EdLoop JEE

PHYSICS · JEE MAIN

Laws of Motion

Previous Year Questions with answers

253 questions · **153** papers · **2002–2026** · newest paper first

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What is in this PDF: every Laws of Motion question we hold from past JEE Main and AIEEE papers, with its options and answer. Where an answer comes from a source other than the official final key, it says so next to the answer.

Step-by-step solutions for every question are free in the EdLoop JEE app (Google Play) and on app.edloop.in. More chapters: pyq.edloop.in/free-pdfs/

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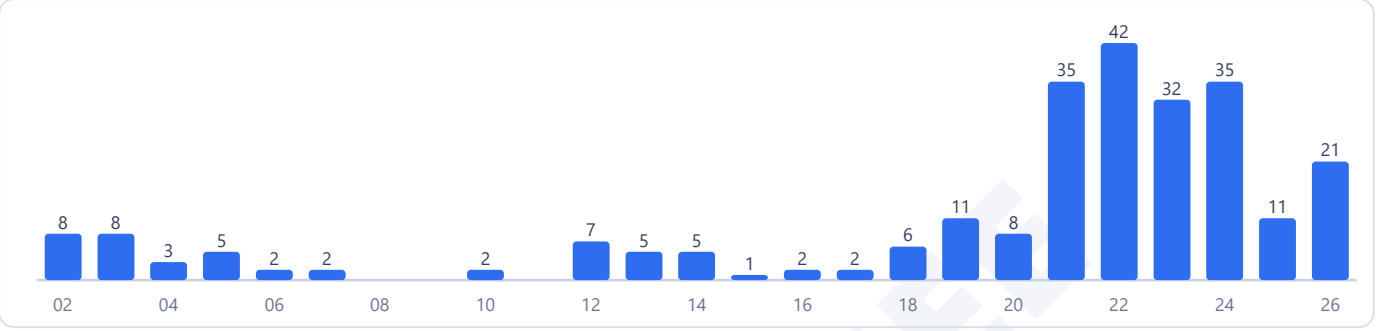
Chapter at a glance

4.3%	253	126 of 162	214 / 39
of Physics questions, 2019–2026	questions, 2002–2026	papers asked it, 2019–2026	MCQ / numerical, 2002–2026

Trend. Steady: 1.2 questions per paper in 2024–2026 against 1.2 in 2019–2023.

Questions per year



Counts are the questions we hold: 253 in 153 papers. 5 questions in this chapter came back in more than one paper.

Most-asked topics in this chapter (2002–2026)

Newton's Laws & Free Body Diagrams	89
Friction	65
Momentum & Impulse	50
Dynamics of Circular Motion	49

How often it comes up

Laws of Motion sits at the theoretical core of classical mechanics in JEE Main Physics. Across the papers we hold from 2019 to 2026, the chapter contributed **195 questions in 162 papers**, which translates to **1.2 questions per paper**, turning up in 126 of those 162 papers. Over this eight-year period, it holds the **8th position among 29 Physics chapters**, claiming 4.3% of all Physics questions.

Its overall presence has stayed about the same across multiple testing eras. From 2002 to 2018, it commanded 4.3% of the Physics section; during the 2024 to 2026 exam cycle, it held precisely that same 4.3% mark, delivering 67 questions in 58 papers. The most concentrated testing occurred in 2024, when our papers recorded 35 questions across 20 papers. Since 2019 there has been no year without it, appearing in 126 of the 162 papers we hold.

Designated as Unit 3: Laws of Motion in NTA's Class 11 syllabus, the chapter provides the free-body methodology and force balance equations used continuously in gravitation, fluids, and rotational dynamics.

Most-asked topics

Between 2019 and 2026, the questions sorted into four balanced topics:

- **Newton's Laws & Free Body Diagrams**: 65 questions. Coupled blocks, pulley-string assemblies, variable force integration, and equilibrium under concurrent forces.
- **Friction**: 48 questions. Static limits, kinetic resistance on inclined planes, two-block slip conditions, and minimum holding forces.
- **Dynamics of Circular Motion**: 42 questions. Vertical circular loops, tension extremes, conical pendulums, and centrifugal death-well cylinders.

- **Momentum & Impulse**: 40 questions. Internal explosions, vector momentum conservation in two dimensions, and force-time impulse areas.

All four topic divisions featured actively in 2026 shifts, requiring students to treat each with equal seriousness.

What the questions look like

Pulley and block questions evaluate your ability to set up coupled equations of motion. A standard setup links two masses on rough or smooth inclines connected via massless cords over light pulleys. Students must write separate second-law equations for each component, identify geometric acceleration constraints, and solve for string tension or system acceleration. When forces vary with time, as when a polynomial force vector acts on an inertial mass, direct integration yields velocity and displacement vectors.

Friction problems test the boundary between static rest and kinetic sliding. Common scenarios place a block on an inclined ramp where the angle exceeds the repose angle, asking for the stopping distance when the block is kicked uphill against both gravity and friction. Another recurring pattern places one block atop another on a smooth floor, asking for the maximum external force applied to the bottom block before upper slip occurs.

Circular dynamics problems split between horizontal and vertical planes. In horizontal setups, a cylindrical rotor spins until static friction along the inner vertical wall balances gravity on a rider. In vertical circular motion, questions probe non-uniform speed variations, asking for bottom launch speed when the string goes slack at an intermediate angular elevation.

A solid fraction of problems requires direct numeric values: 39 of the 195 questions between 2019 and 2026 were numerical answer items with no multiple-choice alternatives.

How to practise it

Master free-body diagrams by isolating each body onto clean scrap paper before writing down equations. Clearly indicate contact normals, friction forces opposing relative motion, gravitational pull, and cord tensions. Choose an acceleration direction for each body that honors string inextensibility, ensuring your coordinate axes align with intended accelerations.

For friction, check static limiting friction before assuming motion occurs. Calculate the maximum static friction value first; if the driving force is smaller, friction equals the applied force and acceleration is zero. Only when driving force exceeds static friction should you employ kinetic friction coefficients in Newton's second law.

In circular motion, identify the physical agent supplying the centripetal force, whether string tension, normal contact, or friction, instead of writing centrifugal force into an inertial frame. For vertical loops, combine mechanical energy conservation between points with the radial force balance equation at the point where tension or normal contact vanishes.

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Q1 JEE Main 2026 · 8 Apr · Shift 2 MCQ

A car moving with a speed of 54 km/h takes a turn of radius 20 m. A simple pendulum is suspended from the ceiling of the car. Determine the angle made by the string of the pendulum with the vertical during the turning. (Take $g = 10$ m/s^2)

(A) $\tan^{-1}(0.5)$

(B) $\tan^{-1}(0.75)$

(C) $\tan^{-1}(1.125)$

(D) $\tan^{-1}(0.25)$

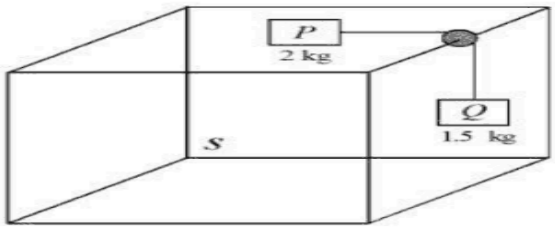
Answer: (C) $\tan^{-1}(1.125)$ · Official NTA final key

Q2 JEE Main 2026 · 6 Apr · Shift 1 MCQ

Two blocks (P and Q) with respectively masses 2 kg and 1.5 kg are joined by a massless thread. These blocks are mounted on a frictionless pully which is fixed on the edge of a cube (S), as shown in the figure below. Block P is positioned on the top surface which has no friction and block Q is in contact with side-surface, having coefficient friction μ. The cube (S) moves towards the right with acceleration of $\frac{g}{2}$, where g is gravitational acceleration. During this movement the block P and Q remain stationary. The value of μ is _____.
(take g = 10 m/s^2)

(see the figure above)

Two blocks (P and Q) with respectively masses 2 kg and 1.5 kg are joined by a massless thread. These blocks are mounted on a frictionless pully which is fixed on the edge of a cube (S), as shown in the figure below. Block P is positioned on the top surface which has no friction and block Q is in contact with side-surface, having coefficient friction μ. The cube (S) moves towards the right with acceleration of $\frac{g}{2}$, where g is gravitational acceleration. During this movement the block P and Q remain stationary. The value of μ is _____.
(take g = 10 m/s^2)



Options :

6952787593. 0.33

6952787594. 0.67

6952787595. 1

6952787596. 0.5

(A) 0.33
(B) 0.67
(C) 1
(D) 0.5

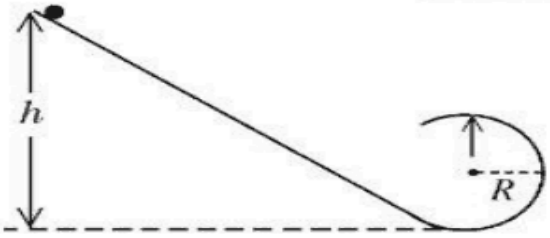
Answer: (B) 0.67 · Official NTA final key

Q3 JEE Main 2026 · 6 Apr · Shift 1 MCQ

A smooth inclined plane ends in a vertical circular loop, as shown in the figure. A small body is released from height h as shown. If the body exerts a force of three times its weight on the plane at the highest point of circle then the height $h = \alpha R$. The value of α is _____.

(see the figure above)

A smooth inclined plane ends in a vertical circular loop, as shown in the figure. A small body is released from height h as shown. If the body exerts a force of three times its weight on the plane at the highest point of circle then the height $h = \alpha R$. The value of α is _____.



Options :

6952787605. 2

6952787606. 4

6952787607. 3

6952787608. 6

(A) 2
(B) 4
(C) 3
(D) 6

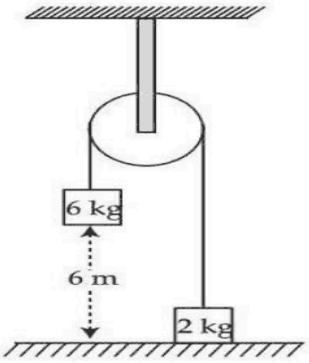
Answer: (B) 4 · Official NTA final key

Q4 JEE Main 2026 · 6 Apr · Shift 2 MCQ

The velocity at which 6 kg mass (shown in figure) strikes the ground when it is released from a height of 6 m above the ground is _____ m/s. Assume pulley is massless and string is light and inextensible.
(Take g = 10 m/s^2)

(see the figure above)

The velocity at which 6 kg mass (shown in figure) strikes the ground when it is released from a height of 6 m above the ground is _____ m/s. Assume pulley is massless and string is light and inextensible. (Take $g = 10\ m/s^2$)



Options :

6911214238. 7.74

6911214239. 7.20

6911214240. 6.55

6911214241. 4.50

(A) 7.74

(B) 7.20

(C) 6.55

(D) 4.50

Answer: (A) 7.74 · Official NTA final key

Q5 JEE Main 2026 · 6 Apr · Shift 2 Numerical

A block takes t time to slide down a plane inclined at 45° to the horizontal. If the surface is made smooth (frictionless), the block takes time $\frac{t}{2}$ to slide down the plane. The coefficient of friction between the block and the inclined plane is $\left(\frac{\alpha}{100}\right)$. The value of α is _____.

Numerical value type: the answer is a number.

Answer: 75. · Official NTA final key

Q6 JEE Main 2026 · 5 Apr · Shift 1 MCQ

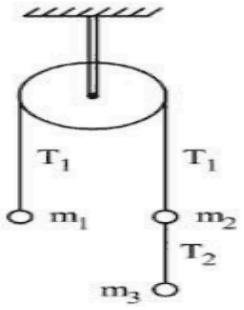
Three masses $m_1 = 4$ kg, $m_2 = 4$ kg and $m_3 = 6$ kg are suspended from a fixed smooth frictionless pully as shown in the figure below. The value of T_1/T_2 is _____.

(take $g = 10\ m/s^2$)

(see the figure above)

Three masses $m_1 = 4$ kg, $m_2 = 4$ kg and $m_3 = 6$ kg are suspended from a fixed smooth frictionless pully as shown in the figure below. The value of T_1/T_2 is _____

(take $g = 10$ m/s^2)



Options :

6952781118. 5/3

6952781119. 2/3

6952781120. 3/5

6952781121. 2/5

(A) 5/3

(B) 2/3

(C) 3/5

(D) 2/5

Answer: (A) 5/3 · Official NTA final key

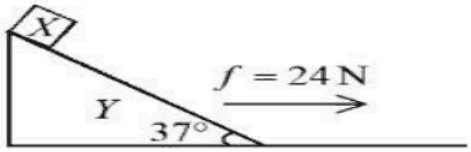
Q7 JEE Main 2026 · 5 Apr · Shift 1 MCQ

A wedge Y with mass of 10 kg and all frictionless surfaces and the inclined surface making 37° with horizontal. A block X with mass 2 kg is placed at the highest point of the wedge as shown in figure is at rest. At $t = 0$ wedge (Y) is pulled toward right with constant force (f) of 24 N. Taking the block X at rest at $t = 0$, the time taken by it to slide down 8.8 m on the slope, while Y is on the move, is _____ s.

(take $\tan(37^\circ) = 3/4$ and $g = 10$ m/s^2)

(see the figure above)

A wedge Y with mass of 10 kg and all frictionless surfaces and the inclined surface making $37°$ with horizontal. A block X with mass 2 kg is placed at the highest point of the wedge as shown in figure is at rest. At $t = 0$ wedge (Y) is pulled toward right with constant force (f) of 24 N. Taking the block X at rest at $t = 0$, the time taken by it to slide down 8.8 m on the slope, while Y is on the move, is_____ s.
(take $\tan(37°) = 3/4$ and $g = 10\ m/s^2$)



Options :

6952781122. 2

6952781123. 4

6952781124. $\sqrt{2}$

6952781125. $2\sqrt{2}$

(A) 2
(B) 4
(C) $\sqrt{2}$
(D) $2\sqrt{2}$

Answer: (A) 2 · Official NTA final key

Q8 JEE Main 2026 · 4 Apr · Shift 1 MCQ

The time taken by a block of mass m to slide down from the highest point to the lowest point on a rough inclined plane is 50 % more compared to the time taken by the same block on identical inclined smooth plane. Both inclined planes are at 45° with the horizontal. The coefficient of kinetic friction between the rough inclined surface and block is _____.

(A) 3/4
(B) 2/3
(C) 5/9
(D) 4/9

Answer: (C) 5/9 · Official NTA final key

Q9 JEE Main 2026 · 4 Apr · Shift 2 MCQ

At $t = 0$, a body of mass 100 g starts moving under the influence of a force $\left(5\hat{i} + 10\hat{j}\right)$N. After 2 s its position is $\left(2x\hat{i} + 5y\hat{j}\right)$ m. The ratio $x : y$ is _____.

(A) $1 : 2$
(B) $2 : 5$
(C) $5 : 2$
(D) $5 : 4$

Answer: (D) $5 : 4$ · Official NTA final key

Q10 JEE Main 2026 · 2 Apr · Shift 2 MCQ

A 0.5 kg mass is in contact against the inner wall of a cylindrical drum of radius 4 m rotating about its vertical axis. The minimum rotational speed of the drum to enable the mass to remain stuck to the wall (without falling) is 5 rad/s. The coefficient of friction between the drum's inner wall surface and mass is _____. (Take g = 10 m/s^2)

(A) 0.1
(B) 0.5
(C) 0.7
(D) 0.3

Answer: (A) 0.1 · Official NTA final key

Q11 JEE Main 2026 · 28 Jan · Shift 1 MCQ

A block of mass 5 kg is moving on an inclined plane which makes an angle of 30° with the horizontal. Friction coefficient between the block and inclined plane surface is $\frac{\sqrt{3}}{2}$. The force to be applied on the block so that the block will move down without acceleration is _____ N.

($g = 10$ m/s^2).

(A) 7.5
(B) 15
(C) 25
(D) 12.5

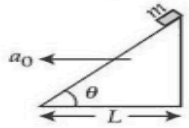
Answer: (D) 12.5 · Official NTA final key

Q12 JEE Main 2026 · 28 Jan · Shift 2 MCQ

A small block of mass m slides down from the top of a frictionless inclined surface, while the inclined plane is moving towards left with constant acceleration a_0. The angle between the inclined plane and ground is θ and its base length is L. Assuming that initially the small block is at the top of the inclined plane, the time it takes to reach the lowest point of the inclined plane is _____.

(see the figure above)

Q.36 A small block of mass m slides down from the top of a frictionless inclined surface, while the inclined plane is moving towards left with constant acceleration a_0. The angle between the inclined plane and ground is θ and its base length is L. Assuming that initially the small block is at the top of the inclined plane, the time it takes to reach the lowest point of the inclined plane is _____.



Options

1. $\sqrt{\frac{4L}{g\ sin2\theta\ -\ a_0(1\ +\ cos2\theta)}}$
2. $\sqrt{\frac{2L}{g\ sin\theta\ -\ a_0 cos\theta}}$
3. $\sqrt{\frac{4L}{g\ cos^2\theta\ -\ a_0\ sin\theta cos\theta}}$
4. $\sqrt{\frac{2L}{g sin\,2\theta - a_0\,(1+cos\,2\theta)}}$

(A) $\sqrt{\frac{4L}{g\sin 2\theta - a_0(1+\cos 2\theta)}}$

(B) $\sqrt{\frac{2L}{g\sin\theta - a_0\cos\theta}}$

(C) $\sqrt{\frac{4L}{g\cos^2\theta - a_0\sin\theta\cos\theta}}$

(D) $\sqrt{\frac{2L}{g\sin 2\theta - a_0(1+\cos 2\theta)}}$

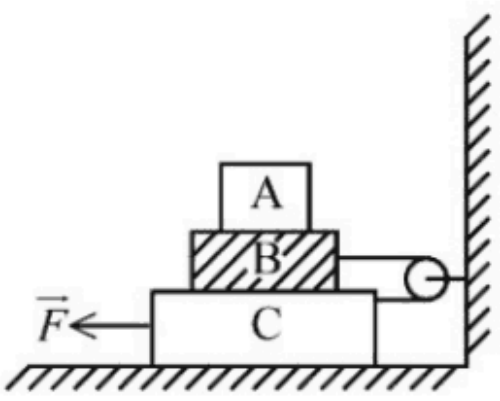
Answer: (A) $\sqrt{\frac{4L}{g\sin 2\theta - a_0(1+\cos 2\theta)}}$ · Official NTA final key

Q13 JEE Main 2026 · 24 Jan · Shift 1 Numerical

In the given figure the blocks A, B and C weigh 4 kg, 6 kg and 8 kg respectively. The co-efficient of sliding friction between any two surfaces is 0.5. The force $\vec{F}$ required to slide the block C with constant speed is _____ N. (Use $g = 10$ m/s^2)

(see the figure above)

Q.46 In the given figure the blocks A, B and C weigh 4 kg, 6 kg and 8 kg respectively. The co-efficient of sliding friction between any two surfaces is 0.5. The force $\vec{F}$ required to slide the block C with constant speed is _____ N. (Use $g = 10$ m/s^2)



Numerical value type: the answer is a number.

Answer: 210. · Official NTA final key

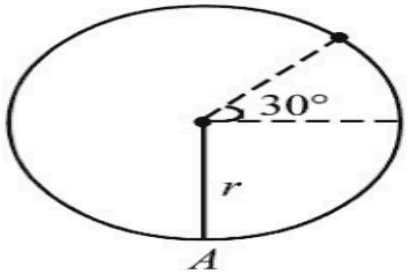
Q14 JEE Main 2026 · 24 Jan · Shift 2 MCQ

In case of vertical circular motion of a particle by a thread of length r if the tension in the thread is zero at an angle 30° shown in figure, the velocity at the bottom point (A) of the circular path is

(g = gravitational acceleration)

(see the figure above)

Q.30 In case of vertical circular motion of a particle by a thread of length r if the tension in the thread is zero at an angle $30°$ shown in figure, the velocity at the bottom point (A) of the circular path is
(g = gravitational acceleration)



Options

1. $\sqrt{\frac{7}{2}gr}$
2. $\sqrt{4gr}$
3. $\sqrt{5gr}$
4. $\sqrt{\frac{5}{2}gr}$

(A) $\sqrt{\frac{7}{2}gr}$
(B) $\sqrt{4gr}$
(C) $\sqrt{5gr}$
(D) $\sqrt{\frac{5}{2}gr}$

Answer: (A) $\sqrt{\frac{7}{2}gr}$ · Official NTA final key

Q15 JEE Main 2026 · 24 Jan · Shift 2 MCQ

A flexible chain of mass m hangs between two fixed points at the same level. The inclination of the chain with the horizontal at the two points of support is 30°. Considering the equilibrium of each half of the chain, the tension of the chain at the lowest point is _____.

(A) $\sqrt{3}mg$
(B) $\frac{\sqrt{3}}{2}mg$
(C) mg
(D) $\frac{1}{2}mg$

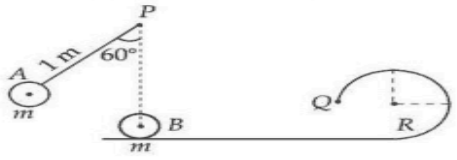
Answer: (B) $\frac{\sqrt{3}}{2}mg$ · Official NTA final key

Q16 JEE Main 2026 · 23 Jan · Shift 1 MCQ

A small bob A of mass m is attached to a massless rigid rod of length 1 m pivoted at point P and kept at an angle of 60° with vertical as shown in figure. At distance of 1 m below point P, an identical bob B is kept at rest on a smooth horizontal surface that extends to a circular track of radius R as shown in figure. If bob B just manages to complete the circular path of radius R upto a point Q after being hit elastically by bob A, then radius R is _____ m.

(see the figure above)

Q.28 A small bob A of mass m is attached to a massless rigid rod of length 1 m pivoted at point P and kept at an angle of 60° with vertical as shown in figure. At distance of 1 m below point P, an identical bob B is kept at rest on a smooth horizontal surface that extends to a circular track of radius R as shown in figure. If bob B just manages to complete the circular path of radius R upto a point Q after being hit elastically by bob A, then radius R is _____m.



Options
1. $\frac{3}{5}$
2. $\frac{2-\sqrt{3}}{5}$
3. $\frac{1}{5}$
4. $\frac{2+\sqrt{3}}{5}$

(A) $\frac{3}{5}$
(B) $\frac{2-\sqrt{3}}{5}$
(C) $\frac{1}{5}$
(D) $\frac{2+\sqrt{3}}{5}$

Answer: (C) $\frac{1}{5}$ · Official NTA final key

Q17 JEE Main 2026 · 23 Jan · Shift 2 MCQ

A body of mass 14 kg initially at rest explodes and breaks into three fragments of masses in the ratio 2 : 2 : 3. The two pieces of equal masses fly off perpendicular to each other with a speed of 18 m/s each. The velocity of the heavier fragment is _____ m/s.

(A) $12\sqrt{2}$
(B) 12
(C) $10\sqrt{2}$
(D) $24\sqrt{2}$

Answer: (A) $12\sqrt{2}$ · Official NTA final key

Q18 JEE Main 2026 · 23 Jan · Shift 2 MCQ

A block is sliding down on an inclined plane of slope θ and at an instant $t = 0$ this block is given an upward momentum so that it starts moving up on the inclined surface with velocity u. The distance (S) travelled by the block before its velocity become zero, is _____.

(g = gravitational acceleration)

(A) $\frac{u^2}{2g\cos\theta}$
(B) $\frac{u^2}{\sqrt{2}g\cos\theta}$
(C) $\frac{u^2}{4g\sin\theta}$
(D) $\frac{2u^2}{g\cos\theta}$

Dropped by NTA. Full marks to everyone. · Official NTA final key

Q19 JEE Main 2026 · 22 Jan · Shift 1 MCQ

A simple pendulum has a bob with mass m and charge q. The pendulum string has negligible mass. When a uniform and horizontal electric field $\vec{E}$ is applied, the tension in the string changes. The final tension in the string, when pendulum attains an equilibrium position is _____.

