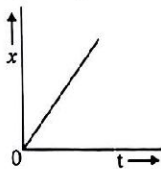**Answer any 5 questions from 1 to 7. Each carries 1 score.** (5 × 1 = 5)

1. Find out the fundamental quantity from among the physical quantities given below :

   (a) velocity   (b) temperature

   (c) force   (d) density

2. A graph of position-time of an object is given

   Choose the correct answer related to this graph

   (a) velocity of object increases

   (b) object is stationary

   (c) object has constant velocity

3. Acceleration due to gravity is independent of _____ . (mass of earth /mass of body)

4. Three vessels A, B and C contain different amounts of liquids are shown. All up to the same height.
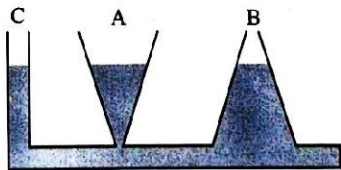
   This phenomenon is an Illustration of _____ .

5. State true or false :

   'The stretching of a coil determined by it's shear modulus.'

6. Name the substance which has the highest specific heat capacity.

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7. Write the expression between average kinetic energy of molecule and absolute temperature of the gas.

Answer any 5 questions from 8 to 14. Each carries 2 scores. **(5 × 2 = 10)**

8. A car moving along a straight highway with speed of 126 km h^{-1} is brought to a stop within a distance of 200 m. What is the retardation of the car (assumed uniform) ?

9. State true or false :

   (a) The magnitude of displacement is either less or equal to the path length of an object between two points.

   (b) A null vector has no magnitude. **(1 + 1)**

10. Differentiate between elastic and inelastic collision.

11. (a) In rotation of a rigid body about a fixed axis, every particle of the body has same _____. (linear velocity / angular velocity)

    (b) The quantity angular velocity is _____. (scalar / vector) **(1 + 1)**

12. (a) Define escape speed.

    (b) Moon has no atmosphere. Give reasons. **(1 + 1)**

13. Match the columns A & B :

	A	B
1.	Isothermal process	Volume constant
2.	Adiabatic process	Temperature constant
3.	Isochoric process	No heat transfer
4.	Isobaric process	Pressure constant

(½ + ½ + ½ + ½)

14. Sate law of equipartition of energy.

Answer any 6 questions from 15 to 21. Each carries 3 scores. $(6 \times 3 = 18)$

15. Draw the following graphs related to freely falling particle :

    (a) position time graph

    (b) velocity time graph

    (c) acceleration time graph $(1 + 1 + 1)$

16. (a) State Newton's second law of motion.

    (b) Derive the equation of force using the above law. $(1 + 2)$

17. (a) Write the expression for the kinetic energy of a rotating body.

    (b) A solid cylinder of mass 20 kg rotates about its axis with angular speed 100 rad s^{-1}. The radius of the cylinder is 0.25 m. What is the kinetic energy associated with the rotation of the cylinder ? $(1 + 2)$

18. (a) Draw typical stress-strain graph.

    (b) Mark the following points on graph :

       (i) proportional limit

       (ii) fracture point $(1 + 2)$

19. (a) The pressure at depth below the surface of a liquid open to the atmosphere is greater than atmospheric pressure. Excess pressure at depth is called _____ .

    (b) Calculate the pressure on a swimmer 10 m below the surface of a lake. $(1 + 2)$

20. (a) State Newton's law of cooling.

    (b) Draw the graph showing the cooling of hot water with time.

    (c) Specify one drawback of Newton's law of cooling. $(1 + 1 + 1)$

21. Sadi Carnot, the scientist arrived at a cycle of processes to be adopted to achieve the maximum efficiency of a heat engine.

   (a) Name the processes in Carnot cycle

   (b) Draw P-V diagram of Carnot cycle for a heat engine with an ideal gas as the working substance. (2 + 1)

Answer any 3 questions from 22 to 25. Each carries 4 scores. (3 × 4 = 12)

22. (a) State the principle of homogeneity of dimensions.

   (b) Consider a simple pendulum, having a bob attached to a string, that oscillates under the action of the force of gravity. Suppose that the period of oscillation of the simple pendulum depends on its length (l), mass of the bob (m) and acceleration due to gravity (g). Derive the expression for its time period using method of dimensions. (1 + 3)

23. (a) Illustrate the conservation of mechanical energy for a ball of mass m dropped from a height H.

   (b) State true or false :-

   The work done by any force in a closed path is zero. (3 + 1)

24. Expression for displacement of particle in Simple Harmonic Motion is $x(t) = A \cos (\omega t + \phi)$. Derive the equation for particle's velocity and it's acceleration.

25. A transverse harmonic wave on a string is described by

   $$y(x, t) = 3.0 \sin (36 t + 0.018 x + \pi/4)$$

   where x and y are in cm and t in s.

   (a) Is this a travelling wave or a stationary wave ?

   (b) If it is travelling, what is it's speed ?

   (c) What is its frequency ?

   (d) What is the initial phase at the origin ? (1 + 1 + 1 + 1)

Answer any 3 questions from 26 to 29. Each carries 5 scores. $(3 \times 5 = 15)$

26. It was Galileo who first stated the independency of the horizontal and the vertical components of projectile motion.

    (a) Write down the horizontal and the vertical components of initial velocity of a projectile.

    (b) Derive equation of maximum height attained by a projectile.

    (c) A cricket ball is thrown at a speed of 28 ms^{-1} in a direction 30° above the horizontal. Calculate the maximum height. $(1 + 2 + 2)$

27. A car is moving in a circular level road with uniform speed.

    (a) Draw a diagram showing all forces acting on it.

    (b) Obtain the equation for maximum velocity of the car.

    (c) Comment on any method to increase the maximum safe velocity of car.

    $(1.5 + 2.5 + 1)$

28. Potential energy is an energy relative to conservative force.

    (a) Define gravitational Potential energy.

    (b) Derive the equation for gravitational Potential energy of a particle on earth surface.

    (c) Is Gravitational Potential energy positive or negative ? Comment on it. $(1 + 3 + 1)$

29. Hydraulic lift and hydraulic brakes are application of a famous law.

    (a) Name and State the law.

    (b) Draw the Schematic diagram illustrating the principle behind the hydraulic lift and obtain the relation for mechanical advantage. $(2 + 3)$

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