DIRECTORATE OF EDUCATION, GNCT OF DELHI

PRACTICE PAPER FOR (SESSION: 2024-25)

CLASS: XI SUBJECT: PHYSICS (042)

DURATION:3 HOURS **MAXIMUM MARKS:70**

General Instructions:

(1) There are 33 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 sixteen questions, twelve MCQ and four Assertion Reasoning based of 1 mark each, Section B contains five questions of two marks each, Section C contains seven questions of three marks each, Section D contains two case study-based questions of four marks each 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 Case study-based questions 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.

(7) You may use the following values of physical constants wherever necessary.

Acceleration due to gravity $g=9.8 m/s^2$

Universal Gravitational constant $G=6.67 \times 10^{-11} Nm^2/Kg^2$

Avogadro Number $N_A=6.022 \times 10^{23}$ /Mol

Universal Gas Constant $R=8.314$ J $Mol^{-1} K^{-1}$

Stefan Boltzmann constant $\sigma = 5.670x10^{-8}$ W $m^{-2} K^{-4}$

Wien's constant $b = 2.898 \times 10^{-3}$ m K

<table>
<tr><th colspan="2">SECTION [A]</th><th>[16X1=16]</th></tr>
<tr><th>Q.N.</th><th>DESCRIPTION OF QUESTION</th><th>MARKS</th></tr>
<tr><td>1.</td><td>The dimensional formula for the Coefficient of viscosity is:

(a)[ML^2T^{-2}] (b)[$ML^{-1}T^{-1}$] (c) [$ML^{-2}T^{-1}$]</td><td>1</td></tr>
<tr><td>2.</td><td>In which of the following examples of motion can the body be considered approximately not a point object:

(a) a railway carriage moving without jerks between two stations.
(b) a monkey sitting on the top of a man cycling smoothly on a circular track.
(c) a spinning cricket ball that turns sharply on hitting the boundary.
(d) tumbling beaker that has slipped off the edge of a table.</td><td>1</td></tr>
<tr><td>3.</td><td>If the tension in the cable supporting an elevator is equal to the weight of elevator, the elevator may be

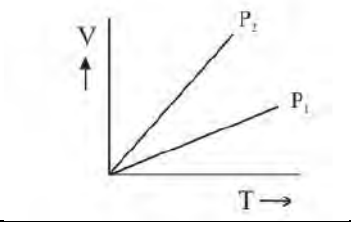
(a) going up with increasing speed (b) going down with increasing speed

(c) going up with uniform speed (d) elevator falls freely under gravity.</td><td>1</td></tr>
<tr><td>4.</td><td>During inelastic collision between two bodies, which of the following quantities always remain conserved

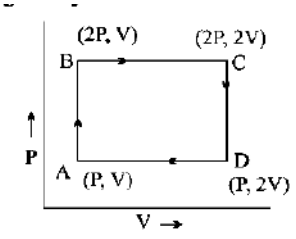
(a) Total kinetic energy (b) Total mechanical energy

(c) Total linear momentum (d) Speed of each body.</td><td>1</td></tr>
<tr><td>5.</td><td>Correct match of column I with column II

<table>
<tr><td>C-1 Body of Radius K</td><td>C-2 Moment of Inertia</td></tr>
<tr><td>(1) Sphere of Radius K about the centre of mass</td><td>P. (3/2) MK^2</td></tr>
<tr><td>(2) Disk of Radius K about its diameter</td><td>Q. (1/2) MK^2</td></tr>
<tr><td>(3) Ring of radius K About a tangential axis perpendicular to its own plane</td><td>R. (2/5) MK^2</td></tr>
<tr><td>(4) Solid cylinder About an axis Passing through centre of mass and perpendicular to its plane</td><td>S. $2MR^2$</td></tr>
</table>
</td><td>1</td></tr>
</table>

