JB Academy, Ayodhya
Annual Examination 2024-25
Class – XI, Sub: Physics

Time : 3 hours **M.Marks:70**

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 has same Dimensional Formula

[a] Force and Power [b] Momentum and Impulse

[c] Work – done and Momentum [d] Energy and power

Q – 2. The Pressure exerted by Liquid Column in vessel is Independent of

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

[c] Cross – sectional area of the vessel [d] Acceleration due to gravity

Q – 3. The Kinetic Energy of a Body of mass 2 Kg and momentum of 2 N-sec is

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

Q – 4. In 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 – 5. The moment of inertia of a rod of mass 3 Kg 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 – 6. Escape velocity from a planet is Ve. If its mass is increased to 8 times and its radius is increased to 2 times, then the new Escape velocity would be

[a] Ve]b] 2 Ve [c] 3 Ve [d] 4 Ve

Q – 7. The ratio of Nodes and Antinodes in closed organ pipe for Fundamental tone will be

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

Q – 8. Find the coefficient of Linear Expansion of iron if the value of coefficient of cubical Expansion is 6 x 10^{-5} /^{0}C

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

Q – 9. A Solid cube is subjected to a normal stress of 5x 10^5 N/m^2 undergoes a Volumetric strain of 0.03 . The Bulk- modulus of material of cube will be

[a] 2.67x 10^7 N/m^2 [b] 1.67 x 10^7 N/m^2 [c] 15 x 10^7N/m^2 [d] None of these

Q – 10. Two sound waves of frequencies 5 Hz and 3 Hz propagating in same direction and superimposing each other . the number of Beats per second will be

[a] 8 Hz [b] 2 Hz [c] 1 Hz [d] 4 Hz

Q – 11. 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 – 12. Which one is Scalar Quantity?

[a] Power [b] Torque [c] Momentum [d] Impulse

Instruction for Question No 13 to 16 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 – 13. [Assertion] Heat from sun reaches the Earth by Convection process.

[Reason] Air can be heated only by convection.

Q – 14. [Assertion] In Simple Harmonic Motion, the velocity is maximum, when Acceleration is minimum.

[Reason] Displacement and velocity in S.H.M. differ in phase by π/2.

Q – 15. [Assertion] Displacement of an object may be zero, when distance travelled by it is not zero.

[Reason] The displacement is the longer distance between initial and final position.

Q – 16. [Assertion] A Planet moves faster, when it is closer to the sun in its orbit and vice-versa.

[Reason] Orbital velocity in orbit of Planet is Constant.

SECTION – B [2 Mark each]

Q – 17. State vector product of two vectors, write its mathematical formula. Calculate the area of the Parallelogram whose two adjacent sides are formed by the vectors A = 3i + 4j and B = - 3i + 7j.

Q – 18. Define Transverse and Longitudinal waves, mention two example of each.

Q – 19. The acceleration of a Particle performing S.H.M. is 12cm/sec^2 at a distance of 3cm from the mean position .Calculate its Time - Period ?

Q – 20. A Metal plate 5cm x 5cm rests on a layer of castor oil 1mm thick whose coefficient of viscosity is 1.55 Nsm^{-2}, Find the horizontal force required to move the plate with a speed of 2cm/sec ?

Q – 21. Mathematically prove that Surface Tension is numerically equal to Surface Energy using required diagram for Experimental Set up.

OR

A rain drop of radius 0.3 mm falls through air with a Terminal velocity of 1 m/sec. the coefficient of viscosity of air is 18 x 10^{-5} poise. Calculate the viscos force on the rain drop?

SECTION – C [3 mark each]

Q – 22. Derive an Expression using diagram for excess pressure inside a liquid – drop of radius R and Surface tension of liquid T.

Q – 23. On a foggy day two drivers spot each other when they are just 80 meter apart. They are travelling at 72 km./h and 60 km/h respectively. Both of them applied brakes retarding there cars at the rate of 5 m/sec^2.Determine whether they avert collision or not ?

Q – 24. State Kepler's laws for planetary - motion using labeled diagram.

Q – 25. Derive First equation for Rotational motion of a rigid body about an axis with constant angular acceleration. If on the application of a constant Torque, a wheel is turned from rest through 400 radians in 10 seconds .Calculate the Angular acceleration?

Q – 26. 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 – 27. Define cofficient of linear expansion and coefficient of snperficial expansion, also derive relation between these two.

