Prachand NEET 2025

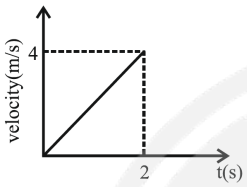
Physics

Laws of motion,

Friction and Circular Motion

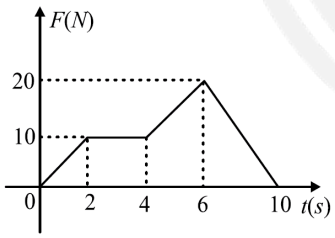
DPP : 01

Q1 For a body of $25\ \text{kg}$ mass, the velocity-time graph is shown in figure. The force acting on the body is:



(A) $25\ \text{N}$
(B) $50\ \text{N}$
(C) $12.5\ \text{N}$
(D) $100\ \text{N}$

Q2 A particle of mass $2\ \text{kg}$ is initially at rest. A force acts on it whose magnitude changes with time. The force time graph is shown below

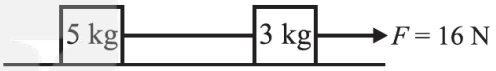


The velocity of the particle after $10\ \text{s}$ is
(A) $20\ \text{ms}^{-1}$
(B) $10\ \text{ms}^{-1}$
(C) $75\ \text{ms}^{-1}$
(D) $50\ \text{ms}^{-1}$

Q3 The linear momentum p of a body moving in one dimension varies with time according to the equation $p = a + bt^2$, where a and b are positive constants. The net force acting on the body is
(A) a constant
(B) proportional to t^2
(C) inversely proportional to t
(D) proportional to t

Q4 A body of mass $2\ \text{kg}$ moving on a horizontal surface with an initial velocity of $4\ \text{m/sec}$ comes to rest after $2\ \text{sec}$. If one wants to keep this body moving on the same surface with a velocity of $4\ \text{m/sec}$, the force required is
(A) $8\ \text{N}$
(B) $4\ \text{N}$
(C) Zero
(D) $2\ \text{N}$

Q5 What is the acceleration of $5\ \text{kg}$ mass?



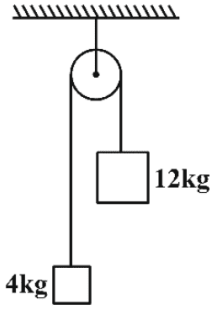
(A) $2\ \text{m/s}^2$
(B) $4\ \text{m/s}^2$
(C) $1\ \text{m/s}^2$
(D) $3\ \text{m/s}^2$

Q6 When a train stops suddenly, passengers in the running train feel an instant jerk in the forward direction because
(A) The back of seat suddenly pushes the passengers forward
(B) Inertia of rest stops the train and takes the body forward
(C) Upper part of the body continues to be in the state of motion whereas the lower part of the body in contact with seat remains at rest
(D) Nothing can be said due to insufficient data

Q7 A block of mass m is released on a smooth inclined plane of inclination θ with the horizontal. The force exerted by the plane on the block has a magnitude
(A) mg
(B) $\frac{mg}{\cos\theta}$
(C) $mg\tan\theta$

(D) $mg\cos\theta$

Q8 In the system shown, pulley is massless and string is light and inextensible. Acceleration with which $4\ \text{kg}$ mass starts moving up is [Take $g = 10\ \text{m/s}^2$]

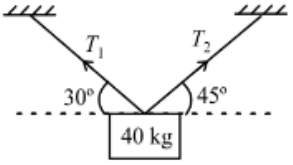


(A) $1\ \text{m/s}^2$
(B) $2\ \text{m/s}^2$
(C) $5\ \text{m/s}^2$
(D) $4\ \text{m/s}^2$

Q9 A body of mass $4\ \text{kg}$ moves in a straight line according to the equation $x = t^3 - 24t$, where x is position in metre and t is time in second. The net force on body at $t = 2\ \text{s}$ will be:
(A) $48\ \text{N}$
(B) $24\ \text{N}$
(C) $16\ \text{N}$
(D) $8\ \text{N}$

Q10 A player catches a ball of $200\ \text{g}$ moving with a speed of $20\ \text{m/s}$. If the time taken to complete the catch is $0.5\ \text{s}$, the force exerted on the player's hand is:-
(A) $8\ \text{N}$
(B) $4\ \text{N}$
(C) $2\ \text{N}$
(D) 0

