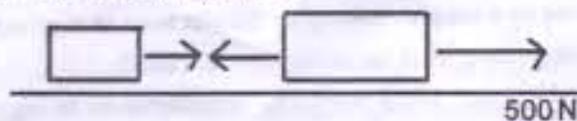




The figure above shows force time graph for a base ball struck by a bat. Determine the :

- (i) Impulse delivered by the ball      (ii) force exerted by the ball

9. What is the gravitational unit of work ? Express it in joule. What is the CGS unit of work?
10. Kinetic energy of a body is increased by 30%. Find the % increase in momentum.
11. A gas bubble from an explosion under water, oscillates with a period  $T$  proportional to  $\rho$  the static pressure,  $d$  the density of water and  $E$  the total energy of the explosion. Find the formula for  $T$  using the method of dimension.
12. Find the components of  $A = 2\hat{i} + 3\hat{j}$  along the directions  $\hat{i} + \hat{j}$  and  $\hat{i} - \hat{j}$ .
13. A cyclist is riding with a speed of 27 km/h. As he approaches a circular turn on the road of radius 80 m, he applies brakes and reduces his speed at a constant rate of 0.5 m/s. What is the magnitude and direction of the acceleration of the cyclist on the circular turn.
14. A man can swim with a speed of 4 km/h in still water. How long does he take to cross a river 1 km wide. If the river flows steadily at 3 km/h and he makes his strokes normal to the river current, how far down the river does he go when he reaches the other bank.
15. The displacement (in metre) of a particle, moving along X-axis is gives by  $x = 18t + 5t^2$ . Calculate :  
(i) the instantaneous velocity at  $t = 2s$   
(ii) average velocity between  $t = 2s$  and  $t = 3s$  10 kg, and  
(iii) the instantaneous acceleration.
16. A horizontal force of 500N pulls 2 masses 10 g and 20 kg on a horizontal (frictionless table) connected by a light string. What is the tension in the string? Does the answer depend on which mass end the force is applied ?



17. Show that Newton's second law of motion is the real law of motion and the other two laws can be deduced from it.
18. What is 'banking of roads' and why are roads banked ? Discuss the motion of a vehicle on a banked road. Arrive at an expression for the maximum speed a car can posses to execute a curved path. The coefficient of friction is ( $\mu$ ) of the road.
19. (i) What is impulse ? Is it a scalar or a vector quantity ? Show that impulse is equal to the change in momentum of a body.  
(ii) Why does a cricketer lower his hands to catch a ball ?
20. What is a conservative force ? Show that gravitational force is a conservative force.
21. Two inclined tracks one gradual and the other steep meet at  $O$  from where 2 stones are

allowed to slide down from rest, one on each track. Will the stones reach the bottom at the same time? Will they reach the bottom at the same time? Will they reach there with the same speeds? Explain with a diagram.

22. A ball is released from the top of a tower of height  $h$  metres. It takes  $T$  seconds to reach the ground. What is the position of the ball in  $\frac{T}{3}$  seconds?

23. Read the following and answer the questions below :

Ram found that the road inside his college campus, leading to the hostel was rough and uneven. The condition of the road worsened during rainy seasons and students found it difficult to ride their two wheelers due to this. Ram and his few friends thought over and came out with an idea. They worked on a project to lay plastic roads (waste polythene mixed in coal tar). They talked to the concerned authorities and made this happen. Now students have no difficulty in riding their vehicles on the road.

- (i) What value did Ram exhibit in working on such a project mentioned above?
  - (ii) What would happen if the road was rough and uneven and how should it affect the students?
  - (iii) How could roads made with plastic (waste polythene mixed in coal tar) be effective?
24. (i) What is an elastic collision? Derive an expression for the final velocities of 2 bodies undergoing elastic collision in one dimension with necessary theory.
- (ii) A bullet of mass 0.012 kg and horizontal speed of 70 m/s strikes a block of wood of mass 0.4 kg and instantly comes to rest w.r. to the block. The block is suspended from the ceiling by means of thin wires. Calculate the height to which the block rises.

OR

- (i) Discuss the motion of an object whirling in a vertical circle. Calculate the speed of the object
    - (i) at any point during its motion
    - (ii) at the lower most point of its motion.
  - (ii) A particle of mass 1 g executes an oscillatory motion on a concave surface of a spherical dish of radius 2 m placed on a horizontal plane. If the motion of the particle begins from a point on the dish at a height of 1 cm from the horizontal plane and coefficient of friction is 0.01 find the total distance covered by the particle before it comes to rest.
25. (a) (i) Derive an expression for the trajectory of a projectile and its velocity at any point in its path.
- (ii) From the top of a tower 156.8 m high a ball is projected upwards with a velocity of

39.2 m/s making an angle of  $30^\circ$  with the horizontal. At what distance from the foot of the tower does the ball strike the ground and what is the time taken ?

OR

(b) A projectile is fired from a height  $h$  above the ground with a velocity  $u$  parallel to the horizontal. Determine :

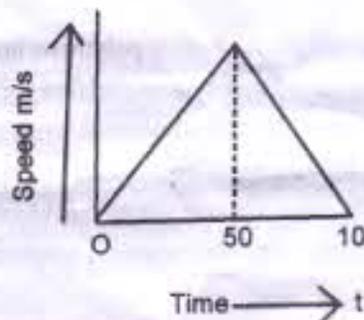
- (i) Its time of flight,
- (ii) Horizontal range, and
- (iii) Velocity at any instant.

(b) A projectile is fired horizontally with a velocity 98 m/s from a hill 490 m high.

- (i) Find the time taken for it to reach the ground.
- (ii) The distance of the target from the hill.
- (iii) velocity with which the body strikes the ground.

26. (a) Derive the equations of motion

(i)  $S = ut + \frac{1}{2}at^2$   $v = \frac{dx}{dt}$



(ii) The velocity time graph of a particle moving along a fixed direction as in the figure.

Obtain the distance covered by the object between (a)  $t=0$  to  $10\text{ s}$

(b)  $t=2$  to  $6\text{ s}$

What is the average speed of the particle over the intervals mentioned above.

OR

26. (b) Derive the equations of motion

$$v = u + at \quad a = \frac{dv}{dt}$$

$$v^2 = u^2 + 2as \quad a = \frac{v dv}{ds}$$

(ii) The displacement of a particle is given by

$$t = \sqrt{x} + 3$$

Find the displacement of the particle when the velocity is zero.