PHYSICS

BOOKS - PEARSON IIT JEE FOUNDATION

DYNAMICS

Example Solution

1. The speeds of a tortoise and a hare are $2ms^{-1}$ and $5ms^{-1}$, respectively. The mass of the hare is 3 kg and that of the tortoise is 10 kg. Which of the two has greater momentum? (Assume speed of each to be steady.)

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2. What is the force exerted by a bullock in pulling a cart of mass 100 kg and accelerating at a rate of 1.5 m s^{-2}?

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3. An object of mass 10 kg is moving with an initial velocity of $10ms^{-1}$. A constant force acts for 4 s on the object giving it a speed of 2 m s^{-1} in the opposite direction. Find the acceleration and force.

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4. A ball of mass 100g moving at a speed of 12 m s^{-1} strikes another ball of mass 200 g at rest. After the collision both the balls stick to each other and move with a common velocity. Find the common velocity.

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5. A gun fires a bullet of mass 50 g with a velocity of 30 m s^{-1} because of which the gun recoils with a velocity 1 m s^{-1}. Find the mass of the gun.

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6. What is the work done by a horse in displacing a cart through 5 m in the direction of the force if the force applied by the horse is 10 N?

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7. 2 joules of work is done in displacing a stone through 0.5 m. Find the force applied on the stone.

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8. A student is able to lift a bag containing books of 20 kg_{wt} by applying a force of 5 kg_{wt} Find the mechanical advantage.

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9. The mechanical advantage of a machine is 4 and its velocity ratio is 5. What is its percentage efficiency?

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10. A machine is operated by a power of 50 N and the power has a downward displacement of 0.25 m in raising a load of mass 100 N through 10 cm. Calculate M.A., V.R. and efficiency.

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11. Why does a professional cleaner or a sweeper prefers a broom stick with large handle than a small broom stick used for household purposes?

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Very Short Answer Type Questions

1. NEWTON'S FIRST LAW OF MOTION

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2. Mass of a body is a _____ quantity whereas its weight is a _____ quantity.

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3. Define inertia.

Watch Video Solution

4. Define momentum.

Watch Video Solution

5. Name the property of bodies (or objects) to resist a change in their state of rest or of motion.

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6. The rate of change of momentum of a body is pro-portional to _____.

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7. Define newton.

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8. When the mass of a body is kept constant, its acceleration is directly proportional to the _____ acting on it.

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9. Powder is sprinkled on a carom board to reduce the _____.

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10. A constant force of 2 N acts on a body for 5 seconds to change its velocity. The change in its momentum is _____.

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11. Define 1 J of work.

Watch Video Solution

12. What is energy?

Watch Video Solution

13. 1 newton = _____ dynes.

Watch Video Solution

14. What is a rigid body?

Watch Video Solution

15. Define centre of gravity.

Watch Video Solution

16. Explain how the centre of gravity of an irregular lamina is determined.

Watch Video Solution

17. A bottle standing on its base is more stable than when it stands on its neck. This is so because when it stands on the base its _____.

Watch Video Solution

18. State the different types of equilibrium.

Watch Video Solution

19. Friction in moving parts of a machine can be reduced by using _____.

Watch Video Solution

20. Give three examples of bodies in unstable equilibrium.

Watch Video Solution

21. Why do we use simple machines?

Watch Video Solution

22. Bottle lid opener is an example of _____ lever

Watch Video Solution

23. (i) What is mechanical advantage?

(ii) Define efficiency of a machine.

Watch Video Solution

24. One S.I. units of force is _____ times one unit of force in CGS system.

Watch Video Solution

25. Define a lever.

Watch Video Solution

26. See-saw is an example of _____ order lever.

Watch Video Solution

27. If load is between the fulcrum and effort of a lever, it is called ___ order lever.

Watch Video Solution

28. The mechanical advantage of a broomstick is _____.

Watch Video Solution

29. What is the use of a pulley?

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Short Answer Type Questions

1. Derive the relation $F = ma$, where the symbols have their usual meanings.

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2. An empty truck of mass 1000 kg is moving at a speed of 36 km h^{-1}. It is loaded with 500 kg material on its way and again moves with the

same speed. Will the momentum of the truck remain the same after loading? If not, find the momentum of the truck after loaded.

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3. Distinguish between mass and weight.

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4. A railway wagon of mass 100 kg is pulled with a force of 1000 N. What is its acceleration?

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5. Explain how the position of the centre of gravity determines whether a body is in stable or unstable equilibrium.

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6. Explain the motion of a rocket as an application of Newton's third law of motion.

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7. A railway engine of mass 2 tons moving at a speed of 72 km h^{-1} collides with a wagon at rest. After collision both have a common velocity of 36 km h^{-1}. Find the mass of the wagon. (1 ton = 1000 kg)

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8. Find the centre of gravity of a triangular lamina, each side of which measures $9\sqrt{3}$ cm

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9. Find the effort required to lift a load of 50 kg_{wt} using a simple machine if its mechanical advantage is

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10. Derive the mechanical advantage of single fixed pulley?

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11. Why are passengers travelling in a double decker bus allowed to stand in a lower deck, but not in the upper deck?

