



TOPPER SAMPLE PAPER 2

XI – PHYSICS

Time: Three Hours

Maximum Marks: 70

General Instructions

- (a) All questions are compulsory.
- (b) There are 30 questions in total. Questions 1 to 8 carry one mark each, questions 9 to 18 carry two marks each, questions 19 to 27 carry three marks each and questions 28 to 30 carry five marks each.
- (c) 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.
- (d) Use of calculator is not permitted.
- (e) You may use the following physical constants wherever necessary.

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

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

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

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

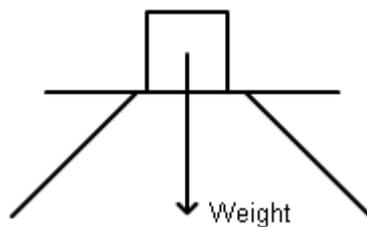
$$k_B = 1.38 \times 10^{23} JK^{-1}$$

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

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

Q1. Give dimensions of (i) rotational Kinetic energy (ii) strain. 1

Q2. If the force shown on the block is action, what is its reaction?



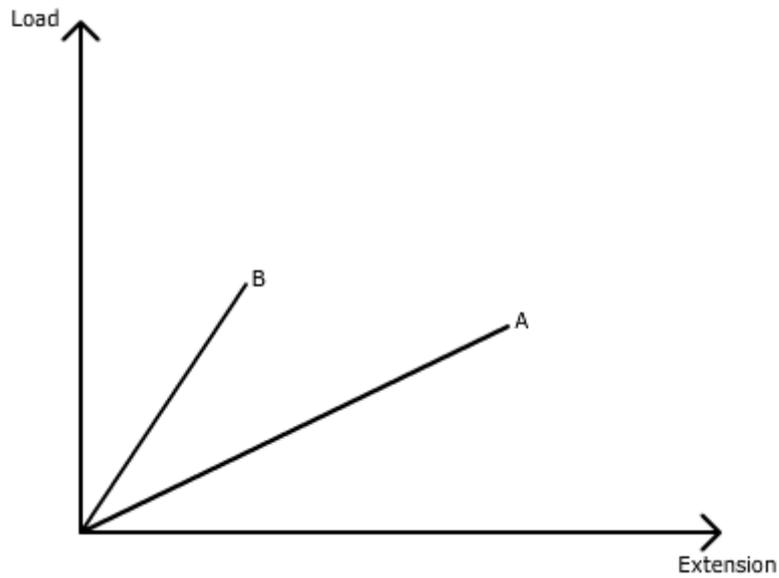
1

Q3. Mention two advantages of 'I' shape of iron beams used in building construction. 1

Q4. 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

Q5. Give one example each of natural and forced convection.

1

Q6. Draw cooling curve for hot water.

1

Q7. Why is 'invar' used for making the pendulum of a clock?

1

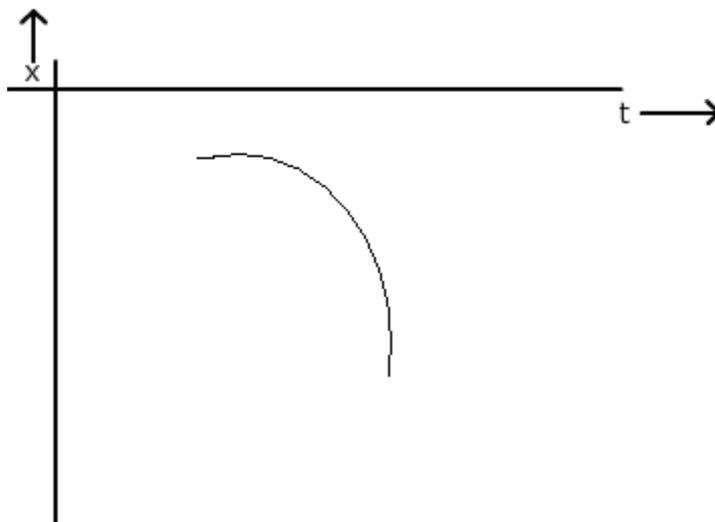
Q8. What do you understand by 'natural frequency' of a vibrating system?

1

Q9. 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

Q10. From the following graph, find the sign of (i) velocity (ii) acceleration. Give reasons for each answer.