Q -28. State and prove Bernoulli theorem for steady flow of liquid in a tube of variable diameter , using labeled diagram.

OR

State Conditions for simple harmonic motion performed by simple –pendulum and derive formula for Time – Period for oscillation for a simple –pendulum of effective –length L ?

SECTION – D [Case-study] [4 Mark each]

Q – 29. When a Liquid flows such that each particle of the liquid passing a given point moves along the same path and has the same velocity as its predecessor, the flow is called streamline flow or steady flow. The path taken by a liquid particle in steady flow is called streamline . It is defined as a curve whose tangent at any point is in the direction of liquid velocity at that point. No two streamlines can cross each other .steady flow is possible only at low speeds .when the liquid velocity exceeds a certain critical velocity ,the particle follows a zig - zag path. such a disordered or irregular motion is called Turbulent flow. The minimum liquid velocity at which the flow changes from streamlined to turbulent is called critical velocity . The critical velocity of a liquid of viscosity n ,density p and flowing through a pipe of diameter D is given by

$$V_c = R_n \eta / p D$$

R_n is a dimensionless number ,called Reynold's Number ,which determine the nature of the flow of the liquid

$$R_n = {}^{p} V_c D / \eta$$

If $0 < R_n < 2000$, then the Flow is steady .

If $R_n > 3000$, the flow is turbulent .

If $2000 < R_n < 3000$, the flow switches from steady to turbulent and vice-versa .

(i) The dimensional Formula of Reynold's Number will be

[a] $[M L^2 T^2]$ [b] $[M^0 L^0 T]$ [c] $[M^0 L^0 T^0]$ [d] None of these

(ii) Critical velocity of Liquid

[a] decreases when Radius decreases [b] increases when radius decreases

[c] decreases when density increases [d] increases when density increases

(iii) The Reynold 's Number of a flowing liquid in a tube is 3500, the nature of flow will be

[a] stream line flow [b] laminar flow [c] Turbulent Flow [d] None of these

(iv) Velocity profile for Laminar flow of a viscos liquid will be

[a] Plane lamina [b] Parabolic Lamina [c] Irregular Lamina [d] Circular lamina

Q – 30. 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 surrounding. 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 surrounding 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, the 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 corresponds to

[a] Heat flow from hotter to colder body. [b] Law of conservation of momentum

[c] conservation of energy [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 increases [b] when volume of the system decreases

[c] when volume of the system remains unchanged. [d] None of these.

[iii] If 100 joule of heat energy given to a thermodynamics system a work done of 75 joule performed by the system. What will be the internal energy of the system?

[a] 25 joule b] 75 joule [c] 100 joule [d] None of these

[iv] Isothermal process took place at

[a] Constant volume [b] Constant Pressure [c] Constant temperature [d] None of these

SECTION - E [5 Mark each]

Q -31. [a] Derive an formula for height of liquid column in a capillary tube [Ascent- formula] using suitable labelled diagram.

[b] A metallic cube whose each side is 10 cm is subjected to a shearing force of 100 Kgf. The top surface is displaced through 0.25 cm with respect to the bottom .Calculate the shearing stress, strain and shear-modulus.

OR

[a] Define terminal velocity of a spherical object falling in a viscos – medium derive expression for it using a labelled diagram .

[b] A column of water40 cm high supports a 30 cm column of an unknown liquid . what is the density of liquid ? [Given that density of water = 103 Kg /m^3].

Q – 32. [a] Obtain Expression for Kinetic-energy , potential-energy and total Mechanical energy of a body executing simple harmonic motion using diagram and Integration method.

[b] A particle is executing Simple Harmonic motion of Amplitude A . At what distance from mean position the kinetic energy is equal to the potential energy?

OR

[a] Define stationary wave and with the help of diagram , mathematically show that in a stretched string fixed both the ends even and odd both type of harmonics are produce .

[b] How far does the sound travel in air when a tuning fork of freqnency 256 Hz makes 64 vibration ?

[Given that velocity of sound in air =320 m/sec].

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

[b] At what height above the Earth's surface, the value of g is same as in a mine 80 Km deep?

OR

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

[b] A car of mass 1000 Kg accelerates uniformly from rest to a velocity of 54Km/h in 5 seconds .Calculate its gain in Kinetic –energy and power of engine of car during this time –interval.

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