

**Mizoram Board
Class XI
Physics
Sample Paper-2**

Time: - 3 hours

Maximum Marks: - 70 Marks

General Instructions

- (a) All questions are compulsory.
- (b) There are 29 questions in total. Questions 1 to 8 carry one mark each, questions 9 to 16 carry two marks each, questions 17 to 25 carry three marks each and questions 27 to 29 carry five marks each.
- (c) Question 26 is a value based question carrying four marks.
- (d) There is no overall choice. However, an internal choice has been provided in one question of two marks, one question of three marks and all three questions of five marks each. You have to attempt only one of the given choices in such questions.
- (e) Use of calculator is not permitted.
- (f) You may use the following physical constants wherever necessary.

$$e = 1.6 \times 10^{-19} C$$

$$c = 3 \times 10^8 ms^{-1}$$

$$h = 6.6 \times 10^{-34} JS$$

$$\mu_o = 4\pi \times 10^{-7} NA^{-2}$$

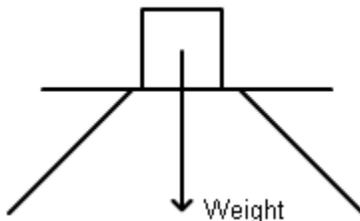
$$k_B = 1.38 \times 10^{23} JK^{-1}$$

$$N_A = 6.023 \times 10^{23} / mole$$

$$m_n = 1.6 \times 10^{-27} kg$$

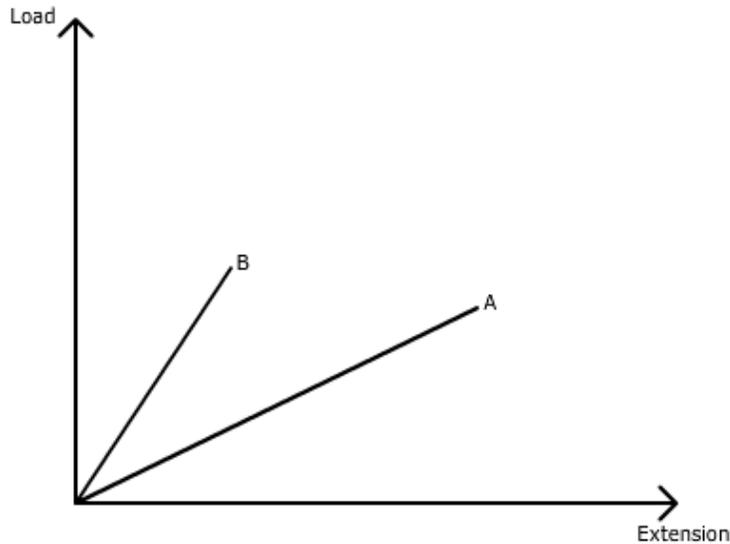
1. Give dimensions of (i) rotational Kinetic energy (ii) strain. (1)

2. If the force shown on the block is action, what is its reaction? (1)



3. Mention two advantages of 'I' shape of iron beams used in building construction. (1)

4. The graph below shows load extension curve for two wires A and B of the same material and of same length. Which one of them is thicker? (1)



5. Give one example each of natural and forced convection. (1)

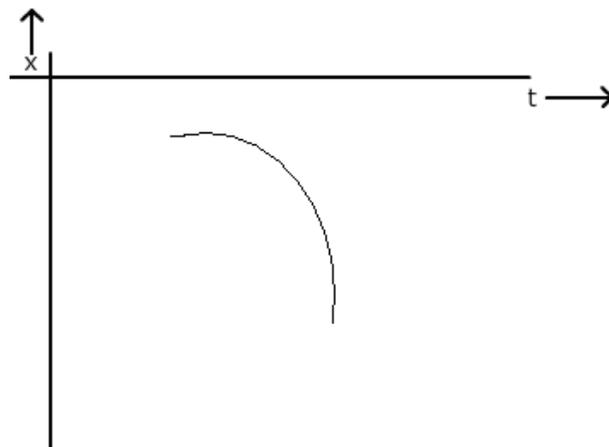
6. Draw cooling curve for hot water. (1)

