

BUDHA DAL PUBLIC SCHOOL, PATIALA

Final Examination (19 February 2026)

Class XI (Science)

Subject - Physics (Set - A)

M.M. 70

Time: 3hrs

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 16 questions, 12 MCQ and 4 Assertion Reasoning based of 1 mark each. **Section B** contains 5 questions of two marks each, **Section C** contains 7 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) Use of calculators is not allowed.

Section - A

- Q1. The vectors $\vec{A} = n\hat{i} - \hat{j} + 2\hat{k}$ and $\vec{B} = 2\hat{i} + 2\hat{j} - \hat{k}$ are perpendicular to each other. The positive value of n is
a) 1 b) 2 c) 3 d) 4
- Q2. The maximum velocity (in ms^{-1}) with which a car driver must traverse a flat curve of radius 150 m and coefficient of friction 0.6 to avoid skidding is
a) 60 b) 30 c) 15 d) 25
- Q3. If the momentum of a body increases by 0.01%, then its K.E. will increase by
a) 0.01% b) 0.02% c) 0.03% d) 0.04%
- Q4. When disc rotates with uniform angular velocity, which of the following is incorrect?
a) The sense of rotation remains the same.
b) The orientation of the axis of rotation remains the same.
c) The speed of rotation is non-zero and remains same.
d) The angular acceleration is non-zero and remains the same.
- Q5. The dimension formula for co-efficient of viscosity is
a) $[\text{ML}^2 \text{T}^{-2}]$ b) $[\text{ML}^{-1} \text{T}^{-1}]$ c) $[\text{MLT}^{-2}]$ d) $[\text{M}^2 \text{L}^{-2} \text{T}^{-1}]$
- Q6. In old age, arteries carrying blood in the human body become narrow resulting in an increase in the blood pressure. This follows from
a) Pascal's law b) Stoke's law c) Bernoulli's principle d) Archimedes's principle
- Q7. According to Wien's law
a) $\lambda_m T = \text{constant}$ b) $\frac{\lambda_m}{T} = \text{constant}$ c) $\lambda_m \sqrt{T} = \text{constant}$ d) $\frac{\lambda_m}{\sqrt{T}} = \text{constant}$
- Q8. The period of a simple pendulum of infinite length is
a) infinity b) zero c) 2s d) 84 minutes
- Q9. The work done in blowing a soap bubble of radius 0.2 m, given that surface tension of soap solution is $60 \times 10^{-3} \text{ N/m}$ is
a) $24\pi \times 10^{-4} \text{ J}$ b) $2.4\pi \times 10^{-4} \text{ J}$ c) $96\pi \times 10^{-4} \text{ J}$ d) $1.92\pi \times 10^{-4} \text{ J}$
- Q10. A body of mass m is orbiting the earth at radius r from the centre of earth. Another body of mass $2m$ is orbiting at a distance $2r$. What is the ratio of their time period?
a) 1:2 b) $1:\sqrt{2}$ c) $1:2^{2/3}$ d) $1:2\sqrt{2}$

A - 1



- Q11. Two identical balls A and B collide head on elastically. If velocities of A and B, before the collision are +0.5 m/s and -0.3 m/s respectively, then their velocities, after the collision, are respectively.
- a) -0.5 m/s and +0.3 m/s b) +0.5 m/s and +0.3 m/s
c) +0.3 m/s and -0.5 m/s d) -0.3 m/s and +0.5 m/s

- Q12. Equation of a plane progressive wave is given by $y = 0.6 \sin 2\pi \left(t - \frac{x}{2}\right)$. On reflection from a denser medium its amplitude becomes $\frac{2}{3}$ of the amplitude of the incident wave. The equation of the reflected wave is

- a) $y = 0.6 \sin 2\pi \left(t + \frac{x}{2}\right)$ b) $y = 0.4 \sin 2\pi \left(t + \frac{x}{2}\right)$
c) $y = -0.4 \sin 2\pi \left(t + \frac{x}{2}\right)$ d) $y = -0.4 \sin 2\pi \left(t - \frac{x}{2}\right)$

In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R). Mark the correct choice as:

