

**NAVODAYA VIDYALAYA SAMITI**

**SESSION 2021 – 22 TERM II**

**SUBJECT- PHYSICS**

**CLASS XI**

**MM : 35**

**TIME : 2 Hours**

**General Instructions:**

- (i) **There are 12 questions in all. All questions are compulsory.**
- (ii) **This question paper has three sections: Section A, Section B and Section C.**
- (iii) **Section A contains three questions of two marks each, Section B contains eight questions of three marks each, Section C contains one case study-based question of five marks.**
- (iv) **There is no overall choice. However, an internal choice has been provided in one question of two marks and two questions of three marks. You have to attempt only one of the choices in such questions.**
- (v) **You may use log tables if necessary but use of calculator is not allowed.**

**SECTION A**

Q 1. What is an isothermal process? What are the essential conditions for an isothermal process to take place?

Q 2. Why and how Laplace corrected Newton's formula for velocity of sound in gases?

OR

Discuss the effect of following factors on the speed of sound:

- (a) Pressure      (b) Density      (c) Humidity      (d) Temperature

Q 3. Define modulus of elasticity. Name its three components.

**SECTION B**

Q 4. A structural steel rod has a radius of 10 mm and a length of 1 m. A 100 kN force  $F$  stretches it along its length. Calculate (a) the stress, (b) elongation, and (c) strain on the rod.

Given that the Young's modulus of the structural steel is  $2.0 \times 10^{11} \text{ N m}^{-2}$ .

Q 5. Derive the ascent formula for rise of liquid in capillary tube. What will happen, if the length of the capillary tube is smaller than the height to which the liquid rises. Explain.

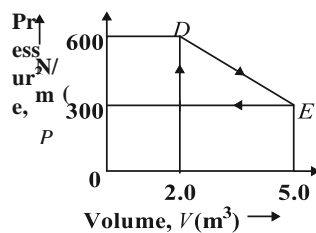
Q 6. Explain how a small spherical rigid body attains terminal velocity while falling through a viscous liquid. Hence derive an expression for the terminal speed.

Q 7. (a) What is calorimetry?

(b) 0.15 kg of ice at  $0^{\circ}\text{C}$  is mixed with 0.30 kg of water at  $50^{\circ}\text{C}$  in a container. Find the resultant temperature. Given the Latent heat of fusion of ice =  $3.35 \times 10^5 \text{ J/kg}$  and water =  $4200 \text{ J kg}^{-1} \text{ K}^{-1}$ .

Q 8. (a) What do you understand by reversible and irreversible processes? Give examples. What are the necessary conditions for a process to be reversible?

(b) Deduce the work done in the following complete cycle :



OR

Two samples of an ideal gas initially at the same temperature and pressure are allowed to expand from a volume  $V$  to  $2V$ , one isothermally and other adiabatically. In which case, will

- the work done be more?
- the final pressure be more?
- the final temperature be more? Justify your answers.

Q 9. Explain why

- there is no atmosphere on moon.
- there is fall in temperature with altitude.

Q 10. Draw (a) displacement-time graph of a particle executing SHM with phase angle equal to zero (b) velocity-time graph and (c) acceleration-time graph of the particle.

Q 11. (a) On what factors does the energy of a simple harmonically vibrating particle depends?

(b) A 2 kg particle undergoes SHM according to  $x = 1.5 \sin(\pi t/4 + \pi/6)$ , when  $x$  is in metre and  $t$  in second. What is the total mechanical energy of the particle?

OR

Plot the corresponding reference circle for each of the following simple harmonic motions. Indicate the initial ( $t = 0$ ) position of the particle, the radius of the circle, and the angular speed of the rotating particle. For simplicity, the sense of rotation may be fixed to be anticlockwise in every case: ( $x$  is in cm and  $t$  is in s) (a)  $x = -2\sin(3t + \pi/3)$   
 (b)  $x = \cos(\pi/6 - t)$

### SECTION C

Q 12. (i-v) Transverse waves forms if the particles of the medium vibrate at right angle to the direction of wave motion energy propagation, the wave is called transverse wave. These are propagated as crests and troughs. Longitudinal waves forms if the particles of the medium vibrate in the direction of wave motion, the wave is called longitudinal. These are propagated as compressions and rarefactions and wave is also known as pressure or compressional wave. Wave on spring or sound waves in air are examples of longitudinal waves.

- (i). In a transverse wave, the particles of the medium  
 (a) vibrate in a direction perpendicular to the direction of the propagation  
 (b) vibrate in a direction parallel to the direction of the propagation  
 (c) move in circle  
 (d) move in ellipse.
- (ii). A transverse wave consists of  
 (a) only crests  
 (b) only troughs  
 (c) both crests and troughs  
 (d) rarefactions and compressions
- (iii). Ultrasonic waves produced by a vibrating quartz crystal are  
 (a) only longitudinal  
 (b) only transverse  
 (c) both longitudinal and transverse  
 (d) neither longitudinal nor transverse
- (iv). Sound waves travel fastest in  
 (a) solids  
 (b) liquids  
 (c) gases  
 (d) vacuum
- (V). Sound waves in air cannot be polarized because  
 (a) their speed is small  
 (b) they require medium  
 (c) they are longitudinal  
 (d) their speed is temperature dependent