(g: acceleration due to gravity)

(A) $\sqrt{m^2g^2 - q^2E^2}$
(B) $\sqrt{m^2g^2 + q^2E^2}$
(C) $mg + qE$
(D) $mg - qE$

Answer: (B) $\sqrt{m^2g^2 + q^2E^2}$ · Official NTA final key

Q20 JEE Main 2026 · 21 Jan · Shift 1 MCQ

A 4 kg mass moves under the influence of a force $\vec{F} = \left(4t^3\hat{i} - 3t\hat{j}\right)$ N where t is the time in second. If mass starts from origin at $t = 0$, the velocity and position after $t = 2$ s will be :

(A) $\vec{v} = 3\hat{i} + \frac{3}{2}\hat{j}\ \vec{r} = \frac{6}{5}\hat{i} + \hat{j}$
(B) $\vec{v} = 4\hat{i} - \frac{3}{2}\hat{j}\ \vec{r} = \frac{6}{5}\hat{i} - \hat{j}$
(C) $\vec{v} = 4\hat{i} + \frac{5}{2}\hat{j}\ \vec{r} = \frac{8}{5}\hat{i} + 2\hat{j}$
(D) $\vec{v} = 4\hat{i} - \frac{3}{2}\hat{j}\ \vec{r} = \frac{8}{5}\hat{i} - \hat{j}$

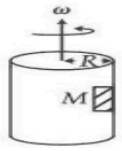
Answer: (D) $\vec{v} = 4\hat{i} - \frac{3}{2}\hat{j}\ \vec{r} = \frac{8}{5}\hat{i} - \hat{j}$ · Official NTA final key

Q21 JEE Main 2026 · 21 Jan · Shift 2 MCQ

A large drum having radius R is spinning around its axis with angular velocity ω, as shown in figure. The minimum value of ω so that a body of mass M remains stuck to the inner wall of the drum, taking the coefficient of friction between the drum surface and mass M as μ, is :

(see the figure above)

Q.38 A large drum having radius R is spinning around its axis with angular velocity ω, as shown in figure. The minimum value of ω so that a body of mass M remains stuck to the inner wall of the drum, taking the coefficient of friction between the drum surface and mass M as μ, is :



Options

1. $\sqrt{\frac{\mu g}{R}}$
2. $\sqrt{\frac{g}{\mu R}}$
3. $\sqrt{\frac{2g}{\mu R}}$
4. $\sqrt{\frac{g}{2\mu R}}$

(A) $\sqrt{\frac{\mu g}{R}}$
(B) $\sqrt{\frac{g}{\mu R}}$
(C) $\sqrt{\frac{2g}{\mu R}}$
(D) $\sqrt{\frac{g}{2\mu R}}$

Answer: (B) $\sqrt{\frac{g}{\mu R}}$ · Official NTA final key

Q22 JEE Main 2025 · 8 Apr · Shift 2 MCQ

A body of mass 2 kg moving with velocity of $\vec{v}_{in} = 3\hat{i} + 4\hat{j}\ ms^{-1}$ enters into a constant force field of 6 N directed along positive z-axis. If the body remains in the field for a period of $\frac{5}{3}$ seconds, then velocity of the body when it emerges from force field is.

(A) $4\hat{i}+3\hat{j}+5\hat{k}$
(B) $3\hat{i}+4\hat{j}-5\hat{k}$
(C) $3\hat{i}+4\hat{j}+5\hat{k}$
(D) $3\hat{i}+4\hat{j}+\sqrt{5}\hat{k}$

Answer: (C) $3\hat{i}+4\hat{j}+5\hat{k}$ · Key from source paper

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Q23 JEE Main 2025 · 7 Apr · Shift 1 MCQ

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

(A) $1-\frac{\sqrt{3}}{2}$
(B) $\sqrt{3}-1$
(C) $\frac{\sqrt{3}}{2}$
(D) $\frac{\sqrt{2}}{3}$

Answer: (B) $\sqrt{3}-1$ · Key from source paper

Q24 JEE Main 2025 · 4 Apr · Shift 1 MCQ

A body of mass m is suspended by two strings making angles θ_1 and θ_2 with the horizontal ceiling with tensions T_1 and T_2 simultaneously. T_1 and T_2 are related by $T_1=\sqrt{3}T_2$, the angles θ_1 and θ_2 are

(A) $\theta_1=30^\circ\theta_2=60^\circ$ with $T_2=\frac{3mg}{4}$
(B) $\theta_1=45^\circ\theta_2=45^\circ$ with $T_2=\frac{3mg}{4}$
(C) $\theta_1=60^\circ\theta_2=30^\circ$ with $T_2=\frac{mg}{2}$
(D) $\theta_1=30^\circ\theta_2=60^\circ$ with $T_2=\frac{4mg}{5}$

Answer: (C) $\theta_1=60^\circ\theta_2=30^\circ$ **with** $T_2=\frac{mg}{2}$ · Key from source paper

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Q25 JEE Main 2025 · 4 Apr · Shift 2 MCQ

A block of mass 25 kg is pulled along a horizontal surface by a force at an angle 45° with the horizontal. The friction coefficient between the block and the surface is 0.25. The block travels at a uniform velocity. The workdone by the applied force during a displacement of 5 m of the block is :

(A) 735 J
(B) 245 J
(C) 970 J
(D) 490 J

Answer: (B) 245 J · Key from source paper

Q26 JEE Main 2025 · 2 Apr · Shift 2 MCQ

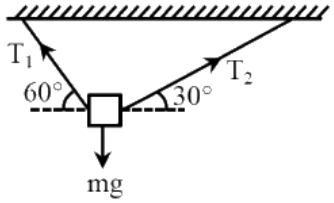
A body of mass 1 kg is suspended with the help of two strings making angles as shown in figure. Magnitudes of tensions T_1 and T_2, respectively, are (in N) :

(Take acceleration due to gravity $10m/s^2$)

(see the figure above)

7. 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 $10m/s^2$)



(1) $5\sqrt{3},5$ (2) $5,5\sqrt{3}$ (3) 5,5 (4) $5\sqrt{3},5\sqrt{3}$

(A) $5\sqrt{3},5$
(B) $5,5\sqrt{3}$
(C) 5,5
(D) $5\sqrt{3},5\sqrt{3}$

Answer: (A) $5\sqrt{3},5$ · Key from source paper

Q27 JEE Main 2025 · 29 Jan · Shift 2 MCQ

A sand dropper drops sand of mass $m(t)$ on a conveyer belt at a rate proportional to the square root of speed (v) of the belt, i.e. $\frac{dm}{dt} \propto \sqrt{v}$. If P is the power delivered to run the belt at constant speed then which of the following relationship is true?

(A) $\mathrm{P} \propto \sqrt{v}$
(B) $\mathrm{P} \propto v$
(C) $\mathrm{P}^2 \propto v^5$
(D) $\mathrm{P}^2 \propto v^3$

Answer: (C) $\mathrm{P}^2 \propto v^5$ · Key from source paper

Q28 JEE Main 2025 · 28 Jan · Shift 2 MCQ

A balloon and its content having mass M is moving up with an acceleration ' a '. The mass that must be released from the content so that the balloon starts moving up with an acceleration ' $3a$' will be (Take ' g ' as acceleration due to gravity)

(A) $\frac{2\mathrm{Ma}}{3a+g}$
(B) $\frac{3\mathrm{Ma}}{2a-g}$
(C) $\frac{3\mathrm{Ma}}{2a+g}$
(D) $\frac{2\mathrm{Ma}}{3a-g}$

Answer: (A) $\frac{2\mathrm{Ma}}{3a+g}$ · Key from source paper

Q29 JEE Main 2025 · 24 Jan · Shift 1 MCQ

A car of mass ' m ' moves on a banked road having radius ' r ' and banking angle θ. To avoid slipping from banked road, the maximum permissible speed of the car is v_0. The coefficient of friction μ between the wheels of the car and the banked road is

(A) $\mu = \frac{v_0^2 + rg\tan\theta}{rg + v_0^2\tan\theta}$

(B) $\mu = \frac{v_0^2 - rg\tan\theta}{rg - v_0^2\tan\theta}$

(C) $\mu = \frac{v_0^2 - rg\tan\theta}{rg + v_0^2\tan\theta}$

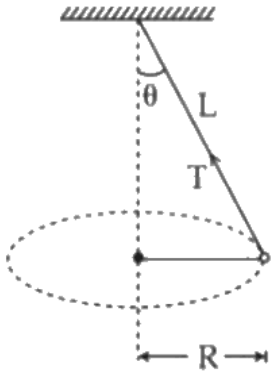
(D) $\mu = \frac{v_0^2 + rg\tan\theta}{rg - v_0^2\tan\theta}$

Answer: (C) $\mu = \frac{v_0^2 - rg\tan\theta}{rg + v_0^2\tan\theta}$ · Key from source paper

Q30 JEE Main 2025 · 24 Jan · Shift 2 Numerical

see figure

Q47.



A string of length L is fixed at one end and carries a mass of M at the other end. The mass makes $\left(\frac{3}{\pi}\right)$ rotations per second about the vertical axis passing through end of the string as shown. The tension in the string is ..... ML.

Numerical value type: the answer is a number.

Answer: 36. · Key from source paper

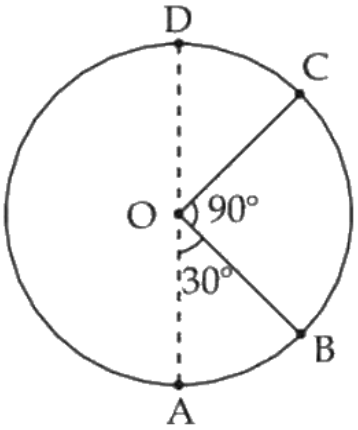
Q31 JEE Main 2025 · 22 Jan · Shift 2 MCQ

A body of mass 100 g is moving in circular path of radius 2 m on vertical plane as shown in figure. The velocity of the body at point A is 10 m/s. The ratio of its kinetic energies at point B and C is :

(see the figure above)

(Take acceleration due to gravity as 10 m/s^2)

Q37. A body of mass 100 g is moving in circular path of radius 2 m on vertical plane as shown in figure. The velocity of the body at point A is 10 m/s. The ratio of its kinetic energies at point B and C is :



(Take acceleration due to gravity as 10 m/s^2)

(1) $\frac{2+\sqrt{2}}{3}$
(2) $\frac{2+\sqrt{3}}{3}$
(3) $\frac{3+\sqrt{3}}{2}$
(4) $\frac{3-\sqrt{2}}{2}$

(A) $\frac{2+\sqrt{2}}{3}$
(B) $\frac{2+\sqrt{3}}{3}$
(C) $\frac{3+\sqrt{3}}{2}$
(D) $\frac{3-\sqrt{2}}{2}$

Answer: (C) $\frac{3+\sqrt{3}}{2}$ · Key from source paper

Q32 JEE Main 2025 · 22 Jan · Shift 2 Numerical

A tube of length 1 m is filled completely with an ideal liquid of mass 2 M , and closed at both ends. The tube is rotated uniformly in horizontal plane about one of its ends. If the force exerted by the liquid at the other end is F then angular velocity of the tube is $\sqrt{\frac{F}{\alpha M}}$ in SI unit. The value of α is _____ .

Numerical value type: the answer is a number.

Answer: 1. · Key from source paper

Q33 JEE Main 2024 · 9 Apr · Shift 1 MCQ

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 :

(A) 8 : 1
(B) 5 : 3
(C) 4 : 3
(D) 9 : 7

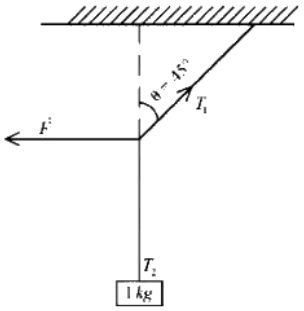
Answer: (D) 9 : 7 · Key from source paper

Q34 JEE Main 2024 · 9 Apr · Shift 2 MCQ

A 1 kg mass is suspended from the ceiling by a rope of length 4 m. A horizontal force '$\vec{F}$' is applied at the mid point of the rope so that the rope makes an angle of 45° with respect to the vertical axis as shown in figure. The magnitude of F is : (Assume that the system is in equilibrium and $g = 10$ m/s^2)

(see the figure above)

Q3. A 1 kg mass is suspended from the ceiling by a rope of length 4 m. A horizontal force ' F ' is applied at the mid point of the rope so that the rope makes an angle of 45° with respect to the vertical axis as shown in figure. The



magnitude of F is : (Assume that the system is in equilibrium and $g = 10\ \mathrm{m/s^2}$)

(1) 10 N
(2) $\frac{10}{\sqrt{2}}$ N
(3) 1 N
(4) $\frac{1}{10\times\sqrt{2}} N$

(A) 10 N
(B) $\frac{10}{\sqrt{2}}$ N
(C) 1 N
(D) $\frac{1}{10\times\sqrt{2}}$ N

Answer: (A) 10 N · Key from source paper

Q35 JEE Main 2024 · 9 Apr · Shift 2 MCQ

A nucleus at rest disintegrates into two smaller nuclei with their masses in the ratio of 2 : 1. After disintegration they will move :

(A) in the same direction with same speed.
(B) in opposite directions with the same speed.
(C) in opposite directions with speed in the ratio of 2 : 1 respectively.
(D) in opposite directions with speed in the ratio of 1 : 2 respectively.

Answer: (D) in opposite directions with speed in the ratio of 1 : 2 respectively. · Key from source paper

Q36 JEE Main 2024 · 8 Apr · Shift 1 MCQ

A stationary particle breaks into two parts of masses m_A and m_B which move with velocities v_A and v_B respectively. The ratio of their kinetic energies $(K_B : K_A)$ is :

(A) $v_B : v_A$
(B) $m_B : m_A$
(C) $m_B v_B : m_A v_A$
(D) $1 : 1$

Answer: (A) $v_B : v_A$ · Key from source paper

Q37 JEE Main 2024 · 8 Apr · Shift 1 MCQ

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:

(A) 3 N
(B) 300 N
(C) 150 N
(D) 30 N

Answer: (D) 30 N · Key from source paper

Q38 JEE Main 2024 · 8 Apr · Shift 2 MCQ

A given object takes n times the time to slide down 45° rough inclined plane as it takes the time to slide down an identical perfectly smooth 45° inclined plane. The coefficient of kinetic friction between the object and the surface of inclined plane is :

(A) $\sqrt{1-\frac{1}{n^2}}$
(B) $1-n^2$
(C) $1-\frac{1}{n^2}$
(D) $\sqrt{1-n^2}$

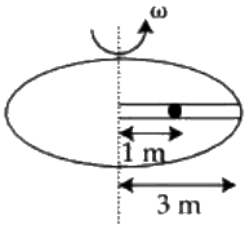
Answer: (C) $1-\frac{1}{n^2}$ · Key from source paper

Q39 JEE Main 2024 · 8 Apr · Shift 2 Numerical

A circular table is rotating with an angular velocity of ω rad/s about its axis (see figure). There is a smooth groove along a radial direction on the table. A steel ball is gently placed at a distance of 1 m on the groove. All the surfaces are smooth. If the radius of the table is 3 m, the radial velocity of the ball w.r.t. the table at the time ball leaves the table is $x\sqrt{2}\omega$ m/s, where the value of x is _____.

(see the figure above)

Q22. A circular table is rotating with an angular velocity of ωrad/s about its axis (see figure). There is a smooth groove along a radial direction on the table. A steel ball is gently placed at a distance of 1 m on the groove. All the surfaces are smooth. If the radius of the table is 3 m, the radial velocity of the ball w.r.t. the table at the time ball leaves the table is $x\sqrt{2}\omega$m/s, where the value of x is _____.



Numerical value type: the answer is a number.

Answer: 2. · Key from source paper

Q40 JEE Main 2024 · 6 Apr · Shift 1 MCQ

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:

(A) $\frac{1+\sqrt{5}}{\sqrt{5}-1}$
(B) $\frac{\sqrt{2}-1}{\sqrt{2}+1}$
(C) $\frac{1+\sqrt{5}}{\sqrt{2}-1}$
(D) $\frac{\sqrt{3}+1}{\sqrt{2}-1}$

Answer: (B) $\frac{\sqrt{2}-1}{\sqrt{2}+1}$ · Key from source paper

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Q41 JEE Main 2024 · 6 Apr · Shift 2 MCQ

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

(A) 100 N
(B) 200 N
(C) 300 N
(D) 150 N

Answer: (C) 300 N · Key from source paper

Q42 JEE Main 2024 · 6 Apr · Shift 2 MCQ

A car of 800 kg is taking turn on a banked road of radius 300 m and angle of banking 30°. If coefficient of static friction is 0.2 then the maximum speed with which car can negotiate the turn safely:

($g = 10$ m/s^2, $\sqrt{3} = 1.73$)

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(A) 264 m/s
(B) 51.4 m/s
(C) 70.4 m/s
(D) 102.8 m/s

Answer: (B) 51.4 m/s · Key from source paper

Q43 JEE Main 2024 · 5 Apr · Shift 1 MCQ

A wooden block of mass 5 kg rests on a soft horizontal floor. When an iron cylinder of mass 25 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 ms^{-2}. The action force of the system on the floor is equal to:

(A) 196 N
(B) 291 N
(C) 294 N
(D) 297 N

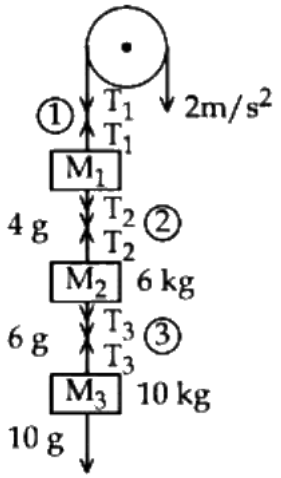
Answer: (B) 291 N · Key from source paper

Q44 JEE Main 2024 · 5 Apr · Shift 1 Numerical

Three blocks M_1, M_2, M_3 having masses 4 kg, 6 kg and 10 kg respectively are hanging from a smooth pully 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).

(see the figure above)

Q22. Three blocks M_1, M_2, M_3 having masses 4 kg, 6 kg and 10 kg respectively are hanging from a smooth pully 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 $\mathrm{m/s}^2$).

Numerical value type: the answer is a number.

Answer: 240. · Key from source paper

Q45 JEE Main 2024 · 5 Apr · Shift 2 MCQ

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

(A) $\frac{\pi}{4}$
(B) $\frac{\pi}{6}$
(C) $\frac{\pi}{2}$
(D) $\frac{\pi}{3}$

Answer: (C) $\frac{\pi}{2}$ · Key from source paper

Q46 JEE Main 2024 · 5 Apr · Shift 2 MCQ

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 :

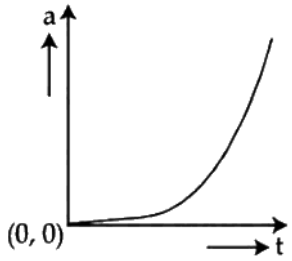
(A) 1.47 N
(B) 147 N
(C) 14.7 N
(D) 1470 N

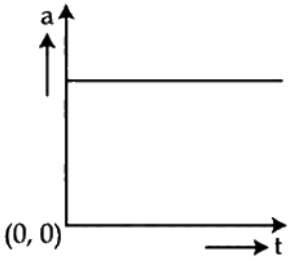
Answer: (B) 147 N · Key from source paper

Q47 JEE Main 2024 · 4 Apr · Shift 1 MCQ

A wooden block, initially at rest on the ground, is pushed by a force which increases linearly with time t. Which of the following curve best describes acceleration of the block with time:

Q5. A wooden block, initially at rest on the ground, is pushed by a force which increases linearly with time t. Which of the following curve best describes acceleration of the block with time:

(1)


(2)


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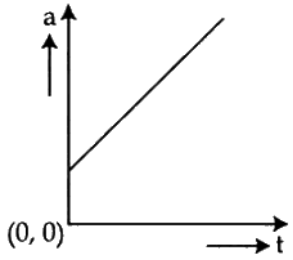
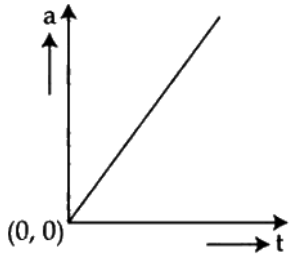


(4)


(A) *see figure*
(B) *see figure*
(C) *see figure*
(D) *see figure*

Answer: (D) · Key from source paper

Q48 JEE Main 2024 · 4 Apr · Shift 2 MCQ

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:

(A) 1.7
(B) $\frac{1}{\sqrt{3}}$
(C) 0.5
(D) 1

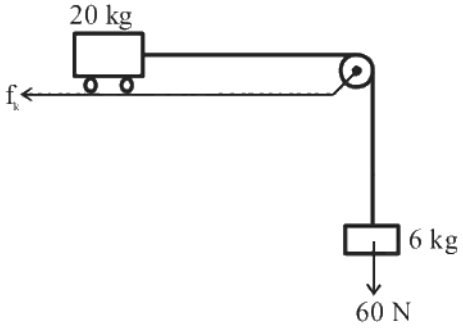
Answer: (D) 1 · Key from source paper

Q49 JEE Main 2024 · 1 Feb · Shift 1 MCQ

Consider a block and trolley system as shown in figure. If the coefficient of kinetic friction between the trolley and the surface is 0.04, the acceleration of the system in $\mathrm{m\ s^{-2}}$ is: (Consider that the string is massless and unstretchable and the pulley is also massless and frictionless) :

(see the figure above)

Q4. Consider a block and trolley system as shown in figure. If the coefficient of kinetic friction between the trolley and the surface is 0.04, the acceleration of the system in $\mathrm{m\ s^{-2}}$ is: (Consider that the string is massless and unstretchable and the pulley is also massless and frictionless) :



(1) 3
(2) 4
(3) 2
(4) 1.2

(A) 3
(B) 4
(C) 2
(D) 1.2

Answer: (C) 2 · Key from source paper

Q50 JEE Main 2024 · 1 Feb · Shift 1 MCQ

A ball of mass 0.5 kg is attached to a string of length 50 cm. The ball is rotated on a horizontal circular path about its vertical axis. The maximum tension that the string can bear is 400 N. The maximum possible value of angular velocity of the ball in rad s^{-1} is,:

(A) 1600
(B) 40
(C) 1000
(D) 20

Answer: (B) 40 · Key from source paper

Q51 JEE Main 2024 · 1 Feb · Shift 2 MCQ

A cricket player catches a ball of mass 120 g moving with 25 $\mathrm{m\ s}^{-1}$ 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):

(A) 24
(B) 12
(C) 25
(D) 30

Answer: (D) 30 · Key from source paper

Q52 JEE Main 2024 · 1 Feb · Shift 2 MCQ

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) $2\hat{i} + 3\hat{j} + 3\hat{k}$

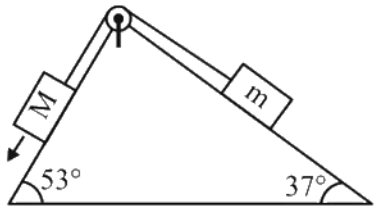
Answer: (C) $2\hat{i} + \hat{j} + \hat{k}$ · Key from source paper

Q53 JEE Main 2024 · 31 Jan · Shift 1 MCQ

In the given arrangement of a doubly inclined plane two blocks of masses M and m are placed. The blocks are connected by a light string passing over an ideal pulley as shown. The coefficient of friction between the surface of the plane and the blocks is 0.25. The value of m, for which $M = 10$ kg will move down with an acceleration of 2 m s^{-2}, is: (take $g = 10$ m s^{-2} and $\tan 37^\circ = \frac{3}{4}$)

(see the figure above)

Q5. In the given arrangement of a doubly inclined plane two blocks of masses M and m are placed. The blocks are connected by a light string passing over an ideal pulley as shown. The coefficient of friction between the surface of the plane and the blocks is 0.25. The value of m, for which $M = 10$ kg will move down with an acceleration of 2 m s^{-2}, is: (take $g = 10$ m s^{-2} and $\tan 37° = \frac{3}{4}$)



(1) 9 kg
(2) 4.5 kg
(3) 6.5 kg
(4) 2.25 kg

(A) 9 kg
(B) 4.5 kg
(C) 6.5 kg
(D) 2.25 kg

Answer: (B) 4.5 kg · Key from source paper

Q54 JEE Main 2024 · 31 Jan · Shift 1 MCQ

A coin is placed on a disc. The coefficient of friction between the coin and the disc is μ. If the distance of the coin from the center of the disc is r, the maximum angular velocity which can be given to the disc, so that the coin does not slip away, is :

(A) $\frac{\mu g}{r}$
(B) $\sqrt{\frac{r}{\mu g}}$
(C) $\sqrt{\frac{\mu g}{r}}$
(D) $\frac{\mu}{\sqrt{rg}}$

