



VENKATESHWAR INTERNATIONAL SCHOOL

Sector -10, Dwarka, New Delhi – 110075

Annual Examination (2022–2023)

CLASS – XI

PHYSICS

Time: 3 hrs.

Max. Marks: 70

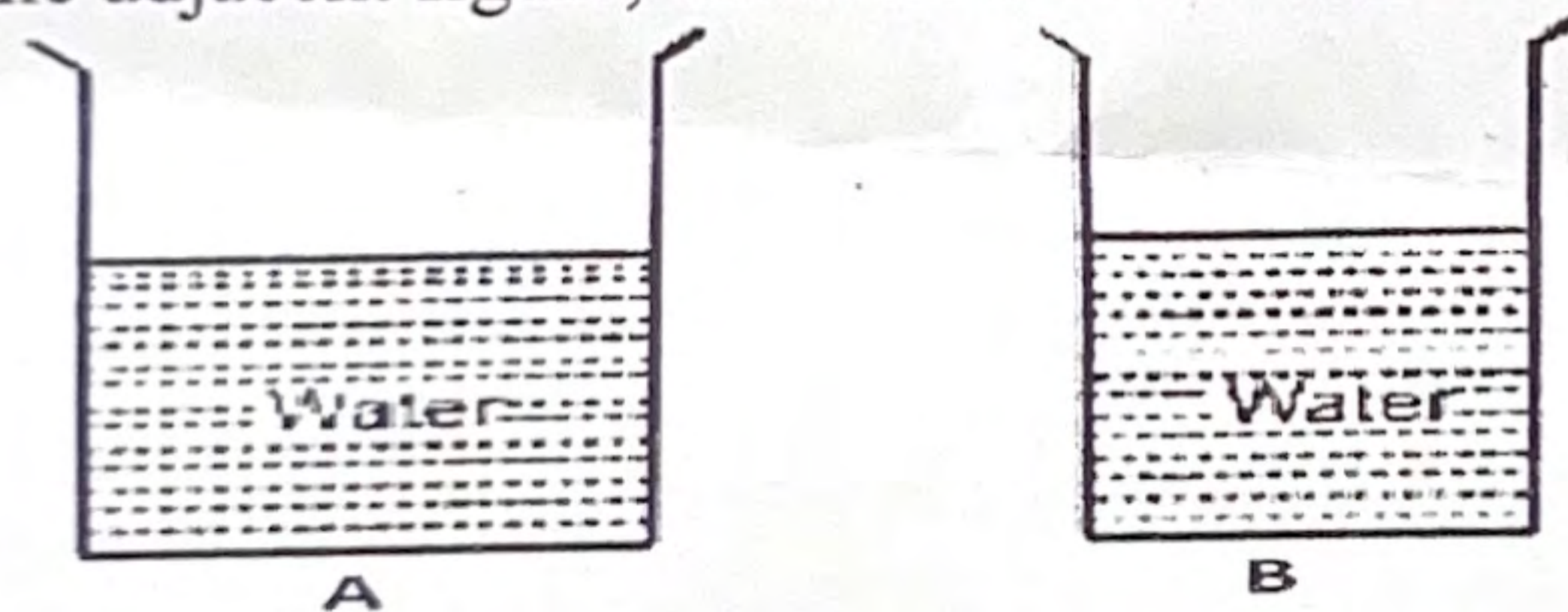
General Instructions:

- This question paper consists of 35 questions in 5 sections.
- All questions are compulsory. However, an internal choice is provided in some questions. A student is expected to attempt only one of these questions.
- Section A consists of 18 objective type questions carrying 1 mark each.
- Section B consists of 7 Very Short questions carrying 02 marks each. Answers to these questions should be in the range of 30 to 50 words.
- Section C consists of 5 Short Answer type questions carrying 03 marks each. Answers to these questions should be in the range of 50 to 80 words.
- Section D consists of 3 Long Answer type questions carrying 05 marks each. Answer to these questions should be in the range of 80 to 120 words.
- Section E consists of 2 source-based/case-based units of assessment of 04 marks each with sub-parts

SECTION –A

Select and write one most appropriate option out of the four options given for each of the questions 1 – 18.

1. From the adjacent figure, the correct observation is 1



- The pressure on the bottom of tank A is greater than at the bottom of B.
- The pressure on the bottom of the tank A is smaller than at the bottom of B.
- The pressure depends on the shape of the container
- The pressure on the bottom of A and B is the same.

