HIGHER SECONDARY – FIRST YEAR
PHYSICS
IMPORTANT QUESTIONS & PROBLEMS

UNIT : 1, NATURE OF PHYSICAL WORLD AND MEASUREMENT

2 Marks Questions

1. What is parallax?
2. Define light year.
3. What are systematic errors? How to minimize the systematic error?
4. What are least count errors? How is it minimized?
5. What are Gross errors? How is it minimized?
6. Define Dimensional formula and dimensional equation.
7. Define dimensional constant and dimensionless constant.
8. Define dimensional variable and dimensionless variable.
9. What are the uses of dimensional analysis?
10. Write principle of homogeneity of dimensions.
11. From a point on the ground, the top of a tree is seen to have an angle of elevation 60^0. The distance between the tree and a point is 50 m. Calculate the height of the tree?
12. A RADAR signal is beamed towards a planet and its echo is received 7 minutes later. If the distance between the planet and the Earth is 6.3×10^{10} m. Calculate the speed of the signal?
13. Check the correctness of the equation $\frac{1}{2} mv^2 = mgh$ using dimensional analysis method.
14. In a submarine equipped with sonar, the time delay between the generation of a pulse and its echo after reflection from an enemy submarine is observed to be 80 s. If the speed of sound in water is 1460 ms^{-1}. What is the distance of enemy submarine?
15. Jupiter is at a distance of 824.7 million km from the Earth. Its angular diameter is measured to be 35.72˝. Calculate the diameter of Jupiter.

3 Marks Questions

1. How will you measure the diameter of the Moon using parallax method?
2. Write the rules for determining significant figures.
3. What are the limitations of dimensional analysis?
4. Write short notes on the Dimensionless quantities.
5. A physical quantity x is given by $x = \frac{a^2 b^2}{c\sqrt{d}}$. If the percentage errors of measurement in a, b, c and d are 4%, 2%, 3% and 1% respectively, then calculate the percentage error in the calculation of x.

5 Marks Questions

1. Write a note on triangulation method and radar method to measure larger distances.
2. Explain in detail the various types of errors.
3. What do you mean by propagation of errors? Explain the propagation of errors in addition and multiplication.
4. Write the rules for rounding off.
5. Convert 76 cm of mercury pressure into Nm^{-2} using the method of dimensions.
6. If the value of universal gravitational constant in SI is 6.6×10^{-11} Nm^2 kg^{-2}, then find its value in CGS System?
7. Obtain an expression for the time period T of a simple pendulum. The time period T depends on (i) mass 'm' of the bob (ii) length 'l' of the pendulum and (iii) acceleration due to gravity g at the place where the pendulum is suspended. (Constant k = 2π).

UNIT : 2, KINEMATICS

2 Marks Questions

1. Explain what is meant by Cartesian coordinate system?
2. Define a vector. Give examples.
3. Define a scalar. Give examples.
4. Define displacement and distance.
5. Write down the kinematic equations for angular motion.
6. What is point mass?
7. Define magnitude of a vector.
8. Define parallel and anti-parallel vectors.
9. Write the kinetic equations for linear motion.
10. What is meant by projectile?
11. Give some examples for projectile motion.
12. Write the assumptions need to study about the projectile motion.
13. Two vectors $\vec{A}$ and $\vec{B}$ of magnitude 5 units and 7 units respectively make an angle 60^0 with each other. Find the magnitude of the resultant vector and its direction with respect to the vector $\vec{A}$.
14. Given the vector $\vec{A} = 2\vec{\imath} + 3\vec{\jmath}$, what is $3\vec{A}$?
15. Given two vectors $\vec{A} = 2\vec{\imath} + 4\vec{\jmath} + 5\vec{k}$ and $\vec{B} = \vec{\imath} + 3\vec{\jmath} + 6\vec{k}$. Find the product $\vec{A} \cdot \vec{B}$, and the magnitudes of $\vec{A}$ and $\vec{B}$. What is the angle between them?
16. Check whether the following vectors are orthogonal.
    i) $\vec{A} = 2\vec{\imath} + 3\vec{\jmath}$ and $\vec{B} = 4\vec{\imath} - 5\vec{\jmath}$ ii) $\vec{C} = 5\vec{\imath} + 2\vec{\jmath}$ and $\vec{D} = 2\vec{\imath} - 5\vec{\jmath}$
17. Consider two trains A and B moving along parallel tracks with the same velocity in the same direction. Let the velocity of each train be 50 km h-1 due east. Calculate the relative velocities of the trains.
18. How long will a boy sitting near the window of a train travelling at 36 km h^{-1} see a train passing by in the opposite direction with a speed of 18 km h^{-1}. The length of the slow-moving train is 90 m.