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12. What is the efficiency of a machine, given mechanical advantage is 2 and velocity ratio is 4?

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13. Derive the mechanical advantage of single movable pulley?

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Essay Type Questions

1. State the law of conservation of liner momentum.

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2. Obtain the relation between mechanical advantage, velocity ratio and efficiency.

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3. Explain how the centre of gravity of an irregular lamina is determined.

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4. What is the M.A. of an inclined plane equal to ?

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5. Explain how the centre of gravity of an irregular lamina is determined.

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Level 1

1. All mechanical forces are contact forces.

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2. A constant external force acts on a body in motion. If the mass of the body is doubled with the force remaining the same, its acceleration also doubles.

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3. The principle used in swimming is Newton's third law of motion.

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4. Bottle lid opener is an example of _____ lever

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5. Whenever a force is applied on a body, work is done.

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6. The line drawn in the direction of force is called the line of action of that force. State true / false.

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7. Frictional force always acts in a direction opposite to the weight of the body.

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8. NEWTON'S FIRST LAW OF MOTION

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9. A wheel barrow is an example of _____ order of lever.

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10. For greater stability, the position of center of gravity should be low and base area should be _____.

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11. The force exerted by a body on the earth is _____ the force exerted by the earth on the body.

View Text Solution

12. A' can finish certain work in one day and B can finish the same work in two days. The ratio of energy spent by A to that spent by B is _____.

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13. Momentum is the product of _____ and _____.

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14. A car changes its speed from 20 km h^{-1} to 50 km h^{-1}. This is possible only if _____ is applied on the car.

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15.

	Column A			Column B
$A.$	Dyne	( )	$a.$	Maximum static friction
$B.$	Momentum	( )	$b.$	Mechanical advantage is two
$C.$	Inertia	( )	$c.$	Newton's third law
$D.$	Mass	( )	$d.$	Centroid of the triangle
$E.$	Limiting friction	( )	$e.$	Newton's first law
$F.$	C.G. of a triangular lamina	( )	$f.$	Lever of third order
$G.$	kg m s^{-2}	( )	$g.$	CGS unit of force
$H.$	Forceps	( )	$h.$	Mass $\times$ veloctiy
$I.$	Working of rocket	( )	$i.$	Scalar quantity
$J.$	single movable pulley	( )	$j.$	newton

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16. When two marbles, collide, their total momentum before collision is equal to

A. the difference in their momentum after collision

B. the average of their momentum after collision

C. the square of the sum of their momentum after collision

D. their total momentum after collision.

Answer: D

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17. A nut cracker is a _____ order lever.

A. first order lever

B. second order lever

C. third order level

D. None of the above

Answer: B

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18. A man standing on one leg is an example of _____.

A. unstable equilibrium

B. stable equilibrium

C. neutral equilibrium

D. Both (b) and (c)

Answer: A

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19. The momentum of a body

A. is associated with its motion.

B. is a product of mass of the body and its velocity

C. is a vector quantity

D. All the above

Answer: D

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20. The wrong statement in the following is _____.

A. action and reaction act on two different bodies

B. action and reaction are equal in magnitude

C. action and reaction are opposite in direction

D. None of the above

Answer: D

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21. When a fast moving vehicle is stopped suddenly the persons sitting in it tend to fall forward. This is due to _____.

A. inertia of rest

B. inertia of motion

C. inertia of direction

D. All the above

Answer: B

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22. When a person jumps up,

A. he exerts a force on the ground

B. the ground exerts a force on him

C. Both (a) and (b) are true

D. Both (a) and (b) are false

Answer: C

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23. When a stationary vehicle suddenly starts, the persons in it tend to fall backward. This is due to

A. inertia of rest

B. inertia of motion

C. inertia of direction

D. All the above

Answer: A

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24. The mechanical advantage of tongs is

A. always equal to one

B. always less than one

C. always greater than one

D. sometimes less than one and sometimes greater than one.

Answer: B

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25. Identify the wrong statement.

The momentum of a body is

A. the product of mass and velocity of the body

B. the product of force and time

C. the vector quantity

D. measured in kg m s^{-1} in S.I. system.

Answer: B

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26. The centre of gravity of a boomerang is always situated

A. inside the material of the body

B. outside the material of the body

C. at one of its ends

D. None of the above

Answer: B

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27. An inclined plane of length 2 m is used to lift a load of 100 kg_{wt}. The force required to lift the load is 20 kg_{wt}. The height through which the load is lifted is _____ m

A. 2

B. 2.5

C. 1.5

D. 0.4

Answer: D

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28. To increase the stability of a ship

A. the base area should be made large

B. height of its centre of gravity should be kept as low as possible

C. Both (a) and (b)

D. Neither (a) nor (b)

Answer: C

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29. A spring balance is attached to a lever of negligible mass as shown in the diagram. A body of mass 10 kg_{wt} hangs from the lever. The reading of the spring balance is _____ kg_{wt}

A. 2

B. 5

C. 6

D. 3.5

Answer: C

View Text Solution

30. A cone resting on its apex is an example of

A. unstable equilibrium

B. stable equilibrium

C. neutral equilibrium

D. None of these

Answer: A

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31. The force of attraction between an electron revolving around the nucleus and the nucleus is _____ force.

