VIKAS BHARATI PUBLIC SCHOOL

SAMPLE PAPER (SESSION: 2025-26)
CLASS: XI

SUBJECT: PHYSICS (042)

Time : 3 Hrs. **M.M: 70**

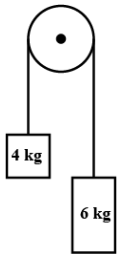
Note: *1. This question paper contains 6 printed pages and 33 questions.*

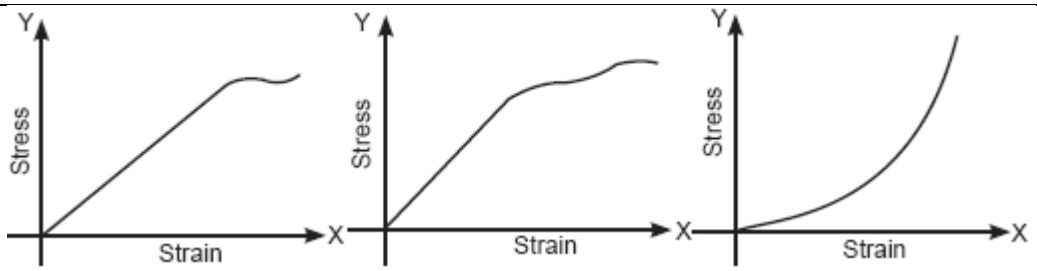
2. All questions are compulsory.

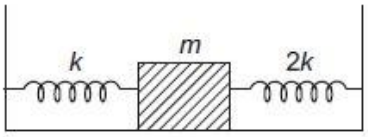
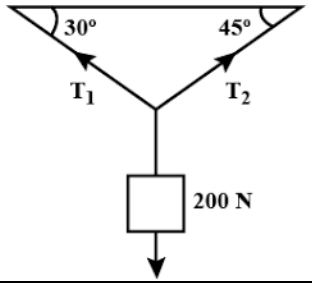
3. Section A contains sixteen questions, twelve MCQ and four Assertion Reasoning based of 1 mark each, Section B contains five questions of two marks each, Section C contains seven questions of three marks each, Section D contains two case study-based questions of four marks each and Section E contains three long answer questions of five marks each.

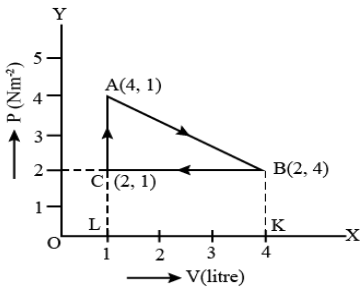
4. There is no overall choice. However internal choice has been provided. You have to attempt only one of the choices in such questions.

		SECTION A	
1.		Van der wall's equation is $\left(P + \frac{a}{V^2}\right)(V - b) = RT$ where P is pressure and V is volume. Find the dimensions of a. (a) $[ML^5T^{-2}]$ (b) $[ML^{-1}T^{-2}]$ (c) $[ML^4T^{-2}]$ (d) $[M^2L^5T^{-2}]$	1
2.		If the velocity of light c, the gravitational constant G and Planck constant h are chosen as the fundamental units, the dimension of mass is: (a) $h^{1/2}c^{1/2}G^{-1/2}$ (b) $h^{1/2}c^{-1/2}G^{1/2}$ (c) $h^{-1/2}c^{1/2}G^{-1/2}$ (d) $h^{-1/2}c^{-1/2}G^{-1/2}$	1
3.		What should be the angle θ between two vectors for their resultant to be minimum? (a) 30º (b) 45º (c) 90º (d) 180º	1
4.		A body of mass M moving with velocity V explodes into two equal parts. If one comes to rest and the other body moves with velocity v, what would be the value of v? (a) V (b) $V/\sqrt{2}$ (c) 2V (d) 4V	1

