

VISHWA BHARATI PUBLIC SCHOOL, DWARKA

Annual Examination (2024-2025)

Date: 27/01/2025

CLASS 11 – PHYSICS

Maximum Marks: 70

Time Allowed: 3 hours

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) 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 Questions of five marks each.
- (4) 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 CBQ in section D and all three questions in section E. You have to attempt only one of the choices in such questions.
- (5) Use of calculators are not allowed

Section A

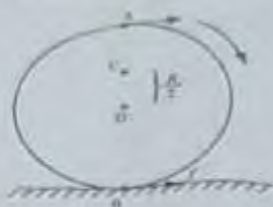
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|---|---|-----|
| 1 | A ball is dropped from the top of a building 100 m high. At the same instant another ball is thrown upwards with a velocity of 40 m/s from the bottom of the building. The two balls will meet after:
a) 5 s
b) 2 s
c) 2.5 s
d) 3 s | [1] |
| 2 | At time $t = 0$ a particle starts travelling from a height, $7\hat{z}$ cm in a plane keeping z coordinate constant. At any instant of time its position along the $\hat{x}$ and $\hat{y}$ directions are defined as $3t$ and $5t^2$ respectively. At $t = 1$ s acceleration of the particle will be
a) $3\hat{x} + 15\hat{y}$
b) $-30\hat{y}$
c) $30\hat{y}$
d) $3\hat{x} + 15\hat{y} + 7\hat{z}$ | [1] |
| 3 | A car of mass m starts from rest and acquires a velocity along east $\mathbf{v} = v\hat{i}$ ($V > 0$) in two seconds. Assuming the car moves with uniform acceleration, the force exerted on the car is
a) $\frac{mv}{2}$ exerted by the engine.
b) more than $\frac{mv}{2}$ eastward exerted due to the engine and overcomes the friction of the road | [1] |

	c) $\frac{mv}{2}$ eastward and is due to the friction on the tyres exerted by the road d) $\frac{mv}{2}$ eastward and is exerted by the car engine	
4	A bullet of mass 0.012 kg and horizontal speed 70 ms^{-1} strikes a block of wood of mass 0.4 kg and instantly comes to rest with respect to the block. The block is suspended from the ceiling by means of thin wires. Calculate the height to which the block rises. Also, estimate the amount of heat produced in the block?. a) 72.2 cm, 28.5 J b) 21.2 cm, 28.5 J c) 29.2 cm, 29.5 J d) 23.2 cm, 38.5 J	[1]
5	Three masses are placed on the x - axis: 300 g at origin, 500 g at $x = 40 \text{ cm}$ and 400 g at $x = 70 \text{ cm}$. The distance of the center of mass from the origin is a) 30 cm b) 40 cm c) 45 cm d) 50 cm	[1]
6	A satellite of the earth is revolving in a circular orbit with a uniform speed v. If the gravitational force suddenly disappears, the satellite will: a) move with a velocity v tangentially to the original orbit b) fall with increasing velocity c) ultimately come to rest, some where on the original orbit d) continue to move with velocity v along the original orbit	[1]
7	There are two wires of same material and same length while the diameter of second wire is two times the diameter of first wire, then the ratio of extension produced in the wire by applying same load will be a) 2: 1 b) 1: 1 c) 4: 1 d) 1: 2	[1]
8	If dimensions of critical velocity v_c, of liquid flowing through a tube, are expressed as $[\eta^x \rho^y r^z]$, where η, ρ and r are the coefficient of viscosity of liquid, density of liquid and radius of the tube respectively, then the values of x, y and z are given by a) - 1, - 1, - 1 b) 1, 1, 1 c) - 1, - 1, 1	[1]

