NDA-CDS 2 2024

GS

LIVE

PHYSICS

CLASS 7

NAVJYOTI SIR

SSBCrack EXAMS

08 July 2024 Live Classes Schedule

8:00AM	08 JULY 2024 DAILY CURRENT AFFAIRS	RUBY MA'AM
9:00AM	08 JULY 2024 DAILY DEFENCE UPDATES	DIVYANSHU SIR

SSB INTERVIEW LIVE CLASSES

9:00AM	OVERVIEW OF SRT & SDT	ANURADHA MA'AM

NDA 2 2024 LIVE CLASSES

1:00PM	GS - PHYSICS - CLASS 7	NAVJYOTI SIR
4:00PM	MATHS - STATISTICS - CLASS 1	NAVJYOTI SIR

CDS 2 2024 LIVE CLASSES

1:00PM	GS - PHYSICS - CLASS 7	NAVJYOTI SIR

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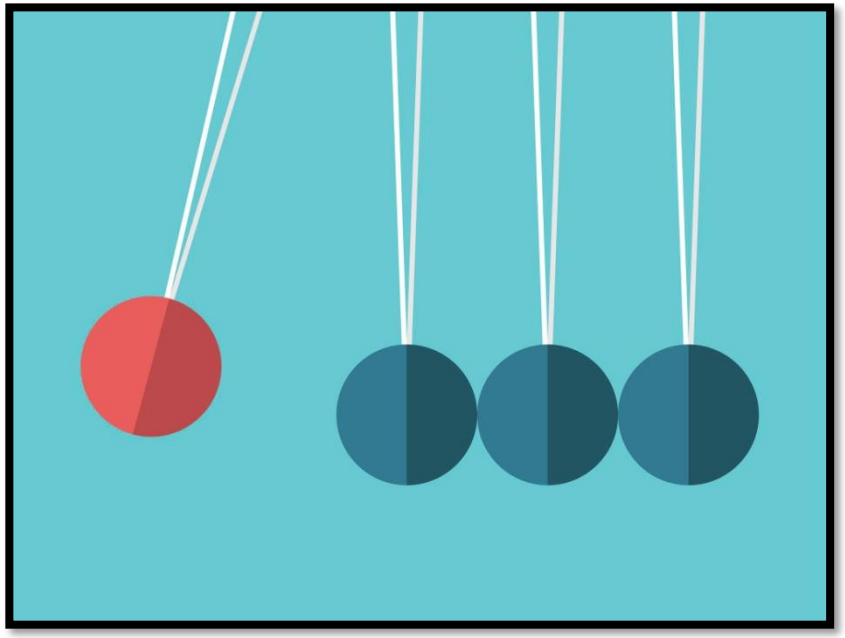
LAWS OF MOTION



WHAT WILL WE STUDY ?

- Inertia
- First Law of Motion
- Momentum and Force
- Second Law of Motion
- Third Law of Motion
- Conservation of Momentum

INERTIA

- **The property of an object by virtue of which it cannot change its state of rest or of uniform motion along a straight line on its own, is called inertia.**
- **<u>Greater the mass of a body greater will be its inertia</u> and vice-versa.**
- **Inertia is of three types :**

