CHAPTER

04

Laws of Motion

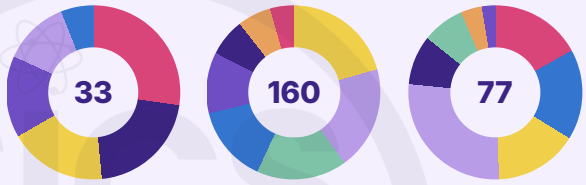
MHT CET · JEE · NEET Physics

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EXAM WEIGHTAGE



MHT CET 2019–2026 | **JEE Main** 2002–2026 | **NEET** 1988–2026

	CET	JEE	NEET
Connected Bodies & Pulleys	6 18%	33 21%	12 16%
Inertia, First & Second Laws	4 12%	31 19%	9 12%
Friction Basics	2 6%	23 14%	13 17%
Friction on an Incline	0 0%	27 17%	6 8%
Impulse & Momentum Conservation	9 27%	7 4%	13 17%
Equilibrium, Third Law & Frames	5 15%	18 11%	2 3%
Apparent Weight & Lift	7 21%	11 7%	7 9%
Two-Body Friction	0 0%	10 6%	3 4%
Circular Motion (Related PYQs)	0 0%	0 0%	12 16%

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01 CONCEPT Inertia, Momentum & F = ma

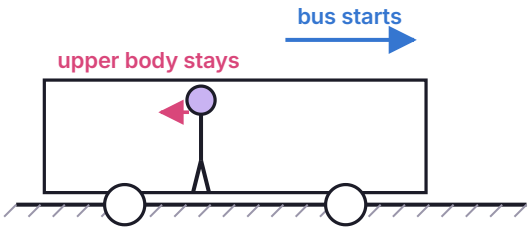
IN ONE LINE

A body changes its motion only when a **net external force** acts on it, and the force equals the rate of change of momentum.

4.1.1 Inertia

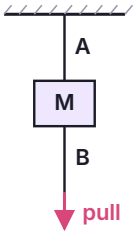
- Inertia is the property by which a body cannot change its state of rest or uniform motion by itself.
- It is not a physical quantity: no unit, no dimension.
- It depends only on **mass**, not on velocity.
- A point mass is a body whose size is negligible compared with the distance it covers.

Inertia of	Example
rest	Passenger thrown back when a bus starts; dust leaves a beaten carpet; coin falls in a glass when the card is flicked
motion	Passenger falls forward when a bus stops; athlete runs before a long jump
direction	Stone flies off along the tangent when the string breaks; mud leaves a wheel along the tangent



Lower body moves with the bus; upper body stays back

- Bullet on a window: very short contact, so only a small part of the glass moves ⇒ a clean hole.
- Ball on a window: longer contact ⇒ the whole pane cracks.



Mass M hanging between two strings

- **Sudden jerk** on B: inertia of M stops the force reaching A ⇒ B breaks.
- **Steady pull** on B: tension in A is more by Mg ⇒ A breaks.

4.1.2 Newton's first law

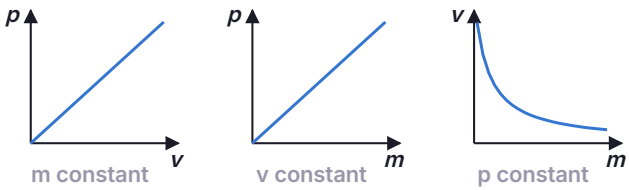
- A body stays at rest or in uniform straight-line motion unless an external force acts on it.
- Net force zero ⇒ acceleration zero.
- No force is needed to keep a body moving uniformly in a straight line.
- The first law defines force and inertia.

4.1.3 Linear momentum

$$p = mv$$

- Vector, along the velocity.
- Unit: kg m s^{-1}. Dimension: $[MLT^{-1}]$.
- Same momentum: the lighter body moves faster.

$$\frac{v_1}{v_2} = \frac{m_2}{m_1}$$



$p \propto v$, $p \propto m$, and $v \propto \frac{1}{m}$ for fixed p

4.1.4 Newton's second law

$$F = \frac{dp}{dt} = m\frac{dv}{dt} = ma$$

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- Force and acceleration are in the same direction.
- F = ma holds when mass stays constant.

$$\text{mass changing: } F = m\frac{dv}{dt} + v\frac{dm}{dt}$$

4.1.5 Units of force

$$[F] = [MLT^{-2}]$$

Unit	Value
1 N	1 kg m s^{-2} = 10^5 dyne
1 kgf	9.8 N
1 gf	980 dyne

4.1.6 Useful results from F = ma

$$\text{same force on two masses: } a = \frac{a_1 a_2}{a_1 + a_2}$$

$$\text{stopped in distance s: } a = \frac{u^2}{2s}$$

$$v^2 = kx \Rightarrow 2a = k, \text{ a constant}$$

- Find a first, then multiply by m.
- Two forces at an angle: find the resultant first, then divide by m.
- Momentum after falling a height h: p = m√(2gh), so p ∝ √h.

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Solved Examples 01 Inertia, Momentum & F = ma

SOLVED 1 MHT CET 2019 · 2 May · Shift 2

An aircraft is moving with uniform velocity 150 m/s in the space. If all the forces acting on it are balanced, then it will

(a) keep moving with same velocity
(b) remain floating at its place
(c) escape in space
(d) fall down on earth

STEP 1 Balanced forces ⇒ net force = 0
STEP 2 First law: zero net force ⇒ no change in velocity
STEP 3 It will **keep moving with the same velocity**

Answer: **(a)**

SOLVED 2 MHT CET 2024 · 10 May · Shift 2

Which one of the following is NOT a contact force?

(a) Force of friction.
(b) Normal reaction.
(c) Gravitational force.
(d) Viscous force.

STEP 1 Friction, normal reaction and viscous force need touching surfaces
STEP 2 Gravity acts across empty space
STEP 3 **Gravitational force** is not a contact force

Answer: **(c)**

SOLVED 3 AIPMT 2012 · Mains

A stone is dropped from a height h. It hits the ground with a certain momentum P. If the same stone is dropped from a height 100% more than the previous height, the momentum when it hits the ground will change by

(a) 68% (b) 41%
(c) 200% (d) 100%

STEP 1 $v = \sqrt{(2gh)}$, so $P \propto \sqrt{h}$
STEP 2 New height 2h ⇒ $P' = \sqrt{2}\,P = 1.41\,P$
STEP 3 Change = **41%**

Answer: **(b)**

SOLVED 4 MHT CET 2025 · 22 Apr · Shift 2

A constant force acts on two different masses independently and produces accelerations A_1 and A_2. When the same force acts on their combined mass, the acceleration produced is

(a) $A_1 - A_2$ (b) $A_1 + A_2$
(c) $\frac{A_1A_2}{A_1 + A_2}$ (d) $\sqrt{(A_1^2 + A_2^2)}$

STEP 1 $m_1 = \frac{f}{A_1}$, $m_2 = \frac{f}{A_2}$
STEP 2 $\frac{1}{A} = \frac{m_1 + m_2}{f} = \frac{1}{A_1} + \frac{1}{A_2}$
STEP 3 $A = \frac{\mathbf{A_1A_2}}{\mathbf{A_1 + A_2}}$

Answer: **(c)**

SOLVED 5 MHT CET 2020 · 16 Oct · Shift 1

A body of mass 2 kg is acted upon by two forces each of magnitude 1 N and inclined at 60° with each other. The acceleration of the body in m/s² is [cos 60° = 0.5]

(a) √0.75 (b) √0.65
(c) √0.20 (d) √0.35

STEP 1 Resultant = $\sqrt{(1 + 1 + 2\cos 60°)} = \sqrt{3}$ N
STEP 2 $a = \frac{\sqrt{3}}{2}$ m/s²
STEP 3 $a = \sqrt{(\frac{3}{4})} = \sqrt{\mathbf{0.75}}$

Answer: **(a)**

SOLVED 6 AIPMT 1997

A force of 6 N acts on a body at rest and of mass 1 kg. During this time, the body attains a velocity of 30 m/s. The time for which the force acts on the body is

(a) 7 seconds
(b) 5 seconds
(c) 10 seconds
(d) 8 seconds

STEP 1 $a = \frac{F}{m} = 6$ m/s²
STEP 2 $v = at \Rightarrow 30 = 6t$
STEP 3 $t = \mathbf{5}$ **s**

Answer: **(b)**

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Solved Examples 01 Inertia, Momentum & F = ma (contd.)