A. a magnetic

B. an electrostatic

C. a gravitational

D. a mechanical.

Answer: B

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32. Friction in moving parts of a machine can be reduced by using _____.

A. lubricants

B. ball bearings

C. iron filings

D. Both (a) and (b).

Answer: D

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33. A ball is thrown in upwards direction then the force(s) acting on it is (are)

A. gravitational force

B. mechanical force

C. fictional force

D. Both (a) and (c).

Answer: D

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34. Air friction can be reduced by _____ the shape of the objects.

A. the use of lubricants

B. polishing surfaces

C. by increasing the height

D. Both (a) and (b).

Answer: D

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35. The rate of change of momentum of a body is pro-portional to _____.

A. directly proportional to the force applied on the body

B. inversely proportional to the force applied on the body

C. directly proportional to its surface area

D. inversely proportional to its surface area.

Answer: A

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36. A constant force of 100 N acts on the body for 8 s for changing its momentum. The change of momentum of the body is _____ newton second.

A. 400

B. 800

C. 200

D. 100

Answer: B

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37. Explain Action and reaction

A. always act on two different bodies

B. are equal in magnitude

C. are opposite in direction

D. All the above

Answer: D

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38. A block of mass 3 kg which is at rest on a surface is pulled horizontally by a force. If the displacement of the block is 15 m in the first 3 s and the surface offers a resistance of 2 N, find the sequence of steps to calculate the magnitude of applied force.

(a) Note down the values of s, u, t and frictional force

(b) The applied force on the block is the sum of frictional force and net force

(c) Substitute the values of s, u and t in the equation of motion nad solve for 'a'

(d) Using Newton's second law of motion, calculate the net force acting on the block.

A. a d b c

B. a c b d

C. a c d b

D. a b d c

Answer: C

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39. An object of mass 500 g moving with a speed of 10 m s^{-1} collides with another object of mass 250 g moving with a speed of 2 m s^{-1} in the opposite direction. After collision both the objects move in the same direction with common velocity. Write the proper order of steps to find out their common velocity after collision.

(a) Calculate the total momentum of two bodies before collision as $m_1u_1 + m_2u_2$.

(b) Write down the given values of m_1 and m_2 in SI system

(c) Write the expression for their total momentum after collision as

$(m_1 + m_2)$ v where v is their common velocity.

(d) Assign proper signs to the initial velocities u_1 and u_2.

(e) Using law of conservation of momentum Equate the above two expressions and determine the value of v as $\frac{m_1u_1 + m_2u_2}{m_1 + m_2}$

A. b d a c e

B. b d c e a

C. a d b c e

D. c d e b a

Answer: A

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40. The work done to move an object of mass 2 kg to a height of 50 m from the ground is _____ J. $\left(g = 10ms^{-2}\right)$

A. 100

B. 1000

C. 500

D. 5000

Answer: B

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41. The centre of gravity of a ring is situated _____.

A. inside the material of the ring

B. outside the material of the ring at the centre

C. outside the material of the ring anywhere away from the centre

D. None of the above

Answer: B

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42. A bottle standing on its base is more stable than when it stands on its neck. This is so because when it stands on the base its _____.

A. base area is more

B. centre of gravity is nearer to the base

C. centre of gravity is at the top

D. Both (a) and (b).

Answer: D

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43. Define mechanical advantage of a lever.

A. always equal to one

B. always less than one

C. always greater than one

D. dependent on where it is held.

Answer: B

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44. We know, $L \times dL = E \times dE$, for a given type of lever, the effort arm is always less than loadarm, then

A. The V.R is less than one

B. The M.A is less than one

C. The given simple machine is a third order lever

D. All the above.

Answer: D

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45. Raju while drawing water from a well with help of a fixed pulley found that he applied more force than the weight of bucket and water. Then,

A. M.A is less than 1

B. efficiency of the pulley is more than 100%

C. V.R is equal to one

D. Both (a) and (c).

Answer: A

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Level 2

1. Explain why a person falling from certain height on a hard surface gets hurt more seriously than when he falls on a soft surface.

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2. A system of pulleys is used to lift a load of 1000 kg_{wt}. If the efficiency of the pulley system is 80% and velocity ratio is 20, find the effort required to lift the load.

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3. Explain why we take short steps while walking on slippery surfaces.

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4. Explain how winnowing allows the grain to get separated from the husk.

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5. A crowbar is of length 3 m. Where should the fulcrum be placed along the length of the crowbar so that a boulder of 9 kg_{wt} be lifted with it by applying an effort of 10 N? $\left(g = 10ms^{-2}\right)$

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6. A bullet of mass 50 g is fired from a gun. If the bullet acquires a velocity of 100 m s^1 in 0.1 second, what is the recoil force on the gun?

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7. Explain which of Newton's laws of motion are applicable in the following cases.

(1) A person swimming in water.

(2) A person gets hurt when jumping on the hard cement surface.

(3) A mango falls from the tree when the branch of the tree is suddenly shaken.

(4) The recoil of the gun when the bullet is fired from it.

(5) To compare accelerations produced in spheres of mass m and 2m, when equal force is applied to them.