- a) Both Assertion (A) and Reason (R) true and Reason (R) is the correct explanation of Assertion (A).
b) Both Assertion (A) and Reason (R) are true but Reason (R) is not a correct explanation of Assertion (A).
c) Assertion (A) is true but Reason (R) is false.
d) Assertion (A) is false and Reason (R) is also false.
- Q13. Assertion (A) : If the ice on the polar caps of the earth melts, then length of day will increase.
Reason (R) : Moment of inertia of earth increases as ice on polar caps melts.
- Q14. Assertion (A) : Smaller drops of liquid resist deforming forces better than the larger drops.
Reason (R) : Excess pressure inside a drop is directly proportional to its surface area.
- Q15. Assertion (A) : In an isothermal process, whole of the heat energy supplied to a system is converted into work.
Reason (R) : According to first law of thermodynamics $\Delta Q = \Delta U + P\Delta V$.
- Q16. Assertion (A) : The frequency of oscillation of a simple pendulum mounted in a satellite revolving around the earth is zero.
Reason (R) : The frequency of oscillation is directly proportional to $\sqrt{g}$.

Section - B

- Q17. In a glass capillary tube, water rises upto a height of 10 cm, while mercury falls down by 5cm in the same capillary. If the angles of contact for mercury glass is 60° and the water glass is 0° , then find the ratio of surface tension of mercury and water.

OR

Obtain the expression for the excess of pressure inside a liquid drop.

- Q18. Define total energy and binding energy of a satellite. Derive expression for them.
- Q19. A ball rolls off the top of a stair case with a constant horizontal velocity u . If each step is h metre high and w metre wide, then show that the ball will hit the edge of n th step, if $n = \frac{2hu^2}{gw^2}$
- Q20. What is meant by buckling?
- Q21. Derive an expression of work done during isothermal process.

Section - C

- Q22. a) Derive the relation between torque and moment of inertia of a body.
b) How will you distinguish between a hard boiled egg and a raw egg by spinning each on a table top?

A-2



A moving particle of mass m , makes a head on elastic collision with a particle of mass $2m$, which is initially at rest. Show that colliding particle losses $8/9$ of its K.E., after collision.

Q24.

Obtain an expression for the maximum speed with which a vehicle can safely negotiate a curved rough road banked at an angle θ .

Q25.

a) Define velocity head and gravitational head.

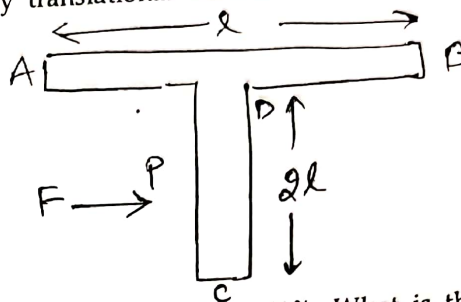
b) What is Magnus effect? Discuss it using the Bernoulli's principle.

Q26.

How much below the surface of earth does acceleration due to gravity become 1% of its value at the earth's surface? The earth is assumed to be a sphere of radius $6.4 \times 10^6 \text{ m}$.

Q27.

A T shaped object with dimensions shown in figure is lying on a smooth floor. A force F is applied at point P parallel to AB such that object has only translational motion without rotation. Find the Distance of the location of point P from point C.



Q28. The length of a simple pendulum executing S.H.M. is increased by 21%. What is the percentage increase in the time period of simple pendulum?

Section - D

Q29. Read the following paragraph and answer the questions that follow.

A gas is a collection of large number of molecules. These molecules are perfectly elastic, identical and hard spheres. The pressure exerted by an ideal gas is given by $P = \frac{1}{3} \rho C^2 = \frac{1}{3} \frac{M}{V} C^2$

Using standard gas equation $PV = RT$, we find that $C^2 = \frac{3RT}{M}$ or $C \propto \sqrt{T}$ or $\frac{1}{2} m C^2 \propto T$, where $\frac{1}{2} C^2$ is average translation kinetic energy per molecule of gas

(i) At 0 K, what happens?