19. A train was moving at the rate of 54 km h^{-1} when brakes were applied. It came to rest within a distance of 225 m. Calculate the retardation produced in the train.
20. Calculate the average velocity of the particle whose position vector changes from $\vec{r_1} = 3\hat{\imath} + 6\hat{\jmath}$ to $\vec{r_2} = 2\hat{\imath} + 3\hat{\jmath}$ in a time 5 second.
21. Convert the vector $\hat{r} = 3\hat{\imath} + 2\hat{\jmath}$ into a unit vector.

3 Marks Questions

1. Define average velocity and represent it graphically.
2. Write the expression for the magnitude and direction of the relative velocity
3. Derive the relation between linear velocity and angular velocity.
4. Find the expressions tangential acceleration.
5. Derive an expression for the centripetal acceleration of a body moving in a circular path of radius 'r' with uniform speed.
6. Explain the subtraction of vectors.
7. A man moving in rain holds an umbrella inclined to the vertical though the rain drops are falling vertically. Why?
8. Two vectors $\vec{A}$ and $\vec{B}$ are given in the component form as $\vec{A} = 5\vec{\imath} + 7\vec{\jmath} - 4\vec{k}$ and $\vec{B} = 6\vec{\imath} + 3\vec{\jmath} + 2\vec{k}$. Find $\vec{A} + \vec{B}$, $\vec{B} + \vec{A}$, $\vec{A} - \vec{B}$, $\vec{B} - \vec{A}$.
9. Two vectors are given as $\vec{r} = 2\vec{\imath} + 3\vec{\jmath} + 5\vec{k}$ and $\vec{F} = 3\vec{\imath} - 2\vec{\jmath} + 4\vec{k}$. Find the resultant vector $\vec{\tau} = \vec{r} \times \vec{F}$.
10. The velocity of three particles A, B, C are given below. Which particle travels at the greatest speed?
    $\bar{v}_A = 3\vec{\imath} - 5\vec{\jmath} + 2\vec{k}$; $\bar{v}_B = \vec{\imath} + 2\vec{\jmath} + 3\vec{k}$; $\bar{v}_C = 5\vec{\imath} + 3\vec{\jmath} + 4\vec{k}$
11. What are the resultants of the vector product of two given vectors given by $\vec{A} = 4\hat{\imath} - 2\hat{\jmath} + \hat{k}$ and $\vec{B} = 5\hat{\imath} + 2\hat{\jmath} - 4\hat{k}$.

5 Marks Questions

1. Explain in detail the triangle law of addition.
2. Discuss the properties of scalar and vector products.
3. Derive the kinematic equations of motion for constant acceleration.
4. Derive the equations of motion for a particle (a) falling vertically
   (b) projected vertically
5. Derive the equation of motion, range and maximum height reached by the particle thrown at an oblique angle θ with respect to the horizontal direction.
6. Define the term motion and explain the different types of motion.
7. Find horizontal range and time of flight projectile in horizontal projection.

UNIT : 3, LAWS OF MOTION

2 Marks Questions

1. State Newton's second law.
2. What is the meaning by 'pseudo force'?
3. State Newton's Third law.
4. Under what condition will a car skid on a levelled circular road?
5. Define impulse.
6. State Newton's First law.
7. What is free body diagram? What are the steps to be followed for developing free body diagram?
8. State Lami's theorem.
9. State the law of conservation of total linear momentum.
10. What are the applications of angle of repose?
11. Why is it dangerous to stand near the open door of moving bus?
12. A man jumping on concrete floor is more dangerous than in sand floor, why?
13. If two objects of masses 2.5 kg and 100 kg experience the same force 5 N, what is the acceleration experienced by each of them?
14. A particle of mass 2 kg experiences two forces, $\vec{F}_1 = 5\vec{\imath} + 8\vec{\jmath} + 7\vec{k}$ and , $\vec{F}_2 = 3\vec{\imath} - 4\vec{\jmath} + 3\vec{k}$. What is the acceleration of the particle?
15. If a stone of mass 0.25 kg tied to a string executes uniform circular motion with a speed of 2 ms^{-1} of radius 3 m, what is the magnitude of tensional force acting on the stone?
16. Consider a circular road of radius 20 meter banked at an angle of 15 degrees. With what speed a car has to move on the turn so that it will have safe turn?
17. A spider of mass 50 g is hanging on a string of a cob web. What is the tension in the string?
18. A car takes a turn with velocity 50 ms-1 on the circular road of radius of curvature 10 m. calculate the centrifugal force experienced by a person of mass 60kg inside the car?