SOLVED 7 NEET 2026

The magnitude and direction of the acceleration produced in a body of mass 5 kg when two mutually perpendicular forces 8 N and 6 N act on it, are respectively:

(a) 20 m s^{-2}; $\tan^{-1}(\frac{4}{3})$ with 8 N force

(b) 2 m s^{-2}; $\tan^{-1}(\frac{3}{4})$ with 6 N force

(c) 2 m s^{-2}; $\tan^{-1}(\frac{4}{3})$ with 8 N force

(d) 2 m s^{-2}; $\tan^{-1}(\frac{3}{4})$ with 8 N force

STEP 1 Resultant = $\sqrt{(8^2 + 6^2)} = 10$ N

STEP 2 $a = \frac{10}{5} = 2$ m s^{-2}

STEP 3 $\tan\theta = \frac{6}{8} \Rightarrow$ **2 m s^{-2}, $\tan^{-1}(\frac{3}{4})$ with 8 N**

Answer: **(d)**

SOLVED 8 AIPMT 2009

A body, under the action of a force $\vec{F} = 6\hat{i} - 8\hat{j} + 10\hat{k}$, acquires an acceleration of 1 m s^{-2}. The mass of this body must be

(a) 10 kg (b) 20 kg

(c) $10\sqrt{2}$ kg (d) $2\sqrt{10}$ kg

STEP 1 $|F| = \sqrt{(36 + 64 + 100)} = \sqrt{200}$ N

STEP 2 $m = \frac{|F|}{a} = \sqrt{200}$

STEP 3 $m = \mathbf{10\sqrt{2}}$ **kg**

Answer: **(c)**

SOLVED 9 JEE Main 2024 · 1 Feb · Shift 2

A body of mass 4 kg experiences two forces $\vec{F}_1 = 5\hat{i} + 8\hat{j} + 7\hat{k}$ and $\vec{F}_2 = 3\hat{i} - 4\hat{j} - 3\hat{k}$. The acceleration acting on the body is:

(a) $2\hat{i} + \hat{j} + \hat{k}$ (b) $4\hat{i} + 2\hat{j} + 2\hat{k}$

(c) $-2\hat{i} - \hat{j} - \hat{k}$ (d) $2\hat{i} + 3\hat{j} + 3\hat{k}$

STEP 1 $\vec{F} = \vec{F}_1 + \vec{F}_2 = 8\hat{i} + 4\hat{j} + 4\hat{k}$

STEP 2 $a = \frac{F}{4}$

STEP 3 $a = \mathbf{2\hat{i} + \hat{j} + \hat{k}}$

Answer: **(a)**

SOLVED 10 JEE Main 2023 · 29 Jan · Shift 2

A force acts for 20 s on a body of mass 20 kg, starting from rest, after which the force ceases and then the body describes 50 m in the next 10 s. The value of force will be:

(a) 40 N (b) 20 N

(c) 5 N (d) 10 N

STEP 1 After the force stops, speed is constant:
$v = \frac{50}{10} = 5$ m/s

STEP 2 $a = \frac{5}{20} = 0.25$ m/s^2

STEP 3 $F = 20 \times 0.25 =$ **5 N**

Answer: **(c)**

SOLVED 11 JEE Main 2025 · 7 Apr · Shift 2

An object with mass 500 g moves along x-axis with speed $v = 4\sqrt{x}$ m/s. The force acting on the object is:

(a) 8 N (b) 4 N

(c) 5 N (d) 6 N

STEP 1 $v^2 = 16x$; compare with $v^2 = u^2 + 2ax$

STEP 2 $2a = 16 \Rightarrow a = 8$ m/s^2

STEP 3 $F = 0.5 \times 8 =$ **4 N**

Answer: **(b)**

SOLVED 12 JEE Main 2024 · 5 Apr · Shift 2

A particle moves in x-y plane under the influence of a force F such that its linear momentum is $p(t) = \hat{i}\cos(kt) - \hat{j}\sin(kt)$. If k is constant, the angle between F and p will be:

(a) $\frac{\pi}{2}$ (b) $\frac{\pi}{3}$

(c) $\frac{\pi}{4}$ (d) $\frac{\pi}{6}$

STEP 1 $\vec{F} = \frac{dp}{dt} = -k[\hat{i}\sin(kt) + \hat{j}\cos(kt)]$

STEP 2 $\vec{F} \cdot \vec{p} = -k[\sin kt \cos kt - \cos kt \sin kt] = 0$

STEP 3 Angle = $\frac{\pi}{2}$

Answer: **(a)**

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02 CONCEPT
Force Vectors, Spring & Variable Forces

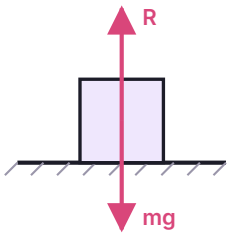
IN ONE LINE

Force is a vector: apply F = ma **separately along each axis**. When the force varies, integrate.

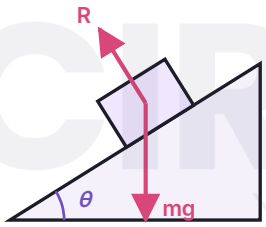
4.2.1 Kinds of force

- **Contact** forces: friction, normal reaction, tension, viscous force.
- **Field** forces: gravitation, electric, magnetic.
- **Conservative**: gravitational, electric, elastic. **Non-conservative**: friction, viscous.

Force	Strength order
nuclear	strongest
electromagnetic	next
weak	next
gravitational	weakest



Normal reaction



R = mg cos θ on a slope

Normal reaction is perpendicular to the surface

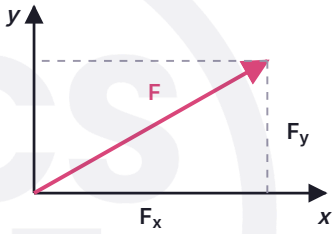


Tension pulls the block, never pushes

4.2.2 What a force does

Situation	Effect
force too small	body stays at rest
force along motion	speed rises
force against motion	speed falls
force ⊥ velocity (uniform circle)	only direction changes
force at another angle	both change

4.2.3 Components: one equation per axis



F resolved along x and y

$$\vec{F} = F_x\hat{i} + F_y\hat{j} + F_z\hat{k}$$

$$F_x = ma_x \cdot F_y = ma_y \cdot F_z = ma_z$$

- Motion along each axis is independent of the others.
- A force along z changes only v_z.
- Given position r(t): differentiate twice to get a, then F.
- Given force F: divide by m, then use v = u + at and r = ut + ½at² for each axis.

$$a = \frac{v-u}{t} \Rightarrow F = m\,\frac{v-u}{t}$$

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LAWS OF MOTION

LEVEL 1 · EASY

Topic-wise Previous Year Questions

MHT CET · NEET · JEE Main

128	37	9
questions	concepts	topics

CONTENTS

01	Inertia, First & Second Laws	Q 1–17	17 Qs
02	Equilibrium, Third Law & Frames	Q 18–27	10 Qs
03	Impulse & Momentum Conservation	Q 28–43	16 Qs
04	Apparent Weight & Lift	Q 44–61	18 Qs
05	Connected Bodies & Pulleys	Q 62–90	29 Qs
06	Friction Basics	Q 91–109	19 Qs
07	Friction on an Incline	Q 110–116	7 Qs
08	Two-Body Friction	Q 117–120	4 Qs
09	Circular Motion (Related PYQs)	Q 121–128	8 Qs
	Answer key		

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TOPIC 01

Inertia, First & Second Laws

17 PYQs · Easy 17 · Medium 0 · Difficult 0 | MHT CET 4 · NEET 7 · JEE 6

Concepts covered: Inertia & Newton's first law (2) · Types of force & contact forces (1) · Second law: F = ma (9) · Momentum & F = dp/dt (1) · Force as a vector: x, y, z motion (2) · Spring force (2)

LEVEL 1 · EASY 17 questions

◆ Inertia & Newton's first law 2 Qs

1. An aircraft is moving with uniform velocity $150\ \mathrm{m/s}$ in the space. If all the forces acting on it are balanced, then it will

MHT CET 2019 · 2 MAY · SHIFT 2

(a) keep moving with same velocity
(b) remain floating at its place
(c) escape in space
(d) fall down on earth

2. Physical independence of force is a consequence of

AIPMT 1991

(a) third law of motion (b) second law of motion
(c) first law of motion (d) all of these laws

◆ Types of force & contact forces 1 Q

3. Which one of the following is 'NOT' a contact force?

MHT CET 2024 · 10 MAY · SHIFT 2

(a) Force of friction. (b) Normal reaction.
(c) Gravitational force. (d) Viscous force.

◆ Second law: F = ma 9 Qs

4. A constant force acts on two different masses independently and produces accelerations A_1 and A_2. When the same force acts on their combined mass, the acceleration produced is

MHT CET 2025 · 22 APR · SHIFT 2

(a) $A_1 - A_2$ (b) $\mathrm{A}_1 + \mathrm{A}_2$
(c) $\frac{A_1 A_2}{A_1 + A_2}$ (d) $\sqrt{A_1^2 + A_2^2}$

5. A body of mass $2\ \mathrm{kg}$ is acted upon by two forces each of magnitude $1\ \mathrm{N}$ and inclined at 60° with each other. The acceleration of the body in $\mathrm{m/s}$ is $[\cos 60^\circ = 0.5]$

MHT CET 2020 · 16 OCT · SHIFT 1

(a) $\sqrt{0.75}$ (b) $\sqrt{0.65}$ (c) $\sqrt{0.20}$ (d) $\sqrt{0.35}$

6. The magnitude and direction of the acceleration produced in a body of mass 5 kg when two mutually perpendicular forces 8 N and 6 N act on it, are respectively:

NEET 2026

(a) $20\ \mathrm{m\,s^{-2}}$; $\tan^{-1}(4/3)$ with 8 N force
(b) $2\ \mathrm{m\,s^{-2}}$; $\tan^{-1}(3/4)$ with 6 N force
(c) $2\ \mathrm{m\,s^{-2}}$; $\tan^{-1}(4/3)$ with 8 N force
(d) $2\ \mathrm{m\,s^{-2}}$; $\tan^{-1}(3/4)$ with 8 N force

7. A body, under the action of a force $\vec{F} = 6\hat{i} - 8\hat{j} + 10\hat{k}$, acquires an accelerations of 1 m/s2. The mass of this body must be

AIPMT 2009

(a) 10 kg (b) 20 kg
(c) $10\sqrt{2}$ kg (d) $2\sqrt{10}$ kg

8. A force of $6\ \mathrm{N}$ acts on a body at rest and of mass $1\ \mathrm{kg}$. During this time, the body attains a velocity of $30\ \mathrm{m/s}$. The time for which the force acts on the body is

AIPMT 1997

(a) 7 seconds (b) 5 seconds
(c) 10 seconds (d) 8 seconds

9. A $10\ \mathrm{N}$ force is applied on a body produce in it an acceleration of $1\ \mathrm{m/s^2}$. The mass of the body is

AIPMT 1996

(a) 15 kg (b) 20 kg (c) 10 kg (d) 5 kg

10. A force vector applied on a mass is represented as $\vec{F} = 6\hat{i} - 8\hat{j} + 10\hat{k}$ and accelerates with $1\ \mathrm{m/s^2}$. What will be the mass of the body?

