

**CLASS-XI**  
**SUB: PHYSICS (THEORY)**

**TIME ALLOWED: 3 HOURS**

**MM: 70**

**General Instructions:**

- (i) **All** questions are compulsory.
- (ii) There are **26** questions in total. Question Nos. **1 to 5** are very short answer type questions and carry one mark each.
- (iii) Question Nos. **6 to 10** carry two marks each, Question **11 to 22** carry three marks each and question **24 to 26** carry five marks each.
- (iv) There is no overall choice. However, an internal choice has been provided in **one** question of **two** marks; **one** question of **three** marks and all three questions of **five** marks each. You have to attempt only one of the choice in such questions.
- (v) Question No. **23** is value based question carries **four** marks.
- (vi) Use of calculators is **not** permitted. However, you may use log tables if necessary.

1. State the number of significant figures in  
(i)  $0.007\text{m}^2$  (ii)  $2.64 \times 10^{24} \text{ kg}$  1
2. When is the magnitude of  $\vec{A} + \vec{B}$  equal to the magnitude of  $\vec{A} - \vec{B}$ ? 1
3. Why does gun recoils when a bullet is being fired? 1
4. State Newton's law of Cooling. 1
5. How does rise in temperature effect (i) viscosity of gases (ii) viscosity of liquids. 1
6. Using dimensions convert 1 erg (cgs unit of energy) into joule. 2
7. A progressive wave is given by  $y(x,t) = 8 \cos (300t - 0.15x)$ . Where x in metre, y in cm and t in second. What is the 2  
(i) wavelength,  
(ii) frequency of the wave
8. Define gravitational potential. Give its S.I. unit. 2

9. An engine has been designed to work between source and sink at temperature  $177^{\circ}\text{C}$  and  $27^{\circ}\text{C}$  respectively. If energy input is  $3600\text{ J}$ . What is the work done by the engine? 2
10. Find the value of  $\gamma = C_p/C_v$  for diatomic gas. Where symbol have usual meaning **OR** 2
- State and explain the law of equipartition of energy for monatomic gases.
11. From a uniform disc of radius  $R$ , a circular disc of radius  $R/2$  is cut out. The centre of the hole is at  $R/2$  from the centre of original disc. Locate the centre of gravity of the resultant flat body. 3
12. A body of mass  $2\text{ kg}$  initially at rest moves under the action of an applied horizontal force of  $7\text{ N}$  on a table with coefficient of kinetic friction  $= 0.1$ . Compute the 3
- (a) work done by the applied force in  $10\text{ s}$ ,
- (b) work done by friction in  $10\text{ s}$ ,
- (c) work done by the net force on the body in  $10\text{ s}$ .
13. State first law of thermodynamics. On its basis establish the relation between two molar specific heats for a gas. 3
14. Derive the following equations of motion for an object moving with constant acceleration along a straight line using graphical method . 3
- (i)  $S = u t + \frac{1}{2} a t^2$
- (ii)  $v^2 = u^2 + 2as$  ,
- Where symbols have usual meanings.
15. A player throws a ball upwards with an initial speed of  $29.4\text{ ms}^{-1}$ . 3
- (i) What is the direction of acceleration during the upward motion of the ball?
- (ii) What are the velocity and acceleration of the ball at the highest point of its motion?
- (iii) To what height does the ball rise?
16. Write S.I. unit of torque and angular momentum. Also deduce the relation between angular momentum and torque. 3

17. Define escape velocity. Obtain an expression for escape velocity of a body from the surface of the earth? 3

**OR**

Derive expression for the orbital velocity of a satellite and its time period. 3

18. A liquid is in streamlined flow through a tube of non-uniform cross-section. Prove that sum of its kinetic energy, pressure energy and potential energy per unit volume remains constant. 3

19. Show that for small oscillations the motion of a simple pendulum is simple harmonic. Derive an expression for its time period. 3

20. State and Prove Work- Energy Theorem. 3

21. Read each statement below carefully and state with reasons and examples, if it is true or false ;

A particle in one-dimensional motion 3

(a) with zero speed at an instant may have non-zero acceleration at that instant,

(b) with zero speed may have non-zero velocity,

(c) with constant speed must have zero acceleration.

22. Derive the expression for pressure exerted by an ideal gas using kinetic theory of gases. 3

23. Amar went to Big Bazaar to purchase certain goods .There he noticed an old lady struggling with her shopping. Immediately he showed her the lift and explained to her how it carries the load from one floor to the next. Even then the Old lady was not convinced. Then Amar took her in the lift and showed her how to operate it. The old lady was very happy.

a) What values does Amar possess? 4

b)A man of mass 80 kg stands on a weighing machine in a lift which is moving

(i) upwards with uniform speed of 5 m/s.

(ii) downwards with a uniform acceleration of  $5 \text{ m/s}^2$

What would be the reading on the machine in each case? Take  $g = 9.8 \text{ ms}^{-2}$

24. What is the need for Banking of road? Obtain an expression for the maximum speed with which a vehicle can safely negotiate a curved road banked at an angle  $\theta$ . The coefficient of friction between the wheel and the road is  $\mu$ . 5

**OR**

Define (i) static friction,(ii) limiting friction (iii) kinetic friction.

State laws of limiting friction.

Show how the force of friction  $f$  varies with the applied force  $F$ . 5

25. (a)What is meant by terminal velocity?

(b)Write an expression for viscous force on the basis of Stoke's Formula. 5

(c) Hence derive an expression for terminal velocity of a spherical body in terms of radius of the body, density of the liquid and object and viscosity of the liquid.

**OR**

(a)Derive an expression for the rise of liquid in capillary tube of uniform diameter and sufficient length.

(b) A liquid drop of diameter  $D$  breaks up into 27 tiny drops. Find the resulting change in energy. Take surface tension of the liquid as  $S$ . 5

26.

(a) Write Newton's formula for the speed of sound in gases. Why and what correction was applied by Laplace in this formula?

(b) At what temperature will the velocity of sound be double its value at 273K?

**OR**

(a) What is Doppler Effect in sound? 5

(b) Derive an expression of apparent frequency of sound, when both the source and the observer are in motion .

(c) A train standing at the outer signal of railway station blows a Whistle of frequency 400 Hz in still air. Find the frequency of the whistle when the train approaches the platform with a speed of  $10 \text{ ms}^{-1}$ . (Speed of sound in still air =  $340 \text{ ms}^{-1}$ ) 5