PHYSICS

BOOKS - MBD

LAWS OF MOTION

Example

1. How is inertia related to mass of a body?

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2. If you jerk a piece of paper under a book quick enough, the book will not move. Why?

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3. If net force acting on a body is zero, then will the body remain necessarily in rest position?

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4. Calculate the mass of a body weighting 100 N. Take g = $10ms^{-2}$.

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5. If a body is not at rest, the net external force acting on it cannot be zero. is it true or false?

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6. Define one newton.

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7. What is the net force on a cork floating on water?

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8. Prove that if no external force is acting on a body. Its momentum will remain unchanged.

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9. If two ends of a spring balance are pulled each by a force of 10 kg. wt. What will be the reading of the balance?

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10. Action and reaction forces do not balance each other. Why?

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11. A meteorite burns in the atmosphere before it reaches the earth's surface. what happens to its momentum?

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12. What is impulsive force?

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13. When a ball is thrown upwards, its momentum first decreases and then increases. Is conservation of linear momentum violated in this process?

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14. Explain why:- a horse cannot pull a cart and run in empty space.

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15. Why does a gun recoil when a bullet is fired from the gun ? Explain.

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16. On what factors inertia of a body depends?

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17. Why does an athlete run before taking a high jump ?

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18. We slip easily on a rainy day because coefficient of friction

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19. Why a person sitting inside a vehicle is thrown outwards, when vechile rounds a curve suddenly?

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20. How do you account for function of mudguards in vehicles?

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21. What is friction?

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22. What is the unit of coefficient of limiting friction?

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23. Define angle of friction.

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24. Why are tyres made circular?

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25. Can we get off a frictionless horizontal surface by jumping?

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26. Explain how friction helps in walking.

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27. It is difficult to move a cycle along a road with its brakes on. Why?

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28. Is a large brake on a bicycle wheel more effective than small one ? Explain.

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29. Name the two types of dynamic (kinetic) friction.

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30. What is the cause of friction? In which case is it maximum?

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31. How does coefficient of friction is altered when the weight of body is doubled?

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32. Friction is a self- adjusting force. Is it correct?

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33. How friction is reduced in fast moving vehicle?

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34. Automobile tyres have generally irregular projections over their surfaces. Why?

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35. Why are rockets given conical shape?

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36. What is the angular velocity of the hour hand of a clock?

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37. Why skidding takes place on a rainy day along a curved path?

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38. Give an example when a body moving with unifrom speed has acceleration?

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39. Name the physical quantities which remains constant for a particle moving along a circular path in a horizontal plane in uniform motion.

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40. What provides the centripetal force to a caar taking turn on a level road?

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41. Define centrifugal force.

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42. What provides the centripetal force to a satellite revolving around the earth?

Watch Video Solution

43. What is the relation between coefficient of friction and angle of repose?

Watch Video Solution

44. What is the unit of coefficient of limiting friction?

Watch Video Solution

45. Out of satic friction, limiting friction and dynamic friction, which is largest?

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46. Give the magnitude and direction of the net force acting on:- a drop of rain falling down with a constant speed.

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47. Give the magnitude and direction of the net force acting on:- a cork of mass 10 g floating on water.

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48. Give the magnitude and direction of the net force acting on:- a kite skillfully held stationary in the sky.

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49. Give the magnitude and direction of the net force acting on:- a car moving with a constant velocity of $30 km / h$ on a rough road.

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50. Give the magnitude and direction of the net force acting on:- a high-speed electron in space far from all material objects, and free of electric and magnetic fields.

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51. A pebble of mass 0.05 kg is thrown vertically upwards. Give the direction and magnitude of the net force on the pebble:- during its upward motion.

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52. A pebble of mass 0.07 kg is thrown vertically upwards. Give the direction and magnitude of the net force on the pebble:- at the highest point where it is momentarily at rest. Do your answers change if the pebble was thrown at an angle of 45° with the horizontal direction? Ignore air resistance.

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53. Give the magnitude and direction of the net force acting on a stone of mass 0.1kg:- just after it is dropped from the window of a stationary train, Neglect air resistance throughout.

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54. Give the magnitude and direction of the net force acting on a stone of mass 0.1kg:- just after it is dropped from the window of a train

running at a constant velocity of $36km/h$, Neglect air resistance throughout.

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55. Give the magnitude and direction of the net force acting on a stone of mass 0.1kg:- just after it is dropped from the window of a train accelerating with $1ms^{-2}$, Neglect air resistance throughout.

Watch Video Solution

56. Give the magnitude and direction of the net force acting on a stone of mass 0.1kg:- lying on the floor of a train which is accelerating with $1ms^{-2}$, the stone being at rest relative to the train.Neglect air resistance throughout.

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57. One end of a string of length t is connected to a particle of mass m and the other to a small peg on a smooth horizontal

table. If the particle moves in a circle with speed v the net force on the particle (directed towards the centre) is : T is the tension in the string. [Choose the correct alternative].

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58. A constant retarding force of 50 N is applied to a body of mass 20 kg moving initially with a speed of $15ms^{-1}$. How long does the body take to stop ?

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59. A constant force acting on a body of mass 3.0 kg changes its speed from $2.0ms^{-1}$to $3.5ms^{-1}$ in 25 s. The direction of the motion of the body remains unchanged. What is the magnitude and direction of the force ?

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60. A body of mass 5 kg is acted upon by two perpendicular forces 8 N and 6 N. Give the

magnitude and direction of the acceleration of the body.

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61. The driver of a three-wheeler moving with a speed of $36 km / h$ sees a child standing in the middle of the road and brings his vehicle to rest in 4.0 s just in time to save the child. What is the average retarding force on the vehicle ? The mass of the three-wheeler is 400 kg and the mass of the driver is 65 kg.

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62. A rocket with a lift-off mass 20,000 kg is blasted upwards with an initial acceleration of $5.0ms^{-2}$. Calculate the initial thrust (force) of the blast.

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63. A body of mass 0.40 kg moving initially with a constant speed of $10ms^{-1}$ to the north is subject to a constant force of 8.0 N directed

towards the south for 30 s. Take the instant the force is applied to be t = 0, the position of the body at that time to be x = 0, and predict its position at t = -5 s, 25 s, 100 s.

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64. A truck starts from rest and accelerates uniformly at $2.0ms^{-2}$. At t = 10 s, a stone is dropped by a person standing on the top of the truck (6 m high from the ground). What are the:- velocity. (Neglect air resistance.)

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65. A truck starts from rest and accelerates uniformly at $2.0ms^{-2}$. At t = 10 s, a stone is dropped by a person standing on the top of the truck (6 m high from the ground). What are the:- acceleration of the stone at t = 11s? (Neglect air resistance.)

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66. A bob of mass 0.1 kg hung from the ceiling of a room by a string 2 m long is set into oscillation. The speed of the bob at its mean position is $1ms^{-1}$. What is the trajectory of the bob if the string is cut when the bob is:- at one of its extreme positions,

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oscillation. The speed of the bob at its mean position is $1ms^{-2}$. What is the trajectory of the bob if the string is cut when the bob is:- at its mean position.

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68. A man of mass 70 kg stands on a weighing scale in a lift which is moving :- upwards with a uniform speed of $10ms^{-1}$, what would be the reading on scale?

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69. A man of mass 70 kg stands on a weighing scale in a lift which is moving :- downwards with a uniform acceleration of $5ms^{-2}$,

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70. A man weighs 70 kg. He stands on a weighing scale in a lift which is moving?

upwards with a uniform acceleration of $5ms^{-2}$.

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71. A man of mass 70 kg stands on a weighing scale in a lift which is moving :- What would be the reading if the lift mechanism failed and it hurtled down freely under gravity ?

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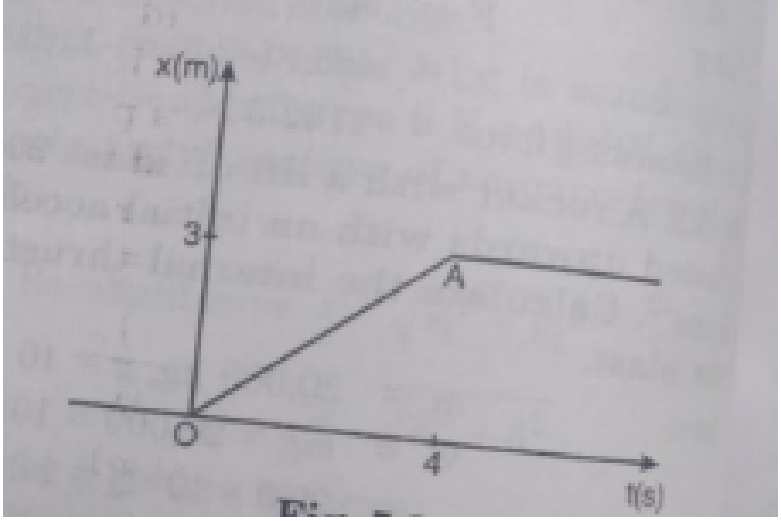
72. The fig shows the position the position-time graph of a particle of mass 4 kg. What is the



Force on the particle for $t < 0$, $t > 4s$, impulse $0 < t < 4$ s ?