2

Q11. What is the maximum height reached by an oblique projectile if its time of flight is  $T$ ? 2

Q12. 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

Q13. What are concurrent forces? Under what conditions will a body remain in equilibrium? 2

Q14. 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

Q15. 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. 2

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

Q16. A Carnot's engine takes 2095 J of heat per cycle from source at 400 K and rejects 1676 J to the sink. Calculate the temperature of the sink and efficiency of the engine. 2

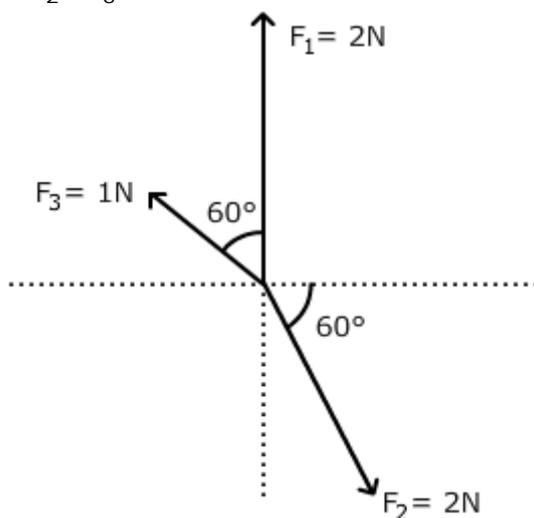
Q17. Define SHM. Under what conditions is the motion of a pendulum simple harmonic? 2



Q18. A particle is executing SHM. What fraction of its energy is kinetic when the displacement is half the amplitude? 2

Q19. 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

Q20. Find  $\vec{F}_1 + \vec{F}_2 - \vec{F}_3$



3

Q21. (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

Q22. 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

Q23. (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  $\hat{i} - \hat{j} + \hat{k}$ .

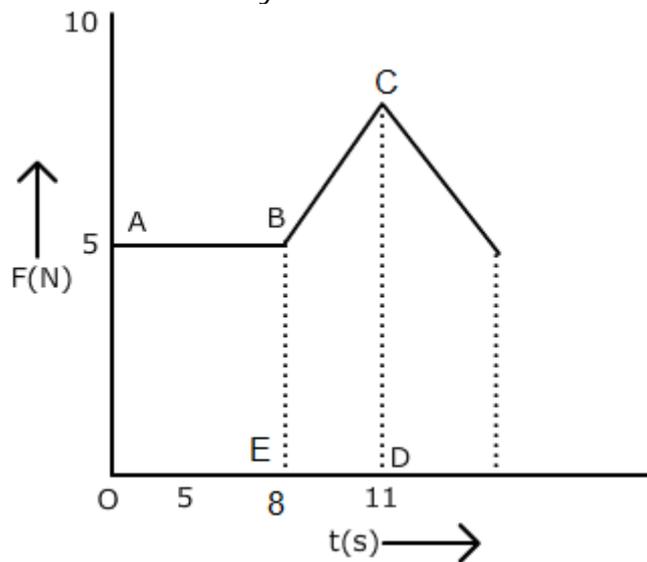
(b) How do we find the direction of angular velocity?

3

Q24. 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



- Q25. 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
- Q26. State the main features of kinetic theory of an ideal gas. 3
- Q27. State the first law of thermodynamics. Establish the relation between  $C_p$  and  $C_v$ . 3
- Q28. (a) Force-time graph for a body is given below. What is the velocity of the body at the end of 11 sec? Mass of the body is 7 kg and assumes it to be initially at rest.



- (b) When an automobile moving with a speed of 36 km/h reaches an upward inclined road of angle  $30^\circ$ , its engine is switched off. If the coefficient of friction involved is 0.1, use an appropriate free body diagram to find the retardation suffered by the automobile. 5
- Q29. 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  $0.01 \text{ m}^2$ ? 5

OR

Define angle of contact. For what nature of angle of contact will a liquid wet the solid?

A liquid drop of diameter 4 mm breaks into 1000 droplets of equal size. Calculate the resultant change in surface energy if the surface tension of the liquid is 0.07 N/m. 5



Q30. A displacement wave is represented by  $y = 0.25 \times 10^{-3} \sin (500t + 0.025z)$ . 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

5

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