2. The dimensional formula of modulus of rigidity is 1

- MLT^{-2}
- MLT^{-1}
- ML^2T^2
- $ML^{-1}T^{-2}$

3. Which one is not correct? 1

- In an isobaric process, $\Delta P = 0$
- In an isochoric process, $\Delta W = 0$
- In an isothermal process, $\Delta T = 0$
- In an isothermal process, $\Delta Q = 0$

4. Match the following

I	Boyle's Law	P	Isochoric process
J	Charles' Law	Q	Isothermal process
K	Gay Lussac's Law	R	Isobaric process

- a) I-Q, J-R, K-P
- b) I-R, J-Q, K-P
- ☒ c) I-Q, J-P, K-R
- d) I-P, J-Q, K-R

5. The magnitude of acceleration of particle executing SHM at the position of maximum displacement is:

1

- a) Zero
- b) Minimum
- ☒ c) Maximum
- d) none of these

6. The acceleration due to gravity g and mean density of earth ρ are related by which of the following relations ? [G = gravitational constant and R = radius of earth].

1

- a) $\rho = 3G/4\pi gR^2$
- b) $\rho = 3G/4\pi gR^3$
- ☒ c) $\rho = 3g/4\pi GR$
- d) $\rho = 4\pi gR^3/3G$

7. The moment of inertia of a uniform circular disc of radius R and mass M about a tangent perpendicular to its plane is

1

- a) $1/2MR^2$
- b) MR^2
- c) $2/5 MR^2$
- d) $3/2MR^2$

8. A metal ball of mass 2 kg moving with speed of 36 km/hr is having a collision with a stationary ball of mass 3 kg. If after collision, both the balls move together, the loss in kinetic energy due to collision is :

1

- a) 80J
- b) 40J
- ☒ c) 60J
- d) 160J

9. Out of the following pair, which one does NOT have identical dimensions

1

- a) Impulse and momentum
- b) Angular momentum and Planck's constant
- c) Work and torque
- ☒ d) Moment of inertia and moment of a force

10. If the normal force of friction is doubled, then coefficient of friction is

- a) halved
- c) not changed

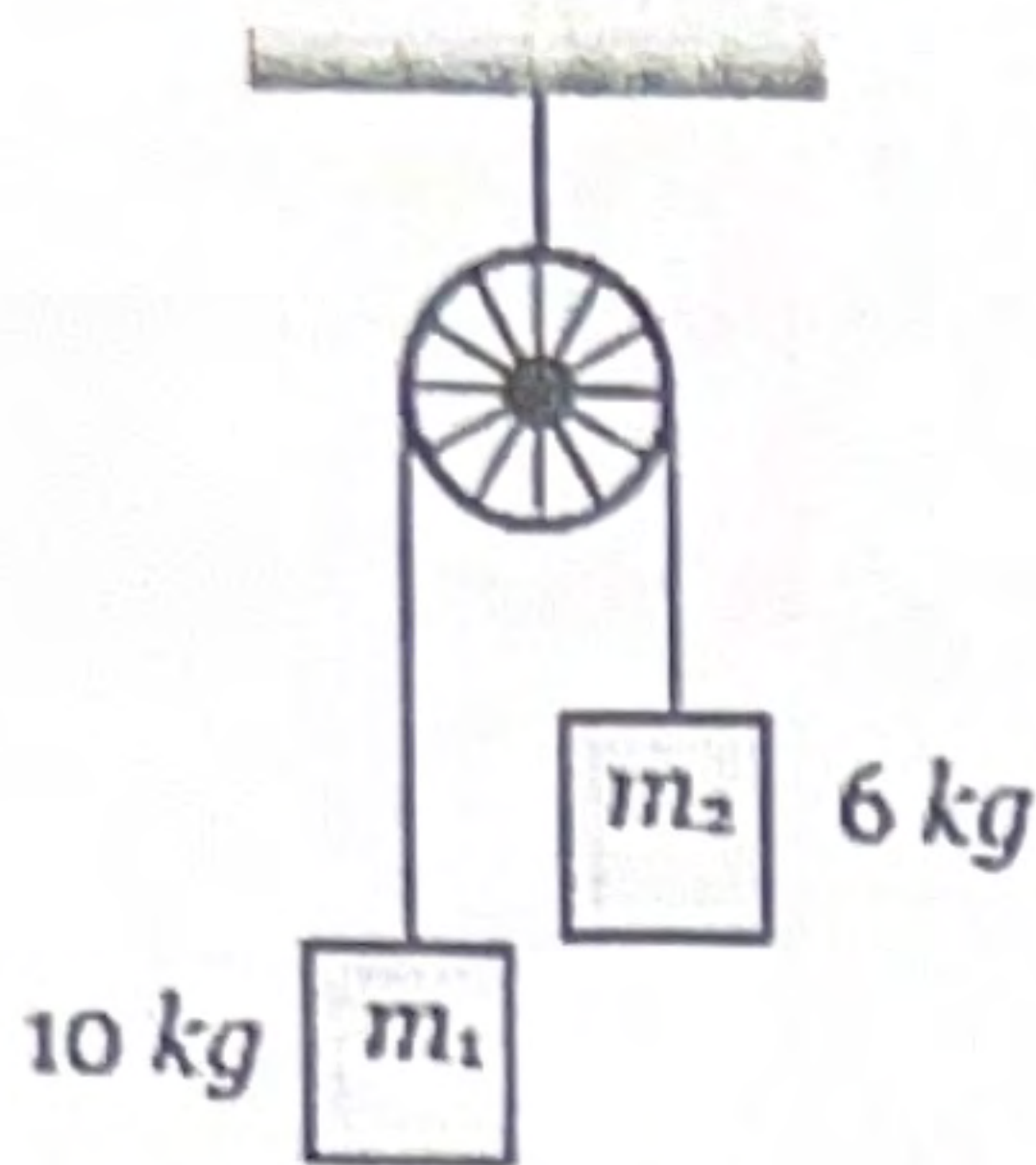
MIL-2
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b) doubled

