



INDIAN SCHOOL MUSCAT
SENIOR SECTION
DEPARTMENT OF PHYSICS
CLASS XI
LAWS OF MOTION
WORKSHEET - 3

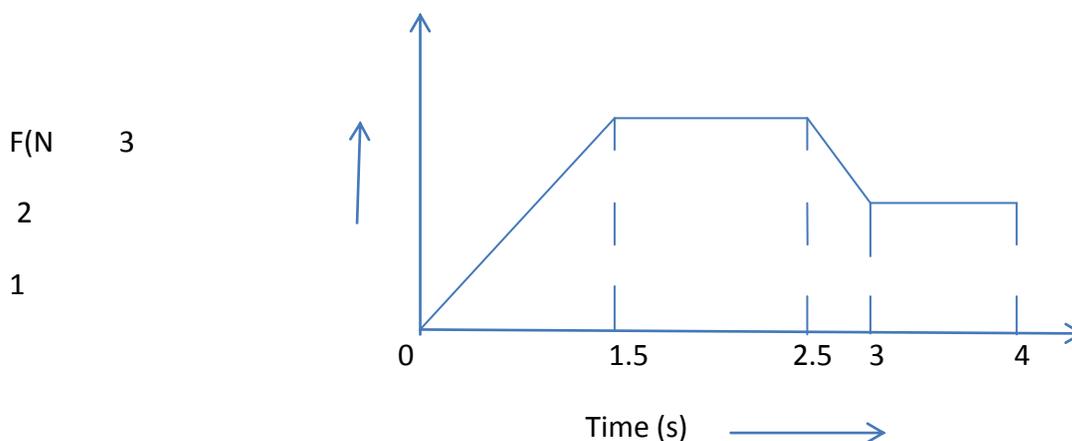
SECTION – A CONCEPTUAL AND APPLICATION TYPE QUESTIONS

1. If the net force acting on the body be zero, will the body remain necessarily in rest position ? 1
Explain your answer .
2. Action and reaction forces do not balance each other .why ? 1
3. If a force is acting on a moving body perpendicular to the direction of motion , then what will be its effect on the speed and direction of the body ? 1
4. Is the linear momentum of a ball falling freely conserved ?why ? 1
5. Why passengers are thrown forward from their seats when a speeding bus stops suddenly ? 1
6. Why are the passengers thrown outwards when a car in which they are travelling suddenly take a circular turn ? 1
7. Show that if the net force acting on a particle is zero, its momentum will remain unchanged . 1
8. A cricket player lower his hands to catch the ball safely . Explain why ? 1
9. It is easy to catch a table tennis ball than a cricket ball even both are moving with same velocity . why ? 1
10. Can a bomb initially at rest explodes into three pieces which fly in mutually perpendicular directions ? 2
11. While firing a bullet , the gun should be held tight to the shoulder .Why ? 1
12. What is the principle of working of a rocket ? 1
13. Carts with rubber tyres are easier to ply than those with iron wheels .why ? 1
14. On what factors does the coefficient of friction depend ? 2
15. A horse has to apply more force to start a cart than to keep it moving .Why ? 1
16. Proper inflation of tyres of vehicles save fuel .Why ? 1
17. What is the angle between frictional force and instantaneous velocity of the body moving over a rough surface ? 1
18. Does the angle of banking depend on the mass of vehicle ? 1

19. Why does a cyclist bend inwards while riding along a curved road ? 1
20. A lift is going up with an acceleration $3g$. A man is inside the lift and his mass is m . What will be the reaction of the floor on the man ? 1

SECTION – B NUMERICAL PROBLEMS

1. A truck starts from rest and rolls down a hill with constant acceleration . It travels a distance of 400 m in 20 s . Calculate the acceleration of the truck and force acting on it , if its mass is 7 metric ton .
2. A car of mass 1000 kg is moving with a velocity of 10 m/s and is acted upon by a forward force of 1000 N due to engine and retarding force of 500 N due to friction . What will be the velocity after 10 seconds ? 2
3. A machine gun fires a bullet of mass 40 g with a speed of 1200 m/s . The person holding the gun can exert a maximum force of 144 N on it . What is the number of bullets that can be fired from the gun per second ? 2
4. A golf ball of mass 60 g at rest is hit with a striker . Find the impulse of the hit if the ball stops after travelling a horizontal distance of 50 m with a uniform retardation of 4 ms^{-2} . 2
5. A shell of mass 0.02 kg is fired by a gun of mass 10 kg . If the muzzle speed of the shell is 80 m/s , what is the recoil speed of the gun ? 2
6. Two billiard balls each of mass 50 g moving in opposite directions with a speed of 36 km/hr collide and rebound with the same velocity . What is the impulse imparted to each ball due to the other ? 2
7. A mass of 6 kg is suspended by a rope of 2m from a ceiling. A force of 50 N in the horizontal direction is applied at the midpoint of the rope . What is the angle the rope makes with the vertical in equilibrium ? 2
8. The initial speed of a body of mass 2 kg is 5 m/s . A force acts for 4 s in the direction of motion of the body . The force – time graph is as shown. Calculate the impulse of the force and the final speed of the body . 2



