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CLASS 11 PHYSICS · NCERT CHAPTER 4 · IMU CET PRACTICE

Laws of Motion

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Questions: 45 MCQs

Each question has exactly one correct option. Attempt all questions first, then check the Answer Key and Solutions at the end.

- 1 Newton's first law of motion gives the concept of
 - (A) inertia
 - (B) work
 - (C) energy
 - (D) momentum
- 2 Inertia of a body depends on its
 - (A) shape
 - (B) volume
 - (C) velocity
 - (D) mass
- 3 A force of 10 N acts on a body of mass 2 kg for 3 s. The change in momentum is
 - (A) 60 kg m/s
 - (B) 6.67 kg m/s
 - (C) 15 kg m/s
 - (D) 30 kg m/s
- 4 A cricket player lowers his hands while catching a ball in order to
 - (A) reduce the time of impact
 - (B) increase the force on the ball
 - (C) increase the time of impact and reduce the force
 - (D) reduce the change in momentum
- 5 A bullet of mass 10 g is fired from a gun of mass 5 kg with speed 500 m/s. The recoil speed of the gun is
 - (A) 1 m/s
 - (B) 0.5 m/s
 - (C) 10 m/s
 - (D) 2 m/s
- 6 A man of mass 60 kg stands on a weighing machine in a lift accelerating upward at 2 m/s^2 . The reading is ($g = 10 \text{ m/s}^2$)
 - (A) 120 N
 - (B) 720 N
 - (C) 600 N
 - (D) 480 N
- 7 In a lift falling freely, the apparent weight of a person is
 - (A) half the true weight
 - (B) zero
 - (C) equal to true weight
 - (D) twice the true weight
- 8 A lift is moving downward with acceleration 3 m/s^2 . A 50 kg man inside it has apparent weight ($g = 10 \text{ m/s}^2$)
 - (A) 150 N
 - (B) 650 N
 - (C) 500 N
 - (D) 350 N



- 9 Two blocks of masses 3 kg and 2 kg on a smooth surface are pushed by a 10 N force applied on the 3 kg block. The contact force between them is
(A) 2 N (B) 4 N
(C) 6 N (D) 10 N
- 10 Two masses 4 kg and 6 kg are connected by a string over a frictionless pulley (Atwood machine). The acceleration of the system is ($g = 10 \text{ m/s}^2$)
(A) 4 m/s^2 (B) 2 m/s^2
(C) 5 m/s^2 (D) 1 m/s^2
- 11 In the Atwood machine with 4 kg and 6 kg masses, the tension in the string is ($g = 10 \text{ m/s}^2$)
(A) 48 N (B) 50 N
(C) 40 N (D) 60 N
- 12 The coefficient of static friction is generally
(A) less than the coefficient of kinetic friction
(B) equal to the coefficient of kinetic friction
(C) greater than the coefficient of kinetic friction
(D) equal to zero
- 13 A block of mass 5 kg rests on a horizontal surface with $\mu_s = 0.4$. The minimum horizontal force to start moving it is ($g = 10 \text{ m/s}^2$)
(A) 2 N (B) 50 N
(C) 20 N (D) 12.5 N
- 14 A block of 2 kg lies on a rough floor ($\mu = 0.5$). A horizontal force of 4 N is applied. The friction force acting on it is ($g = 10 \text{ m/s}^2$)
(A) 6 N (B) 10 N
(C) zero (D) 4 N
- 15 The angle of repose θ and the coefficient of static friction μ are related by
(A) $\mu = \sin \theta$ (B) $\mu = \cot \theta$
(C) $\mu = \tan \theta$ (D) $\mu = \cos \theta$
- 16 A block slides down a smooth inclined plane of inclination 30° . Its acceleration is ($g = 10 \text{ m/s}^2$)
(A) 5 m/s^2 (B) 2.5 m/s^2
(C) 8.66 m/s^2 (D) 10 m/s^2
- 17 A block slides down a rough incline of 45° with $\mu = 0.5$. Its acceleration is ($g = 10 \text{ m/s}^2$)
(A) 3.54 m/s^2 (B) 2.5 m/s^2
(C) 7.07 m/s^2 (D) 5 m/s^2
- 18 The maximum speed with which a car can take a turn of radius 40 m on a level road with $\mu = 0.4$ is ($g = 10 \text{ m/s}^2$)
(A) 4 m/s (B) 12.6 m/s
(C) 40 m/s (D) 16 m/s
- 19 The ideal banking angle θ for a speed v on a curve of radius r satisfies
(A) $\cos \theta = v^2/(rg)$ (B) $\sin \theta = v^2/(rg)$
(C) $\tan \theta = v^2/v^2$ (D) $\tan \theta = v^2/(rg)$