AIPMT 1996

(a) 10 kg (b) 20 kg (c) $10\sqrt{2}$ kg (d) $2\sqrt{10}$ kg

11. A body of mass $4\ \mathrm{kg}$ experiences two forces $\vec{F}_1 = 5\hat{i} + 8\hat{j} + 7\hat{k}$ and $\vec{F}_2 = 3\hat{i} - 4\hat{j} - 3\hat{k}$. The acceleration acting on the body is:

JEE MAIN 2024 · 1 FEB · SHIFT 2

(a) $2\hat{i} + \hat{j} + \hat{k}$ (b) $4\hat{i} + 2\hat{j} + 2\hat{k}$
(c) $-2\hat{i} - \hat{j} - \hat{k}$ (d) $2\hat{i} + 3\hat{j} + 3\hat{k}$

12. A bullet of mass 0.1 kg is fired on a wooden block to pierce through it, but it stops after moving a distance of 50 cm into it. If the velocity of bullet before hitting the wood is 10 m/s and it slows down with uniform deceleration, then the magnitude of effective retarding force on the bullet is 'x' N. The value of 'x' to the nearest integer is _____.

JEE MAIN 2021 · 18 MAR · SHIFT 1 *(Numerical)*

◆ Momentum & F = dp/dt 1 Q

13. A stone is dropped from a height h. It hits the ground with a certain momentum P. If the same stone is dropped from a height 100% more than the previous height, the momentum when it hits the ground will change by

AIPMT 2012 · MAINS

(a) 68% (b) 41% (c) 200% (d) 100%

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◆ Force as a vector: x, y, z motion 2 Qs

14. The position vector of a particle related to time t is given by

$\vec{r} = \left(10t\hat{i} + 15t^2\hat{j} + 7\hat{k}\right)m$

The direction of net force experienced by the particle is:

JEE MAIN 2023 · 15 APR · SHIFT 1

(a) Positive x - axis (b) Positive y - axis

(c) Positive z - axis (d) In x y plane

15. A Body of mass 5 kg under the action of constant force $\overrightarrow{F}$ = Fx $\hat{i}$ + Fy $\hat{j}$ has velocity at t = 0 s as $\overrightarrow{v}$ = (6 $\hat{i}$ – 2$\hat{j}$) m/s and at t = 10 s as $\overrightarrow{v}$ = + 6$\hat{j}$ m/s. The force $\overrightarrow{F}$ is:

JEE MAIN 2014 · 11 APR · SHIFT 1

(a) $(-3\hat{i} + 4\hat{j})$ N (b) $\left(-\frac{3}{5}\hat{i} + \frac{4}{5}\hat{j}\right)N$

(c) $(3i - \hat{} 4\hat{j})$ N (d) $\left(\frac{3}{5}\hat{i} - \frac{4}{5}\hat{j}\right)N$

◆ Spring force 2 Qs

16. A massless spring gets elongated by amount x_1 under a tension of 5 N. Its elongation is x_2 under the tension of 7 N. For the elongation of $(5x_1 - 2x_2)$, the tension in the spring will be,

JEE MAIN 2025 · 23 JAN · SHIFT 2

(a) 20 N (b) 39 N (c) 11 N (d) 15 N

17. A particle of mass 0.3 kg subjected to a force $F = -kx$ with $k = 15\ N/m$. What will be its initial acceleration if it is released from a point 20 cm away from the origin?

AIEEE 2005

(a) 15 m/s^2 (b) 3 m/s^2 (c) 10 m/s^2 (d) 5 m/s^2

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TOPIC 02

Equilibrium, Third Law & Frames

10 PYQs · Easy 10 · Medium 0 · Difficult 0 | MHT CET 3 · NEET 0 · JEE 7

Concepts covered: Force triangle, Lami & resultant (5) · Strings & ropes in equilibrium (3) · Frames of reference & pseudo force (2)

LEVEL 1 · EASY 10 questions

◆ Force triangle, Lami & resultant 5 Qs

18. A door $1.2\,\mathrm{m}$ wide requires a force of $1\,\mathrm{N}$ to be applied perpendicular at the free end to open or close it. The perpendicular force required at a point $0.2\,\mathrm{m}$ distant from the hinges for opening or closing the door is

MHT CET 2022 · 11 AUG · SHIFT 2

(a) 3.6 N (b) 2.4 N (c) 1.2 N (d) 6.0 N

19. Three forces $F_1 = 10\,\mathrm{N}, F_2 = 8\,\mathrm{N}, \mathrm{F}_3 = 6\,\mathrm{N}$ are acting on a particle of mass $5\,\mathrm{kg}$. The forces F_2 and F_3 are applied perpendicularly so that particle remains at rest. If the force F_1 is removed, then the acceleration of the particle is:

JEE MAIN 2023 · 12 APR · SHIFT 1

(a) $4.8\ \mathrm{ms}^{-2}$ (b) $7\ \mathrm{ms}^{-2}$
(c) $2\ \mathrm{ms}^{-2}$ (d) $0.5\ \mathrm{ms}^{-2}$

20. Statement: 1

If three forces $\vec{F}_1, \vec{F}_2$ and $\vec{F}_3$ are represented by three sides of a triangle and $\vec{F}_1 + \vec{F}_2 = -\vec{F}_3$, then these three forces are concurrent forces and satisfy the condition for equilibrium. Statement: 2

A triangle made up of three forces $\vec{F}_1, \vec{F}_2$ and $\vec{F}_3$ as its sides taken in the same order, satisfy the condition for translatory equilibrium.

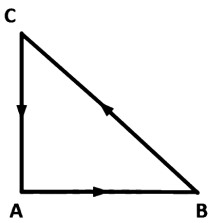
In the light of the above statements, choose the most appropriate answer from the options given below:

JEE MAIN 2021 · 31 AUG · SHIFT 2

(a) Statement - I is false but Statement - II is true
(b) Statement - I is true but Statement - II is false
(c) Both Statement-I and Statement-II are false
(d) Both Statement-I and Statement-II are true

21. Three forces start acting simultaneously on a particle moving with velocity, $\vec{v}$. These forces are represented in magnitude and direction by the three sides of a triangle ABC. The particle will now move with velocity

AIEEE 2003



(a) less than $\vec{v}$
(b) greater than $\vec{v}$
(c) $|v|$ in the direction of the largest force BC
(d) $\vec{v}$, remaining unchanged

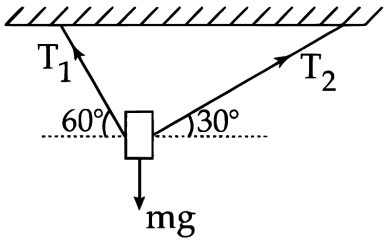
22. When forces F_1, F_2, F_3 are acting on a particle of mass m such that F_2 and F_3 are mutually perpendicular, then the particle remains stationary. If the force F_1 is now removed then the acceleration of the particle is

AIEEE 2002

(a) F_1/m (b) F_2F_3/mF_1
(c) $(F_2 - F_3)/m$ (d) F_2/m

◆ Strings & ropes in equilibrium 3 Qs

23.



A body of mass 1 kg is suspended with the help of two strings making angles as shown in figure. Magnitudes of tensions T_1 and T_2, respectively, are (in N):

(Take acceleration due to gravity $10\,\mathrm{m/s}^2$)

JEE MAIN 2025 · 2 APR · SHIFT 2

(a) $5\sqrt{3}, 5$ (b) $5\sqrt{3}, 5\sqrt{3}$
(c) 5,5 (d) $5, 5\sqrt{3}$

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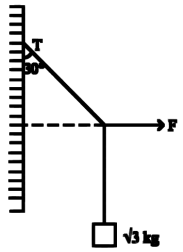
24. A body of weight $200\,\text{N}$ is suspended from a tree branch through a chain of mass $10\,\text{kg}$. The branch pulls the chain by a force equal to (if $g = 10\,\text{m/s}^2$):

JEE MAIN 2024 · 6 APR · SHIFT 2

(a) 300 N (b) 100 N (c) 150 N (d) 200 N

25. A block of $\sqrt{3}\,\text{kg}$ is attached to a string whose other end is attached to the wall. An unknown force F is applied so that the string makes an angle of 30° with the wall. The tension T is: (Given $g = 10\,\text{ms}^{-2}$)

JEE MAIN 2023 · 30 JAN · SHIFT 2



(a) 15 N (b) 10 N (c) 25 N (d) 20 N

◆ Frames of reference & pseudo force 2 Qs

26. Which of the following person is in an inertial frame of reference?

MHT CET 2026 · 19 APR · SHIFT 1

(a) A pilot in an aeroplane which is taking off.
(b) A driver driving a bus which is moving with constant velocity.
(c) A child revolving in a merry - go - round.
(d) A man in a train which is slowing down to stop.

27. Which one of the following person is in an inertial frame of reference?

MHT CET 2025 · 20 APR · SHIFT 1

(a) A person (man) in a train which is slowing down to stop.
(b) A person (child) revolving in a merry-go-round.
(c) A person (driver) in a bus which is moving with constant velocity.
(d) A person (pilot) in an aeroplane which is taking off.