5.		The resultant of two equal forces acting at right angle to each other is 1414 N. The magnitude of either force is: (a) 10N (b)100N (c) 1000N (d) 10000N	1
6.		A particle moves in one dimension. Its velocity is given by $v(t)=c_2t^2+c_1t+c_0$ where c_0 ,c_1 and c_2 are constants. What is the acceleration of the particle at time t = 1s? (a) c_1+2c_2 (b) c_0 (c) c_1+c_2 (d) c_1	1
7.		A spring of force constant 800N/m has an extension of 5cm. The work done in extending it from 5cm to 15cm is: (a) 16 J (b) 8 J (c) 32 J (d) 24 J	1
8.		The distance between the centres of carbon and oxygen atoms in carbon monoxide gas molecules is 1.2 Å. Find the distance of centre of mass of molecules from carbon atom. (a) 0.3 Å (b) 0.7 Å (c) 0.5 Å (d) 0.9 Å	1
9.		Two bodies of mass 4 kg and 6 kg are tied to the ends of a massless string. The string passes over a pulley which is frictionless (see figure). The acceleration of the system in terms of acceleration due to gravity (g) is:  (a) g/2 (b) g/5 (c) g/10 (d) g	1
10.		The mass of moon is 1/81 of earth's mass and radius is 1/4 that of earth. If the escape speed from the surface of the earth is 11.2 km/s, its value for the moon is: (a) 0.14 km/s (b) 0.76 km/s (c) 2.45 km/s (d) 5.28 km/s	1
11.		If the length of a simple pendulum is increased by 45%, what is the percentage increase in its time period? (a) 10.5% (b) 18.5% (c) 22.5% (d) 30.5%	1
12.		Following are the graphs of elastic materials. Which one corresponds to that of brittle material?	1

		 (a) i (b) ii (c) iii (d) i and ii	
		For question numbers 13 to16, two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below. a) Both A and R are true and R is the correct explanation of A. b) Both A and R are true but R is NOT the correct explanation of A. c) A is true but R is false. d) A is false and R is true.	
13.		**Assertion (A):** A body becomes massless at the centre of earth. **Reason (R):** This follows from g' = g (1 – d/R)	1
14.		**Assertion(A):** Angular speed of a planet around the sun decreases when it is closer to the sun. **Reason(R):** Total angular momentum of the system remains constant.	1
15.		**Assertion (A):** When the momentum of a body is doubled then its kinetic energy becomes four times the initial kinetic energy. **Reason (R):** The kinetic energy is inversely proportional to the square of the momentum.	1
16.		**Assertion (A):** In an elastic collision between two bodies, the relative velocity of approach before collision is equal to the relative velocity of separation after the collision. **Reason (R):** In an elastic collision, the linear momentum of the system is conserved.	1
		SECTION B	
17.		A bullet fired into a fixed target loses half of its velocity after penetrating 3 cm. How much further it will penetrate before coming to rest if it faces constant resistance to motion?	2
18.		A car of mass 1000 kg moving with a speed 18 km h^{-1} on a smooth road collides with a horizontally mounted spring of spring constant 6.25×10^{3}N m^{-1}. What is the maximum compression of the spring?	2
19.		Derive an expression for the orbital velocity of a satellite.	2
20.		Find the change in internal energy of a block of copper of mass 200 g when it is heated from 25℃ to 75℃. The specific heat of copper=0.1 cal/g/℃ and the change in volume is considered negligible.	2

21.		Two springs of force constants k and 2k are connected to a mass m as shown below. Find the frequency of oscillation of the mass. 	2
		SECTION C	
22.		Assuming that the critical velocity V of a viscous liquid flowing through a capillary tube depends on the radius (r) of the tube, density (ρ) of the liquid and viscosity (η) of the liquid, find an expression for critical velocity.	3
23.		A body of weight 200N is suspended with the help of strings as show in figure. Find the tensions T_1 and T_2 in the strings. 	3
24.		A 10kW drilling machine is used to drill a bore in a small aluminium block of mass 8.0kg. How much is the rise in temperature of the block in 2.5 minutes, assuming 50% of power is used up in heating the machine itself or lost to the surrounding? Specific heat of aluminium =0.91J/g/℃.	3
25.	(a)	If the change in the value of 'g' at a height 'h' above the surface of earth is same as that at a depth 'd' below it (both d and h being much smaller than radius of the earth), then how are d and h related to each other?	3
	(b)	A solid cylinder of mass 20 kg rotates about its axis with angular speed 100 rad/s. The radius of the cylinder is 0.25 m. Calculate the moment of inertia and kinetic energy associated with the rotation of the cylinder?	
26.	(a)	Derive the relation between torque applied and angular momentum produced in a rigid body.	3
	(b)	A child stands at the centre of a turntable with his two arms outstretched. The turntable is set rotating with an angular speed of 40 rev/min. How much is the angular speed of the child, if he folds his hands back and thereby reduces his moment of inertia to (2/5) times the initial value? Assume that the turntable rotates without friction.	
27.		Write Newton's formula for the speed of sound wave in air. What are the limitations of this formula? Explain how Laplace corrected this formula. Derive the expression for the corrected speed of sound in air.	3

