DIRECTORATE OF EDUCATION, GNCT OF DELHI

ANNUAL PRACTICE PAPER

(SESSION: 2025-26)

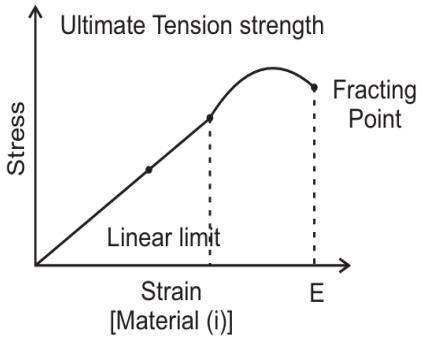
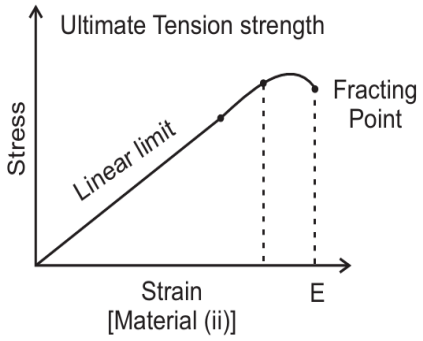
CLASS: XI SUBJECT: PHYSICS (042)

Time Allowed: 3 hours **Maximum Marks: 70**

General Instructions

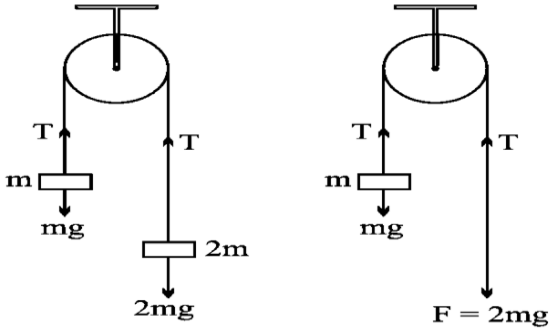
1. There are 33 questions in all. All questions are compulsory.
2. **This question paper has five sections: Section A, Section B, Section C, Section D and Section E.**
3. **All the sections are compulsory.**
4. **Section A** contains **sixteen questions, twelve MCQ and four assertion reasoning based 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 two questions in Section B, one question in Section C 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. You may use the following values of physical constants where ever necessary
7. You may use the following values of physical constants wherever necessary.
   i. Acceleration due to gravity $g=9.8 m/s^2$
   ii. Universal Gravitational constant $G=6.67 \times 10^{-11} Nm^2/Kg^2$
   iii. Avogadro Number $N_A=6.022 \times 10^{23}$ /Mol
   iv. Universal Gas Constant $R=8.314$ J Mol^{-1} K^{-1}
   v. Stefan Boltzmann constant $\sigma = 5.670x10^{-8}$ W m^{-2} K^{-4}
   vi. Wien's constant $b = 2.898 \times 10^{-3}$ m K

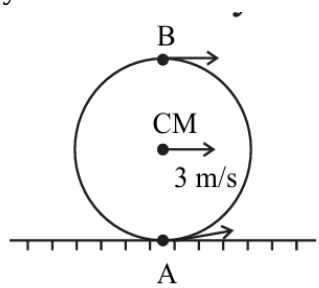
<table>
<tr><th colspan="3">SECTION (A) [16X1=16]</th></tr>
<tr><th>Q.N.</th><th>QUESTIONS</th><th>MARK</th></tr>
<tr><td>1.</td><td>Which of the following is NOT a rule for arithmetic operations with significant figures?
(A) In multiplication or division, the final result should retain as many significant figures as in the original number with the least significant figures.
(B) In addition, or subtraction, the final result should retain as many decimal places as in the number with the least decimal places.
(C) In addition, or subtraction, the final result should retain as many significant figures as in the original number with the least significant figures.
(D) Exact numbers in formulae have an infinite number of significant figures.</td><td>1</td></tr>
<tr><td>2.</td><td>Match the type of motion in Column I with the corresponding characteristic of its x-t graph in Column II.
<table><tr><th></th><th>Column I</th><th></th><th>Column II</th></tr><tr><td>1.</td><td>Uniform motion</td><td>P.</td><td>Parabola</td></tr><tr><td>2.</td><td>Uniformly accelerated motion (starting from rest, positive acceleration)</td><td>Q.</td><td>Straight line inclined to time axis</td></tr><tr><td>3.</td><td>Object at rest</td><td>R.</td><td>Parabola opening upwards</td></tr><tr><td>4.</td><td>Uniformly decelerated motion (positive initial velocity)</td><td>S.</td><td>Horizontal straight line</td></tr></table>(A) 1-Q, 2-R, 3-S, 4-P (B) 1-S, 2-P, 3-Q, 4-R
(C) 1-Q, 2-P, 3-S, 4-R (D) 1-R, 2-S, 3-P, 4-Q</td><td>1</td></tr>
<tr><td>3.</td><td>The horizontal component of a projectile’s velocity, in the absence of air resistance:
(A) Continuously increases throughout its flight path.
(B) Continuously decreases until it reaches its maximum height.
(C) Remains constant throughout its flight path.
(D) Becomes zero at the peak of its trajectory.</td><td>1</td></tr>
</table>