- 20** The centripetal force needed for a car to take a turn on a level road is provided by
(A) engine force (B) normal reaction
(C) friction between tyres and road (D) weight of the car
- 21** A stone of mass 0.5 kg is whirled in a horizontal circle of radius 1 m at 4 m/s. The tension in the string is (neglect gravity)
(A) 8 N (B) 4 N
(C) 2 N (D) 16 N
- 22** Action and reaction forces
(A) are always perpendicular (B) act on different bodies
(C) act on the same body (D) cancel each other
- 23** A horse pulls a cart. The force that makes the horse move forward is
(A) the force exerted by the horse on the cart
(B) the horse's weight
(C) the reaction of the ground on the horse's hooves
(D) the force exerted by the cart on the horse
- 24** A rocket works on the principle of conservation of
(A) mass (B) linear momentum
(C) angular momentum (D) energy only
- 25** A force $F = 6t$ N acts on a 2 kg body initially at rest. Its velocity after 2 s is
(A) 24 m/s (B) 3 m/s
(C) 6 m/s (D) 12 m/s
- 26** A ball of mass 0.2 kg moving at 10 m/s hits a wall and rebounds with the same speed. The impulse on the ball is
(A) zero (B) 1 N s
(C) 4 N s (D) 2 N s
- 27** A 0.15 kg ball moving at 20 m/s is stopped in 0.05 s. The average force applied is
(A) 150 N (B) 30 N
(C) 3 N (D) 60 N
- 28** Three blocks of masses 1 kg, 2 kg and 3 kg are connected by strings on a smooth table and pulled by 12 N applied on the 3 kg block. The tension in the string between 1 kg and 2 kg blocks is
(A) 4 N (B) 2 N
(C) 12 N (D) 6 N
- 29** A body is in equilibrium under three concurrent forces. Then
(A) the vector sum of the forces is zero
(B) the forces must be mutually perpendicular
(C) the forces must be equal in magnitude
(D) the body must be at rest



- 30** A mass of 10 kg hangs from a rope. The rope is pulled sideways by a horizontal force so that it makes 30° with the vertical. The horizontal force is ($g = 10 \text{ m/s}^2$)
- (A) 86.6 N (B) 57.7 N
(C) 50 N (D) 100 N
-
- 31** A block of mass m is on a smooth incline of angle θ . The normal reaction is
- (A) $mg \tan \theta$ (B) $mg \sin \theta$
(C) mg (D) $mg \cos \theta$
-
- 32** A car accelerates from rest to 20 m/s in 10 s. If the car's mass is 1000 kg, the net force on it is
- (A) 200 N (B) 20000 N
(C) 1000 N (D) 2000 N
-
- 33** Friction force is independent of
- (A) the normal reaction
(B) the area of contact (for given normal force)
(C) the nature of surfaces
(D) the roughness of surfaces
-
- 34** Rolling friction is generally
- (A) much smaller than sliding friction (B) equal to sliding friction
(C) equal to static friction (D) greater than sliding friction
-
- 35** A body of mass 2 kg moving at 4 m/s is acted on by a force of 8 N opposite to its motion. It will come to rest in
- (A) 4 s (B) 0.5 s
(C) 1 s (D) 2 s
-
- 36** A man pushes a wall but the wall does not move. Which statement is correct?
- (A) The force of the man is greater than the reaction
(B) The man does work on the wall
(C) The wall exerts no force on the man
(D) The wall exerts an equal and opposite force on the man
-
- 37** A block of mass 4 kg is pulled on a rough surface ($\mu = 0.25$) by a horizontal force of 20 N. Its acceleration is ($g = 10 \text{ m/s}^2$)
- (A) 5 m/s^2 (B) 2 m/s^2
(C) 2.5 m/s^2 (D) 1.25 m/s^2
-
- 38** A body of mass 5 kg is acted on by two perpendicular forces of 6 N and 8 N. Its acceleration is
- (A) 2 m/s^2 (B) 2.8 m/s^2
(C) 1.4 m/s^2 (D) 0.4 m/s^2
-
- 39** The minimum speed at the top of a vertical circle of radius R for a body tied to a string to complete the circle is
- (A) $\sqrt{2gR}$ (B) $\sqrt{5gR}$
(C) zero (D) $\sqrt{gR}$
-

