

STD XI

PHYSICS

MARK:70
TIME:3h

PHYSICS PAPER – 1 (THEORY)

(Maximum Marks: 70)

(Time allowed: Three hours)

*(Candidates are allowed additional 15 minutes for only reading the paper.
They must NOT start writing during this time.)*

All questions are compulsory.

This question paper is divided into 4 Sections, A, B, C and D as follows:

Section A

Question number 1 is of twelve marks.

All parts of this question are compulsory.

Section B

Question numbers 2 to 12 carry 2 marks each with two questions having internal choice.

Section C

Question numbers 13 to 19 carry 3 marks each with two questions having internal choice.

Section D

Question numbers 20 to 22 are long-answer type questions and carry 5 marks each.

Each question has an internal choice.

The intended marks for questions are given in brackets [].

All working, including rough work, should be done on the same sheet as and adjacent to the rest of the answer.

Answers to sub parts of the same question must be given in one place only. A list of useful physical constants is given at the end of this paper.

A simple scientific calculator without a programmable memory may be used for calculations.

SECTION A

Answer all questions

Question 1

A. Choose the correct alternatives a , b , c , d for each of the questions given below :

- (i) The mass & volume of a body are measured as 200g & 5 cm³ respectively with possible errors of 0.01g & 0.1 cm³. The percentage error in density is
(a) 4% b) 2.5 % c) 0.25% d) 2%
- (ii) A body is rotating about an axis with a constant angular speed of 1.0 rad / s. The moment of inertia of the body is numerically equal to
(a) Torque b) angular momentum c) kinetic energy d) radius of gyration
- (iii) A lift is falling under gravity . What is the time period of the pendulum attached to its ceiling?
(a) Zero b) 1 s c) infinity d) 2s

- (iv) The Reynolds's number for fluid in a pipe is independent of the
 (a) Viscosity of the fluid (b) Velocity of the fluid (c) Length of the pipe (d) Diameter of the pipe
- (v) The radii of two drops are in the ratio 3:2 ,their terminal velocities are in the ratio
 (a) 9:4 (b) 2:3 (c) 3:2 (d) 2:9

B. Answer the following questions briefly and to the point:

- (i) State parallelogram law of vectors?
- (ii) Define centre of mass of a system of particles.
- (iii) The force F on a body is given by $F=at+bt^2$, where t is the time.
 What are the dimensions of a & b ?
- (iv) State the law of vibrations of a stretched string?
- (v) When an automobile travels for a long distance ,the air pressure in the tyres increase slightly .Why?
- (vi) State any two conditions stokes law is valid?
- (vii) What do you mean by radius of gyration of a body about its axis of rotation?
 [12x1]=12]

SECTION B

Answer all questions

Question 2

- i) Which quantity is measured by the speedometer of an automobile?
- ii) A stone falls from a cliff & travels 24.5m in the last second before it reaches the ground at the foot of the cliff. Find the height of the cliff ($g=9.8 \text{ m/s}^2$).

[2]

Question 3

Two vectors $\vec{A} = 5\hat{i} - 3\hat{j} + a\hat{k}$ & $\vec{B} = 3\hat{i} + \hat{j} + 4\hat{k}$ are perpendicular to each other.

- i) Find the value of a .
- ii) Hence calculate their cross product .

[2]

Question 4

- a) i) At what angle a body must be projected to cover maximum distance in the horizontal plane?
 ii) At this projection ,what will be the ratio of maximum horizontal range to maximum height attained by the projectile?

OR

- b) i) Define angular velocity of a body in a circular motion .
 ii) Calculate the angular velocity of rotation of earth about its axis.

Question 5

What are geo stationary satellite ? State its uses?(Any four)

Question 6

[2]

- i) State the factors on which moment of inertia of a body about an axis depends .
- ii) Three particles of mass 50g each are located at the corners of an equilateral triangle of side 5cm .Calculate the moment of inertia of the system about an axis passing through one corner & perpendicular to the plane of the triangle.

[2]

Question 7

Give reason for the following:

- i) A rifle gives a backward kick on firing a bullet?
- ii) Proper inflation of tyres of vehicles saves fuel. Why?

[2]

Question 8

Write the expression for the speed of transverse wave & longitudinal wave in a solids? (specify the terms)

[2]

Question 9

Distinguish between streamline flow & turbuline flow?

[2]

Question 10

Derive the differential equation of Simple harmonic motion?

[2]

Question 11

a) Draw the stress-strain curve for a loaded wire . On the graph mark the important points

OR

b) A wire increases by 10^{-3} of its length when a stress of $1 \times 10^8 \text{ N/m}^2$ is applied on it. Calculate the Young's modulus of the material of the wire?

[2]

Question 12

Using the law of equipartition of energy ,obtain a relation between the degrees of freedom and the specific heat ratio γ of a polyatomic gas .