d) tripled

11. Two masses m_1 and m_2 are attached to a string which passes over a frictionless smooth pulley. When $m_1=10$ kg, $m_2=6$ kg, the acceleration of masses is

1



- a) 20 m/s^2
b) 5 m/s^2
✓ c) 2.5 m/s^2
d) 10 m/s^2
12. An automobile engine develops 100 KW when rotating at a speed of 1800 rev/min. What torque does it deliver?

30 rev/s
 $\omega = 60\pi$

1

13. In a wave motion $y = a \sin(kx - \omega t)$, y can represent
- a) time period
✓ b) displacement
c) amplitude
d) frequency.

1

14. Two rain drops of same radius r falling with terminal velocity v merge and form a bigger drop of radius R . The terminal velocity of the bigger drop is
- a) vR/r
b) vR^2/r^2
c) v
d) $2v$

1

15. If the liquid neither rises nor falls in a capillary tube, the angle of contact is
- a) 0°
b) 180°
✓ c) 90°
d) 45°

1

16. At what height above the surface of earth the value of "g" decreases by 2 % [radius of the earth is 6400 km] ?
- a) 32 Km
✓ b) 64 Km
c) 128 Km
d) 1600 Km

1

Q. no 17 and 18 are Assertion - Reasoning based questions.

These consist of two statements – Assertion (A) and Reason (R).

Answer these questions selecting the appropriate option given below:

