JB Academy, Ayodhya
Annual Examination 2024

M.M : 70 **Class XI ,Subject (Physics)** **Time : 3 hr.**

General Instructions:

1. **There are 33 Questions in all. All Questions are compulsory.**
2. **This Question paper has five sections.**
3. **All sections are compulsory.**
4. **Section – A contains sixteen questions, twelve MCQ and four Assertion – Reasoning based of one 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 long answer questions of five marks each.**
5. **There is no overall choice. However, an internal choice has been provided in one question in Section – B, one question in Section – C and all three questions in Section – E . You have to attempt only one of the choices in such questions.**
6. **Use of Calculators is not allowed.**

SECTION – A [1 mark each]

Q -1 Which Pair having same Dimensional formula

[a] Force and Power [b] Surface Tension and Surface energy

[c] Stress and Strain [d] work Done and Momentum

Q – 2 Find the coefficient of Linear Expansion of Iron if the value of coefficient of Cubical Expansion is $6 \times 10^{-5}/^{0}$ C

[a] $12 \times 10^{-5}/^{0}$C [b] $2 \times 10^{-5}/^{0}$C [c] $6 \times 10^{-5}/^{0}$C [d] $3 \times 10^{-5}/^{0}$C

Q – 3 The pressure exerted by Liquid Column in a vessel is independent of

[a] Density of Liquid [b] Height of Liquid

[c] cross-sectional area of vessel [d] Acceleration due to gravity

Q – 4 The Kinetic energy of a body of mass 2 Kg and momentum 2 N-sec is

[a] 1Joule [b] 2 Joule [c] 3 Joule [d] 4 Joule

Q – 5 In an Elastic Collision

[a] both momentum and K.E. are conserved. [b] both momentum and K.E. are not conserved.

[c] Only Energy is conserved. [d] only momentum is conserved.

Q – 6 The moment of inertia of a rod of mass 3Kg and length of 2 meter about an axis passing through its centre and perpendicular to its length will be

[a] 1 kg – m^2 [b] 2 kg – m^2 [c] 3 Kg – m^2 [d] 4 kg – m^2

Q – 7 What will be the effect on horizontal Range of a Projectile when its velocity is doubled, Keeping the angle of Projection same ?

[a] Twice [b] Four times [c] unaffected [d] three times

Q – 8 A particle with velocity of 2m/sec at t = 0 second moves along straight line with acceleration 0.2 m/sec^2 . What will be its displacement in 10 seconds?

[a] 10 meter [b] 20 meter [c] 30 meter [d] 40 meter

Q – 9 A gun fires a bullet of mass 0.05 kg with a velocity of 30 m/sec. Because of this, the gun is pushed back with a velocity of 1 m/ sec . the mass of the gun is

[a] 5.5 Kg [b] 3.5 Kg [c] 1.5 Kg [d] 0.5 Kg

Q – 10 The Moment of Inertia of a Rigid body comes into the role during

[a] Circular- motion [b] Linear - motion [c] Rotational – motion [d] Revolutionary – motion

Q – 11 The escape velocity from Earth for a body of mass 20gm is 11.2 km/sec . what will be its value for a body of mass 100 gm?

[a] 56 Km/sec [b] 11.2Km/sec [c] 2.2 Km/sec [d] None of these

Q – 12 At what Temperature the Centigrade and Fahrenheit scales are equal?

[a] 40 º [b] - 40 º [c] 37 º [d] – 80 º

Q – 13 The ratio of Nodes and Antinodes in a stretched string for Fundamental Tone will be

[a] 1 : 1 [b] 2 : 1 [c] 2 : 3 [d] 1 : 2

Instruction for Question No 16 to 18 Assertion [A] and Reason [R]. Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below

(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 and R is true.

Q – 14 [A] To hear distinct Beats, slight difference in frequencies of superimposing sound waves is essential.

[R] The principle of superposition justifies the formation of beats.

Q – 15 [A] Heat from sun reaches the earth by convection process.

[R] Air can be heated only by convection.

Q – 16 [A] On a rainy Day, it is difficult to drive a car or bus at high speed.

[R] The value of coefficient of friction is lowered due to wetting of the surface.

SECTION – B [2 mark each]

Q – 17 Define Transverse and longitudinal waves, Give two Examples for each.

Q – 18 State Zeroth law of Thermodynamics with suitable diagram.

Q – 19 What do you mean by Second's Pendulum, Calculate its effective length.

Q – 20 Define Radius of Gyration of a Rigid body. Calculate radius of gyration of a straight Rod of mass 100 gm and length 100 cm about an axis passing through its centre and perpendicular?

Q – 21 State Pascal's law, list two system working on this principle.

OR

Calculate the work done in blowing a soap bubble from a radius of 2 cm to 3 cm, the surface tension of soap solution is 30 dyne/cm.

SECTION – C [3 mark each]

Q – 22 State principle of superposition, mathematically prove that whenever two plane progressive waves superimposing each other then affected particle of medium also vibrates simple harmonically.

Q – 23 State Conditions for Simple harmonic motion and derive an expression for the Time- period of the horizontal Oscillations of a mass less loaded spring.

Q – 24 Derive an Expression for excess pressure inside a liquid drop of radius R and surface tension of liquid T.

