

# CLASS XI – ANNUAL EXAMINATION

## 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.)

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*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.*

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## SECTION A

*Answer **all** questions.*

### Question 1

(A) Choose the correct alternative (a), (b), (c) or (d) for each of the questions [5×1] given below:

- (i) If the percentage error in measuring the radius of sphere is 2%, then the percentage error in calculating the volume of the sphere is:
- (a) 6%
  - (b) 4%
  - (c) 2%
  - (d) 0 (zero)

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This Paper consists of 7 printed pages and one blank page.

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Turn over

- (ii) If two soap bubbles have radii in the ratio of 1 : 2, then the ratio of excess pressure will be:
- (a) 1 : 2
  - (b) 1 : 4
  - (c) 2 : 1
  - (d) 4 : 1
- (iii) At absolute temperature (T), the average kinetic energy of an ideal gas molecule is:
- (a)  $\frac{1}{2}kT$
  - (b)  $\frac{2}{3}kT$
  - (c)  $\frac{3}{2}kT$
  - (d)  $kT$
- (iv) In a cyclic process the internal energy of a gas:
- (a) increases.
  - (b) remains constant.
  - (c) decreases.
  - (d) becomes zero.
- (v) The type of vibrations produced in the wires of a stringed instrument are:
- (a) progressive longitudinal vibrations.
  - (b) progressive transverse vibrations.
  - (c) standing longitudinal vibrations.
  - (d) standing transverse vibrations.

(B) Answer the following questions briefly and to the point:

[7×1]

- (i) Give the **dimensional** formula of co-efficient of viscosity.
- (ii) What is meant by **relative velocity**?
- (iii) State the **Work–Energy** Theorem.
- (iv) What is **Poisson's Ratio**?
- (v) Why do people prefer to wear white clothes during summer?
- (vi) Give a relation between pressure and volume in an isothermal process for one mole of an ideal gas.
- (vii) A particle executing simple harmonic motion (S.H.M.) is given by  $y = 6 \sin(6\pi t)$ . Calculate the value of frequency of the particle.

**SECTION B**  
*Answer all questions.*

**Question 2** [2]

- (a) Give any **one** example of fundamental physical quantities.  
(b) Round off 4.876 up to **two** significant figures.

**Question 3** [2]

State any **two** uses of dimensional analysis.

**Question 4** [2]

A stone tied to an end of a string 40 cm long is whirled in a circle at a constant speed. If the stone makes 28 revolutions in 20 seconds, calculate the **magnitude** of its linear velocity.

**Question 5** [2]

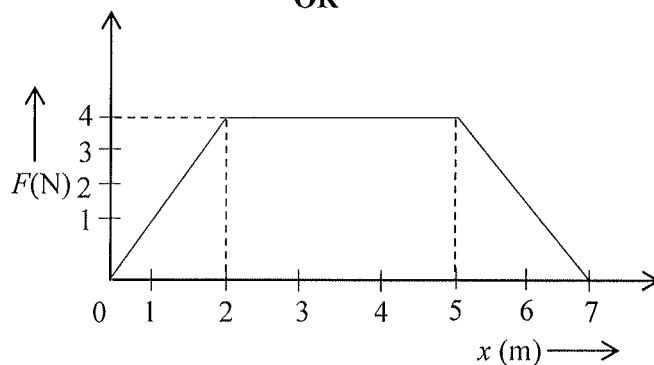
State **one** difference between conservative force and non-conservative force and give one example for each of these forces.

**Question 6** [2]

- (a) A stone at rest is dropped from a height of 15 m. It loses 30% of its kinetic energy in striking the ground. Calculate the height to which it bounces back from the ground.

OR

- (b)



*Figure 1*

A force ' $F$ ' acts on a body to displace it along  $x$  axis as shown in *Figure 1* above. Calculate the work done in moving the body from  $x = 0$  to  $x = 7$  m.

**Question 7** [2]

Define **moment of Inertia** of a rigid body and write an expression for 'parallel axis' theorem.

**Question 8** [2]

At what height above the surface of the earth does the acceleration due to gravity become 16% to that of its value on the surface of the earth? (Take  $g = 10 \text{ m/s}^2$ )

**Question 9** [2]

Plot a **stress** versus **strain** graph for a metal wire.

**Question 10** [2]

Give any **one** practical application which is based on the phenomenon of surface tension and state its **SI** unit.

**Question 11** [2]

Define **Law of Equipartition of Energy**. State the degrees of freedom for a **triatomic** gas molecule.

**Question 12** [2]

(a) A Carnot's heat engine working between 150 K and 300 K has a work output of 500 J per cycle. Calculate the heat supplied to the engine from the source.