  1. Inertia of Rest

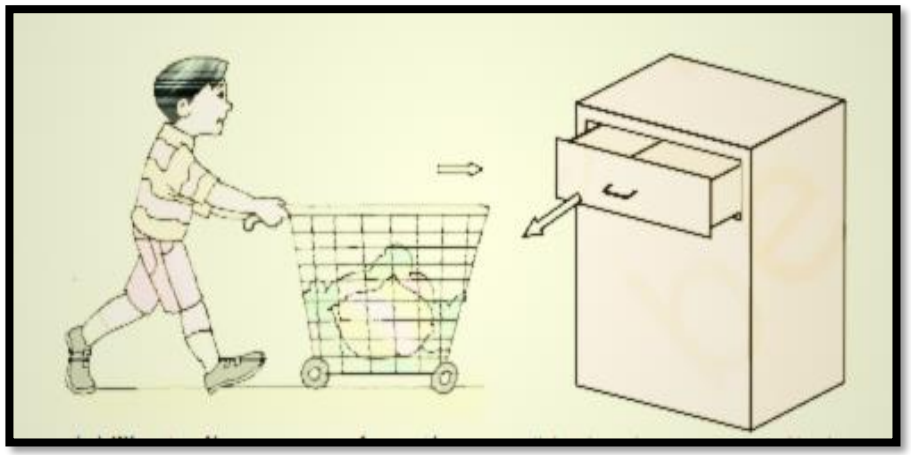
  2. Inertia of Motion

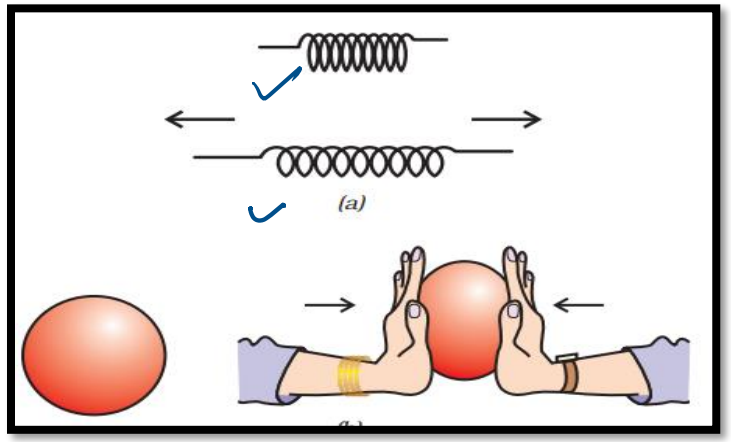
  3. Inertia of Direction

FORCE

- **Force is a push or pull which changes or tries to change the state of rest, the state of uniform motion, size or shape of a body.**
- **It is a vector quantity. Its SI unit is Newton (N).**
- **Forces can be categorised into two types:**

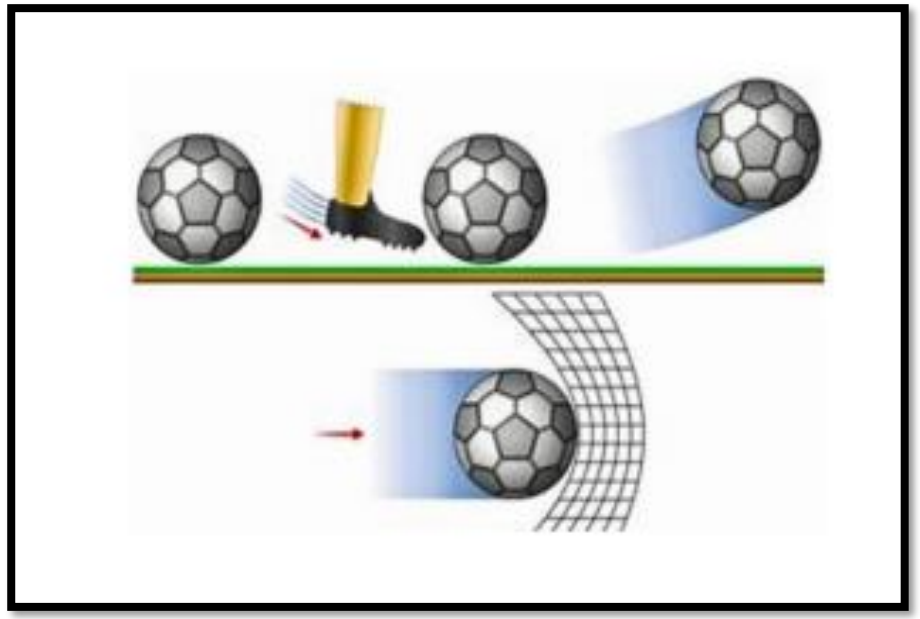
1. **Contact Forces : Frictional , Spring Force etc.**
2. **Non – Contact Forces : Gravitational , Electrostatic etc.**





FIRST LAW OF MOTION

- **A body continues to be in its state of rest or in uniform motion along a straight line unless an external force is applied on it.**
- **This law is also called law of inertia.**



MOMENTUM

- **The total amount of motion present in a body.**
- **Linear momentum of a body is equal to the product of its mass and velocity. It is denoted by p. Linear momentum, p = mv.**
- **It is a vector quantity and its direction is in the direction of velocity of the body. Its SI unit is kg m/s.** (kgms-1)

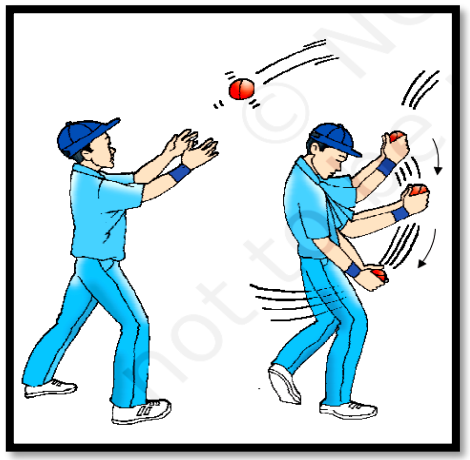
mass (kg) x velocity (ms-1)

