

XI – STD – PHYSICS - PUBLIC QUESTIONS

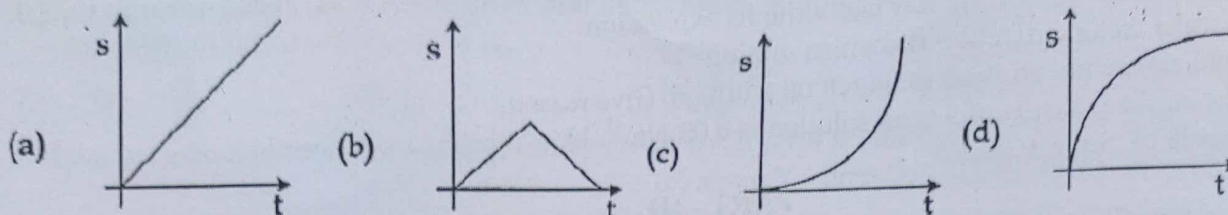
MARCH-19

PART - I

15 × 1 = 15

Answer all the questions

1. Which graph represents uniform acceleration?



2. A body of 5 kg is thrown up vertically with a kinetic energy of 100 J. If the acceleration due to gravity is 10ms^{-1} , find the height at which the kinetic energy becomes half of the original value
 a) 10 m b) 20 m c) 50 m d) 100 m
3. The process in which the heat transfer is by actual movement of molecules in fluids such as liquids and gases is called
 a) Thermal conductivity b) Convection c) Conduction d) radiation
4. If the temperature of the wire is increased, then the Young's modulus will
 (a) increase rapidly (b) increase by very a small amount (c) remain the same (d) decrease
5. The amplitude and time period of a simple pendulum bob are 0.05m and 2s respectively. Then the maximum velocity of the bob is
 a) 0.157 ms^{-1} b) 0.257 ms^{-1} c) 0.10 ms^{-1} d) 0.025 ms^{-1}
6. There will be small bubble at one end and bigger bubble at other end of pipe. Which among the following will happen?
 a) remains in equilibrium b) smaller will grow until they collapse
 c) bigger will grow until they collapse d) none of the above
7. A closed cylindrical container is partially filled with water. As the container rotates in a horizontal plane about a perpendicular bisector, its moment of inertia,
 (a) remains constant b) depends on direction of rotation. (c) increases (d) decreases
8. Which of the following represents a wave?
 a) $\frac{1}{x+vt}$ b) $\sin(x + vt)$ c) $(x - vt)^3$ d) $x(x + vt)$
9. Which of the following pairs of physical quantities have same dimension?
 a) torque and power b) force and torque c) force and power d) torque and energy
10. If the internal energy of an ideal gas U and volume V are doubled then the pressure
 (a) halves (b) quadruples (c) doubles (d) remains same
11. For a satellite moving in an orbit around the earth, the ratio of kinetic energy to potential energy is
 a) 2 b) $\sqrt{2}$ c) $\frac{1}{2}$ d) $\frac{1}{\sqrt{2}}$
12. 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 interior?
 a) 33.33J b) 44.44J c) 66.67J d) 50J
13. If the linear momentum of the object is increased by 0.1%, then the kinetic energy is increased by
 (a) 0.4% (b) 0.01% (c) 0.1 % (d) 0.2%
14. What is angular displacement made by a particle after 5s, when it starts from rest with an angular acceleration 0.2 rad s^{-2} ?
 a) 4 rad b) 1 rad c) 2.5 rad d) 5 rad
15. In an isochoric process, which is relevant among the following:
 a) $\Delta U = 0$ b) $\Delta T = 0$ c) $W = 0$ d) $Q = 0$

PART - II

Answer any six questions. Question number 24 is compulsory.

6 × 2 = 12

16. Write any two errors of systematic errors. Explain them.
 17. What is projectile? Give two examples.

18. State Newton's second law of motion.
19. 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?
20. Why it is more difficult to revolve a stone tied to longer string than a stone tied to a shorter string?
21. State Stefan-Boltzmann law and write its expression
22. List the factors affecting Brownian motion
23. Soldiers are not allowed to march on a bridge. Give reason.
24. The surface tension of a soap solution is 0.03 Nm^{-1} . How much work is done in producing soap bubble of radius 0.05m ?

PART - III

Answer any six questions. Question number 33 is compulsory.

$6 \times 3 = 18$

25. What is the torque of the force $\vec{F} = 3\hat{i} - 2\hat{j} + 4\hat{k}$ acting at a point $\vec{r} = 2\hat{i} + 3\hat{j} + 5\hat{k}$ about the origin?
26. What are the various types of friction. Suggest a few methods to reduce friction
27. A heavy body and a light body have same momentum. Which one of them has more kinetic energy and why?
28. Find the rotational kinetic energy of a ring of mass 9 kg and radius 3 m rotating with 240 rpm about an axis passing through its centre and perpendicular to its plane.
29. What do you mean by weightlessness? Explain the state of weightlessness of a freely falling body.
30. Derive an expression for a terminal velocity of a small sphere falling through a viscous liquid
31. Explain linear expansion of solid
32. Write any six postulates of kinetic theory of gases
33. Two waves of wavelength 99 cm and 100 cm both travelling with velocity of 396 ms^{-1} are made interfere. Calculate the number of beats produced by them per second.