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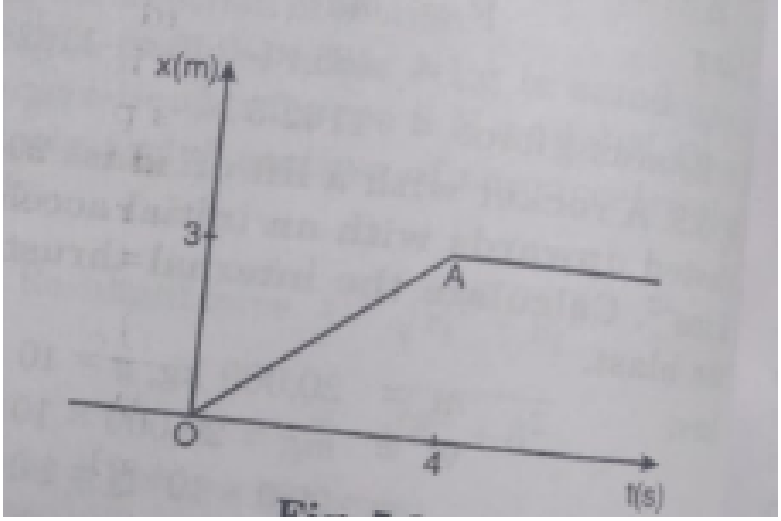

Impulse at t = 0 and t = 4 s : (consider one-dimensional motion only).

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74. Two bodies of masses 10 kg and 20 kg respectively kept on a smooth, horizontal surface are tied to the ends of a light string, a

horizontal force F = 600 N is applied to:-B along the direction of string. What is the tension in the string in each case?

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75. Two bodies of masses 10 kg and 20 kg respectively kept on a smooth, horizontal surface are tied to the ends of a light string, a horizontal force F = 600 N is applied to:-B along the direction of string. What is the tension in the string in each case?

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76. Two masses 8 kg and 12 kg are connected at the two ends of a light inextensible string that goes over a frictionless pulley. Find the acceleration of the masses, and the tension in the string when the masses are released.

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77. A nucleus is at rest in the laboratory frame of reference. Show that if it disintegrates into

two smaller nuclei the products must move in opposite directions.

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78. Two billiard balls each of mass 0.05 kg moving in opposite directions with speed $6ms^{-1}$ collide and rebound with the same speed. What is the impulse imparted to each ball due to the other ?

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79. A shell of mass 0.020 kg is fired by a gun of mass 100 kg. If the muzzle speed of the shell is $80ms^{-1}$, what is the recoil speed of the gun ?

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80. A batsman deflects a ball by an angle of 45° without changing its initial speed which is equal to $54km/h$. What is the impulse imparted to the ball ? (Mass of the ball is 0.15 kg.)

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81. A stone of mass 0.25 kg tied to the end of a string is whirled round in a circle of radius 1.5 m with a speed of $40 rev./\min$ in a horizontal plane. What is the tension in the string ? What is the maximum speed with which the stone can be whirled around if the string can withstand a maximum tension of 200 N ?

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82. If, in Exercise 5.21, the speed of the stone is increased beyond the maximum permissible value, and the string breaks suddenly, which of the following correctly describes the trajectory of the stone after the string breaks :- the stone moves radially outwards.

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83. If, in Exercise 5.21, the speed of the stone is increased beyond the maximum permissible value, and the string breaks suddenly, which of

the following correctly describes the trajectory of the stone after the string breaks :- the stone flies off tangentially from the instant the string breaks.

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84. If, in Exercise 5.21, the speed of the stone is increased beyond the maximum permissible value, and the string breaks suddenly, which of the following correctly describes the trajectory of the stone after the string breaks :- the

stone flies off at an angle with the tangent whose magnitude depends on the speed of the particle ?

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85. Explain why:- a horse cannot pull a cart and run in empty space.

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86. Explain why:- passengers are thrown forward from their seats when a speeding bus stops suddenly.

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87. Explain why:- it is easier to pull a lawn mower than to push it.

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88. Explain why:- a cricketer moves his hands backwards while holding a catch.

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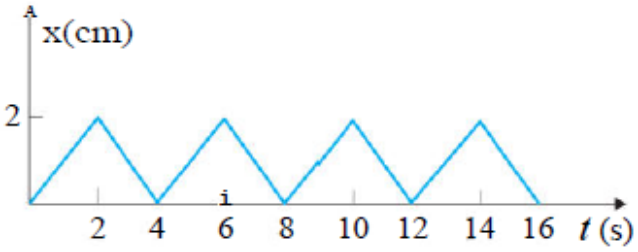
89. Figure 5.17 shows the position-time graph of a body of mass 0.04 kg. Suggest a suitable physical context for this motion. What is the time between two consecutive impulses received by the body ? What is the magnitude

of each impulse ?



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90. A helicopter of mass 1000 kg rises with a vertical acceleration of $15ms^{-2}$. The crew and the passengers weigh 300 kg. Give the magnitude and direction of the:- force on the floor by the crew and passengers,

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91. A helicopter of mass 1000 kg rises with a vertical acceleration of $15ms^{-2}$. The crew and the passengers weigh 300 kg. Give the magnitude and direction of the:- action of the rotor of the helicopter on the surrounding air,

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the passengers weigh 300 kg. Give the magnitude and direction of the:- action of the rotor of the helicopter on the surrounding air,

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93. A stream of water flowing horizontally with a speed of $15ms^{-1}$ gushes out of a tube of cross-sectional area $10^{-2}m^2$, and hits a vertical wall nearby. What is the force exerted on the wall by the impact of water, assuming it does not rebound ?

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94. Ten one-rupee coins are put on top of each other on a table. Each coin has a mass m Give the magnitude and direction of:- the force on the 7th coin (counted from the bottom) due to all the coins on its top,

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95. Ten one-rupee coins are put on top of each other on a table. Each coin has a mass m Give

the magnitude and direction of:- the force on the 7th coin by the eighth coin,

Watch Video Solution

96. Ten one-rupee coins are put on top of each other on a table. Each coin has a mass m Give the magnitude and direction of:- the reaction of the 6th coin on the 7th coin.

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97. An aircraft executes a horizontal loop at a speed of $720 km/h$ with its wings banked at 15°. What is the radius of the loop ?

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98. A train runs along an unbanked circular track of radius 30 m at a speed of $54 km/h$. The mass of the train is $10^6 kg$. What provides the centripetal force required for this purpose — Hie engine or the rails ? What is the angle

of banking required to prevent wearing out of the rail ?

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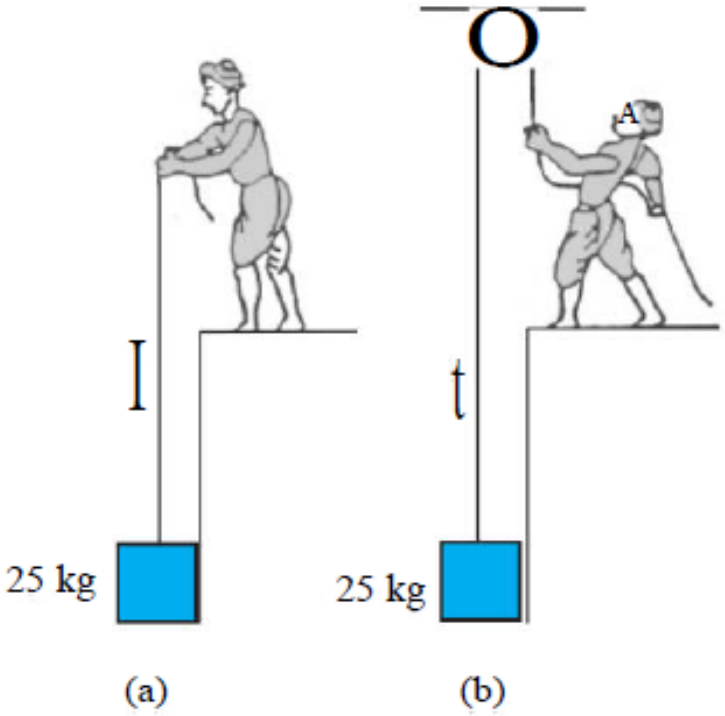
99. A block of mass 25 kg is raised by a 50 kg man in two different ways as shown in Fig. 5.19. What is the action on the floor by the man in the two cases ? If the floor yields to a normal force of 700 N, which mode should the man adopt to lift the block without the floor

yielding ?