SECOND LAW OF MOTION

- **The rate of change of linear momentum is proportional to the applied force and change in momentum takes place in the direction of applied force.**

$$\mathbf{F} \propto \frac{d\mathbf{p}}{dt} \Rightarrow \mathbf{F} = k\frac{d}{dt}(m\mathbf{v})$$

$$\mathbf{F} = \frac{m d\mathbf{v}}{dt} = m\mathbf{a} \quad (k = 1)$$



F = mass x acceleration

Newton ≡ kg x ms^{-2}

1N = 1 kg ms^{-2}

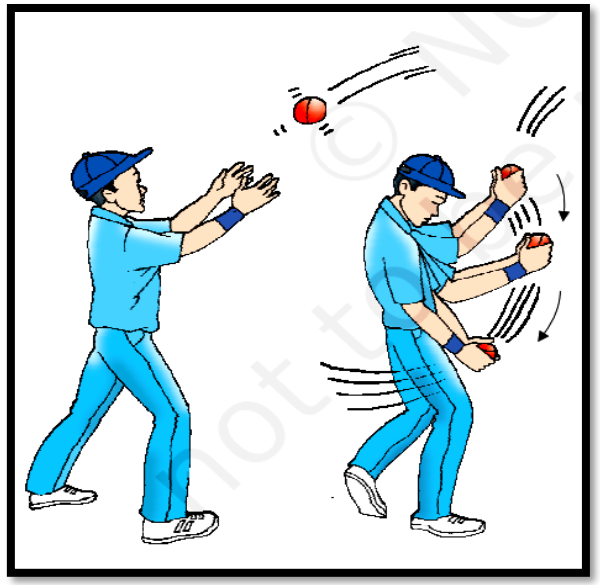
- **It is easier for a person to push an empty shopping cart than a full one.**

IMPULSE

- **The product of Force and time for which it acts is called impulse.**
- **Impulse = Force ´× Time = Change in momentum**

Unit ⇒ kgms⁻¹

- **It is a vector quantity and its direction is in the direction of force.**



$$F \propto \frac{dp}{dt}$$

$$Fdt \propto dp$$

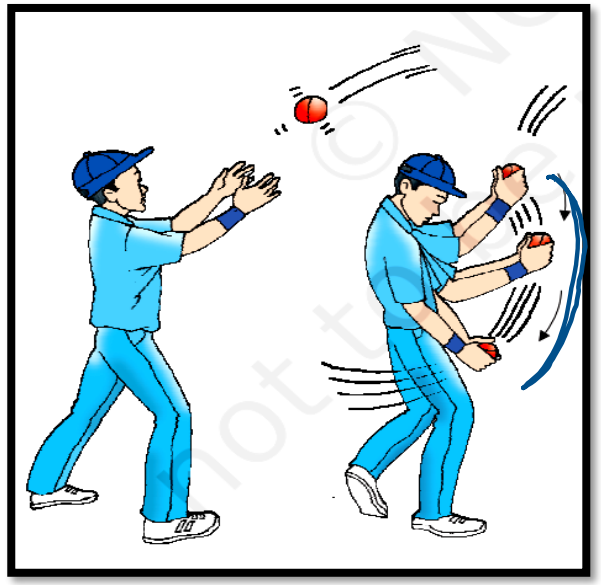
$$F(t_2 - t_1) = k(p_2 - p_1)$$

$$\text{Impulse} = F(t_2 - t_1) = (p_2 - p_1)$$

If $p_2 - p_1$ is to be kept constant,

if F has to decrease,

then $t_2 - t_1$ (contact time has to increase)



$dt = t_2 - t_1$ is increased, so as to decrease F.

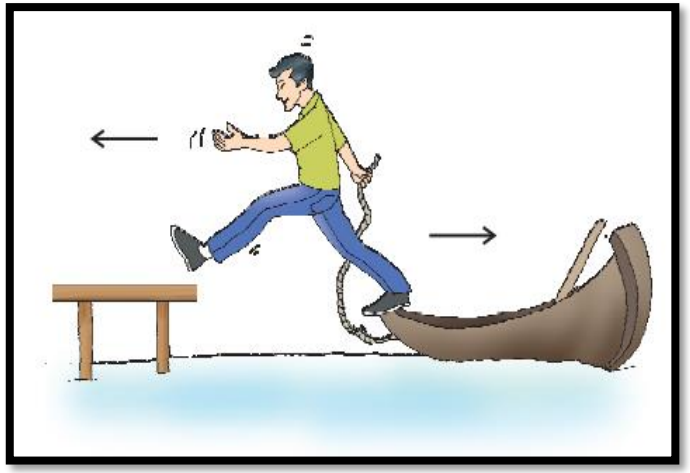
(As), $\int F\,dt$ is constant, impulse is constant.

