

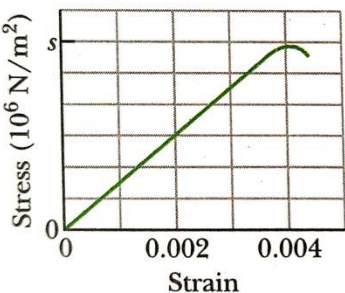
CLASS XI
PHYSICS THEORY
TERM II
SESSION 2021 - 22

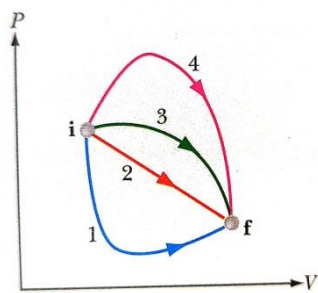
MM : 35

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		
1	Two identical sinusoidal waves, $y_1(x,t)$ and $y_2(x,t)$, travel along a stretched string in the positive direction of x-axis. They give rise to a resultant wave $y(x,t)$. The phase difference between the two waves is (a) 0 and (b) π or 180° . Represent the corresponding resultant waves in both the cases graphically.	2
2	Briefly explain on the basis of kinetic theory of gases, why do the pressure of a gas is increased when the gas is heated? OR Using the law of equi-partition of energy, determine the values of C_p , C_v and γ for diatomic gases (rigid rotators).	2
3	The following figure shows the stress-strain curve for a material. The scale of the stress axis is set by $s = 300$, in units of 10^6 N/m^2 . What are (a) the Young's modulus and (b) the approximate yield strength for this material? 	2
SECTION-B		
4	Give reasons: (a) A small gap is left between the iron rails of railway tracks. (b) Water is preferred to any other liquid in the hot water bottles.	3
5	(a) What is gravitational potential energy? (b) You move a ball of mass m away from a sphere of mass M . (i) Does the gravitational potential energy of the system of ball and sphere increases or decreases? (ii) Work done by the gravitational force between the ball and the sphere is positive or negative?	3

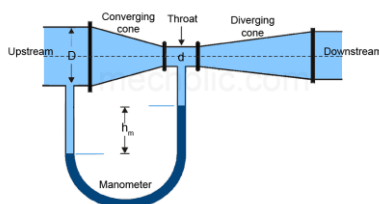
6	(a) In what manner, does the escape velocity of a particle depend upon its mass? (b) Jupiter has a mass 318 times that of the earth and its radius is 11.2 times the earth's radius. Estimate the escape velocity of a body from Jupiter's surface, given that the escape velocity from the earth's surface is 11.2 km/s.	3
7	(a) Deduce the relation between torque and angular momentum. (b) Find the torque of a force $7\hat{i} - 3\hat{j} - 5\hat{k}$ about the origin which acts on a particle whose position vector is $\hat{i} + \hat{j} - \hat{k}$.	3
8	<p>a) The figure here shows four paths on a P-V diagram along which a gas can be taken from state i to state f. Rank the paths (greatest first) according to the change ΔU_{int} in the internal energy of the gas.</p>  <p>b) One mole of oxygen (assume it to be an ideal gas) expands at a constant temperature T of 310 K from an initial volume V_1 of 12 L to a final volume V_f of 19 L. How much work is done by the gas during the expansion? (Take value $\ln(1.58) = 0.45$)</p> <p style="text-align: center;">OR</p> <p>Two cylinders A and B of equal capacity are connected to each other via a stopcock. A contains a gas at standard temperature and pressure. B is completely evacuated. The entire system is thermally insulated. The stopcock is suddenly opened. Answer the following:</p> <p>(a) What is the final pressure of the gas in A and B ? (b) What is the change in internal energy of the gas? (c) What is the change in the temperature of the gas? (d) Do the intermediate states of the system (before settling to the final equilibrium state) lie on its P-V-T Surface?</p>	3
9	(a) State the theorem of perpendicular axis. (b) Calculate the moment of inertia of the earth about its diameter, taking it to be a sphere of mass 10^{25} kg and diameter 12800 km.	3
10	Calculate the heat required to convert 3kg of ice at -12°C kept in a calorimeter to steam at 100°C at atmospheric pressure. Given: Specific heat capacity of ice = $2100 \text{ Jkg}^{-1}\text{K}^{-1}$ Specific heat capacity of water = $4186 \text{ Jkg}^{-1}\text{K}^{-1}$ Latent heat of fusion of ice = $3.35 \times 10^5 \text{ Jkg}^{-1}$ Latent heat of steam = $2.256 \times 10^6 \text{ Jkg}^{-1}$	3
11	(a) What is an ideal simple pendulum? Derive an expression for its time period. (b) Three physical pendulums, of masses, m_0 , $2m_0$ and $3m_0$ have the same shape and size and are suspended at the same point. Rank the masses according to the periods of the pendulums, greatest first.	3

OR

What are damped simple harmonic oscillations? Write an expression for the angular frequency of the damped oscillator. Show graphically the exponential decrease of its amplitude with time.

SECTION-C – CASE STUDY

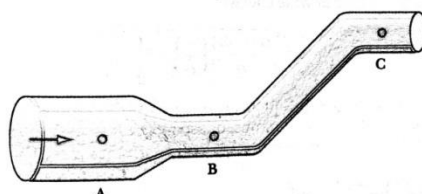
12 Venturi meters are flow measurement instruments which use a converging section of pipe to give an increase in the flow velocity and a corresponding pressure drop from which the flow rate can be deduced. They have been in common use for many years, especially in the water supply industry.



(a) On what principle, does the venturi-meter works? 1

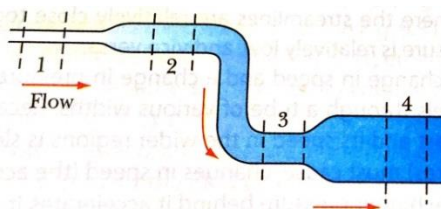
(i) Equation of continuity	(ii) Bernoulli's Principle
(iii) Pascal's law	(iv) Archimedes' Principle

(b) Fluid is flowing from left to right through a pipe. Points A and B are at the same elevation but the cross-sectional areas of the pipe are different. Points B and C are at different elevations, but the cross-sectional areas are the same. Rank the pressures at the three points, highest to lowest. 1



(i) A and B (a tie), C	(ii) C, A and B (a tie)
(iii) A,B,C	(iv) C, B, A

(c) Water flows smoothly through the pipe shown in the figure, descending in the process. Rank the four numbered sections of the pipe according to the flow speed v through them. 1



(i) All tie	(ii) 1, then 2 and 3 tie, 4
(iii) 4,3,2,1	(iv) 1 and 2 tie, then 3 and 4 tie

(d) Which of the following is not an application of Bernoulli's Principle? 1

(i) Magnus Effect	(ii) Aerofoil
(iii) Spray gun	(iv) Hydraulic lifts

(e) Can Bernoulli's equation be used to describe the flow of water through a rapid in a river? Explain. 1