3 Marks Questions

1. Using free body diagram, show that it is easy to pull an object than to push it.
2. Explain various types of friction. Suggest a few methods to reduce friction.
3. When a cricket player catches the ball, he/she pulls his /her hands gradually in the direction of the ball's motion. Why?
4. Prove the law of conservation of linear momentum. Use it to find the recoil velocity of a gun when a bullet is fired from it.
5. Briefly explain 'Rolling Friction'.
6. Write the salient features of Static and Kinetic friction.
7. A book of mass m is at rest on the table. (1) What are the forces acting on the book? (2) What are the forces exerted by the book? (3) Draw the free body diagram for the book.

8. An object of mass 10 kg moving with a speed of 15 m s^{-1} hits the wall and comes to rest within a) 0.03 second b) 10 second. Calculate the impulse and average force acting on the object in both the cases.
9. Consider a circular levelled road of radius 10 m having coefficient of static friction 0.81. Three cars (A, B and C) are travelling with speed 7 ms^{-1}, 8 ms^{-1} and 10 ms^{-1} respectively. Which car will skid when it moves in the circular level road? (g =10 ms^{-2})

5 Marks Questions

1. Explain the motion of blocks connected by a string in i) Vertical motion ii) Horizontal motion.
2. State Newton's three laws and discuss their significance.
3. Describe the method of measuring angle of repose.
4. Explain the need for banking of tracks.
5. How will you confirm Newton's third law by the way of two bodies in contact on a horizontal surface?
6. Briefly explain what are all the forces act on a moving vehicle on a levelled circular road?

UNIT : 4, WORK, ENERGY AND POWER

2 Marks Questions

1. Write the differences between conservative and Non-conservative forces.
2. Explain the characteristics of elastic and inelastic collision.
3. Define the Coefficient of restitution (COR).
4. Give the graphical representations of the work done by a variable force.
5. Write the significance of kinetic energy in the work-kinetic energy theorem.
6. Define Work – kinetic energy theorem.
7. Define Instantaneous power.
8. What is Elastic Collision?
9. What is Inelastic Collision?
10. A box is pulled with a force of 25 N to produce a displacement of 15 m. If the angle between the force and displacement is 30^0, find the work done by the force.
11. Water in a bucket tied with rope is whirled around in a vertical circle of radius 0.5 m. Calculate the minimum velocity at the lowest point so that the water does not spill from it in the course of motion. (g = 10 ms^{-2})

3 Marks Questions

1. Define the loss of kinetic energy in inelastic collision.
2. What is inelastic collision? In which way it is different from elastic collision.
3. Mention few examples in day to day life for inelastic collision.
4. Deduce the relation between momentum and kinetic energy.
5. Two objects of masses 2 kg and 4 kg are moving with the same momentum of 20 kg m s^{-1}.
   (a) Will they have same kinetic energy? (b) Will they have same speed?
6. Let the two springs A and B be such that $k_A > k_B$. On which spring will more work have to be done if they are stretched by the same force?

7. Calculate the energy consumed in electrical units when a 75 W fan is used for 8 hours daily for one month (30 days).
8. Show that the ratio of velocities of equal masses in an inelastic collision when one of the masses is stationary is $\frac{v_1}{v_2} = \frac{1-e}{1+e}$

5 Marks Questions

1. State and explain work energy principle. Mention any three examples for it.
2. Arrive at an expression for elastic collision in one dimension and discuss various cases.
3. State and prove the law of conservation of energy.
4. Derive an expression for the potential energy of a body near the surface of the Earth.
5. What is meant by elastic potential energy? Derive an expression for the elastic potential energy of the spring?