PART - IV

Answer all the questions

$5 \times 5 = 25$

34. a). Explain the principle of homogeneity of dimensions and derive the force acting on a body moving in a circular path depends on the mass of the body(m), velocity v and the radius r of the circular path. Obtain an expression for the force by dimensional analysis (K=1)
(OR)
b) State and prove Bernoulli's theorem for a flow of incompressible, non- viscous and streamlined flow of liquid
35. a) 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.
(OR)
b) State and prove parallel axis theorem
36. a) What is elastic collision? Derive an expression for final velocities of two bodies which undergo elastic collision in one dimension
(OR)
b) How will you determine the velocity of sound using resonance air column apparatus ?
37. a) Derive Mayer's relation for ideal gas
(OR)
b) Explain horizontal oscillation of a spring
38. a) i) Write down the equation of a freely falling body under gravity
ii) A ball is thrown vertically upwards with the speed of 19.6 ms^{-1} from the top of the building and reaches the earth in 6s. Find the height of the building
(OR)
b) i) What is orbital velocity ? Obtain an expression for it.
ii) Calculate the value of orbital velocity for an artificial satellite of earth orbiting at a height of 100 km. (Mass of the earth = 6×10^{24} kg., radius of the earth = 6400 km

JULY 2019

PART - I

Answer all the questions

15 × 1 = 15

1. If $\pi = 3.14$, then value of π^2 is ; (a) 9.8596 (b) 9.860 (c) 9.806 (d) 9.9
2. If an object is thrown vertically upward with initial speed 'u' from the ground, then the time taken by the object to return to the ground is ;
(a) $\frac{u^2}{2g}$ (b) $\frac{u}{2g}$ (c) $\frac{u}{g}$ (d) $\frac{2u}{g}$
3. If the position vector of a particle is given by $\vec{r} = 5t^2\hat{i} + 7t\hat{j} + 4\hat{k}$, then its velocity lies in ;
(a) X - Y plane (b) X - Y plane (c) along Y - direction (d) along X - direction
4. Force acting on a particle moving at constant speed ;
(a) always zero (b) need not be zero (c) always non - zero (d) cannot be concluded
5. Which of the following force is pseudo force ?
(a) viscous force (b) surface tension (c) centrifugal force (d) gravitational force
6. What is the minimum velocity with which a body of mass 'm' must enter a vertical loop of radius 'R', so that it can complete a loop ? (a) $\sqrt{2gR}$ (b) $\sqrt{3gR}$ (c) $\sqrt{5gR}$ (d) \sqrt{gR}
7. A rigid body rotates with an angular momentum 'L'. If its K.E is halved, then angular momentum will be ; (a) L (b) $\frac{L}{2}$ (c) 2 L (d) $\frac{L}{\sqrt{2}}$
8. A round object of mass 'M' and radius 'R' rolls down without slipping along an inclined plane. The frictional force ;
(a) decreases the rotational and translational motion (b) dissipates kinetic energy as heat
(c) converts translational energy into rotational energy (d) decreases the rotational motion
9. If the radius of Earth is 'R', at what height acceleration due to gravity becomes zero ?
(a) R (b) $\frac{R}{4}$ (c) 2R (d) $\frac{R}{2}$
10. If two wires have same dimension but of different materials, the graph between load and extension is as follows, then which of the following is true ;
(a) $Y_B = Y_A$ (b) $Y_A < Y_B$
(c) $Y_B > Y_A$ (d) $Y_B = Y_A = 0$
11. The wettability of a surface by a liquid depends primarily on ;
(a) viscosity (b) surface tension (c) density (d) angle of contact between the surface and liquid
12. The efficiency of a heat engine working between 27°C and 127°C is ;
(a) 50 % (b) 25 % (c) 12.5 % (d) 75 %
13. The ratio $\gamma = \frac{c_p}{c_v}$ for a gas mixture containing of 8 g of helium and 16 g of oxygen is ;
(a) 2315 (b) 1523 (c) 2711 (d) 1727
14. In a simple harmonic oscillation, the acceleration against displacement for one complete oscillation will be ;
(a) an ellipse (b) a circle (c) a parabola (d) a straight line
15. A person standing between two parallel hills fires a gun and hears the first echo, after 't₁' s and second echo after 't₂' s. The distance between the hill is ;
(a) $\frac{v(t_1 - t_2)}{2}$ (b) $\frac{v(t_1 t_2)}{2(t_1 + t_2)}$ (c) 2 (t₁ + t₂) (d) $\frac{v(t_1 + t_2)}{2}$

PART - II

Answer any six questions. Question number 20 is compulsory.

6 × 2 = 12

16. Check the following equation by dimensional method ; $E = mc^2$
17. What is the difference between scalar and vector? . Give examples.
18. State Lami's theorem.
19. Define centre of gravity.

20. An electron moving with velocity $2.2 \times 10^6 \text{ms}^{-1}$, revolving in circular orbit of radius 0.53 \AA . Calculate its angular momentum.
21. Define Reynolds number. Give its importance.
22. Define Specific heat capacity.
23. Define root mean square speed.
24. A particle executing SHM covers a displacement of half of amplitude in one second. Calculate its time period.

PART – III

Note : Answer any six questions . Question number 33 is compulsory.

$6 \times 3 = 18$

25. What are the limitations of dimensional analysis.
26. Find the maximum speed at which a car turn round a curve of 36 m radius on a level road. Given the coefficient of friction between the tyre and road is 0.53
27. Give the difference between elastic collision and inelastic collision.
28. The position vector of a particle has length of 1 m makes an angle of 30° with X - axis. What are the lengths of x and y components of the position vector?
29. State Kepler's laws of planetary motion.
30. Explain any three factors affecting surface tension of a liquid.
31. Define degrees of freedom? Give examples
32. Explain any three applications of reflection of sound waves.
33. A child is playing on a sliding board. If he is sliding down ; (1) Mention the forces acting on the child (2) Draw FBD (free body diagram) (3) Write the force equation.