7. Why is 'invar' used for making the pendulum of a clock? (1)

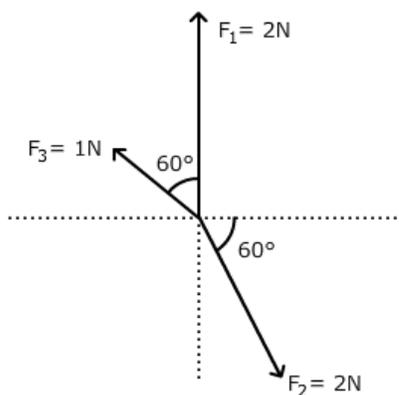
8. What do you understand by 'natural frequency' of a vibrating system? (1)

9. What is absolute error? The temperature of two bodies measured by a thermometer are $t_1 = 20^\circ\text{C} \pm 0.5^\circ\text{C}$ and $t_2 = 50^\circ\text{C} \pm 0.5^\circ\text{C}$. What is the temperature difference and the error therein? (2)

10. From the following graph, find the sign of (i) velocity (ii) acceleration. Give reasons for each answer. (2)



- 11.** What is the maximum height reached by an oblique projectile if its time of flight is T ? (2)
- 12.** Explain very briefly, why
 (i) A horse cannot pull a cart and run in empty space?
 (ii) Passengers are thrown outward when a moving bus takes a sudden turn. (2)
- 13.** What are concurrent forces? Under what conditions will a body remain in equilibrium? (2)
- 14.** Why does a satellite not need any fuel to circle around the earth? Is it possible to put an artificial satellite in an orbit such that it always remains visible directly over New Delhi? (2)
- 15.** A gas mixture consists of molecules of type A, B and C with molecular masses $m_A > m_B > m_C$. Rank the three types according to (a) average kinetic energy (b) rms speed, greatest first. Give justification for each answer.
- Or**
- What would be the ratio of initial and final pressures if the masses of all the molecules of a gas are halved and their speeds doubled? What is the kinetic energy per unit volume of a gas if its pressure is $2 \times 10^5 \text{ N/m}^2$. (2)
- 16.** Show that the velocity of sound increases by 61 cm/s for every 1°C . (2)
- 17.** The motion of a car along y-axis is given by $v(t) = -12t + 12$ where velocity v is in m/s and time t in seconds. Find the instantaneous position of the car as a function of time if at $t = 0$ it was at 5 m. Also find its acceleration at $t = 2$ second. (3)
- 18.** Find $\vec{F}_1 + \vec{F}_2 - \vec{F}_3$ (3)



19.

- (i) Classify the following into conservative and non-conservative spring force, human push, gravitational force, viscous drag.
 (ii) Potential energy of a system due to a conservative force F is U . What is the relation between them? (3)

20. Define coefficient of restitution. In an elastic collision of two bodies are the momentum and energy of each body conserved? Why is heavy water chosen in a nuclear reactor to slow down fast moving neutrons? (3)

Or

- (a) Find the torque of a force $7\hat{i} + 3\hat{j} - 5\hat{k}$ about the origin. The force acts on a particle whose position vector is $\hat{i} - \hat{j} + \hat{k}$.
 (b) How do we find the direction of angular velocity? (3)

21. State perpendicular axis theorem. What is the moment of inertia of a ring of mass 2 kg and radius 0.5m about an axis passing through its centre and perpendicular to its plane? Also find moment of inertia about a parallel axis through its edge. (3)

22. Find the potential energy of a system of four identical particles placed at the vertices of a square of side a . Also obtain the potential at the centre of the square. (3)

23. Define moment of inertia. What is the moment of inertia of a ring about a tangent to the circle of the ring? (3)

24. What is a Carnot's engine? What is its efficiency? (3)

25. Derive a relation for the distance covered in n^{th} second by a uniformly accelerated body. (3)

26. Suresh was struggling to understand Kepler's second law of planetary motion. Then his friend Ravi explained to him how the planets move around Sun obeying Kepler's laws of planetary motion.