Answer: (C) $\sqrt{\frac{\mu g}{r}}$ · Key from source paper

Q55 JEE Main 2024 · 31 Jan · Shift 1 MCQ

An artillery piece of mass M_1 fires a shell of mass M_2 horizontally. Instantaneously after the firing, the ratio of kinetic energy of the artillery and that of the shell is :

(A) $\frac{M_1}{(M_1+M_2)}$
(B) $\frac{M_2}{M_1}$
(C) $\frac{M_2}{(M_1+M_2)}$
(D) $\frac{M_1}{M_2}$

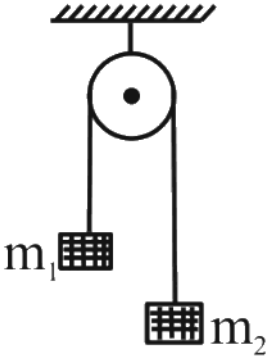
Answer: (B) $\frac{M_2}{M_1}$ · Key from source paper

Q56 JEE Main 2024 · 31 Jan · Shift 2 MCQ

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 $\frac{g}{8}$, then the ratio of masses is

(see the figure above)

Q3. 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 $\frac{g}{8}$, then the ratio of masses is



(1) $\frac{9}{7}$
(2) $\frac{8}{1}$
(3) $\frac{4}{3}$
(4) $\frac{5}{3}$

(A) $\frac{9}{7}$
(B) $\frac{8}{1}$
(C) $\frac{4}{3}$
(D) $\frac{5}{3}$

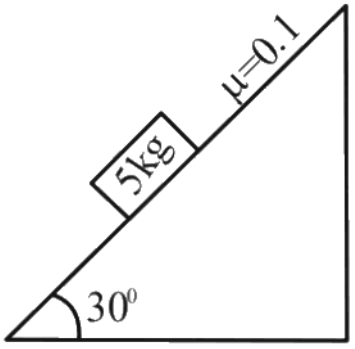
Answer: (A) $\frac{9}{7}$ · Key from source paper

Q57 JEE Main 2024 · 31 Jan · Shift 2 MCQ

A block of mass 5 kg is placed on a rough inclined surface as shown in the figure. If $\vec{F}_1$ is the force required to just move the block up the inclined plane and $\vec{F}_2$ is the force required to just prevent the block from sliding down, then the value of $\vec{F}_1 - \vec{F}_2$ is: [Use $g = 10\ \mathrm{m\ s^{-2}}$]

(see the figure above)

Q4. A block of mass 5 kg is placed on a rough inclined surface as shown in the figure. If $\vec{F}_1$ is the force required to just move the block up the inclined plane and $\vec{F}_2$ is the force required to just prevent the block from sliding down, then the value of $\vec{F}_1 - \vec{F}_2$ is: [Use $g = 10$ m s^{-2}]



(1) $25\sqrt{3}$ N
(2) $5\sqrt{3}$ N
(3) $\frac{5\sqrt{3}}{2}$ N
(4) 10 N

(A) $25\sqrt{3}$ N
(B) $5\sqrt{3}$ N
(C) $\frac{5\sqrt{3}}{2}$ N
(D) 10 N

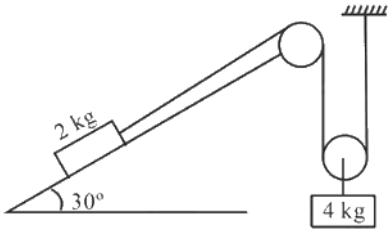
Answer: (B) $5\sqrt{3}$ N · Key from source paper

Q58 JEE Main 2024 · 30 Jan · Shift 1 MCQ

All surfaces shown in figure are assumed to be frictionless and the pulleys and the string are light. The acceleration of the block of mass 2 kg is:

(see the figure above)

Q3. All surfaces shown in figure are assumed to be frictionless and the pulleys and the string are light. The acceleration of the block of mass 2 kg is:



(1) g
(2) $\frac{g}{3}$
(3) $\frac{g}{2}$
(4) $\frac{g}{4}$

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

Answer: (B) $\frac{g}{3}$ · Key from source paper

Q59 JEE Main 2024 · 30 Jan · Shift 1 MCQ

A spherical body of mass 100 g is dropped from a height of 10 m from the ground. After hitting the ground, the body rebounds to a height of 5 m. The impulse of force imparted by the ground to the body is given by: (given $g = 9.8\ \mathrm{m\,s^{-2}}$)

(A) 32 kg m s $^{-1}$

(B) 2 kg m s $^{-1}$

(C) 9 kg m s $^{-1}$

(D) 39 kg m s $^{-1}$

Answer: (D)

1. 39 kg m s^{-1}

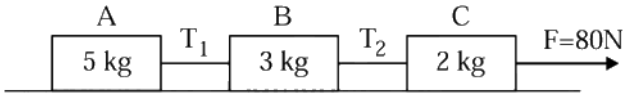
· Key from source paper

Q60 JEE Main 2024 · 30 Jan · Shift 2 MCQ

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:

(see the figure above)

Q3. 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:



(1) 40N, 64N (2) 60N, 80N

(3) 88N, 96N (4) 80N, 100N

(A) 40 N, 64 N

(B) 60 N, 80 N

(C) 88 N, 96 N

(D) 80 N, 100 N

Answer: (A) 40 N, 64 N · Key from source paper

Q61 JEE Main 2024 · 30 Jan · Shift 2 MCQ

A block of mass m is placed on a surface having vertical cross section given by $y = \frac{x^2}{4}$. If coefficient of friction is 0.5, the maximum height above the ground at which block can be placed without slipping is:

(A) $\frac{1}{4}$ m
(B) $\frac{1}{2}$ m
(C) $\frac{1}{6}$ m
(D) $\frac{1}{3}$ m

Answer: (A) $\frac{1}{4}$ m · Key from source paper

Q62 JEE Main 2024 · 29 Jan · Shift 1 MCQ

If the radius of curvature of the path of two particles of same mass are in the ratio 3 : 4, then in order to have constant centripetal force, their velocities will be in the ratio of:

(A) $\sqrt{3} : 2$
(B) $1 : \sqrt{3}$
(C) $\sqrt{3} : 1$
(D) $2 : \sqrt{3}$

Answer: (A) $\sqrt{3} : 2$ · Key from source paper

Q63 JEE Main 2024 · 29 Jan · Shift 2 MCQ

A stone of mass 900 g is tied to a string and moved in a vertical circle of radius 1 m making 10 rpm. The tension in the string, when the stone is at the lowest point is (if $\pi^2 = 9.8$ and $g = 9.8$ m s^{-2})

(A) 97 N
(B) 9.8 N
(C) 8.82 N
(D) 17.8 N

Answer: (B) 9.8 N · Key from source paper

Q64 JEE Main 2024 · 27 Jan · Shift 1 MCQ

A train is moving with a speed of 12 m s^{-1} on rails which are 1.5 m apart. To negotiate a curve radius 400 m, the height by which the outer rail should be raised with respect to the inner rail is (Given, g = 10 m s^{-2}):

(A) 6.0 cm
(B) 5.4 cm
(C) 4.8 cm
(D) 4.2 cm

Answer: (B) 5.4 cm · Key from source paper

Q65 JEE Main 2024 · 27 Jan · Shift 1 MCQ

A body of mass 1000 kg is moving horizontally with a velocity 6 m s^{-1}. If 200 kg extra mass is added, the final velocity (in m s^{-1}) is:

(A) 6
(B) 2
(C) 3
(D) 5

Answer: (D) 5 · Key from source paper

Q66 JEE Main 2024 · 27 Jan · Shift 2 MCQ

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 :

(A) Statement I is correct but Statement II is incorrect
(B) Statement I is incorrect but Statement II is correct
(C) Both Statement I and Statement II are incorrect
(D) Both Statement I and Statement II are correct

Answer: (B) Statement I is incorrect but Statement II is correct · Key from source paper

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Q67 JEE Main 2024 · 27 Jan · Shift 2 MCQ

A ball suspended by a thread swings in a vertical plane so that its magnitude of acceleration in the extreme position and lowest position are equal. The angle (θ) of thread deflection in the extreme position will be :

(A) $\tan^{-1}\left(\sqrt{2}\right)$
(B) $2\tan^{-1}\frac{1}{2}$
(C) $\tan^{-1}\frac{1}{2}$
(D) $2\tan^{-1}\frac{1}{\sqrt{5}}$

Answer: (B) $2\tan^{-1}\frac{1}{2}$ · Key from source paper

Q68 JEE Main 2023 · 13 Apr · Shift 1 MCQ

A bullet of 10 g leaves the barrel of gun with a velocity of 600 m s^{-1}. If the barrel of gun is 50 cm long and mass of gun is 3 kg, then value of impulse supplied to the gun will be:

(A) 6 N s
(B) 3 N s
(C) 36 N s
(D) 12 N s

Answer: (A) 6 N s · Key from source paper

Q69 JEE Main 2023 · 13 Apr · Shift 2 MCQ

A vehicle of mass 200 kg is moving along a levelled curved road of radius 70 m with angular velocity of 0.2 rad s^{-1}. The centripetal force acting on the vehicle is:

(A) 560 N
(B) 2800 N
(C) 2240 N
(D) 14 N

Answer: (A) 560 N · Key from source paper

Q70 JEE Main 2023 · 12 Apr · Shift 1 MCQ

Three forces $F_1 = 10$ N, $F_2 = 8$ N, $F_3 = 6$ N are acting on a particle of mass 5 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

(A) $7\ \mathrm{m\ s^{-2}}$
(B) $0.5\ \mathrm{m\ s^{-2}}$
(C) $4.8\ \mathrm{m\ s^{-2}}$
(D) $2\ \mathrm{m\ s^{-2}}$

Answer: (D) $2\ \mathrm{m\ s^{-2}}$ · Key from source paper

Q71 JEE Main 2023 · 11 Apr · Shift 1 MCQ

A coin placed on a rotating table just slips when it is placed at a distance of 1 cm from the centre. If the angular velocity of the table is halved, it will just slip when placed at a distance of _____ from the centre:

(A) 8 cm
(B) 4 cm
(C) 1 cm
(D) 2 cm

Answer: (B) 4 cm · Key from source paper

EdLoop JEE

Q72 JEE Main 2023 · 11 Apr · Shift 1 MCQ

An average force of 125 N is applied on a machine gun firing bullets each of mass 10 g at the speed of $250\ \mathrm{m\ s^{-1}}$ to keep it in position. The number of bullets fired per second by the machine gun is :

(A) 50
(B) 25
(C) 100
(D) 5

Answer: (A) 50 · Key from source paper

Q73 JEE Main 2023 · 10 Apr · Shift 2 MCQ

Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R
Assertion A : An electric fan continues to rotate for some time after the current is switched off.
Reason R: Fan continues to rotate due to inertia of motion.
In the light of above statements, choose the most appropriate answer from the options given below.

(A) A is correct but R is not correct
(B) A is not correct but R is correct
(C) Both A and R are correct and R is the correct explanation of A
(D) Both A and R are correct but R is NOT the correct explanation of A

Answer: (C) Both A and R are correct and R is the correct explanation of A · Key from source paper

Q74 JEE Main 2023 · 8 Apr · Shift 1 MCQ

At any instant the velocity of a particle of mass 500 g is $(2t\,\hat{i} + 3t^2\,\hat{j})\ \mathrm{m\,s^{-1}}$. If the force acting on the particle at $t = 1$ s is $(\hat{i} + x\,\hat{j})$ N. Then the value of x will be:

(A) 3
(B) 4
(C) 2
(D) 6

Answer: (A) 3 · Key from source paper

Q75 JEE Main 2023 · 8 Apr · Shift 2 MCQ

A bullet of mass $0.1\ \mathrm{kg}$ moving horizontally with speed $400\ \mathrm{m\,s^{-1}}$ hits a wooden block of mass $3.9\ \mathrm{kg}$ kept on a horizontal rough surface. The bullet gets embedded into the block and moves $20\ \mathrm{m}$ before coming to rest. The coefficient of friction between the block and the surface is _____ .

(A) 0.90
(B) 0.50
(C) 0.65
(D) 0.25

Answer: (D) 0.25 · Key from source paper

Q76 JEE Main 2023 · 8 Apr · Shift 2 Numerical

A body of mass $5\ \mathrm{kg}$ is moving with a momentum of $10\ \mathrm{kg\,m\,s^{-1}}$. Now a force of $2\ \mathrm{N}$ acts on the body in the direction of its motion for $5\ \mathrm{s}$. The increase in the Kinetic energy of the body is _____ J.

Numerical value type: the answer is a number.

Answer: 30. · Key from source paper

Q77 JEE Main 2023 · 6 Apr · Shift 1 MCQ

A small block of mass $100\ \mathrm{g}$ is tied to a spring of spring constant $7.5\ \mathrm{N\,m^{-1}}$ and length $20\ \mathrm{cm}$. The other end of spring is fixed at a particular point A. If the block moves in a circular path on a smooth horizontal surface with constant angular velocity $5\ \mathrm{rad\,s^{-1}}$ about point A, then tension in the spring is

(A) $0.75\ \mathrm{N}$
(B) $0.25\ \mathrm{N}$
(C) $0.50\ \mathrm{N}$
(D) $1.5\ \mathrm{N}$

Answer: (A) $0.75\ \mathrm{N}$ · Key from source paper

Q78 JEE Main 2023 · 6 Apr · Shift 2 MCQ

A child of mass $5\ \mathrm{kg}$ is going round a merry-go-round that makes 1 rotation in $3.14\ \mathrm{s}$. The radius of the merry-go-round is $2\ \mathrm{m}$. The centrifugal force on the child will be

(A) $80\ \mathrm{N}$
(B) $40\ \mathrm{N}$
(C) $100\ \mathrm{N}$
(D) $50\ \mathrm{N}$

Answer: (B) $40\ \mathrm{N}$ · Key from source paper

Q79 JEE Main 2023 · 1 Feb · Shift 1 MCQ

A block of mass 5 kg is placed at rest on a table of rough surface. Now, if a force of 30 N is applied in the direction parallel to surface of the table, the block slides through a distance of 50 m in an interval of time 10 s. Coefficient of kinetic friction is (given, g = 10 $\mathrm{m\,s^{-2}}$):

EdLoop JEE

(A) 0.60
(B) 0.75
(C) 0.50
(D) 0.25

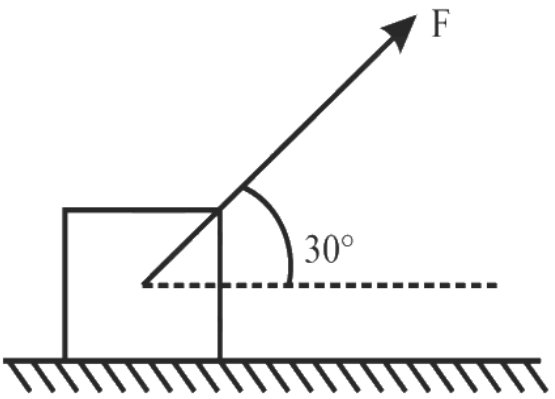
Answer: (C) 0.50 · Key from source paper

Q80 JEE Main 2023 · 1 Feb · Shift 2 MCQ

As shown in the figure a block of mass 10 kg lying on a horizontal surface is pulled by a force F acting at an angle 30°, with horizontal. For μ_s = 0.25, the block will just start to move for the value of F: [Given g = 10 $\mathrm{m \cdot s^{-2}}$]

(see the figure above)

Q3. As shown in the figure a block of mass 10 kg lying on a horizontal surface is pulled by a force F acting at an angle 30°, with horizontal. For $\mu_s = 0.25$, the block will just start to move for the value of F: [Given g = 10 $\mathrm{m \cdot s^{-2}}$]



(1) 33.3 N
(2) 25.2 N
(3) 20 N
(4) 35.7 N

(A) 33.3 N
(B) 25.2 N
(C) 20 N
(D) 35.7 N

Answer: (B) 25.2 N · Key from source paper

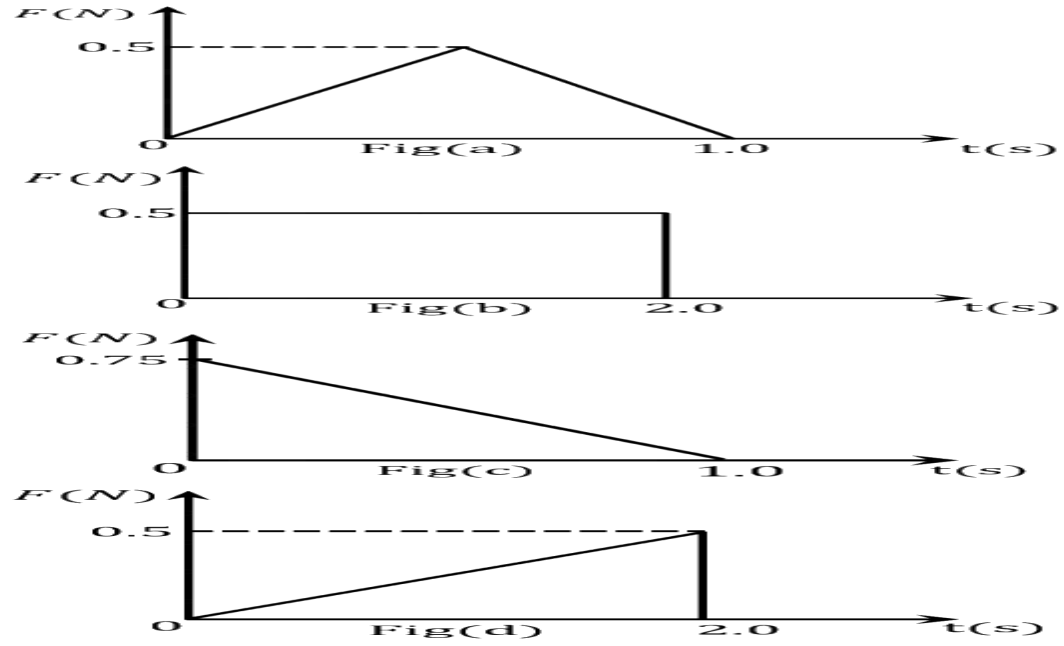
Q81 JEE Main 2023 · 1 Feb · Shift 2 MCQ

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

(see the figure above)

The impulse is highest in figure.

Q6. Figures (a), (b), (c) and (d) show variation of force with time.



The impulse is highest in figure.
(1) Fig (c)
(2) Fig (b)
(3) Fig (a)
(4) Fig (d)

(A) Fig (c)
(B) Fig (b)
(C) Fig (a)
(D) Fig (d)

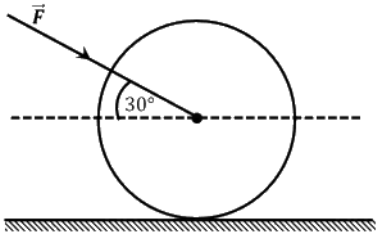
Answer: (B) Fig (b) · Key from source paper

Q82 JEE Main 2023 · 31 Jan · Shift 1 MCQ

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 m s^{-2})

(see the figure above)

Q3. 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 $g = 10$ m s^{-2})



(1) $800\sqrt{2}$ N
(2) 600 N
(3) 800 N
(4) $200\sqrt{3}$ N

(A) $800\sqrt{2}$ N
(B) 600 N
(C) 800 N
(D) $200\sqrt{3}$ N

Answer: (C) 800 N · Key from source paper

Q83 JEE Main 2023 · 31 Jan · Shift 1 MCQ

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 force exerted by the balls on the wall is

(A) $\frac{100mv}{t}$
(B) $\frac{200mv}{t}$
(C) $200\ mvt$
(D) $\frac{mv}{100t}$

Answer: (B) $\frac{200mv}{t}$ · Key from source paper

Q84 JEE Main 2023 · 31 Jan · Shift 2 MCQ

A stone of mass 1 kg is tied to end of a massless string of length 1 m. If the breaking tension of the string is 400 N, then maximum linear velocity, the stone can have without breaking the string, while rotating in horizontal plane, is:

(A) 20 m s^{-1}
(B) 40 m s^{-1}
(C) 400 m s^{-1}
(D) 10 m s^{-1}

Answer: (A) 20 m s^{-1} · Key from source paper

Q85 JEE Main 2023 · 31 Jan · Shift 2 MCQ

A body of mass 10 kg is moving with an initial speed of 20 m s^{-1}. 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 m s^{-2})

(A) 0.2
(B) 0.3
(C) 0.5
(D) 0.4

Answer: (D) 0.4 · Key from source paper

Q86 JEE Main 2023 · 30 Jan · Shift 1 MCQ

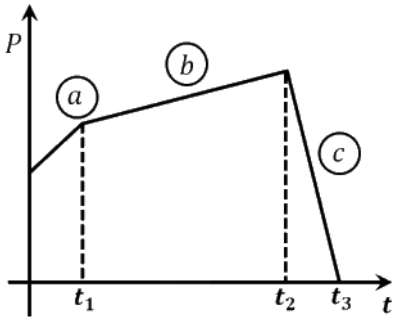
The figure represents the momentum time $(p-t)$ curve for a particle moving along an axis under the influence of the force. Identify the regions on the graph where the magnitude of the force is maximum and minimum respectively ?

If $t_3 - t_2 < t_1$

(see the figure above)

Q3. The figure represents the momentum time $(p\text{-}t)$ curve for a particle moving along an axis under the influence of the force. Identify the regions on the graph where the magnitude of the force is maximum and minimum respectively ?

If $t_3 - t_2 < t_1$



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

(A) c and a
(B) b and c
(C) c and b
(D) a and b

Answer: (C) c and b · Key from source paper

Q87 JEE Main 2023 · 30 Jan · Shift 1 MCQ

A ball of mass 200 g rests on a vertical post of height 20 m. A bullet of mass 10 g, travelling in horizontal direction, hits the centre of the ball. After collision both travels independently. The ball hits the ground at a distance 30 m and the bullet at a distance of 120 m from the foot of the post. The value of initial velocity of the bullet will be (if $g = 10$ m s^{-2}) :

(A) 120 m s^{-1}
(B) 60 m s^{-1}
(C) 400 m s^{-1}
(D) 360 m s^{-1}

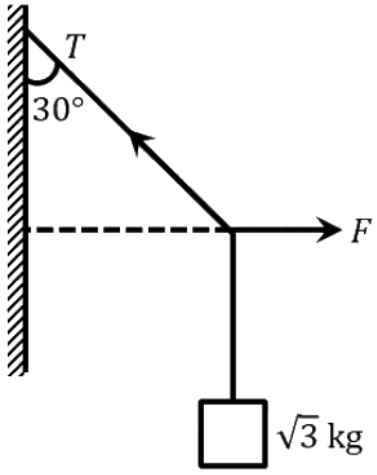
Answer: (D) 360 m s^{-1} · Key from source paper

Q88 JEE Main 2023 · 30 Jan · Shift 2 MCQ

A block of $\sqrt{3}$ 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 m s $^{-2}$)

(see the figure above)

Q5. A block of $\sqrt{3}$ 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 $g = 10\ m\ s^{-2}$)



(1) 20 N
(2) 25 N
(3) 10 N
(4) 15 N

(A) 20 N
(B) 25 N
(C) 10 N
(D) 15 N

Answer: (A) 20 N · Key from source paper

Q89 JEE Main 2023 · 30 Jan · Shift 2 MCQ

A machine gun of mass 10 kg fires 20 g bullets at the rate of 180 bullets per minute with a speed of 100 m s^{-1} each. The recoil velocity of the gun is :

(A) 0.02 m s^{-1}
(B) 2.5 m s^{-1}
(C) 1.5 m s^{-1}
(D) 0.6 m s^{-1}

Answer: (D) 0.6 m s^{-1} · Key from source paper

Q90 JEE Main 2023 · 29 Jan · Shift 1 Numerical

A tennis ball is dropped on to the floor from a height of $9.8\ m$. It rebounds to a height $5.0\ m$. Ball comes in contact with the floor for $0.2\ s$. The average acceleration during contact is _____ $m\,s^{-2}$.

[Given $g = 10\ \mathrm{m\,s^{-2}}$]

Numerical value type: the answer is a number.