PART – IV

Note : Answer all the questions

$5 \times 5 = 25$

34. (a) Explain in detail the triangle law of addition .
(OR)
(b) Discuss the four types of oscillation .
35. (a) Explain the vertical motion of blocks connected by a string.
(OR)
(b) What are stationary waves? Write the characteristics of stationary waves.
36. a) Derive the expression of moment of inertia of rod about an axis passing through its centre and perpendicular to the rod.
(OR)
(b) State ideal gas laws. Derive equation of state for ideal gas
37. a) Derive the expression for escape speed.
(OR)
b) Explain the different type of moduli of elasticity
38. a) Two objects of masses 3 kg and 6 kg are moving with same momentum of 30 kg m s^{-1}
(i) Will they have same kinetic energy? (ii) Will they have same speed? Prove it
(OR)
(b) In series of successive measurements in an experiment, the readings of period of rotation of a wheel were found out to be 2.15 s, 2.25 s, 2.28 s and 2.32 s. Calculate,
(i) mean value of period of rotation (ii) absolute error in each measurement
(iii) mean absolute error (iv) relative error and (v) percentage error.
Express the result in proper form

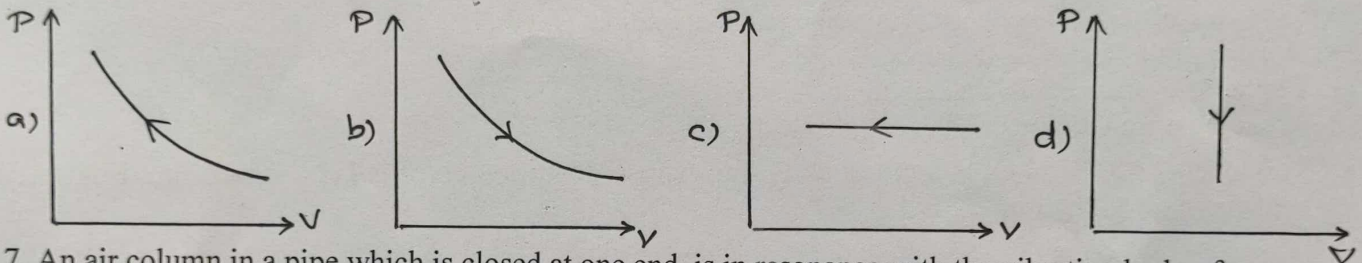
March - 20

PART - I

Answer all the questions

 $15 \times 1 = 15$

- When a car takes a sudden left turn on a curved road, passengers are pushed towards the right due to
 - absence of inertia
 - inertia of direction
 - inertia of motion
 - inertia of rest
- A spring constant k is cut into two pieces such that the length of one piece is double the length of the other. Then the longer piece will have a force constant of
 - $6k$
 - $\frac{2}{3}k$
 - $\frac{3}{2}k$
 - $3k$
- The length of a body is measured as 3.51 m, if the accuracy is 0.01 m, then the percentage error in the measurement is
 - 351%
 - 1%
 - 0.28%
 - 0.035%
- Which one of the following is a scalar quantity
 - speed
 - velocity
 - displacement
 - linear momentum
- An air column in a pipe which is closed at one end, will be in resonance with the vibrating body of frequency 83 Hz. Then the length of the air column is
 - 1.5 m
 - 0.5 m
 - 1.0 m
 - 2.0 m
- Which one of the following P-V diagrams corresponds to isobaric compression?



- An air column in a pipe which is closed at one end, is in resonance with the vibrating body of frequency 83 Hz. Then the length of the air column is : (velocity of sound in air = 332ms^{-1})
 - 1.5 m
 - 0.5 m
 - 2.0 m
 - 1.0 m
- Identify the unit vector in the following:
 - $\frac{i+j}{\sqrt{2}}$
 - $\hat{i} + \hat{j}$
 - $\frac{i}{\sqrt{2}}$
 - $\hat{k} - \frac{j}{\sqrt{2}}$
- The dimensional formula for Moment of Inertia :
 - $\text{ML}^{-1}\text{T}^{-1}$
 - ML^2T^{-2}
 - MLT^2
 - ML^2
- A body of mass 20 kg moving with a speed of 10ms^{-1} on a horizontal smooth surface collides with a massless spring of spring constant 5 N/m. If the mass stops after collision, distance of compression on the spring will be
 - 10 m
 - 50 m
 - 5 m
 - 20 m
- Human audible wavelength range (velocity of sound in air = 340ms^{-1}) is
 - 17 m to 170 m
 - 0.17 m to 17 m
 - 0.017 m to 17 m
 - 1.7 m to 17 m
- Moment of inertia of a solid cylinder of mass M , length l and radius r about its own axis is:
 - $M\left(\frac{r^2}{2} + \frac{l^2}{12}\right)$
 - Mr^2
 - $\frac{1}{4}Mr^2$
 - $\frac{1}{2}Mr^2$
- The efficiency of a heat engine working between the freezing point and boiling point of water is:
 - 12.5%
 - 6.25%
 - 20%
 - 26.8%
- rms speed of hydrogen molecule at 27°C
 - 193kms^{-1}
 - 1.93kms^{-1}
 - 19.3kms^{-1}
 - 0.193kms^{-1}
- The ratio between the rms speed and most probable speed of gas molecule at a given temperature is
 - $2\sqrt{2} : 1$
 - $\sqrt{3} : \sqrt{2}$
 - $\sqrt{2} : \sqrt{3}$
 - $\sqrt{1} : 2\sqrt{2}$

PART - II

Answer any six questions. Question number 24 is compulsory.