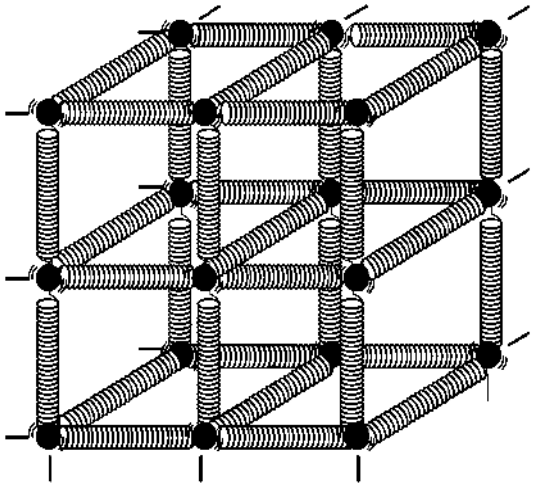
	(a) 1-R,2-S, 3-S, 4-Q (b) 1-Q,2-P, 3- S, 4-R (c) 1-P,2-R, 3-S, 4-Q (d) 1-R,2-P, 3- S, 4-Q	
6.	If one moves from the surface of the earth to the moon, what will be the effect on its weight: (a) Weight of the person decreases continuously with height from the surface of the earth (b) Weight of the person increases with height from the surface of earth (c) Weight of a person first decreases with height and then increases with height from surface of earth (d) Weight of person first increases with height and then decreases with height from the surface of earth.	1
7.	Which of the process described below are irreversible? (a) The increase in temperature of an iron rod by hammering it (b) A gas in a small container at a temperature T1 is brought in contact with a big reservoir at a higher Temperature. T2 which inverses the temperature of the gas (c) A quasi - state isothermal expansion of an ideal gas in cylinder fitted with a frictionless piston (d) An ideal gas is enclosed in a piston cylinder arrangement with adiabatic Walls. A weight W is added to the piston, resulting in compression of a gas.	1
8.	In V-T diagram shown in fig. what is the relation between P_1 and P_2 (a)$P_1=P_2$ (b) $P_1<P_2$ (c) $P_1>P_2$ (d) $P_1+P_2=1$ 	1
9.	The translational kinetic energy of gas molecules for 1 mol of gas is equal to: (a) 3/2(KT) (b) 3/2(RT) (c) 2/3(KT) (d) ½(RT)	1
10.	The angle of contact at the interface of water glass is 0°, Ethyl alcohol–glass is 0°, Merecing–glass is 140° & Methyl iodide-glass is 30°. A glass capillary is put its a trough containing one of these for liquids. It is observed that the meniscus is convex. The liquid in the trough is	1

	(a) Water (b) Ethyl alcohol (c) Mercury (d) Methyl iodide.	
11.	A pendulum suspended from the ceiling of a train has a period T, when the train is at rest. When the train is accelerating with a uniform acceleration a, the period of oscillation will (a) Increase (b) Decrease (c) Remain unaffected (d) Become infinite	1.
12.	The displacement of plane progressive wave moving along positive x-axis is: (a)$y = A\sin(kx - wt)$ (b)$\mathrm{y} = A\sin(kx + wt)$ (c)$\mathrm{y} = A\sin(kx - w)$ (d)$\mathrm{y} = A\sin(kt - wx)$	1
	(Questions number 13 to 16 are Assertion (A) and Reason (R) type questions. Two statements are given one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer from the codes (A), (B), (C) and (D) as given below. **(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).** **(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).** **(C) Assertion (A) is true, but Reason (R) is false.** **(D) Assertion (A) is false and Reason (R) is also false.**	
13.	**Assertion (A):** Newton's second law is the real law of motion. **Reason(R):** Newton's second law is applicable for inertial frame of reference.	1
14.	**Assertion (A)**: Moment of inertia of a body is same, whatever be the axis of rotations. **Reason (R)**: Moment of inertia depends only a distribution of mass.	1
15.	**Assertion:** Sound waves cannot propagate through vacuum but light waves can. **Reason:** Sound waves cannot be polarized but light waves can be polarized.	1

16.	**Assertion:** The function Y(t)=A$\sin \omega t$ represents a simple Harmonic Motion (SHM) **Reason (R)**: The displacement of a particle in SHM is directly proportional to square of its acceleration.	1
	SECTION [B]	**[05X2=10]**
17.	The length, breadth and thickness of a rectangular sheet of metal are 4.234 m, 1.005 m, and 2.01 cm respectively. Give the area and volume of the sheet to correct significant figures.	2
18.	A bullet of mass 0.04 kg moving with a speed of 90 m s^{-1} enters a heavy wooden block and is stopped after a distance of 60 cm. What is the average resistive force exerted by the block on the bullet?	2
19.	Two springs A and B are identical except that A is harder than B ($K_A > K_B$) if these are stretched by the equal force. In which spring will more work be done?	2
20[A]	If radius of the earth is shrunk by 10% and mass remaining same, then what will be percentage change in acceleration due to gravity. **OR**	2
20[B]	A satellite is moving round the earth with velocity v_0 what should be the minimum percentage increase in its velocity so that the satellite escapes.	2
21	An ideal monatomic gas is taken round the cycle ABCDA as shown. Calculate the work done during the cycle.  **(For visually Impaired students)** State cyclic and non-cyclic process. Write the formula for work done in adiabatic and isothermal process.	2 2
	SECTION [C]	**[07X3=21]**