**OR**

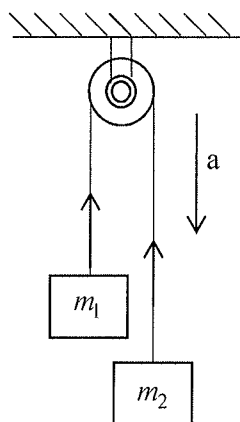
(b) A reversible heat engine works between two temperatures whose difference is  $100^\circ$ . If it absorbs 700 J of heat from the source and gives 500 J to the sink, calculate the temperatures of the source and the sink.

**SECTION C**

*Answer all questions.*

**Question 13** [3]

(a) Derive an equation for acceleration and tension for a system of two masses  $m_1$  and  $m_2$  connected as shown in **Figure 2** below:



**Figure 2**

OR

- (b) Obtain an equation for tension 'T' produced in the string and acceleration of the system of two masses  $m_1$  and  $m_2$  in terms of applied force 'F' as shown in *Figure 3* below:



*Figure 3*

**Question 14**

[3]

A projectile is fired horizontally with a velocity of 50 m/s from top of a hill 500 m high. (Take  $g = 10 \text{ m/s}^2$ )

Calculate:

- (i) Time taken for it to reach the ground.
- (ii) The horizontal range.

**Question 15**

[3]

Obtain an equation for the coefficient of static friction ' $\mu_s$ ' for a body of mass 'm' just beginning to slide on an inclined plane.

**Question 16**

[3]

Obtain a relation between Torque ' $\tau$ ' and Angular Momentum ' $J$ ' of a body rotating about an axis passing through the centre of mass of the body.

**Question 17**

[3]

Prove **Bernoulli's** Theorem for an ideal fluid.

**Question 18**

[3]

State the following:

- (i) Wien's displacement law.
- (ii) Newton's law of cooling.
- (iii) First Law of Thermodynamics.

**Question 19**

[3]

- (a) The equation of a stationary wave is  $y = 10 \cos\left(\frac{\pi x}{3}\right) \sin 20\pi t$ , where  $x$  and  $y$  are in centimetres and time in seconds.

Calculate:

- (i) Amplitude (A).
- (ii) Wave length ( $\lambda$ ).
- (iii) Time period (T).

**OR**

- (b) The equation of a simple harmonic progressive wave is  $y = 0.50 \sin(314t - 1.5x)$ , where  $t$  is measured in seconds,  $x$  and  $y$  are measured in metre respectively.

Calculate:

- (i) Frequency.
- (ii) Wave length.
- (iii) Velocity of the wave.

**SECTION D**

*Answer all questions.*

**Question 20**

[5]

- (a) (i) Derive an equation for orbital velocity of an artificial satellite revolving at a height ( $h$ ) from the surface of the earth.
- (ii) Plot a graph of variation of acceleration due to gravity ( $g^1$ ) with depth ( $d$ ) from the surface of the earth.

**OR**

- (b) (i) State **Kepler's** third law of planetary motion.
- (ii) Obtain an expression for the gravitational potential energy 'U' for a body above the earth's surface at a distance 'r' from the centre of the earth.

**Question 21**

[5]

- (a) (i) Calculate the angle between a 4N force and a 5N force for their resultant to be 7N.
- (ii) When brakes are applied to a truck moving on a straight road with a speed of 90 km/hr, it covers a distance of 100 m before coming to rest.

Calculate:

- 1. The uniform retardation of the truck.
- 2. The time taken by the truck to stop.

**OR**

- (b) (i) Two forces ( $A - B$ ) and  $(A + B)$  act at an angle ' $\theta$ ' such that the magnitude of the resultant is  $\sqrt{3A^2 + B^2}$ . Calculate the angle between the two forces.
- (ii) A bike initially at rest, starts to move on a straight track and covers a distance of 12.5 m in 10 seconds (assuming uniform acceleration). Calculate acceleration of the bike.

**Question 22.**

[5]

- (a) (i) Derive an equation for the first mode of vibration of an air column in an open organ pipe.
- (ii) Two tuning forks 'P' and 'Q' when sounded together produce 10 beats per second. On loading fork 'P' with a little wax, when sounded together, forks 'P' and 'Q' produce 4 beats per second. If the frequency of fork 'Q' is 620 Hz., determine the frequency of fork 'P'.

**OR**

- (b) (i) Show that the oscillations of a simple pendulum exhibit simple harmonic motion (S.H.M.).
- (ii) State any **two** differences between plane progressive wave and standing wave.

Useful Constant:
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Radius of earth $R_e = 6400$ km.
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