 $6 \times 2 = 12$

- Check the correctness of the equation $\frac{1}{2}mv^2 = mgh$ using dimensional analysis
- Define displacement and distance.

18. Why there is no lunar eclipse and solar eclipse every month?
19. State the law of conservation of angular momentum
20. Define coefficient of restitution
21. During cyclic process, a heat engine absorbs 500 J of heat from a hot reservoir, does work and ejects an amount of heat 300J into the surroundings(cold reservoir). Calculate the efficiency of the heat engine
22. Why there is no hydrogen in the Earth atmosphere?
23. Write down the factors affecting velocity of sound in gases
24. If the length of the pendulum is increased by 44% from its original length, calculate the percentage increase in time period of the pendulum

PART – III

Note : Answer any six questions . Question number 33 is compulsory.

6 × 3 = 18

25. Explain RADAR pulse method for determining large distances.
26. An object is thrown with initial speed 5ms^{-1} with an angle of projection 30° . Calculate the maximum height reached and horizontal range.
27. When a cricket player catches the ball, he pulls his hand in the direction of the ball's motion. Why?
28. State Kepler's three laws in planetary motion
29. Write the difference between transverse and longitudinal waves.
30. We use straw to suck soft drinks. Why?
31. Explain Resonance. Give an example.
32. What are the conditions for reversible process?
33. A force $(4\hat{i} - 3\hat{j} + 5\hat{k})\text{N}$ is applied at a point whose position vector is $(7\hat{i} + 4\hat{j} - 2\hat{k})\text{m}$. Find the torque of force about origin

PART – IV

Note : Answer all the questions

5 × 5 = 25

34. a) Derive the expression for centripetal acceleration.
(OR)
b) State and explain work – Energy principle. Mention the inferences of work kinetic energy theorem
35. a) What do you mean by propagation of errors? Explain the propagation of errors in division of two quantities.
(OR)
b) Derive the expression for the work done in an adiabatic process
36. a) i) Derive the expression for variation of acceleration due to gravity (g) with depth from the surface of earth (d) .
ii) Find the ratio of the acceleration due to gravity at height $R/2$ from the surface of earth to the value at a depth $R/2$ from the surface of the earth (R – radius of earth)
(OR)
b) Explain bending of cyclist in curves and arrive at an expression for angle of bending
37. a) Derive the expression for moment of inertia of a thin uniform rod about an axis passing through its centre and perpendicular to its length
(OR)
b) Explain in detail the four type of oscillations
38. a) i) Determine the height of an accessible object using triangulation method
ii) From a point on the ground, the top of a tree is seen to have an angle of elevation 60° . The distance between the tree and a point is 50 m. Calculate the height of the tree?
(OR)
b) Derive an expression for a terminal velocity of a sphere moving in a highly viscous fluid, using Stoke's formula

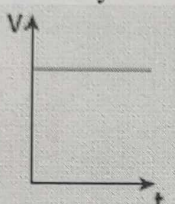
OCTOBER, 2020

PART - I

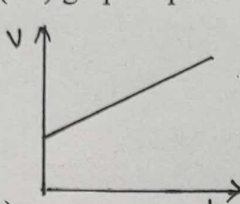
Answer all the questions

 $15 \times 1 = 15$

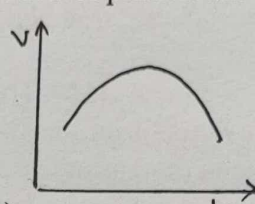
- If the error in the measurement of radius is 2%, then the error in the determination of volume of the sphere will be (a) 2% (b) 4% (c) 6% (d) 8%
- A stone of mass 0.5 kg tied to a string executes uniform circular motion in a circle of radius 2m with a speed of 4ms^{-1} . The magnitude of tension acting on the stone will be (a) 3 N (b) 10 N (c) 0.5 N (d) 4 N
- If a particle executes uniform circular motion in the xy plane in clock wise direction, then the angular velocity is in (a) +y direction (b) +z direction (c) -z direction (d) -x direction
- The velocity - time (v-t) graph representing motion of particle moving with uniform velocity is



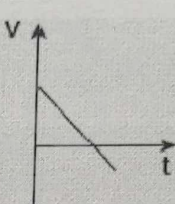
a)



b)



c)



d)
- A rigid body rotates with an angular momentum L. If its kinetic energy is halved, the angular momentum becomes (a) L (b) $L/2$ (c) $2L$ (d) $L/\sqrt{2}$
- The energy consumed in electrical units when a 60 W fan is used for 8 hours daily for one month (30 days) is nearly (a) 14 units (b) 18 units (c) 16 units (d) 20 units
- In a vertical circular motion, the minimum speed at the lowest point required by the mass to complete a circular motion is (Radius of the circular path is r). (a) $\sqrt{2gr}$ (b) $2gr$ (c) $\sqrt{5gr}$ (d) $5gr$
- The wettability of a surface by a liquid depends primarily on (a) viscosity (b) surface tension (c) density (d) angle of contact between the surface and the liquid
- An object of mass 10kg is hanging from a spring scale which is attached to the root of a lift. If the lift is free fall, the reading in the spring scale is (a) 98 N (b) zero (c) 49 N (d) 9.8 N
- All natural processes occur such that entropy should (a) always increase (b) always decrease (c) first increase and then decrease (d) does not change
- The graph between volume of a given mass of gas and temperature when its pressure remains constant is: (a) an ellipse (b) a circle (c) a straight line (d) a parabola
- When a damped harmonic oscillator completes 100 oscillations, its amplitude is reduced to of its initial value. What will be its amplitude when it completes 200 oscillations? (a) $\frac{1}{5}$ (b) $\frac{2}{3}$ (c) $\frac{1}{6}$ (d) $\frac{1}{9}$
- Which of the following is an example of non-linear triatomic molecule? (a) Water (b) Hydrogen (c) Helium (d) Nitrogen
- If S_p and S_v denote the specific heats of nitrogen gas per unit mass at constant pressure and constant volume respectively, then (JEE 2007) (a) $s_p - s_v = 28R$ (b) $s_p - s_v = R/28$ (c) $s_p - s_v = R/14$ (d) $s_p - s_v = R$
- The three frequencies of harmonics of closed organ pipe will be in the ratio (a) 1 : 2 : 3 (b) 1 : 3 : 5 (c) 1 : 4 : 9 (d) 2 : 4 : 6