- 40** A pendulum bob of mass 0.1 kg on a 1 m string passes the lowest point at 2 m/s. The tension at that point is ($g = 10 \text{ m/s}^2$)
- (A) 1 N (B) 0.6 N
(C) 0.4 N (D) 1.4 N
-
- 41** An object of mass 3 kg is at rest. If a force $F = (6\hat{i} + 8\hat{j}) \text{ N}$ acts on it, its speed after 1 s is
- (A) $14/3 \text{ m/s}$ (B) $10/3 \text{ m/s}$
(C) 30 m/s (D) 10 m/s
-
- 42** The direction of kinetic friction is always
- (A) opposite to the relative motion between surfaces
(B) perpendicular to the surface
(C) along the direction of motion
(D) towards the centre
-
- 43** A monkey of mass 20 kg climbs a rope that can withstand a maximum tension of 300 N. The maximum acceleration with which it can climb up is ($g = 10 \text{ m/s}^2$)
- (A) 15 m/s^2 (B) 2.5 m/s^2
(C) 5 m/s^2 (D) 10 m/s^2
-
- 44** A block is placed on a rough incline. As the angle of the incline is slowly increased, the block starts sliding at 37° . The coefficient of static friction is ($\tan 37^\circ = 0.75$)
- (A) 0.75 (B) 0.6
(C) 1.33 (D) 0.8
-
- 45** A body of mass 1 kg moving in a circle of radius 2 m completes one revolution in π seconds. The centripetal force on it is
- (A) 8 N (B) 16 N
(C) 2 N (D) 4 N
-

Answer Key

1	2	3	4	5	6	7	8	9	10
A	D	D	C	A	B	B	D	B	B
11	12	13	14	15	16	17	18	19	20
A	C	C	D	C	A	A	B	D	C
21	22	23	24	25	26	27	28	29	30
A	B	C	B	C	C	D	B	A	B
31	32	33	34	35	36	37	38	39	40
D	D	B	A	C	D	C	A	D	D
41	42	43	44	45					
B	A	C	A	A					

Hints & Solutions

- (A)** The first law states that a body continues in its state of rest or uniform motion unless acted on by a net force — the property called inertia.
- (D)** Mass is the quantitative measure of inertia.
- (D)** $\Delta p = F \times t = 10 \times 3 = 30 \text{ kg m/s}$.
- (C)** $F = \Delta p / \Delta t$; increasing Δt reduces the average force on the hands.
- (A)** Momentum conservation: $0.01 \times 500 = 5 \times V \rightarrow V = 1 \text{ m/s}$.
- (B)** $N = m(g + a) = 60 \times 12 = 720 \text{ N}$.
- (B)** $N = m(g - a)$ with $a = g \rightarrow N = 0$ (weightlessness).
- (D)** $N = m(g - a) = 50 \times 7 = 350 \text{ N}$.
- (B)** $a = 10/5 = 2 \text{ m/s}^2$. Contact force on $2 \text{ kg} = 2 \times 2 = 4 \text{ N}$.
- (B)** $a = (m_2 - m_1)g / (m_1 + m_2) = 2 \times 10/10 = 2 \text{ m/s}^2$.
- (A)** $T = 2m_1m_2g / (m_1 + m_2) = 2 \times 4 \times 6 \times 10/10 = 48 \text{ N}$.
- (C)** Limiting static friction exceeds kinetic friction, so $\mu_s > \mu_k$.
- (C)** $f_{\max} = \mu_s mg = 0.4 \times 50 = 20 \text{ N}$.
- (D)** Limiting friction $= 0.5 \times 20 = 10 \text{ N} > 4 \text{ N}$, so the block stays at rest and static friction $=$ applied force $= 4 \text{ N}$.
- (C)** At the angle of repose, $mg \sin \theta = \mu mg \cos \theta \rightarrow \mu = \tan \theta$.
- (A)** $a = g \sin \theta = 10 \times 0.5 = 5 \text{ m/s}^2$.
- (A)** $a = g(\sin \theta - \mu \cos \theta) = 10 \times 0.707 \times 0.5 \approx 3.54 \text{ m/s}^2$.
- (B)** $v_{\max} = \sqrt{(\mu rg)} = \sqrt{(0.4 \times 40 \times 10)} = \sqrt{160} \approx 12.6 \text{ m/s}$.
- (D)** Without friction, $N \sin \theta = mv^2/r$ and $N \cos \theta = mg \rightarrow \tan \theta = v^2/(rg)$.
- (C)** On a flat road, the static friction acting towards the centre supplies the centripetal force.
- (A)** $T = mv^2/r = 0.5 \times 16/1 = 8 \text{ N}$.
- (B)** By Newton's third law, they are equal and opposite but act on different bodies, so they never cancel.