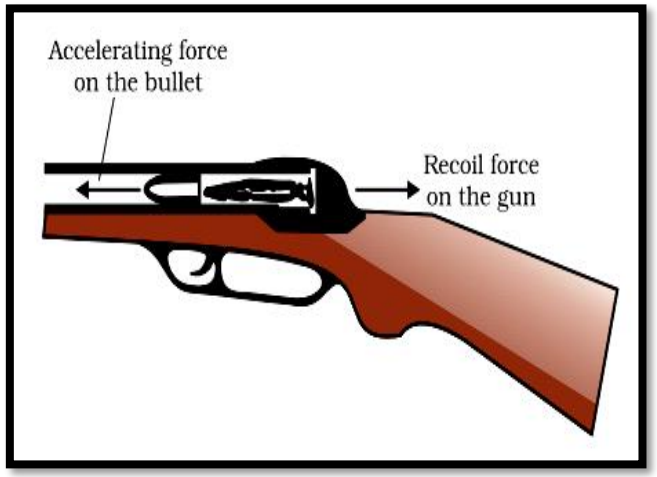
A fielder increasing his time of contact of hands with ball,

So F is reduced.

THIRD LAW OF MOTION

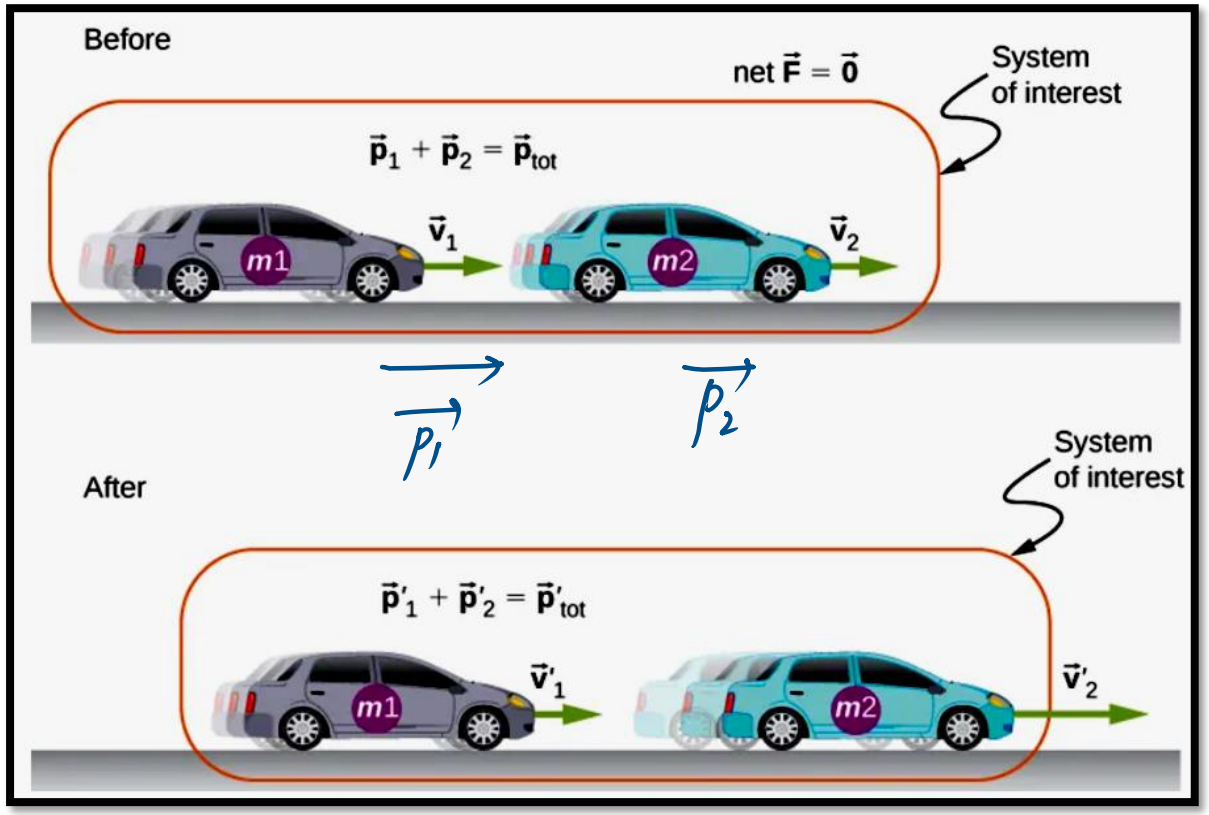
- For every action there is an equal and opposite reaction.
- Forces always occur in pairs. Force on a body A by B is equal and opposite to the force on the body B by A.
- There is no cause- effect relation implied in the third law. The force on A by B and the force on B by A act at the same instant.