Answer: 120. · Key from source paper

Q91 JEE Main 2023 · 29 Jan · Shift 1 MCQ

A car is moving on a horizontal curved road with radius $50\ \mathrm{m}$. The approximate maximum speed of car will be, if friction between tyres and road is 0.34. [Take $g = 10\ \mathrm{m\,s^{-2}}$]

(A) $3.4\ \mathrm{m\,s^{-1}}$

(B) $22.4\ \mathrm{m\,s^{-1}}$

(C) $13\ \mathrm{m\,s^{-1}}$

(D) $17\ \mathrm{m\,s^{-1}}$

Answer: (C) $13\ \mathrm{m\,s^{-1}}$ · Key from source paper

Q92 JEE Main 2023 · 29 Jan · Shift 1 MCQ

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 :

(A) $\frac{2\sqrt{3}+1}{2}$

(B) $\frac{1}{2\sqrt{3}}$

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

(D) $\frac{2\sqrt{3}-1}{2}$

Answer: (B) $\frac{1}{2\sqrt{3}}$ · Key from source paper

Q93 JEE Main 2023 · 29 Jan · Shift 2 MCQ

The time taken by an object to slide down 45° rough inclined plane is n times as it takes to slide down a perfectly smooth 45° incline plane. The coefficient of kinetic friction between the object and the incline plane is:

(A) $\sqrt{\frac{1}{1-n^2}}$

(B) $\sqrt{1-\frac{1}{n^2}}$

(C) $1+\frac{1}{n^2}$

(D) $1-\frac{1}{n^2}$

Answer: (D) $1-\frac{1}{n^2}$ · Key from source paper

Q94 JEE Main 2023 · 29 Jan · Shift 2 MCQ

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

(A) 40 N
(B) 5 N
(C) 20 N
(D) 10 N

Answer: (B) 5 N · Key from source paper

Q95 JEE Main 2023 · 25 Jan · Shift 1 MCQ

A car is moving with a constant speed of $20\ \mathrm{m\,s^{-1}}$ in a circular horizontal track of radius $40\ \mathrm{m}$. A bob is suspended from the roof of the car by a massless string. The angle made by the string with the vertical will be : (Take $g = 10\ \mathrm{m\,s^{-2}}$)

(A) $\frac{\pi}{6}$
(B) $\frac{\pi}{2}$
(C) $\frac{\pi}{4}$
(D) $\frac{\pi}{3}$

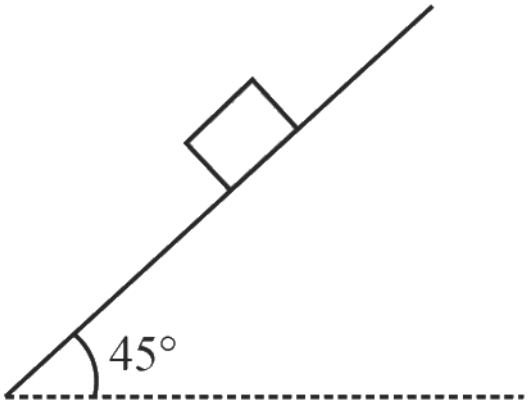
Answer: (C) $\frac{\pi}{4}$ · Key from source paper

Q96 JEE Main 2023 · 25 Jan · Shift 2 MCQ

Consider a block kept on an inclined plane (inclined at $45°$) as shown in the figure. If the force required to just push it up the incline is 2 times the force required to just prevent it from sliding down, the coefficient of friction between the block and inclined plane (μ) is equal to :

(see the figure above)

Q4. Consider a block kept on an inclined plane (inclined at 45°) as shown in the figure. If the force required to just push it up the incline is 2 times the force required to just prevent it from sliding down, the coefficient of friction between the block and inclined plane (μ) is equal to :



(1) 0.33
(2) 0.60
(3) 0.25
(4) 0.50

(A) 0.33
(B) 0.60
(C) 0.25
(D) 0.50

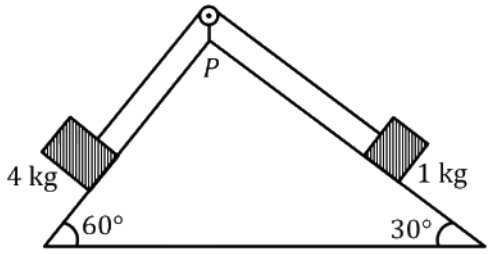
Answer: (A) 0.33 · Key from source paper

Q97 JEE Main 2023 · 24 Jan · Shift 1 MCQ

As per given figure, a weightless pulley P is attached on a double inclined frictionless surface. The tension in the string (massless) will be (if $g = 10\ \mathrm{m\,s^{-2}}$)

(see the figure above)

Q3. As per given figure, a weightless pulley P is attached on a double inclined frictionless surface. The tension in the string (massless) will be (if $g = 10$ m s^{-2})



(1) $4\sqrt{3} + 1$ N
(2) $4\sqrt{3} + 1$ N
(3) $4\sqrt{3}$ - 1 N
(4) $4\sqrt{3}$ - 1 N

(A) $(4\sqrt{3}+1)$ N
(B) $4(\sqrt{3}+1)$ N
(C) $4(\sqrt{3}-1)$ N
(D) $(4\sqrt{3}-1)$ N

Answer: (B) $4(\sqrt{3}+1)$ N · Key from source paper

Q98 JEE Main 2023 · 24 Jan · Shift 1 MCQ

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:

(A) Both Statement I and Statement II are false
(B) Statement I is true but Statement II is false
(C) Both Statement I and Statement II are true
(D) Statement I is false but Statement II is true

Answer: (B) Statement I is true but Statement II is false · Key from source paper

Q99 JEE Main 2023 · 24 Jan · Shift 2 MCQ

A body of mass 200 g is tied to a spring of spring constant $12.5\ \mathrm{N\,m^{-1}}$, while the other end of spring is fixed at point O. If the body moves about O in a circular path on a smooth horizontal surface with constant angular speed $5\ \mathrm{rad\,s^{-1}}$, then the ratio of extension in the spring to its natural length will be :

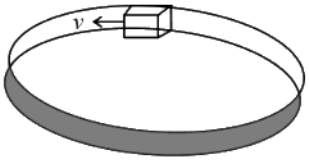
(A) $1:2$
(B) $1:1$
(C) $2:3$
(D) $2:5$

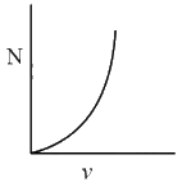
Answer: (C) $2:3$ · Key from source paper

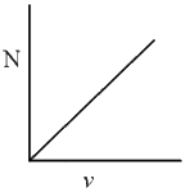
Q100 JEE Main 2022 · 29 Jul · Shift 1 MCQ

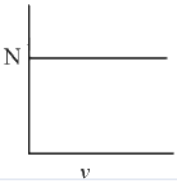
A smooth circular groove has a smooth vertical wall as shown in figure. A block of mass m moves against the wall with a speed v. Which of the following curve represents the correct relation between the normal reaction on the block by the wall (N) and speed of the block (v)?
(see the figure above)

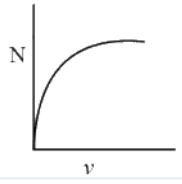
Q5. A smooth circular groove has a smooth vertical wall as shown in figure. A block of mass m moves against the wall with a speed v. Which of the following curve represents the correct relation between the normal reaction on the block by the wall (N) and speed of the block (v)?



(1)


(2)


(3)


(4)


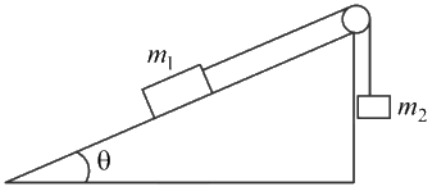
(A) *see figure*
(B) *see figure*
(C) *see figure*
(D) *see figure*

Answer: (A) · Key from source paper

Q101 JEE Main 2022 · 29 Jul · Shift 2 MCQ

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 $g = 10\ \mathrm{m\ s^{-2}}$]
(see the figure above)

Q4. 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 $g = 10$ m s^{-2}]



(1) 30 N
(2) 40 N
(3) 50 N
(4) 60 N

(A) 30 N
(B) 40 N
(C) 50 N
(D) 60 N

Answer: (B) 40 N · Key from source paper

Q102 JEE Main 2022 · 29 Jul · Shift 2 Numerical

A tube of length 50 cm is filled completely with an incompressible liquid of mass 250 g and closed at both ends. The tube is then rotated in horizontal plane about one of its ends with a uniform angular velocity $x\sqrt{F}\ \mathrm{rad\ s^{-1}}$. If F be the force exerted by the liquid at the other end then the value of x will be _____.

Numerical value type: the answer is a number.

Answer: 4. · Key from source paper

Q103 JEE Main 2022 · 28 Jul · Shift 1 MCQ

A balloon has mass of 10 g in air. The air escapes from the balloon at a uniform rate with velocity $4.5\ \mathrm{cm\ s^{-1}}$. If the balloon shrinks in 5 s completely. Then, the average force acting on that balloon will be (in dyne).

(A) 3
(B) 9
(C) 12
(D) 18

Answer: (B) 9 · Key from source paper

Q104 JEE Main 2022 · 28 Jul · Shift 1 MCQ

In two different experiments, an object of mass 5 kg moving with a speed of 25 ms^{-1} hits two different walls and comes to rest within
(i) 3 second, (ii) 5 seconds, respectively.
Choose the correct option out of the following :

(A) Impulse and average force acting on the object will be same for both the cases.
(B) Impulse will be same for both the cases but the average force will be different.
(C) Average force will be same for both the cases but the impulse will be different.
(D) Average force and impulse will be different for both the cases.

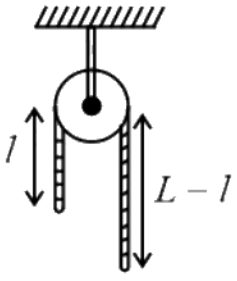
Answer: (B) Impulse will be same for both the cases but the average force will be different. · Key from source paper

Q105 JEE Main 2022 · 28 Jul · Shift 2 MCQ

A uniform metal chain of mass m and length L passes over a massless and frictionless pulley. It is released from rest with a part of its length l is hanging on one side and rest of its length $L-l$ is hanging on the other side of the pulley. At a certain point of time, when $l=\frac{L}{x}$, the acceleration of the chain is $\frac{g}{2}$. The value of x is _____.

(see the figure above)

Q3. A uniform metal chain of mass m and length L passes over a massless and frictionless pulley. It is released from rest with a part of its length l is hanging on one side and rest of its length $L-l$ is hanging on the other side of the pulley. At a certain point of time, when $l=\frac{L}{x}$, the acceleration of the chain is $\frac{g}{2}$. The value of x is _____.



(1) 6
(2) 2
(3) 1.5
(4) 4

(A) 6
(B) 2
(C) 1.5
(D) 4

Answer: (D) 4 · Key from source paper

Q106 JEE Main 2022 · 28 Jul · Shift 2 MCQ

A pressure-pump has a horizontal tube of cross-sectional area $10\ \mathrm{cm}^2$ for the outflow of water at a speed of $20\ \mathrm{m\,s}^{-1}$. The force exerted on the vertical wall just in front of the tube which stops water horizontally flowing out of the tube, is: [given : density of water $= 1000\ \mathrm{kg\,m}^{-3}$]

(A) $300\ \mathrm{N}$
(B) $500\ \mathrm{N}$
(C) $250\ \mathrm{N}$
(D) $400\ \mathrm{N}$

Answer: (D) $400\ \mathrm{N}$ · Key from source paper

Q107 JEE Main 2022 · 27 Jul · Shift 1 MCQ

A bag is gently dropped on a conveyor belt moving at a speed of 2 $\mathrm{m\,s}^{-1}$. The coefficient of friction between the conveyor belt and bag is 0.4 Initially, the bag slips on the belt before it stops due to friction. The distance travelled by the bag on the belt during slipping motion is : [Take g = 10 $\mathrm{m\,s}^{-2}$]

(A) 2 m
(B) 0.5 m
(C) 3.2 m
(D) 0.8 ms

Answer: (B) 0.5 m · Key from source paper

Q108 JEE Main 2022 · 27 Jul · Shift 1 MCQ

Sand is being dropped from a stationary dropper at a rate of 0.5 $\mathrm{kg\,s}^{-1}$ on a conveyor belt moving with a velocity of 5 $\mathrm{m\,s}^{-1}$. The power needed to keep belt moving with the same velocity will be

(A) 1.25 W
(B) 2.5 W
(C) 6.25 W
(D) 12.5 W

Answer: (D) 12.5 W · Key from source paper

EdLoop JEE

Q109 JEE Main 2022 · 27 Jul · Shift 2 MCQ

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 :

(A) Mg
(B) $Mg\cos\theta$
(C) $\sqrt{Mg\sin\theta + Mg\cos\theta}$
(D) $Mg\sin\theta\sqrt{1+\mu}$

Answer: (A) Mg · Key from source paper

Q110 JEE Main 2022 · 27 Jul · Shift 2 MCQ

A block A takes 2 s to slide down a frictionless incline of 30° and length l, kept inside a lift going up with uniform velocity v. If the incline is changed to 45°, the time taken by the block, to slide down the incline, will be approximately:

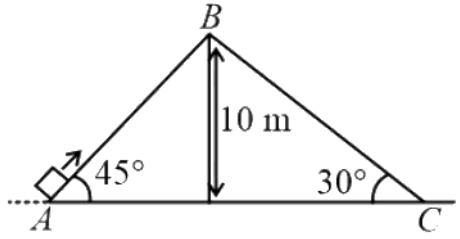
(A) 2.66 s
(B) 0.83 s
(C) 1.68 s
(D) 0.70 s

Answer: (C) 1.68 s · Key from source paper

Q111 JEE Main 2022 · 27 Jul · Shift 2 Numerical

Two inclined planes are placed as shown in figure. A block is projected from the Point A of inclined plane AB along its surface with a velocity just sufficient to carry it to the top Point B at a height 10 m. After reaching the Point B the block slides down on inclined plane BC. Time it takes to reach to the point C from point A is $t\left(\sqrt{2}+1\right)$s. The value of t is _____ (use $g = 10\ \text{m s}^{-2}$)
(see the figure above)

Q21. Two inclined planes are placed as shown in figure.
A block is projected from the Point A of inclined plane AB along its surface with a velocity just sufficient to carry it to the top Point B at a height 10 m. After reaching the Point B the block slides down on inclined plane BC. Time it takes to reach to the point C from point A is $t\left(\sqrt{2}+1\right)$s. The value of t is _____ (use $g = 10\ \text{m s}^{-2}$)



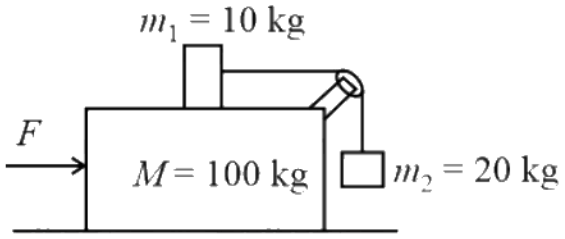
Numerical value type: the answer is a number.

Answer: 2. · Key from source paper

Q112 JEE Main 2022 · 26 Jul · Shift 1 MCQ

Three masses $M = 100$ kg, $m_1 = 10$ kg and $m_2 = 20$ kg are arranged in a system as shown in figure. All the surfaces are frictionless and strings are inextensible and weightless. The pulleys are also weightless and frictionless. A force F is applied on the system so that the mass m_2 moves upward with an acceleration of $2\ \mathrm{ms}^{-2}$. The value of F is
(Take $g = 10\ \mathrm{ms}^{-2}$)
(see the figure above)

Q2. Three masses $M = 100$ kg, $m_1 = 10$ kg and $m_2 = 20$ kg are arranged in a system as shown in figure. All the surfaces are frictionless and strings are inextensible and weightless. The pulleys are also weightless and frictionless. A force F is applied on the system so that the mass m_2 moves upward with an acceleration of $2\ \mathrm{ms}^{-2}$. The value of F is
(Take $g = 10\ \mathrm{ms}^{-2}$)



(1) 3360 N
(2) 3380 N
(3) 3120N
(4) 3240N

(A) 3360 N
(B) 3380 N
(C) 3120N
(D) 3240N

Answer: (A) 3360 N · Key from source paper

Q113 JEE Main 2022 · 26 Jul · Shift 1 MCQ

A monkey of mass 50 kg climbs on a rope which can withstand the tension (T) of 350 N. If monkey initially climbs down with an acceleration of $4\ \mathrm{m\ s}^{-2}$ and then climbs up with an acceleration of $5\ \mathrm{m\ s}^{-2}$. Choose the correct option ($\mathrm{g} = 10\ \mathrm{m\ s}^{-2}$)

(A) T = 700 N while climbing upward
(B) T = 350 N while going downward
(C) Rope will break while climbing upward
(D) Rope will break while going downward

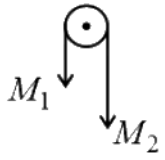
Answer: (C) Rope will break while climbing upward · Key from source paper

Q114 JEE Main 2022 · 26 Jul · Shift 2 MCQ

Two masses M_1 and M_2 are tied together at the two ends of a light inextensible string that passes over a frictionless pulley. When the mass M_2 is twice that of M_1. the acceleration of the system is a_1. When the mass M_2 is thrice that of M_1. The acceleration of The system is a_2. The ratio $\frac{a_1}{a_2}$ will be

(see the figure above)

Q2. Two masses M_1 and M_2 are tied together at the two ends of a light inextensible string that passes over a frictionless pulley. When the mass M_2 is twice that of M_1. the acceleration of the system is a_1. When the mass M_2 is thrice that of M_1. The acceleration of The system is a_2. The ratio $\frac{a_1}{a_2}$ will be



(1) $\frac{1}{3}$
(2) $\frac{2}{3}$
(3) $\frac{3}{2}$
(4) $\frac{1}{2}$

A $\frac{1}{3}$
B $\frac{2}{3}$
C $\frac{3}{2}$
D $\frac{1}{2}$

Answer: (B) $\frac{2}{3}$ · Key from source paper

Q115 JEE Main 2022 · 26 Jul · Shift 2 MCQ

A ball of mass $0.15\ \text{kg}$ hits the wall with its initial speed of $12\ \text{m s}^{-1}$ and bounces back without changing its initial speed. If the force applied by the wall on the ball during the contact is $100\ \text{N}$. calculate the time duration of the contact of ball with the wall.

A $0.018\ \text{s}$
B $0.036\ \text{s}$
C $0.009\ \text{s}$
D $0.072\ \text{s}$

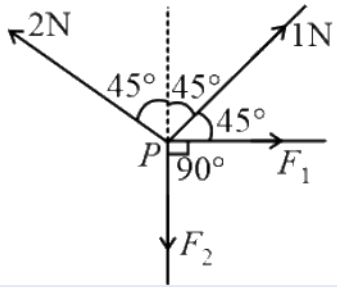
Answer: (B) $0.036\ \text{s}$ · Key from source paper

Q116 JEE Main 2022 · 25 Jul · Shift 1 Numerical

Four forces are acting at a point P in equilibrium as shown in figure. The ratio of force F_1 to F_2 is $1 : x$ where x = _____.

(see the figure above)

Q22. Four forces are acting at a point P in equilibrium as shown in figure. The ratio of force F_1 to F_2 is $1:x$ where $x =$ _____ .



Numerical value type: the answer is a number.

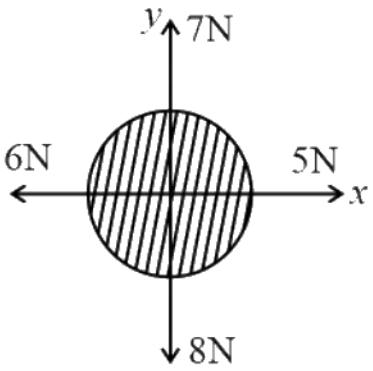
Answer: 3. · Key from source paper

Q117 JEE Main 2022 · 25 Jul · Shift 2 MCQ

For a free body diagram shown in the figure, the four forces are applied in the 'x' and 'y' directions. What additional force must be applied and at what angle with positive x-axis so that the net acceleration of body is zero?

(see the figure above)

Q3. For a free body diagram shown in the figure, the four forces are applied in the 'x' and 'y' directions. What additional force must be applied and at what angle with positive x-axis so that the net acceleration of body is zero?



(1) $\sqrt{2}$ N, 45°
(2) $\sqrt{2}$ N, 135°
(3) $\frac{2}{\sqrt{3}}$ N, 30°
(4) 2 N, 45°

(A) $\sqrt{2}$ N, 45°
(B) $\sqrt{2}$ N, 135°
(C) $\frac{2}{\sqrt{3}}$ N, 30°
(D) 2 N, 45°

Answer: (A) $\sqrt{2}$ N, 45° · Key from source paper

Q118 JEE Main 2022 · 25 Jul · Shift 2 MCQ

Two billiard balls of mass 0.05 kg each moving in opposite directions with $10\ \text{ms}^{-1}$ collide and rebound with the same speed. If the time duration of contact is $t = 0.005$ s, then what is the force

exerted on the ball due to each other?

(A) 100 N
(B) 200 N
(C) 300 N
(D) 400 N

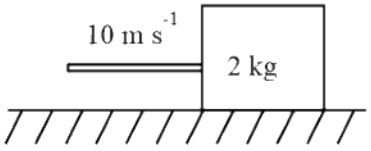
Answer: (B) 200 N · Key from source paper

Q119 JEE Main 2022 · 29 Jun · Shift 1 MCQ

A block of metal weighing 2 kg is resting on a frictionless plane (as shown in figure). It is struck by a jet releasing water at a rate of $1\ \mathrm{kg\,s^{-1}}$ and at a speed of $10\ \mathrm{m\,s^{-1}}$. Then, the initial acceleration of the block, in $\mathrm{m\,s^{-2}}$, will be

(see the figure above)

Q4. A block of metal weighing 2 kg is resting on a frictionless plane (as shown in figure). It is struck by a jet releasing water at a rate of 1 kg s^{-1} and at a speed of 10 m s^{-1}. Then, the initial acceleration of the block, in m s^{-2}, will be



(1) 3
(2) 6
(3) 5
(4) 4

(A) 3
(B) 6
(C) 5
(D) 4

Answer: (C) 5 · Key from source paper

Q120 JEE Main 2022 · 29 Jun · Shift 1 MCQ

A body of mass M at rest explodes into three pieces, in the ratio of masses $1:1:2$. Two smaller pieces fly off perpendicular to each other with velocities of $30\ \mathrm{m\,s^{-1}}$ and $40\ \mathrm{m\,s^{-1}}$ respectively. The velocity of the third piece will be

(A) $35\ \mathrm{m\,s^{-1}}$
(B) $50\ \mathrm{m\,s^{-1}}$
(C) $25\ \mathrm{m\,s^{-1}}$
(D) $15\ \mathrm{m\,s^{-1}}$

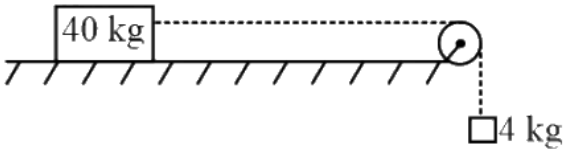
Answer: (C) $25\ \mathrm{m\,s^{-1}}$ · Key from source paper

Q121 JEE Main 2022 · 29 Jun · Shift 2 MCQ

A block of mass $40\ \text{kg}$ slides over a surface, when a mass of $4\ \text{kg}$ 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 $g = 10\ \text{m s}^{-2}$.)

(see the figure above)

Q3. 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 $g = 10\ \text{m s}^{-2}$.)



(1) $\frac{8}{11}\ \text{m s}^{-2}$
(2) $1\ \text{m s}^{-2}$
(3) $\frac{1}{5}\ \text{m s}^{-2}$
(4) $\frac{4}{5}\ \text{m s}^{-2}$

(A) $\frac{8}{11}\ \text{m s}^{-2}$
(B) $1\ \text{m s}^{-2}$
(C) $\frac{1}{5}\ \text{m s}^{-2}$
(D) $\frac{4}{5}\ \text{m s}^{-2}$

Answer: (A) $\frac{8}{11}\ \text{m s}^{-2}$ · Key from source paper

Q122 JEE Main 2022 · 29 Jun · Shift 2 MCQ

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

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

Answer: (B) $\frac{3g}{4}$ · Key from source paper

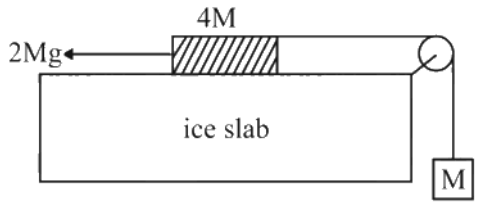
Q123 JEE Main 2022 · 28 Jun · Shift 1 Numerical

A hanging mass M is connected to a four times bigger mass by using a string pulley arrangement, as shown in the figure. The bigger mass is placed on a horizontal ice-slab and being pulled by $2Mg$ force. In this situation, tension in the string is $\frac{x}{5}Mg$ for $x =$ _____. Neglect mass of the string and

friction of the block (bigger mass) with ice slab.
(Given g = acceleration due to gravity)

(see the figure above)

Q21. A hanging mass M is connected to a four times bigger mass by using a string pulley arrangement, as shown in the figure. The bigger mass is placed on a horizontal ice-slab and being pulled by 2 Mg force. In this situation, tension in the string is $\frac{x}{5}$Mg for $x =$_____. Neglect mass of the string and friction of the block (bigger mass) with ice slab.
(Given g = acceleration due to gravity)



Numerical value type: the answer is a number.