PART - II

Answer any six questions. Question number 24 is compulsory.

 $6 \times 2 = 12$

- What are fundamental quantities? Give examples.

17. The position vector and angular velocity of a particle executing uniform circular motion at an instant are $2\hat{i}$ and $4\hat{k}$ respectively. Find its linear velocity at that instant
18. When walking on ice one should take short steps. Why?
19. What is radius of gyration?
20. State universal law of gravitation ?
21. Explain red shift and blue shift in Doppler Effect.
22. What is PV – diagram?
23. List the factors affecting the mean free path
24. A metal cube of side 0.20 m is subjected to a shearing force of 4000 N. The top surface is displaced through 0.50 cm with respect to the bottom. Calculate the shear modulus of elasticity of the metal.

PART – III

Note : Answer any six questions . Question number 33 is compulsory.

6 × 3 = 18

25. Write about dimensional variables and dimensionless variable with an example
26. A train was moving at the rate of 54kmh^{-1} when brakes were applied. It comes to rest with a distance of 225m. Calculate the retardation produced in the train
27. Distinguish between elastic and inelastic collision
28. Derive an expression for kinetic energy of a rigid body in rotational motion
29. Suppose we go 200km above and below the surface of the Earth , what are the g values at these points? In which case , is the value of g small?
30. Write any three applications of surface tension
31. Why does heat flow from hot object to cold object?
32. Write any six postulates of kinetic theory of gases
33. Calculate the amplitude, angular frequency, frequency, time period and initial phase for the simple harmonic oscillation given equation $y = 0.3 \sin (40\pi t + 1.1)$

PART – IV

Note : Answer all the questions

5 × 5 = 25

34. a) 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.
(OR)
b) What is meant by angular harmonic oscillation? Derive an expression for time period of angular harmonic oscillation.
35. a) i). What are the uses of dimensional analysis ?
ii) Convert 76 cm of mercury pressure into Nm^{-2} using the method of dimensions
(OR)
b) i) Derive the relation between momentum and kinetic energy
ii) 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? Prove it
36. a) Derive the linear kinematic equations of motion for constant accelerated motion
(OR)
b) Explain the types of equilibrium with suitable examples
37. a) What is thermal expansion? Explain the three types of thermal expansion and obtain the relation between them
(OR)
b) What are stationary waves?. Explain the formation of stationary waves
38. Derive the expression for orbital speed and time period of a satellite
(OR)

Derive Poiseuille's formula for the volume of the liquid flowing per second through a pipe under streamline flow.

XI std - PHYSICS - August - 2021

Time Allowed: 3.00 Hours

Maximum Marks : 70

PART - I

Note: i) Answer all the questions

15 × 1 = 15

(ii) Choose the most appropriate answer from four given alternatives and write the option code with the corresponding answer

1. Two equal masses m_1 and m_2 are moving along the same straight line with velocities 5ms^{-1} and -9ms^{-1} respectively. If the collision is elastic, then calculate the velocities after the collision of m_1 and m_2 , respectively
 a) -9ms^{-1} and 5ms^{-1} b) -4ms^{-1} and 10ms^{-1} c) 5ms^{-1} and 1ms^{-1} d) 10ms^{-1} and 0ms^{-1}
2. If a particle executes uniform circular motion in the xy plane in clock wise direction, then the angular velocity is in
 a) - z direction b) +y direction c) -x direction d) +z direction
3. A hollow sphere is filled with water. It is hung by a long thread. As the water flows out of a hole at the bottom, the period of oscillation will
 a) increase continuously b) first increase and then decrease
 c) decrease continuously d) first decrease and then increase
4. Which one of the is not a scalar?
 a) Pressure b) Viscosity c) Stress d) Surface tension
5. If an object is thrown vertically up with the initial speed u from the ground, then the time taken by the object to return back to ground is
 a) $\frac{u}{2g}$ b) $\frac{u^2}{2g}$ c) $\frac{2u}{g}$ d) $\frac{u^2}{g}$
6. The efficiency of a heat engine working between the freezing point and boiling point of water is
 a) 26.8% b) 6.25% c) 12.5% d) 20%
7. When an object is at rest on the inclined rough surface,
 a) static friction is not zero and kinetic friction is zero
 b) static and kinetic frictions acting on the object is zero
 c) static and kinetic frictions are not zero
 d) static friction is zero but kinetic friction is not zero
8. A couple produces a) rotation and translation b) pure rotation c) no motion d) pure translation
9. A transverse wave moves from a medium A to a medium B. In medium A, the velocity of the transverse wave is 500ms^{-1} and the wavelength is 5 m. The frequency and the wavelength of the wave in medium B when its velocity is 600ms^{-1} , respectively are
 a) 120 Hz and 6 m b) 120 Hz and 5 m c) 100 Hz and 6 m d) 100 Hz and 5 m
10. The dimensional formula of Planck's constant h is
 a) $[\text{MLT}^{-1}]$ b) $[\text{ML}^2\text{T}^{-1}]$ c) $[\text{ML}^3\text{T}^{-3}]$ d) $[\text{ML}^2\text{T}^{-3}]$
11. Unit of surface energy is: a) Nm^3 b) Nm^{-2} c) Nm d) Nm^{-1}
12. The gravitational potential energy of the Moon with respect to Earth is
 a) can be positive or negative b) always positive c) always zero d) always negative
13. A spring is connected to a mass m suspended from it and its time period for vertical oscillation is T . The spring is now cut into two equal halves and the same mass is suspended from one of the halves. The period of vertical oscillation is
 a) $T' = \sqrt{2T}$ b) $T' = \sqrt{2} T$ c) $T' = \sqrt{\frac{T}{2}}$ d) $T' = \frac{T}{\sqrt{2}}$
14. If the internal energy of an ideal gas U and volume V are doubled then the pressure
 a) halves b) doubles c) quadruples d) remains same
15. Consider a circular leveled road of radius 10 m having coefficient of static friction 0.81. With what speed a car has to move on the turn so that it will have safe turn ($g = 10\text{ms}^{-2}$)
 a) 12ms^{-1} b) 8ms^{-1} c) 14ms^{-1} d) 10ms^{-1}