Q – 25 For vectors $\vec{A}$ = i + 2j – k and B = - i + j – 2k, Find the values of

[a] A + B [b] A – B [c] A.B [d] Angle between A and B

Q - 26 Define Modulus of Rigidity. A metallic cube whose each side is 10 cm is subjected to a shearing force of 100 Kg f. The top face is displaced through 0.25 cm with respect to the bottom. Calculate Tangential - stress, shear – strain and Modulus of Rigidity of metal.

Q – 27 [a] Two bodies of masses 1 kg and 2 kg are located at (1, 2) and (- 1, 3) respectively. Calculate the co – ordinates of the centre of mass.

[b] A grindstone has a constant Angular acceleration of 4 rad /sec^2 starting from rest, Calculate the Angular speed of the grind stone after 2.5 seconds?

Q – 28 Derive a formula for height of Liquid in Capillary tube [Ascent – Formula] using Suitable diagram.

OR

The Equation of plane – Progressive wave is

$$Y = 10 \sin 2\pi (t - 0.005x)$$

Where y and x are in cm and t in seconds. Calculate the Amplitude, Frequency, wavelength and velocity of the wave?

SECTION – D [4 Mark each] CASE –STUDY

Q - 29 Heat and work are two modes of energy transfer to a system. Heat is the energy transfer arising due to temperature difference between the system and the surroundings, work is energy transfer brought about by other means, such as moving the piston of a cylinder containing the gas, by raising or lowering some weight connected to it. The first Law of thermodynamics is the general Law of conservation of energy applied to any system in which energy transfer from a system to the surroundings occurs through heat and work. According to the first law of thermodynamics, if some heat is supplied to a system which is capable of doing work, then the quantity of heat Q absorbed by the system will be equal to the sum of the increase in its internal energy U and the external work W done by the system of surroundings.

$$Q=U+W$$

i. First law of thermodynamics corresponding to
   a. Conservation of energy
   b. Heat flow from hotter to cooler body
   c. Law of conservation of momentum
   d. Newton's law of cooling

ii. When is the heat supplied to a system is equal to the increase in its internal energy?
   a. when volume of the system increase
   b. when volume of the system decreases
   c. when volume of the system remains unchanged
   d. none of these

iii. if 100 joules of the energy given to a thermodynamics system a work done of 75 joules performed by the system. What will be the internal energy of the system?
   a. 25 joules
   b. 75 joules
   c. 100 joules
   d. None of these

iv. Isothermal process took place at
   a. Contant volume
   b. Constant pressure
   c. Constant temperature
   d. None of these

Q – 30. To put a satellite into an orbit around the Earth, it must be given a minimum vertical velocity so that it can over come gravity and reach a suitable height. The satellite must be given sufficient tangential velocity so that it may not fall back to the Earth. Once it is done, the gravitational force provides the needed centripetal force to maintain the satellite in orbit. The minimum vertical velocity given to the satellite known as Escape velocity. The geo-stationary satellite revolves around the Plant earth along the direction of rotation of Earh and now a days used for many proposes like communication, weather forecasting etc.

i. If v be the orbital velocity of satellite in circular orbit close to the Earth's surface and v_e is the escape velocity from the Earth's surface, then the relation between the two is….

   a. $v_e = v$
   b. $v_e = \sqrt{2}v$
   c. $v = \sqrt{3}\, v_e$
   d. $v_e = 2v$

ii. the orbital velocity of projected satellite does not depend on

   a. mass of Earth
   b. mass of satellite
   c. Gravitational constant
   d. Radius of Earth

iii. The time period of revolution of Geo- stationary satellite is

   a. 365 hours
   b. 24 hours
   c. 12 hours
   d. 12 hours

iv. The sense of rotation of Geo-stationary satellite should be

   a. From west to East
   b. From North to South
   c. From East to West
   d. None of these.

SECTION – E [5 Mark each]

Q – 31 [a] Obtain expression for Kinetic energy, Potential – energy and total Mechanical Energy of an object executing Simple Harmonic Motion using diagram and Integration method.

[b] using suitable labeled diagram mathematically show that only odd harmonics are produced in closed organ pipe.

OR

[a] Define Stationary wave, mathematically show that in a stretched string fixed at both the ends. Even and odd both type of harmonics is produced.

[b] How far does the sound travel in air when a tuning fork of frequency 256 Hz makes 64 vibrations? (Given that velocity of sound in air = 320 m/sec)

Q – 32 [a] State and prove Bernoulli ‘s theorem for steady flow of liquid in a tube of variable diameter, using labelled diagram.

[b] Define vector – Product of two vectors. prove that the vectors A = 2 i – 3 j – k and

B = - 6 i + 9 j + 3k are parallel to each other.

OR

[a] Define terminal velocity of a spherical object in a viscous medium and derive an expression for it using a labeled diagram.

[b] A square metal plate of 10 cm side moves parallel to another plate with a velocity of 10 cm/sec, both plates immersed in water. if the viscous force is 200dyne and coefficient of viscosity of water is 0.01 poise, what is their distance apart?

Q - 33 [a] Derive expression for variation in value of acceleration due to gravity with the depth from the surface of earth using labelled diagram.

[b] Assuming the Earth to be a sphere of uniform mass density, how much would a body weigh half way down to the center of the Earth, if it weighed 250 Newton on the surface of the Earth.

OR

[a] State and prove that work – energy theorem using Integration method with the help of labelled diagram.

[b] A body of mass 4 Kg initially at rest is subjected to a force of 16 Newton. what is the Kinetic energy acquired by the body at the end of 10 seconds?