[2]

SECTION C

Answer all questions

Question 13

- a) i) State the laws of static friction.
- ii) With the help of a diagram, obtain the relation between the angle of response and the coefficient of friction.
- iii) Calculate the impulse necessary to stop a 1500kg car travelling at 90km/hr

Question 14

[3]

- a) i) Distinguish between conservative & non conservative forces (2 points)
- ii) A spring gun has a spring constant of 18 N/ cm. The spring is compressed 12 cm by a ball of mass 15 g. How much is the potential energy of the spring? If the trigger is pulled, what will be the velocity of the ball?

OR

- b) i) State work energy theorem.
- ii) Two bodies of masses m_1 & m_2 have the same linear momentum. What is the ratio of their kinetic energies?
- iii) What percentage of kinetic energy of a moving particle is transferred to a stationary particle, when moving particle strikes with a stationary particle of mass 9 times that of moving particle?

[3]

Question 15

- i) State parallel axis theorem on moment of inertia.
- ii) State & prove the law of conservation of angular momentum.

[3]

Question 16

- i) Define gravitational potential at a point.
- ii) Derive the expression for it.
- iii) A body weighs 36kgf on earth. What will be its weight at a height equal to the radius of earth?

[3]

Question 17

- i) What is a progressive wave?
- ii) With the help of neat diagram derive the displacement relation for harmonic wave travelling along the positive direction of X-axis ?

[3]

Question 18

Derive an expression for elastic potential energy of a stretched wire . Prove that its elastic energy density is equal to $1/2(\text{stress} \times \text{strain})$.

OR

A simple harmonic motion is represented by

$$x = 10 \sin(20t + 0.5)$$

Write down its amplitude, angular frequency, frequency, time period & initial phase, if displacement is measured in meters & time in seconds .

[3]

Question 19

- i) What is a heat engine ? Explain its working principle .
- ii) Obtain the relation between two specific heats of a gas by applying first law of thermodynamics .

[

SECTION D

Question 20

- a) i) Define escape velocity from earth
- ii) Derive an expression for escape velocity .
- iii) State the relation connecting escape velocity & minimum orbit velocity .
- iv) The distance of planet Jupiter from the sun is 5.2 times that of the earth .

Find the period of revolution of Jupiter around the sun .

OR

- b) i) State the laws of rotational motion .
- ii) Obtain the expression for moment of inertia of a solid sphere about its tangent , using parallel axis theorem .

iii) The angular speed of a motor wheel is increased from 1200rpm to 3120 rpm in 16 seconds .

1. What is its angular acceleration?
2. How many revolutions does the wheel make during this time ?

[5]

Question 21

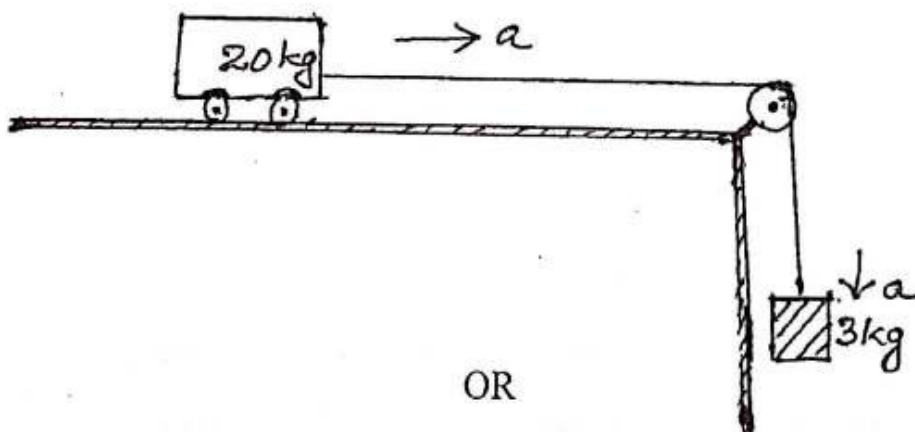
- i) State the principle of superposition of waves .
- ii) Write any four factors which affect the speed of sound in a gas ?
- iii) Obtain the expression for a stationary wave formed by two sinusoidal waves travelling along the same path in opposite directions & obtain the position of nodes & antinodes .

OR

- i) State Newton's law of cooling . Explain it mathematically?
- ii) Write any two postulates of the kinetic theory of an ideal gas ?
- iii) i. Calculate the total number of degree of freedom for a mole of diatomic gas at N.T.P.
ii. What is the efficiency of a carnot engine working between ice point & steam point [5]

Question 22

- i) What do you mean by banking of roads?
- ii) Derive an expression for the maximum possible velocity of a car on a banking road .
- iii) i. What is the acceleration of the block and the trolley system shown in the figure .
ii. Also calculate the tension in the string (coefficient of friction between the trolley and the surface is 0.04, $g=10\text{m/s}^{-2}$)



OR

- i) Derive an expression for the time period of simple pendulum under small oscillations?
- ii) With the help of neat diagram explain various modes of vibration of an open pipe?
- iii) The length of an organ pipe at both ends is 0.5 m. Calculate the fundamental frequency of the pipe, if the velocity of sound in air be 350 m/s. If one end of the pipe is closed, then what will be the fundamental frequency ?

[5]