Answer: 6. · Key from source paper

Q124 JEE Main 2022 · 28 Jun · Shift 1 Numerical

A man of 60 kg is running on the road and suddenly jumps into a stationary trolly car of mass 120 kg. Then the trolly car starts moving with velocity $2\ \mathrm{m\,s^{-1}}$. The velocity of the running man was _____ $\mathrm{m\,s^{-1}}$, when he jumps into the car.

Numerical value type: the answer is a number.

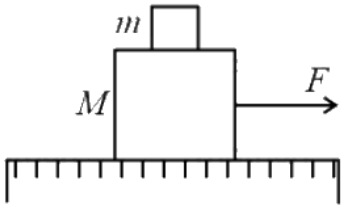
Answer: 6. · Key from source paper

Q125 JEE Main 2022 · 27 Jun · Shift 1 MCQ

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 ($g = 9.8\ \mathrm{m\,s^{-2}}$)

(see the figure above)

Q4. 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 $\left(g = 9.8\ \mathrm{m\,s^{-2}}\right)$



(1) 9.8 N
(2) 39.2 N
(3) 49 N
(4) 78.4 N

(A) $9.8\ \mathrm{N}$
(B) $39.2\ \mathrm{N}$
(C) $49\ \mathrm{N}$
(D) $78.4\ \mathrm{N}$

Answer: (C) $49\ \mathrm{N}$ · Key from source paper

Q126 JEE Main 2022 · 27 Jun · Shift 1 · Numerical

A pendulum of length $2\ \mathrm{m}$ consists of a wooden bob of mass $50\ \mathrm{g}$. A bullet of mass $75\ \mathrm{g}$ is fired towards the stationary bob with a speed v. The bullet emerges out of the bob with a speed $\frac{v}{3}$ and the bob just completes the vertical circle. The value of v is _____ $\mathrm{m\ s^{-1}}$ (if $g = 10\ \mathrm{m\ s^{-2}}$).

Numerical value type: the answer is a number.

Answer: 10. · Key from source paper

Q127 JEE Main 2022 · 27 Jun · Shift 2 · MCQ

One end of a massless spring of spring constant k and natural length l_0 is fixed while the other end is connected to a small object of mass m lying on a frictionless table. The spring remains horizontal on the table. If the object is made to rotate at an angular velocity ω about an axis passing trough fixed end, then the elongation of the spring will be

(A) $\frac{k-m\omega^2 l_0}{m\omega^2}$
(B) $\frac{m\omega^2 l_0}{k+m\omega^2}$
(C) $\frac{m\omega^2 l_0}{k-m\omega^2}$
(D) $\frac{k+m\omega^2 l_0}{m\omega^2}$

Answer: (C) $\frac{m\omega^2 l_0}{k-m\omega^2}$ · Key from source paper

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Q128 JEE Main 2022 · 27 Jun · Shift 2 · Numerical

A mass of $10\ \mathrm{kg}$ is suspended vertically by a rope of length $5\ \mathrm{m}$ from the roof. A force of $30\ \mathrm{N}$ is applied at the middle point of rope in horizontal direction. The angle made by upper half of the rope with vertical is $\alpha = \tan^{-1}\left(x \times 10^{-1}\right)$. The value of x is _____ .
(Given, $g = 10\ \mathrm{m\ s^{-2}}$)

Numerical value type: the answer is a number.

Answer: 3. · Key from source paper

Q129 JEE Main 2022 · 26 Jun · Shift 1 · MCQ

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

(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

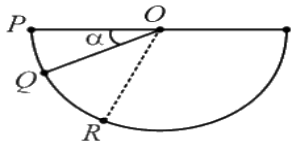
Answer: (B) When the elevator moves downward with constant acceleration · Key from source paper

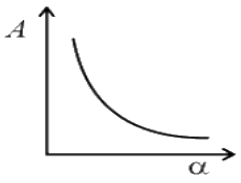
Q130 JEE Main 2022 · 26 Jun · Shift 1 MCQ

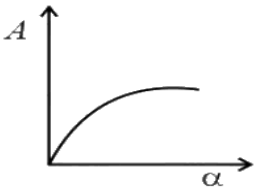
A ball is released from rest from point P of a smooth semi-spherical vessel as shown in figure. The ratio of the centripetal force and normal reaction on the ball at point Q is A while angular position of point Q is α with respect to point P. Which of the following graphs represent the correct relation between A and α when ball goes from Q to R?

(see the figure above)

Q4. A ball is released from rest from point P of a smooth semi-spherical vessel as shown in figure. The ratio of the centripetal force and normal reaction on the ball at point Q is A while angular position of point Q is α with respect to point P. Which of the following graphs represent the correct relation between A and α when ball goes from Q to R?



(1)


(2)


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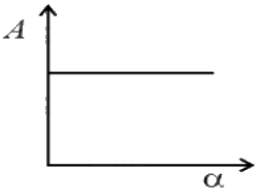
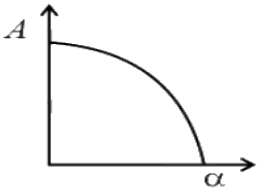


(4)


(A) *see figure*
(B) *see figure*
(C) *see figure*
(D) *see figure*

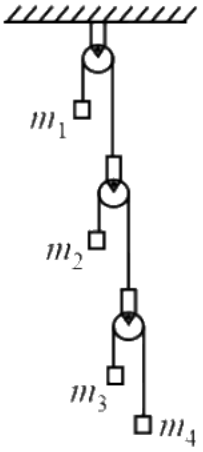
Answer: (C) · Key from source paper

Q131 JEE Main 2022 · 26 Jun · Shift 2 MCQ

In the arrangement shown in figure a_1, a_2, a_3 and a_4 are the accelerations of masses m_1, m_2, m_3 and m_4 respectively. Which of the following relation is true for this arrangement?

(see the figure above)

Q2. In the arrangement shown in figure a_1, a_2, a_3 and a_4 are the accelerations of masses m_1, m_2, m_3 and m_4 respectively. Which of the following relation is true for this arrangement?



(1) $4a_1 + 2a_2 + a_3 + a_4 = 0$
(2) $a_1 + 4a_2 + 3a_3 + a_4 = 0$
(3) $a_1 + 4a_2 + 3a_3 + 2a_4 = 0$
(4) $2a_1 + 2a_2 + 3a_3 + a_4 = 0$

(A) $4a_1 + 2a_2 + a_3 + a_4 = 0$
(B) $a_1 + 4a_2 + 3a_3 + a_4 = 0$
(C) $a_1 + 4a_2 + 3a_3 + 2a_4 = 0$
(D) $2a_1 + 2a_2 + 3a_3 + a_4 = 0$

Answer: (A) $4a_1 + 2a_2 + a_3 + a_4 = 0$ · Key from source paper

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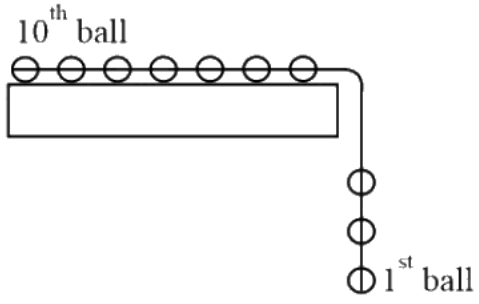
Q132 JEE Main 2022 · 26 Jun · Shift 2 Numerical

A system to 10 balls each of mass 2 kg are connected via massless and unstretchable string. The system is allowed to slip over the edge of a smooth table as shown in figure. Tension on the string between the 7th and 8th ball is _____ N when 6th ball just leaves the table.

(see the figure above)

Q22. A system to 10 balls each of mass 2 kg are connected via massless and unstretchable string. The system is allowed to slip over the edge of a smooth table as shown in figure. Tension on the string between the 7th and 8th ball is _____ N when 6th ball just leaves the table.



Numerical value type: the answer is a number.

Answer: 36. · Key from source paper

Q133 JEE Main 2022 · 26 Jun · Shift 2 Numerical

A batsman hits back a ball of mass $0.4\ \mathrm{kg}$ straight in the direction of the bowler without changing its initial speed of $15\ \mathrm{m\ s^{-1}}$. The impulse imparted to the ball is _____ N s.

Numerical value type: the answer is a number.

Answer: 12. · Key from source paper

Q134 JEE Main 2022 · 25 Jun · Shift 1 Numerical

A uniform chain of $6\ \mathrm{m}$ 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.

Numerical value type: the answer is a number.

Answer: 2. · Key from source paper

Q135 JEE Main 2022 · 25 Jun · Shift 1 Numerical

A force on an object of mass $100\ \mathrm{g}$ is $10\hat{i}+5\hat{j}\ \mathrm{N}$. The position of that object at $t=2\ \mathrm{s}$ is $a\hat{i}+b\hat{j}\ \mathrm{m}$ after starting from rest. The value of $\frac{a}{b}$ will be _____ .

Numerical value type: the answer is a number.

Answer: 2. · Key from source paper

Q136 JEE Main 2022 · 25 Jun · Shift 2 MCQ

A disc with a flat small bottom beaker placed on it at a distance R from its center is revolving about an axis passing through the center and perpendicular to its plane with an angular velocity ω. The coefficient of static friction between the bottom of the beaker and the surface of the disc is μ. The beaker will revolve with the disc if :

(A) $R \leq \frac{\mu g}{2\omega^2}$
(B) $R \leq \frac{\mu g}{\omega^2}$
(C) $R \geq \frac{\mu g}{2\omega^2}$
(D) $R \geq \frac{\mu g}{\omega^2}$

Answer: (B) $R \leq \frac{\mu g}{\omega^2}$ · Key from source paper

Q137 JEE Main 2022 · 25 Jun · Shift 2 Numerical

A curved in a level road has a radius $75\ \mathrm{m}$. The maximum speed of a car turning this curved road can be $30\ \mathrm{m\ s^{-1}}$ without skidding. If radius of curved road is changed to $48\ \mathrm{m}$ and the coefficient of friction between the tyres and the road remains same, then maximum allowed speed would be _____ $\mathrm{m\ s^{-1}}$.

Numerical value type: the answer is a number.

Answer: 24. · Key from source paper

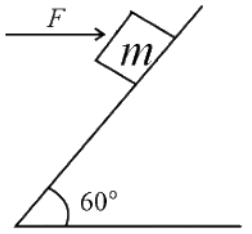
Q138 JEE Main 2022 · 25 Jun · Shift 2 Numerical

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

(see the figure above)

The value of $x =$ _____.

Q23. 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 $x =$ ____.

Numerical value type: the answer is a number.

Answer: 12. · Key from source paper

Q139 JEE Main 2022 · 24 Jun · Shift 1 MCQ

A boy ties a stone of mass $100\ \mathrm{g}$ to the end of a $2\ \mathrm{m}$ long string and whirls it around in a horizontal plane. The string can withstand the maximum tension of $80\ \mathrm{N}$. If the maximum speed with which the stone can revolve is $\frac{K}{\pi}\ \mathrm{rev\ min}^{-1}$. The value of K is :

(Assume the string is massless and un-stretchable)

(A) 400

(B) 300

(C) 600

(D) 800

Answer: (C) 600 · Key from source paper

Q140 JEE Main 2022 · 24 Jun · Shift 1 MCQ

A block of mass $10\ \mathrm{kg}$ starts sliding on a surface with an initial velocity of $9.8\ \mathrm{ms}^{-1}$. The coefficient of friction between the surface and block is 0.5. The distance covered by the block before coming to rest is :[use $\mathrm{g} = 9.8\ \mathrm{ms}^{-2}$]

(A) $9.8\ \text{m}$
(B) $4.9\ \text{m}$
(C) $12.5\ \text{m}$
(D) $19.6\ \text{m}$

Answer: (A) $9.8\ \text{m}$ · Key from source paper

Q141 JEE Main 2022 · 24 Jun · Shift 2 MCQ

A stone of mass m, tied to a string is being whirled in a vertical circle with a uniform speed. The tension in the string is

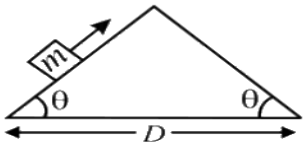
(A) the same throughout the motion.
(B) minimum when the rope is in the horizontal position.
(C) minimum at the highest position of the circular path.
(D) minimum at the lowest position of the circular path.

Answer: (C) minimum at the highest position of the circular path. · Key from source paper

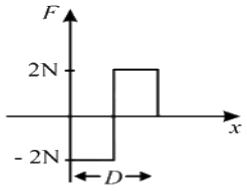
Q142 JEE Main 2021 · 1 Sep · Shift 2 MCQ

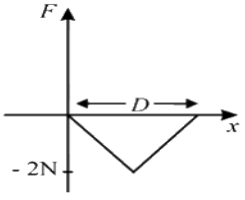
An object of mass m is being moved with a constant velocity under the action of an applied force of 2 N along a frictionless surface with following surface profile.
(see the figure above)
The correct applied force vs distance graph will be :

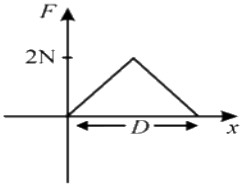
Q2. An object of mass m is being moved with a constant velocity under the action of an applied force of 2 N along a frictionless surface with following surface profile.

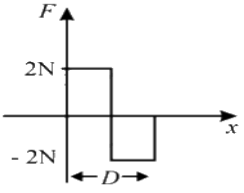


The correct applied force vs distance graph will be :

(1)


(2)


(3)


(4)


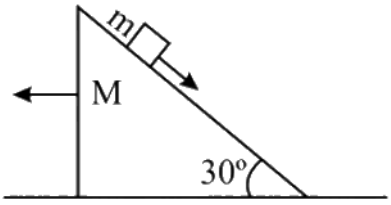
(A) *see figure*
(B) *see figure*
(C) *see figure*
(D) *see figure*

Answer: (D) · Key from source paper

Q143 JEE Main 2021 · 1 Sep · Shift 2 MCQ

A block of mass m slides on the wooden wedge, which in turn slides backward on the horizontal surface. The acceleration of the block with respect to the wedge is:
Given $m = 8$ kg, $M = 16$ kg
Assume all the surfaces shown in the figure to be frictionless.
(see the figure above)

Q4. A block of mass m slides on the wooden wedge, which in turn slides backward on the horizontal surface. The acceleration of the block with respect to the wedge is:
Given $m = 8$ kg, $M = 16$ kg
Assume all the surfaces shown in the figure to be frictionless.



(1) $\frac{3}{5}$ g
(2) $\frac{4}{3}$ g
(3) $\frac{6}{5}$ g
(4) $\frac{2}{3}$g

(A) $\frac{3}{5}$ g
(B) $\frac{4}{3}$ g
(C) $\frac{6}{5}$ g
(D) $\frac{2}{3}$g

Answer: (D) $\frac{2}{3}$g · Key from source paper

Q144 JEE Main 2021 · 1 Sep · Shift 2 Numerical

When a body slides down from rest along a smooth inclined plane making an angle of 30° with the horizontal, it takes time T. When the same body slides down from the rest along a rough inclined plane making the same angle and through the same distance, it takes time αT, where α is a constant greater than 1. The co-efficient of friction between the body and the rough plane is $\frac{1}{\sqrt{x}}\frac{\alpha^2-1}{\alpha^2}$ where $x =$ _____.

Numerical value type: the answer is a number.

Answer: 3. · Key from source paper

Q145 JEE Main 2021 · 31 Aug · Shift 1 Numerical

A car is moving on a plane inclined at 30° to the horizontal with an acceleration of 10 m s^{-2} parallel to the plane upward. A bob is suspended by a string from the roof of the car. The angle in degrees which the string makes with the vertical is (Take $g = 10$ m s^{-2})

Numerical value type: the answer is a number.

Answer: 30. · Key from source paper

Q146 JEE Main 2021 · 31 Aug · Shift 1 Numerical

A block moving horizontally on a smooth surface with a speed of 40 m s^{-1} splits into two equal parts. If one of the parts moves at 60 m s^{-1} in the same direction, then the fractional change in the kinetic energy will be $x : 4$ where $x =$ _____.

Numerical value type: the answer is a number.

Answer: 1. · Key from source paper

Q147 JEE Main 2021 · 31 Aug · Shift 2 MCQ

A block moving horizontally on a smooth surface with a speed of 40 m s^{-1} splits into two parts with masses in the ratio of $1 : 2$. If the smaller part moves at 60 m s^{-1} in the same direction, then the fractional change in kinetic energy is :

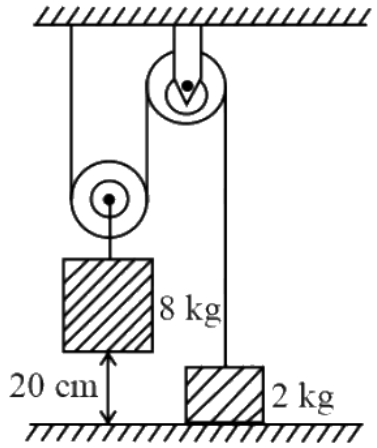
(A) $\frac{1}{3}$
(B) $\frac{2}{3}$
(C) $\frac{1}{4}$
(D) $\frac{1}{8}$

Answer: (D) $\frac{1}{8}$ · Key from source paper

Q148 JEE Main 2021 · 27 Aug · Shift 2 MCQ

The boxes of masses $2\ \text{kg}$ and $8\ \text{kg}$ are connected by a massless string passing over smooth pulleys. Calculate the time taken by box of mass $8\ \text{kg}$ to strike the ground starting from rest. ($\text{g} = 10\ \text{m s}^{-2}$)
(see the figure above)

Q5. The boxes of masses 2 kg and 8 kg are connected by a massless string passing over smooth pulleys. Calculate the time taken by box of mass 8 kg to strike the ground starting from rest. $\left(g = 10\ \mathrm{m\ s^{-2}}\right)$



(1) $0.25\ \mathrm{s}$
(2) $0.34\ \mathrm{s}$
(3) $0.2\ \mathrm{s}$
(4) $0.4\ \mathrm{s}$

(A) $0.25\ \mathrm{s}$
(B) $0.34\ \mathrm{s}$
(C) $0.2\ \mathrm{s}$
(D) $0.4\ \mathrm{s}$

Answer: (D) $0.4\ \mathrm{s}$ · Key from source paper

Q149 JEE Main 2021 · 26 Aug · Shift 1 MCQ

The initial mass of a rocket is $1000\ \mathrm{kg}$. Calculate at what rate the fuel should be burnt so that the rocket is given an acceleration of, $20\ \mathrm{m\ s^{-2}}$. The gases come out at a relative speed of $500\ \mathrm{m\ s^{-1}}$, with respect to the rocket:
[Use $g = 10\ \mathrm{m\ s^{-2}}$]

(A) $10\ \mathrm{kg\ s^{-1}}$
(B) $60\ \mathrm{kg\ s^{-1}}$
(C) $500\ \mathrm{kg\ s^{-1}}$
(D) $6.0 \times 10^{2}\ \mathrm{kg\ s^{-1}}$

Answer: (B) $60\ \mathrm{kg\ s^{-1}}$ · Key from source paper

Q150 JEE Main 2021 · 26 Aug · Shift 2 MCQ

A particle of mass m is suspended from a ceiling through a string of length L. The particle moves in a horizontal circle of radius r such that $r = \frac{L}{\sqrt{2}}$. The speed of particle will be :

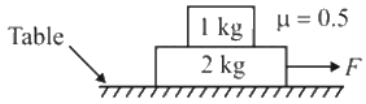
(A) $\sqrt{rg}$
(B) $\sqrt{2rg}$
(C) $\sqrt{\frac{rg}{2}}$
(D) $2\sqrt{rg}$

Answer: (A) $\sqrt{rg}$ · Key from source paper

Q151 JEE Main 2021 · 26 Aug · Shift 2 Numerical

The coefficient of static friction between two blocks is 0.5 and the table is smooth. The maximum horizontal force that can be applied to move the blocks together is _____N (take $g = 10\ \mathrm{m\ s^{-2}}$)
(see the figure above)

Q22. The coefficient of static friction between two blocks is 0.5 and the table is smooth. The maximum horizontal force that can be applied to move the blocks together is _____N (take $g = 10\ \mathrm{m\ s^{-2}}$)



Numerical value type: the answer is a number.

Answer: 15. · Key from source paper

Q152 JEE Main 2021 · 27 Jul · Shift 2 MCQ

A particle of mass M originally at rest is subjected to a force whose direction is constant but magnitude varies with time according to the relation $F = F_0\left[1 - \left(\frac{t-T}{T}\right)^2\right]$ where F_0 and T are constants. The force acts only for the time interval $2T$. The velocity v of the particle after time $2T$ is:

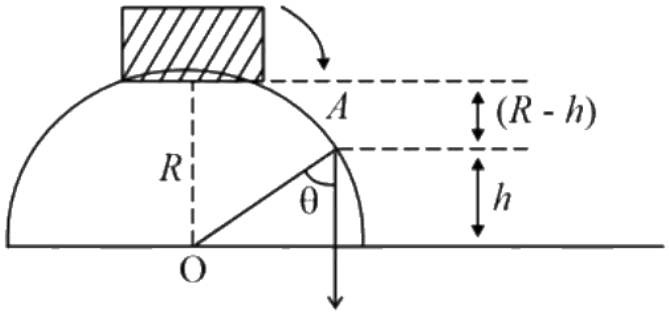
(A) $\frac{2F_0T}{M}$
(B) $\frac{F_0T}{2M}$
(C) $\frac{4F_0T}{3M}$
(D) $\frac{F_0T}{3M}$

Answer: (C) $\frac{4F_0T}{3M}$ · Key from source paper

Q153 JEE Main 2021 · 27 Jul · Shift 2 Numerical

A small block slides down from the top of hemisphere of radius $R = 3\ \mathrm{m}$ as shown in the figure. The height h at which the block will lose contact with the surface of the sphere is m. (Assume there is no friction between the block and the hemisphere)
(see the figure above)

Q22. A small block slides down from the top of hemisphere of radius $R = 3$ m as shown in the figure. The height h at which the block will lose contact with the surface of the sphere is m. (Assume there is no friction between the block and the hemisphere)



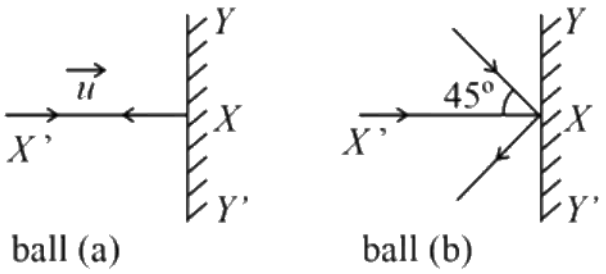
Numerical value type: the answer is a number.