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TOPIC 03

Impulse & Momentum Conservation

16 PYQs · Easy 16 · Medium 0 · Difficult 0 | MHT CET 6 · NEET 5 · JEE 5

Concepts covered: Impulse-momentum theorem (6) · Force-time graph (1) · Recoil & explosion (2) · Machine gun, conveyor & jets (5) · Rocket propulsion (2)

LEVEL 1 · EASY 16 questions

◆ Impulse-momentum theorem 6 Qs

28. A cricket ball of mass 120 g is moving with a velocity of 8 m/s and is hit by a bat so that the ball gets turned back with a velocity of 12 m/s. If the duration of contact between the ball and bat is 0.02 s, the impulse (in Ns) given to the ball by the bat is

MHT CET 2026 · 19 MAY · SHIFT 1

(a) 0.48 (b) 1.2 (c) 2.4 (d) 3.6

29. 100 balls each of mass m moving with speed v simultaneously strike a wall normally and reflected back with same speed, in time t s. The total magnitude of force exerted by the balls on the wall is

MHT CET 2026 · 13 APR · SHIFT 2

(a) $100mv/t$ (b) $200mv/t$
(c) $200mvt$ (d) $mv/100t$

30. A body of mass M hits normally a rigid wall with velocity V and bounces back with the same velocity. The impulse experienced by the body is

AIPMT 2011 · PRELIMS

(a) MV (b) 1.5 MV (c) 2MV (d) zero

31. A cricketer catches a ball of mass 150 gm in 0.1 sec moving with speed 20 m/s, then he experiences force of

AIPMT 2001

(a) 300 N (b) 30 N (c) 3 N (d) 0.3 N.

32. A player caught a cricket ball of mass 150 g moving at a speed of 20 m/s. If the catching process is completed in 0.1 s, the magnitude of force exerted by the ball on the hand of the player is:

JEE MAIN 2024 · 8 APR · SHIFT 1

(a) 150 N (b) 3 N (c) 30 N (d) 300 N

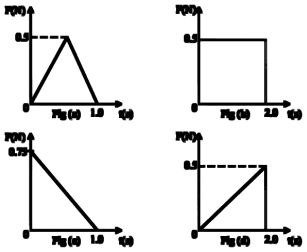
33. A cricket player catches a ball of mass 120 g moving with 25 m/s speed. If the catching process is completed in 0.1 s then the magnitude of force exerted by the ball on the hand of player will be (in SI unit):

JEE MAIN 2024 · 1 FEB · SHIFT 2

(a) 30 (b) 24 (c) 12 (d) 25

◆ Force-time graph 1 Q

34. Figures (a), (b), (c) and (d) show variation of force with time.



The impulse is highest in figure.

JEE MAIN 2023 · 1 FEB · SHIFT 2

(a) Fig (c) (b) Fig (d) (c) Fig (a) (d) Fig (b)

◆ Recoil & explosion 2 Qs

35. A man fires a bullet of mass 200 gm at a speed of 5 m/s. The gun is of one kg mass. By what velocity the gun rebounds backward?

AIPMT 1996

(a) 1 m/s (b) 0.01 m/s
(c) 0.1 m/s (d) 10 m/s

36. A bullet of mass 10 gram is fired with velocity of 100 m/s from the gun of mass 1 kg. Recoil speed of the gun is:

JEE MAIN 2022 · 30 JUL · SHIFT 2

(a) 1 m/s (b) 10 m/s (c) 0.5 m/s (d) 0.1 m/s

◆ Machine gun, conveyor & jets 5 Qs

37. A machine gun fires a bullet of mass 40g with a speed of 600 ms^{-1}. The person holding the gun can bare maximum force of 168N on it. The number of bullets that can be fired from the gun per second is

MHT CET 2026 · 17 APR · SHIFT 2

(a) 8 (b) 7 (c) 6 (d) 5

38. A machine gun fires a bullet of mass 35 gram with a speed of 600 m/s. The person holding the gun can extract a maximum force of 147 N on it. The number of bullets that can be fired from the gun per second is

MHT CET 2025 · 25 APR · SHIFT 1

(a) 3 (b) 5 (c) 7 (d) 9

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39. A conveyor belt is moving with constant velocity (V). Sand is being dropped on the belt at the rate of $\mathrm{Mkg/s}$. The force necessary to keep the belt moving with a constant velocity $\mathrm{Vm/s}$ will be

MHT CET 2025 · 21 APR · SHIFT 2

(a) $\frac{MV}{2}$ N (b) 2 MV N (c) Zero N (d) MV N

40. A machine gun fires bullets of mass 30 g with velocity of $1000\ \mathrm{m/s}$. The man holding the gun can exert a maximum force of $300\ \mathrm{N}$ on it. How many bullets can he fire per second at most?

MHT CET 2023 · 14 MAY · SHIFT 2

(a) 3 (b) 6 (c) 10 (d) 9

41. Sand is being dropped on a conveyer belt at the rate of M kg/s. The force necessary to keep the belt moving with a constant velocity of v m/s will be:

AIPMT 2008

(a) $\frac{Mv}{2}$ newton (b) zero

(c) Mv newton (d) $2\ Mv$ newton

◆ Rocket propulsion 2 Qs

42. In a rocket, fuel burns at the rate of $1\ \mathrm{kg/s}$. This fuel is ejected from the rocket with a velocity of $60\ \mathrm{km/s}$. This exerts a force on the rocket equal to

AIPMT 1994

(a) 6000 N (b) 60000 N (c) 60 N (d) 600 N

43. A rocket with a lift-off mass $3.5 \times 10^4\ kg$ is blasted upwards with an initial acceleration of $10 m/s^2$. Then the initial thrust of the blast is

AIEEE 2003

(a) $3.5 \times 10^5 N$ (b) $7.0 \times 10^5 N$

(c) $14.0 \times 10^5 N$ (d) $1.75 \times 10^5 N$

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TOPIC 04

Apparent Weight & Lift

18 PYQs · Easy 18 · Medium 0 · Difficult 0 | MHT CET 6 · NEET 4 · JEE 8

Concepts covered: Apparent weight in a lift (12) · Cable tension & floor reaction (5) · Climbing a rope (1)

LEVEL 1 · EASY 18 questions

◆ Apparent weight in a lift 12 Qs

44. The weight of man in lift moving in upward direction with an acceleration 'a' is 660 N. When the lift moves in the downward direction with the same acceleration, his weight is found to be 380 N. The real weight of the man when the lift is at rest is

MHT CET 2026 · 20 APR · SHIFT 1

(a) 400 N (b) 460 N (c) 520 N (d) 640 N

45. The weight of man in a stationary lift is w_1 and when it is moving downwards with uniform acceleration ' a ' is w_2. If the ratio $w_1 : w_2 = 4 : 3$, then the value of ' a ' is (g = acceleration due to gravity)

MHT CET 2025 · 23 APR · SHIFT 1

(a) $\frac{g}{3}$ (b) $\frac{g}{4}$ (c) $\frac{3}{4}$ g (d) $\frac{4}{g}$

46. A spring balance is attached to the ceiling of a lift. A man hangs his bag on the spring and the spring balance reads 49 N, when the lift is stationary. If the lift moves downward with an acceleration of $5\ m/s^2$, the reading of the spring balance will be $(g = 9.8\ m/s^2)$

MHT CET 2023 · 13 MAY · SHIFT 2

(a) 15 N (b) 24 N (c) 49 N (d) 74 N

47. A spring balance is attached to the ceiling of a lift. A man hangs his bag on the spring and the spring balance reads 49 N, when the lift is stationary. If the lift moves downward with an acceleration of $5\ m/s^2$, the reading of the spring balance will be $(g = 9.8\ m/s^2)$

MHT CET 2021 · 24 SEP · SHIFT 1

(a) 74 N (b) 15 N (c) 24 N (d) 49 N

48. The weight of a man in a lift moving upwards with an acceleration 'a' is 620 N. When the lift moves downwards with the same acceleration, his weight is found to be 340 N. The real weight of the man is

MHT CET 2021 · 20 SEP · SHIFT 1

(a) 620 N (b) 680 N (c) 380 N (d) 480 N

49. A man weight 80 kg. He stands on a weighting scale in a lift which is moving upwards with a uniform acceleration of 5 m/s2. What would be the reading on the scale? (g = 10 m/s2)

AIPMT 2003

(a) zero (b) 400 N (c) 800 N (d) 1200 N

50. Given below are two statements:

Statement I: An elevator can go up or down with uniform speed when its weight is balanced with the tension of its cable.

Statement II: Force exerted by the floor of an elevator on the foot of a person standing on it is more than his/her weight when the elevator goes down with increasing speed.