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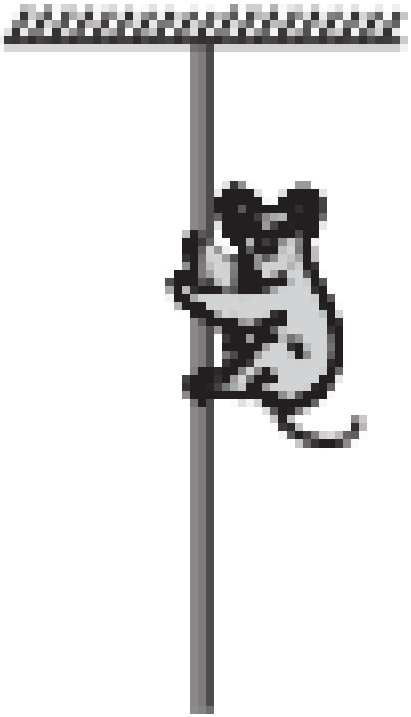
100. A monkey of mass 40kg climbs on a rope (Fig. 5.20) which can stand a maximum tension

of 600 N. in which of the following cases will the rope break: the monkey:-



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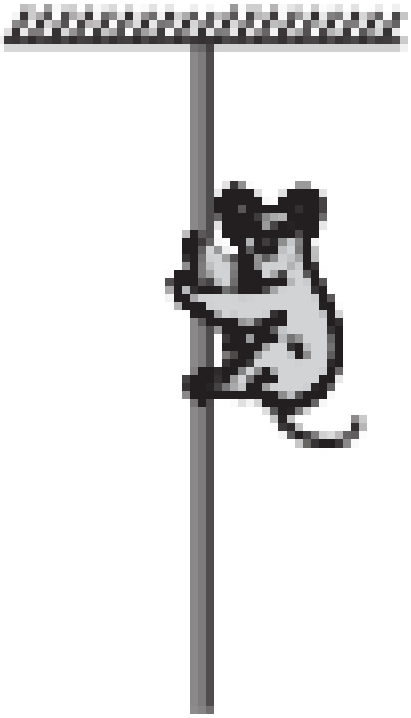
101. A monkey of mass 40kg climbs on a rope (Fig. 5.20) which can stand a maximum tension of 600 N. in which of the following cases will the rope break: the monkey:- climbs down with an acceleration of $4ms^{-2}$،



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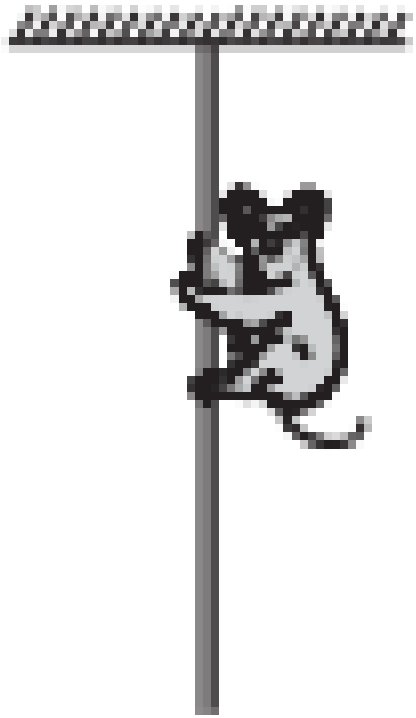

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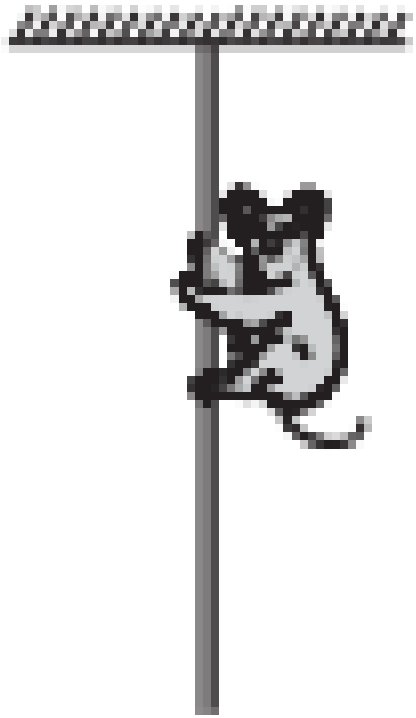

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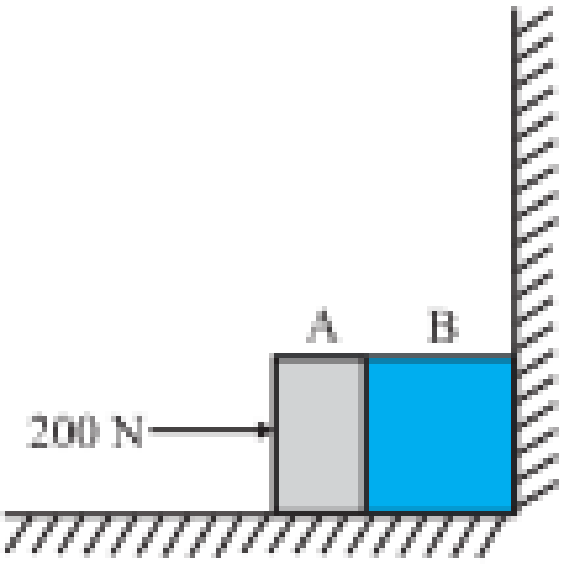
104. Two bodies A and B of masses 5 kg and 10 kg in contact with each other rest on a table against a rigid wall (Fig. 5.21). The coefficient of friction between the bodies and the table is 0.15. A force of 200 N is applied horizontally to A. What are :- the reaction of the partition.



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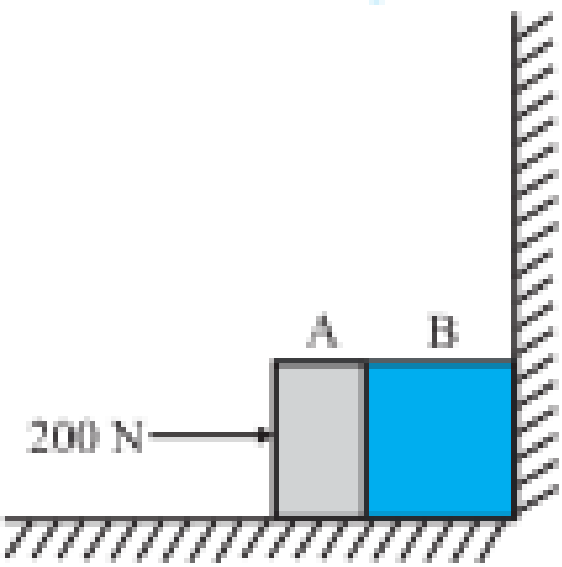

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106. A block of mass 15 kg is placed on a long trolley. The coefficient of friction between the block and the trolley is 0.18. The trolley

accelerate from rest with $0.5ms^{-2}$ for 20 s and then moves with unifrom velocity. Discuss the motion of the block as viewd by an observer with the trolley.

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107. A block of mass 15 kg is placed on a long trolley. The coefficient of friction between the block and the trolley is 0.18. The trolley accelerate from rest with $0.5ms^{-2}$ for 20 s and then moves with unifrom velocity. Discuss

the motion of the block as viewd by an observer with the trolley.

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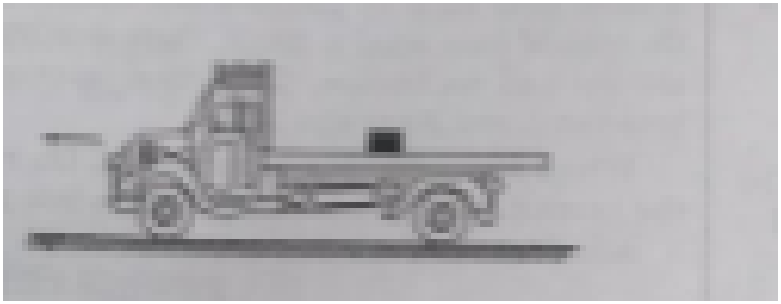
108. The rear side of a truck is open and a box of 40 kg mass is placed 5 m away from the open end as shown. The coefficient of friction between the box and the surface below its is 0.15. On a straight road, the truck starts from rest and accelerates with $2ms^{-2}$. At what distance from the starting point does the box

fall off the truck ?/ (Ignore the size of the box).



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109. A disc revolves with a spped of $33\left(\frac{1}{3}\right) rev/\ \min$, and has a radius of 15 cm. Two coins are placed at 4 cm and 14 cm away from the centre the record. If the co-effcient of friction between the coins and the record is

0.15, which of the coins will revolve with the record?

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110. You may have seen in a circus a motorcyclist driving in vertical loops inside a 'death- well' (a hollow spherical chamber with holes, so the spectators can watch from outside). Explain clearly why the motorcyclist does not drop down when he is at the uppermost point, with no support from below.

What is the minimum speed required at the uppermost position to perform a vertical loop if the radius of the chamber is 25 m?

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111. A 70 kg man stands in contact against the ineer wall of a hollow cylindrical drum of radius 3 m rotating about its vertical axis with $200 rev / \min$. The coeffcient of friction between the wall and his clothing is 0.15. What is the minimum rotational speed of the

cylinder to enable the man of remain stuck to the wall (without falling) when the floor ids suddenly removed?

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112. A thin circular loop of radius R rotates about its vertical diameter with an angular frequency ω. Show that a small bead on the wire loop rem ains at its lowermost point for $\omega \sqrt{\frac{g}{R}}$ What is the angle made by the radius vector joining the centre to the bead with the

vertical downward direction for $\omega = \sqrt{2\frac{g}{R}}$?

neglect friction.

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113. A ball is travelling with unifrom translatory motion. This means that

A. it is at rest

B. the path can be a straight line or circular and the ball travels with uniform speed.

C. all parts of the ball have the same velocity 9magnitude and direction) and the velocity is constant.

D. the centre of the ball moves with constannt velocity and ball spins about its centre uniformly.

Answer:

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114. A meter scale is momving with uniform velocity. this implies.