PART -II

Answer **any six** questions. Question number **24** is **compulsory**.

$6 \times 2 = 12$

16. Define angular velocity
17. State Wien's law
18. Check the correctness of the given equation $v = u + at$, using dimensional analysis method
19. Give any two examples of torque in day - to - day life.
20. Define frequency of simple harmonic motion.
21. A book of mass m is at rest on the table. Draw the free body diagram for the book.
22. Compare the distance between anti-node and neighbouring node.
23. Why is the energy of a satellite or any other planet negative?
24. Calculate the energy consumed in electrical units when a 75 W fan is used for 8 hours daily for one month (30 days)

PART - III

Note : Answer **any six** questions . Question number **33** is **compulsory**.

$6 \times 3 = 18$

25. Derive the relation between momentum and kinetic energy
26. State the laws of transverse vibrations in stretched strings.
27. Show that in horizontal projection, the path of the projectile is a parabola
28. Define center of gravity.
29. State Stefan-Boltzmann law.
30. What are the salient features of static friction and kinetic friction?
31. What are the applications of dimensional analysis ?
32. Define the degrees of freedom. Give an example.
33. If excess pressure is balanced by a column of oil with specific gravity 0.8, 4mm high, where $R = 2.0 \text{ cm}$, find the surface tension of the soap bubble

PART - IV

Note : Answer **all** the questions

$5 \times 5 = 25$

34. Explain the oscillation of liquid column in U-tube.

(OR)

Derive the kinematic equations of motion for constant acceleration.

35. State and explain work energy principle.

(OR)

Explain how overtones are produced in a closed organ pipe

36. Convert 76 cm of mercury pressure into Nm^{-2} using the method of dimensions

(OR)

Explain in detail Newton's law of cooling.

37. State and prove Bernoulli's theorem

(OR)

Derive an expression for kinetic energy in Rotation

38. Explain the need for banking of tracks.

(OR)

Explain the variation of g with depth from the Earth's surface

May - 22

PART - I

Answer all the questions

15 × 1 = 15

- The dimensional formula for gravitational constant G is
(a) $[M^{-1}L^3T^{-2}]$ (b) $[ML^3T^{-2}]$ (c) $[M^{-1}L^{-3}T^{-2}]$ (d) $[ML^{-3}T^2]$
- The ratio $\gamma = C_p / C_v$ for a gas mixture consisting of 8 g of helium and 16 g of oxygen is
(a) 23/15 (b) 15/23 (c) 27/17 (d) 17/27
- A uniform force of $(2\hat{i} + \hat{j})$ N acts on a particle of mass 1 kg. The particle displaces from position $(3\hat{j} + \hat{k})$ m to $(5\hat{i} + 3\hat{j})$ m. The work done by the force on the particle is
(a) 9 J (b) 6 J (c) 10 J (d) 12 J
- If $\pi = 3.14$, then the value of π^2 is
(a) 9.8596 (b) 9.86 (c) 9.860 (d) 9.9
- Which of the following is not a scalar?
a) Pressure (b) viscosity (c) stress (d) surface tension
- A couple produces,
(a) pure rotation (b) pure translation (c) rotation and translation (d) no motion
- Two objects are projected at angles 30° and 60° respectively with respect to the horizontal direction. The range of two objects are denoted as R_{30° and R_{60° . Choose the correct relation from the following
(a) $R_{30^\circ} = R_{60^\circ}$ (b) $R_{30^\circ} = 4R_{60^\circ}$ (c) $R_{30^\circ} = \frac{R_{60^\circ}}{2}$ (d) $R_{30^\circ} = 2R_{60^\circ}$
- If the acceleration due to gravity becomes 4 times its original value, then escape speed
a) becomes halved (b) remains the same (c) 4 times of original value (d) 2 times of original value
- 1 kilowatt hour (1kWh) is
a) 36×10^5 J (b) 36×10^5 Ws (c) 3.6×10^6 J (d) All the above
- If the mass and radius of the Earth are both doubled, then the acceleration due to gravity g'
(a) remains same (b) $\frac{g}{2}$ (c) 2 g (d) 4 g
- The dimensional formula for strain
a) $ML^{-2}T^{-1}$ (b) $M^0L^0T^0$ (c) $ML^{-1}T^{-2}$ (d) M^0LT^0
- The efficiency of a heat engine working between the freezing point and boiling point of water is
a) 6.25% (b) 20% (c) 26.8% (d) 12.5%
- Two equal masses m_1 and m_2 are moving along the same straight line with velocities $5ms^{-1}$ and $-9ms^{-1}$ respectively. If the collision is elastic, then calculate the velocities after the collision of m_1 and m_2 , respectively
a) $-4ms^{-1}$ and $10ms^{-1}$ (b) $10ms^{-1}$ and $0ms^{-1}$ (c) $-9ms^{-1}$ and $5ms^{-1}$ (d) $5ms^{-1}$ and $1ms^{-1}$
- A transverse wave moves from a medium A to a medium B. In medium A, the velocity of the transverse wave is $500ms^{-1}$ and the wavelength is 5 m. The frequency and the wavelength of the wave in medium B when its velocity is $600ms^{-1}$, respectively are
a) 120 Hz and 5 m (b) 100 Hz and 5 m (c) 120 Hz and 6 m (d) 100 Hz and 6 m
- A simple pendulum is suspended from the roof of a school bus which moves in a horizontal direction with acceleration a , then the time period is
a) $T \propto \frac{1}{g^2 + a^2}$ (b) $T \propto \frac{1}{\sqrt{g^2 + a^2}}$ (c) $T \propto \sqrt{g^2 + a^2}$ (d) $T \propto (g^2 + a^2)$

