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.)*

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

(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)

(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 **Poissan'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)

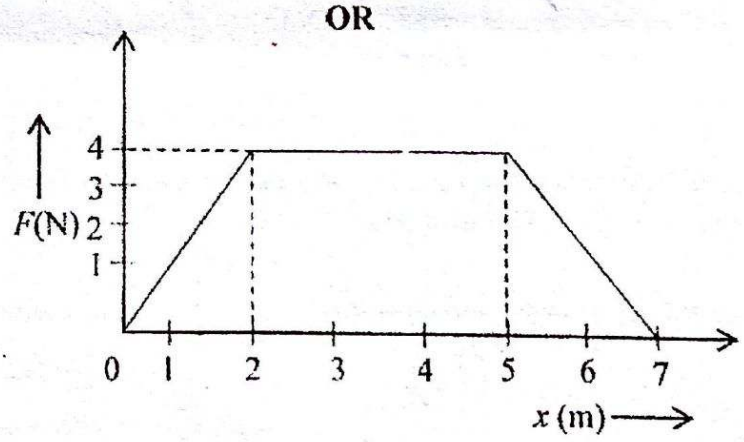

Figure 1

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 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°. 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 mases m_1 and m_2 connected as shown in ***Figure 2*** below:

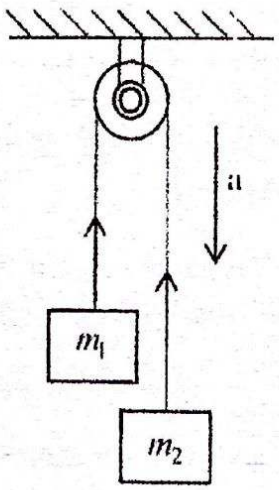

Figure 2

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 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 'μ_s' for a body of mass 'm' just beginning to slide on an inclined plane.

Question 16 [3]

Obtain a relation between Torque 'τ' 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 (λ).

(iii) Time period (T).

OR

(b) The equation of a simple harmonic progressive wave is $y = 0{\cdot}50\sin(314t - 1{\cdot}5x)$, 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 'θ' 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:
Radius of earth R_e = 6400 km.