In the light of the above statements, choose the correct answer from the options given below:

JEE MAIN 2023 · 24 JAN · SHIFT 1

(a) Both Statement I and Statement II are false
(b) Both Statement I and Statement II are true
(c) Statement I is false but Statement II is true
(d) Statement I is true but Statement II is false

51. A block of mass M placed inside a box descends vertically with acceleration 'a'. The block exerts a force equal to one-fourth of its weight on the floor of the box. The value of 'a' will be

JEE MAIN 2022 · 29 JUN · SHIFT 2

(a) $\frac{g}{4}$ (b) $\frac{g}{2}$ (c) $\frac{3g}{4}$ (d) g

52. A person is standing in an elevator. In which situation, he experiences weight loss?

JEE MAIN 2022 · 26 JUN · SHIFT 1

(a) When the elevator moves upward with constant acceleration
(b) When the elevator moves downward with constant acceleration
(c) When the elevator moves upward with uniform velocity
(d) When the elevator moves downward with uniform velocity

53. A spring balance is attached to the ceiling of a lift. A man hangs his bag on the spring and the spring reads 49 N, when the lift is stationary. If the lift moves downward with an acceleration of $5 m/s^2$, the reading of the spring balance will be

AIEEE 2003

(a) 24 N (b) 74 N (c) 15 N (d) 49 N

54. A lift is moving down with acceleration a. A man in the lift drops a ball inside the lift. The acceleration of the ball as observed by the man in the lift and a man standing stationary on the ground are respectively

AIEEE 2002

(a) g, g (b) $g - a, g - a$
(c) $g - a, g$ (d) a, g

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55. A person standing on a spring balance inside a stationary lift measures 60 kg. The weight of that person if the lift descends with uniform downward acceleration of 1.8 m/s2 will be _____ N. [g = 10 m/s2]

JEE MAIN 2021 · 26 FEB · SHIFT 1 *(Numerical)*

◆ Cable tension & floor reaction 5 Qs

56. The mass of the lift is 200 kg, when it ascends with an acceleration of $4\,\mathrm{m/s^2}$ then the tension in the cable supporting the lift will be [Given: Acceleration due to gravity $g = 10\,\mathrm{m/s^2}$]

MHT CET 2024 · 2 MAY · SHIFT 2

(a) 800 N (b) 2800 N (c) 4200 N (d) 2000 N

57. A person of mass 60 kg is inside a lift of mass 940 kg and presses the button on control panel. The lift starts moving upwards with an acceleration 1.0 m/s2. If g = 10 ms^{-}2, the tension in the supporting cable is

AIPMT 2011 · PRELIMS

(a) 8600 N (b) 9680 N (c) 11000 N (d) 1200 N

58. The mass of a lift is 2000 kg. When the tension in the supporting cable is 28000 N, then its acceleration is:

AIPMT 2009

(a) 4 m s^{-}2 upwards (b) 4 m s^{-}2 downwards
(c) 14 m s^{-}2 upwards (d) 30 m s^{-}2 downwards

59. A lift of mass 1000 kg which is moving with acceleration of 1 m/s2 in upward direction, then the tension developed in string which is connected to lift is

AIPMT 2002

(a) 9800 N (b) 10,800 N
(c) 11,000 N (d) 10,000 N.

60. A wooden block of mass $5\,\mathrm{kg}$ rests on a soft horizontal floor. When an iron cylinder of mass $25\,\mathrm{kg}$ is placed on the top of the block, the floor yields and the block and the cylinder together go down with an acceleration of $0.1\,\mathrm{ms^{-2}}$. The action force of the system on the floor is equal to:

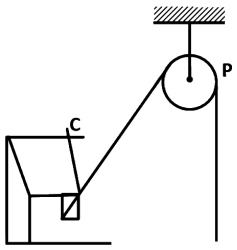
JEE MAIN 2024 · 5 APR · SHIFT 1

(a) 297 N (b) 291 N (c) 196 N (d) 294 N

◆ Climbing a rope 1 Q

61. One end of a mass-less rope, which passes over a mass-less and friction-less pulley P is tied to a hook C while the other end is free. Maximum tension that the rope can bear is $360\,N$. With what value of maximum safe acceleration (in ms^{-2}) can a man of $60\,kg$ climb on the rope?

AIEEE 2002



(a) 16 (b) 6 (c) 4 (d) 8

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TOPIC 05

Connected Bodies & Pulleys

29 PYQs · Easy 29 · Medium 0 · Difficult 0 | MHT CET 5 · NEET 10 · JEE 14

Concepts covered: Block on a smooth surface or incline (4) · Blocks in contact (4) · Blocks joined by strings (5) · Massive rope & chain (2) · Spring balance & spring systems (1) · Single pulley (Atwood) (10) · Pulley with table, incline & constraints (1) · Accelerating wedge (2)

LEVEL 1 · EASY 29 questions

◆ Block on a smooth surface or incline 4 Qs

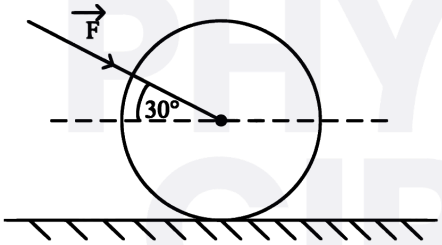
62. A box of mass 5 kg is pulled by a cord, up along a frictionless plane inclined at 30° with the horizontal. The tension in the cord is 30 N. The acceleration of the box is (Take $g = 10\ \text{m s}^{-2}$)

NEET 2024

(a) $2\ \text{m s}^{-2}$ (b) Zero
(c) $0.1\ \text{m s}^{-2}$ (d) $1\ \text{m s}^{-2}$

63. As shown in figure, a 70 kg garden roller is pushed with a force of $\vec{F} = 200$ N at an angle of 30° with horizontal. The normal reaction on the roller is
(Given $g = 10\ \text{m s}^{-2}$)

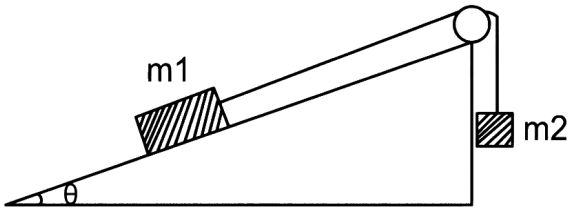
JEE MAIN 2023 · 31 JAN · SHIFT 1



(a) 800 N (b) 600 N (c) $200\sqrt{3}$ N (d) $800\sqrt{2}$ N

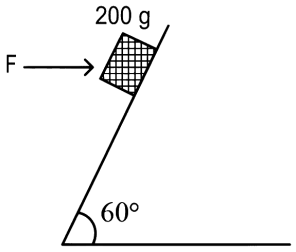
64. Two bodies of masses $m_1 = 5$ kg and $m_2 = 3$ kg are connected by a light string going over a smooth light pulley on a smooth inclined plane as shown in the figure. The system is at rest. The force exerted by the inclined plane on the body of mass m_1 will be: [Take $g = 10\ \text{ms}^{-2}$]

JEE MAIN 2022 · 29 JUL · SHIFT 2



(a) 30 N (b) 40 N (c) 50 N (d) 60 N

65. A block of mass 200 g is kept stationary on a smooth inclined plane by applying a minimum horizontal force $F = \sqrt{x}$N as shown in figure.



The value of x = _____.

JEE MAIN 2022 · 25 JUN · SHIFT 2 *(Numerical)*

◆ Blocks in contact 4 Qs

66. Two blocks of masses 6 kg and 4 kg are placed in contact with each other on a smooth surface as shown. If a force of 5 N is applied on a heavier block, the force on the lighter block is

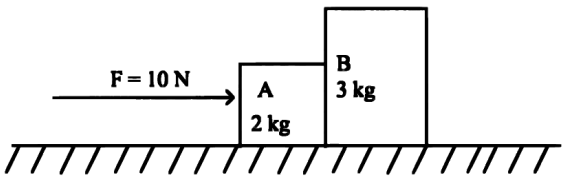
MHT CET 2024 · 3 MAY · SHIFT 1



(a) 5N (b) 4N (c) 2N (d) 1N

67. A horizontal force 10 N is applied to a block A as shown in figure. The mass of blocks A and B are 2 kg and 3 kg respectively. The blocks slide over a frictionless surface. The force exerted by block A on block B is:

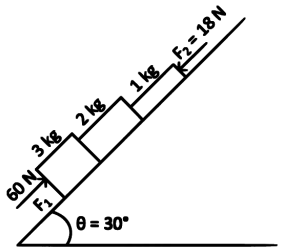
NEET 2024



(a) Zero (b) 4 N (c) 6 N (d) 10 N

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68. In the diagram shown, the normal reaction force between 2 kg and 1 kg is (Consider the surface, to be smooth):
(Given g = 10 ms^{-}2)
NEET 2022 · PHASE 2



(a) 10 N (b) 25 N (c) 39 N (d) 6 N

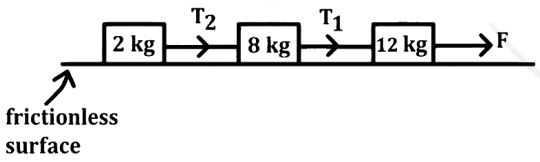
69. Three blocks A, B and C, of masses 4 kg, 2 kg and 1 kg respectively, are in contact on a frictionless surface, as shown. If a force of 14 N is applied on the 4 kg block, then the contact force between A and B is
AIPMT 2015 · CANCELLED PAPER



(a) 8 N (b) 18 N (c) 2 N (d) 6 N

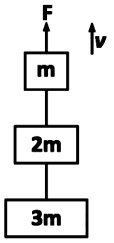
◆ Blocks joined by strings 5 Qs

70. Three blocks of different masses connected with inextensible string are pulled by a force F on a frictionless surface as shown in the figure. The ratio of tensions T_1 to T_2 is
MHT CET 2026 · 20 APR · SHIFT 2



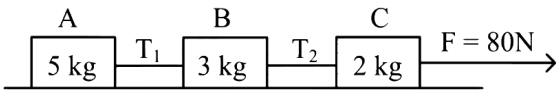
(a) 1 : 5 (b) 5 : 1 (c) 10 : 1 (d) 1 : 10

71. Three blocks with masses m, 2m and 3m are connected by strings, as shown in the figure. After an upward force F is applied on block m, the masses move upwards at constant speed v. What is the net force on the block of mass 2m? (g is the acceleration due to gravity)
NEET 2013