4.	A bird weights 2 N sitting inside a cage of weight 1 N. If it starts flying then what is weight of bird and cage assembly? (A) 1.5 N (B) 3 N (C) 2.5N (D) 4N	1
5.	Which of the following pairs correctly matches a physical concept with its characteristic? (A) Inelastic Collision: Kinetic energy is conserved. (B) Conservative Force: Work done in a closed loop is non-zero. (C) Power: Unit is Joule. (D) Work: Can be negative.	1
6.	If the linear momentum is increased by 50%, then kinetic energy will increase by (A) 50% (B) 100% (C) 125% (D) 25%	1
7.	One circular ring and one circular disc both having same mass and radius. The ratio of their moment of inertia about the axis passing through their centers and perpendicular to their planes will be: (A) 1 : 1 (B) 2 : 1 (C) 1 : 2 (D) 4 : 1	1
8.	Energy required to move a satellite of mass m from an orbit of radius 2R to 3R is, (M mass of earth): (A) $\frac{GMm}{12R^2}$ (B) $\frac{GMm}{3R^2}$ (C) $\frac{GMm}{8R}$ (D) $\frac{GMm}{6R}$	1
9.	The stress strain graph for these materials is shown in the figure. (Assume scale is same for both graph)   (A) Material (ii) is more elastic than material (i) and hence material (ii) is more brittle. (B) Material (i) & (ii) have the same elasticity and the same brittleness. (C)Material (ii) is elastic over the larger region of strain as compared to (i) (D) Material (ii) is more brittle than material (i) **For VI candidates**	1

	A mild steel wire of Length 2L and cross-sectional Area A is stretched well within elastic limit, horizontally between two pillars. A man m is suspended from the mid-point of the wire strain in the wire is: (A) $\frac{X}{L}$ (B) $\frac{X^2}{2L}$ (C) $\frac{X^2}{L}$ (D) $\frac{X^2}{2L^2}$	1
10.	Why does water at the bottom of a lake remain at 4^0C even when the surface freezes? (A) Water has a low specific heat capacity. (B) Water has maximum density at 4^0C. (C) Ice is denser than water. (D) The ground keeps the bottom warm.	1
11.	In an isothermal expansion of an ideal gas, what is the relationship between heat supplied (Q) and work done (W) by the gas? (A) Q=-W (B) Q =W (C) Q = Δ U (D) W= ΔU	1
12.	The two ends of a metal rod are maintained at temperatures 100°C and 110°C. The rate of heat flow in the rod is found to be 4.0 J/s. If the ends are now maintained at temperatures 200°C and 210°C, the rate of flow of heat will be (A) 16.8 J/s (B) 8.0 J/s (C) 4.0 J/s (D) 44.8 J/s	1
Questions number 16 to 18 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):** Minimum number of non-equal vectors in a plane to give zero resultant is three. **Reason (R)**: If $(\vec{A} + \vec{B} + \vec{C} = 0)$, then they must lie in one plane.	1
14.	**Assertion (A):** Value of radius of gyration of body depends upon axis on rotation. **Reason (R):** Radius of gyration is root near square distance of particles of the body from the axis of rotation.	1

