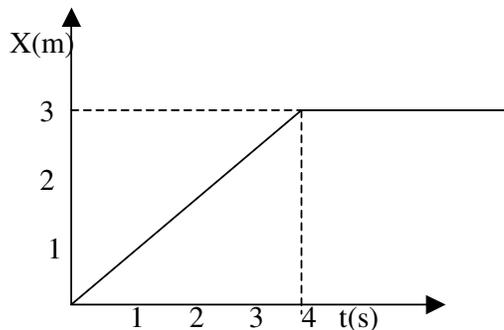


## LAWS OF MOTION

1. " Forces always occur in pairs
  - a. State this statement is true or false on the basis of Newton's law of motion. (1)
  - b. Distinguish b/w 'force' and 'Impulse' on a body. (1)
  - c. state the law of motion which explain about the force acting on a body (1)
  - d. A circular race track of radius 300m is banked at an angle of  $15^\circ$  if the Coefficient of friction between the wheels of a race car and the road is 0.2, what is the maximum speed to avoid skipping? ( 2 ½ )
  
2. A Circular track of radius 400m is kept with outer side of track raised to make  $5^\circ$  with the horizontal. Coefficient of friction is 0.2.
  - a. Name such track (1)
  - b. What is the optimum speed to avoid wear and tear of tyre? (1 ½ )
  - c. What is the maximum permissible speed to avoid skidding? (1 ½ )
  
3. Figure shows the position time graph of a particle of mass 4kg. What is the
  - a) Force on the particle  $t > 4S$ ,  $0 < t < 4S$  (1)
  - b) Impulse at  $t = 0S$  and  $t = 4Sec$



4. A straight line graph with length given in data along X- axis and height h along Y-axis

h (m)	1	2	4	7	9
l (m)	2	4	8	14	18

The shape of graph will resemble an inclined plane. If an object placed on it just slides down by itself.

- a) Is it possible to find co-efficient of friction from graph. Explain (1)
- b) If possible calculate co-efficient of friction from graph. Other wise calculate from tabulation. (1)
- c) Find angle of friction (1)

5A body of mass  $m$  is placed on a rough inclined plane having coefficient of friction  $\mu_k$ . The inclination of plane is  $\theta$

- a. Draw the condition (½)
- b. Which component of weight bring the body to the bottom (2)
- c. Define angle of repose (1).

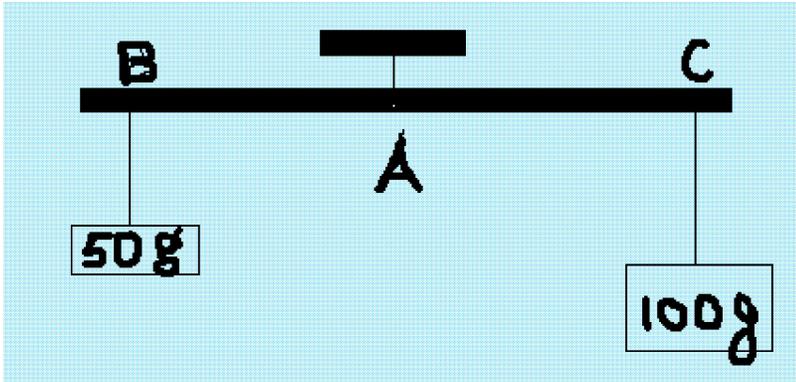
6. While firing a bullet the gun must be held tight to the shoulder

- (a) Which conservation law helps you to explain this? (1)
- (b) 'In firing process the speed of the gun is very low compared to the speed of the bullet' Substantiate the above statement using mathematical expressions. (2)

(c) A shell of 20Kg moving at 50m/s bursts into two parts of masses 15kg and 5kg. If the larger part continues to move in the same direction at 70m/s, what is the velocity and direction of motion of the other piece? (2)

7. A uniform mass less rod is suspended at A by a string, so that it remains horizontal as shown in figure. A 50g is attached at one side and 100g at the other side.

(a) Calculate the position of 100g mass if 50g is at a distance of 10cm from the point of suspension. (1)



(b) In this condition what is the name of A and define it. (1)

(c) At what distance from a 20g is to be suspended instead of 100g in order to keep the stick horizontal. (1)

8. In taking a catch a cricket player moves his hands backwards on holding the ball Why? (1)

9. A passenger sitting in a car at rest pushes it from within. (a)Will the carriage move? Comment.(1)

(b)State the law related to this.(1)

(c)What is the angle of friction between two surfaces in contact if coefficient of friction is  $1/\sqrt{3}$  ?. (2)

(d)What is the magnitude and direction of the net force acting on a drop of rain falling down with a constant speed.(1)

10 While firing a bullet, the gun must be held tight to the shoulder.

(a) Which law of conservation explains the recoil of gun? ( $1/2$ )

(b) Show that recoil velocity is opposite to the muzzle velocity of the bullet. (1)

(c) A gun of mass 5 kg fires a bullet of mass 5 g vertically upwards to a height of 100 m. Calculate the recoil velocity of gun. (1  $1/2$ )

11. Consider a man of mass 65 Kg in a lift. Give his apparent weight with proper explanation in the following cases.

(a) When the lift just starts moving up. (1 score)

(b) When the lift moves with constant speed . (1 score)

(c) Just before the lift stops . (2 score)

(d) When the lift cable breaks ? (1 score)

**OR**

5. Explain why

(a) A horse cannot pull a cart and run in empty space. (1 score)

(b) Passengers are thrown forward from their seats when a speeding bus stops suddenly . (1 score)

(c) It is easier to pull a lawn mover than to push it. (2 score)

(d) A cricketer moves his hands backwards while holding a catch. (1 score)

12. A man balances two bodies of equal masses 'm' at the ends of a uniform rod of negligible mass .

(a) Where is the balancing point? (1 score)

(b) Give the law of balancing condition. (2 score)

(c) If the mass 'm' is added to one side, where is the balancing point? (2 score)

13. A man weighs 70 kg. He stands on a weighing scale in a lift which is moving

- (a) with a uniform acceleration of  $5 \text{ ms}^{-2}$  (1)
- (b) Downwards Upwards with a uniform acceleration of  $5 \text{ ms}^{-2}$  (1)
- (c) Upwards with a uniform speed of 10 m/s (1)
- (d) The lift mechanism failed and is hurtled down freely under gravity (1)

14. A body is placed on a wooden sheet, if one side is raised, it began to slide down when it is raised to make a particular angle.

- (a) Name the angle of inclination (1)
- (b) How is it related to coefficient of friction? (1)

15. True or false?

- (a) If a single force acts on an object, the object accelerates. 1
- (b) If an object is accelerating, a force is acting on it. 1
- (c) If an object is not accelerating, no external force is acting on it. 1

16.a.what you mean by friction? 1

b. Distinguish between static friction and kinetic friction? 2

c. If you push on a heavy box that is at rest, you must exert some force to start its motion. However, once the box is sliding, you can apply a smaller force to maintain its motion Why? 1

17. a. Impulse has the same unit as that of ..... (Force, momentum, inertia, acceleration) (1/2)

b. A cricket ball of mass 500gm moving with a speed of 36 km/h is reflected back with the same speed. (i) What is the impulse applied on it? (ii) If the ball takes a time 0.01s to get reflected, how much is the impulsive force experienced by it? (1 +1= 2)

18. Fill up (1 mark)

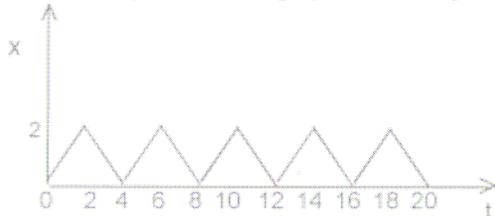
- a) Tyres are made circular because of \_\_\_\_\_
- b) Principle of conservation of momentum follows from Newton's ----- of motion.
- c) A body acted upon by constant force has uniform .....
- d) A retarding force is applied to stop a train. If the speed is doubled, then the distance will be .....

19. .A man sitting on the back seat of a car at rest is pushing on the front seat.

- a) Does the car move? Why?
- b) State the law which helps you to find the answer of the above question?
- c) On the basis of the above law define force and inertia? (1+2+2)

20.

Figure shows the position time graph of the body of mass 0.04 kg



- a) Suggest a suitable physical context for this motion 1/2
- b) What is the time between two consecutive impulses received by the body? 1
- c) What is the magnitude of each impulse? 1

From among Newton's three famous laws of motion,

- a) Which one gives the relation  $\vec{F} = m\vec{a}$  ?  
b) Is this relation applicable to the motion of a rocket ?  
c) Why does a mango fall down when the branch of the tree is shaken?

$\frac{1}{2}$   
 $\frac{1}{2}$   
1  
1

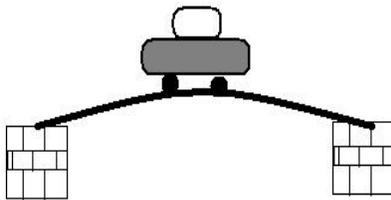
22

Two surfaces if made extremely smooth, will have very low value of friction b/n them'

- a) Is the statement correct ? Justify  
b) A wooden box is lying on the inclined plane. What is the coefficient of friction of the box starts sliding when the angle of inclination is  $30^\circ$ ?

23. To move over circumference of a circle centripetal force is necessary

- a) Prove that a motor car moving over a convex bridge is lighter than the same car resting on the bridge (2)  
b) Why cyclists lean inwards while negotiating a curve? (1)



- c) Find the maximum speed with which a car can turn round a curve of 30m radius on a level road (Given  $\mu = 0.4$ ) (2)

24. a) When the soda water bottle falls freely the gas bubbles will not rise in the bottle. What is your opinion? (1)

b) A man weighting 60kg is standing on a weighting machine in a lift. What is the weight shown by the machine when the lift is

- a) at rest b) moves down with a uniform velocity of 1.2m/s  
c) moves down with a uniform acceleration of  $1.2\text{m/s}^2$   
d) moves up with a uniform acceleration of  $1.2\text{m/s}^2$  (1+1+1+1=4)

25. (a) State the law of conservation of linear momentum. (1)

(b) A shell of mass 0.020 kg is fired by a gun of mass 100 kg. If the muzzle speed of the shell is  $80\text{ m s}^{-1}$ , what is the recoil speed of the gun ? (3)

26. While catching a ball the cricketer lowers his hand Why. (1)

(1) Name the force experienced by the catcher (1)

(2) Passengers are thrown forward from their seats when a speeding bus stops suddenly . Do you agree this statement. Give reason. (1)

27. a. Explain why a. Force cannot pull a cart and run in empty space?

b. Passengers are thrown forward from their seats when a speeding bus stops suddenly?

c. It is easier to pull a lawn roller than to push it?

d. A cricketer move his hands backwards while holding a catch? (4)