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8. A person, sitting in a car, tries to move the car by applying force to its walls. Will the car move? Explain in detail.

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9. Give an example where low inertia is preferred and an example where high inertia is recommended.

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10. Calculate the density of a cubical ice block of side 50 cm if a force 1125 N applied to it produces an acceleration of 10 m s^{-1} in it. Neglect

the force of friction. Assume the ice block remains in solid state without melting.

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11. Explain why a Rolly doll always stands erect

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12. An athelete runs a certain distance before taking a long jump . Why ?

Watch Video Solution

13. Find the magnitude of the foce applied to a block of mass 5 kg at rest it it moves 36 m in the first 6 seconds. Neglect the force of friction.

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14. A clean hole is made in a glass window pane when it is struck by a bullet fired from a gun. Whereas, the same window pane will be broken to pieces when struck by a stone of a similar size. Explain this phenomenon quoting the relevant principles.

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15. A car of mass 1000 kg is moving with a certain speed when a constant braking force 1000 N acts on it for 5s and the speed of the car reduces to half its original speed. Find the further time required to stop the car if the same constant force acts.

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16. A car changes its speed from 20 km h^{-1} to 50 km h^{-1} of mass 3600 kg in 5 s. Determine the net external force applied on the car.

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17. Two forces having magnitudes 3F and 2F, when act in the same direction simultaneously on a body, the net force is equal to 25 N. Find the value of F.

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18. If a force of 50 N is applied on a body and it is still at rest, then find the magnitude of static frictional force acting on it.

Watch Video Solution

19. Find the energy possessed by a bird of 5 kg moving at a constant height of 10 m from the ground with a speed of 2 m s^{-1}. (Take $g = 10ms^{-2}$)

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20. A brick measures 12 cm $\times$ 6 cm $\times$ 3 cm. Initially, it is kept on the ground such that the rectangular surface with the smallest area is in contact with the ground and then it is placed such that the rectangular surface with the largest area touches the ground. Calculate the height of the centre of gravity from the ground in the two cases. Out of the two positions, in which case does the brick have greater stability and why?

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21. Two spheres of mass 10 g and 100 g each falls on the two pans of a table balance from a height of 40 cm and 10 cm, respectively. If both are brought to rest in 0.1 second, determine the force exerted by each sphere on the pans.

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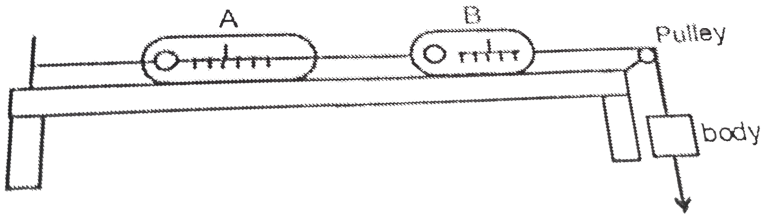
Level 3

1. Two spring balances 'A' and 'B' are connected to each other and placed horizontally over a smooth frictionless table. Balance 'A' is attached to a fixed support and a body is attached to the balance 'B' as shown in figure (a). Do both the spring balances show equal readings? Explain.



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2. A hollow spherical ball is completely filled with water. But due to leakage, water continuously flows out of it and finally no water is left in the ball. Discuss the variation in the position of the center of gravity as the water leaks out.

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3. Two spheres made of clay of masses $'m_1'$ and $'m_2'$ moving along a straight line in the same direction collide with each other. Their velocities just before collision are $'u_1'$ and $'u_2'$ respectively. After collision, they stick together and move with teh same velocity, in the same direction, along the straight line. Find the velocity with which they move together.

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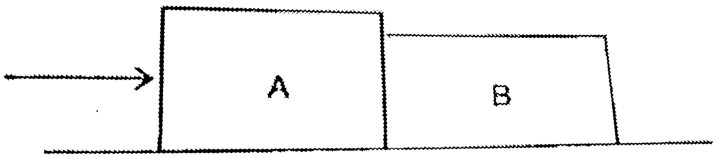
4. A force 50 N acts on a block A of mass 3 kg which is in contact with a block B of mass 2 kg, as shown in the figure. Find the forces acting on A and B. Will the same forces act on A and B if instead of applying the force to A, it is applied to B?



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5. A physics student took a solid sphere of density 2 g cm^{-3} and radius 3.5 cm and applied a force on the sphere. If an acceleration fo 1.5 cms^{-2} is produced in it, find the amount of force applied on it.

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6. A bullet of mass 50 g is fired from a gun. If the bullet acquires a velocity of 100 m s^{1} in 0.1 second, what is the recoil force on the gun?

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7. Ramu saw in a NEWS channel that a goods train of mass 200 metric ton moving with a velocity of 72 km h^{-1} collides with a passenger train of mass 300 metric ton with a velocity of 54 km h^{-1} coming in the opposite direction on the same track and both the trains move together after collision. He calculates their common velocity. Find what could be his answer.

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8. A T.V. stand with wheels is placed on a trolley. What happens if the trolley starts immediately and also if trolley is suddenly stopped?