A. the force acting on the scale is zero, but a torque about the centre of mass can act on the scale.

B. the force acting on the scale is zero and the torque acting about centre of mass of the scale is also zero.

C. the total force acting on it need not be zero but the torque on it is zero.

D. neither the force nor the torque need to be zero.

Answer:

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115. A cricket ball of mass 150 g has an initial velocity $\vec{u} = \left(3\hat{i} + 4\hat{j}\right) ms^{-1}$ and a finaal velocity $\vec{v} = -\left(3\hat{i} + 4\hat{t}\,j\right) ms^{-1}$ after

being hit. The change in momentum (final momentum-initial momentum) is (in $kgms^{-1}$)

A. zero

B. $-\left(0.45\hat{i}+0.6\hat{j}\right)$

C. $-\left(0.9\hat{i}+1.2\hat{j}\right)$

D. $-5\left(\hat{i}+\hat{j}\right).$

Answer:

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116. In the previous problem, if 15.0 cm of water and spirit each are further poured into the respective arms of the tube, what is the difference in the levels of mercury in the two arms ? (Specific gravity of mercury = 13.6)

A. (a) Zero

B. (b) $0.75 kgms^{-1}$

C. $1.5 kgms^{-1}$

D. $14 kgms^{-1}$

Answer:

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117. Conservation of momentum in a collisino between particles can be understood from

A. conservation of energy

B. Newton's first law only

C. Newton's second law only

D. both Newton's second and thrid law

Answer:

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118. A hockey player is moving northward and suddenly turns westward with the same speed to avoid an opponent. The force that acts on the player is

A. frictional force along westward

B. muscle force along southward

C. frictional force along south-west

D. muscle force along south-west.

Answer:

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119. A body of mass 2 kg travels according to the law$x(t) = pt + qt^2 + rt^3$ where $p = 3ms^{-1}$ q = 4 ms^-2 and r = 5 ms^-3`. the force acting on the body at t = 2 seconds is

A. 136 N

B. 134 N

C. 158 N

D. 68 N

Answer:

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120. A body with mass 5 kg is acted upon by a force $F = \left(-3\hat{i} + 4\hat{j} \right)$ N. if its initial velocty at t = 0 is v = $\left(6\hat{i} - 12\hat{j} \right) ms^{-1}$, the time at which it will just have a velocity along the y - axis is

A. never

B. 10 s

C. 2 s

D. 15 s

Answer:

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121. A car of mass m starts from rest and acquires a velocity along east $\overrightarrow{v} = v\hat{i}(v > 0)$ in two seconds. Assuming the car moves with

uniform acceleration, the force exerted on the car is

A. (a) $mv/2$ eastward and is exerted by the car engine.

B. (b) $m\frac{v}{2}$ eastward and is due to the friction on the tyres exerted by the road.

C. (c) more than $m\frac{v}{2}$ eastward exerted due to the engine and overcomes the friction of road.

D. (d) $m\frac{v}{2}$ exerted by the engine.

Answer:

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122. The motion of a particle of mass m is given by x = 0 for t < 0 s, x (t) = A sin 4π t for 0 < t < (1/4) s (A>0), and x = 0 for t > (1/4) s. which of the following statements is true?/

A. The force at t = (1/8) s on the particle is $-16\pi^2$ A m.

B. The particle is acted upon by on impulse of magnitude $4\pi^2$ A m at t = 0 s aand t = (1/4) s.

C. The particle is not acted upon by any force

D. The particle is not acted upon by a constant force.

Answer:

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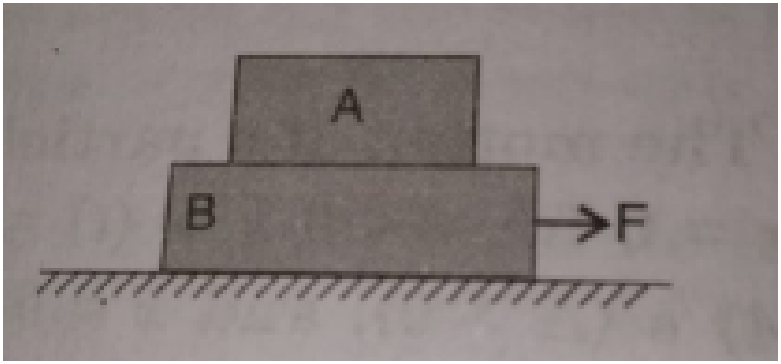
123. Shown in the figure, the co-efficient of friction between the flor and the body B is 0.1. The co-efficient of friction between the bodie B and A is 0.2 A force F is applied as shwon on B. The mas of A is m/2 and of b is m. Which of the following statements are true?



A. The bodies will move together if F = 0.25 mg.

B. the body will slip with respect to B if F = 0.5 mg.

C. the bodies will move together if F = 0.5 mg.

D. the bodies will be at rest if F = 0.1 mg.

Answer:

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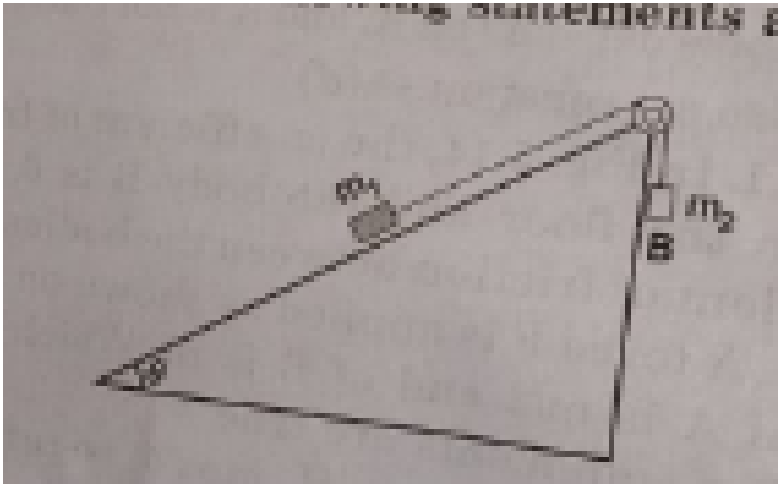
124. Mass $m_1$moves on a slope making an angle θ with the horizontal and is attached to mass m_2 by a string passing over a frictionless pulley as shown in the figre. The co-efficient of frition between m_1 and the slopping surfaace is μ. Which of the following statements are true?



A. if $m_2 > m_1 \sin\theta$, the boyd will move up the plane.

B. If $m\_2 > m_1$ (sin theta + mu cos theta)`, the boyd will move up the plane

C. If $m_2 < m_1(\sin\theta + \mu\cos\theta)$, the body will move up the plane.

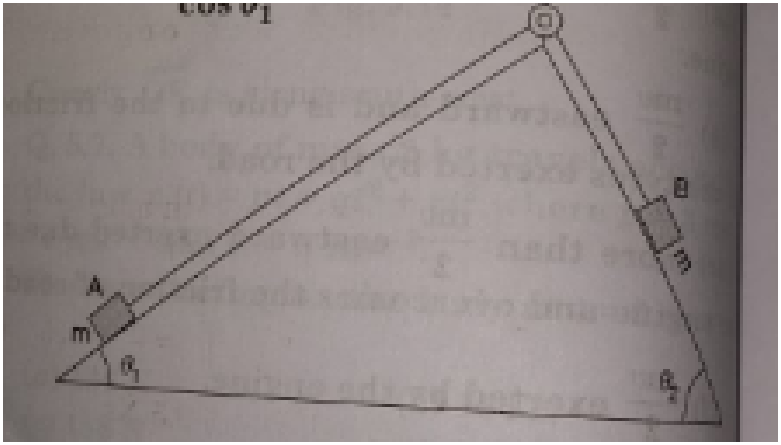
D. If $m_2 < m_1(\sin\theta - \mu\cos\theta)$, the body will move down the plane.

Answer:

Watch Video Solution

125. In the figure, a body A of mass m slides on plane inclined at angle θ_1 to the horizontal and μ_1 is the coefficient of friction between A and the plane. A is connected by a light string passing over a fictionless pulley to another body B, also of mass m, sliding on a frictionless plane inclined at angle θ_2 to the horizontal which of the following statements

are true ?



A. A will never move up the plane.

B. A will just start moving up the plane when $\mu = \dfrac{\sin\theta_2 - \sin\theta_1}{\cos\theta_1}$

C. For A to move up the plane, θ_2 must always be greater than θ_1.

D. B will always slide down with constant speed.

Answer:

 Watch Video Solution

126. Two billiard balls each of mass 0.05 kg moving in opposite directions with speed $6ms^{-1}$ collide and rebound with the same speed. What is the impulse imparted to each ball due to the other ?

A. The impulse imparted to each ball is $0.25kgms^{-1}$ an the force on each ball is 250 N

B. The impulse imparted to each ball is $0.25kgms^{-1}$ and the force exerted on each ball is $25 \times 10^{-5}N$

C. The impulse imparted to each ball is 0.5 Ns.

D. The impulse and the force on each ball are equal in magnitude and opposite in

direction.

Answer:

Watch Video Solution

127. A body of mass 5 kg is acted upon by two perpendicular forces 8 N and 6 N. Give the magnitude and direction of the acceleration of the body.

A. $1ms^{-2}$ at an angle of `tan^-1 (4/3) w.r.t 6 N force.

B. $0.2ms^{-2}$ at an angle of $\tan^{-1}\left(\frac{4}{3}\right) w.r.t6$ force.

C. $1ms^{-2}$ at an angle of tan^-1(3/4) w..t 8 N force.`

D. $0.2ms^{-2}$ at an angle of $\tan^{-1}\left(\frac{3}{4}\right) w.r.t8N$ force.

Answer:

Watch Video Solution

128. A girl riding a bicycle along a straight road with a speed of $5ms^{-1}$ throws a stone of mass 0.5 kg which has a speed of $15ms^{-1}$ with respect to the ground along her direction of motion. The mass of the girl and bicyle is 50 kg. Does the speed of the bicycle change after the stone is thrown? What is the change in speed, if so?