CONSERVATION OF LINEAR MOMENTUM

- **If no external forces acts on a system, then its total linear momentum remains conserved.**



$$(p_{total})_{initial} = (p_{total})_{final}$$

$$m_1 v_1 + m_2 v_2 = m_2 v_1' + m_2 v_2'$$

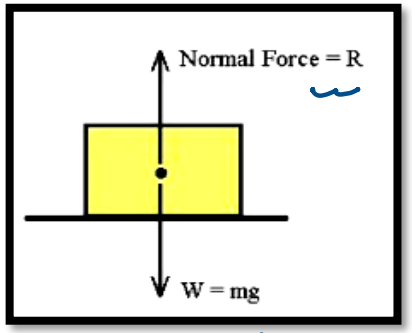
COMMON FORCES IN MECHANICS

- **WEIGHT : It is the force with which a body is pulled towards the centre of the earth due to gravity.**

$W = mg$

- **NORMAL REACTION : It is the force between two surfaces in contact, which is always perpendicular to the surfaces in contact.**

(R)



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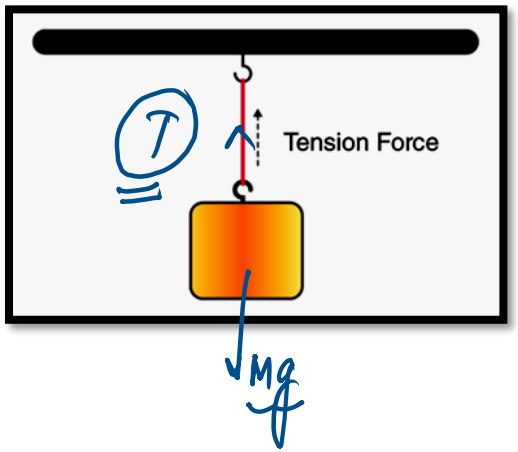
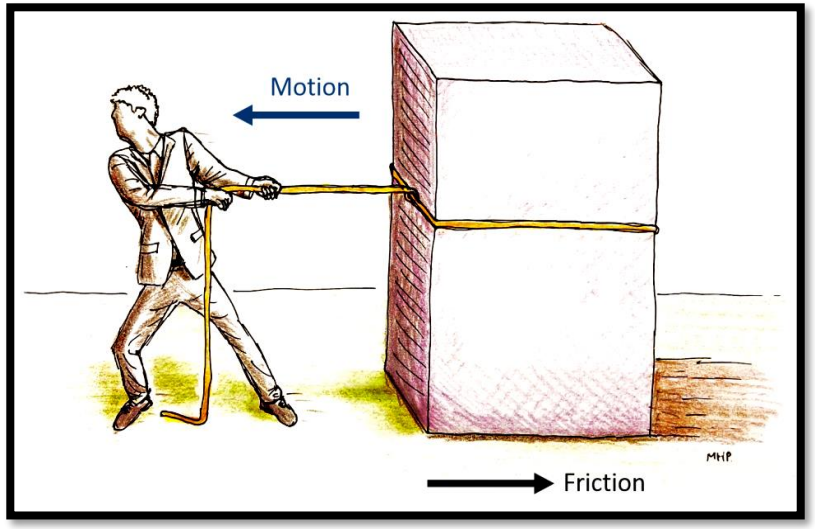
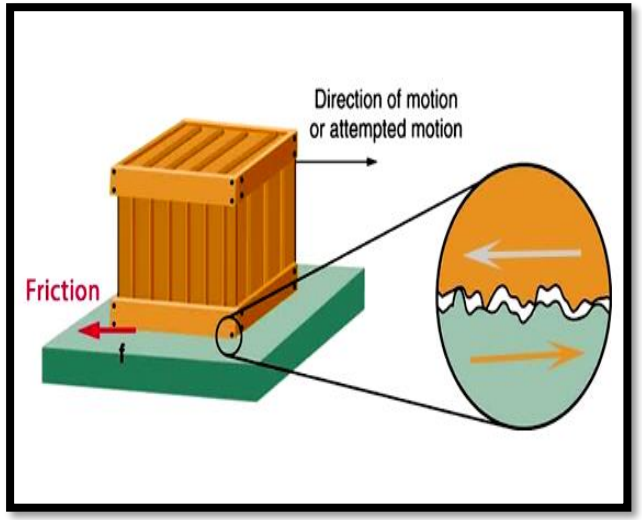
- **TENSION : A pulling Force that stretches a material.**



FRICTION

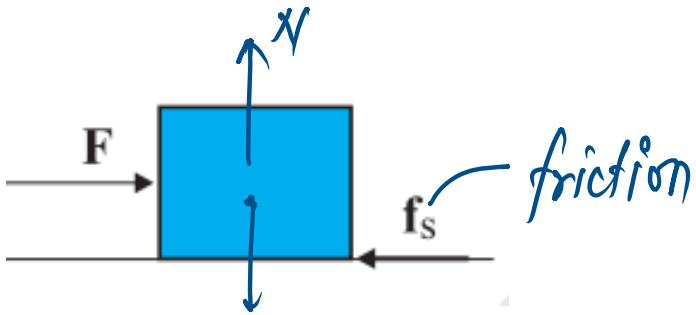
- A force acting on the point of contact of the objects, which opposes the relative motion.
- It acts parallel to the contact surfaces.
- Frictional forces are produced due to intermolecular interactions acting between the molecules of the bodies in contact.