UNIT : 5, MOTION OF SYSTEM OF PARTICLES AND RIGID BODIES

2 Marks Questions

1. Define center of mass.
2. Define torque and mention its unit.
3. Give any two examples of torque in day-to-day life.
4. Define couple.
5. What is radius of gyration?
6. What is the difference between sliding and slipping?
7. State Parallel axis theorem.
8. State Perpendicular axis theorem.
9. The position vectors of two point masses 10 kg and 5 kg are $(-3\vec{\imath} + 2\vec{\jmath} + 4\vec{k})$m and $(3\vec{\imath} + 6\vec{\jmath} + 5\vec{k})$m respectively. Locate the position of centre of mass.
10. A cyclist while negotiating a circular path with speed 20 m s^{-1} is found to bend an angle by 30o with vertical. What is the radius of the circular path? (given, g = 10 ms^{-2})
11. A rolling wheel has velocity of its centre of mass as 5 ms^{-1}. If its radius is 1.5m and angular velocity is 3 $rads^{-1}$, then check whether it is in pure rolling or not.

3 Marks Questions

1. Explain the principle of moments.
2. Write the principles used in beam balance and define Mechanical Advantage.
3. Find the expression for radius of gyration.
4. Obtain the relation between torque and angular acceleration.
5. A force of $(4\vec{\imath} - 3\vec{\jmath} + 5\vec{k})$N is applied at a point whose position vector is $(7\vec{\imath} + 4\vec{\jmath} - 2\vec{k})$m. find the torque of force about the origin.
6. Find the moment of inertia of a hydrogen molecule about an axis passing through its centre of mass and perpendicular to the inter-atomic axis. Given: mass of hydrogen atom 1.7×10^{-27} kg and inter atomic distance is equal to 4×10^{-10}m.

5 Marks Questions

1. Explain the types of equilibrium with suitable examples.
2. Explain why a cyclist bends while negotiating a curve road? Arrive at the expression for angle of bending for a given velocity.
3. Derive the expression for moment of inertia of a rod about its center and perpendicular to the rod.
4. Derive the expression for moment of inertia of a uniform ring about an axis passing through the center and perpendicular to the plane.
5. Derive the expression for moment of inertia of a uniform disc about an axis passing through the center and perpendicular to the plane.
6. State and prove parallel axis theorem.
7. State and prove perpendicular axis theorem.
8. Discuss rolling on inclined plane and arrive at the expression for the acceleration.

UNIT : 6, GRAVITATION

2 Marks Questions

1. State Newton's Universal law of gravitation.
2. Define the gravitational field. Give its unit
3. Define gravitational potential.
4. Why is there no lunar eclipse and solar eclipse every month?
5. Why do we have seasons on Earth?
6. When a man is standing in the elevator, what are forces acting on him.
7. An unknown planet orbits the Sun with distance twice the semi major axis distance of the Earth's orbit. If the Earth's time period is T_1, what is the time period of this unknown planet?
8. If the masses and mutual distance between the two objects are doubled, what is the change in the gravitational force between them?
9. If the angular momentum of a planet is given by $\vec{L}=5t^2\vec{\imath} - 6t\vec{\jmath} + 3\vec{k}$. What is the torque experienced by the planet? Will the torque be in the same direction as that of the angular momentum?

3 Marks Questions

1. State Kepler's three laws.
2. What are geostationary and polar satellites?
3. Explain in detail the idea of weightlessness using lift as an example.
4. Derive the time period of satellite orbiting the Earth.

5 Marks Questions

1. Prove that at points near the surface of the Earth, the gravitational potential energy of the object is U = mgh.
2. Derive an expression for escape speed.
3. Explain the variation of g with latitude.
4. Explain the variation of g with altitude.
5. Explain the variation of g with depth from the Earth's surface.