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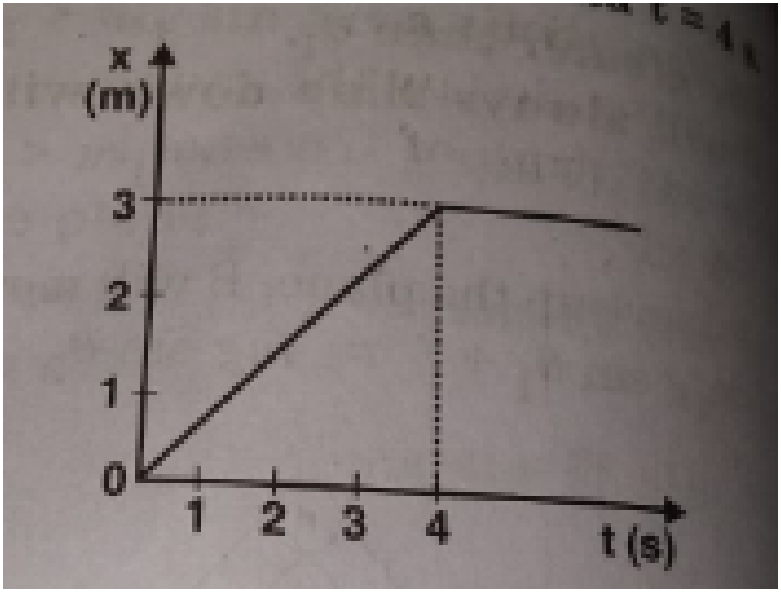
129. A man of mass 70 kg stands on a weighing scale in a lift which is moving :- upwards with a uniform acceleration of $5ms^{-2}$. What would be the readings on the scale in each case?

Watch Video Solution

130. The position time graph of a body of mass 2 kg is as given in the figure. What iws the

impulse on the body at t = 0 s and t = 4 s.



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131. A person driving a car suddenlyapplies the brakes on seeing a child on the road ahead. if

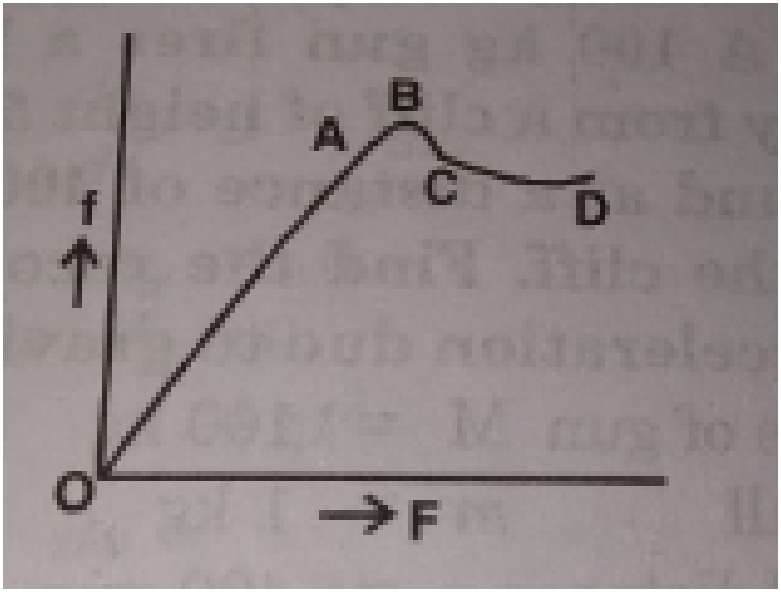
he is not wering seat belt, he falls forward and hits his head against the steering wheel. Why?

Watch Video Solution

132. The velocity of a body of mass 2 kg as a function of t is given by $\overrightarrow{v}(t) = 2t\hat{i} + t^2\hat{j}$. Find the momentum and the force acting on it, at time t = 2s.

Watch Video Solution

133. A block placed on a rough horizontal surface is pulled by a horizontal force F. Let f be the force applied by the rough surface on the block. Plot a graph of f versus F.



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134. Why are porcelain objects wrapped in paper or straw before packing for transportation?

Watch Video Solution

135. Why does a child feel more pain when she falls down on a hard cement floor, then when she falls on the soft muddy ground in the garden?

Watch Video Solution

136. A woman throws an object of mass 500 g with a speed of $25ms^{-1}$.

What is the impulse imparted to the object?

Watch Video Solution

137. A woman throws an object of mass 500 g with a speed of $25ms^{-1}$.

If the object hits a wall and rebounds with half the original speed, what is the change in momentum of the object?

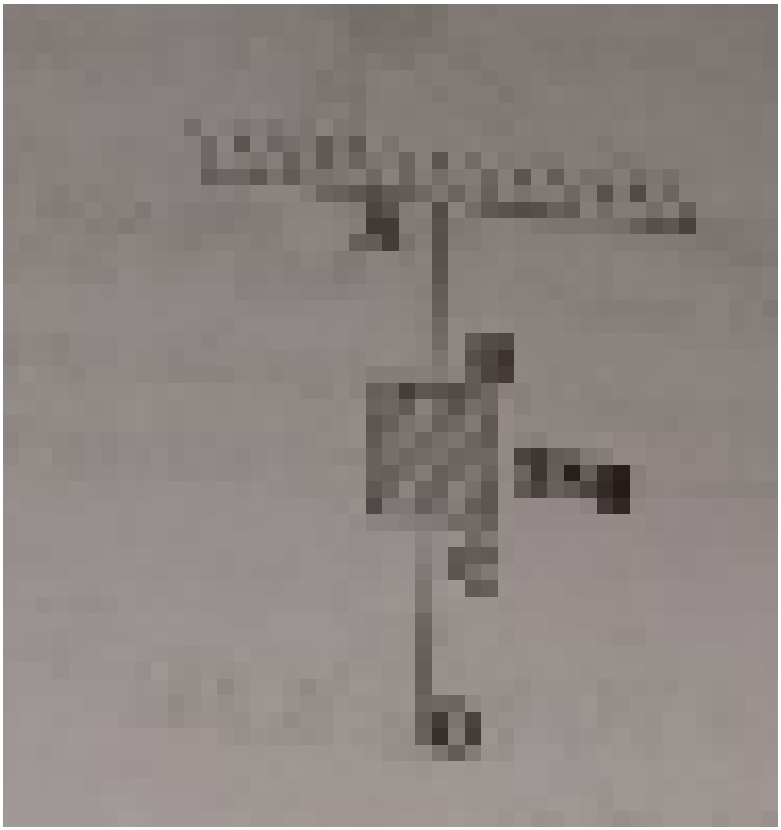
Watch Video Solution

138. Why are mountain roads generally made winding upwards rather than going straight up?

Watch Video Solution

139. A mass of 2 kg is suspended with thread AB. Thread CD of the same type is attached to the other end of 2 kg mass. Lower thread is pulled gradually. harder and harder in the

downward direction so as to apply force on AB. Which of the threds will break and why?



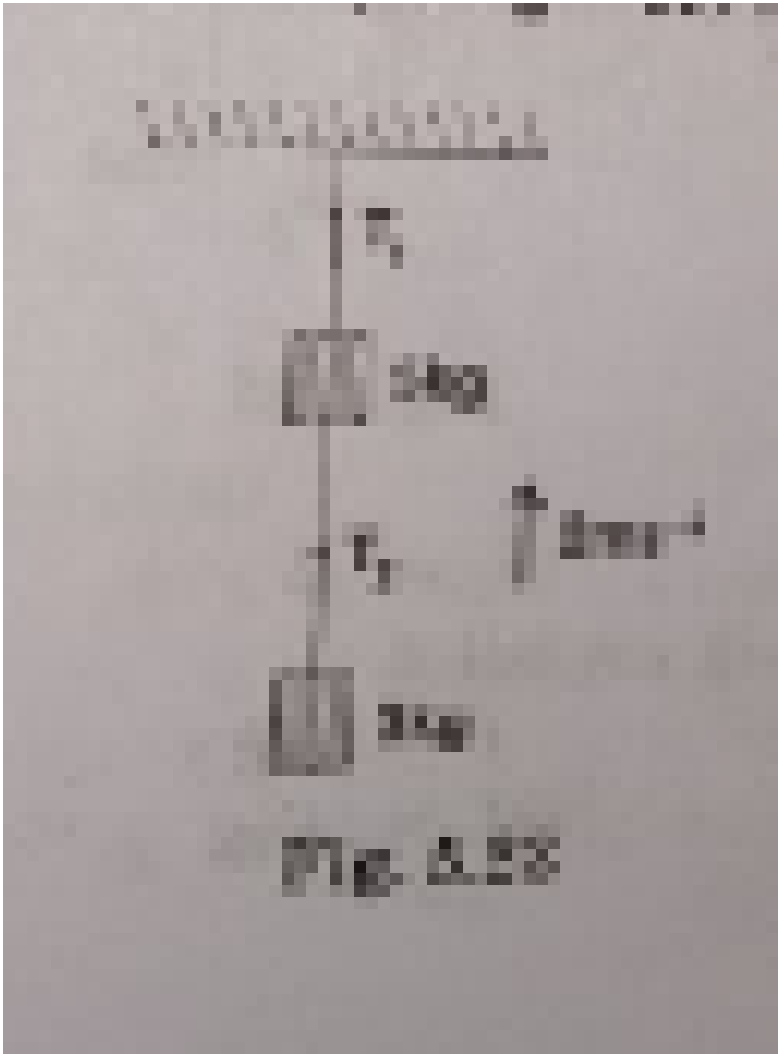
Watch Video Solution

140. A mass of 2 kg is suspended with thread AB. Thread CD of the same type is attached to the other end of 2 kg mass. Lower thread is pulled gradually. harder and harder in the downward direction so as to apply force on AB. In the above given problem if the lower thread is pulled with a jerk, what happens?