Answer: 2. · Key from source paper

Q154 JEE Main 2021 · 25 Jul · Shift 1 MCQ

Two billiard balls of equal mass 30 g strike a rigid wall with same speed of 108 kmph (as shown) but at different angles. If the balls get reflected with the same speed, then the ratio of the magnitude of impulses imparted to ball a and ball b by the wall along X direction is:
(see the figure above)

Q3. Two billiard balls of equal mass 30 g strike a rigid wall with same speed of 108 kmph (as shown) but at different angles. If the balls get reflected with the same speed, then the ratio of the magnitude of impulses imparted to ball a and ball b by the wall along X direction is:



(1) 1:1
(2) $\sqrt{2}:1$
(3) 2:1
(4) $1:\sqrt{2}$

(A) $1:1$
(B) $\sqrt{2}:1$
(C) $2:1$
(D) $1:\sqrt{2}$

Answer: (B) $\sqrt{2}:1$ · Key from source paper

Q155 JEE Main 2021 · 25 Jul · Shift 2 MCQ

A force $\vec{F} = \left(40\hat{i} + 10\hat{j}\right)$ N acts on a body of mass 5 kg. If the body starts from rest, its position vector $\vec{r}$ at time $t = 10$ s will be

(A) $\left(100\hat{i} + 400\hat{j}\right)$ m

(B) $\left(100\hat{i} + 100\hat{j}\right)$ m

(C) $\left(400\hat{i} + 100\hat{j}\right)$ m

(D) $\left(400\hat{i} + 400\hat{j}\right)$ m

Answer: (C) $\left(400\hat{i} + 100\hat{j}\right)$ m · Key from source paper

Q156 JEE Main 2021 · 22 Jul · Shift 1 MCQ

A bullet of 4 g mass is fired from a gun of mass 4 kg. If the bullet moves with the muzzle speed of 50 m s^{-1}, the impulse imparted to the gun and velocity of recoil of gun are

(A) 0.4 kg m s^{-1}, 0.1 m s^{-1}

(B) 0.2 kg m s^{-1}, 0.05 m s^{-1}

(C) 0.2 kg m s^{-1}, 0.1 m s^{-1}

(D) 0.4 kg m s^{-1}, 0.05 m s^{-1}

Answer: (B) 0.2 kg m s^{-1}, 0.05 m s^{-1} · Key from source paper

Q157 JEE Main 2021 · 20 Jul · Shift 1 MCQ

A steel block of 10 kg rests on a horizontal floor as shown. When three iron cylinders are placed on it as shown, the block and cylinders go down with an acceleration 0.2 m s^{-2}. The normal reaction R' by the floor if mass of the iron cylinders are equal and of 20 kg each is (in N),

[Take $g = 10$ m s^{-2} and $\mu_s = 0.2$]

(see the figure above)

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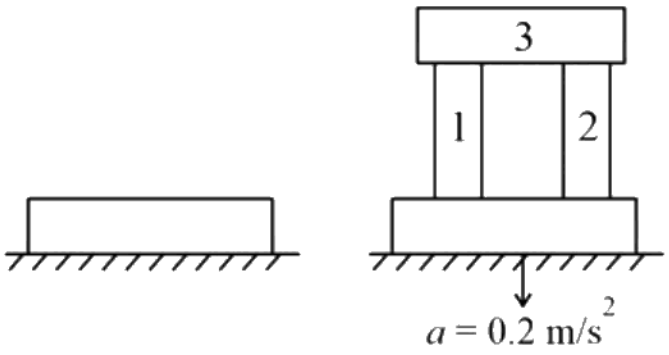
Q4. A steel block of 10 kg rests on a horizontal floor as shown. When three iron cylinders are placed on it as shown, the block and cylinders go down with an acceleration $0.2\ \mathrm{m\ s^{-2}}$. The normal reaction R' by the floor if mass of the iron cylinders are equal and of 20 kg each is (in N),
[Take $g = 10\ \mathrm{m\ s^{-2}}$ and $\mu_s = 0.2$]



(1) 716
(2) 686
(3) 714
(4) 684

(A) 716
(B) 686
(C) 714
(D) 684

Answer: (B) 686 · Key from source paper

Q158 JEE Main 2021 · 20 Jul · Shift 2 Numerical

A body of mass m is launched up on a rough inclined plane making an angle of 30° with the horizontal. The coefficient of friction between the body and plane is $\frac{\sqrt{x}}{5}$ if the time of ascent is half of the time of descent. The value of x is _____ .

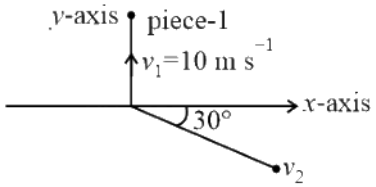
Numerical value type: the answer is a number.

Answer: 3. · Key from source paper

Q159 JEE Main 2021 · 18 Mar · Shift 1 Numerical

A ball of mass 10 kg moving with a velocity $10\sqrt{3}\ \mathrm{m\ s^{-1}}$ along the x -axis, hits another ball of mass 20 kg which is at rest. After the collision, first ball comes to rest while the second ball disintegrates into two equal pieces. One piece starts moving along y -axis with a speed of $10\ \mathrm{m\ s^{-1}}$. The second piece starts moving at an angle of 30° with respect to the x -axis. The velocity of the ball moving at 30° with x -axis is $x\ \mathrm{m\ s^{-1}}$. The configuration of pieces after the collision is shown in the figure below. The value of x to the nearest integer is
(see the figure above)

Q24. A ball of mass 10 kg moving with a velocity $10\sqrt{3}\ \text{m s}^{-1}$ along the x -axis, hits another ball of mass 20 kg which is at rest. After the collision, first ball comes to rest while the second ball disintegrates into two equal pieces. One piece starts moving along y -axis with a speed of $10\ \text{m s}^{-1}$. The second piece starts moving at an angle of 30° with respect to the x -axis. The velocity of the ball moving at 30° with x -axis is $x\ \text{m s}^{-1}$. The configuration of pieces after the collision is shown in the figure below. The value of x to the nearest integer is



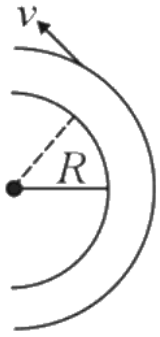
Numerical value type: the answer is a number.

Answer: 20. · Key from source paper

Q160 JEE Main 2021 · 17 Mar · Shift 1 MCQ

A modern grand-prix racing car of mass m is travelling on a flat track in a circular arc of radius R with a speed v. If the coefficient of static friction between the tyres and the track is μ_s, then the magnitude of negative lift F_L acting downwards on the car is:
(see the figure above)

Q2. A modern grand-prix racing car of mass m is travelling on a flat track in a circular arc of radius R with a speed v. If the coefficient of static friction between the tyres and the track is μ_s, then the magnitude of negative lift F_L acting downwards on the car is:



(1) $m\left(\frac{v^2}{\mu_s R}+g\right)$
(2) $m\left(\frac{v^2}{\mu_s R}-g\right)$
(3) $m\left(g-\frac{v^2}{\mu_s R}\right)$
(4) $-m\left(g+\frac{v^2}{\mu_s R}\right)$

(A) $m\left(\frac{v^2}{\mu_s R}+g\right)$
(B) $m\left(\frac{v^2}{\mu_s R}-g\right)$
(C) $m\left(g-\frac{v^2}{\mu_s R}\right)$
(D) $-m\left(g+\frac{v^2}{\mu_s R}\right)$

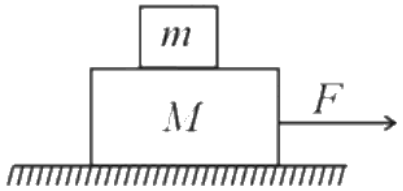
Answer: (B) $m\left(\frac{v^2}{\mu_s R}-g\right)$ · Key from source paper

Q161 JEE Main 2021 · 17 Mar · Shift 1 Numerical

Two blocks ($m = 0.5$ kg and $M = 4.5$ kg) are arranged on a horizontal frictionless table as shown in figure. The coefficient of static friction between the two blocks is $\frac{3}{7}$. Then the maximum horizontal force that can be applied on the larger block so that the blocks move together is N. (Round off to the Nearest Integer) [Take g as $9.8\ \mathrm{m\ s^{-2}}$]

(see the figure above)

Q21. Two blocks ($m = 0.5$ kg and $M = 4.5$ kg) are arranged on a horizontal frictionless table as shown in the figure. The coefficient of static friction between the two blocks is $\frac{3}{7}$. Then the maximum horizontal force that can be applied on the larger block so that the blocks move together is N. (Round off to the Nearest Integer) [Take g as $9.8\ \mathrm{m\ s^{-2}}$]



Numerical value type: the answer is a number.

Answer: 21. · Key from source paper

Q162 JEE Main 2021 · 17 Mar · Shift 2 Numerical

A body of mass 1 kg rests on a horizontal floor with which it has a coefficient of static friction $\frac{1}{\sqrt{3}}$. It is desired to make the body move by applying the minimum possible force F N. The value of F will be _____. (Round off to the Nearest Integer) [Take $g = 10\ \mathrm{m\ s^{-2}}$]

Numerical value type: the answer is a number.

Answer: 5. · Key from source paper

Q163 JEE Main 2021 · 16 Mar · Shift 1 MCQ

A block of 200 g mass moves with a uniform speed in a horizontal circular groove, with vertical side walls of radius 20 cm. If the block takes 40 s to complete one round, the normal force by the side walls of the groove is:

(A) 0.0314 N
(B) 9.859×10^{-2} N
(C) 6.28×10^{-3} N
(D) 9.859×10^{-4} N

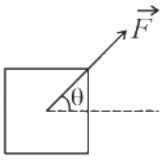
Answer: (D) 9.859×10^{-4} N · Key from source paper

Q164 JEE Main 2021 · 16 Mar · Shift 1 MCQ

A block of mass m slides along a floor while a force of magnitude F is applied to it at an angle θ as shown in figure. The coefficient of kinetic friction is μ_K. Then, the block's acceleration a is given by : (g

is acceleration due to gravity)
(see the figure above)

Q3. A block of mass m slides along a floor while a force of magnitude F is applied to it at an angle θ as shown in figure. The coefficient of kinetic friction is μ_K. Then, the block's acceleration a is given by : (g is acceleration due to gravity)



(1) $-\frac{F}{m}\cos\theta - \mu_K\left(g - \frac{F}{m}\sin\theta\right)$
(2) $\frac{F}{m}\cos\theta - \mu_K\left(g - \frac{F}{m}\sin\theta\right)$
(3) $\frac{F}{m}\cos\theta - \mu_K\left(g + \frac{F}{m}\sin\theta\right)$
(4) $\frac{F}{m}\cos\theta + \mu_K\left(g - \frac{F}{m}\sin\theta\right)$

(A) $-\frac{F}{m}\cos\theta - \mu_K\left(g - \frac{F}{m}\sin\theta\right)$
(B) $\frac{F}{m}\cos\theta - \mu_K\left(g - \frac{F}{m}\sin\theta\right)$
(C) $\frac{F}{m}\cos\theta - \mu_K\left(g + \frac{F}{m}\sin\theta\right)$
(D) $\frac{F}{m}\cos\theta + \mu_K\left(g - \frac{F}{m}\sin\theta\right)$

Answer: (B) $\frac{F}{m}\cos\theta - \mu_K\left(g - \frac{F}{m}\sin\theta\right)$ · Key from source paper

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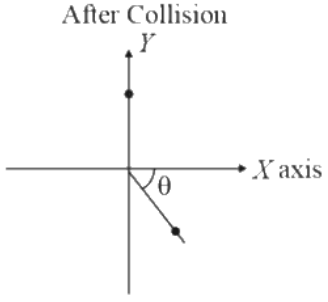
Q165 JEE Main 2021 · 16 Mar · Shift 1 Numerical

A ball of mass 10 kg moving with a velocity $10\sqrt{3}\ \mathrm{m\ s^{-1}}$ along X-axis, hits another ball of mass 20 kg which is at rest. After the collision, the first ball comes to rest and the second one disintegrates into two equal pieces. One of the pieces starts moving along Y-axis at a speed of $10\ \mathrm{m\ s^{-1}}$. The second piece starts moving at a speed of $20\ \mathrm{m\ s^{-1}}$ at an angle θ (degree) with respect to the X-axis. The configuration of pieces after the collision is shown in the figure. The value of θ to the nearest integer is _____.
(see the figure above)

Q24. A ball of mass 10 kg moving with a velocity $10\sqrt{3}\ \mathrm{m\ s^{-1}}$ along X-axis, hits another ball of mass 20 kg which is at rest. After the collision, the first ball comes to rest and the second one disintegrates into two equal pieces. One of the pieces starts moving along Y-axis at a speed of $10\ \mathrm{m\ s^{-1}}$. The second piece starts moving at a speed of $20\ \mathrm{m\ s^{-1}}$ at an angle θ (degree) with respect to the X-axis. The configuration of pieces after the collision is shown in the figure. The value of θ to the nearest integer is _____.



Numerical value type: the answer is a number.

Answer: 30. · Key from source paper

Q166 JEE Main 2021 · 16 Mar · Shift 2 MCQ

Statement I: A cyclist is moving on an unbanked road with a speed of $7\ \mathrm{km\ h^{-1}}$ and takes a sharp circular turn along a path of the radius of $2\ \mathrm{m}$ without reducing the speed. The static friction coefficient is 0.2. The cyclist will not slip and pass the curve $(g = 9.8\ \mathrm{m\,s^{-2}})$
Statement II : If the road is banked at an angle of 45°, cyclist can cross the curve of $2\ \mathrm{m}$ radius with the speed of $18.5\ \mathrm{km\ h^{-1}}$ without slipping. In the light of the above statements, choose the correct answer from the options given below.

(A) Statement I is incorrect and statement II is correct
(B) Statement I is correct and statement II is incorrect
(C) Both statement I and statement II are false
(D) Both statement I and statement II are true

Answer: (D) Both statement I and statement II are true · Key from source paper

Q167 JEE Main 2021 · 16 Mar · Shift 2 Numerical

A body of mass $2\ \mathrm{kg}$ moves under a force of $\left(2\hat{i} + 3\hat{j} + 5\hat{k}\right)\ \mathrm{N}$ It starts from rest and was at the origin initially. After $4\ \mathrm{s}$, its new coordinates are $(8, b, 20)$. The value of b is _____. (Round off to the Nearest Integer)

Numerical value type: the answer is a number.

Answer: 12. · Key from source paper

Q168 JEE Main 2021 · 26 Feb · Shift 1 MCQ

A particle is moving with uniform speed along the circumference of a circle of radius R under the action of a central fictitious force F which is inversely proportional to R^3. Its time period of revolution will be given by :

(A) $T \propto R^{\frac{4}{3}}$
(B) $T \propto R^{\frac{5}{2}}$
(C) $T \propto R^{\frac{3}{2}}$
(D) $T \propto R^2$

Answer: (D) $T \propto R^2$ · Key from source paper

Q169 JEE Main 2021 · 26 Feb · Shift 1 Numerical

A boy pushes a box of mass $2\ \mathrm{kg}$ with a force $\vec{F} = \left(20\hat{i} + 10\hat{j}\right)\ \mathrm{N}$ on a frictionless surface. If the box was initially at rest, then _____ m is displacement along the x-axis after $10\ \mathrm{s}$

Numerical value type: the answer is a number.

Answer: 500. · Key from source paper

Q170 JEE Main 2021 · 26 Feb · Shift 1 Numerical

A person standing on a spring balance inside a stationary lift measures $60\ \text{kg}$. The weight of that person if the lift descends with uniform downward acceleration of $1.8\ \text{m s}^{-2}$ will be _____ N.
$\left[g = 10\ \text{m s}^{-2}\right]$

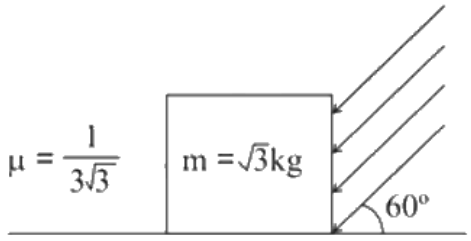
Numerical value type: the answer is a number.

Answer: 492. · Key from source paper

Q171 JEE Main 2021 · 26 Feb · Shift 1 Numerical

As shown in the figure, a block of mass $\sqrt{3}\ \text{kg}$ is kept on a horizontal rough surface of coefficient of friction $\mu = \frac{1}{3\sqrt{3}}$. The critical force to be applied on the vertical surface as shown at an angle 60° with horizontal such that it does not move, will be $3x$. The value of x will
$\left[g = 10\ \text{m s}^{-2};\ \sin 60^\circ = \frac{\sqrt{3}}{2};\ \cos 60^\circ = \frac{1}{2}\right]$
(see the figure above)

Q23. As shown in the figure, a block of mass $\sqrt{3}$ kg is kept on a horizontal rough surface of coefficient of friction $\frac{1}{3\sqrt{3}}$. The critical force to be applied on the vertical surface as shown at an angle 60° with horizontal such that it does not move, will be $3x$. The value of x will
$\left[g = 10\ \text{m s}^{-2};\ \sin 60^\circ = \frac{\sqrt{3}}{2};\ \cos 60^\circ = \frac{1}{2}\right]$



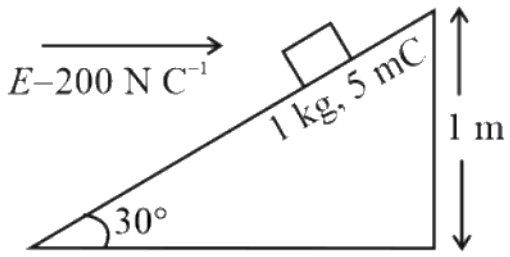
Numerical value type: the answer is a number.

Answer: 3.33. · Key from source paper

Q172 JEE Main 2021 · 26 Feb · Shift 2 MCQ

An inclined plane making an angle of 30° with the horizontal is placed in a uniform horizontal electric field $200\ \frac{\text{N}}{\text{C}}$ as shown in the figure. A body of mass $1\ \text{kg}$ and charge $5\ \text{mC}$ is allowed to slide down from rest at a height of $1\ \text{m}$. If the coefficient of friction is 0.2, find the time taken by the body to reach the bottom. $\left[g = 9.8\ \text{m s}^{-2};\ \sin 30^\circ = \frac{1}{2};\ \cos 30^\circ = \frac{\sqrt{3}}{2}\right]$
(see the figure above)

Q5. An inclined plane making an angle of 30° with the horizontal is placed in a uniform horizontal electric field $200\frac{\text{N}}{\text{C}}$ as shown in the figure. A body of mass 1 kg and charge 5 mC is allowed to slide down from rest at a height of 1 m. If the coefficient of friction is 0.2, find the time taken by the body to reach the bottom.
$\left[g = 9.8\ \text{m s}^{-2};\ \sin 30^\circ = \frac{1}{2};\ \cos 30^\circ = \frac{\sqrt{3}}{2}\right]$



(1) 0.92 s
(2) 1.3 s
(3) 0.46 s
(4) 2.3 s

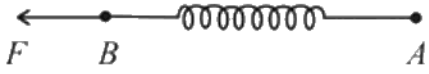
(A) 0.92 s
(B) 1.3 s
(C) 0.46 s
(D) 2.3 s

Answer: (B) 1.3 s · Key from source paper

Q173 JEE Main 2021 · 26 Feb · Shift 2 MCQ

Two masses A and B, each of mass M are fixed together by a massless spring, A force acts on the mass B as shown in figure. If the mass A starts moving away from mass B with acceleration a, then the acceleration of mass B will be :
(see the figure above)

Q6. Two masses A and B, each of mass M are fixed together by a massless spring, A force acts on the mass B as shown in figure. If the mass A starts moving away from mass B with acceleration a, then the acceleration of mass B will be :



(1) $\frac{MF}{F+Ma}$
(2) $\frac{F+Ma}{M}$
(3) $\frac{Ma-F}{M}$
(4) $\frac{F-Ma}{M}$

(A) $\frac{MF}{F+Ma}$
(B) $\frac{F+Ma}{M}$
(C) $\frac{Ma-F}{M}$
(D) $\frac{F-Ma}{M}$

Answer: (D) $\frac{F-Ma}{M}$ · Key from source paper

Q174 JEE Main 2021 · 25 Feb · Shift 1 Numerical

A small bob tied at one end of a thin string of length $1\ \mathrm{m}$ is describing a vertical circle so that the maximum and minimum tension in the string is in the ratio $5:1$. The velocity of the bob at the highest position is _____ $\mathrm{m\ s^{-1}}$. (Take $g = 10\ \mathrm{m\ s^{-2}}$)

Numerical value type: the answer is a number.

Answer: 5. · Key from source paper

Q175 JEE Main 2021 · 24 Feb · Shift 1 Numerical

The coefficient of static friction between a wooden block of mass $0.5\ \mathrm{kg}$ and a vertical rough wall is 0.2. The magnitude of the horizontal force that should be applied on the block to keep it adhere to the wall will be _____ N. $g = 10\ \mathrm{m\ s^{-2}}$

Numerical value type: the answer is a number.

Answer: 25. · Key from source paper

Q176 JEE Main 2021 · 24 Feb · Shift 1 Numerical

An inclined plane is bent in such a way that the vertical cross-section is given by $y = \frac{x^2}{4}$ where y is in vertical and x in horizontal direction. If the upper surface of this curved plane is rough with coefficient of friction $\mu = 0.5$, the maximum height in cm at which a stationary block will not slip downward is _____ cm.

Numerical value type: the answer is a number.

Answer: 25. · Key from source paper

Q177 JEE Main 2020 · 6 Sep · Shift 1 MCQ

An insect is at the bottom of a hemispherical ditch of radius $1\mathrm{m}$. It crawls up the ditch but starts slipping after it is at height h from the bottom. If the coefficient of friction between the ground and the insect is 0.75, then h is : $(g = 10\ \mathrm{m\ s^{-2}})$

(A) $0.20\ \mathrm{m}$
(B) $0.45\ \mathrm{m}$
(C) $0.60\ \mathrm{m}$
(D) $0.80\ \mathrm{m}$

Answer: (A) $0.20\ \mathrm{m}$ · Key from source paper

Q178 JEE Main 2020 · 6 Sep · Shift 2 MCQ

A particle moving in the xy-plane experiences a velocity dependent force $\vec{F} = k\left(v_y\hat{i} + v_x\hat{j}\right)$, where v_x and v_y are the x and y components of its velocity $\vec{v}$. If $\vec{a}$ is the acceleration of the particle, then which of the following statements is true for the particle ?

(A) quantity $\vec{v} \times \vec{a}$ is constant in time

(B) $\vec{F}$ arises from a magnetic field

(C) kinetic energy of particle is constant in time

(D) quantity $\vec{v} \cdot \vec{a}$ is constant in time

Answer: (A) quantity $\vec{v} \times \vec{a}$ is constant in time · Key from source paper

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Q179 JEE Main 2020 · 5 Sep · Shift 2 MCQ

A spaceship in space sweeps stationary interplanetary dust. As a result, its mass increases at a rate $\frac{dM(t)}{dt} = bv^2(t)$, where $v(t)$ is its instantaneous velocity. The instantaneous acceleration of the satellite is:

(A) $-bv^3(t)$

(B) $\frac{-bv^3}{M(t)}$

(C) $-\frac{2bv^3}{M(t)}$

(D) $-\frac{bv^3}{2M(t)}$

Answer: (B) $\frac{-bv^3}{M(t)}$ · Key from source paper

Q180 JEE Main 2020 · 3 Sep · Shift 2 Numerical

A block starts moving up an inclined plane of inclination 30° with an initial velocity of v_0. It comes back to its initial position with velocity $\frac{v_0}{2}$. The value of the coefficient of kinetic friction between the block and the inclined plane is close to $\frac{1}{1000}$, The nearest integer to I is :

Numerical value type: the answer is a number.

