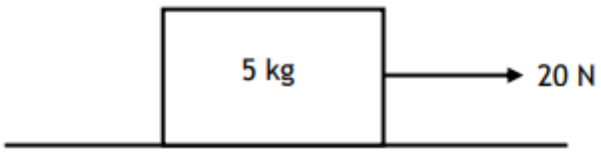
INDIAN SCHOOL AL WADI AL KABIR		
Class: XI	DEPARTMENT OF SCIENCE -2026-27 SUBJECT: PHYSICS	DATE: 30/08/2026
WORKSHEET NO. 4	TOPIC: LAWS OF MOTION	A4 FILE FORMAT
CLASS & SEC:	NAME OF THE STUDENT:	ROLL NO.

OBJECTIVE TYPE QUESTIONS [1 MARK]

1. A block is pulled across a horizontal surface as shown.



The mass of the block is 5 kg. The block is travelling at a constant velocity. Calculate the force of friction acting on the block.

(a) 5 N

(b) 20 N

(c) 25 N

(d) 0 N

2. A 5 kg mass is hung on a weighing balance, and both are allowed to fall freely. State the reading on the balance while the mass and the balance are falling.

(a.) 0 N

(b) 5 N

(c) 50 N

(d) 49 N

Freely falling, R =0

3. Far out in space, the gravitational field strength experienced is negligible. The rocket

motor of a space probe is fired for a short time and the rocket accelerates. Determine what will happen to the rocket when the motor is switched off.

(a) The rocket decelerates until it comes to rest.

(b) The rocket will continue to accelerate forward.

(c) The rocket will change direction.

(d) The rocket will move at a constant velocity.

Since g = 0, due to inertia continues with the same velocity

4. A ball is travelling with uniform translatory motion. This means that
   (a) It is at rest.
   (b) The path can be a straight line or circular, and the ball travels with uniform speed.
   (c) All parts of the ball have the same velocity (magnitude and direction), and the velocity is constant.
   (d) The centre of the ball moves with constant velocity, and the ball spins about its centre uniformly.
5. Conservation of momentum in a collision between particles can be understood from
   (a) Conservation of energy.
   (b) Newton's first law only.
   (c) Newton's second law only.
   (d) Both Newton's second and third laws.
6. The forces which meet at one point but whose lines of action do not lie in one plane are called
   (a) Coplanar concurrent forces.
   (b) Coplanar non-concurrent forces.
   (c) Non-coplanar concurrent forces.
   (d) Non-coplanar non-concurrent forces.

7. In ordinary terrestrial experiments, the observer is in an inertial frame in the following cases
   (a) A child revolving in a giant wheel.
   (b) A driver in a sports car moving with a constant high speed on a straight road
   (c) a pilot on an aeroplane, which is taking off
   (d) a cyclist negotiating a sharp turn.

8. Rocket engines lift a rocket from the Earth's surface because hot gases with high velocity
   (a) Push against the air
   (b) push against the Earth
   (c) react against the rocket and push it up
   (d) heat up the air, which lifts the rocket.

9. If two forces of equal magnitude act simultaneously on a body in the east and the north direction, then
(a) The body will get displaced in the north direction.
(b) The body will get displaced in the east direction.
(c) The body will get displaced in the north-east direction.
(d) The body will remain at rest.

10. The motion of the rocket is based on
(a) The principle of conservation of angular momentum.
(b) The principle of conservation of kinetic energy.
(c) The principle of conservation of mass.
(d) The principle of conservation of linear momentum.

11. A person is standing in an elevator. In which situation does he find himself weightless?
(a) When the elevator moves upwards with constant acceleration.
(b) When the elevator moves upwards with constant velocity.
(c) When the elevator moves downward with acceleration due to gravity.
(d) When the elevator moves downward with constant velocity.