UNIT : 7, PROPERTIES OF MATTER

2 Marks Questions

1. Define stress and strain.
2. State Hooke's law of elasticity.
3. Define Poisson's ratio.
4. Which one of these is more elastic, steel or rubber? Why?
5. State Pascal's law in fluids.
6. State Archimedes principle.
7. What do you mean by up-thrust or buoyancy?
8. State the law of floatation.
9. What is Reynold's number? Give its significance.
10. State Bernoulli's theorem.
11. Two streamlines cannot cross each other. Why?
12. Distinguish between cohesive and adhesive forces.
13. Give some examples for surface tension.
14. Why two holes are made to empty an oil tin?
15. We can cut vegetables easily with a sharp knife as compared to a blunt knife. Why?
16. A wire 10 m long has a cross-sectional area 1.25×10^{-4} m^2. It is subjected to a load of 5 kg. If Young's modulus of the material is 4×10^{10} Nm^{-2}, calculate the elongation produced in the wire. Take g = 10 ms^{-2}.
17. A metallic cube of side 100 cm is subjected to a uniform force acting normal to the whole surface of the cube. The pressure is 10^6 pascal. If the volume changes by 1.5×10^{-5} m^3, calculate the bulk modulus of the material.
18. Let 2.4×10^{-4} J of work is done to increase the area of a fi lm of soap bubble from 50 cm^2 to 100 cm^2. Calculate the value of surface tension of soap solution.
19. In a normal adult, the average speed of the blood through the aorta (radius r = 0.8 cm) is 0.33 ms^{-1}. From the aorta, the blood goes into major arteries, which are 30 in number, each of radius 0.4 cm. Calculate the speed of the blood through the arteries.

3 Marks Questions

1. What are the factors affecting the surface tension of a liquid?
2. What are the applications of surface tension?
3. What are the applications of viscosity?
4. We use straw to suck soft drinks, why?
5. Obtain an equation of continuity for a flow of fluid on the basis of conservation of mass.
6. Write any two applications of Bernoulli's theorem.
7. Write the applications of elasticity.
8. A wire of length 2 m with the area of cross-section 10^{-6} m^2 is used to suspend a load of 980 N. Calculate i) the stress developed in the wire ii) the strain and iii) the energy stored. Given: $Y=12\times10^{10}N\ m^{-2}$
9. Two pistons of a hydraulic lift have diameters of 60 cm and 5 cm. What is the force exerted by the larger piston when 50 N is placed on the smaller piston?

10. A metal plate of area 2.5×10^{-4} m^2 is placed on a 0.25×10^{-3} m thick layer of castor oil. If a force of 2.5 N is needed to move the plate with a velocity 3×10^{-2} m s^{-1}, calculate the coefficient of viscosity of castor oil.
11. A capillary of diameter d mm is dipped in water such that the water rises to a height of 30mm. If the radius of the capillary is made 2/3 of its previous value, then compute the height up to which water will rise in the new capillary?
12. The reading of pressure meter attached with a closed pipe is 5×10^5 N m^{-2}. On opening the valve of the pipe, the reading of the pressure meter is 4.5×10^5 Nm^{-2}. Calculate the speed of the water flowing in the pipe.

5 Marks Questions

1. Explain the different types of modulus of elasticity.
2. Derive the expression for the terminal velocity of a sphere moving in a high viscous fluid using stokes force.
3. Derive Poiseuille's formula for the volume of a liquid flowing per second through a pipe under streamlined flow.
4. What is capillarity? Obtain an expression for the surface tension of a liquid by capillary rise method.
5. State and prove Bernoulli's theorem for a flow of incompressible, non-viscous, and streamlined flow of fluid.

UNIT : 8, HEAT AND THERMODYNAMICS

2 Marks Questions

1. Define molar specific heat capacity.
2. Define latent heat capacity. Give its unit.
3. State Stefan-Boltzmann law.
4. What is Wien's law?
5. State Zeroth law of thermodynamics.
6. Define the quasi-static process.
7. What is PV diagram?
8. State Kelvin-Planck statement of second law of thermodynamics.
9. Define the coefficient of performance.
10. Eiffel tower is made up of iron and its height is roughly 300 m. During winter season (January) in France the temperature is 2^0 C and in hot summer its average temperature 25^0 C. Calculate the change in height of Eiffel tower between summer and winter. The linear thermal expansion coefficient for iron $\alpha = 10\times10^{-6}$ per °C
11. Jogging every day is good for health. Assume that when you jog a work of 500 kJ is done and 230 kJ of heat is given off. What is the change in internal energy of your body?
12. During a cyclic process, a heat engine absorbs 500 J of heat from a hot reservoir, does work and ejects an amount of heat 300 J into the surroundings (cold reservoir). Calculate the efficiency of the heat engine?
13. A refrigerator has COP of 3. How much work must be supplied to the refrigerator in order to remove 200 J of heat from its interion?

14. An ideal refrigerator keeps its content at 0°C while the room temperature is 27°C. Calculate its coefficient of performance.