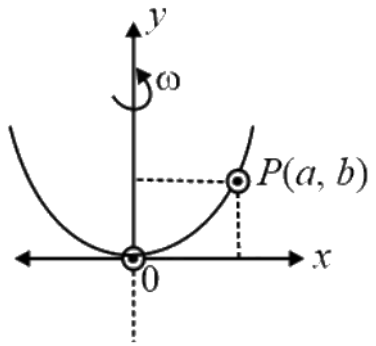
Answer: 346. · Key from source paper

Q181 JEE Main 2020 · 2 Sep · Shift 1 MCQ

A bead of mass m stays at point P(a, b) on a wire bent in the shape of a parabola $y = 4Cx^2$ and rotating with angular speed ω (see figure). The value of ω is (neglect friction)

(see the figure above)

Q3. A bead of mass m stays at point P(a, b) on a wire bent in the shape of a parabola $y = 4Cx^2$ and rotating with angular speed ω (see figure). The value of ω is (neglect friction)



(1) $2\sqrt{2gC}$
(2) $\sqrt{2gC}$
(3) $\sqrt{\frac{2gC}{ab}}$
(4) $\frac{\sqrt{2g}}{C}$

(A) $2\sqrt{2gC}$
(B) $\sqrt{2gC}$
(C) $\sqrt{\frac{2gC}{ab}}$
(D) $\frac{\sqrt{2g}}{C}$

Answer: (A) $2\sqrt{2gC}$ · Key from source paper

Q182 JEE Main 2020 · 9 Jan · Shift 2 MCQ

A spring mass system (mass m, spring constant k and natural length l) rests in equilibrium on a horizontal disc. The free end of the spring is fixed at the centre of the disc. If the disc together with spring mass system rotates about it's axis with an angular velocity ω, $(k \gg m\omega^2)$ the relative change in the length of the spring is best given by the option:

(A) $\sqrt{\frac{2}{3}\left(\frac{m\omega^2}{k}\right)}$
(B) $\frac{2m\omega^2}{k}$
(C) $\frac{m\omega^2}{k}$
(D) $\frac{m\omega^2}{3k}$

Answer: (C) $\frac{m\omega^2}{k}$ · Key from source paper

Q183 JEE Main 2020 · 8 Jan · Shift 1 MCQ

A particle of mass m is fixed to one end of a light spring having force constant k and unstretched length l. The other end is fixed. The system is given an angular speed ω about the fixed end of the spring such that it rotates in a circle in gravity free space. Then the stretch in the spring is:

(A) $\frac{ml\omega^2}{k-\omega m}$
(B) $\frac{ml\omega^2}{k-m\omega^2}$
(C) $\frac{ml\omega^2}{k+m\omega^2}$
(D) $\frac{ml\omega^2}{k+m\omega}$

Answer: (B) $\frac{ml\omega^2}{k-m\omega^2}$ · Key from source paper

Q184 JEE Main 2020 · 7 Jan · Shift 2 MCQ

A mass of $10\ \mathrm{kg}$ is suspended by a rope of length $4\ \mathrm{m}$, from the ceiling. A force F is applied horizontally at the mid-point of the rope such that the top half of the rope makes an angle of 45° with the vertical. Then F equals:
(Take $\mathrm{g} = 10\ \mathrm{m\,s^{-2}}$ and the rope to be massless)

(A) $100\mathrm{N}$
(B) $90\mathrm{N}$
(C) $70\mathrm{N}$
(D) $75\mathrm{N}$

Answer: (A) $100\mathrm{N}$ · Key from source paper

Q185 JEE Main 2019 · 12 Apr · Shift 1 MCQ

A man (mass $= 50\ \mathrm{kg}$) and his son (mass $= 20\ \mathrm{kg}$) are standing on a frictionless surface facing each other. The man pushes his son so that he starts moving at a speed of $0.70\ \mathrm{m\ s^{-1}}$ with respect to the man. The speed of the man with respect to the surface is:

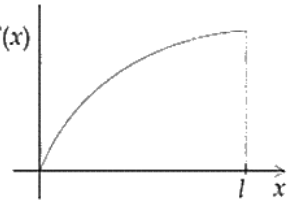
(A) $0.20\ \mathrm{m\ s^{-1}}$
(B) $0.14\ \mathrm{m\ s^{-1}}$
(C) $0.47\ \mathrm{m\ s^{-1}}$
(D) $0.28\ \mathrm{m\ s^{-1}}$

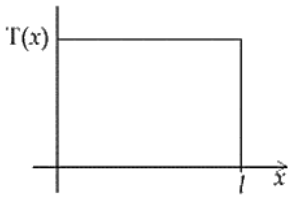
Answer: (A) $0.20\ \mathrm{m\ s^{-1}}$ · Key from source paper

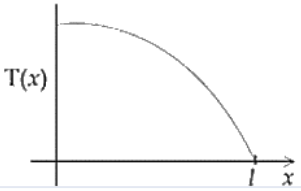
Q186 JEE Main 2019 · 12 Apr · Shift 1 MCQ

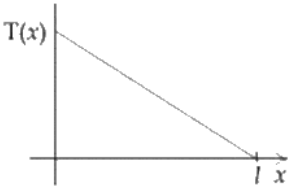
A uniform rod of length l is being rotated in a horizontal plane with a constant angular speed about an axis passing through one of its ends. If the tension generated in the rod due to rotation is $\mathrm{T}\ (x)$ at a distance x from the axis, then which of the following graphs depicts it most closely?

Q6. A uniform rod of length l is being rotated in a horizontal plane with a constant angular speed about an axis passing through one of its ends. If the tension generated in the rod due to rotation is $T(x)$ at a distance x from the axis, then which of the following graphs depicts it most closely?

(1) 

(2) 

(3) 

(4) 

(A) *see figure*
(B) *see figure*
(C) *see figure*
(D) *see figure*

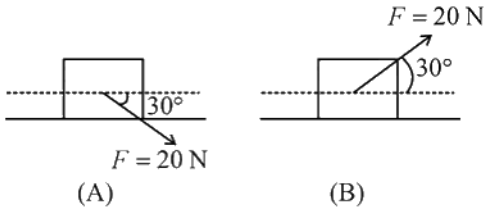
Answer: (C) · Key from source paper

Q187 JEE Main 2019 · 12 Apr · Shift 2 MCQ

A block of mass 5 kg is (i) pushed in case (A) and (ii) pulled in case (B), by a force $F = 20$ N, making an angle of 30° with the horizontal, as shown in the figures. The coefficient of friction between the block and floor is $\mu = 0.2$. The difference between the accelerations of the block, in case (B) and case (A) will be: $(g = 10\ m\ s^{-2})$

(see the figure above)

Q3. A block of mass 5 kg is (i) pushed in case (A) and (ii) pulled in case (B), by a force $F = 20$ N, making an angle of 30° with the horizontal, as shown in the figures. The coefficient of friction between the block and floor is $\mu = 0.2$. The difference between the accelerations of the block, in case (B) and case (A) will be:
$(g = 10\ m\ s^{-2})$



(1) $3.2\ m\ s^{-2}$
(2) $0\ m\ s^{-2}$
(3) $0.8\ m\ s^{-2}$
(4) $0.4\ m\ s^{-2}$

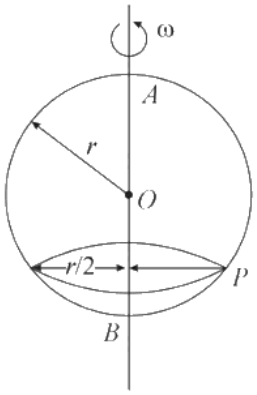
(A) $3.2\ \mathrm{m\,s^{-2}}$
(B) $0\ \mathrm{m\,s^{-2}}$
(C) $0.8\ \mathrm{m\,s^{-2}}$
(D) $0.4\ \mathrm{m\,s^{-2}}$

Answer: (C) $0.8\ \mathrm{m\,s^{-2}}$ · Key from source paper

Q188 JEE Main 2019 · 12 Apr · Shift 2 MCQ

A smooth wire of length $2\pi r$ is bent into a circle and kept in a vertical plane. A bead can slide smoothly on the wire. When the circle is rotating with angular speed ω about the vertical diameter AB, as shown in figure, the bead is at rest with respect to the circular ring at position P as shown. Then the value of ω^2 is equal to:
(see the figure above)

Q6. A smooth wire of length $2\pi r$ is bent into a circle and kept in a vertical plane. A bead can slide smoothly on the wire. When the circle is rotating with angular speed ω about the vertical diameter AB, as shown in figure, the bead is at rest with respect to the circular ring at position P as shown. Then the value of ω^2 is equal to:



(1) $2g/r$
(2) $\frac{\sqrt{3}g}{2r}$
(3) $2g/\left(r\sqrt{3}\right)$
(4) $\left(g\sqrt{3}\right)/r$

(A) $2g/r$
(B) $\frac{\sqrt{3}g}{2r}$
(C) $2g/\left(r\sqrt{3}\right)$
(D) $\left(g\sqrt{3}\right)/r$

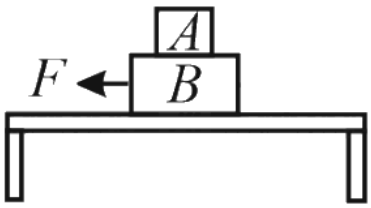
Answer: (C) $2g/\left(r\sqrt{3}\right)$ · Key from source paper

Q189 JEE Main 2019 · 10 Apr · Shift 2 MCQ

Two blocks A and B of masses $m_A = 1\ \mathrm{kg}$ and $m_B = 3\ \mathrm{kg}$ are kept on the table as shown in figure. The coefficients of friction between A and B is 0.2 and between B and the surface of the table is also 0.2. The maximum force F that can be applied on B horizontally, so that the block A does not slide over the block B is :
[Take $g = 10\ \mathrm{m/s^2}$]

(see the figure above)

Q4. Two blocks A and B of masses $m_A = 1$ kg and $m_B = 3$ kg are kept on the table as shown in figure. The coefficients of friction between A and B is 0.2 and between B and the surface of the table is also 0.2. The maximum force F that can be applied on B horizontally, so that the block A does not slide over the block B is : [Take $g = 10\ m/s^2$]



(1) 16 N
(2) 12 N
(3) 40 N
(4) 8 N

(A) 16 N
(B) 12 N
(C) 40 N
(D) 8 N

Answer: (A) 16 N · Key from source paper

Q190 JEE Main 2019 · 8 Apr · Shift 2 MCQ

A body of mass m_1 moving with an unknown velocity of $v_1\,\hat{i}$, undergoes a collinear collision with a body of mass m_2 moving with a velocity $v_2\,\hat{i}$. After the collision, m_1 and m_2 move with velocities of $v_3\,\hat{i}$ and $v_4\,\hat{i}$, respectively. If $m_2 = 0.5\ m_1$ and $v_3 = 0.5\ v_1$, then v_1 is:

(A) $v_4 - \frac{v_2}{4}$
(B) $v_4 - \frac{v_2}{2}$
(C) $v_4 + v_2$
(D) $v_4 - v_2$

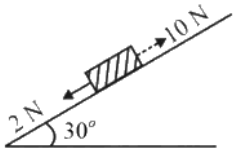
Answer: (D) $v_4 - v_2$ · Key from source paper

Q191 JEE Main 2019 · 12 Jan · Shift 2 MCQ

A block kept on a rough inclined plane, as shown in the figure, remains at rest upto a maximum force $2N$ down the inclined plane. The maximum external force up the inclined plane that does not move the block is $10N$. The coefficient of static friction between the block and the plane is: [Take $g = 10\ m/s^2$]

(see the figure above)

Q3. A block kept on a rough inclined plane, as shown in the figure, remains at rest upto a maximum force $2N$ down the inclined plane. The maximum external force up the inclined plane that does not move the block is $10N$. The coefficient of static friction between the block and the plane is: [Take $g = 10\ m/s^2$]



(1) $\frac{\sqrt{3}}{4}$
(2) $\frac{2}{3}$
(3) $\frac{1}{2}$
(4) $\frac{\sqrt{3}}{2}$

(A) $\frac{\sqrt{3}}{4}$
(B) $\frac{2}{3}$
(C) $\frac{1}{2}$
(D) $\frac{\sqrt{3}}{2}$

Answer: (D) $\frac{\sqrt{3}}{2}$ · Key from source paper

Q192 JEE Main 2019 · 11 Jan · Shift 1 MCQ

A liquid of density ρ is coming out of a hose pipe of radius a with horizontal speed v and hits a mesh. 50% of the liquid passes through the mesh unaffected. 25% looses all of its momentum and 25% comes back with the same speed. The resultant pressure on the mesh will be:

(A) $\frac{1}{4}\rho v^2$
(B) $\frac{3}{4}\rho v^2$
(C) $\frac{1}{2}\rho v^2$
(D) ρv^2

Answer: (B) $\frac{3}{4}\rho v^2$ · Key from source paper

Q193 JEE Main 2019 · 11 Jan · Shift 2 MCQ

A particle of mass m is moving in a straight line with momentum p. Starting at time $t = 0$, a force $F = k$ t acts in the same direction on the moving particle during time interval T so that its momentum changes from p to 3p. Here k is a constant. The value of T is

(A) $2\sqrt{\frac{k}{p}}$
(B) $2\sqrt{\frac{p}{k}}$
(C) $\sqrt{\frac{2k}{p}}$
(D) $\sqrt{\frac{2p}{k}}$

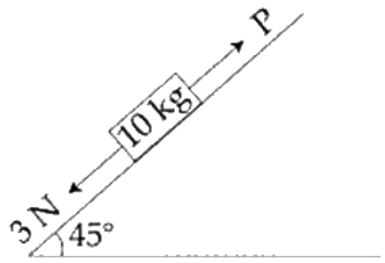
Answer: (B) $2\sqrt{\frac{p}{k}}$ · Key from source paper

Q194 JEE Main 2019 · 9 Jan · Shift 1 MCQ

A block of mass $10\ kg$ is kept on a rough inclined plane as shown in the figure. A force of $3\ N$ is applied on the block. The coefficient of static friction between the plane and the block is 0.6. What should be the minimum value of force P, such that the block does not move downward? (take $g = 10\ ms^{-2}$)

(see the figure above)

Q3. A block of mass $10\ kg$ is kept on a rough inclined plane as shown in the figure. A force of $3\ N$ is applied on the block. The coefficient of static friction between the plane and the block is 0.6. What should be the minimum value of force P, such that the block does not move downward? (take $g = 10\ ms^{-2}$)



(1) $23\ N$
(2) $25\ N$
(3) $18\ N$
(4) $32\ N$

(A) $23\ N$
(B) $25\ N$
(C) $18\ N$
(D) $32\ N$

Answer: (D) $32\ N$ · Key from source paper

Q195 JEE Main 2019 · 9 Jan · Shift 2 MCQ

A mass of $10\ \mathrm{kg}$ is suspended vertically by a rope from the roof. When a horizontal force is applied on the rope at some point, the rope deviated at an angle of 45° at the roof point. If the suspended mass is at equilibrium, the magnitude of the force applied is $(g = 10\ \mathrm{m\,s^{-2}})$

(A) $100\ N$
(B) $200\ N$
(C) $140\ N$
(D) $70\ N$

Answer: (A) $100\ N$ · Key from source paper

Q196 JEE Main 2018 · 16 Apr · Online MCQ

Two particles of the same mass m are moving in circular orbits because of force, given by $F(r) = -\frac{16}{r} - r^3$. The first particle is at a distance $r = 1$, and the second, at $r = 4$. The best estimate for the ratio of kinetic energies of the first and the second particle is closest to

(A) 3×10^{-3}
(B) 6×10^{2}
(C) 6×10^{-2}
(D) 10^{-2}

Answer: (C) 6×10^{-2} · Key from source paper

Q197 JEE Main 2018 · 15 Apr · Shift 1 MCQ

A given object takes n times more time to slide down a 45° rough inclined plane as it takes to slide down a perfectly smooth 45° incline. The coefficient of kinetic friction between the object and the incline is :

(A) $\sqrt{1-\frac{1}{n^2}}$
(B) $1-\frac{1}{n^2}$
(C) $\frac{1}{2-n^2}$
(D) $\sqrt{\frac{1}{1-n^2}}$

Answer: (B) $1-\frac{1}{n^2}$ · Key from source paper

Q198 JEE Main 2018 · 15 Apr · Shift 2 MCQ

A body of mass $2\ \mathrm{kg}$ slides down with an acceleration of $3\ \mathrm{m/s^2}$ on a rough inclined plane having a slope of 30° . The external force required to take the same body up the plane with the same acceleration will be: $(\mathrm{g} = 10\ \mathrm{m/s^2})$

(A) $4\ \mathrm{N}$
(B) $14\ \mathrm{N}$
(C) $6\ \mathrm{N}$
(D) $20\ \mathrm{N}$

Answer: (D) $20\ \mathrm{N}$ · Key from source paper

Q199 JEE Main 2018 · 15 Apr · Shift 2 MCQ

A disc rotates about its axis of symmetry in a hoizontal plane at a steady rate of 3.5 revolutions per second. A coin placed at a distance of $1.25\ \mathrm{cm}$ from the axis of rotation remains at rest on the disc. The coefficient of friction between the coin and the disc is $(\mathrm{g} = 10\ \mathrm{m/s^2})$

(A) 0.5
(B) 0.7
(C) 0.3
(D) 0.6

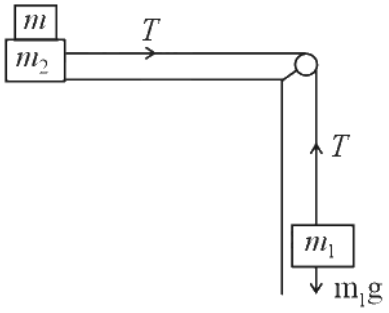
Answer: (D) 0.6 · Key from source paper

Q200 JEE Main 2018 · 8 Apr · Offline MCQ

Two masses $m_1 = 5$ kg and $m_2 = 10$ kg, connected by an inextensible string over a frictionless pulley, are moving as shown in the figure. The coefficient of friction of horizontal surface is 0.15. The minimum weight m that should be put on top of m_2 to stop the motion is:

(see the figure above)

Q3. Two masses $m_1 = 5$ kg and $m_2 = 10$ kg, connected by an inextensible string over a frictionless pulley, are moving as shown in the figure. The coefficient of friction of horizontal surface is 0.15. The minimum weight m that should be put on top of m_2 to stop the motion is:



(1) 10 .3 kg
(2) 18 .3 kg
(3) 27 .3 kg
(4) 43 .3 kg

(A) 10.3 kg
(B) 18.3 kg
(C) 27.3 kg
(D) 43.3 kg

Answer: (C) 27.3 kg · Key from source paper

Q201 JEE Main 2018 · 8 Apr · Offline MCQ

A particle is moving with a uniform speed in a circular orbit of radius R in a central force inversely proportional to the nth power of R. If the period of rotation of the particle is T, then:

(A) $T \propto R^{n/2}$
(B) $T \propto R^{3/2}$ for any n
(C) $T \propto R^{\frac{n}{2}+1}$
(D) $T \propto R^{\frac{n+1}{2}}$

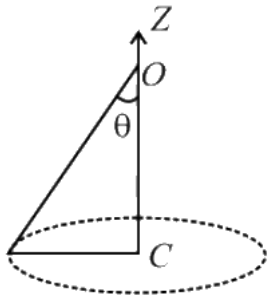
Answer: (D) $T \propto R^{\frac{n+1}{2}}$ · Key from source paper

Q202 JEE Main 2017 · 9 Apr · Online MCQ

A conical pendulum of length l makes an angle $\theta = 45^\circ$ with respect to Z-axis and moves in a circle in the XY plane. The radius of the circle is 0.4 m and its center is vertically below O. The speed of the pendulum, in its circular path, will be - (Take $g = 10\ \mathrm{m\,s^{-2}}$)

(see the figure above)

Q3. A conical pendulum of length l makes an angle $\theta = 45^\circ$ with respect to $Z-$axis and moves in a circle in the XY plane. The radius of the circle is 0.4 m and its center is vertically below O. The speed of the pendulum, in its circular path, will be - $\left(\text{Take } g = 10 \text{ m s}^{-2}\right)$



(1) 0.2 m s^{-1}
(2) 0.4 m s^{-1}
(3) 2 m s^{-1}
(4) 4 m s^{-1}

(A) 0.2 m s^{-1}
(B) 0.4 m s^{-1}
(C) 2 m s^{-1}
(D) 4 m s^{-1}

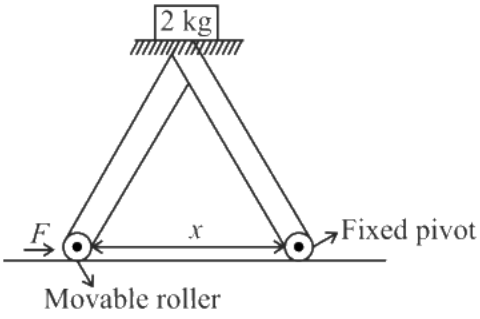
Answer: (C) 2 m s^{-1} · Key from source paper

Q203

JEE Main 2017 · 9 Apr · Online · MCQ

The machine as shown has 2 rods of length 1 m connected by a pivot at the top. The end of one rod is connected to the floor by a stationary pivot and the end of the other rod has roller that rolls along the floor in a slot. As the roller goes back and forth, a 2 kg weight moves up and down. If the roller is moving towards right at a constant speed, the weight moves up with a :
(see the figure above)

Q4. The machine as shown has 2 rods of length 1 m connected by a pivot at the top. The end of one rod is connected to the floor by a stationary pivot and the end of the other rod has roller that rolls along the floor in a slot. As the roller goes back and forth, a 2 kg weight moves up and down. If the roller is moving towards right at a constant speed, the weight moves up with a :



(1) Speed which is $\frac{3}{4}$th of that of the roller when the weight is 0.4 m above the ground
(2) Constant speed
(3) Decreasing speed
(4) Increasing speed

(A) Speed which is $\frac{3}{4}$th of that of the roller when the weight is 0.4 m above the ground
(B) Constant speed
(C) Decreasing speed
(D) Increasing speed

Answer: (C) Decreasing speed · Key from source paper

Q204 JEE Main 2016 · 10 Apr · Online MCQ

Concrete mixture is made by mixing cement, stone and sand in a rotating cylindrical drum. If the drum rotates too fast, the ingredients remain stuck to the wall of the drum and proper mixing of ingredients does not take place. The maximum rotational speed of the drum in revolutions per minute (rpm) to ensure proper mixing is close to :
(Take the radius of the drum to be $1.25\ \mathrm{m}$ and its axle to be horizontal) :

(A) 27.0
(B) 0.4
(C) 1.3
(D) 8.0

Answer: (A) 27.0 · Key from source paper

Q205 JEE Main 2016 · 9 Apr · Online MCQ

A rocket is fired vertically from the earth with an acceleration of $2g$, where g is the gravitational acceleration. On an inclined plane inside the rocket, making an angle θ with the horizontal, a point object of mass m is kept. The minimum coefficient of friction $\mu_{\min}$ between the mass and the inclined surface such that the mass does not move is:

(A) $\tan 2\theta$
(B) $\tan\theta$
(C) $3\tan\theta$
(D) $2\tan\theta$

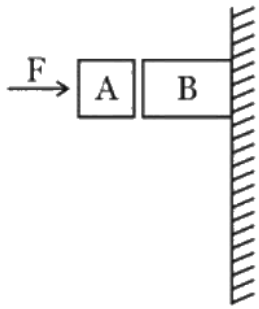
Answer: (B) $\tan\theta$ · Key from source paper

Q206 JEE Main 2015 · 4 Apr · Offline MCQ

see figure

EdLoop JEE

Q3.



Given in the figure are two blocks A and B of weight 20 N and 100 N, respectively. These are being pressed against a wall by a force F and kept in equilibrium as shown. If the coefficient of friction between the blocks is 0.1 and between block B and the wall is 0.15, the frictional force applied by the wall on block B is:

(1) 150 N
(2) 100 N
(3) 80 N
(4) 120 N

(A) 150 N
(B) 100 N
(C) 80 N
(D) 120 N

Answer: (D) 120 N · Key from source paper

Q207 JEE Main 2014 · 19 Apr · Online MCQ

A heavy box is to be dragged along a rough horizontal floor. To do so, the person A pushes it at an angle 30° from the horizontal and requires a minimum force F_{A}, while the person B pulls the box at an angle 60° from the horizontal and needs minimum force F_{B}. If the coefficient of friction between the box and the floor is $\frac{\sqrt{3}}{5}$, the ratio $\frac{F_A}{F_B}$ is

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

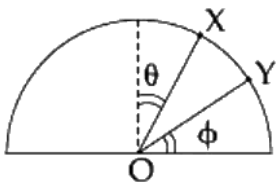
Answer: (B) $\frac{2}{\sqrt{3}}$ · Key from source paper

Q208 JEE Main 2014 · 19 Apr · Online MCQ

see figure

EdLoop JEE

Q3.