PART - II

Answer any six questions. Question number 24 is compulsory.

6 × 2 = 12

- What is Reynold's number?
- Define the degrees of freedom
- 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 $1460ms^{-1}$. What is the distance of enemy submarine?
- State Wien's Displacement law

20. Define – gravitational potential
21. What is simple harmonic motion?
22. State Newton's second law of motion
23. State the law of conservation of angular momentum
24. A particle moves along x- axis in such a way that its co – ordinates x- varies with time 't' according to equation $x = 2 - 5t + 6t^2$. What is the initial velocity of the particle?

PART – III

Note : Answer any six questions . Question number 33 is compulsory.

6 × 3 = 18

25. Distinguish between elastic and inelastic collision
26. Discuss the laws of transverse vibrations in stretched strings
27. Using free body diagram, show that it is easy to pull an object than to push it
28. What are the resultants of the vector product of two vectors given by $\vec{A} = 4\hat{i} - 2\hat{j} + \hat{k}$ and $\vec{B} = 5\hat{i} + 3\hat{j} - 5\hat{k}$
29. Write a short note on polar satellites
30. Give any three applications of viscosity
31. Define torque . Give any two examples of torque in day-to-day life
32. What is meant by periodic and non-periodic motion? Give any two examples for each motion
33. 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) ?

PART – IV

Note : Answer all the questions

5 × 5 = 25

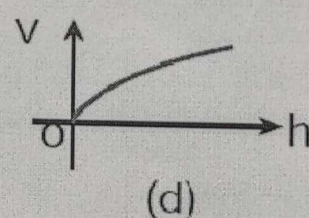
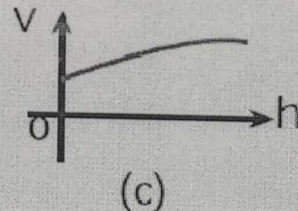
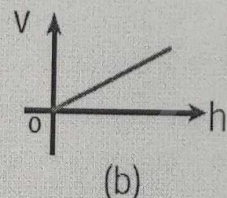
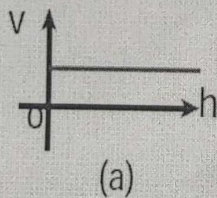
34. a) i) What are the applications of dimensional analysis?
ii) Check the correctness of the equation $\frac{1}{2}mv^2 = mgh$ using dimensional analysis
(OR)
b) Derive an expression for surface tension of a liquid by capillary rise method
35. a) State and explain equipartition of energy
(OR)
b) Derive the linear kinematic equations of motion for constant accelerated motion
36. a) Explain the motion of blocks connected by a string in Vertical motion
(OR)
b) Explain the variation of the g with altitude
37. a) Explain the horizontal oscillations of a spring
(OR)
b) State and explain work – Energy principle. Mention the inferences of work kinetic energy theorem
38. a) Discuss rolling on inclined plane and arrive at the expression for the acceleration
(OR)
b) Explain how overtones are produced in a Closed organ pipe