TYPES OF FRICTION

1. **STATIC FRICTION : It is an opposing force which comes into play when one body tends to move over the surface of the other body but actual motion is not taking place. Static friction is a self-adjusting force which increases as the applied force is increased. Static friction opposes impending motion.**



friction

$f_s \propto R$

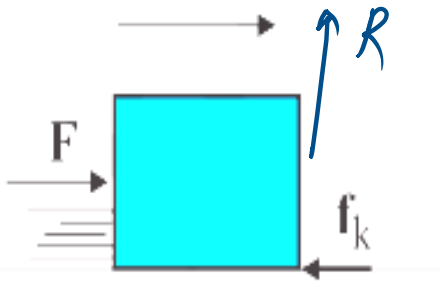
$f_s = \mu R$

$$f_s \leq \mu_s N$$

coefficient of static friction

TYPES OF FRICTION

2. **KINETIC OR SLIDING FRICTION : It is an opposing force that comes into existence when one object is actually moving over the surface of other object.**



Kinetic friction $(f_k) = \mu_k R$ where, μ_k = coefficient of kinetic friction and R = normal reaction.

- **As, rolling friction < sliding friction, therefore it is easier to roll a body than to slide.**

SUMMARY

- Inertia
- Momentum , Force and Impulse
- First , Second and Third Law of Motion
- Conservation of Momentum
- Other Forces
- Friction

SSBCrack EXAMS

1. The SI Unit Of Momentum Is

A. $kgms^{-1}$

B. $kgms^{-2}$

C. $kgm^{-1}s^{-2}$

D. None of these

SSBCrack EXAMS

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A. $kgms^{-1}$

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D. None of these

mass x velocity

kg ms-1

(kgms-1)

SSBCrack EXAMS

2. Car A Of Mass 1500 kg Travelling At 25 m/s Collides With Another Car B Of Mass 1000 kg Travelling At 15 m/s In The Same Direction. After Collision The Velocity of Car A Becomes 20 m/s. What Is The Velocity Of Car B After Collision ?

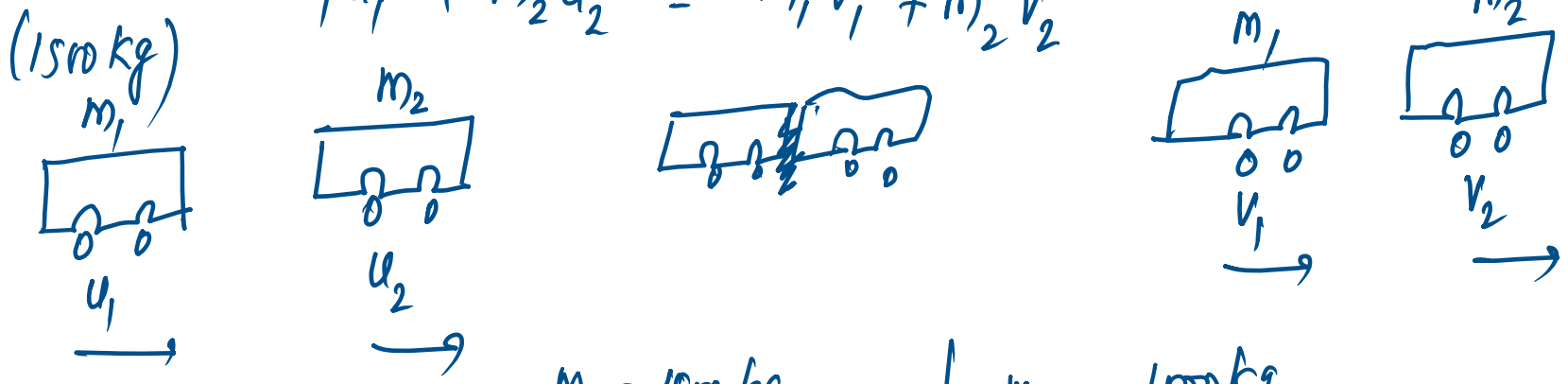
A. 25 m/s

B. 22.5 m/s

C. 36.7 m/s

D. 16.7 m/s

$m_1 u_1 + m_2 u_2 = m_1 v_1 + m_2 v_2$



$m_1 = 1500$ kg
$u_1 = 25$ m/s

$m_2 = 1000$ kg
$u_2 = 15$ m/s

$m_1 = 1500$ kg
$v_1 = 20$ m/s

$m_2 = 1000$ kg
$v_2 = ?$

$$1500 \times 25 + 1000 \times 15 = 1500 \times 20 + 1500 \times v_2$$

$$v_2 = \frac{(15 \times 25 + 15 \times 10) \times 100 - (15 \times 20) \times 100}{1000}$$

$$v_2 = \frac{225 \times 100}{1000} = 22.5 \text{ m/s}$$

$$\frac{1000}{10}$$

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SSBCrack EXAMS

3. When A Body Is Stationary :

A. There Is No Force Acting On It

B. The Forces Acting On It Are Not In Contact With It

C. The Combination Of Forces Acting On It Balances Each Other

D. The Body Is In Vacuum

SSBCrack EXAMS

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SSBCrack EXAMS

4. A Cricket Player Catches A Ball Of Mass 10^{-1} kg Moving With A Velocity Of 25 ms^{-1}. If The Ball Is Caught In 0.1 s , The Force Of The Blow Exerted On The Hand Of The Player Is