Watch Video Solution

141. Two masses 5 kg and 3 kg are suspended with the help of massless inextensible strins as shown in the figure. Calculate T_1 and T_2 when whole system is going upwards with

acceleration = $2ms^2$ (use $g = 9.8ms^{-2}$)



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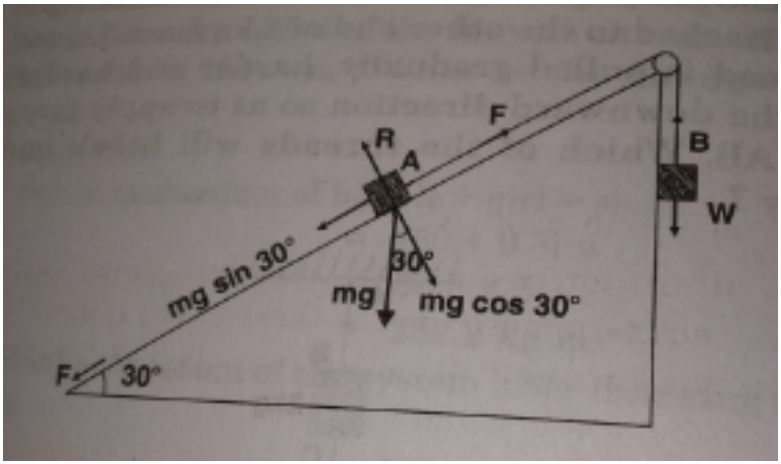
142. Block A of wiehgt 100 N resta on a frictionless inclined plane of slope angle `30^@. A flexible cod attached to A passes over a frictionless pulley and is connected to block B of weight W. Find the weight W for which the system is in equilibrium.



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143. A block f mass M is held against a rough vertical wall by pressing it with a finger. If the coefficient of friction between the block and the wall is μ and the acceleration due to gravity is g. calculate the minimum force required to be applied by the finger to hold the block against the wall?

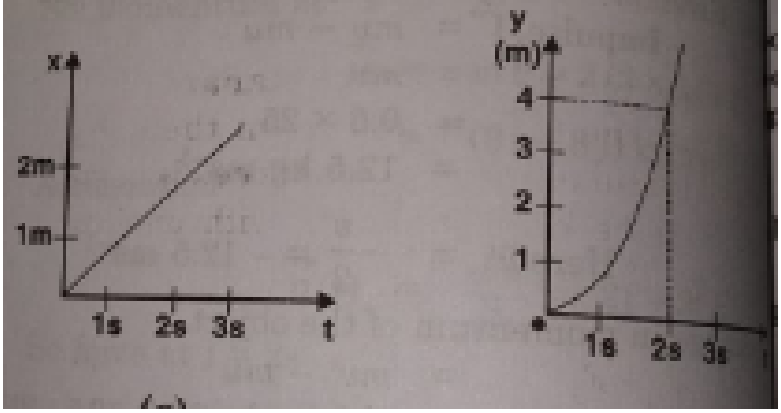
Watch Video Solution

144. A 100 kg gun fires a ball of 1 kg horizontally from a cliff of height 500 m. It

falls on the ground at a distance of 400 m from the bottom of the cliff. Find the recoil velocity of the gun. (acceleration due to gravity = $10ms^{-2}$)

Watch Video Solution

145. In figure. (x,t), (y,t) diagram of a particle in 2-dimensions.



If the particle has a mass of 500 g. Find the force (direction and magnitude) acting on the particle.

Watch Video Solution

146. A person in an elevator accelerating upwards with an acceleration of $2ms^{-2}$,

tosses a coin vertically upwards with a speed of 20 m s^{-1}. After how much time will the coin fall back into his hand? $(g = 10ms^{-2})$

Watch Video Solution

147. These are three forces F_1, F_2, F_3 acting on a body, all acting on a point P on the body. the body is found to move with uniform speed. Show that te forces are coplanar.

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148. These are three forces F_1, F_2, F_3 acting on a body, all acting on a point P on the body. the body is found to move with uniform speed. Show that the torque acting on the body about any point due to these three forces is zero.

Watch Video Solution

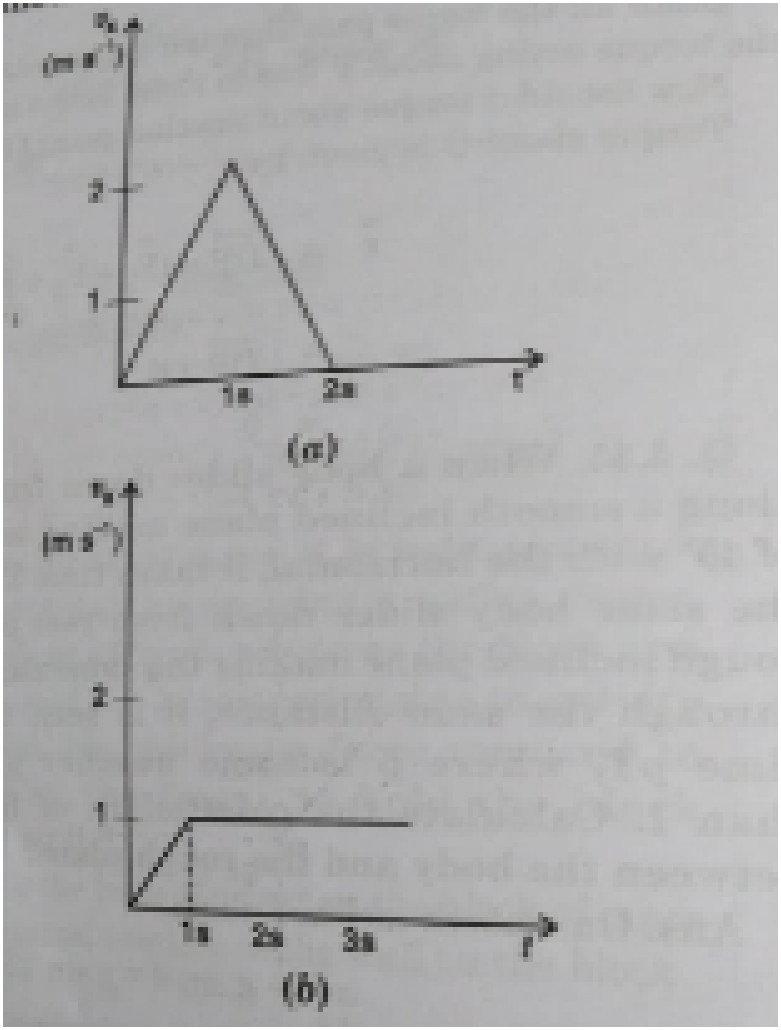
149. When a body slides down from rest along a smooth inclined plane making anangle of 45° with the horizontal, it takes time T. when

the same body slides down from rest along a rough inclined plane making the same angle and through the same distance, it is seen to take time pT, where p is some number greater than 1. Calculate the co-efficient of friction between the body and the rough plane.

Watch Video Solution

150. In figure shows that (v_x, t), and (v_y, t) for a body unit mass. Find the force as a

function of tiime.



Watch Video Solution

151. The displacement vector of a partical of mass m is given by

$\vec{r}(t) = \hat{i}A\cos\omega t + \hat{j}B\sin\omega t.$

Show that the trajectory is an ellipse.

Watch Video Solution

152. The displacement vector of a partical of mass m is given by

$\vec{r}(t) = \hat{i}A\cos\omega t + \hat{j}B\sin\omega t.$

Show that $\vec{F} = -m\omega^2\vec{r}$

Watch Video Solution

153. A cricket bowler releases the ball in two different ways

(a) giving it only horizontal velocity and

(b) giving it horizontal velocity and a small downward velocity.

The speed v_s at the time of release is the same . Both are released at a height H from the ground . which one will have greater speed when the ball hits the ground ? Neglect air resistance.

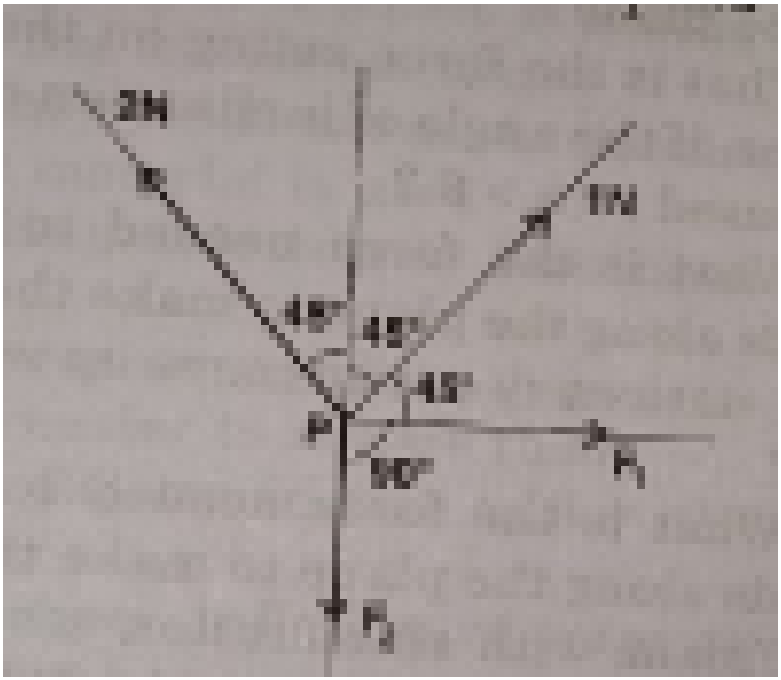
Watch Video Solution

154. A cricket bowler releases tha ball in two different ways

giving it horizontal velocity and a small downward velocity and the speed v_s at the time of release is the same. Both are relased at a height H from the ground. Which one will have greater speed when the ball hits the ground? Neglect air resistance.