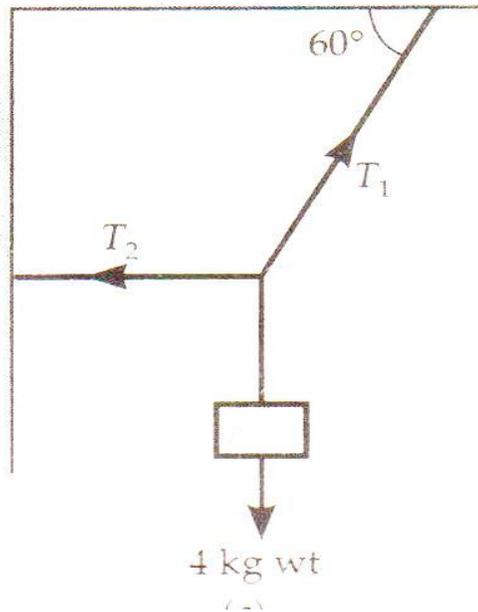
9. A ball moving with a momentum of 5 kg m/s strikes against a wall at an angle of 45° and rebounds at the same angle . Calculate the change in momentum. 2
10. A bomb at rest explodes into three fragments of equal masses. Two fragments fly off at right angles to each other with velocities 9 m/s and 12 m/s respectively . Calculate the speed of the third fragment . 2
11. An elevator and its load weigh a total of 800 kg . Find the tension T in the supporting cable when the elevator ,originally moving downwards at 20 m/s is brought to rest with constant retardation in a distance of 50 m . $g = 10 \text{ m/s}^2$ 2
12. Two bodies of masses 4 kg and 3 kg respectively are connected by a light string passing over a smooth frictionless pulley. Calculate the acceleration of the masses and tension in the string. 2
13. A body of mass 10 kg is sliding down a rough inclined plane which makes an angle of 30° with horizontal . If the coefficient of friction is 0.25 ,find the acceleration of the body ? $g = 10 \text{ m/s}^2$ 2
14. A circular race track of radius 400 m is banked at an angle of 10° . If the coefficient of friction between the wheels of a race car and the road is 0.2 , what is the
 - (i) optimum speed of the car to avoid wear and tear on its tyres
 - (ii) maximum permissible speed to avoid slipping . $g = 9.8 \text{ m/s}^2$
 2
15. A wooden block of mass 2 kg rests on a soft horizontal floor. When an iron cylinder of mass 25 kg is placed on top of the block , the floor yields steadily and the block and the cylinder together go down with an acceleration of 0.1 m/s^2 . What is the action of the block on the floor
 - (a) before
 - (b) after the floor yields ? $g = 10 \text{ m/s}^2$.
 3
16. A train is moving along a horizontal track . A pendulum suspended from the roof makes an angle of 4° with the vertical. Obtain the acceleration of the train . $g = 10 \text{ m/s}^2$ 2
17. A body of mass 10 kg is placed on a smooth horizontal table . It is connected to a string which passes over a frictionless pulley and carries at the other end , a body of mass 5 kg .Calculate the acceleration of the masses and tension in the string. 3
18. A mass of 200 kg is resting on a rough inclined plane of 30° . If the coefficient of friction is $\frac{1}{\sqrt{3}}$, find the least and the greatest forces acting parallel to the plane to keep the mass in equilibrium. 3
19. An aircraft executes a horizontal loop at a speed of 720 km/hr with its wings banked at 15° . What is the radius of the loop ? $g = 10 \text{ m/s}^2$ 2
20. A box of mass 4 kg rests upon an inclined plane . The inclination of the plane to the horizontal is gradually increased .It is found that when the slope of the plane is 1 in 3 , the box starts sliding down the plane . Given $g = 9.8 \text{ m/s}^2$ 3

(i) Find the coefficient of friction between the box and the plane .

(ii) What force applied to the box parallel to the plane will just make it move up the plane ?

21. A ball of mass 0.1 kg is suspended by a string 30 cm long . Keeping the string always taut, the ball describes a horizontal circle of radius 15 cm. Calculate the angular speed . 2

22. Determine the tensions T_1 and T_2 in the strings shown in figure. 2



23. The pulleys and strings shown in the figure are smooth and of negligible mass. For the system to remain in equilibrium, what should be the angle θ ? 3