A. 4 N

B. 25 N

C. 40 N

D. 250 N

Impulse = change in momentum

$F \times (\text{change in time}) = mv_2 - mv_1$

$F \times 0.1 = (0.1\,kg)(25 - 0)$

$F = 25\ N$

4. A Cricket Player Catches A Ball Of Mass 10^{-1} kg Moving With A Velocity Of 25 ms^{-1}. If The Ball Is Caught In 0.1 s , The Force Of The Blow Exerted On The Hand Of The Player Is

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B. 25 N

C. 40 N

D. 250 N

SSBCrack EXAMS

5. A Football And A Stone Have Same Mass,

A. Both Have Same Inertia ✓

B. Both Have Same Momentum ✗

C. Both Have Different Inertia

D. Both Have Different Momentum ✗

Inertia directly related to mass.

5. A Football And A Stone Has Same Mass,

A. Both Have Same Inertia

B. Both Have Same Momentum

C. Both Have Different Inertia

D. Both Have Different Momentum

6. _____ is responsible for the change in magnitude of speed.

A. Momentum

B. Force

C. Speed

D. Kinetic Energy

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A. Momentum

B. Force

C. Speed

D. Kinetic Energy

SSBCrack EXAMS

7. Which one of the following has maximum inertia ?

(a) An atom

(b) A molecule

(c) A one-rupee coin

(d) A cricket ball

SSBCrack EXAMS

7. Which one of the following has maximum inertia ?

(a) An atom

(b) A molecule

(c) A one-rupee coin

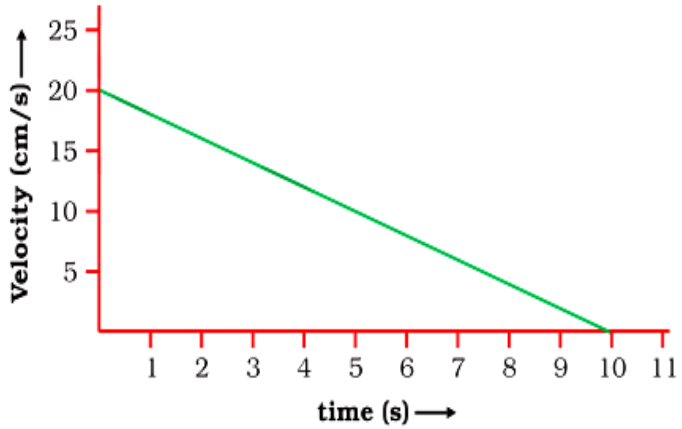
(d) A cricket ball

Answer: D

Max. inertia means max. mass.

SSBCrack EXAMS

8. The velocity-time graph of a ball of mass 20 g moving along a straight line on a long table is shown. How much force does the table exert on the ball to bring it to rest ?



A. 0.0002 N

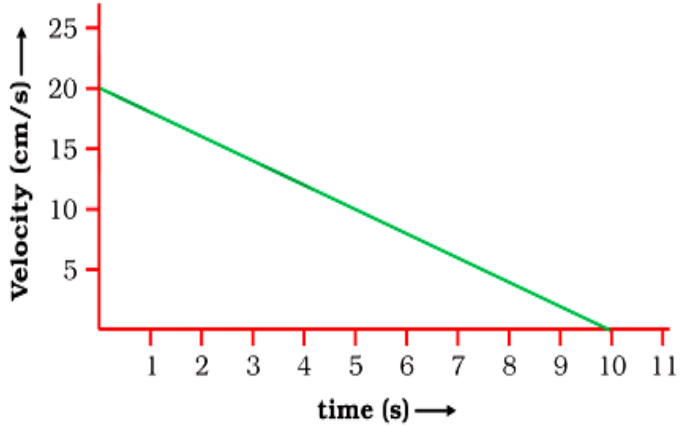
B. - 0.0002 N

C. 0.004 N

D. - 0.0004 N

SSBCrack EXAMS

8. The velocity-time graph of a ball of mass 20 g moving along a straight line on a long table is shown. How much force does the table exert on the ball to bring it to rest ?



A. 0.0002 N

B. - 0.0002 N

C. 0.004 N

D. - 0.0004 N

SSBCrack EXAMS

9. The statement "friction force is a contact force while magnetic force is a non-contact force" is

(a) always true.

(b) true only at 0°C.