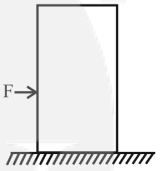
Q11 A body of a mass 40 kg is suspended by two massless strings as shown in the figure, then



(A) $\sqrt{2}T_1 - \sqrt{3}T_2 = 0$ (B) $\sqrt{3}T_1 + \sqrt{2}T_2 = 0$
(C) $\sqrt{3}T_1 - \sqrt{2}T_2 = 0$ (D) $T_1 - T_2 = 0$

Q12 Consider the statement(s) given below and select the correct option.
Statement-I: Action - reaction pair should act on same body.
Statement-II: Action - reaction pair can be of different nature.
(A) Statement I is correct, statement II is incorrect.
(B) Statement I is incorrect, statement II is correct.
(C) Both statements I and II are correct.
(D) Both statements I and II are incorrect.

Q13 A rectangular block is placed on a rough horizontal surface in two different ways as shown, then

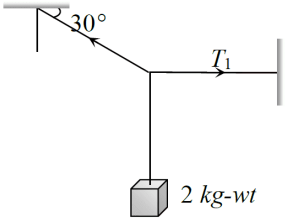


(a)

(b)

(A) friction will be more in case (a)
(B) friction will be more in case (b)
(C) friction will be equal in both the case
(D) friction depends on the relation among its dimensions

Q14 A body of weight $2\ \text{kg}$ is suspended as shown in the figure. The tension T_1 in the horizontal string (in kg wt) is



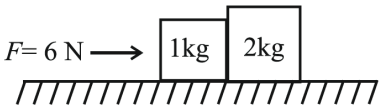
(A) $2/\sqrt{3}$
(B) $\sqrt{3}/2$

(C) $2\sqrt{3}$
(D) 2

Q15 **Assertion :** If the net external force on the body is zero, then its acceleration is zero.
Reason : Acceleration does not depend on force.
(A) Both Assertion and Reason are true and the Reason is the correct explanation of the Assertion.
(B) Both Assertion and Reason are true but Reason is not the correct explanation of the Assertion.
(C) Assertion is true statement but Reason is false.
(D) Both Assertion and Reason are false statements.

Q16 A gun fires a bullet of mass $50\ \text{gm}$ with a velocity of $30\ \text{m sec}^{-1}$. Because of this, the gun is pushed back with a velocity of $1\ \text{m sec}^{-1}$. The mass of the gun is
(A) $15\ \text{kg}$
(B) $30\ \text{kg}$
(C) $1.5\ \text{kg}$
(D) $20\ \text{kg}$

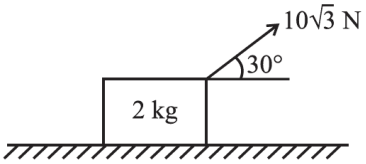
Q17 Arrangement of two block system is as shown. The net force acting on $1\ \text{kg}$ and $2\ \text{kg}$ blocks are (assuming the surfaces to be frictionless) respectively :



(A) $4\ \text{N}, 8\ \text{N}$
(B) $1\ \text{N}, 2\ \text{N}$
(C) $2\ \text{N}, 4\ \text{N}$
(D) $3\ \text{N}, 6\ \text{N}$

Q18 A man is standing at a spring platform. Reading of spring balance is $60\ \text{kg}$ wt. If man jumps outside platform, then reading of spring balance
(A) First increases then decreases to zero
(B) Decreases
(C) Increases
(D) Remains same

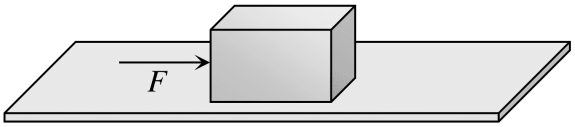
Q19 A block is placed on a surface as shown in the diagram given below. Coefficient of friction between the block and surface is $\sqrt{3}$, then the friction force acting on the block will be: $(g = 10\ \text{m/s}^2)$



(A) $150\ \text{N}$
(B) $15\ \text{N}$
(C) $30\ \text{N}$
(D) $100\ \text{N}$

Q20 A car is moving on a horizontal circular track of radius $0.2\ \text{km}$ with a constant speed. If coefficient of friction between tyres of car and road is 0.45, then speed of car may not be [Take $g = 10\ \text{m/s}^2$]
(A) $15\ \text{m/s}$
(B) $30\ \text{m/s}$
(C) $20\ \text{m/s}$
(D) $40\ \text{m/s}$