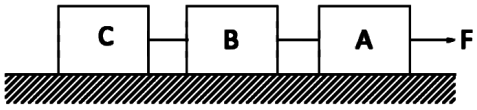
(a) 3mg (b) 6mg (c) zero (d) 2mg

72. Three blocks A, B and C are pulled on a horizontal smooth surface by a force of 80 N as shown in figure



The tensions T_1 and T_2 in the string are respectively:
JEE MAIN 2024 · 30 JAN · SHIFT 2
(a) 40N, 64N (b) 60N, 80N
(c) 80N, 100N (d) 88N, 96N

73. Three identical blocks of masses $m = 2\ kg$ are drawn by a force $F = 10.2\ N$ with an acceleration of $0.6\ ms^{-2}$ on a frictionless surface, then what is the tension (in N) in the string between the blocks B and C?
AIEEE 2002



(a) 9.2 (b) 3.4 (c) 4 (d) 7.8

74. Three blocks M_1, M_2, M_3 having masses 4 kg, 6 kg and 10 kg respectively are hanging from a smooth pulley using rope 1, 2 and 3 as shown in figure. The tension in the rope 1, T_1 when they are moving upward with acceleration of 2 ms^{-2} is _____ N (if g = 10 m/s^2).
JEE MAIN 2024 · 5 APR · SHIFT 1 *(Numerical)*



◆ Massive rope & chain 2 Qs

75. A block of mass M is pulled along a smooth horizontal surface with a rope of mass m by force F. The acceleration of the block will be
MHT CET 2019 · 3 MAY · SHIFT 1
(a) $\frac{F}{(M-m)}$ (b) $\frac{F}{(M+m)}$ (c) $\frac{F}{m}$ (d) $\frac{F}{M}$

76. A block of mass M is pulled along a horizontal frictionless surface by a rope of mass m. If a force P is applied at the free end of the rope, the force exerted by the rope on the block is
AIEEE 2003
(a) $\frac{Pm}{M+m}$ (b) $\frac{Pm}{M-m}$ (c) P (d) $\frac{PM}{M+m}$

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◆ Spring balance & spring systems 1 Q

77. A light spring balance hangs from the hook of the other light spring balance and a block of mass $M\ kg$ hangs from the former one. Then the true statement about the scale reading is

AIEEE 2003

(a) Both the scales read $M\ kg$ each

(b) The scale of the lower one reads $M\ kg$ and of the upper one zero

(c) The reading of the two scales can be anything but the sum of the reading will be $M\ kg$

(d) Both the scales read $M/2\ kg$ each

◆ Single pulley (Atwood) 10 Qs

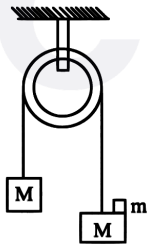
78. An inextensible string passing over a smooth pulley connects two blocks of masses m_1 and m_2 $(m_2 > m_1)$ vertically. If the acceleration of the system is $\left(\frac{g}{n}\right)$, then the ratio of masses $\left(\frac{m_2}{m_1}\right)$ is

MHT CET 2026 · 18 APR · SHIFT 2

(a) $\frac{n}{n+1}$ (b) $\frac{n}{n-1}$ (c) $\frac{n+1}{n-1}$ (d) $\frac{n+1}{n}$

79. Two identical blocks each of mass ' M ' attached to the ends of a massless inextensible string which passes over a pulley with a fixed axis as shown below. A small mass ' m ' is now placed on the block B. The acceleration with which the two blocks move together is [g = gravitational acceleration]

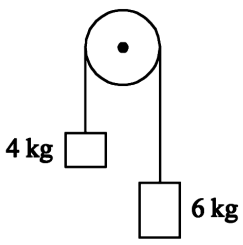
MHT CET 2024 · 2 MAY · SHIFT 1



(a) $\frac{mg}{2M+m}$ (b) $\frac{Mg}{M+2m}$ (c) $\frac{\mathrm{Mg}}{\mathrm{2M+m}}$ (d) $\frac{mg}{M+2m}$

80. Two bodies of mass 4 kg and 6 kg are tied to the ends of a massless string. The string passes over a pulley which is frictionless (see figure). The acceleration of the system in terms of acceleration due to gravity (g) is:

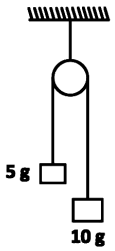
NEET 2020 · PHASE 1



(a) g/2 (b) g/5 (c) g/10 (d) g

81. Two masses as shown in the figure are suspended from a massless pulley. The acceleration of the system when masses are left free is

AIPMT 2000



(a) $\frac{2g}{3}$ (b) $\frac{g}{3}$ (c) $\frac{g}{9}$ (d) $\frac{g}{7}$.

82. A mass of 1 kg is suspended by a thread. It is
(i) lifted up with an acceleration $4.9\ \mathrm{m/s^2}$,
(ii) lowered with an acceleration $4.9\ \mathrm{m/s^2}$.
The ratio of the tensions is

AIPMT 1998

(a) 3 : 1 (b) 1 : 3 (c) 1 : 2 (d) 2 : 1

83. A light unstretchable string passing over a smooth light pulley connects two blocks of masses m_1 and m_2 . If the acceleration of the system is $\frac{g}{8}$, then the ratio of the masses $\frac{m_2}{m_1}$ is:

JEE MAIN 2024 · 9 APR · SHIFT 1

(a) 5 : 3 (b) 8 : 1 (c) 9 : 7 (d) 4 : 3

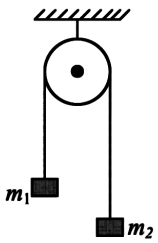
84. A light string passing over a smooth light pulley connects two blocks of masses m_1 and m_2 (where $m_2 > m_1$). If the acceleration of the system is $\frac{g}{\sqrt{2}}$, then the ratio of the masses $\frac{m_1}{m_2}$ is:

JEE MAIN 2024 · 6 APR · SHIFT 1

(a) $\frac{1+\sqrt{5}}{\sqrt{5}-1}$ (b) $\frac{\sqrt{3}+1}{\sqrt{2}-1}$ (c) $\frac{\sqrt{2}-1}{\sqrt{2}+1}$ (d) $\frac{1+\sqrt{5}}{\sqrt{2}-1}$

85. A light string passing over a smooth light fixed pulley connects two blocks of masses m_1 and m_2. If the acceleration of the system is $g/8$, then the ratio of masses is:

JEE MAIN 2024 · 31 JAN · SHIFT 2

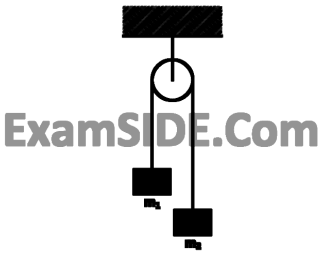


(a) $\frac{8}{1}$ (b) $\frac{9}{7}$ (c) $\frac{5}{3}$ (d) $\frac{4}{3}$

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86. Two masses $m_1 = 5kg$ and $m_2 = 4.8kg$ tied to a string are hanging over a light frictionless pulley. What is the acceleration of the masses when left free to move? $(g = 9.8m/s^2)$

AIEEE 2004


ExamSIDE.Com

(a) 5 m/s^2 (b) 9.8 m/s^2
(c) 0.2 m/s^2 (d) 4.8 m/s^2

87. A light string passing over a smooth light pulley connects two blocks of masses m_1 and m_2 (vertically). If the acceleration of the system is $g/8$, then the ratio of the masses is

AIEEE 2002

(a) 8 : 1 (b) 9 : 7 (c) 4 : 3 (d) 5 : 3

◆ Pulley with table, incline & constraints 1 Q

88. 250 N force is required to raise 75 kg mass from a pulley. If rope is pulled 12 m then the load is lifted to 3 m. the efficiency of pulley system will be

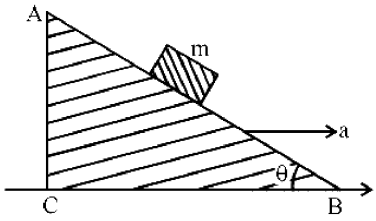
AIPMT 2001

(a) 25% (b) 33.3% (c) 75% (d) 90%

◆ Accelerating wedge 2 Qs

89. A block of mass m is placed on a smooth inclined wedge ABC of inclination θ as shown in the figure. The wedge is given an acceleration 'a' towards the right. The relation between a and θ for the block to remain stationary on the wedge is

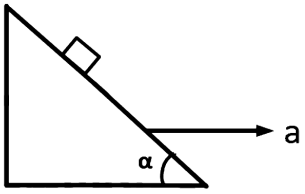
NEET 2018



(a) $a = \frac{g}{\cos ec\theta}$ (b) $a = \frac{g}{\sin\theta}$
(c) $a = g\cos\theta$ (d) $a = g\tan\theta$

90. A block is kept on a frictionless inclined surface with angle of inclination 'α'. The incline is given an acceleration a to keep the block stationary. Then a is equal to

AIEEE 2005



(a) $g\ cosec\ \alpha$ (b) $g/tan\ \alpha$
(c) $g\ tan\ \alpha$ (d) g

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TOPIC 06

Friction Basics

19 PYQs · Easy 19 · Medium 0 · Difficult 0 | MHT CET 2 · NEET 8 · JEE 9

Concepts covered: Static, limiting & kinetic friction (3) · Block held against a wall (2) · Acceleration on a rough surface (1) · Friction in an accelerating vehicle (2) · Stopping by friction (9) · Hanging mass on a rough table (2)

LEVEL 1 · EASY 19 questions

◆ Static, limiting & kinetic friction 3 Qs

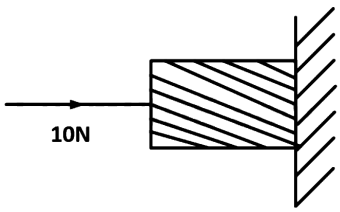
91. Which one of the following statements is incorrect?
NEET 2018
(a) Rolling friction is smaller than sliding friction.
(b) Limiting value of static friction is directly proportional to normal reaction.
(c) Frictional force opposes the relative motion.
(d) Coefficient of sliding friction has dimensions of length.