(c) a false statement.

(d) either true or false depending upon the temperature of the surroundings.

SSBCrack EXAMS

9. The statement "friction force is a contact force while magnetic force is a non-contact force" is

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(c) a false statement.

(d) either true or false depending upon the temperature of the surroundings.

Answer: A

SSBCrack EXAMS

10. A bullet of mass 10 g is horizontally fired with velocity 300 m s^{-1} from a pistol of mass 1 kg. What is the recoil velocity of the pistol?

(a) 0·3 m s^{-1}

(b) 3 m s^{-1}

(c) –3 m s^{-1}

(d) –0·3 m s^{-1}

SSBCrack EXAMS

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(c) –3 m s^{-1}

(d) –0·3 m s^{-1}

Answer: C

11. An Object Of Mass 2 kg Is Sliding With A Constant Velocity Of 4 m/s On A Frictionless Horizontal Table. The Force Required To Keep The Object Moving With The Same Velocity Is

A. 32 N

B. 0 N

C. 2 N

D. 8 N

11. An Object Of Mass 2 kg Is Sliding With A Constant Velocity Of 4 m/s On A Frictionless Horizontal Table. The Force Required To Keep The Object Moving With The Same Velocity Is

A. 32 N

B. 0 N

C. 2 N

D. 8 N

12. With reference to the third law of motion, Action and Reaction happens at _____.

A. Same Time

B. Different Time

C. Action happens first and then Reaction

D. Reaction happens first and then Action

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SSBCrack EXAMS

13. A boy of mass 52 kg jumps with a horizontal velocity of 2 m/s onto a stationary cart of mass 3 kg. The cart is fixed with frictionless wheels. Which one of the following would be the speed of the cart?

(a) 2·15 m/s

(b) 1·89 m/s

(c) 1·51 m/s

(d) 2·51 m/s

SSBCrack EXAMS

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(d) 2·51 m/s

Answer: B

SSBCrack EXAMS

14. Sand falls vertically on a conveyor belt at a rate of 0·1 kg/s. In order to keep the belt moving at a uniform speed of 2 m/s, the force required to be applied on the belt is :

(a) 0 N

(b) 0·2 N

(c) 1·0 N

(d) 2·0 N

SSBCrack EXAMS

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(c) 1·0 N

(d) 2·0 N

Answer: B

SSBCrack EXAMS

15. The motion of a particle of mass m is described by the relation, $y = ut - \frac{1}{2}gt^2$, where u is the initial velocity of the particle. The force acting on the particle is

(a) $F = m\left(\frac{du}{dt}\right)$

(b) $F = mg$

(c) $F = m\left(\frac{dy}{dt}\right)$

(d) $F = -mg$

SSBCrack EXAMS

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(a) $F = m\left(\frac{du}{dt}\right)$

(b) $F = mg$

(c) $F = m\left(\frac{dy}{dt}\right)$

(d) $F = -mg$

Answer: D

16. A driver accelerates his car first at the rate of 4 m/s^2 and then at the rate of 8 m/s^2. Calculate the ratio of forces exerted by the engine.

A. 2 : 3

B. 3 : 4

C. 2 : 1

D. 1 : 2

16. A driver accelerates his car first at the rate of 4 m/s^2 and then at the rate of 8 m/s^2. Calculate the ratio of forces exerted by the engine.

A. 2 : 3

B. 3 : 4

C. 2 : 1

D. 1 : 2

17. A Goalkeeper In A Game Of Football Pulls His Hands Backwards After Holding The Ball Shot At Goal. This Enables The Goalkeeper To

A. Exert Large Force On The Ball

B. Increase The Force Exerted By The Ball On Hands

C. Increase The Rate Of Change Of Momentum

D. Decrease The Rate Of Change Of Momentum

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18. Type of inertia that tends to Resist the change in case of an athlete often jumps before taking a long jump

A. Inertia of Rest

B. Inertia of Motion

C. Inertia of Direction

D. Uniformly Accelerated Motion

SSBCrack EXAMS

18. Type of inertia that tends to Resist the change in case of an athlete often jumps before taking a long jump

A. Inertia of Rest

B. Inertia of Motion

C. Inertia of Direction

D. Uniformly Accelerated Motion

19. A Sedan Car Of Mass 200 kg Is Moving With A Certain Velocity. It Is Brought To Rest By The Application Of Brakes , Within A Distance Of 20 m When The Average Resistance Being Offered To It Is 500 N. What Was The Velocity Of The Motor Car ?

A. 40 m/s

B. 30 m/s

C. 20 m/s

D. 10 m/s

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C. 20 m/s

D. 10 m/s

20 . In the absence of External force , the velocity _____.

A. Remains constant

B. Vanishes

C. Changes continously

D. None of the Above

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A. **Remains constant**

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D. None of the Above

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PHYSICS

CLASS 8

NAVJYOTI SIR

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