Annual Examination 2023

Class XI

Subject - Physics

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

General instructions

(1) There are 35 Questions in all. All questions are compulsory.
(2) This question paper has five sections A, B, C, D and E . All the sections are compulsory.
(3) Section A contains eighteen MCQs of 1 mark each, Section B contains seven Questions of two mark each, Section C contains five questions of three marks each, Section D contains three long questions of five marks each and Section E contains two case study based questions of 4 marks each.
(4) There is no overall choice. However, an internal choice has been provided in section B, C, D and E.

SECTION – A [1 Mark each]

Q – 1. For maximum Horizontal Range, the angle of projection should be

[a] 30^0 [b] 45^0 [c] 90^0 [d] 15^0

Q – 2. At what temperature, the Centigrade and Fahrenheit scales are equal ?

[a] 40^0 [b] -40^0 [c] 37^0 [d] -80^0

Q – 3. Which one of the following is not a unit of Bulk – Modulus ?

[a] Newton/meter [b] Newton / meter^2 [c] Dyne / cm^2 [d] Pascal

Q – 4. A Particle with velocity of 2 m/sec at t= 0 second moves along straight line with acceleration 0.2 m/sec^2. What will be its displacement in 10 second

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

Q – 5. The Phase difference between velocity and displacement at any instant of a particle executing Simple harmonic motion is

[a] 0 [b] $\pi / 2$ [c] π [d] 2π

Q – 6 Which one is Scalar Quantity ?

[a] Force [b] momentum [c] Power [d] Impulse

Q – 7. The Escape velocity from Earth for a body of 20 gm is 11.2 km / sec , what will be its value for a body of 100 gm ?

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

Q-8. A body moves a distance of 10 meter along a straight line under the action of 5 Newton force, if the work done is 25 Joule, then the angle between the force and direction of motion is

[a] 60^0 [b] 75^0 [c] 30^0 [d] 45^0

Q – 9. which pair having same Dimensional Formula

[a] Force & Power [b] Surface tension & Surface Energy

[c] Stress & Strain [d] Work Done & momentum

Q – 10. The ratio of Nodes and Antinodes in a stretched string for Fundamental Note will be

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

Q – 11. The Rocket propulsion is based on

[a] Newton's Law of Gravitation [b] Newton's First law

[c] Newton's Third Law [d] Kepler's Law

Q – 12. Three identical metal balls , each of radius r are placed touching each other on a horizontal surface such that an equilateral triangle is formed when centres of three balls are joined . the centre of the mass of the system is located at

[a] line joining centres of any two balls [c] centre of one of the ball

[b] horizontal surface [d] point of intersection of medians

Q – 13. Find the coefficient of linear Expansion of Iron if the value of coefficient of Cubical expansion is 6×10^{-5} $/^0C$

[a] 12×10^{-5} $/^0C$ [b] 2×10^{-5} $/^0C$

[c] 6×10^{-5} $/^0C$ [d] 3×10^{-5} $/^0C$

Q -14. Which one is conservative Force

[a] Frictional Force [b] Nuclear Force

[c] Gravitational Force [d] None of these

Q – 15. 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

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 are 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 also True

Q – 16. Assertion [A] To hear distinct Beats, slight difference in frequencies of superimposing sound wave is essential.

Reason [R] The principle of superposition justify the formation of beats.

Q – 17. Assertion [A] : Heat from sun reaches the Earth by convection.

Reason [R] : Air can be heated only by convection.

Q – 18. Assertion [A] : On a rainy day , it is difficult to drive a car or bus at high speed .

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

SECTION – B [2 Mark each]

Q – 19. A bullet travelling with a velocity of 16 m/ sec penetrates a tree trunk and comes to rest in 0.4 meter. Find the time taken during the retardation ?

Q – 20. Define Transverse and Longitudinal waves ? Give two examples for each .

Q – 21. State Zeroth law of thermodynamics with suitable diagram .

Q – 22. What do you mean by Seconds pendulum. Calculate its effective length ?