(a) Both A and R are true and R is the correct explanation of A

(b) Both A and R are true and R is not the correct explanation of A

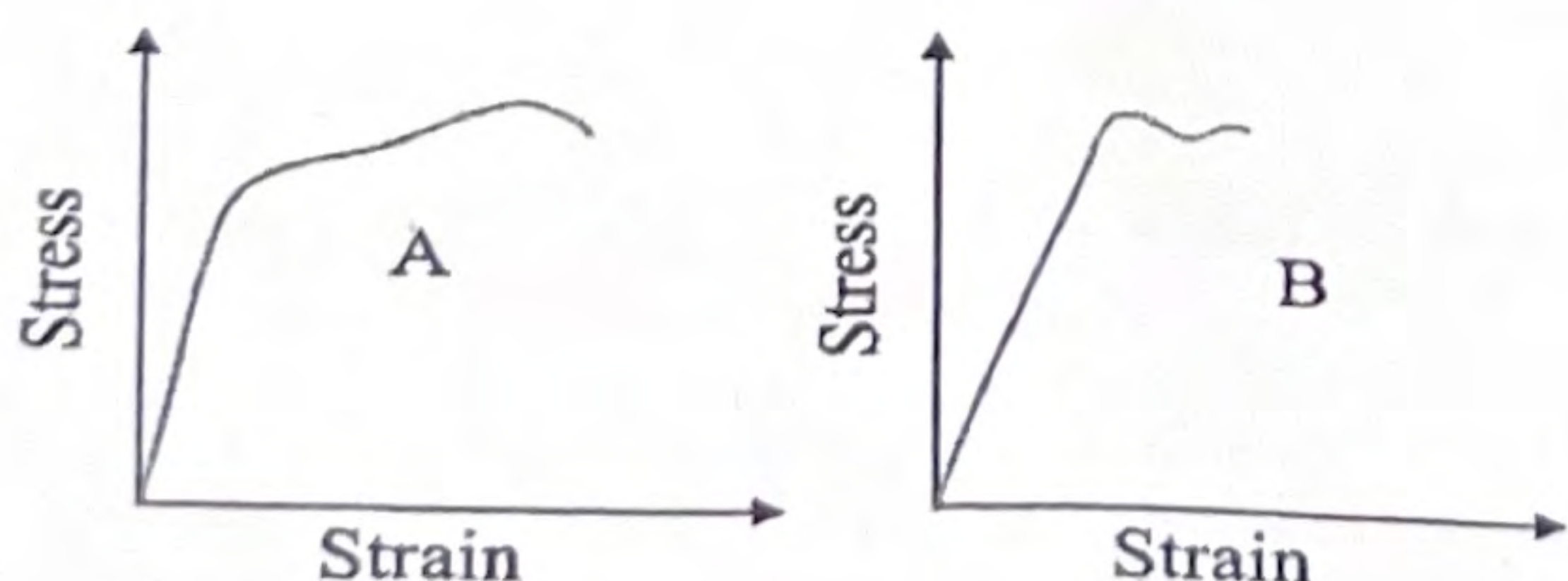
(c) A is true but R is false

(d) Both A and R are false.

17. ☒ Assertion (A): Steel is more elastic than rubber. (T) 1
Reason (R): Shear Modulus of a material is always considerably smaller than the Young Modulus for it. (T)
18. ☒ Assertion (A): In adiabatic compression, the internal energy and temperature of the system gets decreased. (d) 1
Reason (R): The adiabatic compression is a slow process.

SECTION-B

19. ☒ Two forces whose magnitudes are in ratio of 3:5 give a resultant of 35 N. If the angle of inclination be 60° , calculate the magnitude of each force. 2
20. ☒ In a heat engine, the temperature of the source and sink are 500 K and 375 K. If the engine consumes 25×10^5 J per cycle, find the efficiency of the engine and work done per cycle. 2
21. ☒ Calculate the work done in blowing a soap bubble from a radius of 2 cm to 3 cm. The surface tension of the soap solution is 30 dyne /cm. 2
- OR
- Derive an expression for excess pressure inside a liquid drop.
22. ☒ The stress-strain graphs for materials A and B are shown below. The graphs are drawn to the same scale. 2
a) Which of the material has greater Young's modulus? Why?
b) Which is more brittle and why?