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9. The physics teacher gave a rod of length 'L' units to Roy and the teacher asked Roy to find the shift in the centre of gravity when $1/4$ of the total length of the rod is removed. What will be the Roy's answer in terms of L?

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10. A rectangular tank is completely filled with water. But due to leakage, water continuously flows out of it and finally, the tank is empty. Discuss the variation in the position of the centre of gravity as the water leaks out.

Watch Video Solution

11. Find the centre of gravity of a solid right circular cone of height 40 cm from its top (vertex).

Watch Video Solution

12. An inclined plane of length 6 cm is used to lift a load of 42 N, by applying an effort of 7 N. Find the height of the plane.

Watch Video Solution

13. A system of pulleys is used to lift a load of 1000 kg_{wt}. If the efficiency of the pulley system is 80% and velocity ratio is 20, find the effort required to lift the load.

Watch Video Solution

14. A ball of mass 100g moving at a speed of 12 m s^{-1} strikes another ball of mass 200 g at rest. After the collision both the balls move with a common velocity. Find the common velocity.

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Example

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Test Your Concepts Very Short Answer Type Questions

1. State and explain Newton's first law of motion.

Watch Video Solution

2. Mass of a body is a _____ quantity whereas its weight is a _____ quantity.

Watch Video Solution

3. Define inertia.

Watch Video Solution

4. _____ is the measure of inertia.

Watch Video Solution

5. Define momentum.

Watch Video Solution

6. _____ is the physical quantity that changes or tends to change the state of rest or of uniform motion of a body.

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7. The rate of change of momentum of a body is pro-portional to _____.

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8. Define newton.

Watch Video Solution

9. When the mass of a body is kept constant, its acceleration is directly proportional to the _____ acting on it.

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10. Powder is sprinkled on a carom board to reduce the _____.

Watch Video Solution

11. A constant force of 2 N acts on a body for 5 seconds to change its velocity. The change in its momentum is _____.

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12. Define work. Give example of zero work

Watch Video Solution

13. What is energy?

Watch Video Solution

14. 1 newton = _____ dynes.

Watch Video Solution

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19. State the different types of equilibrium.

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20. Friction in moving parts of a machine can be reduced by using _____.

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29. What is a first order lever?

Watch Video Solution

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Watch Video Solution

31. What is the use of a pulley?

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Test Your Concepts Short Answer Type Questions

1. Derive F = ma#!#2nd Law of Motion

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2. Explain the inertia of rest through some examples.

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3. An empty truck of mass 1000 kg is moving at a speed of 36 km h^{-1}. It is loaded with 500 kg material on its way and again moves with the same speed. Will the momentum of the truck remain the same after loading? If not, find the momentum of the truck after loaded.

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4. Bring out the differecnes between the mass and the weight of a body.

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5. A railway wagon of mass 100 kg is pulled with a force of 1000 N. What is its acceleration?

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6. Explain how the position of the centre of gravity determines whether a body is in stable or unstable equilibrium.

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7. Explain the motion of a rocket as an application of Newton's third law of motion.

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8. A railway engine of mass 2 tons moving at a speed of 72 km h^{-1} collides with a wagon at rest. After collision both have a common velocity of 36 km h^{-1}. Find the mass of the wagon. (1 ton = 1000 kg)

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9. Find the centre of gravity of a triangular lamina, each side of which measures $9\sqrt{3}$ cm

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10. When is a rigid body said to be in equilibrium ? State the necessary conditions for a body to be in equilibrium.

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11. Find the effort required to lift a load of 50 kg_{wt} using a simple machine if its mechanical advantage is 4

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12. Derive the mechanical advantage of single fixed pulley?

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13. Why are passengers travelling in a double decker bus allowed to stand in a lower deck, but not in the upper deck?

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14. What is the efficiency of a machine, given mechanical advantage is 2 and velocity ratio is 4?

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15. Derive the mechanical advantage of single movable pulley?

Watch Video Solution

Test Your Concepts Essay Type Questions

1. State and Prove the law of conservation of angular momentum. Also discuss, at least two applications.

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2. Obtain the relation between mechanical advantage, velocity ratio and efficiency.

Watch Video Solution

3. Explain how the centre of gravity of an irregular lamina is determined.

Watch Video Solution

4. Explain how the centre of gravity of an irregular lamina is determined.

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Concept Application Level 1 State Whether The Following Statement Is True Or False

1. Biological forces, mechanical forces and frictional forces are the examples of:

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2. A constant external force acts on a body in motion. If the mass of the body is doubled with the force remaining the same, its acceleration also doubles. State true/false.

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3. The principle used in swimming is Newton's third law of motion.

Watch Video Solution

4. Answer true or false.

A bottle opener is an example of second class lever.

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5. Whenever a force is applied on a body, work is done.

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6. Frictional force always acts in a direction opposite to the weight of the body.

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Concept Application Level 1 Fill In The Blanks

1. Why is Newton's first law of motion also called law of inertia?

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2. A wheel barrow is an example of _____ order of lever.

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3. The force exerted by a body on the Earth is _____ the force exerted by the Earth on the body.

Watch Video Solution

4. A' can finish certain work in one day and B can finish the same work in two days. The ratio of energy spent by A to that spent by B is _____ .