		OR Write expression of Kinetic energy and potential energy in SHM. Hence show that total energy is conserved in SHM.	
28.		A liquid drop of diameter 4 mm breaks into 1000 droplets of equal size. Calculate the resultant change in surface energy, the surface tension of the liquid is 0.07N/m.	3
		SECTION D	
29.		An isothermal process is one in which pressure and volume of the system changes, but temperature remains constant. Such a process is carried out very slowly in a container with conducting walls so that heat gets sufficient time to get exchanged between the system and the surrounding. Answer the following questions based on the given paragraph.	
	(a)	When a gas is suddenly compressed, it gets heated up. Explain it on the basis of first law of thermodynamics.	1
	(b)	The P−V diagram for a cyclic process is a triangle ABC. Calculate work done during the process from B to C. (Pressure is in Nm^{-2} and volume is in litre.)  	1
	(c)	Obtain an expression for work done by a gas in an isothermal expansion.	2
30.		When a car negotiates a curved road, the force of friction between the road and the tyres provides the centripetal force required to keep the car in motion around the curve. The large amount of friction between the tyres and the road produces considerable wear and tear of the tyres. To avoid dependence of friction the curved road is given an inclination sloping upwards towards the outer circumference. Answer the following questions based on the given paragraph.	
	(a)	The radii of circular paths of two particles of same masses are in the ratio 6:8. What should be the ratio of their velocities to have a constant centripetal force.	1
	(b)	Why do we need banking of the curved road?	1
	(c)	Derive the expression of maximum speed of a car with which the car can turn safely when going around a circular level road.	2
		SECTION E	
31.	(a)	Derive expression for time period of a simple pendulum.	2

	(b)	A particle executing SHM along a straight line has a velocity of 4m/s when at a distance of 3m from its mean position and 3m/s when at a distance of 4m from it. Find the amplitude and angular frequency.	3
		OR	
	(a)	A simple harmonic oscillation is represented by the equation y= 0.40 sin (440 t+0.61), in which y and t are in m and s respectively. Calculate the amplitude, angular frequency, frequency of the oscillations.	2
	(b)	Analytically derive expression of frequency of vibration of an open organ pipe of length L. Also show that various frequencies of an open organ pipe are in the ratio 1:2:3:4 harmonics.	3
32.	(a)	A projectile is fired horizontally with a velocity u making an angle Θ with the horizontal. Derive expressions for time of flight and horizontal range. Also find the condition for the maximum horizontal range.	3
	(b)	A man runs across the roof-top of a tall building and jumps horizontally with hope of landing on the roof of the next building which is at a lower height than the first. If his speed is 9m/s, the horizontal distance between the two buildings is 10m and height difference is 9m, will he be able to land on the next building? Substantiate your answer. ($g=10m/s^2$)	2
		OR	
	(a)	A particle starts from origin at t=0 with velocity 5.0ˆi m/s and moves in x-y plane under action of a force which produces a constant acceleration of (3.0ˆi+2.0ˆj) m/s^2. (i) What is the y-coordinate of the particle, at the instant its x-coordinate is 84 m? (ii) What is the speed of the particle at this instant of time?	3
	(b)	Find the relation between linear velocity and angular velocity?	2
33.	(a)	State and prove Bernoulli's principle for the flow of non-viscous fluids.	3
	(b)	A copper block of mass 2.5 kg is heated in a furnace to a temperature of 500℃ and then placed on a large ice block. What is the maximum amount of ice that can melt? The specific heat of copper=0.39 J/g/℃ and heat of fusion of water=335 J/g.	2
		OR	
	(a)	Derive an expression for the excess pressure inside a liquid drop.	3
	(b)	The excess pressure inside a soap bubble of radius 6mm is balanced by 2mm column of oil of density 800 kgm^{-3}. Find the surface tension of soap solution. ($g=9.8m/s^2$)	2