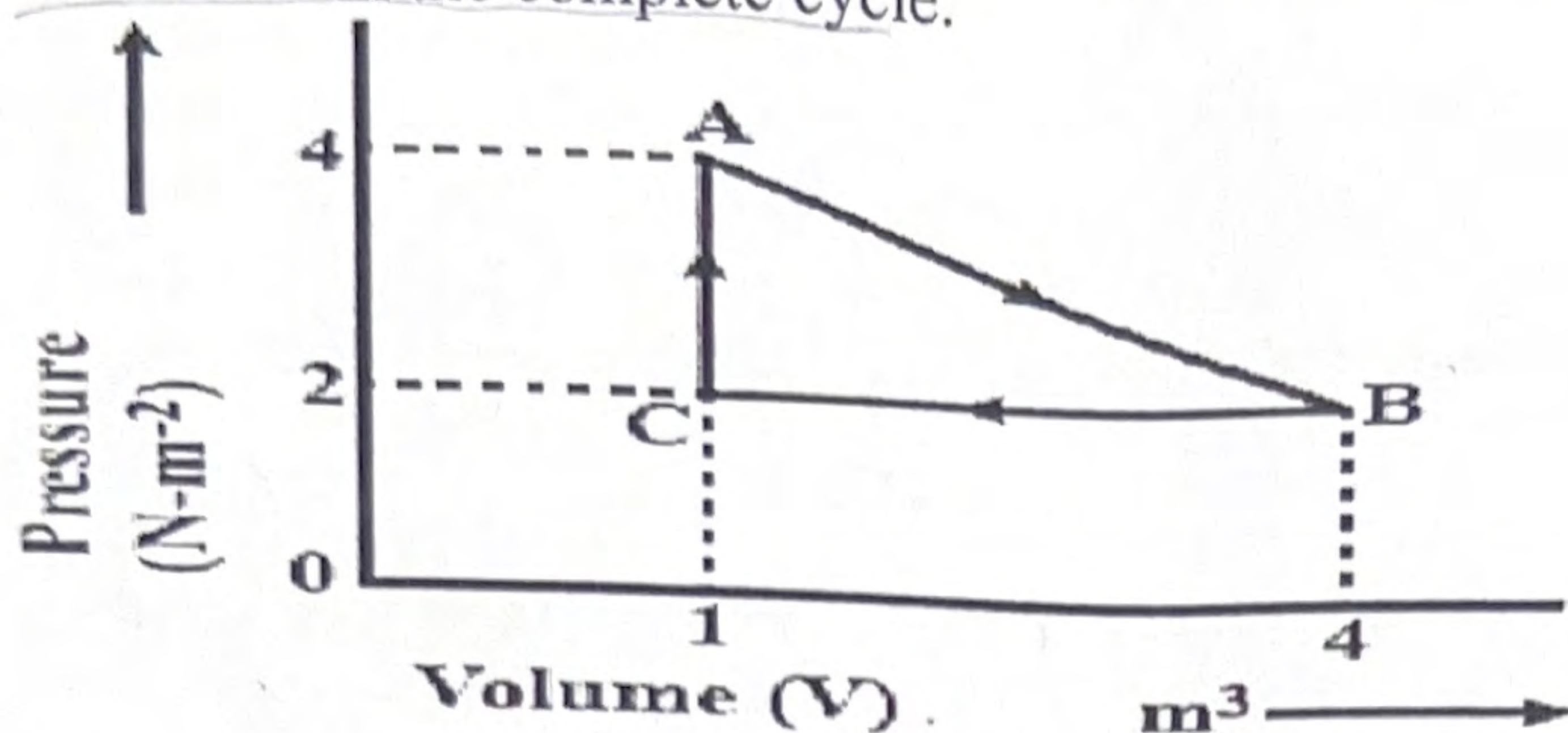
23. ☒ a) Express mathematically Newton's law of cooling. 2
b) Why is invar used in making a clock pendulum?
24. ☒ Show that the average kinetic energy of a gas molecule is directly proportional to the temperature of the gas. 2
25. ☒ A car of mass 2000 kg is lifted up a distance of 30 m by a crane in 1 min. A second crane does the same job in 2 min. What is the power supplied by each crane? 2

SECTION-C

26.

The P - V diagram for a cyclic process is a triangle ABC drawn in order. The co-ordinates of A, B, C are (4,1), (2,4), and (2,1). The co-ordinates are in the order (P-V). Calculate work done during the process from A to B and B to C. Also, calculate work done in the complete cycle.

3



27.

A projectile is fired horizontally with a velocity of 98 m/s from the top of a hill 490 m high. Find-

3

- the time taken to reach the ground.
- the distance of the target from the hill
- the velocity with which the projectile hits the ground.

28.

A ball is thrown upward with an initial velocity of 100 m/s. After how much time will it return? Draw velocity-time graph for the ball and find from the graph

3

- the maximum height attained by the ball
- height of the ball after 15 s. Take $g = 10 \text{ m/s}^2$.

29.

Two particles of masses 100 g and 300 g at a given time have positions $2\mathbf{i}+5\mathbf{j}+13\mathbf{k}$ and $-6\mathbf{i}+4\mathbf{j}-2\mathbf{k}$ m respectively and velocities $10\mathbf{i}-7\mathbf{j}-3\mathbf{k}$ and $7\mathbf{i}-9\mathbf{j}+6\mathbf{k}$ m/s respectively. Determine the instantaneous position and velocity of centre of mass.