Watch Video Solution

5. Momentum is the product of _____ and _____ .

Watch Video Solution

6. A car changes its speed from 20 km h^{-1} to 50 km h^{-1} of mass 3600 kg in 5 s. Determine the net external force applied on the car.

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Concept Application Level 1

1. Match the entries given in Column A with appropriate ones in Column B.

Column A			Column B
A. Dyne	( )	a.	Maximum static friction
B. Momentum	( )	b.	Mechanical advantage is two.
C. Inertia	( )	c.	Newton's third law.
D. Mass	( )	d.	Centroid of the triangle
E. Limiting friction	( )	e.	Newton's first law
F. C.G. of a triangular lamina	( )	f.	Lever of third order
G. kg m s^{-2}	( )	g.	CGS unit of force
H. Forceps	( )	h.	Mass × velocity
I. Working of rocket	( )	i.	Scalar quantity
J. Single movable pulley	( )	j.	newton

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2. When two marbles collide, their total momentum before collision is equal to

A. the difference in their momentum after collision.

B. the average of their momentum after collision.

C. the square of the sum of their momentum after collision.

D. their total momentum after collision.

Answer: D

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3. A nut cracker is a _____ order lever.

A. first-order lever

B. second-order lever

C. third-order lever

D. None of the above

Answer: B

Watch Video Solution

4. A man standing on one leg is an example of _____.

A. unstable equilibrium

B. stable equilibrium

C. neutral equilibrium

D. Both (b) and (c)

Answer: A

Watch Video Solution

5. The momentum of a body

A. is associated with its motion.

B. is a product of mass of the body and its velocity.

C. is a vector quantity.

D. All the above

Answer: D

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6. The wrong statement in the following is a)Acid-rain takes place mostly because of presence of oxides of nitrogen and sulphur in the atmosphere. b)Chloro fluoro carbons are responsible for O_3 depletion c)Green house is responsible for global warming. d)O_3 layer allows UV radiations to reach the earth

A. action and reaction act on two different bodies

B. action and reaction are equal in magnitude

C. action and reaction are opposite in direction

D. None of the above

Answer: D

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7. When a fast moving vehicle is stopped suddenly the persons sitting in it tend to fall forward. This is due to _____.

A. inertia of rest

B. inertia of motion

C. inertia of direction

D. All the above

Answer: B

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8. When a person jumps up,

A. he exerts a force on the ground.

B. the ground exerts a force on him.

C. Both (a) and (b) are true

D. Both (a) and (b) are false

Answer: C

Watch Video Solution

9. When a fast moving vehicle is stopped suddenly the persons sitting in it tend to fall forward. This is due to _____.

A. inertia of rest.

B. inertia of motion.

C. inertia of direction.

D. All the above

Answer: A

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10. Derive the mechanical advantage of single fixed pulley?

A. always equal to one.

B. always less than one.

C. always greater than one.

D. sometimes less than one and sometimes greater than one.

Answer: B

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11. Identify the wrong statement.

The momentum of a body is

A. the product of mass and velocity of the body.

B. the product of force and time.

C. the vector quantity.

D. measured in kg m s^{-1} in S.I. system.

Answer: B

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12. The centre of gravity of a boomerang is always situated

A. inside the material of the body.

B. outside the material of the body.

C. at one of its ends.

D. None of the above

Answer: B

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13. An inclined plane of length 2 m is used to lift a load of 100 kg_{wt}. The force required to lift the load is 20 kg_{wt}. The height through which the load is lifted is _____ m

A. 2

B. 2.5

C. 1.5

D. 0.4

Answer: D

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14. To increase the stability of a ship

A. the base area should be made large.

B. height of its centre of gravity should be kept as low as possible.

C. Both (a) and (b)

D. Neither (a) nor (b)

Answer: C

View Text Solution

15. A spring balance is attached to a lever of negligible mass as shown in the diagram. A body of mass 10 kgwt hangs from the lever. The reading of the spring balance is _____ kgwt

A. 2

B. 5

C. 6

D. 3.5

Answer: C

View Text Solution

16. A cone resting on its apex is an example of

A. unstable equilibrium.

B. stable equilibrium.

C. neutral equilibrium.

D. None of these

Answer: A

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17. The force of attraction between an electron revolving around the nucleus and the nucleus is _____ force.

A. a magnetic

B. an electrostatic

C. a gravitational

D. a mechanical

Answer: B

Watch Video Solution

18. Friction in moving parts of a machine can be reduced by using _____.

A. lubricants

B. ball bearings

C. iron filings

D. Both (a) and (b)

Answer: D

Watch Video Solution

19. A ball is thrown in upwards direction then the force(s) acting on it is (are)

A. gravitational force.

B. mechanical force.

C. fictional force.

D. Both (a) and (c).

Answer: D

Watch Video Solution

20. Air friction can be reduced by making the shape of the objects

A. the use of lubricants.

B. polishing surfaces.

C. by increasing the height.

D. Both (a) and (b)

Answer: D

Watch Video Solution

21. The rate of change of momentum of a body is pro-portional to _____.

A. directly proportional to the force applied on the body.

B. inversely proportional to the force applied on the body.

C. directly proportional to its surface area.

D. inversely proportional to its surface area.

Answer: A

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22. A constant force of 100 N acts on the body for 8 s for changing its momentum. The change of momentum of the body is _____ newton second.