12. Which of the following is a non- conservative force?
(a) Interatomic force
(b) Gravitational force
(c) Electrostatic force
(d) Viscous force

Read the Assertion and Reason carefully to mark the correct option out of the options given below :
(a) If both Assertion and Reason are true and the Reason is the correct explanation of the Assertion.
(b) If both Assertion and Reason are true but Reason is not the correct explanation of the Assertion.
(c) If Assertion is true but Reason is false.
(d) If the Assertion and Reason both are false.
(e) If Assertion is false but Reason is true.

13. Assertion: Inertia is the property by virtue of which the body is unable to change by itself the state of rest only.
Reason: Bodies do not change their state unless acted upon by an unbalanced external force.
14. Assertion: If the net external force on the body is zero, then its acceleration is zero.
Reason: Acceleration does not depend on force.
ANSWERS

[1]C [2] A [3] D [4] C [5]D [6] C [7] B[8]C [9]C [10]D [11]C [12] D [13]E[14]C

SHORT ANSWER QUESTIONS [2 MARKS]

15. Two billiard balls, each of mass 0.05kg moving in opposite directions with speed 6m/s collide and rebound with the same speed. What is the impulse imparted to each ball due to the other?

16. A bullet of mass 10 g is fired from a gun of mass 8kg with a velocity 160m/s. Find the velocity of recoil of the gun.

17. Show that if the force acting on a particle is zero, its momentum will remain unchanged.

18. Why are the wheels of vehicles provided with mudguards?

19. Why are the wheels of the automobiles made circular?

20. A bullet of mass 0.01kg moving with a velocity 100m/s strikes a wooden plank of thickness 0.5 m and emerges with a velocity 30m/s. Find the resistance offered by the plank, assuming it is uniform.

21. Forces of 16N and 12N are acting on a mass of 200kg in mutually perpendicular directions. Find the magnitude of the acceleration produced.

ANSWERS

15. (Ans: - Impulse = change in momentum = mv-mu = -mv-[-mu]

Impulse = 0.6 kg m/s)

16. (Ans. V = - m x v/M = -0.01x 160/8 = -0.2m/s)

20. $v^2 - u^2/2s$ Ans-91N]

21.F1 =16N and F2 = 12N ,m = 200kg, θ = 90

F = ma

And

$F = \sqrt{F_1^2 + F_2^2 + 2F_1F_2\cos\theta}$, $a = 0.1 m/s^2$)

SHORT ANSWER QUESTIONS [3 MARKS]

22. A horizontal force of 500N pulls 2 masses 10 kg and 20 kg [lying on a frictionless table], connected by a light string. What is the tension in the string? Does the answer depend on which mass the pull is being applied?

23. A jet of water issuing horizontally at the rate of 10kg/s strikes a vertical wall with a velocity of 10m/s and rebounds with half the original velocity. What is the force exerted on the wall?

24. A car of mass 1500kg is moving with a speed of 12.5m/s on a circular path of radius 20m on a level road. What should be the frictional force between the car and the road so that the car does not slip? What should be the value of the coefficient of friction to attain this force?

25. A circular race track of radius 300m is banked at an angle of 15°. 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 race car to avoid wear and tear on its tyres
(ii) Maximum permissible speed to avoid slipping?

26. What is impulse? Show that impulse = change in momentum.

ANSWERS

22. a = 50/3 m/s^2

For 20kg mass,

500 -T = 20 x50/3

Or T = 166.7N

For 20 kg,

500-T = 10 x 50/3

Or T = 333.3N

23. m=10kg, t=1s, u=10m/s,v=-5m/s

F = m[v-u]/t

F =150N

24.Frictional force = centripetal force.
$mv^2/r = \mu mg$
μ =0.8

25. optimum speed , V = $\sqrt{rgtan\theta}$
V = $\sqrt{789}$ = 28.1 m/s

V = $\sqrt{\frac{rg[\mu_s + tan\theta\}}{1-\mu_s Tan\theta}}$

V = 38.1m/s

CASE STUDY [4 MARKS]

25. To verify the laws of limiting friction, we take a wooden block A of weight 2N. This block is placed on a horizontal table provided with a frictionless pulley on one side. One end of a string is attached to the hook of the block. The string is then passed over the pulley, and a pan is attached to the free end of the string. Any number of weights can be added to the pan. We added the weights one by one, like 4N,8N and 10N,14N --- and when the weight added is 10N, the body just begins to move.