3 Marks Questions

1. Draw the PV diagram for Isothermal Process.
2. Write the applications of thermal conversion.
3. Discuss various modes of heat transfer.
4. Explain in detail the working of a refrigerator.
5. A person does 30 kJ work on 2 kg of water by stirring using a paddle wheel. While stirring, around 5 kcal of heat is released from water through its container to the surface and surroundings by thermal conduction and radiation. What is the change in internal energy of the system?
6. Calculate the number of moles of air is in the inflated balloon at room temperature The radius of the balloon is 10 cm, and pressure inside the balloon is 180 kPa.

5 Marks Questions

1. Explain in detail the thermal expansion.
2. Explain Calorimetry and derive an expression for final temperature when two thermodynamic systems are mixed.
3. Explain in detail Newton's law of cooling.
4. Derive Mayer's relation for an ideal gas.
5. Derive the work done in an isothermal process.
6. Derive the work done in an adiabatic process.
7. Explain the heat engine and obtain its efficiency.
8. Derive the expression for Carnot engine efficiency.

UNIT : 9, KINETIC THEORY OF GASES

2 Marks Questions

1. Why moon has no atmosphere?
2. Define the term degrees of freedom.
3. State the law of equipartition of energy.
4. List the factors affecting the mean free path.
5. What are the factors which affect Brownian motion?
6. Why No hydrogen in Earth's atmosphere?
7. A gas is at temperature 80°C and pressure 5×10^{-10}N m^{-2}. What is the number of molecules per m3 if Boltzmann's constant is 1.38×10^{-23} J K^{-1}
8. Estimate the total number of air molecules in a room of capacity 25m^3 at a temperature of 27°C.

3 Marks Questions

1. What is the relation between the average kinetic energy and pressure?
2. Describe the Brownian motion.
3. Ten particles are moving at the speed of 2, 3, 4, 5, 5, 5, 6, 6, 7 and 9 m s^{-1}. Calculate rms speed, average speed and most probable speed.
4. Find the adiabatic exponent γ for mixture of μ_1 moles of monoatomic gas and μ_2 moles of a diatomic gas at normal temperature (27^{0}C) .

5. An oxygen molecule is travelling in air at 300 K and 1 atm, and the diameter of oxygen molecule is 1.2×10^{-10}m. Calculate the mean free path of oxygen molecule.

5 Marks Questions

1. Write down the postulates of kinetic theory of gases.
2. Explain in detail the kinetic interpretation of temperature.
3. Describe the total degrees of freedom for mono-atomic molecule, diatomic molecule and tri-atomic molecule.
4. Derive the ratio of two specific heat capacities of mono-atomic, diatomic and Tri-atomic molecules.
5. Derive the expression for mean free path of the gas.

UNIT : 10, OSCILLATIONS

2 Marks Questions

1. What is meant by force constant of a spring?
2. Define time period of simple harmonic motion.
3. What is an epoch?
4. State the laws of simple pendulum?
5. What is meant by free oscillation?
6. Consider two springs whose force constants are 1 Nm^{-1} and 2 Nm^{-1} which are connected in series. Calculate the effective spring constant (k_s) and comment on k_s
7. If the length of the simple pendulum is increased by 44% from its original length, calculate the percentage increase in time period of the pendulum.

3 Marks Questions

1. Explain damped oscillation. Give an example.
2. Define forced oscillation. Give an example.
3. Explain resonance. Give an example.
4. Consider a simple pendulum of length l = 0.9 m which is properly placed on a trolley rolling down on a inclined plane which is at θ = 45° with the horizontal. Assuming that the inclined plane is frictionless, calculate the time period of oscillation of the simple pendulum.
5. A piece of wood of mass m is floating erect in a liquid whose density is ρ. If it is slightly pressed down and released, then executes simple harmonic motion. Show that its time period of oscillation is T = $2\pi\sqrt{\frac{m}{A\,g\rho}}$

5 Marks Questions

1. What is meant by angular harmonic oscillation? Compute the time period of angular harmonic oscillation.
2. Explain the horizontal oscillations of a spring.
3. Describe the vertical oscillations of a spring.
4. Write short notes on the oscillations of liquid column in U-tube.
5. Explain briefly about the graphical representation of Displacement, Velocity and Acceleration in SHM.
6. Explain the effective spring constant in series connection and parallel connection