15.	**Assertion (A):** The velocity increases, when water flowing in a broader pipe enter a narrow pipe. **Reason(R):** According to equation of continuity, product of area of cross section and velocity is constant.	1
16.	**Assertion(A):** When a simple pendulum is made to oscillate on the surface of moon, its time period Increases. **Reason(R):** Moon is much smaller as compared to earth.	1
	SECTION (B) **[5X2=10]**	
17.	(a) Find the value of 10 J in a system which has 100cm, 10 g and 30 s as fundamental unit. **OR** (b) If a composite physical quantity in terms of moment of inertia I, force F, velocity v, work W and length L is defined as Q $=\frac{IFv^3}{WL^3}$, find dimensions of Q and identify it.	2
18.	Smooth block is released at rest on a 45° incline and then slides a distance d. If the time taken of slide on rough incline is n times as large as that to slide than on a smooth incline. Show that coefficient of friction ($\mu = 1 - \frac{1}{n^2}$)	2
19.	A mass 'M' is broken into two parts of masses m_1 and m_2. How are m_1 and m_2 related so that force of gravitational attraction between the two parts is maximum.	2
20.	(a) Define compressibility and write its units and dimensions. OR (b) Derive an expression for elastic potential energy per unit volume in terms of stress and strain.	2
21.	Two rods of different metals of coefficient of linear expansion α_1 and α_2 and initial length $l_1$and l_2 respectively are heated to the same temperature. Find relation in α_1, α_2, l_1 and l_2 such that difference between their lengths remain constant.	2
	SECTION (C) **[7X3=21]**	
22.	A balloon is ascending at the rate of 14 m/s at a height of 98 m above the ground, when a packet is dropped from the balloon. After how much time and with what velocity does it reach the ground?	3

23.	(a) Prove that the maximum horizontal range is four times the maximum height attained by the projectile, when fired at an inclination so as to have maximum range. **OR** (b) Show that there are two values of time for which a projectile is at the same height. Also show that the sum of these two times is equal to the time of light.	3
24.	The pulley arrangement of fig. is identical. The mass of the rope is negligible. In (a) mass m is lifted up by attaching a mass (2 m) to the other end of the rope. In (b), m is lifted up by pulling the other end of the rope with a constant downward force F = 2 mg. In which case, the acceleration of m is more?  **For VI candidates** Two blocks of mass 2 kg and 5 kg are connected by an ideal string passing over a pulley. The block of mass 2 kg is free to slide on a surface inclined at an angle of 30° with the horizontal whereas 5 kg block hangs freely. Find the acceleration of the system and the tension in the string.	3
25.	Show that in an elastic one-dimensional collision the relative velocity of approach before collision is equal to the relative velocity of separation after collision.	3
26.	(a) Obtain an expression for escape velocity of a body from the surface of earth in terms of mass (M) of the earth, universal gravitational constant (G) and radius of the earth (R). (b) Does the escape velocity depend on- (i) location from where it is projected. (ii) the height of the location from where the body is launched.	3

27.	There are two spheres of same material and same radius at same temperature but one being solid while the other hollow. Which sphere will expand more if (a) they are heated to the same temperature (b) same amount of heat is given to each of them? Explain with proper calculation if required.	3
28.	The ratio of specific heat capacity at constant pressure to the specific heat capacity at constant volume of a diatomic gas decreases with increase in temperature. Explain.	3
	SECTION (D)	**[4X2=8]**
29.	One of the most common motions observed is daily life is the rolling motion. All wheels used in transportation have rolling motion. Rolling motion can be regarded as a combination of pure rotation and pure translation (without slipping). This means that at any instant of time, the bottom of the body which is in contact with the surface is at rest always. Total kinetic energy of a rolling body is the sum of translational kinetic energy and rotational kinetic energy of the rolling body. Answer the following questions based on the above: (i) For a pure rolling (without slipping) of a spherical rigid body when of the following friction is not correct. (A) During pure rolling, the force of friction acts in the same direction as the direction of motion of the CM of the body (B) The instantaneous speed of the point of contact during rolling is zero. (C) For perfect rolling, work done against friction is zero. (D) A sphere moving down a perfectly frictional inclined plane will undergo pure rolling motion. (ii) A spherical body is rolling over a horizontal surface without slipping such that the velocity of centre of mass (CM) of the body is 3 m/s. The velocity of point A & B on the body at any instant is (A) 0 m/s, 6 m/s (B) 0 m/s, 3 m/s (C) 3 m/s, 0 m/s (D) 6 m/s, 0 m/s 	1 1

