

Final Paper (8 March 2017)  
Class XI  
PHYSICS  
(Set-B)

Time: 3hr

M.M.70

**NOTE: ALL QUESTIONS ARE COMPULSORY.**

*Q1 to Q 5 carry 1 mark each.*

*Q 6 to Q10 carry 2 marks each.*

*Q 11 to Q 22 carry of 3 marks each.*

*Q23 carry 4 mark.*

*Q 24 to 26 carry 5 marks each.*

*Use of Calculator not permitted.*

1. Is the total linear momentum conserved during short time of an elastic collision? (1)
  2. A unit vector is represented by  $a\hat{i} + b\hat{j} + c\hat{k}$ . If the values of a & b are 0.6 and 0.8 respectively, find the value of c. (1)
  3. An astronaut accidentally gets thrown out of his small spaceship accelerating in interstellar space at a constant rate of  $100\text{m/s}^2$ . What is the acceleration of the astronaut the instant after he is outside the spaceship? (1)
  4. Why a force is applied at right angles to the heavy door at the outer edge while closing or opening it? (1)
  5. Why a body weighs more at the poles than at the equator? (1)
  6. Derive the expression of potential energy stored in a stretched thin wire. (2)
- OR**
7. Why steel is more elastic than rubber? (2)
  7. Derive Ascent formula. (2)
  8. A pipe 20cm long is closed at one end which harmonic mode of the pipe is resonantly excited by a 430Hz source? Will this same source be in resonance with the pipe if both ends are open? (2)
  9. Prove the expression of work done in an isothermal process. (2)
  10. Derive equation of continuity. (2)
  11. Obtain an expression for a stationary wave formed by two sinusoidal waves travelling along the same path in opposite directions in case of stretched string and also discuss first and second mode of vibrations. (3)

12. a) A bullet fired at an angle of  $30^\circ$  with the horizontal hits the ground 3km away. By adjusting the angle of projection, can one hope to hit a target 5km away? Assume the muzzle speed to be fixed and neglect air resistance. (3)  
 b) What the angle of projection for which the horizontal range & the maximum height are equal.
13. A body tied to one end of a string is made to revolve in a vertical circle. Derive the expression for the velocity of the body and tension at the bottom and the top of the circle. (3)
14. a) Derive an expression for the rotational K.E of a rigid body rotating with angular velocity  $\omega$  and hence define moment of Inertia. (2)  
 b) The speed of the inner layer of the whirlwind in a tornado is alarmingly high. Why? (1)
15. a) Derive the expression of orbital velocity of satellite. (2)  
 b) A satellite revolves close to the surface of a planet. How is its orbital velocity related with velocity of escape from that planet? (1)
16. a) Derive Stoke's formula for a spherical body falling in a viscous medium (2)  
 b) At what speed will the velocity head of stream of water be 40cm? (2)

**OR**

- Explain Bernoulli's equation & derive it also. (1)
17. A newly designed thermometer has its lower fixed point and upper fixed point marked  $5^\circ$  and  $95^\circ$  respectively. Compute the temperature on this scale corresponding to  $50^\circ\text{C}$ . (3)
18. Derive the expression of pressure exerted by an ideal gas on basis of kinetic theory of gases. (3)
19. Explain dynamics of particle in S.H.M. and hence find the total energy stored when a particle is in S.H.M. (3)
20. Explain Doppler's effect in sound and hence find expression for apparent frequency. (3)
21. Explain working of refrigerator & hence find coefficient of performance. (3)
22. Explain bending of cyclist. Determine the angle through which a cyclist bend from the vertical while negotiating a circular turn. (3)

23. Vinay, the younger brother of Shiva told Shiva that a magician performed a show in his school. The magician was lying on the bed of nails. All students were stunned by the action of magician. Vinay told Shiva that magician had super natural power. Shiva told Vinay that magician had no super natural power. He also told Vinay that even he could have a nap on a bed of nails. Shiva performed the action and Vinay was satisfied that magician had no super natural power. (4)
- a) How is possible for a person to have a nap on a bed of nails?
  - b) Can a person stand on a bed of nails?
  - c) What values are shown by Shiva?

24. Explain working of Carnot heat engine and hence find its efficiency also. (5)

**OR**

- a) Derive expression for rate of flow of liquid through horizontal cylindrical pipe of radius  $r$  and length ' $l$ '.
- b) Explain working of venturimeter.

25. a) Prove that the oscillation of a simple pendulum are in S.H.M. (5)  
b) What is the effect on time period of simple? Pendulum when the length of pendulum is equal to a) Radius of earth b) infinite length

**OR**

- a) Prove that the oscillation of liquid in U-tube are simple harmonic. (5)
- b) Calculate the length of a simple pendulum which ticks two second.

26. a) Write Newton's formula for the speed of sound in air. What was wrong with this formula? What correction was made by laplace in this formula. (3)  
(2)
- b) Discuss the effect of following factors on the speed of sound through air: (a) Pressure (b) Density

**OR**

- a) The distances of two planets from the sun are  $10^{13}\text{m}$  &  $10^{12}\text{m}$  respectively. Find the ratio of time periods and speeds of the two planets. (3)  
(2)
- b) Explain the Kepler's laws of planetary motion and derive law of periods.