- (a) Comment upon the values of Ravi.
 (b) State Kepler's laws of planetary motion. (4)

- 27.** Derive an expression for maximum speed a vehicle should have, to take a turn on a banked road. Hence deduce expression for angle of banking at which there is minimum wear and tear to the tyres of the vehicle.

Or

Explain the following:

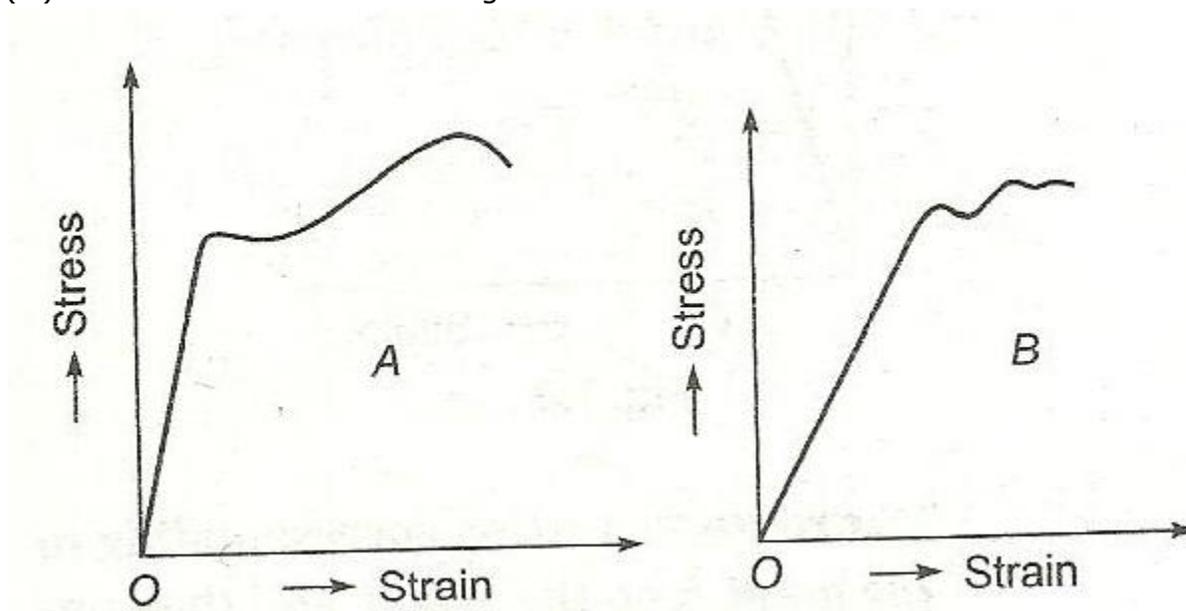
- (i) free vibrations
- (ii) damped oscillations
- (iii) maintained oscillations
- (iv) forced oscillation
- (v) resonant or sympathetic vibrations. (5)

- 28.** What do you understand by 'laminar flow' and 'streamlined flow'? Water is flowing with a speed of 2 m/s in a horizontal pipe with cross sectional area $2 \times 10^{-2} \text{ m}^2$ at pressure $4 \times 10^4 \text{ Pa}$. What will be the pressure at a smaller cross section where the area decreases to 0.01 m^2 ?

Or

The stress versus strain graphs for two materials A and B are shown in the figure. The graphs are to the same scale.

- (i) Which material has greater Young's modulus?
- (ii) Which material is more ductile?
- (iii) Which is more brittle?
- (iv) Which of the two is the stronger material?



(5)

29. A displacement wave is represented by $y = 0.25 \times 10^{-3} \sin (500t + 0.025 \text{ Hz})$ where y , t and z are in cm, sec and m respectively.

Deduce:

- (i) the direction of travel of the wave
- (ii) wave frequency
- (iii) wavelength
- (iv) the wave speed
- (v) maximum particle velocity

Or

- (a) What is Doppler effect? A whistle is being rotated in a horizontal circle. What will be the effect on the sound frequency for a listener standing (i) outside the circle (ii) at the centre of the circle.
- (b) What is the beat frequency when two tuning forks of frequency 200 Hz and 205 Hz are sounded together? Mention one application of beats. (5)