A. 400

B. 800

C. 200

D. 100

Answer: B

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23. Action and reaction

A. always act on two different bodies.

B. are equal in magnitude.

C. are opposite in direction.

D. All the above

Answer: D

Watch Video Solution

24. A block of mass 3 kg which is at rest on a surface is pulled horizontally by a force. If the displacement of the block is 15 m in the first 3 s and the surface offers a resistance of 2 N, find the sequence of steps to calculate the magnitude of applied force.

(a) Note down the values of s, u, t and frictional force

(b) The applied force on the block is the sum of frictional force and net force

(c) Substitute the values of s, u and t in the equation of motion nad solve for 'a'

(d) Using Newton's second law of motion, calculate the net force acting on the block.

A. A D B C

B. A C D B

C. A C B D

D. A B D C

Answer: C

Watch Video Solution

25. An object of mass 500 g moving with a speed of 10 m s^{-1} collides with another object of mass 250 g moving with a speed of 2 m s^{-1} in the opposite direction. After collision both the objects move in the same direction with common velocity. Write the proper order of steps to find out their common velocity after collision.

(a) Calculate the total momentum of two bodies before collision as $m_1u_1 + m_2u_2$.

(b) Write down the given values of m_1 and m_2 in SI system

(c) Write the expression for their total momentum after collision as

$(m_1 + m_2)$ v where v is their common velocity.

(d) Assign proper signs to the initial velocities u_1 and u_2.

(e) Using law of conservation of momentum Equate the above two expressions and determine the value of v as $\frac{m_1u_1 + m_2u_2}{m_1 + m_2}$

A. B D A C E

B. A D B C E

C. B D C E A

D. C D E B A

Answer: A

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26. The work done to move an object of mass 2 kg to a height of 50 m from the ground is _____ J. $\left(g = 10ms^{-2}\right)$

A. 100

B. 500

C. 1000

D. 5000

Answer: B

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27. The centre of gravity of a ring is situated _____.

A. inside the material of the ring

B. outside the material of the ring at the centre

C. outside the material of the ring anywhere away from the centre

D. None of the above

Answer: B

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28. A bottle standing on its base is more stable than when it stands on its neck. This is so because when it stands on the base its _____.

A. base area is more.

B. centre of gravity is nearer to the base.

C. centre of gravity is at the top.

D. Both (a) and (b).

Answer: D

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29. The mechanical advantage of a broomstick is _____ .

A. always equal to one.

B. always less than one.

C. always greater than one.

D. dependent on where it is held.

Answer: B

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30. We know, $L \times dL = E \times dE$, for a given type of lever, the effort arm is always less than loadarm, then

A. The V.R. is less than one.

B. The M.A is less than one.

C. The given simple machine is a third-order lever.

D. All the above.

Answer: D

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31. Raju while drawing water from a well with help of a fixed pulley found that he applied more force than the weight of bucket and water. Then,

A. M.A is less than 1.

B. efficiency of the pulley is more than 100%.

C. V.R is equal to one.

D. Both (a) and (c).

Answer: A

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Concept Application Level 2

1. Explain why a person falling from certain height on a hard surface gets hurt more seriously than when he falls on a soft surface.

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2. A system of pulleys is used to lift a load of 1000 kg_{wt}. If the efficiency of the pulley system is 80% and velocity ratio is 20, find the effort required to lift the load.

Watch Video Solution

3. Explain why we take short steps while walking on slippery surfaces.

View Text Solution

4. Explain how winnowing allows the grain to get separated from the husk.

View Text Solution

5. A crowbar is of length 3 m. Where should the fulcrum be placed along the length of the crowbar so that a boulder of 9 kg_{wt} be lifted with it by applying an effort of 10 N? $\left(g = 10ms^{-2}\right)$

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6. A bullet of mass 50 g is fired from a gun. If the bullet acquires a velocity of 100 m s^1 in 0.1 second, what is the recoil force on the gun?

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7. A person, sitting in a car, tries to move the car by applying force to its walls. Will the car move? Explain in detail.

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8. Give an example where low inertia is preferred and an example where high inertia is recommended.

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9. Calculate the density of a cubical ice block of side 50 cm if a force 1125 N applied to it produces an acceleration of 10 m s^{-1} in it. Neglect the force of friction. Assume the ice block remains in solid state without melting.

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10. Explain why waves on strings are always transverse?

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11. An athelete runs a certain distance before taking a long jump . Why ?

Watch Video Solution

12. Find the magnitude of the foce applied to a block of mass 5 kg at rest it it moves 36 m in the first 6 seconds. Neglect the force of friction.

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13. A clean hole is made in a glass window pane when it is struck by a bullet fired from a gun. Whereas, the same window pane will be broken to pieces when struck by a stone of a similar size. Explain this phenomenon quoting the relevant principles.

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14. A car of mass 1000 kg is moving with a certain speed when a constant braking force 1000 N acts on it for 5s and the speed of the car

reduces to half its original speed. Find the further time required to stop the car if the same constant force acts.