A particle is released on a vertical smooth semicircular track from point X so that, OX makes angle θ from the vertical (see figure). The normal reaction of the track on the particle vanishes at the point Y where OY makes an angle ϕ with the horizontal. Then

(1) $\sin\phi = \frac{2}{3}\cos\theta$ (2) $\sin\phi = \frac{3}{4}\cos\theta$

(3) $\sin\phi = \frac{1}{2}\cos\theta$ (4) $\sin\phi = \cos\theta$

(A) $\sin\phi = \frac{2}{3}\cos\theta$

(B) $\sin\phi = \frac{3}{4}\cos\theta$

(C) $\sin\phi = \frac{1}{2}\cos\theta$

(D) $\sin\phi = \cos\theta$

Answer: (A) $\sin\phi = \frac{2}{3}\cos\theta$ · Key from source paper

Q209 JEE Main 2014 · 11 Apr · Online MCQ

A body of mass $5\ \text{kg}$ under the action of constant force $\vec{F} = F_x\hat{i} + F_y\hat{j}$ has velocity at $t = 0\ \text{s}$ as $\vec{v} = (6\hat{i} - 2\hat{j})\text{m/s}$ and at $t = 10\ \text{s}$ as $\vec{v} = +6\hat{j}\text{m/s}$. The force $\vec{F}$ is:

(A) $(-3\hat{i} + 4\hat{j})\text{N}$

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

(C) $(3\hat{i} - 4\hat{j})\text{N}$

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

Answer: (A) $(-3\hat{i} + 4\hat{j})\text{N}$ · Key from source paper

Q210 JEE Main 2014 · 9 Apr · Online MCQ

Water is flowing at a speed of $1.5\ \text{m s}^{-1}$ through a horizontal tube of cross-sectional area $10^{-2}\ \text{m}^2$ and you are trying to stop the flow by your palm. Assuming that the water stops immediately after hitting the palm, the minimum force that you must exert should be (density of water = $10^3\ \text{kg m}^{-3}$)

(A) 33.7 N

(B) 45 N

(C) 15 N

(D) 22.5 N

Answer: (D) 22.5 N · Key from source paper

Q211 JEE Main 2014 · 6 Apr · Offline MCQ

A block of mass m is placed on a surface with a vertical cross section given by $y = \frac{x^3}{6}$. If the coefficient of friction is 0.5, the maximum height above the ground at which the block can be placed without slipping is

(A) $\frac{1}{6}$ m
(B) $\frac{2}{3}$ m
(C) $\frac{1}{3}$ m
(D) $\frac{1}{2}$ m

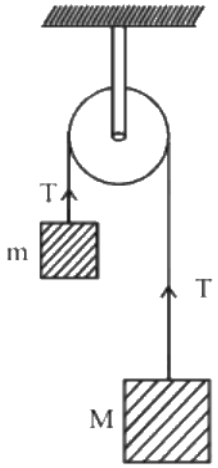
Answer: (A) $\frac{1}{6}$ m · Key from source paper

Q212 JEE Main 2013 · 25 Apr · Online MCQ

Two blocks of masses m and M are connected by means of a metal wire of cross-sectional area A passing over a frictionless fixed pulley as shown in the figure. The system is then released. If $M = 2$ m, then the stress produced in the wire is:

(see the figure above)

Q5. Two blocks of masses m and M are connected by means of a metal wire of cross-sectional area A passing over a frictionless fixed pulley as shown in the figure. The system is then released. If M = 2 m, then the stress



produced in the wire is:

(1) $\frac{2mg}{3A}$
(2) $\frac{4mg}{3A}$
(3) $\frac{mg}{A}$
(4) $\frac{3mg}{4A}$

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

Answer: (B) $\frac{4mg}{3A}$ · Key from source paper

Q213 JEE Main 2013 · 23 Apr · Online MCQ

A body of mass ' m ' is tied to one end of a spring and whirled round in a horizontal plane with a constant angular velocity. The elongation in the spring is 1 cm. If the angular velocity is doubled, the elongation in the spring is 5 cm. The original length of the spring is :

(A) 15 cm
(B) 12 cm
(C) 16 cm
(D) 10 cm

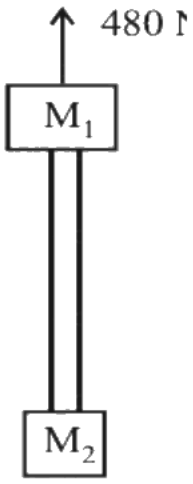
Answer: (A) 15 cm · Key from source paper

Q214 JEE Main 2013 · 22 Apr · Online MCQ

Two blocks of mass $M_1 = 20$ kg and $M_2 = 12$ kg are connected by a metal rod of mass 8 kg. The system is pulled vertically up by applying a force of 480 N as shown. The tension at the mid-point of the rod is:

(see the figure above)

Q3. Two blocks of mass $M_1 = 20$ kg and $M_2 = 12$ kg are connected by a metal rod of mass 8 kg. The system is pulled vertically up by applying a force of 480 N as shown. The tension at the mid-point of the rod is:



(1) 144 N
(2) 96 N
(3) 240 N
(4) 192 N

(A) 144 N
(B) 96 N
(C) 240 N
(D) 192 N

Answer: (D) 192 N · Key from source paper

Q215 JEE Main 2013 · 22 Apr · Online MCQ

A body starts from rest on a long inclined plane of slope 45°. The coefficient of friction between the body and the plane varies as $\mu = 0.3x$, where x is distance travelled down the plane. The body will have maximum speed (for $g = 10\ \mathrm{m/s^2}$) when $x =$

(A) $9.8\ \mathrm{m}$
(B) $27\ \mathrm{m}$
(C) $12\ \mathrm{m}$
(D) $3.33\ \mathrm{m}$

Answer: (D) $3.33\ \mathrm{m}$ · Key from source paper

Q216 JEE Main 2013 · 9 Apr · Online MCQ

A uniform sphere of weight W and radius 5 cm is being held by a string as shown in the figure. The tension in the string will be :

(A) $12\dfrac{W}{5}$
(B) $5\dfrac{W}{12}$
(C) $13\dfrac{W}{5}$
(D) $13\dfrac{W}{12}$

Answer: (D) $13\dfrac{W}{12}$ · Key from source paper

Q217 AIEEE 2012 · 26 May · Online MCQ

A satellite moving with velocity v in a force free space collects stationary interplanetary dust at a rate of $\frac{dM}{dt} = \alpha v$ where M is the mass (of satellite + dust) at that instant. The instantaneous acceleration of the satellite is

(A) $-\frac{\alpha v^2}{2M}$
(B) $-\frac{\alpha v^2}{M}$
(C) $-\alpha v^2$
(D) $-\frac{2\alpha v^2}{M}$

Answer: (B) $-\frac{\alpha v^2}{M}$ · Key from source paper

Q218 AIEEE 2012 · 26 May · Online MCQ

This question has Statement 1 and Statement 2 . Of the four choices given after the Statements, choose the one that best describes the two Statements. Statement 1: If you push on a cart being pulled by a horse so that it does not move, the cart pushes you back with an equal and opposite force. Statement 2: The cart does not move because the force described in statement 1 cancel each other.

(A) Statement 1 is true, Statement 2 is true, Statement 2 is the correct explanation of Statement 1.
(B) Statement 1 is false, Statement 2 is true.
(C) Statement 1 is true, Statement 2 is false.
(D) Statement 1 is true, Statement 2 is true, Statement 2 is not the correct explanation of Statement 1.

Answer: (C) Statement 1 is true, Statement 2 is false. · Checked by our team

Q219 AIEEE 2012 · 19 May · Online MCQ

Sand is being dropped on a conveyer belt at the rate of $2\ \mathrm{kg}$ per second. The force necessary to keep the belt moving with a constant speed of $3\ \mathrm{ms}^{-1}$ will be

(A) $12\ \mathrm{N}$
(B) $6\ \mathrm{N}$
(C) zero
(D) $18\ \mathrm{N}$

Answer: (B) $6\ \mathrm{N}$ · Key from source paper

Q220 AIEEE 2012 · 19 May · Online MCQ

A block of weight W rests on a horizontal floor with coefficient of static friction μ. It is desired to make the block move by applying minimum amount of force. The angle θ from the horizontal at which the force should be applied and magnitude of the force F are respectively.

(A) $\theta = \tan^{-1}(\mu), F = \frac{\mu W}{\sqrt{1+\mu^2}}$
(B) $\theta = \tan^{-1}\left(\frac{1}{\mu}\right), F = \frac{\mu W}{\sqrt{1+\mu^2}}$
(C) $\theta = 0, F = \mu W$
(D) $\theta = \tan^{-1}\left(\frac{\mu}{1+\mu}\right), F = \frac{\mu W}{1+\mu}$

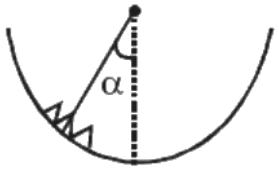
Answer: (A) $\theta = \tan^{-1}(\mu), F = \frac{\mu W}{\sqrt{1+\mu^2}}$ · Key from source paper

Q221 AIEEE 2012 · 12 May · Online MCQ

An insect crawls up a hemispherical surface very slowly. The coefficient of friction between the insect and the surface is $1/3$. If the line joining the centre of the hemispherical surface to the insect makes an angle α with the vertical, the maximum possible value of α so that the insect does not slip is given by

(see the figure above)

Q3. An insect crawls up a hemispherical surface very slowly. The coefficient of friction between the insect and the surface is $1/3$. If the line joining the centre of the hemispherical surface to the insect makes an angle α with the vertical, the maximum possible value of α so that the insect does not slip is given by



(1) $\cot\alpha = 3$
(2) $\sec\alpha = 3$
(3) $\operatorname{cosec}\alpha = 3$
(4) $\cos\alpha = 3$

(A) $\cot\alpha = 3$
(B) $\sec\alpha = 3$
(C) $\operatorname{cosec}\alpha = 3$
(D) $\cos\alpha = 3$

Answer: (A) $\cot\alpha = 3$ · Key from source paper

Q222 AIEEE 2012 · 12 May · Online MCQ

A projectile moving vertically upwards with a velocity of $200\ \mathrm{ms}^{-1}$ breaks into two equal parts at a height of 490 m. One part starts moving vertically upwards with a velocity of $400\ \mathrm{ms}^{-1}$. How much time it will take, after the break up with the other part to hit the ground?

(A) $2\sqrt{10}$ s
(B) 5 s
(C) 10 s
(D) $\sqrt{10}$ s

Answer: (C) 10 s · Key from source paper

Q223 AIEEE 2012 · 7 May · Online MCQ

An engine pumps water continuously through a hose. Water leaves the hose with velocity v and m is mass per unit length of the water jet. If this jet hits a surface and came to rest instantaneously, the force on the surface is

(A) mv^3
(B) mv^2
(C) $\frac{1}{2}mv^2$
(D) $\frac{1}{2}mv^3$

Answer: (B) mv^2 · Key from source paper

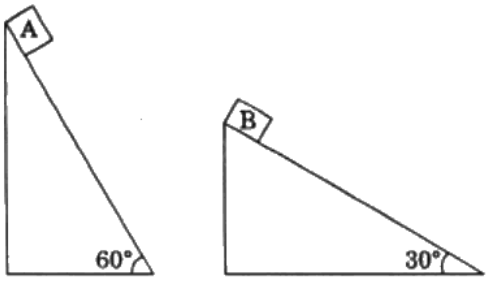
Q224 AIEEE 2010 MCQ

Two fixed frictionless inclined plane making an angle 30° and 60° with the vertical are shown in the figure. Two block A and B are placed on the two planes. What is the relative vertical acceleration of A

with respect to B ?

(see the figure above)

Q4. Two fixed frictionless inclined plane making an angle 30° and 60° with the vertical are shown in the figure. Two block A and B are placed on the two planes. What is the relative vertical acceleration of A with respect to B ?



(1) $4.9\ \text{ms}^{-2}$ in horizontal direction

(2) $9.8\ \text{ms}^{-2}$ in vertical direction

(3) zero

(4) $4.9\ \text{ms}^{-2}$ in vertical direction

(A) $4.9\ \text{ms}^{-2}$ in horizontal direction

(B) $9.8\ \text{ms}^{-2}$ in vertical direction

(C) zero

(D) $4.9\ \text{ms}^{-2}$ in vertical direction

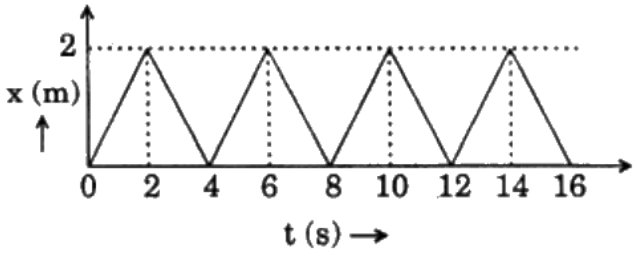
Answer: (D) $4.9\ \text{ms}^{-2}$ **in vertical direction** · Key from source paper

Q225 AIEEE 2010 MCQ

The figure shows the position - time $(x - t)$ graph of one-dimensional motion of a body of mass 0.4 kg. The magnitude of each impulse is

(see the figure above)

Q7. The figure shows the position - time $(x - t)$ graph of one-dimensional motion of a body of mass 0.4 kg. The magnitude of each impulse is



(1) 0.4Ns

(2) 0.8Ns

(3) 1.6Ns

(4) 0.2Ns

(A) 0.4Ns

(B) 0.8Ns

(C) 1.6Ns

(D) 0.2Ns

Answer: (B) 0.8Ns · Key from source paper

Q226 AIEEE 2007 MCQ

A block of mass 'm' is connected to another block of mass 'M' by a spring (massless) of spring constant 'k'. The blocks are kept on a smooth horizontal plane. Initially the blocks are at rest and the spring is unstretched. Then a constant force 'F' starts acting on the block of mass 'M' to pull it. Find the force on the block of mass 'm'

(A) $\frac{mF}{M}$
(B) $\frac{(M+m)F}{m}$
(C) $\frac{mF}{(m+M)}$
(D) $\frac{MF}{(m+M)}$

Answer: (C) $\frac{mF}{(m+M)}$ · Key from source paper

Q227 AIEEE 2007 MCQ

A body weighing 13 kg is suspended by two strings 5 m and 12 m long, their other ends being fastened to the extremities of a rod 13 m long. If the rod be so held that the body hangs immediately below the middle point. The tensions in the strings are

(A) 12 kg and 13 kg
(B) 5 kg and 5 kg
(C) 5 kg and 12 kg
(D) 5 kg and 13 kg

Answer: (C) 5 kg and 12 kg · Key from source paper

Q228 AIEEE 2006 MCQ

A player caught a cricket ball of mass 150 g moving at a rate of 20 m/s. If the catching process is completed in 0.1 s, the force of the blow exerted by the ball on the hand of the player is equal to

(A) 300 N
(B) 150 N
(C) 3 N
(D) 30 N

Answer: (D) 30 N · Key from source paper

Q229 AIEEE 2006 MCQ

A bomb of mass 16 kg at rest explodes into two pieces of masses of 4 kg and 12 kg. The velocity of the 12 kg mass is $4\ \mathrm{ms}^{-1}$. The kinetic energy of the other mass is

(A) 96 J
(B) 144 J
(C) 288 J
(D) 192 J

Answer: (C) 288 J · Key from source paper

Q230 AIEEE 2005 MCQ

A smooth block is released at rest on a 45° incline and then slides a distance d. The time taken to slide is n times as much to slide on rough incline than on a smooth incline. The coefficient of friction is

(A) $\mu_k = 1 - \frac{1}{n^2}$
(B) $\mu_k = \sqrt{1 - \frac{1}{n^2}}$
(C) $\mu_s = 1 - \frac{1}{n^2}$
(D) $\mu_s = \sqrt{1 - \frac{1}{n^2}}$

Answer: (A) $\mu_k = 1 - \frac{1}{n^2}$ · Key from source paper

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Q231 AIEEE 2005 MCQ

The upper half of an inclined plane with inclination ϕ is perfectly smooth while the lower half is rough. A body starting from rest at the top will again come to rest at the bottom if the coefficient of friction for the lower half is given by

(A) $2\sin\phi$
(B) $2\cos\phi$
(C) $2\tan\phi$
(D) $\tan\phi$

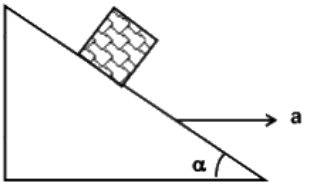
Answer: (C) $2\tan\phi$ · Key from source paper

Q232 AIEEE 2005 MCQ

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

(see the figure above)

Q12. 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



(1) $g/\tan\alpha$ (2) $g\,\text{cosec}\,\alpha$
(3) g (4) $g\tan\alpha$

(A) $g/\tan\alpha$
(B) $g\,\text{cosec}\,\alpha$
(C) g
(D) $g\tan\alpha$

Answer: (D) $g\tan\alpha$ · Key from source paper

Q233 AIEEE 2005 MCQ

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

(A) $3\ \text{m/s}^2$
(B) $15\ \text{m/s}^2$
(C) $5\ \text{m/s}^2$
(D) $10\ \text{m/s}^2$

Answer: (D) $10\ \text{m/s}^2$ · Key from source paper

Q234 AIEEE 2005 MCQ

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

(A) 800 m
(B) 1000 m
(C) 100 m
(D) 400 m

Answer: (B) 1000 m · Key from source paper

Q235 AIEEE 2004 MCQ

A machine gun fires a bullet of mass 40 g with a velocity 1200 ms^{-1}. The man holding it can exert a maximum force of 144 N on the gun. How many bullets can he fire per second at the most?

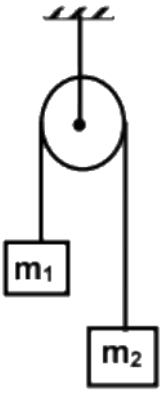
(A) one
(B) four
(C) two
(D) three

Answer: (D) three · Key from source paper

Q236 AIEEE 2004 MCQ

Two masses m_1 = 5 kg and m_2 = 4.8 kg tied to a string are hanging over a light frictionless pulley. What is the acceleration of the masses when lift free to move (g = 9.8 $\mathrm{m/s^2}$)
(see the figure above)

Q9. Two masses $m_1 = 5$ kg and $m_2 = 4.8$ kg tied to a string are hanging over a light frictionless pulley. What is the



acceleration of the masses when lift free to move $(g = 9.8\ \mathrm{m/s^2})$
(1) $0.2\ \mathrm{m/s^2}$ (2) $9.8\ \mathrm{m/s^2}$
(3) $5\ \mathrm{m/s^2}$ (4) $4.8\ \mathrm{m/s^2}$

(A) 0.2 $\mathrm{m/s^2}$
(B) 9.8 $\mathrm{m/s^2}$
(C) 5 $\mathrm{m/s^2}$
(D) 4.8 $\mathrm{m/s^2}$

Answer: (A) 0.2 $\mathrm{m/s^2}$ · Key from source paper

Q237 AIEEE 2004 MCQ

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 $\mathrm{m/s^2}$)

(A) 2.0
(B) 4.0
(C) 1.6
(D) 2.5

Answer: (A) 2.0 · Key from source paper

Q238 AIEEE 2003 MCQ

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

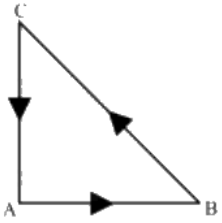
(A) 24 N
(B) 74 N
(C) 15 N
(D) 49 N

Answer: (A) 24 N · Key from source paper

Q239 AIEEE 2003 MCQ

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
(see the figure above)

Q11. 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



(1) less than $\vec{v}$
(2) greater than $\vec{v}$
(3) $|v|$ in the direction of the largest force BC
(4) $\vec{v}$, remaining unchanged

(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

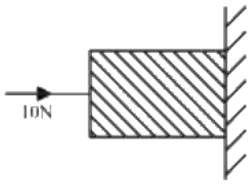
Answer: (D) $\vec{v}$, remaining unchanged · Key from source paper

Q240 AIEEE 2003 MCQ

A horizontal force of 10 N is necessary to just hold a block stationary against a wall. The co-efficient of friction between the block and the wall is 0.2. The weight of the block is

(see the figure above)

Q12. A horizontal force of 10 N is necessary to just hold a block stationary against a wall. The co-efficient of friction between the block and the wall is 0.2. The weight of the block is



(1) 20 N
(2) 50 N
(3) 100 N
(4) 2 N

(A) 20 N
(B) 50 N
(C) 100 N
(D) 2 N

Answer: (D) 2 N · Key from source paper

Q241 AIEEE 2003 MCQ

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

(A) 0.02
(B) 0.03
(C) 0.04
(D) None of these

Answer: (D) None of these · Key from source paper

Q242 AIEEE 2003 MCQ

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

(A) $\frac{Pm}{M+m}$
(B) $\frac{Pm}{M-m}$
(C) P
(D) $\frac{PM}{M+m}$

Answer: (D) $\frac{PM}{M+m}$ · Key from source paper

Q243 AIEEE 2003 MCQ

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

(A) Both the scales read Mkg each
(B) The scale of the lower one reads Mkg and of the upper one zero
(C) The reading of the two scales can be anything but the sum of the reading will be Mkg
(D) Both the scales read M/2 kg each

Answer: (A) Both the scales read Mkg each · Key from source paper

Q244 AIEEE 2003 MCQ

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

(A) 3.5×10^5 N
(B) 7.0×10^5 N
(C) 14.0×10^5 N
(D) 1.75×10^5 N

Answer: (B) 7.0×10^5 N · Checked by our team

Q245 AIEEE 2003 MCQ

Consider the following two statements: (A) Linear momentum of a system of particles is zero (B) Kinetic energy of a system of particles is zero Then

(A) A does not imply B and B does not imply A
(B) A implies B but B does not imply A
(C) A does not imply B but B implies A
(D) A implies B and B implies A

Answer: (C) A does not imply B but B implies A · Key from source paper

Q246 AIEEE 2002 MCQ

The minimum velocity (in ms^{-1}) with which a car driver must traverse a flat curve of radius 150 m and coefficient of friction 0.6 to avoid skidding is

(A) 60
(B) 30
(C) 15
(D) 25

Answer: (B) 30 · Key from source paper

EdLoop JEE

Q247 AIEEE 2002 MCQ

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

(A) g, g
(B) g - a, g - a
(C) g - a, g
(D) a, g

Answer: (C) g - a, g · Key from source paper

Q248 AIEEE 2002 MCQ

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

(A) $\mathrm{F_1/m}$
(B) $\mathrm{F_2\,F_3/mF_1}$
(C) $(F_2 - F_3)/m$
(D) $\mathrm{F_2/m}$

Answer: (A) $\mathrm{F_1/m}$ · Key from source paper

Q249 AIEEE 2002 MCQ

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

(A) 8 : 1
(B) 9 : 7
(C) 4 : 3
(D) 5 : 3

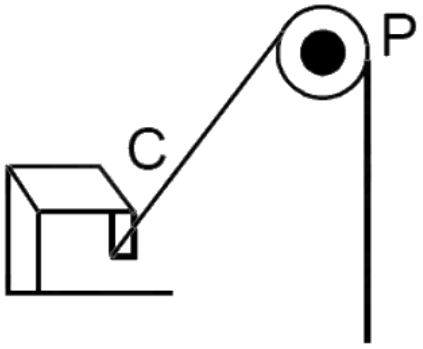
Answer: (B) 9 : 7 · Key from source paper

Q250 AIEEE 2002 MCQ

One end of a massless rope, which passes over a massless and frictionless 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 $\mathrm{ms^{-2}}$) can a man of 60 kg climb down the rope?
(see the figure above)

EdLoop JEE

Q11. One end of a massless rope, which passes over a massless and frictionless 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?

(1) 16 (2) 6

(3) 4 (4) 8

(A) 16

(B) 6

(C) 4

(D) 8

Answer: (C) 4 · Key from source paper

Q251 AIEEE 2002 MCQ

A bead of weight w can slide on smooth circular wire in a vertical plane. The bead is attached by a light thread to the highest point of the wire and in equilibrium, the thread is taut and make an angle θ with the vertical then tension of the thread and reaction of the wire on the bead are

(A) $T = w\cos\theta\ R = w\tan\theta$

(B) $\mathrm{T} = 2\mathrm{w}\cos\theta\ \mathrm{R} = \mathrm{w}$

(C) $\mathrm{T} = \mathrm{w}\ \mathrm{R} = \mathrm{w}\sin\theta$

(D) $T = w\sin\theta\ R = w\cot\theta$

Answer: (B) $\mathrm{T} = 2\mathrm{w}\cos\theta\ \mathrm{R} = \mathrm{w}$ · Checked by our team

Q252 AIEEE 2002 MCQ

A solid sphere, a hallow sphere and a ring are released from top of an inclined plane (frictionless) so that they slide down the plane. Then maximum acceleration down the plane is for (no rolling)

(A) solid sphere

(B) hollow sphere

(C) ring

(D) all same

Answer: (D) all same · Key from source paper

Q253 AIEEE 2002 MCQ

If suddenly the gravitational force of attraction between Earth and a satellite revolving around it becomes zero, then the satellite will

(A) continue to move in its orbit with same velocity
(B) move tangentially to the originally orbit in the same velocity
(C) become stationary in its orbit
(D) move towards the earth.

Answer: (B) move tangentially to the originally orbit in the same velocity · Checked by our team

EdLoop JEE