	For VI candidates A sphere of radius 1m is rolling over a horizontal floor without slipping with an angular velocity of 1 rad/s. The linear velocity of the centre of mass (CM) of the sphere is (A) 0.5 m/s (B) 1 m/s (C) 2 m/s (D) Zero	1
	(iii) A solid sphere and hollow sphere both of same mass and same radius and made of same material are allowed to roll down on inclined plane, then (A) solid sphere reaches the bottom first (B) hallow sphere reaches the bottom first (C) both reaches the bottom of the same time and same velocity. (D) solid sphere remains stay at inclined plane.	1
	(iv) If a solid sphere of mass 1 kg and radius 0.1 m rolls without slipping at a uniform velocity of 1 m/s, along a straight line on a horizontal floor, then kinetic energy of the sphere is: (A) 7 J (B) 0.7J (C) 70 J (D) 700 J	1
30.	A block of mass 'm' is attached to a light spring with spring constant 'k'. The other end of the spring is fixed to a rigid wall. The block is pulled to a distance x_0 from its equilibrium position on a frictionless horizontal surface and then released. The block then oscillates back and forth. Answer the following questions based on the above: (i) What is the force law for a particle executing SHM?	1
	(ii) What is the angular frequency (w) of oscillation for this spring-mass system?	1
	(iii) A 5 kg collar is attached to a spring of spring constant 500 N m–1. It slides without friction over a horizontal rod. The collar is displaced from its equilibrium position by 10.0 cm and released. Calculate (a) the period of oscillation, (b) the maximum speed.	2
	SECTION (E)	**[5X3=15]**
31.	(a)(i) On a level road, which force provides the necessary centripetal force for the car to take a circular turn? (ii) Why circular roads are banked? Derive an expression for angle of banking for safe circular turn. Consider that coefficient of friction between the tires and road is μ.	5

	OR (b) (i) A heavy ball of mass m is suspended from a thread of length r and is being rotated in a vertical circle. Show that the tension in the string at the lowest point exceeds the tension in the string at the highest point by six times the weight of the body. (ii) Find the velocity of mass m at lowest and highest points and the condition for looping the loop	5
32.	(a) (I) Obtain an expression for the excess pressure inside (i) a liquid drop (ii) soap bubble (iii) air bubble inside a liquid. (II) A liquid drop of Diameter 'D' breaks up into n tiny drops. Find the resulting change in energy. OR (b) (I) Define terminal velocity. Obtain an expression for terminal velocity of a sphere falling through a viscous liquid. (II) With what terminal velocity will an air bubble 0.8 mm in diameter rise in a liquid of viscosity 0.15 Ns/m^2 and specific gravity 0.9?	5 5
33.	(a) The transverse displacement of a string (clamped at its both ends) is given by $$y(x, t) = 0.06 \sin\left(\frac{2\pi}{3}x\right) \cos(120\,\pi t)$$ where x and y are in m and t in s. The length of the string is 1.5 m and its mass is 3.0×10^{-2} kg. Answer the following: (i) Does the function represent a travelling wave or a stationary wave? (ii) Interpret the wave as a superposition of two waves travelling in opposite directions. What is the wavelength, frequency, and speed of each wave? (iii) Determine the tension in the string. **OR** (b) (i) A meter-long tube open at one end, with a movable piston at the other end, shows resonance with a fixed frequency source (a tuning fork of frequency 340 Hz) when the tube length is 25.5 cm or 79.3 cm. Estimate the speed of sound in air at the temperature of the experiment. The edge effects may be neglected. (ii) A pipe 20 cm long is closed at one end. Which harmonic mode of the pipe is resonantly excited by a 430 Hz source? Will the same source be in resonance with the pipe if both ends are open? (Speed of sound in air is 340 $m\ s^{-1}$).	5 5