Watch Video Solution

15. A car changes its speed from 20 km h^{-1} to 50 km h^{-1} of mass 3600 kg in 5 s. Determine the net external force applied on the car.

Watch Video Solution

16. Two forces having magnitudes 3F and 2F, when act in the same direction simultaneously on a body, the net force is equal to 25 N. Find the value of F.

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17. If a force of 50 N is applied on a body and it is still at rest, then find the magnitude of static frictional force acting on it.

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18. Find the energy possessed by a bird of 5 kg moving at a constant height of 10 m from the ground with a speed of 2 m s^{-1}. (Take $g = 10ms^{-2}$)

Watch Video Solution

19. A brick measures 12 cm $\times$ 6 cm $\times$ 3 cm. Initially, it is kept on the ground such that the rectangular surface with the smallest area is in contact with the ground and then it is placed such that the rectangular surface with the largest area touches the ground. Calculate the height of the centre of gravity from the ground in the two cases. Out of the two positions, in which case does the brick have greater stability and why?

Watch Video Solution

Concept Application Level 3

1. Two spheres of mass 10 g and 100 g each falls on the two pans of a table balance from a height of 40 cm and 10 cm, respectively. If both are brought to rest in 0.1 second, determine the force exerted by each sphere on the pans.

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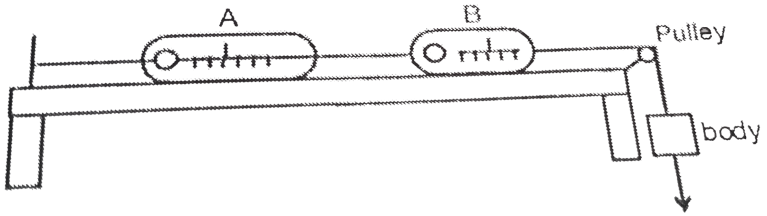
2. Two spring balances 'A' and 'B' are connected to each other and placed horizontally over a smooth frictionless table. Balance 'A' is attached to a fixed support and a body is attached to the balance 'B' as shown in figure (a). Do both the spring balances show equal readings? Explain.



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3. A hollow spherical ball is completely filled with water. But due to leakage, water continuously flows out of it and finally no water is left in the ball. Discuss the variation in the position of the center of gravity as the water leaks out.

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4. Two spheres made of clay of masses $'m_1'$ and $'m_2'$ moving along a straight line in the same direction collide with each other. Their velocities just before collision are $'u_1'$ and $'u_2'$ respectively. After collision, they stick together and move with teh same velocity, in the same direction, along the straight line. Find the velocity with which they move together.

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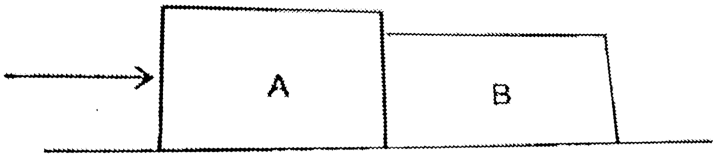
5. A force 50 N acts on a block A of mass 3 kg which is in contact with a block B of mass 2 kg, as shown in the figure. Find the forces acting on A and B. Will the same forces act on A and B if instead of applying the force to A, it is applied to B?



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6. A physics student took a solid sphere of density 2 g cm^{-3} and radius 3.5 cm and applied a force on the sphere. If an acceleration fo 1.5 cms^{-2} is produced in it, find the amount of force applied on it.

Watch Video Solution

7. A bullet of mass 50 g is fired from a gun. If the bullet acquires a velocity of 100 m s^{1} in 0.1 second, what is the recoil force on the gun?

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8. Ramu saw in a NEWS channel that a goods train of mass 200 metric ton moving with a velocity of 72 km h^{-1} collides with a passenger train of mass 300 metric ton with a velocity of 54 km h^{-1} coming in the opposite direction on the same track and both the trains move together after collision. He calculates their common velocity. Find what could be his answer.

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9. A T.V. stand with wheels is placed on a trolley. What happens if the trolley starts immediately and also if trolley is suddenly stopped?

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10. The physics teacher gave a rod of length 'L' units to Roy and the teacher asked Roy to find the shift in the centre of gravity when $1/4$ of the total length of the rod is removed. What will be the Roy's answer in terms of L?

Watch Video Solution

11. A rectangular tank is completely filled with water. But due to leakage, water continuously flows out of it and finally, the tank is empty. Discuss the variation in the position of the centre of gravity as the water leaks out.

Watch Video Solution

12. Find the centre of gravity of a solid right circular cone of height 40 cm from its top (vertex).

Watch Video Solution

13. An inclined plane of length 6 cm is used to lift a load of 42 N, by applying an effort of 7 N. Find the height of the plane.

Watch Video Solution

14. A system of pulleys is used to lift a load of 1000 kg_{wt}. If the efficiency of the pulley system is 80% and velocity ratio is 20, find the effort required to lift the load.

Watch Video Solution

15. A ball of mass 100g moving at a speed of 12 m s^{-1} strikes another ball of mass 200 g at rest. After the collision both the balls move with a common velocity. Find the common velocity.

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