

:2:

6. What is the angle between the vectors $\vec{P} \times \vec{Q}$ and $\vec{Q} \times \vec{P}$.
7. Write the condition necessary for a motion to be SHM.
8. Position – time graph of a body is a straight line parallel to the time axis. What does this imply?

Question 9 – 16 carry 2 marks each :

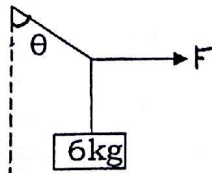
9. Differentiate impulse and impulsive force.
10. Prove that there are two angles of projection for the same horizontal range ?
11. Two planets are made of same materials. Find the ratio of acceleration due to gravity on their surfaces in terms of their radii.
12. Time period of oscillation (T) of a simple pendulum may depend on (1) length of the pendulum l (2) mass of the bob, m (3) acceleration due to gravity, g . Obtain an expression for time period by dimensional method.
13. Distinguish between reversible and irreversible process.
14. Derive Mayer's relation.
15. At what temperature will oxygen molecules have the same rms velocity as hydrogen molecules at 60°C . Molecular mass of hydrogen and oxygen - 2 and 32 respectively.
16. Obtain the relation between linear velocity and angular velocity.

OR

A particle moves round a circle with constant speed. Derive an expression for the centripetal acceleration.

Question 17 – 25 carry 3 marks each :

17. A mass of 6 kg is suspended by a rope of length 2m from a ceiling . A force 50N in the horizontal direction is applied at the midpoint of the rope. What is the angle the rope makes with the vertical in equilibrium ($g=10\text{m/s}^2$). Neglect the mass of the rope.



18. i) State and prove work-energy theorem.
ii) Two cars of same mass are moving on a level road, one at twice the speed of other. Compare their kinetic energies.
19. Derive an expression for the excess of pressure inside a liquid drop on account of surface tension.

:3:

20. A grindstone has moment of inertia of 6kgm^2 about its axis. A constant torque is applied and the grindstone is found to acquire a speed of 150r.p.m. in 10 seconds after starting from rest. Calculate the torque.
21. Derive an expression for first cosmic velocity.
22. Define moment of inertia of a body about an axis. Derive an expression for kinetic energy of a rotating body.
23. i) Mention the postulates of kinetic theory of gases (any two).
ii) What is the kinetic interpretation of pressure exerted by a gas.
24. What is meant by Doppler effect in sound. Obtain the general expression for the apparent frequency of sound.
25. A ball falls on a floor from a height of 19.6m. Calculate the velocity with which it strikes the ground. To what height will the ball rebound if it loses 25% of its energy on striking the floor. ($g = 9.8\text{m/s}^2$)

Question 26 carry 4 marks :

26. Having seen a big stone falling from the top of a tower, Ravi pulled his friend Kiran away. The stone hit Ravi slightly and he got hurt. But he was saved from a major accident.
 - a) What made Ravi act in such a way.
 - b) From the top of a tower 100m. in height a ball is dropped and at the same time another ball is projected vertically upward from the ground with a velocity of 25m/s. Find when and where the two balls meet. (Take $g = 9.8\text{m/s}^2$).

Question 27 - 29 carry 5 marks each :

27. State and prove law of conservation of momentum based on (i) Newton's second law (ii) Newton's third law.

OR

 - i) Define coefficient of friction. How is it related to angle of friction.
 - ii) Prove that angle of friction is equal to angle of repose.
28. i) Define terminal velocity. Derive an expression for the terminal velocity in case of a sphere falling through a viscous fluid such as glycerine.
ii) State Stefan's law.

OR

 - i) State and prove Bernoulli's theorem. Mention two applications.
 - ii) State Wien's displacement law.
29. Derive expressions for the kinetic and potential energies of a harmonic oscillator. Hence show that total energy is conserved in SHM. Draw a graph to show variation of energy with distance.

OR

Explain various modes of vibration of air column in open and closed pipes. Show that a closed pipe can produce only odd harmonics whereas an open pipe produces all harmonics.