- a) efficiency of engines becomes infinite
- b) all liquids freezes
- c) molecular motion ceases
- d) none of these

(ii) At 27°C temperature, the kinetic energy of an ideal gas is E_1 . If the temperature of gas is increased to 327°C then kinetic energy will be

- (a) $E_1/\sqrt{2}$
- (b) $\sqrt{2} E_1$
- (c) $2E_1$
- (d) $\frac{E_1}{2}$

(iii) The average kinetic energy of a gas molecule is

- (a) Proportional to pressure of gas
- (b) Inversely proportional to the volume of gas
- (c) Inversely proportional to absolute temperature of gas
- (d) Proportional to absolute temperature of gas

(iv) The molecule of an ideal gas at 27°C have a certain mean velocity. At what approximate temperature, will the mean velocity be doubled

- a) 1200°C
- b) 927°C
- c) 327°C
- d) 54°C

OR

(iv) In the kinetic theory of gases, it is assumed that the molecules

- a) repel each other
- b) collide elastically
- c) are massless particles
- d) move with uniform speed

Q30. Read the following paragraph and answer the questions that follow.

The property of a fluid by virtue of which an internal frictional force comes into play between different layers when there is a relative motion between the layers. It is also termed as fluid friction or viscous drag of fluid whenever the liquid flows on horizontal surface in the form of layers of different velocities, a relative motion is produced between them. This relative motion is maintained under the effect of external force. According to Newton a viscous force or viscous drag (F) acts between layers and it depend on

$F \propto A$ and (ii) $F \propto \frac{dv}{dx}$ (velocity gradient between layers) $F \propto A \frac{dv}{dx}$ or $F = -\eta A \frac{dv}{dx}$ where η is coefficient of viscosity.

For liquids $\eta \propto \frac{1}{\sqrt{T}}$ and for gases $\eta \propto \sqrt{T}$ Viscosity of gases does not depend on pressure.

(i) The coefficient of viscosity of hot air is

- a) greater than coefficient of viscosity for cold air
- b) smaller than coefficient of viscosity for cold air
- c) same as coefficient of viscosity for cold air
- d) increase or decrease depending on external pressure

(ii) Viscous force exerted by the liquid flowing between two plates in a streamline flow depends upon the

- a) area of plates
- b) coefficient of viscosity of the liquid
- c) velocity gradient in the direction perpendicular to plates
- d) all of these

(iii) Spherical balls of radius R are falling in a viscous fluid of viscosity η with velocity v . The retarding viscous force acting on spherical ball is

- a) directly proportional to R but inversely proportional to v .
- b) directly proportional to both R and velocity v .
- c) inversely proportional to both radius R and velocity v .
- d) inversely proportional to R but directly proportional to v .

(iv) Viscosity is closely related to

- (a) inertia b) shearing strain c) friction d) none of these

(v) Kinematic viscosity is depend upon

- (a) pressure b) density c) level d) flow

Q31. What are Beats? Discuss the formation of beats analytically. Prove that the frequency is equal to the difference between the frequency of the superimposing waves.

OR

Write Newton's formula for the velocity of sound in air. Why and what correction was applied by Laplace in this formula. Also prove modified formula for velocity of sound.

- Q32.
- a) Find the apparent weight of a person standing on a weighing machine placed in a lift, when lift is
 - (i) moving upward or downward with constant velocity.
 - (ii) moving upward with an acceleration ' a '.
 - b) Show that Newton's second law is the real law of motion.
 - c) Rain appears to fall vertically downward with a speed of 4km/hr for a person moving eastward with a speed of 3km/hr. Calculate the actual speed and direction of the rain.

OR

a) If 27 drops of rain were to be combine to form one new large spherical drop, then what should be the velocity of this large spherical drop? Consider the terminal velocity of 27 drops of equal size falling through the air is 0.20 m/s .

b) Explain why water with detergent dissolved in it should have small angles of contact.

c) Explain why surface tension of a liquid is independent of the area of surface.

Q33.

a) Define gravitational potential energy. Derive an expression for the gravitational potential energy of a body at distance r from the centre of earth.

b) A light string passing over a smooth light pulley connects two blocks of masses m_1 and m_2 (vertically). Calculate the ratio of the masses if the acceleration of the system is $g/8$.

OR

a) Describe various modes of vibration in an open ends organ pipe.

b) Show that the ratio of frequencies of different harmonics with the first harmonic in open pipe is $1 : 2 : 3$.

c) In an open organ pipe, the fundamental frequency is 30Hz . If the organ pipe is closed at one end then what will be the fundamental frequency?