	d) 1, -1, -1	
9	A composite rod made of copper ($\alpha = 1.8 \times 10^{-5} \text{ K}^{-1}$) and steel ($\alpha = 12 \times 10^{-5} \text{ K}^{-1}$) is heated. Then a) it bends with steel on concave side b) data is insufficient c) it does not expand d) it bends with copper on concave side	[1]
10	A steam engine delivers $5.4 \times 10^8 \text{ J}$ of work per minute and services $3.6 \times 10^9 \text{ J}$ of heat per minute from its boiler. What is the efficiency of the engine? How much heat is wasted per minute? a) 14 percent, $3.0 \times 10^9 \text{ J}$ b) 12 percent, $2.8 \times 10^9 \text{ J}$ c) 13 percent, $2.9 \times 10^9 \text{ J}$ d) 15 percent, $3.06 \times 10^9 \text{ J}$	[1]
11	Air at 20.0°C in the cylinder of a diesel engine is compressed from an initial pressure of 1.00 atm and a volume of 800.0 cm^3 to a volume of 60.0 cm^3. Assume that air behaves as an ideal gas with $\gamma = 1.4$ and that the compression is adiabatic. Find the final temperature of the air. a) 826 K b) 679 K c) 765 K d) 898 K	[1]
12	If the period of oscillation of mass M suspended from a spring is one second, then the period of mass 4 M will be: a) 4s b) 2s c) $\frac{1}{2} \text{ s}$ d) $\frac{1}{4} \text{ s}$	[1]
13	Assertion (A): Power of machine gun is determined by both, the number of bullets fired per second and kinetic energy of bullets. Reason (R): Power of any machine is defined as work done (by it) per unit time. 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 but R is true.	[1]
14	Assertion: If the volume of a body remains unchanged, when subjected to tensile strain, the value	[1]

	of Poisson's ratio is $-\frac{1}{2}$. Reason: Phosphor bronze has low Young's modulus and higher rigidity modulus. a) Assertion and reason both are correct statements and reason is correct explanation for assertion. b) Assertion and reason both are correct statements but reason is not correct explanation for assertion. c) Assertion is correct statement but reason is wrong statement. d) Assertion is wrong statement but reason is correct statement.	
15	Assertion: Viscous force is measurement of resistance of a liquid. Reason: Work done by viscous force converts kinetic energy into heat energy of liquid. a) Assertion and reason both are correct statements and reason is correct explanation for assertion. b) Assertion and reason both are correct statements but reason is not correct explanation for assertion. c) Assertion is correct statement but reason is wrong statement. d) Assertion is wrong statement but reason is correct statement.	[1]
16	Assertion (A): Liquids usually expand more than solids. Reason (R): The intermolecular forces in liquids are weaker than in solids. 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 but R is true.	[1]
Section B		
17	Why can't we use a pendulum to work as a clock in a satellite?	[2]
18	A body is moving with a uniform velocity of 10 m s^{-1} on a circular path of diameter 2.0 m. Calculate (i) the difference between the magnitude of the displacement of the body and the distance covered in half a round and (ii) the magnitude of the change in velocity of the body in half a round.	[2]
19	A train has to negotiate a curve of 400 m. By how much should the outer rail be raised with respect to the inner rail for a speed of 48 kmh^{-1} ? The distance between the rails is 1 m.	[2]
20	Define power. Prove that $P = \vec{F} \cdot \vec{v}$, where the symbols have their usual meanings.	[2]
21	A particle executes SHM on a straight-line path. The amplitude of oscillation is 2 cm. When the displacement of the particle from the mean position is 1 cm, the magnitude of its acceleration is equal to its velocity. Find the time period, maximum velocity and maximum acceleration of SHM. OR If the length of a simple pendulum is increased by 25%, then what is the change in its time period?	[2]
Section C		
22	A batsman deflects a ball by an angle of 45° without changing its initial speed which is equal to 54 km/h . What is the impulse imparted to the ball? (Mass of the ball is 0.15 kg .)	[3]

- 23 A disc rotating about its axis with angular speed ω is placed lightly (without any translational push) on a perfectly frictionless table. The radius of the disc is R . What are the linear velocities of the points A, B and C on the disc? Will the disc roll in the direction indicated? [3]



OR

Estimate the moment of inertia for a disc of radius R and mass M about an axis passing through its centre and perpendicular to its plane.

