

VIKAS BHARATI PUBLIC SCHOOL
SAMPLE PAPER (SESSION 2023-24)

Class: XI

SUBJECT: PHYSICS

Time : 3 Hrs.

M.M : 70

Note: 1. This question paper contains 7 printed pages and 33 questions.

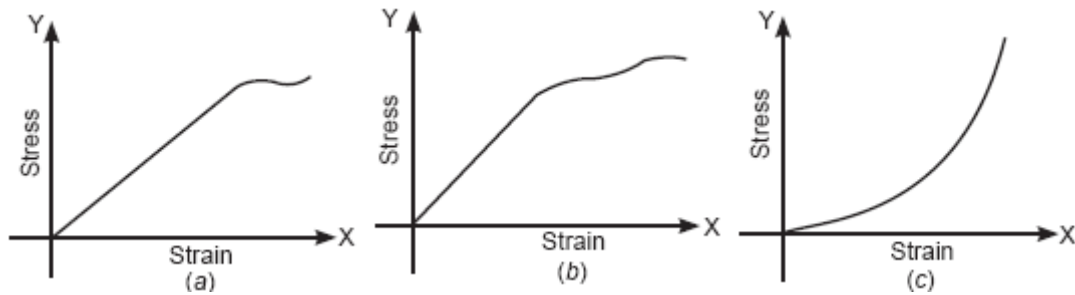
2. All questions are compulsory.

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.		The pair of quantities having the same dimensions is: (a) Displacement, velocity (b) Time, frequency (c) wavelength, focal length (d) Force, acceleration	1
2.		The velocity v of a particle is given in terms of time t is $v = at + \frac{b}{t+c}$. The dimensions of a, b, c are: (a) $L^2; T; LT^{-2}$ (b) $LT^2; LT; L$ (c) $LT^{-2}; L; T$ (d) $L; LT; T^2$	1
3.		The angle between vector $A = (i + j)$ and vector $B = (i - j)$ is: a) 30° b) 45° c) 90° d) 180°	1
4.		During the motion of a lift, apparent weight of a body becomes twice its actual weight when: (a) lift is moving down with acc. = g (b) lift is moving up with acc. = g (c) lift is moving down with uniform velocity = 9.8 ms^{-1} (d) lift is moving up with uniform velocity = 9.8 ms^{-1} .	1

5.	A body of mass m collides against a wall with the velocity v and rebounds with the same speed. Its change of momentum is: (a) $2mv$ (b) mv (c) $-mv$ (d) zero	1
6.	If the resultant of two forces of magnitudes B & Q acting at a point at an angle 60° is $\sqrt{7}Q$ then P/Q is: (a) 1 (b) 2 (c) $3/2$ (d) 4	1
7.	In which case does the potential energy decrease? (a) On compressing the spring. (b) On stretching a spring. (c) On moving a body against gravitational pull. (d) On the raising of an air bubble in water.	1
8.	An earth satellite is moving around the earth in a circular orbit. In such case, what is conserved? (a) Velocity (b) Linear momentum (c) Angular momentum (d) None of the above.	1
9.	The orbital speed of an artificial satellite in a circular orbit just above the earth's surface is v . For a satellite orbiting at an altitude of half the earth's radius the orbital speed is (a) $(3/2)v$ (b) $(\sqrt{3/2})v$ (c) $(\sqrt{2/3})v$ (d) $(2/3)v$	1
10.	A body of mass m is placed on earth surface which is taken from earth surface to a height of $h = 3R$, then change in gravitational potential energy is (a) $\frac{1}{4}mgR$ (b) $\frac{2}{3}mgR$ (c) $\frac{3}{4}mgR$ (d) $\frac{1}{3}mgR$	1
11.	When a spring is stretched by 2 cm, it stores 100 J of energy. If it is stretched further by 2cm, the stored energy will be increased by: a) 100 J b) 200 J c) 300 J d) 400 J	1
12.	Following are the graphs of elastic materials. Which one corresponds to that of brittle material?	1



For question numbers 13,14,15 and 16, 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 bullet is fired from a rifle. If the rifle recoils freely, the kinetic energy of rifle is more than that of the bullet.

