

22. Derive an expression for the time period of a simple pendulum. (3)
23. Assuming that the mass M of the largest stone that can be moved by a flowing river depends upon 'V' the velocity 'ρ' the density of water and 'g' the acceleration due to gravity. Using dimensions show that M varies with the sixth power of the velocity of flow. (3)
24. Prove that the average kinetic energy of a molecule of an ideal gas is directly proportional to the absolute temperature of the gas. (3)
25. What is meant by elastic collision? Show that in case of one dimensional elastic collision of two bodies the relative velocity of separation after the collision is equal to the relative velocity of approach before the collision. (3)
26. Derive an expression for the centripetal acceleration. (3)
27. (a) State the laws of moments of inertia. (3)
(b) Moment of inertia of a ring of mass M and radius 'r' about any diameter is $(\frac{1}{2})Mr^2$. What is its moment of inertia about any tangent of the ring ?
28. State and prove Bernoulli's theorem. Write any two applications. (5)

OR

Define Capillarity. Derive an expression for the ascent of a liquid in a capillary tube.

29. Derive expressions for the kinetic and potential energies of a harmonic oscillator. Hence show that total energy is conserved in SHM. (5)

OR

- i) What is Doppler effect ? Derive an expression for the apparent frequency of sound .
- ii) The pitch of the whistle of an engine appears to drop to $(\frac{5}{6})^{\text{th}}$ of the true value when it moves away from stationary observer. Calculate the speed of the engine. (velocity of sound = 340ms^{-1}).
30. Deduce expression for (a) Time of flight (b) Horizontal range and (C) Maximum height reached by a projectile, in terms of its initial velocity and angle of projection. (5)

OR

- i) Show that the path followed by an oblique projectile is a parabola.
- ii) The range of a particle when launched at an angle of 15° with the horizontal is 1.5Km. What is the range of the projectile when launched at an angle of 45° to the horizontal.

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7. Why is it easier to maintain the motion than to start it ? (1)
8. The hotter liquid flows faster than the cold ones. Why? (1)
9. At what height above the earth's surface the value of acceleration due to gravity 'g' is the same as in a mine 100 km deep? (2)
10. Derive an expression for the efficiency of a carnot heat engine. (2)
11. Show that impulse is equal to the change in momentum. (2)
12. The bob of a pendulum is released from horizontal position A. If the length of the pendulum is 1.5m. What is the speed with which the bob reaches the lower most point B, given that it dissipates 5% of its initial energy against air resistance? (2)
13. Define angle of friction. Show that tangent of angle of friction is equal to coefficient of friction. (2)
14. State the laws of kinetic friction (2)
OR
State the laws of static friction
15. Derive the relation between torque and angular momentum. (2)
16. Differentiate reversible and irreversible processes. Give one example each. (2)
17. At what temperature will oxygen molecules have the same rms velocity as hydrogen molecules at 60° C. Molecular mass of hydrogen and oxygen are 2 and 32 respectively. (2)
18. Doppler effect in sound is asymmetric. Justify your answer. (2)
19. Define acceleration due to gravity. Show that the value of 'g' decreases with altitude. (3)
OR
Derive an expression for the escape velocity.
20. What is meant by surface energy of a liquid? Show that the surface energy is equal to surface tension. (3)
21. Suresh noticed a big Granite rock in his locality. He thought that if they worked up on it they could earn money. He took permission from the government, completed all the formalities. He broke the rock using a bomb. The rock was made in to slices. They established a Granite industry. Many of the people in the surroundings started to earn and live comfortably. (3)
 - a) What values of Suresh impress you?
 - b) A bomb is thrown in a horizontal direction with a velocity of 50m/s. It explodes into two parts of masses 6 kg and 3 kg. The heavier fragment continues to move in the horizontal direction with a velocity 80m/s. Calculate the velocity of the lighter fragment.