UNIT : 11, WAVES

2 Marks Questions

1. Explain Doppler Effect.
2. Explain red shirt and blue shift in Doppler Effect.
3. What is reverberation?
4. The average range of frequencies at which human beings can hear sound waves varies from 20 Hz to 20 kHz. Calculate the wavelength of the sound wave in these limits. (Assume the speed of sound to be 340 ms^{-1}.
5. Calculate the speed of sound in a steel rod whose Young's modulus $Y = 2 \times 10^{11}\ Nm^{-2}$ and $\rho = 7800\ kg\ m^{-3}$.
6. An increase in pressure of 100 kPa causes a certain volume of water to decrease by 0.005% of its original volume. (a) Calculate the bulk modulus of water? (b) Compute the speed of sound (compressional waves) in water?
7. A mobile phone tower transmits a wave signal of frequency 900MHz. Calculate the length of the waves transmitted from the mobile phone tower.
8. The sound level from a musical instrument playing is 50 dB. If three identical musical instruments are played together then compute the total intensity. The intensity of the sound from each instrument is $10^{-12}\ W\ m^{-2}$
9. A student performed an experiment to determine the speed of sound in air using the resonance column method. The length of the air column that resonates in the fundamental mode with a tuning fork is 0.2 m. If the length is varied such that the same tuning fork resonates with the first overtone at 0.7 m. Calculate the end correction.
10. The speed of a wave in a certain medium is 900 m/s. If 3000 waves pass over a certain point of the medium in 2 minutes, then compute its wavelength?
11. Consider two organ pipes of same length in which one organ pipe is closed and another organ pipe is open. If the fundamental frequency of closed pipe is 250 Hz. Calculate the fundamental frequency of the open pipe.

3 Marks Questions

1. What is meant by an echo? Explain.
2. Write characteristics of wave motion.
3. Describe the formation of beats.
4. Discuss the law of transverse vibrations in stretched strings.
5. Write the applications of reflection of sound waves:
6. Write characteristics of progressive waves.
7. Derive the relation between intensity and loudness.
8. If a flute sounds a note with 450Hz, what are the frequencies of the second, third, and fourth harmonics of this pitch? If the clarinet sounds with a same note as 450Hz, then what are the frequencies of the lowest three harmonics produced.
9. If the third harmonics of a closed organ pipe is equal to the fundamental frequency of an open organ pipe, compute the length of the open organ pipe if the length of the closed organ pipe is 30 cm.
10. A sound of frequency 1500 Hz is emitted by a source which moves away from an observer and moves towards a cliff at a speed of 6 ms^{-1}.

(a) Calculate the frequency of the sound which is coming directly from the source.

(b) Compute the frequency of sound heard by the observer reflected off the cliff. Assume the speed of sound in air is 330 ms^{-1}.

11. A ship in a sea sends SONAR waves straight down into the seawater from the bottom of the ship. The signal reflects from the deep bottom bed rock and returns to the ship after 3.5 s. After the ship moves to 100 km it sends another signal which returns back after 2s. Calculate the depth of the sea in each case and also compute the difference in height between two cases.

5 Marks Questions

1. Show that the velocity of a travelling wave produced in a string is v = $\sqrt{\frac{T}{\mu}}$
2. Describe Newton's formula for velocity of sound waves in air and also discuss the Laplace's correction.
3. Explain how the interference of waves is formed.
4. What is a sonometer? Give its construction and working. Explain how to determine the frequency of tuning fork using sonometer.
5. Write short notes on intensity and loudness.
6. Explain how overtones are produced in a Closed organ pipe.
7. Explain how overtones are produced in a Open organ pipe.
8. How will you determine the velocity of sound using resonance air column apparatus?
9. Write the expression for the velocity of longitudinal waves in an elastic medium.

PREPARED BY

RAJENDRAN M, M.Sc., B.Ed., C.C.A.,
P. G. TEACHER IN PHYSICS,
DEPARTMENT OF PHYSICS,
SRI RAMANA MAHARSHI MATRIC HR SEC SCHOOL,
KAVERIYAMPOONDI,
TIRUVANNAMALAI DISTRICT – 606 603.
mrrkphysics@gmail.com,
murasabiphysics@gmail.com, physicsrasa@gmail.com

"thoehs; KOtJk; xt;nthU kz;j;Js;Ak;
NeHikaha;, cz;ikaha; ciof;fpdwtHfs;d;
fuq;fNs J}a;ikahd fuq;fs;."