Reason (R): In case of rifle bullet system, the law of conservation of momentum violates.

14. Assertion (A): The heat supplied to a system is always equal to the increase in its internal energy.

Reason (R): When a system changes from one thermal equilibrium to another, some heat is absorbed by it.

15. Assertion (A): In a perfectly inelastic collision in the absence of external forces, the kinetic energy is never conserved.

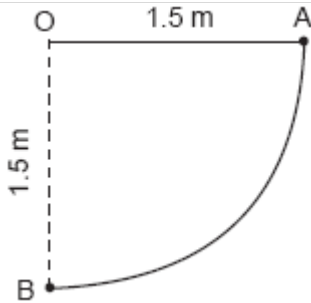
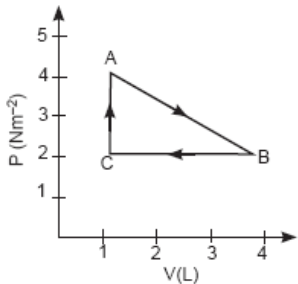
Reason (R): The objects deformed and stick together in this type of collision

16. Assertion (A): A body loses weight when it is at the centre of the earth.

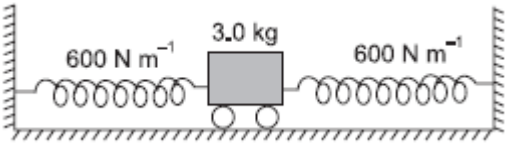
Reason (R): At the centre of earth, $g = 0$. Therefore, weight = $mg = 0$.

SECTION B

17. The bob of a pendulum is released from a horizontal A as shown. If the length of the pendulum is 1.5 m, what is the speed with which the bob arrives at the lowermost point B, given that it dissipates 5% of its initial energy against air resistance?

			
18.	Draw the graph showing the variation of potential energy and kinetic energy of a block attached to a spring, which obeys Hooke's law.		2
19.	The change in the value of g at a height h above the earth is same as at a depth d below it. If h and d are small as compared to the radius of the earth, what is the ratio (h/d) ?		2
20.	The P-V diagram for a cyclic process is a triangle ABC drawn in order. The co-ordinates of A, B, C are (4, 1), (2, 4) and (2, 1). The co-ordinates are in the order (P-V). Pressure is in Nm^{-2} and volume is in litre. Calculate work done during the process from A to B, B to C.		2
21.	Obtain an expression for work done by a gas in an isothermal expansion.		2
	SECTION C		
22.	The time of oscillation (t) of a small drop of liquid under surface tension depends upon the density ρ , radius r and surface tension (σ). Prove dimensionally that $t \propto \sqrt{\frac{\rho r^3}{\sigma}}$		3
23.	A burglar's car had a start with an acceleration of 2m/s^2 . A police van came after 5s and continued to chase the burglar's car with a uniform velocity of 20m/s . Find the time in which the police van overtakes the burglar's car?		3
24.	A block of mass 25 kg is raised by a 50 kg man in two different ways as shown. What is the action on the floor by the man in the two cases? If the floor yields to a normal force of 700 N , which mode should the man adopt to lift the block without the floor yielding?		3