Q – 23. State Theorem of parallel axes for moment of Inertia of a plane lamina using labelled diagram, write its mathematical form.

Q – 24 Write relation between Kinetic energy and momentum of a moving object . if a light body and a heavy body have the same momentum . which one will have greater Kinetic energy ?

Q – 25 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 .

OR

State Pascal's law, list its two system working on this principle.

SECTION – C [3 mark]

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 Derive an Expression for excess pressure inside a liquid drop of radius R and Surface tension of liquid T .

Q – 28 State Newton's law of Gravitation. If the diameter of the Earth becomes twice its present value but its mass remains unchanged, then how would be the weight of an object on the surface of the earth affected ?

Q – 29 State conditions for Simple harmonic motion (S.H.M.) and derive formula for Time-period of Oscillation for a simple Pendulum of effective length L.

Q – 30 State and prove Bernoulli's theorem for Steady flow of liquid in a tube of variable diameter, using labelled diagram

OR

With the help of diagram , mathematically show that in a stretched string fixed at both the ends , even and odd both type of harmonics are produced .

SECTION – D [5 mark each]

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

[b] Define Young's Modulus and obtain expression for it using a labelled diagram .

OR

[a] Derive Terminal velocity of a spherical object in a viscous medium and expression for it using a labelled diagram.

[b] A rain drop of radius 3 mm falls through air with terminal velocity of 1 m/ sec. the coefficient of viscosity of air is 18 x 10^{-5} poise. Find the viscous force on the rain drop.

Q – 32 (a) Find the moment of inertia of a sphere about a tangent to the sphere, given the moment of inertia of the sphere about any of its diameters to be 2 $MR^2/5$, where M is the mass of the sphere and R is the radius of the sphere.
(b) Given the moment of inertia of a disc of mass M and radius R about any of its diameters to 1 be 1/4 MR^2, find the moment of inertia about an axis normal to the disc passing through a point on its edge.

Q – 33 [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 ?

OR

[a] Derive expression for variation of g with height from the surface of earth using Binomial theorem and 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 centre of the earth if it weighed 250 Newton on the surface of the earth ?

SECTION – E [4 Mark each] [Case – study]

Q – 34 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 corresponds 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 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

Q – 35. When a body moves along a circular path with a uniform speed, its motion is said to be uniform circular motion . In uniform circular motion, the direction of the velocity vector which acts along the tangent to the path changes continuously but it magnitude always remains constant. So uniform circular motion is an accelerated motion. A body undergoing uniform circular motion is acted upon by an acceleration which is directed along the radius towards the center of the circular path. This acceleration is called centripetal acceleration. The magnitude of the acceleration is a constant given by:

$$a_c = v^2 / r = \omega^2 r = (2\pi n)^2 r = 4 \pi^2 n^2 r$$

But the direction of a_c changes continuously, always pointing towards he center. So centripetal acceleration is not a constant vector. The resultant acceleration of a body in circular motion is towards the centre only if its speed is constant.

(i) A body executing uniform circular motion has at any instant its velocity vector and acceleration vector :

{a} along the same direction {b} in opposite direction

{c} normal to each other {d} not related to each other

(ii) The angular speed of a fly wheel making 120 revolutions/minute is

{a} π rad/sec {b} 2 π rad/ sec {c} 4 π rad/sec {d} 4 π^2/sec

(iii) A particle moves with a constant speed v along a circular path of radius r and completes the circle in time T. Then acceleration of the particle will be

(a) 2 π^2 v/ T (b) 4 π r/ T (c) 2 π^2 r/ T^2 (d) 4 π v^2/ T^2

(iv) A stone tied to the end of a string 1m long is whirled in a horizontal circle with a constant speed. If the stone makes 22 revolutions in 44 sec, what is the magnitude and direction of acceleration of the stone ?

{a} π^2/4 m/sec^2 and direction along the radius towards the centre

[b] π^2 m/sec^2 and direction along the radius away from the centre.

[c] π^2 m/sec^2 and direction along the radius towards the centre.

[d] π^2 m/sec^2 and direction along the tangent to the circle