- 24 A vertical off-shore structure is built to withstand a maximum stress of 10^9 Pa. Is the structure suitable for putting up on top of an oil well in the ocean? Take the depth of the ocean to be roughly 3 km, and ignore ocean currents. [3]
- 25 One kilogram molecule of a gas at 400K expands isothermally until its volume is doubled. Find the amount of work done and heat produced. [3]
- 26 Prove that the average Kinetic Energy of a molecule of an ideal gas is directly proportional to the absolute temperature of the gas. [3]
- 27 Prove that the sum of kinetic energy, potential energy and total energy of a particle doing SHM is constant. [3]
- 28 What are standing waves? Discuss analytical Method of formation of standing waves in stretched string? [3]

Section D

- 29 Read the text carefully and answer the questions: A system of two blocks is attached with a spring and stretched by two equal and opposite forces as shown in the figure. Let the maximum stretch of spring towards each block is $\frac{x}{2}$. [4]



- The magnitude of spring force on block B is
 - $kx - 2$
 - $2kx$
 - kx
 - $\frac{kx}{2}$
- The equation of SHM for block B when F from both blocks is removed, is
 - $F_{SHM} = kx$
 - $F_{SHM} = -kx$

$$c) F_{SHM} = -m\omega^2 x$$

$$d) F_{SHM} = -\frac{m\omega^2 x}{2}$$

3. The time period of the two blocks system is

$$a) 2\pi\sqrt{\frac{2m}{k}}$$

$$b) 2\pi\sqrt{\frac{m}{4k}}$$

$$c) 2\pi\sqrt{\frac{m}{k}}$$

$$d) 2\pi\sqrt{\frac{m}{2k}}$$

4. In SHM,

- PE is stored due to elasticity of system
- KE is stored due to inertia of system
- Both KE and PE are stored by virtue of elasticity of system
- PE is stored due to elasticity of system and KE is stored due to inertia of system

a) Option (a)

b) Option (d)

c) Option (b)

d) Option (c)

OR

5.

- Time period of a spring - mass system depends on its amplitude.
- Time period of a spring - mass system depends on its mass.
- Time period of a spring - mass system depends on spring constant.

a) I and II

b) II and III

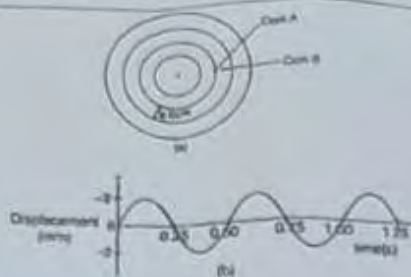
c) All of these

d) I and III

30 Read the text carefully and answer the questions: A stone is dropped in a liquid at rest in a tank. The fig. (a) below shows circular wave fronts. The waves produced at the centre of a circular ripple tank. Two corks A and B, floats on the water and moves up & down on the surface as the wave passes. The wavelength of the wave is 8.0 cm.

The Fig. (b) shows how the displacement of A varies with time.

[4]



1. Name the type of waves produced on water surface.
 - a) Longitudinal wave
 - b) EM wave
 - c) Transverse wave
 - d) Sound wave
2. What is the amplitude of the vibrations of A as wave passes?
 - a) 0.50mm
 - b) 8 mm
 - c) 2 mm
 - d) 0.25 mm
3. The horizontal distance between A and B is half the wavelength of the wave, then the displacement of B with time is
 - a) opposite to that of A with equal magnitude
 - b) double in magnitude as that of A
 - c) same as that of A with equal magnitude
 - d) half in magnitude as that of A
4. What is the frequency of the wave?
 - a) 0.2Hz
 - b) 4 Hz
 - c) 0.4Hz
 - d) 2Hz

OR

5. If the distance between the center of the ripple tank and its edge is 40 cm, then the time taken by the wave to travel from the center of the tank to the edge is
 - a) 2.5 s
 - b) 4.5 s
 - c) 3 s

d) 5 s	
31	Two mercury droplets of radii 0.1 cm and 0.2 cm collapse into one single drop. What amount of energy is released? The surface tension of mercury $S = 435.5 \times 10^{-3} \text{ N/m}$. When two or more droplets collapse to form a bigger drop, then show that its surface area decreases and energy is released equal to $S \Delta A$. OR Derive an expression for the excess pressure inside a soap bubble.
32	Describe the working of Carnot engine. Obtain an expression for its efficiency. OR What is heat engine. Discuss the working of heat engine in brief.
33	Derive an expression for nth mode of vibration in case of a closed end organ pipe. Hence, give the value of $V_1 : V_3 : V_5$. OR Obtain the Newton Formula for the speed of sound waves in gases? What correction was made by Laplace in the Newton formula?

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17/01/20