum.

14. Define average velocity and how is it calculated?
15. State and explain Newton's Law of Universal Gravitation.
16. What is the difference between transverse and longitudinal waves?

SECTION-C SHORT ANSWER QUESTIONS

17. Can you associate vectors with (a) the length of the wire bent into a loop, (b) a plane area, (c) a sphere? Explain.
18. State the Work-Energy Theorem and derive its equation.
19. Explain the concept of gravitational potential energy. Derive the expression for the gravitational potential energy of a mass (m) at a height (h) above the Earth's surface.
20. Define Young's Modulus. Derive its expression and explain its significance.
21. Explain the concept of specific heat capacity. How does it differ for different materials? Provide an example.
22. Explain the First Law of Thermodynamics. How does it relate to internal energy?
23. What is Simple Harmonic Motion. Derive the expression for the time period of a mass-spring system.

SECTION-D CASE STUDY BASED QUESTION

24. Consider a system consisting of two blocks: Block A with a mass of 2 kg and Block B with a mass of 3 kg. Block A is positioned at the coordinate $X_A = 2m$ and Block B at $X_B = 5m$ along a straight line.
 - i) What is the position of the center of mass of the two-block system?
 - a) 3.0 m
 - b) 3.8 m
 - c) 4.0 m
 - d) 5.0 m
 - ii) If Block A is moved to $X_A = 4m$, what will happen to the center of mass?
 - a) It will decrease
 - b) It will increase
 - c) It will remain the same
 - d) It will become 5.0 m
 - iii) What is the total mass of the system?
 - a) 2 kg
 - b) 3 kg
 - c) 5 kg
 - d) 6 kg
 - iv) If Block B is moved to $X_B = 6m$, what is the new center of mass?
 - a) 3.6 m
 - b) 4.0 m
 - c) 4.4 m
 - d) 4.6 m

SECTION-E LONG ANSWER QUESTIONS

25. Explain Newton's First Law of Motion. Discuss its significance and provide examples to illustrate the concept of inertia. Additionally, describe how this law is related to the concept of a reference frame.

OR

Explain the concept of friction as it relates to Newton's Laws of Motion. Describe the different types of friction. Also, discuss how friction can be both beneficial and detrimental in various scenarios.

26. Explain the concept of pressure in fluids and derive the expression for pressure at a depth in a fluid.

OR

Define and explain the concept of buoyancy and Archimedes' Principle. Discuss its significance with examples.

27. Explain the Kinetic Theory of Gases and derive the expression for the pressure exerted by a gas on the walls of its container.

OR

- a) Using Kinetic Theory of Gases, derive the expression for the root mean square (RMS) speed of gas molecules.
- b) A sample of an ideal gas has a molar mass of 32 g/mol. Calculate the RMS speed of the gas at a temperature of 300 K.

Distribution of Marks & Blue Print

S.N.	Name of the Unit	1 Mark MCQ Questions	2 marks Questions	3 marks Questions	4 marks Questions	5 marks Questions	Total Marks	Marks Clubbing for Flexibility
1	Units and Measurements	1	1	-	-	-	3	3
2	Motion in a Straight line	1	1	-	-	-	3	7
3	Motion in a Plane	1	-	1	-	-	4	
4	Laws of Motion	1	-	-	-	1	6	10
5	Work, Energy and Power	1	-	1	-	-	4	
6	System of Particles and Rotational Motion	-	-	-	1	-	4	4
7	Gravitation	-	1	1	-	-	5	5
8	Mechanical Properties of Solids	-	-	1	-	-	3	13
9	Mechanical Properties of Fluids	1	-	-	-	1	6	
10	Thermal Properties of Matter	1	-	1	-	-	4	
11	Thermodynamics	1	-	1	-	-	4	10
12	Kinetic theory	1	-	-	-	1	6	
13	Oscillations	1	-	1	-	-	4	8
14	Waves	2	1	-	-	-	4	
		12	8	21	4	15	60	60