25.	a)	Why do you prefer to use a wrench of long arm?	3
	b)	A 3 m long ladder weighing 20 kg leans on a frictionless wall. Its feet rest on the floor 1 m from the wall. Find the reaction forces of the wall and the floor.	
26.	a)	Derive the relation: $L = I\omega$	3
	b)	The distance between the centres of carbon and oxygen atoms in carbon monoxide gas molecules is 1.13 Å. Locate the centre of mass of the molecules relative to carbon atom.	
27.		Obtain an expression for a stationary wave formed by two sinusoidal waves travelling along the same path in the opposite direction analytically and obtain the positions of nodes and antinodes. OR The fundamental frequency of sonometer wire increases by 5 Hz. If its tension is increased by 21%, how will the frequency be affected if its length is increased by 10%?	3
28.		A liquid drop of diameter 4 mm breaks into 1000 droplets of equal size. Calculate the resultant change in the surface energy, the surface tension of the liquid is 0.07 N/m.	3
		SECTION D	
29.		We can say that heat is the form of energy transferred between two (or more) systems or a system and its surroundings by virtue of temperature difference. The SI unit of heat energy transferred is expressed in joule (J) while SI unit of temperature is Kelvin (K), and degree Celsius ($^{\circ}\text{C}$) is a commonly used unit of temperature. When an object is heated, many changes may take place. Its temperature may rise; it may expand or change state. A measure of temperature is obtained using a thermometer. Many physical properties of materials change sufficiently with temperature. Some such properties are used as the basis for constructing thermometers. The two familiar temperature scales are the Fahrenheit temperature scale and the Celsius temperature scale.	
	(a)	What is absolute zero temperature.	1
	(b)	Write the Relation between Kelvin (T) and Celsius temperature (t_c) scale?	1
	(c)	Convert the boiling temperature of gold, 2966 $^{\circ}\text{C}$, into degrees Fahrenheit and kelvin.	2
30.		According to Newton's second law of motion, $F=ma$, where F is force required to produce an acceleration a in a body of mass m. if $a = 0$, then $F=0$ i.e. no external force is required to	

		<p>move a body uniformly along a straight line. If a force act on a body for t seconds, the effect of force is given by impulse = $F \times t$</p> <p>Answer the following questions based on the given paragraph.</p>	
	(a)	Explain why a cricketer moves his hands backwards while holding a catch.	1
	(b)	An impulsive force of 100 N acts on a body for 1 s. What is the change in its linear momentum.	1
	(c)	A cricket ball of mass 150 g is moving with a velocity of 12 m/s and is hit by a bat so that the ball is turned back with a velocity of 20m/s. if duration on contact between the ball and bat is 0.01 s, find the impulse of force.	2
		SECTION E	
31.	(a)	<p>A harmonic oscillation is represented by $y = 0.34 \cos (3000 t + 0.74)$, where y and t are in m and s respectively.</p> <p>Deduce : (i) the amplitude, (ii) angular frequency, (iii) the period</p>	3
		<p>What is the frequency of oscillation of a simple pendulum mounted in a cabin that is freely falling under gravity?</p> <p style="text-align: center;">OR</p>	2
	(a)	<p>A trolley of mass 3.0 kg, as shown in Figure, is connected to two springs, each of spring constant 600 N m^{-1}. If the trolley is displaced from its equilibrium position by 5.0 cm and released, what is (a) the period of ensuing oscillations, and (b) the maximum speed of the trolley ?</p> 	3
	(b)	Derive expression of frequency of vibration of parallel combination.	2
32.	(a)	A bomb is dropped from an airplane when it is directly above a target at a height of 1000 m. The airplane is moving horizontally with a speed of 500 kmh^{-1} . By the how much distance will the bomb miss the target?	3
	(b)	A ball is thrown at an angle θ with the horizontal and the range is maximum. Calculate the value of $\tan\theta$.	2
		OR	
	(a)	<p>A particle starts from the origin at $t = 0$ s with a velocity of $10.0\hat{j}$ m/s and moves in the x-y plane with a constant acceleration of $(8.0\hat{i} + 2.0\hat{j}) \text{ ms}^{-2}$.</p> <p>(i) At what time is the x-coordinate of the particle 16 m? What is the y-coordinate of the</p>	3

		particle at that time? (ii) What is the speed of the particle at the time?	
	(b)	Two cars are going in two concentric circular orbits of radius r_1 and r_2 with angular velocities ω_1 and ω_2 . What is the ratio of their linear velocities?	2
33.	(a)	Derive an expression for the terminal velocity of a small spherical body falling through a viscous medium.	3
	(b)	An iron ball of radius 0.3 cm falls through a column of oil density 0.94 g/cm^3 . It is found to attain a terminal velocity of 0.5 cm/s. Determine the viscosity of the oil. The density of iron is 7.8 g/cm^3 . OR	2
	(a)	Derive expression for excess pressure inside a liquid drop.	3
	(b)	What would be the gauge pressure inside an air bubble of 0.2 mm radius situation just below the surface of the water? The surface tension of the water is 0.07 N/m.	2