23. (C) The horse pushes the ground backward; the ground's reaction pushes the horse (and system) forward.
24. (B) Gases are expelled backward with momentum, so the rocket gains equal and opposite momentum.
25. (C) Impulse = $\int_0^2 6t \, dt = 3t^2 = 12 \, \text{N s} \rightarrow v = 12/2 = 6 \, \text{m/s}$.
26. (C) $\Delta p = m(v - (-v)) = 0.2 \times 20 = 4 \, \text{N s}$.
27. (D) $F = \Delta p / \Delta t = 0.15 \times 20 / 0.05 = 60 \, \text{N}$.
28. (B) $a = 12/6 = 2 \, \text{m/s}^2$. The string between 1 kg and 2 kg pulls only the 1 kg block: $T = 1 \times 2 = 2 \, \text{N}$.
29. (A) For translational equilibrium, $\Sigma F = 0$ (the body may be at rest or in uniform motion).
30. (B) $T \cos 30^\circ = 100$, $T \sin 30^\circ = F \rightarrow F = 100 \tan 30^\circ \approx 57.7 \, \text{N}$.
31. (D) Perpendicular to the incline, N balances $mg \cos \theta$.
32. (D) $a = 2 \, \text{m/s}^2 \rightarrow F = 1000 \times 2 = 2000 \, \text{N}$.
33. (B) To a good approximation, friction depends on the normal force and nature of surfaces, not on the apparent area of contact.
34. (A) That is why wheels and ball bearings are used to reduce friction.
35. (C) $a = 8/2 = 4 \, \text{m/s}^2$ (retardation) $\rightarrow t = 4/4 = 1 \, \text{s}$.
36. (D) Newton's third law: the wall pushes back with equal force. No displacement, so no work.
37. (C) Friction = $0.25 \times 40 = 10 \, \text{N}$. $a = (20 - 10)/4 = 2.5 \, \text{m/s}^2$.
38. (A) $F = \sqrt{(36 + 64)} = 10 \, \text{N} \rightarrow a = 10/5 = 2 \, \text{m/s}^2$.
39. (D) At the top, $T + mg = mv^2/R$; with $T \geq 0$, $v_{\min} = \sqrt{gR}$.
40. (D) $T = mg + mv^2/r = 1 + 0.1 \times 4/1 = 1.4 \, \text{N}$.
41. (B) $|F| = 10 \, \text{N} \rightarrow a = 10/3 \, \text{m/s}^2 \rightarrow v = 10/3 \, \text{m/s}$ after 1 s.
42. (A) Kinetic friction opposes relative sliding between the surfaces in contact.
43. (C) $T - mg = ma \rightarrow 300 - 200 = 20a \rightarrow a = 5 \, \text{m/s}^2$.
44. (A) $\mu_s = \tan \theta_{\text{repose}} = \tan 37^\circ = 0.75$.
45. (A) $\omega = 2\pi/\pi = 2 \, \text{rad/s}$. $F = m\omega^2 r = 1 \times 4 \times 2 = 8 \, \text{N}$.

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