Q21 A block of mass $2\ \text{kg}$ is kept on the floor. The coefficient of static friction is 0.4. If a force F of $2.5\ \text{N}$ is applied on the block as shown in the figure, the frictional force between the block and the floor will be



(A) $2.5\ \text{N}$
(B) $5\ \text{N}$
(C) $7.84\ \text{N}$
(D) $10\ \text{N}$

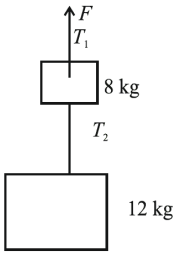
Q22 A small metallic sphere of mass m is suspended from the ceiling of a car accelerating on a horizontal road with constant acceleration a. The tension in the string attached with metallic sphere is
(A) mg
(B) $m(g + a)$

(C) $m(g-a)$
(D) $m\sqrt{g^2+a^2}$

Q23 A stone of mass m is tied to a string of length l and rotated in a circle with a constant speed v. If the string is released, the stone flies
(A) Radially outward
(B) Radially inward
(C) Tangentially outward
(D) With an acceleration $\frac{mv^2}{l}$

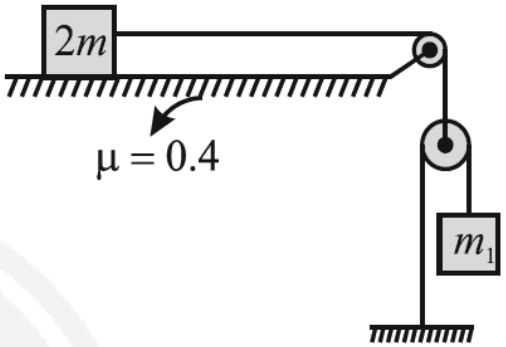
Q24 **Assertion:** A player lowers his hands while catching a cricket ball and suffers less reaction force.
Reason: The time of catch increases when cricketer lowers its hand while catching a ball.
(A) Both Assertion and Reason are true and the Reason is the correct explanation of Assertion.
(B) Both Assertion and Reason are true but the Reason is not the correct explanation of the Assertion.
(C) Assertion is true but Reason is false.
(D) Both Assertion and Reason are false.

Q25 In the diagram, two blocks are connected by a string. The upper block is suspended by a separate string. When a force $F = 600\ \text{N}$ is exerted on the upper string, both blocks accelerate upward at a rate of $a\ \text{m/s}^2$. If we denote the tensions in the two segments as T_1 and T_2, given that the acceleration due to gravity (g) is $10\ \text{m/s}^2$, which of the following is/are True ?



I. $a = 20\ \text{m/s}^2, T_2 = 360\ \text{N}$
II. $T_1 = 600\ \text{N}, T_2 = 360\ \text{N}$
III. $a = 40\ \text{m/s}^2, T_1 = 600\ \text{N}$
IV. $a = 20\ \text{m/s}^2, T_2 = 600\ \text{N}$
(A) I and III are correct
(B) I and II are correct
(C) I and IV are correct
(D) III and II are correct

Q26 The maximum value of the block m_1 for which the system will remain in equilibrium (coefficient of friction between block $2m$ and plane surface is $\mu = 0.4$, Pulleys are massless) is;



(A) $\frac{2}{5}m$
(B) $\frac{m}{2}$
(C) $\frac{4}{5}m$
(D) $\frac{3}{5}m$

Q27 A body of mass $2\ \text{kg}$ is lying on a rough inclined plane of inclination 30°. The magnitude of force parallel to the incline needed to make the block just move up the plane, if the coefficient of static friction is 0.3, is: [Take g = 10 m/s^2]
(A) $(5+\sqrt{3})\ \text{N}$
(B) $(5+3\sqrt{3})\ \text{N}$
(C) $(10+3\sqrt{3})\ \text{N}$
(D) $(10+\sqrt{3})\ \text{N}$

Q28 Which one of the following statements is incorrect?
(A) Frictional force opposes the relative motion
(B) Limiting value of static friction is directly proportional to normal reaction
(C) Rolling friction is smaller than sliding friction
(D) Coefficient of sliding friction has dimensions of length

Q29 **Assertion:** On a rainy day, it is difficult to drive a car or bus at high speed.
Reason: The value of coefficient of friction is lowered due to wetting of the surface.

(A) If both Assertion and Reason are true and the Reason is the correct explanation of Assertion.
(B) If both Assertion and Reason are true but the Reason is not the correct explanation of the Assertion.
(C) If Assertion is true but Reason is false.
(D) If both Assertion and Reason are false.