22.	Draw the following graphs for an object projected upward with a velocity u' which comes back to the same point after some time: (i) Acceleration versus time graph. (ii) Speed versus time graph. (iii) Velocity versus time graph. **(For visually Impaired students)** A car moving along a straight highway with speed of 126 km h^{-1} is brought to a stop within a distance of 200 m. What is the retardation of the car (assumed uniform) and how long does it take for the car to stop?	3 3
23.	Two discs of moments of inertia I_1 and I_2 about their respective axes (normal to the disc and passing through the center), and rotating with angular speed ω_1 and ω_2 are brought into contact face to face with their axes of rotation coincident, (i) What is the angular speed of the two-disc system? (ii) Show that the kinetic energy of the combined system is less than the sum of the initial kinetic energies of the two discs. Explain. Take $\omega_1 \neq \omega_2$.	3
24.	A body of mass M at rest is struck by a moving body of mass m. Prove that fraction of the initial K.E. of the mass m transferred to the struck body is $4\ m\ M/\ (m + M)^2$ in an elastic collision.	3
25[A] 25[B]	Define escape velocity obtain an expression for escape velocity of a body from the surface of earth? Does the escape velocity depend on location from where it is projected? **OR** State Kepler's three laws of planetary motion. Name the physical quantity which remain constant during planetary motion.	3
26.	(a) Show that the coefficient of area expansion, $(\Delta A/A)/\Delta T$, of a rectangular sheet of the solid is twice its linear expansivity α. (b) A blacksmith fixes iron ring on the rim of the wooden wheel of a horse cart. The diameter of the rim and the iron ring are 5.243 m and 5.231 m, respectively at 27 °C. To what temperature should the ring be heated so as to fit the rim of the wheel?	3
27.	What are the basic assumptions of kinetic theory of gases? On their basis derive an expression for the pressure exerted by an ideal gas.	3

28.	A rectangular box lies on a rough inclined surface. The coefficient of friction between the surface and the box is (μ). Let the mass of the box be m. (a) At what angle of inclination θ of the plane to the horizontal will the box just start to slide down the plane? (b) What is the force acting on the box down the plane, if the angle of inclination of the plane is increased to α > θ. (c) What is the force needed to be applied upwards along the plane to make the box either remain stationary or just move up with uniform speed	3
	SECTION [D] **[02X4=8]**	
29.	The maximum permissible speed for a vehicle to negotiate a tum on a level circular road (without getting slip), depends upon the value of coefficient of friction μ between the tires and road. But in practice, this limiting value of speed for sharp tum is quite low, especially in hilly areas where the turns are too sharp. In order to move the vehicle at a reasonable speed without getting skid/slip to go around the sharp tums of the inner one. It is called banking of road. On a banked road, the horizontal component of the normal force and the frictional force contribute to provide centripetal force to keep the car moving on a circular turn without slipping. At the optimum speed, the normal reaction's component is enough to provide the needed centripetal force, and the frictional force is not needed.	
(i)	Which statement is not correct about banking of roads? (a) Banking of roads reduces wear and tear on tyres of vehicles. (b) It provides required centripetal force. (c) both (a) and (b) correct (d) neither (a) nor (b) is correct.	1
(ii)	A car sometime overturns while taking a turn. When it overturns, it is (a) the inner wheel, which leaves the ground first. (b) the outer wheel, which leaves the ground first. (c) both the wheels leave the ground simultaneously. (d) either wheel, which leaves the ground first.	1
(iii)	A bend in a level road has a radius of 100 m, the maximum speed a car turning this bend may have without skidding. If the coefficient of friction between road and tyres is 0.8: (a)28 cm/s (b)28 m/s (c)2.8 m/s (d)28 km/s	1