92. A heavy box of mass 50 kg is moving on a horizontal surface. If co-efficient of kinetic friction between the box and horizontal surface is 0.3 then force of kinetic friction is:
JEE MAIN 2024 · 5 APR · SHIFT 2
(a) 1470 N (b) 147 N (c) 1.47 N (d) 14.7 N

93. Given below are two statements:
Statement (I): The limiting force of static friction depends on the area of contact and independent of materials.
Statement (II): The limiting force of kinetic friction is independent of the area of contact and depends on materials.
In the light of the above statements, choose the most appropriate answer from the options given below:
JEE MAIN 2024 · 27 JAN · SHIFT 2
(a) Statement I is incorrect but Statement II is correct
(b) Both Statement I and Statement II are correct
(c) Both Statement I and Statement II are incorrect
(d) Statement I is correct but Statement II is incorrect

◆ Block held against a wall 2 Qs

94. A horizontal force of 10 N is necessary to just hold a block stationary against a wall. The coefficient of friction between the block and the wall is 0.2. The weight of the block is
AIEEE 2003



(a) $20N$ (b) $50N$ (c) $100N$ (d) $2N$

95. The coefficient of static friction between a wooden block of mass 0.5 kg and a vertical rough wall is 0.2. The magnitude of horizontal force that should be applied on the block to keep it adhere to the wall will be _____ N. [g = 10 ms^{-2}]
JEE MAIN 2021 · 24 FEB · SHIFT 1 *(Numerical)*

◆ Acceleration on a rough surface 1 Q

96. A block of mass 10 kg placed on rough horizontal surface having coefficient of friction μ = 0.5, if a horizontal force of 100 N acting on it then acceleration of the block will be
AIPMT 2002
(a) 10 m/s2 (b) 5 m/s2
(c) 15 m/s2 (d) 0.5 m/s2.

◆ Friction in an accelerating vehicle 2 Qs

97. A box of mass 15 kg is kept on the floor of a stationary trolley. The coefficient of static friction between the box and the trolley is 0.12. Keeping the box in stationary state over the trolley, the maximum acceleration with which the trolley can be moved horizontally in ms^{-2} is: $(g = 10\ \text{m/s}^2)$
NEET 2026
(a) 2.1 (b) 1.8 (c) 1.5 (d) 1.2

98. Calculate the maximum acceleration of a moving car so that a body lying on the floor of the car remains stationary. The coefficient of static friction between the body and the floor is 0.15 $\left(g = 10\ \text{m s}^{-2}\right)$.
NEET 2023
(a) 150 m s^{-2} (b) 1.5 m s^{-2}
(c) 50 m s^{-2} (d) 1.2 m s^{-2}

◆ Stopping by friction 9 Qs

99. A block of mass 1 kg is kept on ice surface. When velocity of 4 m/s is given to it, it stops by friction in 5 second. The coefficient of friction is (acceleration due to gravity, $g = 10\ \text{m/s}^2$)
MHT CET 2026 · 12 MAY · SHIFT 2
(a) 0.02 (b) 0.04 (c) 0.08 (d) 0.09

100. A block of mass m is moving on rough horizontal surface with momentum p. The coefficient of friction between the block and surface is μ. The distance covered by block before it stops is [g = acceleration due to gravity]
MHT CET 2020 · 16 OCT · SHIFT 2
(a) $\frac{2\mu M^2 g}{p^2}$ (b) $\frac{p}{2\mu Mg}$ (c) $\frac{2\mu Mg}{p}$ (d) $\frac{p^2}{2\mu M^2 g}$

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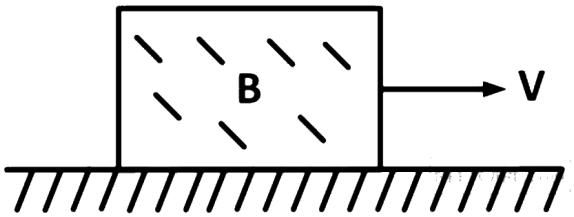
101. A conveyor belt is moving at a constant speed of 2 ms $^{-}$1. A box is gently dropped on it. The coefficient of friction between them is $\mu = 0.5$. The distance that the box will move relativce to belt before coming to rest on it, taking g = 10 m s^{-}2,, is

AIPMT 2011 · MAINS

(a) 0.4 m (b) 1.2 m (c) 0.6 m (d) zero

102. A block B is pushed momentarily along a horizontaly surface with an initial velocity V. If μ is the coefficient of sliding friction between B and the surface, block B will come to rest after a time

AIPMT 2007



(a) gμ/V (b) g/V
(c) V/g (d) V/(gμ).

103. Consider a car moving along a straight horizontal road with a speed of 72 km/h. If the coefficient of static friction between the tyres and the road is 0.5, the shortest distance in which the car can be stopped is (taking $g = 10\ \text{m/s}^2$)

AIPMT 1992

(a) 30 m (b) 40 m (c) 72 m (d) 20 m

104. A body of mass 10 kg is moving with an initial speed of 20 m/s. The body stops after 5 s due to friction between body and the floor. The value of the coefficient of friction is:

(Take acceleration due to gravity $g = 10\ \text{ms}^{-2}$)

JEE MAIN 2023 · 31 JAN · SHIFT 2

(a) 0.3 (b) 0.2 (c) 0.5 (d) 0.4

105. A block of mass 10 kg starts sliding on a surface with an initial velocity of 9.8 ms^{-}1. The coefficient of friction between the surface and block is 0.5. The distance covered by the block before coming to rest is:

[use g = 9.8 ms^{-}2]

JEE MAIN 2022 · 24 JUN · SHIFT 1

(a) 4.9 m (b) 9.8 m (c) 12.5 m (d) 19.6 m

106. Consider a car moving on a straight road with a speed of 100 m/s. The distance at which car can be stopped is $[\mu_k = 0.5]$

AIEEE 2005

(a) 1000 m (b) 800 m (c) 400 m (d) 100 m

107. A marble block of mass 2 kg lying on ice when given a velocity of 6 m/s is stopped by friction in 10 s. Then the coefficient of friction is

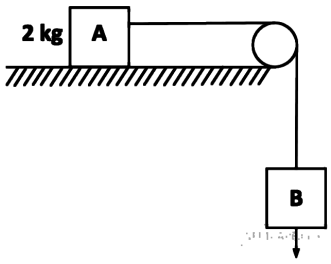
AIEEE 2003

(a) 0.02 (b) 0.03 (c) 0.04 (d) 0.06

◆ Hanging mass on a rough table 2 Qs

108. The coefficient of static friction, μs, between block A of mass 2 kg and the table as shown in the figure is 0.2. What would be the maximum mass value of block B so that the two blocks do not move? The string and the pulley are assumed to be smooth and massless. (g = 10 m/s2)

AIPMT 2004

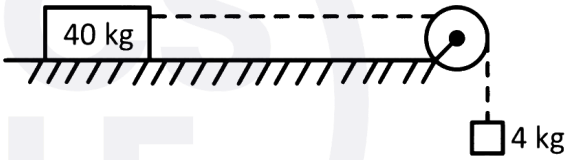


(a) 2.0 kg (b) 4.0 kg (c) 0.2 kg (d) 0.4 kg

109. A block of mass 40 kg slides over a surface, when a mass of 4 kg is suspended through an inextensible massless string passing over frictionless pulley as shown below.

The coefficient of kinetic friction between the surface and block is 0.02. The acceleration of block is. (Given g = 10 ms^{-}2.)

JEE MAIN 2022 · 29 JUN · SHIFT 2



(a) 1 ms^{-2} (b) 1/5 ms^{-2}
(c) 4/5 ms^{-2} (d) 8/11 ms^{-2}

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TOPIC 07

Friction on an Incline

7 PYQs · Easy 7 · Medium 0 · Difficult 0 | MHT CET 0 · NEET 2 · JEE 5

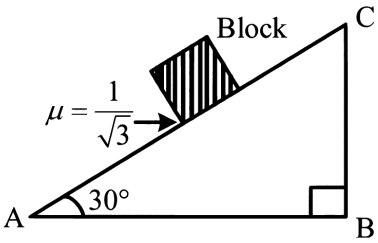
Concepts covered: Angle of repose & block at rest (5) · Sliding down & up a rough incline (2)

LEVEL 1 · EASY 7 questions

◆ Angle of repose & block at rest 5 Qs

110. A block of mass 2 kg is placed on inclined rough surface AC (as shown in figure) of coefficient of friction μ. If g = 10 m s^{-2}, the net force (in N) on the block will be:

NEET 2023



(a) $10\sqrt{3}$ (b) zero (c) 10 (d) 20

111. A block has been placed on a inclined plane with the slope angle θ, block slides down the plane at constant speed. The coefficient of kinetic friction is equal to

AIPMT 1993

(a) $\sin\theta$ (b) $\cos\theta$ (c) g (d) $\tan\theta$

112. A 2 kg brick begins to slide over a surface which is inclined at an angle of 45° with respect to horizontal axis. The co-efficient of static friction between their surfaces is:

JEE MAIN 2024 · 4 APR · SHIFT 2

(a) 1 (b) 1.7 (c) 0.5 (d) $\frac{1}{\sqrt{3}}$

113. A block of mass M slides down on a rough inclined plane with constant velocity. The angle made by the incline plane with horizontal is θ. The magnitude of the contact force will be:

JEE MAIN 2022 · 27 JUL · SHIFT 2

(a) Mg (b) $Mg\cos\theta$
(c) $\sqrt{Mg\sin\theta + Mg\cos\theta}$ (d) $Mg\sin\theta\sqrt{1+\mu}$

114. A block rests on a rough inclined plane making an angle of 30° with the horizontal. The coefficient of static friction between the block and the plane is 0.8. If the frictional force on the block is 10 N, the mass of the block (in kg) is $(take\ \ g = 10\ m/s^2)$

AIEEE 2004

(a) 1.6 (b) 4.0 (c) 2.0 (d) 2.5

◆ Sliding down & up a rough incline 2 Qs

115. A cubic block of mass m is sliding down on an inclined plane at 60° with an acceleration of $\frac{g}{2}$, the value of coefficient of kinetic friction is

JEE MAIN 2025 · 7 APR · SHIFT 1

(a) $\frac{\sqrt{3}}{2}$ (b) $\frac{\sqrt{2}}{3}$ (c) $1-\frac{\sqrt{3}}{2}$ (d) $\sqrt{3}-1$

116. A block of mass m slides down the plane inclined at angle 30° with an acceleration $\frac{g}{4}$. The value of coefficient of kinetic friction will be:

JEE MAIN 2023 · 29 JAN · SHIFT 1

(a) $\frac{2\sqrt{3}-1}{2}$ (b) $\frac{\sqrt{3}}{2}$ (c) $\frac{1}{2\sqrt{3}}$ (d) $\frac{2\sqrt{3}+1}{2}$

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TOPIC 08

Two-Body Friction

4 PYQs · Easy 4 · Medium 0 · Difficult 0 | MHT CET 0 · NEET 2 · JEE 2

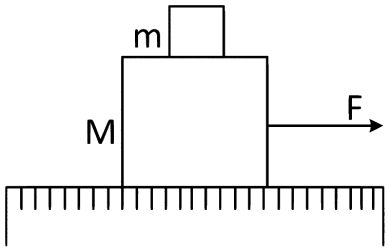
Concepts covered: Block on block (1) · Hanging chain (2) · Block on a cart or pressed to a wall (1)

LEVEL 1 · EASY 4 questions

◆ Block on block 1 Q

117. A system of two blocks of masses m = 2 kg and M = 8 kg is placed on a smooth table as shown in figure. The coefficient of static friction between two blocks is 0.5. The maximum horizontal force F that can be applied to the block of mass M so that the blocks move together will be:

JEE MAIN 2022 · 27 JUN · SHIFT 1



(a) 9.8 N (b) 39.2 N (c) 49 N (d) 78.4 N

◆ Hanging chain 2 Qs

118. A heavy uniform chain lies on horizontal table top. If the coefficient of friction between the chain and the table surface is 0.25, then the maximum fraction of the length of the chain that can hang over one edge of the table is

AIPMT 1991

(a) 20% (b) 25% (c) 35% (d) 15%

119. A uniform chain of 6 m length is placed on a table such that a part of its length is hanging over the edge of the table. The system is at rest. The co-efficient of static friction between the chain and the surface of the table is 0.5, the maximum length of the chain hanging from the table is _____ m.

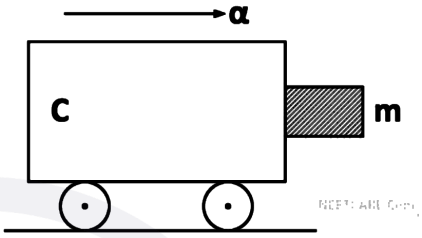
JEE MAIN 2022 · 25 JUN · SHIFT 1 *(Numerical)*

◆ Block on a cart or pressed to a wall 1 Q

120. A block of mass m is in contact with the cart C as shown in the figure.

The coefficient of static friction between the block and the cart is μ. The acceleration α of the cart that will prevent the block from falling satisfies

AIPMT 2010 · PRELIMS



(a) $\alpha > \frac{mg}{\mu}$ (b) $\alpha > \frac{g}{\mu m}$ (c) $\alpha \geq \frac{g}{\mu}$ (d) $\alpha < \frac{g}{\mu}$

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TOPIC 09

Circular Motion (Related PYQs)

8 PYQs · Easy 8 · Medium 0 · Difficult 0 | MHT CET 0 · NEET 8 · JEE 0

Concepts covered: Circular motion (8)

LEVEL 1 · EASY 8 questions

121. A car travels on a circular racetrack of radius 50 m, which is banked at an angle θ. If the car travels at a speed $10\ \text{ms}^{-1}$, then the wear and tear on its tyres is minimum. Taking the acceleration due to gravity to be $10\ \text{ms}^{-2}$, the value of θ is:

RE-NEET 2026

(a) $\tan^{-1}(2\sqrt{3})$ (b) $\tan^{-1}\left(\frac{1}{5}\right)$
(c) $\tan^{-1}\left(\frac{2}{5}\right)$ (d) $\tan^{-1}(\sqrt{3}/2)$

122. A particle moving with uniform speed in a circular path maintains:

NEET 2024

(a) Constant velocity
(b) Constant acceleration
(c) Constant velocity but varying acceleration
(d) Varying velocity and varying acceleration

123. A mass m is attached to a thin wire and whirled in a vertical circle. The wire is most likely to break when:

NEET 2019

(a) the wire is horizontal
(b) inclined at an angle of 60° from vertical
(c) the mass is at the lowest point
(d) the mass is at the highest point

124. One end of string of length l is connected to a particle of mass 'm' and the other end is connected to a small peg on a smooth horizontal table. If the particle moves in circle with speed 'v', the net force on the particle (directed towards centre) will be (T represents the tension in the string)

NEET 2017

(a) $T + \frac{mv^2}{l}$ (b) $T - \frac{mv^2}{l}$ (c) zero (d) T

125. Two stones of masses m and 2m are whirled in horizontal circles, the heavier one in a radius $\frac{r}{2}$ and the lighter one in radius r. The tangential speed of lighter stone is n times that of the value of heavier stone when they exprience same centripetal forces. The value of n is

AIPMT 2015

(a) 4 (b) 1 (c) 2 (d) 3

126. A 500 kg car takes a round turn of radius 50 m with a velocity of 36 km/h. The centripetal force is

AIPMT 1999

(a) 250 N (b) 750 N (c) 1000 N (d) 1200 N

127. A ball of mass 0.25 kg attached to the end of a string of length 1.96 m is moving in a horizontal circle. The string will break if the tension is more than 25 N. What is the maximum speed with which the ball can be moved?

AIPMT 1998

(a) 14 m/s (b) 3 m/s
(c) 3.92 m/s (d) 5 m/s

128. When milk is churned, cream gets separated due to

AIPMT 1991

(a) centripetal force (b) centrifugal force
(c) fricitional force (d) gravitational force

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ANSWER KEY

Shaded by level: **Easy**

01 Inertia, First & Second Laws

1. (a)	2. (c)	3. (c)	4. (c)	5. (a)	6. (d)	7. (c)	8. (b)	9. (c)	10. (c)
11. (a)	12. 10	13. (b)	14. (b)	15. (a)	16. (c)	17. (c)			

02 Equilibrium, Third Law & Frames

18. (d)	19. (c)	20. (d)	21. (d)	22. (a)	23. (a)	24. (a)	25. (d)	26. (b)	27. (c)

03 Impulse & Momentum Conservation

28. (c)	29. (b)	30. (c)	31. (b)	32. (c)	33. (a)	34. (d)	35. (a)	36. (a)	37. (b)
38. (c)	39. (d)	40. (c)	41. (c)	42. (b)	43. (b)				

04 Apparent Weight & Lift

44. (c)	45. (b)	46. (b)	47. (c)	48. (d)	49. (d)	50. (d)	51. (c)	52. (b)	53. (a)
54. (c)	55. 492	56. (b)	57. (c)	58. (a)	59. (b)	60. (b)	61. (c)		

05 Connected Bodies & Pulleys

62. (d)	63. (a)	64. (b)	65. 12	66. (c)	67. (c)	68. (b)	69. (d)	70. (b)	71. (c)
72. (a)	73. (d)	74. 240	75. (b)	76. (d)	77. (a)	78. (c)	79. (a)	80. (b)	81. (b)
82. (a)	83. (c)	84. (c)	85. (b)	86. (c)	87. (b)	88. (c)	89. (d)	90. (c)	

06 Friction Basics

91. (d)	92. (b)	93. (a)	94. (d)	95. 25	96. (b)	97. (d)	98. (b)	99. (c)	100. (d)
101. (a)	102. (d)	103. (b)	104. (d)	105. (b)	106. (a)	107. (d)	108. (d)	109. (d)	

07 Friction on an Incline

110. (b)	111. (d)	112. (a)	113. (a)	114. (c)	115. (d)	116. (c)			

08 Two-Body Friction

117. (c)	118. (a)	119. 2	120. (c)						

09 Circular Motion (Related PYQs)

121. (b)	122. (d)	123. (c)	124. (d)	125. (c)	126. (c)	127. (a)	128. (b)		

Note: *"Bonus" = no option is correct as the question is printed (dropped in the official key). Numerical questions show the numerical answer.*

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