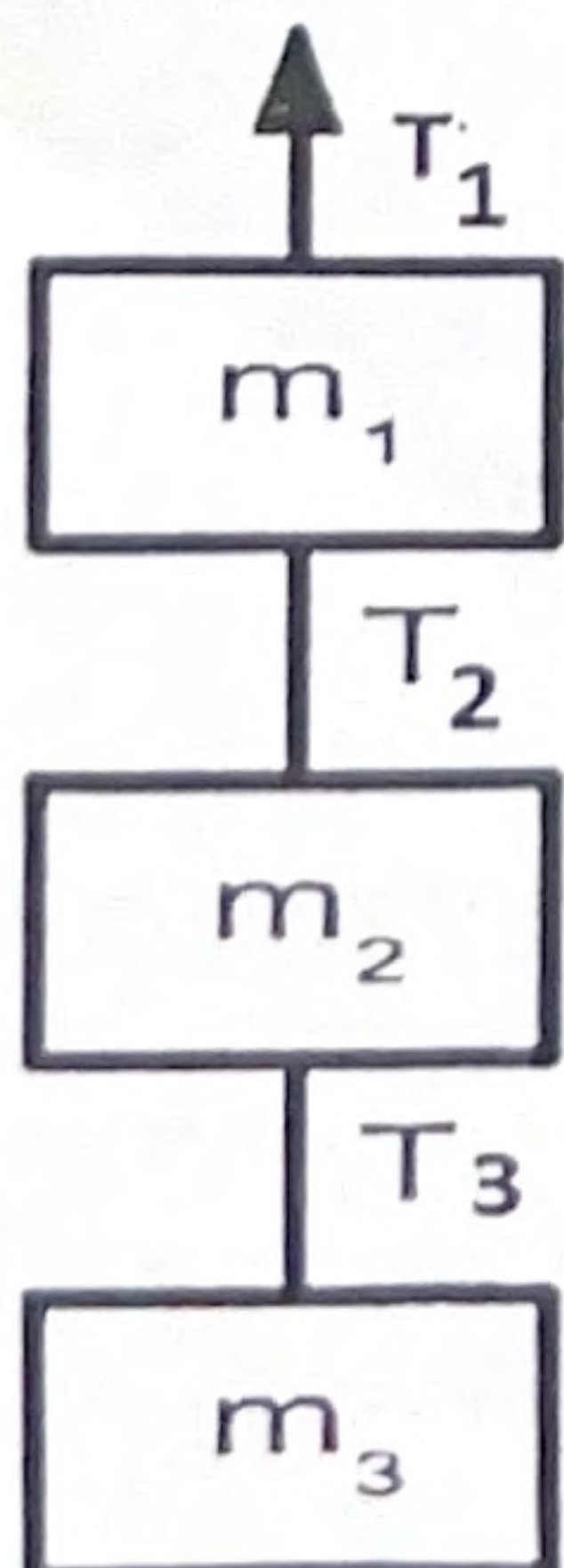
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30.

The masses m_1 , m_2 and m_3 of the three bodies are 5, 2 and 3 kg respectively. Calculate the values of T_1 , T_2 and T_3 when-

3

- the whole system is going upward with acceleration of 2 m/s^2 .
- the whole system is stationary. Take $g = 9.8 \text{ m/s}^2$.



SECTION-D

31. a) Derive expressions for the kinetic and potential energies of a simple harmonic oscillator and hence show that the total energy is conserved in simple harmonic motion.
b) A simple harmonic motion is represented by $x = 10 \sin (20t + 0.5)$. Write its amplitude, angular frequency, frequency and time period, if displacement is measured in metres and time in seconds.

OR

- a) Show that simple harmonic motion may be regarded as the projection of uniform circular motion along a diameter of the circle and hence deduce an expression for the velocity of a particle executing S.H.M.
b) A block whose mass is 1 kg is fastened to a spring. The spring has a spring constant of 50 N/m. The block is pulled to a distance $x = 10$ cm from its equilibrium position at $x = 0$ on a frictionless surface from rest at $t = 0$. Calculate the kinetic, potential and total energy of the block when it is 5 cm away from the mean position.
32. a) Differentiate between transverse and longitudinal wave.
b) Audible frequencies have a range 20 Hz to 20,000 Hz. Express this range in terms of i) Time period ii) Wavelength in air and iii) angular frequency. Given velocity of sound in air is 330 m/s.