Watch Video Solution

155. There are four forces acting at a point P produced by strings as show in the figure, which is at rest. The forces F_1 and F_2 are



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156. A rectangular box lies on a rough incli ned surface. The co-efficient of friction between the surface and the box is μ. Let the mass of the box is be m.

At what angle of inclination θ of the plane to the horizontal will the box just start to slide down the plane?

Watch Video Solution

157. A rectangular box lies on a rough inclined surface at θ. The co-efficient of friction between the surface and the box is μ. Let the mass of the box is m.

What is the force acting on the box down the plane, if the angle of inclination of the plane is increased to $\alpha > \theta$?

Watch Video Solution

158. A rectangular box lies on a rough incli ned surface. The co-efficient of friction between the surface and the box is μ. Let the mass of the box is be m.

What is the force needed to be applied upwards along the plane to make the box either remains stationary or just move up with unifrom speed?

Watch Video Solution

159. A rectangular box lies on a rough incli ned surface. The co-efficient of friction between the surface and the box is μ. Let the mass of the box is be m.

What is the force needed to be applied upwards along the plane to make the box move up the plane with acceleration α?

Watch Video Solution

160. A helicopter of mass 1000 kg rises with a vertical acceleration of $15ms^{-2}$. The crew and the passengers weigh 300 kg. Give the magnitude and direction of the:- force on the floor by the crew and passengers,

Watch Video Solution

161. A helicopter of mass 1000 kg rises with a vertical acceleration of $15ms^{-2}$. The crew and the passengers weigh 300 kg. Give the

magnitude and direction of the:- action of the rotor of the helicopter on the surrounding air,

Watch Video Solution

162. A helicopter of mass 1000 kg rises with a vertical acceleration of $15ms^{-2}$. The crew and the passengers weigh 300 kg. Give the magnitude and direction of the:- force on the floor by the crew and passengers,

Watch Video Solution

163. When a body is stationary

A. there is no force acting on it

B. the forces acting on it are not in contact with it

C. the forces acting on it balance each oter

D. the body is in vaccum.

Answer:

Watch Video Solution

164. A shell in flight explodes into four unequal parts. Which of the following is conserved?

A. Momentum and kinetic energy

B. Momentum

C. Kinetic energy

D. Neither momentum nor kinetic energy.

Answer:

Watch Video Solution

165. A man sitting in a train which is in motion is facing the engine. He tosses a coin up. the coin falls behind him. The train is :

A. moving forward with acceleration

B. moving forward with uniform speed

C. moving backward wth uniform speed

D. moving backward with acceleration

Answer:

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166. A stretching force of 1 N is applied at one end of a spring balance and an equal sretching force is applied at the other end at the same time. The reading on the balance will be

A. 0 N

B. 1 N

C. 2 N

D. 0.5 N

Answer:

Watch Video Solution

167. A bird weights 2 kg and is inside a cage of 1 kg. If it starts flying then what is weight of bird and cage assembly?

A. 1.5 kg

B. 2.5 kg

C. 3 kg

D. 4 kg

Answer:

Watch Video Solution

168. A man weighs 80 kg. He stands on a weighing scale in the lift, which is moving upward with a uniform acceleration of $5ms^{-2}$ what whould be the reading on the scale? $(g = 10m/s^2)$.

A. Zero

B. 400 N

C. 800N

D. 1200 N

Answer:

Watch Video Solution

169. Three forces start acting simultaneously on a particle moving with velocity $\overrightarrow{v}$. There forces are represented in magntiude and direction y three sides of a triangle taken in the same order. The particle will nw move with a velocity

A. less than $\overrightarrow{v}$

B. more than $\overrightarrow{v}$

C. $\overrightarrow{v}$ only

D. cannot say

Answer:

Watch Video Solution

170. Air is thrown on the sail of a stationary boat by an electric fan kept on it. The boat will

A. remain stationary

B. start moving in the direction in which air is blown.

C. start moving in the direction opposite to that in which air in blown.

D. start moving with uniform acceleration.

Answer:

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171. Brakes of very small contact area are not used although friction is independent of area because friction

A. resists motion

B. causes wear and tear

C. depends upo nature of materials

D. operating in this case is sliding friction.

Answer:

172. Why are tyres made circular?

A. less material is used

B. rolling friction is less than sliding friction

C. it is easier to inflate them

D. it is easier to deflate them

Answer:

Watch Video Solution

173. Proper inflation of tyres saves fuel. this is because:

A. contact area is increased

B. contact area is decreased

C. normal reaction is reduced

D. normal reaction is increased

Answer:

Watch Video Solution

174. Aeroplanes jets etc. are stremlined to reduce

A. dynamic friction

B. sliding frictioni

C. rolling friction

D. fluid friction

Answer:

Watch Video Solution

175. A horse pulls a cart harder during the first few steps because.

A. limiting friction is higher than kinetic friction

B. kinetic friction is higher than limiting friction

C. sliding friction is higher than rolling friction

D. frictional forces stops acting after few steps.

Answer:

Watch Video Solution

176. A box is placed on an inlcined plane and has to be pushed down. The angle of inlcination is

A. equal angle of friction

B. more than angle of friction

C. equal to angle of friction

D. less than angle of repose

Answer: less thaan the angle of repose.

Watch Video Solution

177. A stretching force of 1 N is applied at one end of a spring balance and an equal sretching force is applied at the other end at the same time. The reading on the balance will be

A. its kinetic energy will go on increasing

its kinetic energy will go on decreasing

B. kinetic energy will remains constant

C. centripetal force will do work on it.

D.

Answer:

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178. Fill in the blanks:

Newton's ___ law is te real law of motion.

Watch Video Solution

179. Fill in the blanks:

Spark coming out of a grinding stone is the example is ____.

Watch Video Solution

180. Fill in the blanks:

An __ force is required to keep a body in uniform circular motion.

Watch Video Solution

181. Fill in the blanks:

1 kg f = ___ N.

Watch Video Solution

182. Fill in the blanks:

Mathamaticlly, Newton's third law of motion is given by___.

Watch Video Solution

183. What is force ? Give its units.

Watch Video Solution

184. What is inertia?

Watch Video Solution

185. Are Newton's first law of motion and Galileo's law on inertia different?

Watch Video Solution

186. What is linear momentum ?

Watch Video Solution

187. What is law of conservation of momentum ?

Watch Video Solution

188. What is the concept of inertia mass?

Watch Video Solution

189. Why does an athlete run before taking a high jump ?

Watch Video Solution

190. If we shake branches of a fruit tree, the fruits fall. Explain.

Watch Video Solution

191. If a ball is thrown up in a moving train, it comes back to the sme place, why?

Watch Video Solution

192. What is the cause of friction? In which case is it maximum?

Watch Video Solution

193. How does coefficient of friction is altered when the weight of body is doubled?

Watch Video Solution

194. In which direction the force of friction acts?

Watch Video Solution

195. Explain why:- a horse cannot pull a cart and run in empty space.

Watch Video Solution

196. Since action and reaction are always equal in magntiude and opposite in direction, how can anything ever be accelerated?

Watch Video Solution

197. A body is moving such that its linear momentum remains constant. Is the body in equilibrium?

Watch Video Solution

198. It is difficult to move a cycle along a road with its brakes on. Why?

Watch Video Solution

199. Carts with rubber wheels are easier to ply than those with iron wheels. Why?

Watch Video Solution

200. Why are tyres made circular?

Watch Video Solution

201. What is centripetal force?

Watch Video Solution

202. Why is a curved road banked on the outer side?/

Watch Video Solution

203. Friction is a self- adjusting force. Is it correct?

Watch Video Solution

204. How friction is reduced in fast moving vehicle?

Watch Video Solution

205. The quantity of motion contained in a body is called ____.

Watch Video Solution

206. One newton is equal to ___.

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207. The product of mass of a body and its acceleration is called _____.

Watch Video Solution

208. Newton's second law gives the measure of the __.

Watch Video Solution

209. The product of average force and time for which the force acts is called ___.

Watch Video Solution

210. Action and reaction are always ____ and ___.

Watch Video Solution

211. Newton's second law gives the measure of the __.

 Watch Video Solution

212. For swimming, we use Newton's ___ law of motion.

 Watch Video Solution

213. Bodies of larger mass need ____ iniital effort to put them in motion.

Watch Video Solution

214. The friction between two surfaces __, when the surfaces are made highly smooth.

Watch Video Solution

215. The static friction ___ on the nature of surfaces of the two bodies.

Watch Video Solution

216. Are Newton's first law of motion and Galileo's law on inertia different?

Watch Video Solution

217. By which other name the first law of motion is known ?

Watch Video Solution

218. Is linear momentum a scalar or a vector quantity?

Watch Video Solution

219. Why does a passenger fall forward when he alights from the moving bus ?

Watch Video Solution

220. Bodies of larger mass need ___ iniital effort to put them in motion.

Watch Video Solution

221. Show that a heavier body having the same velocity as that of lighter body, possesses more momentum.

Watch Video Solution

222. A heavier and lighter body have the same momentum. Show that lighter body possesses more velocity.

Watch Video Solution

223. Heavier the rifle, lesser the kick. Why?

Watch Video Solution

224. When a ball is thrown upwards, its momentum first decreases and then increases. Is conservation of linear momentum violated in this process?