AUGUST -22
PART - I

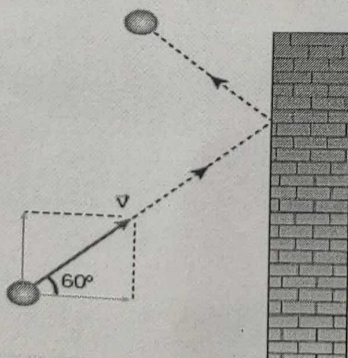
Answer all the questions

15 × 1 = 15

1. A ball of mass 1 kg and another of mass 2 kg are dropped from a tall building whose height is 80 m. After, a fall of 40m each towards Earth, their respective kinetic energies will be in the ratio of
 (a) $\sqrt{2} : 1$ (b) $1 : \sqrt{2}$ (c) $2 : 1$ (d) $1 : 2$
2. If an object is dropped from the top of a building and it reaches the ground at $t = 4$ s, then the height of the building is (ignoring air resistance) ($g = 9.8 \text{ ms}^{-2}$)
 (a) 77.3 m (b) 78.4 m (c) 80.5 m (d) 79.2 m
3. A pendulum is hung in a very high building oscillates to and fro motion freely like a simple harmonic oscillator. If the acceleration of the bob is 16 ms^{-2} at a distance of 4 m from the mean position, then the time period is a) 2 s b) 1 s c) 2π s (d) π s
4. g_e and g_p denote the acceleration due to gravity in the Earth and a planet. The mass and radius of the planet are twice that of the Earth. Then
 a) $g_p = \frac{g_e}{2}$ b) $g_p = 2g_e$ c) $g_p = g_e$ d) $g_p = \frac{g_e}{\sqrt{2}}$
5. A rope is wound around a hollow cylinder of mass 3 kg and radius 40cm. What is the angular acceleration of the cylinder if the rope is pulled with a force 30 N? (a) 0.25 rad s^{-2} (b) 25 rad s^{-2} (c) 5 m s^{-2} (d) 25 m s^{-2} .
6. When a cycle tyre suddenly bursts, the air inside the tyre expands. This process is
 a) isothermal b) adiabatic c) isobaric d) isochoric
7. If a particle executes uniform circular motion, choose the correct Statement
 (a) The velocity and speed are constant. (b) The acceleration and speed are constant.
 (c) The velocity and acceleration are constant. (d) The speed and magnitude of acceleration are constant.
8. An object of mass 10 kg is hanging on a spring scale which is attached to the roof of a lift. If the lift is in free fall, the reading in the spring scale is (a) 98 N (b) zero (c) 49 N (d) 9.8 N
9. A uniform rope having mass m hangs vertically from a rigid support. A transverse wave pulse is produced at the lower end. Which of the following plots shows the correct variation of speed v with height h from the lower end?



10. If an object is at rest and no external force is applied on the object, the static friction acting on the object is
 a) Zero b) $\mu_s mg$ c) $\mu_s mg \sin\theta$ d) $\mu_s mg \cos\theta$
11. In a horizontal pipe of non-uniform cross section, water flows with a velocity of 1 ms^{-1} at a point where the diameter of the pipe is 20 cm. The velocity of water (m s^{-1}) at a point where the diameter of the pipe is
 (a) 8 (b) 16 (c) 24 (d) 32
12. A particle of mass m is moving with speed u in a direction which makes 60° with respect to x axis. It undergoes elastic collision with the wall. What is the change in momentum in x and y direction?



- (a) $\Delta p_x = -mu, \Delta p_y = 0$ (b) $\Delta p_x = -2mu, \Delta p_y = 0$
 (c) $\Delta p_x = 0, \Delta p_y = mu$ (d) $\Delta p_x = mu, \Delta p_y = 0$

13. Which of the following pairs of physical quantities have same dimension?
 a) force and power b) torque and energy c) torque and power d) force and torque
14. A book is at rest on the table which exerts a normal force on the book. If this force is considered as reaction force, what is the action force according to Newton's third law?
 a) Gravitational force exerted by Earth on the book b) Gravitational force exerted by the book on Earth
 (c) Normal force exerted by the book on the table d) None of the above
15. In stationary waves, the distance between a node and its neighbouring anti-node is
 a) $\frac{\lambda}{4}$ b) $\frac{\lambda}{2}$ c) $\frac{3\lambda}{4}$ d) λ

PART - II

Note : Answer any six questions. Question number 24 is compulsory.

6 × 2 = 12

16. Write any two limitations of dimensional analysis ?
17. What is meant by Escape speed in the case of the Earth?
18. A mobile phone tower transmits a wave signal of frequency 900MHz. Calculate the length of the waves transmitted from the mobile phone tower
19. State Stefan-Boltzmann law and write its expression
20. Define center of mass
21. What is meant by periodic and non-periodic motion?.
22. State Hooke's law of elasticity
23. Define Inertia
24. 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.

PART - III

Note : Answer any six questions . Question number 33 is compulsory.

6 × 3 = 18

25. State Newton's three laws of motion
26. An electron of mass 9.1×10^{-31} kg revolves round the nucleus in a circular orbit of radius 0.53 Å. What is the angular momentum of the electron? (velocity of the electron $v = 2.2 \times 10^6$ m/s)
27. Distinguish between streamlined flow and turbulent flow
28. What is meant by Gross error? How shall we minimize it?
29. Derive the expression for the energy of the satellite
30. Show that path of the projectile is a parabola in horizontal projection
31. Derive the relation between momentum and kinetic energy
32. State the laws of simple pendulum.
33. 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?

PART - IV

Note : Answer all the questions

5 × 5 = 25

34. a) Derive the expression for moment of inertia of a rod about its center and perpendicular to the axis of the rod (OR)
 b) What is Sonometer ? Give its construction and working. Explain how to determine the frequency of tuning fork using Sonometer.
35. a) What is inelastic collision? Derive an expression for loss of kinetic energy in perfect inelastic Collision (OR)
 b) Explain in detail the kinetic interpretation of temperature
36. a) Explain in detail Newton's law of cooling. (OR)
 b) Describe the method of measuring angle of repose
37. a) Explain in detail the triangle law of addition (OR)
 b) Derive Poiseuille's formula for the volume of the liquid flowing per second through a pipe under stream line flow
38. a) Write a note on triangulation method and radar method to measure larger distances (OR)
 b) Explain the variation of the g with depth from the earth surface