OR

- a) Prove that the angular momentum of a particle is equal to twice the product of its mass and areal velocity.
b) How does it lead to Kepler's second law of planetary motion?
33. a) Define orbital velocity of a satellite. Derive expression for the orbital velocity of a satellite.
b) Show that the escape velocity of a body from the earth's surface is $\sqrt{2}$ times its velocity in a circular orbit just above the earth's surface.
c) The distances of two planets from the sun are 10^{13} m and 10^{12} m respectively. Find the ratio of time periods of the two planets.

OR

- a) Define gravitational potential energy. Derive an expression for the gravitational potential energy of a body of mass m located at distance r from the centre of the earth.
b) How is gravitational potential energy related to gravitational potential?

SECTION-E

Read the passage 34 and 35. Answer any 4 questions from the subparts (i) to (v).

34. Viscosity is the property of a fluid by virtue of which an internal resistance comes into play when the liquid is in motion, and opposes the relative motion between its different layers. Thus, it is the resistance of a fluid to flow. When liquid flows over flat surface, a backward viscous force acts tangentially to every layer. Viscosity is an essential feature of liquids that are used for lubrication, like lubricating oils and grease. Fast-moving liquids like water have low Viscosity and slow-moving liquids like honey have high Viscosity.
- i) The SI unit of coefficient of viscosity is
(a) Nm/s (b) Nm^2/s (c) $\text{N}/(\text{m}^2\text{s}^{-1})$ (d) Nms^2
- ii) Viscous force exerted by the liquid flowing between two plates in a streamline flow depends upon

- (a) velocity gradient in the direction perpendicular to the plates
- (b) area of the plates
- (c) coefficient viscosity of the liquid
- (d) all of these

iii) The coefficient of viscosity for hot air

- (a) is greater than the coefficient of viscosity for cold air
- (b) is smaller than the coefficient of viscosity for cold air
- (c) is same as the coefficient of viscosity for cold air
- (d) will increase or decrease depending on the external pressure

iv) The relative velocity of two consecutive layers is 8 cm/s. If the perpendicular distance between the layers is 0.1 cm, then the velocity gradient will be

- (a) 0.8 s^{-1}
- (b) 0.08 s^{-1}
- (c) 80 s^{-1}
- (d) 8 s^{-1}

v) A square plate of 0.1 m side moves parallel to a second plate with a velocity of 1 m/s, both plates being immersed in water. If the viscous force is 0.002 N and the coefficient of viscosity is 0.01 poise, the distance between the plates is

- (a) 0.1 m
- (b) 0.05 m
- (c) 0.005 m
- (d) 0.0005 m

35.

When an incompressible and non-viscous liquid flows in streamlined motion through a tube of non-uniform cross-section, the total mass of the liquid going into the tube through any cross-section per second should be equal to the total mass coming out of the same tube from any other cross-section per second

For an incompressible liquid, $av = \text{constant}$

This is equation of continuity which implies that liquid velocity at any section of the pipe is inversely proportional to the cross-section of the pipe at that section.

Bernoulli's principle states that the sum of pressure energy, kinetic energy and potential energy per unit volume of an incompressible non-viscous fluid in a streamlined, irrotational flow remains constant along a streamline.

i) Bernoulli's principle is based on the law of conservation of

- (a) energy
- (b) mass
- (c) linear momentum
- (d) angular momentum.

ii) In old age arteries carrying blood in the human body become narrow resulting in an increase in the blood pressure. This follows from

- (a) Pascal's law
- (b) Stoke's law
- (c) Bernoulli's principle
- (d) Archimedes' principle

iii) An Incompressible fluid flows steadily through a cylindrical pipe which has radius $2R$ at point A and R at a point B further along the flow direction. If the velocity at A is v , then that at B is

- (a) $v/2$
- (b) v
- (c) $2v$
- (d) $4v$

iv) At what speed will the velocity head of stream of water be 40 cm?

- (a) 280 cm/s
- (b) 28 cm/s
- (c) 0.28 cm/s
- (d) 2.8 cm/s

v) While studying about fluid mechanics, equations and postulates stand for the fluids which are

- (a) non-viscous only
- (b) incompressible only
- (c) non-viscous and incompressible
- (d) liquid only