Watch Video Solution

225. A horse pulls a cart harder during the first few steps because.

Watch Video Solution

226. Explain why:- it is easier to pull a lawn mower than to push it.

Watch Video Solution

227. Why is limiting friction greater than kinetic friction?

Watch Video Solution

228. Polishing beyond certain limit may increase friction between the surfaces. Explain.

Watch Video Solution

229. Define angle of friction.

Watch Video Solution

230. Derive an expression for aceleration of a bdy moving down an inclined plane.

Watch Video Solution

231. What is the need of banking a circular road?

Watch Video Solution

232. Explain the need for banking of tracks.

Watch Video Solution

233. Define the term inertia. Explain three types of inertia with examples.

Watch Video Solution

234. State and explain the Newton's First Law of Motion.

Watch Video Solution

235. What is Newton's second law of motion? How can the force be measured using second law of motion?

Watch Video Solution

236. What are different units of force and how are these related to each other?

Watch Video Solution

237. Discuss consequences of Newton's second law of motion.

Watch Video Solution

238. State and explain Newton's third Law of motion.

Watch Video Solution

239. Determine aparent weight of a person in a lift

when lift is at rest

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240. Determine aparent weight of a person in a lift

when lift is moving upward with unifrom velocity

 Watch Video Solution

241. Determine aparent weight of a person in a lift

when lift is moving downward with uniform velocity.

Watch Video Solution

242. Determine aparent weight of a person in a lift

lift is moving up with acceleration a

Watch Video Solution

243. Determine aparent weight of a person in a lift

when lift to moving down with acceleration a,

Watch Video Solution

244. Determine aparent weight of a person in a lift

when lift is moving down with a = g.

Watch Video Solution

245. Derive the expression for acceleration and tension in a string in a connected motion.

Watch Video Solution

246. Fill in the blanks:

Newton's ___ law is te real law of motion.

Watch Video Solution

247. What is law of conservation of momentum ?

Watch Video Solution

248. State and explain the law of conservation of linear momentum. Explain recoil of a gun and explosion of a bomb.

Watch Video Solution

249. What is the principle of atom bomb?

Watch Video Solution

250. What is an impulse? How is it related to the change in momentum?

Watch Video Solution

251. Illustrate some applications of impulse.

Watch Video Solution

252. Define concurrent forces and describe equilibrium of concurrent forces.

Watch Video Solution

253. Derive the law of conservation of linear momentum from Newton's third law of motion.

Watch Video Solution

254. What is a frame of reference? Explain inertial and non-inertial frames of reference.

Watch Video Solution

255. Is earth an inertial frame of reference?

Watch Video Solution

256. Define friction. What is its cause? Distinguish between static friction, limiting

friction and kinetic friction. How do they vary with the applied force?

Watch Video Solution

257. State laws of limiting friction. Define coefficient of limiting friction and coefficient of kinetic friction. What are units and dimensions of coefficient of friction?

Watch Video Solution

258. Define angle of repose and show that the coefficient of limiting friction is equalto tangent of repose. Hence show that angle of epose is equal to angle of friction.

Watch Video Solution

259. Rolling friction is:

Watch Video Solution

260. What are the methods of reducing friction?/

Watch Video Solution

261. What is centripetal force?

Watch Video Solution

262. Define centrifugal force.

Watch Video Solution

263. Calculate the maximum speed with which a vehicle can travel on a level circular road without skidding.

Watch Video Solution

264. What provides the centripetal force to a caar taking turn on a level road?

Watch Video Solution

265. Calculate the speed with which a vehicle can safely move on a banked circular road. How can wear and tear of tyres be reduced on such a road? (taking into consideration the friction between tyres and road).

Watch Video Solution

266. Derive an expression for the angle of bending of a cyclist on a curved track.

Watch Video Solution

267. What is a simple pendulum? Obtin expression for its angular acceleration. When its bob is diplaced through an angle.

Watch Video Solution

268. Derive the expression for acceleration and tension in a string in a connected motion.

Watch Video Solution

269. A stone of mass mtied to the end of a string revolves in a vertical circle of radius R. The net forces at the lowest and highest points of the circle directed vertically downwards are : [Choose the correct alternative] T_1 and v_1 denote the tension and speed at the lowest point. T_2 and v_2 denote corresponding values at the highest point.

(a) $mg - T1$ $mg + T2$

(b) $mg + T1$ $mg - T2$

(c) $mg + T1\text{-}(mv2l) / R$ $mg \sim T2 + (mv^{\prime}) / R$

(d) $mg - T_1 - (m v_1^2) / R$ $mg + T2 + (\mathrm{m}\ \mathrm{u}2) / R$

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270. A bullet of mass 0.04 kg moving with a speed of $90ms^{-1}$ enters a heavy wooden block and is stopped after a distance of 60 cm. What is the average resistive force exerted by the block on the bullet?

Watch Video Solution

271. A rocket of initial mass 6000 kg ejects mass at a constant rate of $16kgs^{-1}$ with constant relative speed of $11kms^{-1}$. What is

the acceleration of the rocket a minute after the blast? (Neglect gravity).

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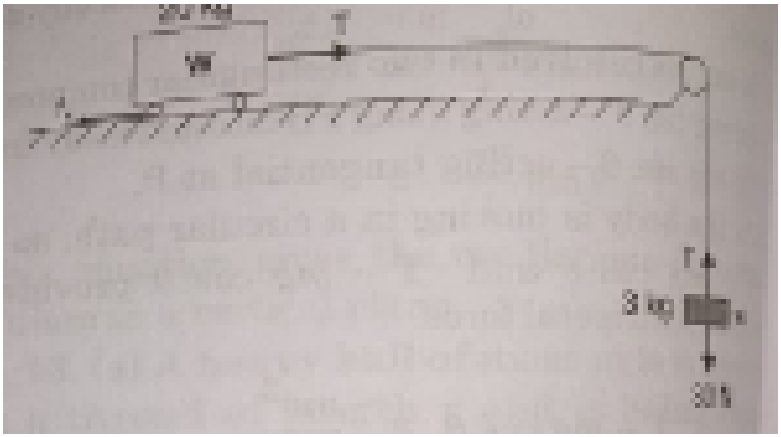
272. A mass of 4 kg rests on a horizontal plane. The plane is gradually inclined at an angle $\theta = 15^\circ$ with the horizontal, the mass just begins to slide. What is the coefficient of static friction between the block and the surface?

Watch Video Solution

273. What is the acceleration of the block and trolley system shown in the figure, if the coefficient of kinetic friction between the trolley and the surface is 0.04?/ What is the tension in the string? (Take g = $10ms^{-2}$) Neglect the mass of the string.



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274. The upper half of an inclined plane with inclination θ is perfectly smooth, while the lower half is rough. A bdy starting from rest at the top will again come to rest at the bottom, find the coefficient of friction for the lower half.

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275. A piece of uniform string hangs vertically so that its free end just touches horizontal surface of a table. The upper end of the strig is

now released. Show that at any instant during the falling of string, the total force on the surface is three times the weight of that part of string lying on the surface.

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276. Two particles of equal masses m and m are connected by a light string of length 2l. A constant force F is applied continuously at the mid-point of the string, always along the perpendicular bisector of the straight line

joining the two particles. Show that when the distance between the two particles is x, the acceleration of the particle is

$$a = \frac{F}{m} = \frac{x}{\left(1^2 - x^2\right)^{1/2}}$$

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277. The total mass of an elevator with a 80 kg man in it is 1000 kg. This elevator moving upward with a speed of $8ms^{-1}$ is brought to rest over a distance of 16 m. Calculate

the tension T in the cable supporting the elevator

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278. The total mass of an elevator with a 80 kg man in it is 1000 kg. This elevator moving upward with a speed of $8ms^{-1}$ is brought to rest over a distance of 16 m. Calculate the force exerted on man by the elevator floor.

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279. A truck starts from rest and accelerates uniformly at $2.0ms^{-2}$. At t = 10 s, a stone is dropped by a person standing on the top of the truck (6 m high from the ground). What are the:- velocity. (Neglect air resistance.)

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280. A truck starts from rest and accelerates uniformly at $2.0ms^{-2}$. At t = 10 s, a stone is dropped by a person standing on the top of the truck (6 m high from the ground). What

are the:- acceleration of the stone at t = 11s? (Neglect air resistance.)

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281. Is linear momentum a scalar or a vector quantity?

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282. Rockets can move in airfree space but jet planes cannot. Why?

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283. Is earth an inertial frame of reference?

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284. Why are tyres made circular?

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285. Is friction independent of actual area orf contact?

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286. Carts with rubber wheels are easier to ply than those with iron wheels. Why?

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287. Why is itmore difficult to catch a cricket ball than to catch a tennis ball moving with the same velocity?

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288. What happens to a stone tied to the end of a string and whirled in a circle if the string suddenly breaks?

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289. Why is it difficult to walk on ice?

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290. Two masses 8 kg and 12 kg are connected at the two ends of a light inextensible string that goes over a frictionless pulley. Find the acceleration of the masses, and the tension in the string when the masses are released.

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291. How does Newton's first law of motion leads to the definition of force?

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292. Define momentum of a body. Also give its units.

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293. Determine aparent weight of a person in a lift

when lift is moving upward with unifrom velocity

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294. Angle of friciton (θ) and angle of repose (a) are related as

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