Q30 A shell, initially at rest, suddenly explodes into two equal fragments A and B. Which one of the following is observed?
(A) *A* and *B* move in the same direction at the same speed.
(B) *A* and *B* move at right angles to each other at the same speed.
(C) *A* and *B* move in opposite directions at the same speed.
(D) *A* and *B* move in any direction at the same speed.

Answer Key

Q1	(B)	Q16	(C)
Q2	(D)	Q17	(C)
Q3	(D)	Q18	(A)
Q4	(B)	Q19	(B)
Q5	(A)	Q20	(D)
Q6	(C)	Q21	(A)
Q7	(D)	Q22	(D)
Q8	(C)	Q23	(C)
Q9	(A)	Q24	(A)
Q10	(A)	Q25	(B)
Q11	(C)	Q26	(A)
Q12	(D)	Q27	(C)
Q13	(C)	Q28	(D)
Q14	(C)	Q29	(A)
Q15	(C)	Q30	(C)

Hints & Solutions

Note: scan the QR code to watch video solution

Q1 Text Solution:

(B)

$$\mathrm{F} = \mathrm{m} \times \mathrm{a} = 25 \times \frac{dv}{dt} = 25 \times 2 = 50\ \mathrm{N}$$

Video Solution:

Q2 Text Solution:

(D)

Area under the F-t cure = change in momentum

$$\frac{1}{2} \times 2 \times (10) + 2 \times 10 + \frac{1}{2}(10 + 20) \times 2 + \frac{1}{2} \times 4 \times 20 = m(v - u)$$

$$\Rightarrow\ 10 + 20 + 30 + 40 = 2(v - 0)$$

Or $100 = 2v$

Or $v = 50\ \mathrm{ms}^{-1}$.

Video Solution:

Q3 Text Solution:

(D)

$$F = \frac{dp}{dt} \equiv \frac{d}{dt}\left(a + bt^2\right) = 2bt \therefore F \propto t$$

Video Solution:

Q4 Text Solution:

(B)

$$u = 4\ \mathrm{m/s}, v = 0, t = 2\mathrm{sec}$$

$$v = u + at \Rightarrow 0 = 4 + 2a \Rightarrow a = -2\ \mathrm{m/s}^2$$

$$\therefore\ \text{Retarding force } = ma = 2 \times 2 = 4\ \mathrm{N}$$

This force opposes the motion. If the same amount of force is applied in forward direction, then the body will move with constant velocity.

Video Solution:

Q5 Text Solution:

(A)

$$a = \frac{F}{m_1 + m_2} = \frac{16}{8} = 2\ \mathrm{m/s}^2$$

Video Solution:

Q6 Text Solution:

(C)

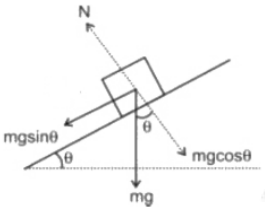
When a train stops suddenly, the lower part of the body comes to rest, but the upper part of the body continues to move forward due to inertia.

So, passengers feel an instant jerk in the forward direction.

Video Solution:

Q7 **Text Solution:**

(D)



Force exerted by the plane on the block will be N

$N = mg\cos\theta$

Video Solution:

Q8 **Text Solution:**

(C)

$$a = \frac{(m_1 - m_2)\, g}{m_1 + m_2}$$

$a = \frac{12-4}{12+4} \times 10 = \frac{8}{16} \times 10 = 5\ \mathrm{m/s^2}$

Video Solution:

Q9 **Text Solution:**

(A)

$$v = \frac{dx}{dt}, a = \frac{dv}{dt}$$
$$F = ma$$

Sol. $v = \frac{dx}{dt} = 3t^2 - 24$

Now, $a = \frac{dv}{dt} = 6t$

$$F = ma = 4 \times 6t = 24t$$

At $t = 2s$

$$F = 24 \times 2 = 48\ \mathrm{N}$$

Video Solution:

Q10 **Text Solution:**

(A)

$$F = \left|\frac{m(v-u)}{t}\right| = \left|\frac{0.2(0-20)}{0.5}\right| = 8\ \mathrm{N}$$

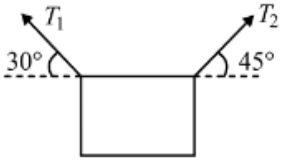
Magnitude of force exerted on player's hand is 8 N

Video Solution:

Q11 **Text Solution:**

(C)

From $F \cdot B. D$ of block



$$T_1 \cos 30^\circ = T_2 \cos 45^\circ$$
$$\frac{T_1\sqrt{3}}{2} - \frac{T_2}{\sqrt{2}} = 0$$
$$\sqrt{3}T_1 - \sqrt{2}T_2 = 0$$

Video Solution:

Q12 **Text Solution:**

(D)

Action and reaction pair should act on different bodies and should be of same nature.