[i] Laws of friction state that

[a] limiting friction is neither created nor destroyed

[b] limiting friction is directly proportional to normal reaction

[c] friction is inversely proportional to normal reaction

[d] limiting friction does not depends on normal reaction

[ii] In the above experiment, what is the magnitude of limiting friction?

[a] 8N [b] 10N [c] 14N [d] 4N

[iv] A body of mass 50kg is kept on a horizontal surface of coefficient of static friction 0.5. Find the least horizontal force required to just start the motion.[g = 10 $\frac{m}{s^2}$]

[a] 210N [b] 198 N [c] 250N [d] 225N

[v] Which one is easier? : To pull a lawn mower or to push a lawn mower by applying the same force 'F' in both cases.

[a] pull, because the frictional force acting is μ{ mg- FsinΘ}

[b] pull, because the frictional force acting is μ FcosΘ

[c] push, because the frictional force acting is μ mg

[d] push, because the frictional force acting is μ R

Answers

[25]

[i] [b] limiting friction is directly proportional to the normal reaction

[ii] [b] 10N

[iii] [c] 250N

[iv] [a] pull, because the frictional force acting is μ {mg- F sin θ}

LONG ANSWER QUESTIONS [5 MARKS]

26. (i)What is friction?

(ii) What are the 3 types of friction? Explain each with an example.

(iii) What is limiting friction? Represent graphically the relationship between the applied force and frictional force, label limiting friction. (Refer notes)

27. (i) What is recoil velocity? Derive an expression for the recoil velocity of a gun. What is the significance of the negative sign in the final expression?

(ii)A lighter body or a heavier body will have less recoil velocity. Why? (Refer notes)

28. (i) Derive an expression for the maximum velocity of a vehicle while taking a curve of radius ‘r’[i] on a level road [ii] on a banked road

(ii) It is easier to push an object than to pull. Explain with the help of a diagram. (Refer notes)

29. (i) State and prove the law of conservation of momentum. (Refer notes)

(ii) A bullet of mass 0.01 kg is fired horizontally into a 4kg wooden block at rest on a horizontal surface. The coefficient of kinetic friction between the block and the surface is 0.25. The bullet gets embedded in the block, and the combination moves 20m before coming to rest. With what speed did the bullet strike the block?

$f_k = \mu_k \cdot N$

where N is the normal force. Since the system is on a horizontal surface, $N = (M + m)g$, where $g \approx 10\,\text{m/s}^2$.

Calculating N:

$N = (4\,\text{kg} + 0.01\,\text{kg}) \cdot 10\,\text{m/s}^2 = 40.1\,\text{N}$

Now, calculating f_k:

$f_k = 0.25 \cdot 40.1\,\text{N} = 10.025\,\text{N}$

$$f_k = (M + m)a \implies a = \frac{f_k}{M + m}$$

Substituting the values:

$$a = \frac{10.025\,\text{N}}{4.01\,\text{kg}} \approx 2.5\,\text{m/s}^2$$

$v^2 = u^2 + 2as$

Here, $u = 0$ (initial speed before coming to rest), $a = -2.5\,\text{m/s}^2$ (retardation), and $s = 20\,\text{m}$

$0 = v^2 - 2 \cdot 2.5 \cdot 20$

$v^2 = 100 \implies v = 10\,\text{m/s}$

$m \cdot u = (M + m) \cdot v$

Substituting the known values:

$0.01 \cdot u = (4 + 0.01) \cdot 10$

$$0.01 \cdot u = 40.1 \implies u = \frac{40.1}{0.01} = 4010\,\text{m/s}$$

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