Important Questions for class XI Session Ending Examination

**Units and Measurements**

Learn and practice:

* The dimensional formulae and SI Units for different physical quantities.
* Finding significant figures in a given measurement.
* Calculation of errors.(fraction and percent)

1. What do you understand by dimension of a physical quantity? Describe the principal of homogeneity of dimensions. Give an example.
2. The time period of simple pendulum depends upon its length “l” and acceleration due to gravity “g”.

Derive an expression for its time period using methods of dimension.

1. State the number of significant figures in the following:

a) 0.007 m2 b) 2064 x 1024 Kg c) 0.2370 g cm-3 d)6.320 J

e) 6.032 N m-2 f) 0.0006032 m2

1. Each side of a cube is measured to be 7.203 m. What are the total surface area and the volume of the cube to appropriate significant figures?
2. 5.74 g of a substance occupies 1.2 cm3. Express its density by keeping the significant figures in view.
3. What are the limitations of dimensional analysis? (atlest 5 points)
4. Define coherent system of units. What are the seven basic units in SI?

**Motion in a straight line**

1. Draw the position -time graph for the motion with
   1. positive acceleration,
   2. negative acceleration and
   3. zero acceleration
2. State the three kinematic equations for uniformly accelerated motion. Obtain these equations of motion for constant acceleration using method of calculus and graph.
3. Discuss the motion of an object under free fall. Neglect the air resistance. Plot the graphs of variation of acceleration, velocity and distance with time.
4. Deduce the equation x = x0 + v0t + ½ at2 for a body moving with uniform acceleration. (practice other two equations also)
5. Answer briefly
6. A ball is thrown straight up. What is its velocity and acceleration at the highest point of motion?
7. Can a body in one dimensional motion with zero speed may have non zero velocity?
8. If the acceleration of a particle is constant in magnitude but not in direction, what type of path the particle will follow?

**Motion in a plane**

1. Explain the parallelogram law of addition of vectors

Find the magnitude and direction of the resultant of two vectors A and B in terms of their magnitudes and angle θ between them.

1. The position of particle is given by  m where t is in seconds and the coefficients have proper units for r to be in metres.
   1. Find v and a of the particle
   2. find the magnitude and direction of v at t = 2.0 s
2. What is a projectile? Show that the path of a projectile fired at an angle with the horizontal is parabola.
3. Obtain the expressions for time of flight, maximum height and horizontal range of a projectile fired at an angle with the horizontal
4. A cricket ball is thrown at a speed of 28 ms-1in a direction 300 above the horizontal. Calculate
   1. the maximum height,
   2. the time taken by the ball to return to the same level and
   3. the distance from the thrower to the point where the ball returns to the same level.
5. The ceiling of a long hall is 25 m high. What is the maximum horizontal distance that a ball thrown with a speed of 40 ms-1 can go without hitting the ceiling of the wall?
6. Draw a neat diagram to explain that for a particle in uniform circular motion, acceleration is directed towards centre of the circle and obtain the expression for the centripetal acceleration.
7. For a given velocity of a projectile at what angle should it be projected to so as to reach maximum horizontal range? Velocity of a particle is 10 ms-1at what angle to the horizontal should it be projected so that it covers maximum horizontal range.
8. Two vectors are inclined at an angle θ.Show how would you add these vectors analytically. Discuss the special cases, when

a) θ = 00 b) θ = 900  c) θ = 1800 .

**Laws of Motion**

1. State the law of conservation of momentum. Give an example. Why does heavy riffle not kick as strongly as a light riffle using the same cartridges?
2. What are concurrent forces? Obtain the condition for the equilibrium of three concurrent forces.
3. What is limiting friction? State the laws of limiting friction.
4. What is kinetic and static friction.
5. What do you mean by banking of roads? Why it is required? Obtain the expression for angle of banking. (Consider the friction between tyres and road).