Both statements I and II are incorrect.

Video Solution:

Q13 **Text Solution:**

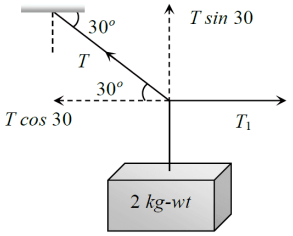
(C)

Friction does not depend on area of surface in contact. So, friction will be equal in both the cases.

Video Solution:

Q14 **Text Solution:**

(C)



$$T \sin 30 = 2 \text{ kg wt}$$
$$\Rightarrow T = 4 \text{ kg wt}$$
$$T_1 = T \cos 30^\circ$$
$$= 4 \cos 30^\circ = 2\sqrt{3} \text{ kg wt}$$

Video Solution:

Q15 **Text Solution:**

(C)

According to Newton's second law

Acceleration $= \frac{\text{Force}}{\text{Mass}}$ i.e., if net external force on the body is zero then acceleration will be zero.

Video Solution:

Q16 **Text Solution:**

(C)

Linear momentum will be conserved

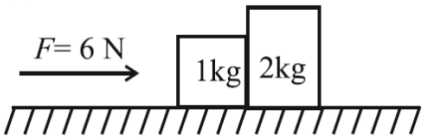
$m_B v_B - m_G v_G = 0$

$$m_G = \frac{m_B v_B}{v_G} = \frac{50 \times 10^{-3} \times 30}{1} = 1.5 \text{ kg}$$

Video Solution:

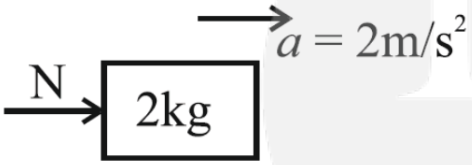
Q17 Text Solution:

(C)



$$\text{Acceleration of the system} = \frac{F_{\text{ext}}}{M_{\text{Total}}}$$
$$= \frac{6}{3} = 2\ \text{m/s}^2$$

for 2 kg block



$$\text{N} = 2(2) = 4\ \text{N}$$

for 1 kg block

$$F_{\text{net}} = 6 - 4 = 2\ \text{N}$$

Video Solution:

Q18 Text Solution:

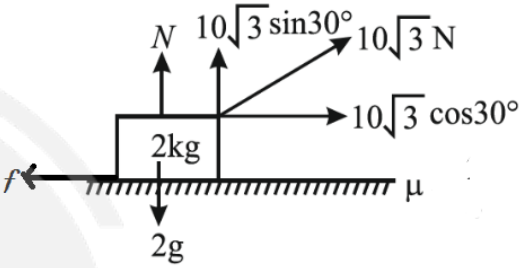
(A)

For jumping he presses the spring platform, so the reading of spring balance increases first and then, as the man's feet leave the contact of the spring balance, the reading of the spring balance decreases to zero.

Video Solution:

Q19 Text Solution:

(B)



$$(f)_l = \mu N = \mu\,(2g - 10\sqrt{3}\sin 30^\circ)$$
$$= \sqrt{3}(20 - 5\sqrt{3}) = 19.64\ \text{N}$$
$$(f)_l \geq 10\sqrt{3}\cos 30^\circ$$

So, $f = 10\sqrt{3} \times \frac{\sqrt{3}}{2} = 15\ \text{N}$

Video Solution:

Q20 Text Solution:

(D)

$$R = 0.2 \times 10^3\ \text{m}$$
$$\mu = 0.45$$
$$V_{\max} = \sqrt{\mu R g} = \sqrt{\frac{45}{100} \times 2 \times 100 \times 10}$$
$$V_{\max} = \sqrt{900} = 30\ \text{m/s}$$

Maximum speed of circular motion of the car possible is 30 m/s. So V = 40 m/s is not possible.

Video Solution:

Q21 Text Solution:

(A)

Applied force $= 2.5\ \text{N}$

Limiting friction

$= \mu mg = 0.4 \times 2 \times 10 = 8\ \text{N}$

For the given condition applied force is lesser than limiting friction.