(iv)	The maximum safe speed of car negotiating a circular tum of radius r on a friction less banked track with angle of banking θ is: (a)$\sqrt{rg\tan\theta}$ (b)$\sqrt{g\tan\theta}$ (c)$\sqrt{r\tan\theta}$ (d)$\sqrt{\mu rg\tan\theta}$ **OR** The maximum safe speed of car negotiating a circular turn of radius r on a banked track with angle of banking θ is: (a)$\sqrt{\frac{(\mu+\tan\theta)}{1-\mu\tan\theta}}$ (b) $\sqrt{(\frac{rg(\mu+\tan\theta)}{1-\mu\tan\theta}}$ (c) $\sqrt{(\frac{rg(\mu-\tan\theta)}{1-\mu\tan\theta}}$ (d) $\sqrt{(\frac{rg(\mu+\tan\theta)}{1+\mu\tan\theta}}$	1 1
30.	Elastic behavior of a solid plays a very important role in human life. in a solid, each atom or molecule is surrounded by neighboring atoms or molecules. These are bonded together by interatomic or intermolecular forces and stay in a stable equilibrium position. When a solid is deformed, the atoms or molecules are displaced from their equilibrium positions causing a change in the interatomic (or intermolecular) distances. When the deforming force is removed, the interatomic forces tend to drive them back to their original positions. Thus, the body regains its original shape and size. The restoring mechanism can be visualized by taking a model of spring-ball system shown in the Fig. Here the balls represent atoms and springs represent interatomic forces. If you try to displace any ball from its equilibrium position, the spring system tries to restore the ball back to its original position. 	
(i)	In stable equilibrium: (a)Potential energy is positive (b) Potential energy is negative (c) Potential energy is minimum (d) Potential energy is maximum.	1
(ii)	When a solid is deformed, the atoms or molecules are displaced from their equilibrium positions then: (a)Force is attractive and potential energy is maximum (b) Force is attractive and potential energy is minimum (c) Force is repulsive and potential energy is maximum (d) Force is repulsive and potential energy is minimum	1

(iii)	A cylinder is stretched by two equal forces applied normal to its cross-sectional area. The restoring force per unit area in this case is called: (a)tensile stress (b) compressive stress (c) shearing stress (d) longitudinal strain.	1
(iv)	In which of the following is not the SI unit of the ratio of stress and strain: (a) pascal (b)N/m^2 (c)Nxm^2 (d)$dyne/cm^2$ **OR** A spring is stretched by applying a load to its free end. The strain produced in the spring is (a) Volumetric (b) Shear (c) Longitudinal & Shear (d) Longitudinal.	1 1
	SECTION [E]	**[03X5=15]**
31[A]	(i) At what angle of projection should a body be projected so that the maximum height attained by projectile is equal to the horizontal range. (ii) An aircraft is flying at a height of 3400 m above the ground. If the angle subtended at a ground observation point by the aircraft positions 10.0 s a part is 30°, wat is the speed of the aircraft? **OR**	5
31[B]	(i)Define centripetal acceleration and write its C.G.S. unit. (ii)Derive an expression for centripetal acceleration for a body moving with constant speed v along circumference of a circular track of radius r and mass m. Show that it is directed along radius and towards of the center of the circular path.	5
32[A]	(a)State and prove Bernoulli's theorem. Write its two limitations. (b) Name the physical quantity corresponding to each term of Bernoulli's theorem. **OR**	5
32[B]	(a)Define terminal velocity. (b)Obtain an expression for terminal velocity of a spherical body of radius r falling through a viscous medium of viscosity σ and density of the sphere is ρ. Use the formula to explain the rise of air bubbles in a liquid and floating of clouds.	5

33[A]	(i) Show that for a particle in linear SHM, the average kinetic energy over a period of oscillation is equal to average potential energy over the same period. (ii) At what distance from the mean position is the kinetic energy in SHM is equal to potential energy. **OR**	5
33[B]	(i)Discuss the formation of harmonics in a stretched string. Show that in case of a stretched string the first four harmonics are in the ratio 1:2:3:4 (ii) A steel rod 100 cm long is clamped at its middle. The fundamental frequency of longitudinal vibrations of the rod as given to be 2.53 kHz. What is the speed of sound in steel?	5