**Work, Energy and Power**

1. State and prove work-energy theorem for a variable force.
2. What is law of conservation of energy? Prove it in case of a ball of mass ‘m’ dropped from a height ‘h’.
3. What are conservative forces? Give two examples.
4. Show that the spring force is a conservative force, taking the example of a block attached to a free end of a spring, the other being fixed to a rigid support and free to move on a frictionless surface. Show the plots (i) Fs versus x and (ii) total energy versus x showing clearly the variation of K.E and P.E
5. What is an elastic collision? Discuss the elastic collision of two bodies in one dimension. Calculate the velocities of the bodies after collision. Discuss what happens when (i) both masses are equal (ii) a lighter mass collides with a heavy mass at rest.
6. A light body and a heavy body have the same momentum. Which is having more kinetic energy?
7. Kinetic energy of a body is increased by 300%. Find the percentage increase in the momentum.

**System of Particles and Rotational Motion**

1. Define centre of mass. Write the expression for the centre of mass of a system of n particles. Give the location of centre of mass of a
   1. Sphere
   2. Cylinder
   3. Ring
   4. Cube

each of uniform mass and density. Does the centre of mass of a body necessarily lie inside the body?

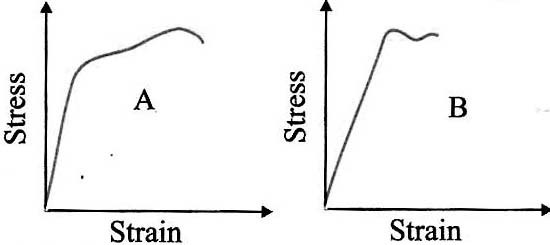
1. Define angular momentum. State its SI unit. Write the dimensional formula.
2. State and explain the principle of conservation of angular momentum
3. What is moment of inertia? State its SI unit. Write dimensional formula. What are the factors on which the moment of inertia of a body depends? Does the moment of inertia change with axis of rotation?
4. What is radius of gyration? Obtain the expression for radius of gyration of a body. Is radius of gyration of a body a constant quantity?
5. Establish the relation between torque and angular acceleration. Hence define the moment of inertia.
6. Establish the relation between moment of inertia, angular velocity and angular momentum. Hence define the moment of inertia
7. Obtain the relation between torque and angular momentum.

**Gravitation**

1. State the universal law of gravitation. Write the SI unit, dimensional formula and value of universal gravitational constant.
2. What is acceleration due to gravity of earth? Obtain an expression for the same.
3. What is escape speed? Obtain the expression for escape speed of a body from the earth. Does the escape speed of a body from the earth depends on
   1. Mass of earth
   2. Location from where it is projected
   3. The direction of projection and
   4. The height of the location from where the body is launched
4. Explain with the help of a mathematical derivation how does the acceleration due to gravity varies with
   1. Altitude and
   2. Depth
5. What is escape and orbital velocity and derive the expression for them.
6. What is gravitational potential energy? Obtain the expression for the same. Where is the value of gravitational potential energy maximum?
7. What is a geostationary satellite? State the conditions which should be satisfied so that the satellite appears stationary w.r.t to earth.
   * 1. Why moon has no atmosphere?

**Elasticity**

1. State Hooke’s law in elasticity. Explain why steel is more elastic than rubber?
2. Discuss the stress Vs strain graph of metallic wire when stretched up to breaking point. How does the stress Vs strain graph give the ductility or brittleness of a substance?
3. Define the terms Young’s modulus and Bulk Modulus Write their SI units.
4. The stress - strain graphs for two materials A and b are shown in the figure given below. The graphs are drawn to the same scale. Answer the following questions giving reasons.
   1. Which of the materials has the greater young’s modulus?
   2. Which of the two is stronger material?
   3. Which of the materials is more ductile?



**Fluid Mechanics**

1. State Pascal’s law and explain with a neat labeled diagrams, how this law is used in Hydraulic lift and Hydraulic brakes
2. On what factors does the pressure exerted by a liquid column depends? Obtain the expression for the pressure exerted by liquid column.
3. What is coefficient of viscosity? Write its SI unit and dimensional formula. How does friction and viscosity differ?
4. Obtain the expression for terminal velocity when a spherical body falls through a viscous fluid. Explain, why rain drops falling under gravity do not acquire very high velocity?
5. Give reasons Explain why a parachute is used while jumping from an aeroplane? A bigger rain drop falls faster than a smaller one?
6. State and prove Bernoulli’s theorem. What are the assumptions made? Write any one application of it.
7. What is capillary rise? Obtain the expression for height in a capillary tube. Does the liquid over flow in capillary tube of insufficient height? Explain your answer with the help of a mathematical expression.
8. Describe the principle, working and one application of Venturi-meter.
9. Show that surface energy is numerically equal to surface tension.
10. What is angle of contact? How does the value of angle of contact determine whether a liquid will spread on a solid surface or form a droplet? The angle of contact of mercury with glass is obtuse, while that of water with glass is acute. Explain why?
11. What is equation of continuity in relation flow of liquid in a pipe?
12. Obtain the expression for excess pressure inside a liquid drop and bubble.

**Heat and Thermodynamics**

1. Define the coefficient of linear expansion. Obtain the relation between the three coefficients of expansion.
2. What is anomalous expansion of water? Draw a graph of temperature versus density of water. The top of the lake is frozen. Air in contact is at -150 C. What do you expect the maximum temperature of water a) in contact with the lower surface of ice and b) at the bottom of the lake?
3. Define Molar Specific heat capacity. Write its SI unit.
4. Define Boiling point and Melting point. What is the effect of pressure on them? Why cooking is difficult on hills?
5. What are the three modes of transfer of heat? Give an example each. Explain the formation of trade winds.
6. On what factors do the flow of heat from one end of a conductor to the other end depends on? What is thermal conductivity? Houses made of concrete roofs get very hot during summer days why?
7. What are the assumptions of kinetic theory of gases? Obtain an expression for the pressure exerted by a gas on the walls of the container.
8. Show that the average kinetic energy of a molecule is proportional to the absolute temperature of a gas.
9. What is meant by degrees of freedom of a gas molecule? Calculate the degrees of freedom for a monatomic gas, diatomic gas and triatomic gas at low temperature. Do the value degrees of freedom change at high temperature? Give reason to your answer.
10. State the law of equipartition of energy. Obtain the values of Cp , Cv and γ for a monoatomic and diatomic gas at low temperature. What is mean free path? Obtain an expression for the same.
11. Why do gases have two specific heats? Define them. Obtain a relation between them. (Method 1: using Q = mcΔT and Method 2: first law of thermodynamics)
12. What is an adiabatic process? Obtain the expression for work done during adiabatic process.
13. What is an isothermal process? Obtain the expression for work done during isothermal process.

**Oscillations**

1. Show that the projection of uniform circular motion on a diameter of the circle in which the motion takes place is SHM. Obtain the expression for 1.velocity 2. Acceleration. 3. Time period
2. Show that the total mechanical energy of a simple harmonic oscillator is independent of time by obtaining a suitable relation. Draw a graph of total energy (E) as function of position x for a simple harmonic oscillator with amplitude A.
3. Show that oscillations of a simple pendulum swinging through small angles, is simple harmonic by obtaining a suitable expression.
4. What are forced oscillations? What is resonance? Why soldiers are asked to break steps while crossing the bridges?
5. Prove that the time period of harmonic oscillator (mass less loaded spring) is where k is spring constant and m is mass attached to spring.
6. A simple pendulum executes SHM approximately. Why then is the time period of simple pendulum independent of the mass of the pendulum?

**Waves**

1. Given below are some examples of wave motion. State in each case if the wave motion is transverse, longitudinal or a combination of both:
   1. Motion of a kink in a longitudinal spring produced by displacing one end of spring sideways.
   2. Waves produced in a cylinder containing a liquid by moving its position back and forth.
   3. Waves produced by a motor boat sailing in water.
   4. Ultrasonic waves in air produced by a vibrating quartz crystal.
2. A wave traveling along a string is described by y (x, t) = 0.0005 sin (80.0 x – 3.0 t) in which the numerical constants are in SI units. Calculate
   1. The amplitude.
   2. The wave length and
   3. The period of frequency of the wave. Also, calculate the displacement y of the wave at a distance x = 30 cm and time t = 20 s.
3. A transverse harmonic wave on a string is described by where x and y are in cm and t in s. The positive direction of x is from left to right.
   1. Is this a traveling or a stationary wave? If it is travelling, what is the speed and direction of its propagation?
   2. What is its amplitude and frequency?
   3. What is the initial phase at origin?
   4. What is the least distance between two successive crests in the wave?
4. What is the principle of superposition of waves?
5. Compare and contrast between transverse waves and longitudinal waves.
6. Compare and contrast between longitudinal and standing waves.