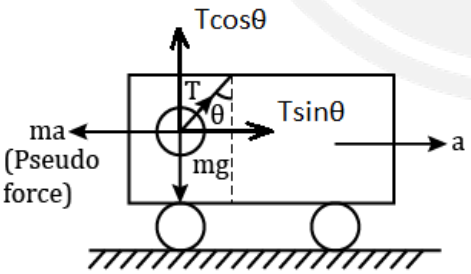
Static friction on a body = Applied force

$= 2.5\ \text{N}$

Video Solution:

Q22 Text Solution:

(D)



$$T = \sqrt{(ma)^2 + (mg)^2} = m\sqrt{a^2 + g^2}$$

Video Solution:

Q23 Text Solution:

(C)

For a stone rotated in a circle by a string, the centripetal force is provided by the tension in the string. When the stone is in circular motion, the instantaneous velocity will be tangential to the path at every point

If the string is released, the stone flies in the direction of instantaneous velocity i.e tangentially outwards.

Video Solution:

Q24 Text Solution:

(A)

Here the force which the ball exerts on our hand times the time duration of force is equal to the change in momentum.

$F \times \Delta t = \Delta p$

The time of catch increases when cricketer lowers its hand while catching a ball. So by increasing the duration we are reducing the effect of force on our hand.

Both Assertion and Reason are true and the Reason is the correct explanation of Assertion.

Video Solution:

Q25 Text Solution:

(B)

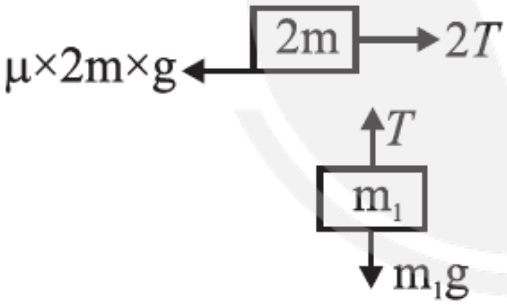
$$F-(8+12)g=(8+12)a$$
$$600-200=20a$$
$$400=20a$$
$$a=20\ \mathrm{m/s^2}$$

$$T_2-12g=12a$$
$$T_2=120+(12\times 20)$$
$$=120+240$$
$$=360N$$
$$F=T_1=600N$$

Video Solution:

Q26 Text Solution:

(A)



$$2T=\mu\times 2mg \quad \ldots..(1)$$
$$T=m_1g \quad \ldots.(2)$$
Using (1) and (2)
$$\Rightarrow 2m_1g=\mu\times 2mg$$
$$m_1=\mu\times m=0.4m=\frac{2}{5}m$$

Video Solution:

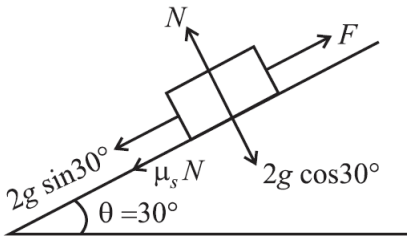
Q27 Text Solution:

(C)

From FBD of body

To just move up

$$F=(2g\sin 30^\circ+\mu_S N)$$
$$N=(2g\cos 30^\circ)$$



$$F_{\min}=\left(2\times 10\times\frac{1}{2}\right)$$
$$+\left(0.3\times 2\times 10\times\frac{\sqrt{3}}{2}\right)$$
$$=(10+3\sqrt{3})\mathrm{N}$$

Video Solution:

Q28 Text Solution:

(D)

Frictional force opposes the relative motion between two surfaces in contact with each other.

$$f=\mu N$$
$$\Rightarrow \mu=\frac{f}{N}$$

Coefficient of sliding friction is dimensionless quantity.

Statement given in option D is incorrect.

Video Solution:

Q29 Text Solution:

(A)

The value of coefficient of friction is lowered due to wetting of the surface. This can cause the car or bus to not stop at the desired point and increase the chances of skidding. Thus, On a rainy day, it is difficult to drive a car or bus at high speed.

Video Solution:

Q30 **Text Solution:**

(C)

$F_{ext} = 0$

So, Momentum will be conserved.

$P_i = P_f$

$0 = m\overrightarrow{v_A} + m\overrightarrow{v_B}$

$\Rightarrow \overrightarrow{v_A} = -\overrightarrow{v_B}$

A and *B* move in opposite directions at the same speed.

Video Solution: