PHYSICS

BOOKS - MODERN PUBLICATION

Force

Exercise

1. An elevator weighs 4000kg When the upward tension in the supporting cable is 48000 N what is the upward acceleration?

Starting from rest, how far does it rise in 3 seconds ?

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2. 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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3. 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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4. A machine gun fires a bullet of mass 50 g with a velocity $1500ms^{-1}$. The man holding it, can exert a maximum force of 600 N on the

gun. How many bullets can he fire per second at the most ?

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5. A circket ball of mass 500 g is mocing with speed of $36kmh^{-1}$. It is reflected back with the same speed. What is the impulse applied on it ?

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6. A force of 10 N acts on a body for 3 microsecond (μs). Calculate the impulse. If mass of the body is 5g, calculate the change of velocity.

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7. A bosy of mass 0.25 kg moving with velocity $12ms^{-1}$ is stopped by applying a force of 0.6 N. Calculate the time taken to stop the body. Also calculate the impluse of this force.

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8. A hammer wrighing 1 kg moving with the speed of $10ms^{-1}$ strikes the head of a nail driving it 10 cm into a wall. Neglecting the mass of the nail, calculate the acceleration during the impact.

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9. A hammer wrighing 1 kg moving with the speed of $10ms^{-1}$ strikes the head of a nail

driving it 10 cm into a wall. Neglecting the mass of the nail, calculate the acceleration during the impact.

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10. A hammer weighing 1 kg moving with the speed of $10ms^{-1}$ strikes the head of a nail driving it 10 cm into a wall. Neglecting the mass of the nail, calculate the impulse.

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11. A spring balance is attached to the ceiling of a stationary lift. A man suspends a block from the hook of the spring balance and the balance reads 98 N. What will be the reading of the spring balance, if the lift starts moving downward with an acceleration of $2ms^{-2}$?

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12. A heavy load of mass 600 kg is placed on the weighing machine lying in a lift. What will

be reading of the weighing machine, when the lift is at rest ?

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13. A heavy load of mass 600 kg is placed on the weighing machine lying in a lift. What will be reading of the weighing machine, when the lift is moving upwards with an acceleration of $2.2ms^{-2}$?

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14. A heavy load of mass 600 kg is placed on the weighing machine lying in a lift. What will be reading of the weighing machine, when the lift is moving downwards with an acceleration of $2.8ms^{-2}$?

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15. A heavy load of mass 600 kg is placed on the weighing machine lying in a lift. What will be reading of the weighing machine, when the

lift is falling freely due to the rupture of the cable?

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16. During explosion, a bomb explodes into three pieces. Two fragments, whose masses are 0.8 kg and 0.5 kg fly off with velocities of $10ms^{-1}$ and $16ms^{-1}$ respectively along the paths at right angles to each other. If the third fragment goes off with a velocity of $24ms^{-1}$,

then find its mass and direction of motion w.r.t. the first fragment.

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17. Two masses 7 kg and 12 kg are connected at the two ends of a light inextensible string that passes over a frictionless pulley [Fig.

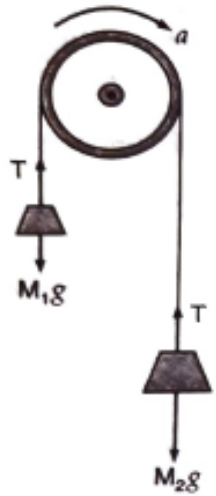

Fig. 1.16

Fig. 1.17 (a)

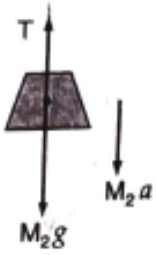

Fig. 1.17 (b)

]. Find the acceleration of the masses and the tension in the string , when the masses are released.

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18. A horizontal force 600 N pulls two masses 10 kg and 20 kg lying on a frictionless table conneced by a light string find tension in the string if the force is applied on 20 kg mass.

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19. Two blocks, each having, mass 20 kg, rest on a frictionless surface as shown in Fig

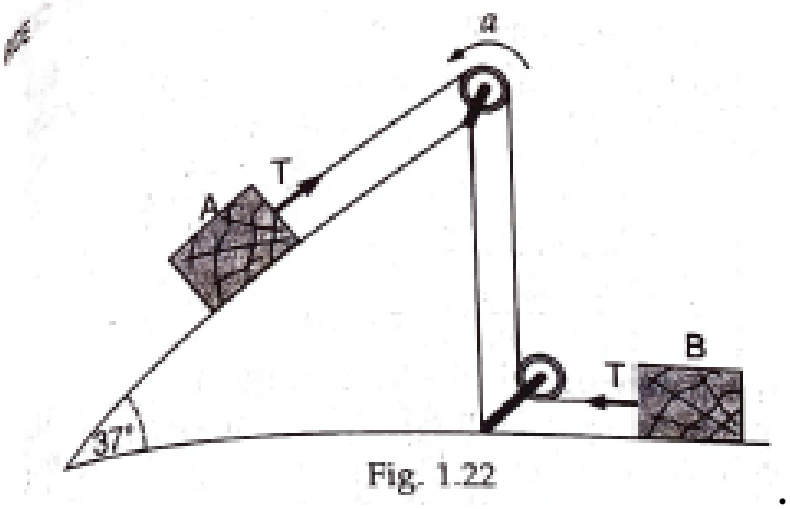

Fig. 1.22

Assuming the pulleys to be light and frictionless, calculate acceleration of the system. assume $\sin\theta = 3/5$

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20. Two blocks, each having, mass 20 kg, rest on a frictionless surface as shown in Fig

Assuming the pulleys to be light and frictionless, calculate the tension in the string.

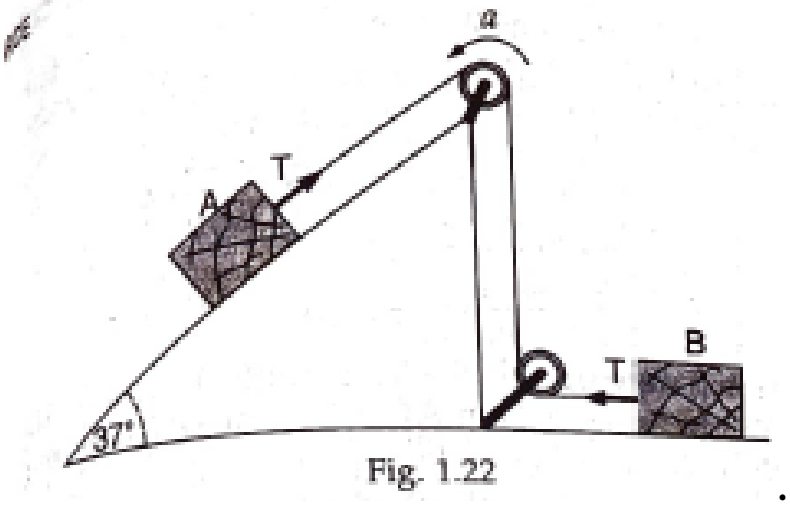

Fig. 1.22

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21. Two blocks, each having, mass 20 kg, rest on a frictionless surface as shown in Fig Assuming the pulleys to be light and

frictionless, calculate the time required for block A to move 1 m down the plane.

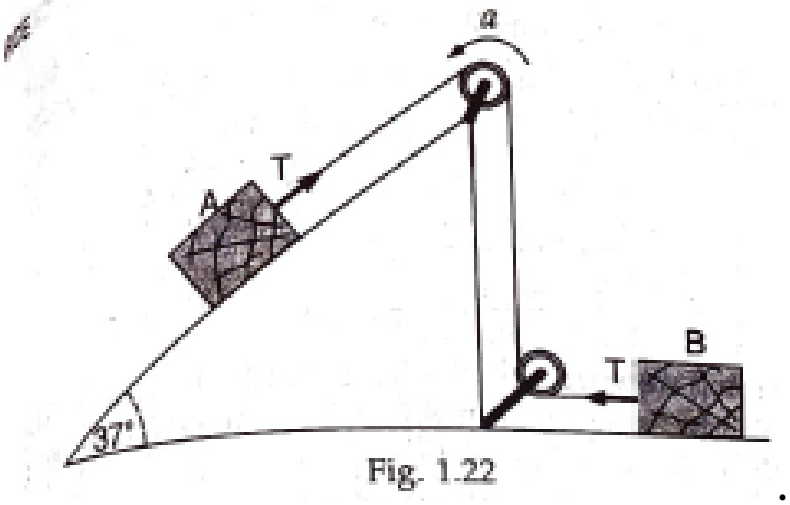

Fig. 1.22

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22. Two blocks connected by an inextensible string passing over a light frictionless pulley are resting on two smooth inclined planes as

shown in Determine the acceleration of the blocks and the tension in the string. Assume the string to be massless. Fig.

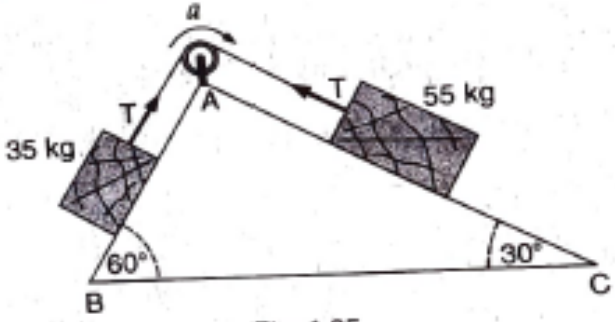

Fig. 1.25

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23. A particle of mass $10^{-2}kg$ is moving along the positive X-axis under the influence of a force $F(x) = -\frac{K}{2x^{2'}}$ where $K = 10^{-2}Nm^2$

. When it is at x=1.0m, its velocity $v = 0$. Find its velocity, when it reaches $x = 0.50m$.

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24. A disc of mass 10g is kept floating horizontally by throwing 10 marbles s^{-1} against it from below. If the mass of each marble is 5g, calculate the velocity with which the marbles are striking the disc. Assume that the marbles strike the disc normally and rebound downward with the same speed.

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25. A cricket ball of mass 150g is moving with a velocity of $12ms^{-1}$ and is hit by a bat so that the ball is turned back with a velocity of $20ms^{-1}$. The force of blow acts for 0.01s on the ball. Find the average force exerted by the bat on the ball.

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26. A uniform rope of lrngth L is pulled by constant force F. What is the tension in the rope at a distance l from the end, where it is applied ?

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27. 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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28. A lift is going up. The total mass of the lift and the passengers is 1500kg. The variation in the speed of the lift is given by the graph as shown in Fig.

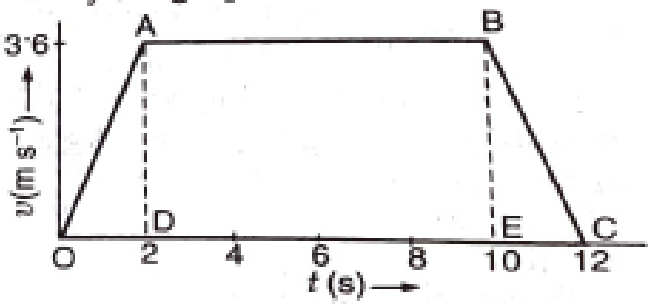

Fig. 1.30

. What will be the tension in the rope pulling the lift at time t equal to $11s$.

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29. A lift is going up. The total mass of the lift and the passengers is 1500kg. The variation in the speed of the lift is given by the graph as shown in Fig.

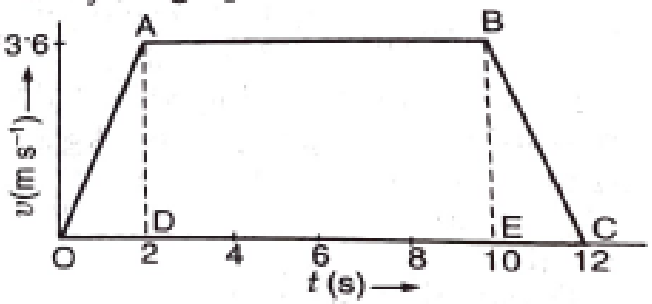

Fig. 1.30

. What will be the tension in the rope pulling the lift at time t equal to 6s.

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30. A lift is going up. The total mass of the lift and the passengers is 1500kg. The variation in the speed of the lift is given by the graph as shown in Fig.

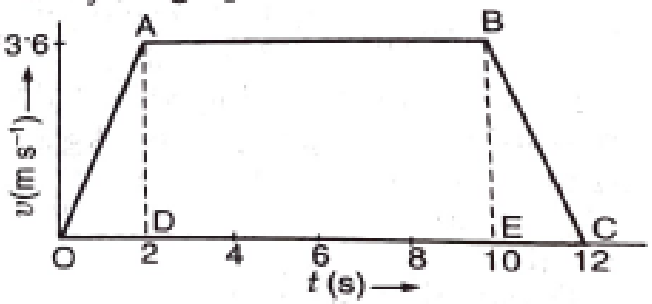

Fig. 1.30

. What will be the tension in the rope pulling the lift at time t equal to $1s$?

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31. A lift is going up. The total mass of the lift and the passengers is 1500kg. The variation in the speed of the lift is given by the graph as shown in Fig.

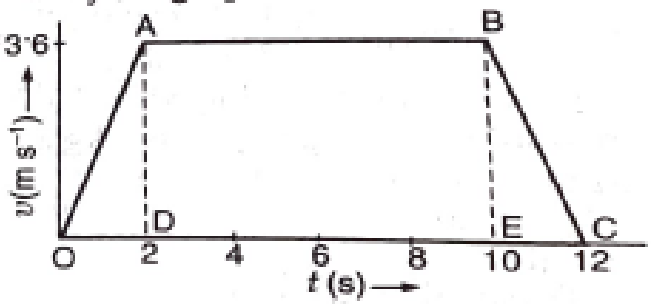

Fig. 1.30

. What will be the average acceleration during the course of the entire motion ?

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32. A lift is going up. The total mass of the lift and the passengers is 1500kg. The variation in the speed of the lift is given by the graph as shown in Fig. What is the height, to which the

lift takes the passengers ?.

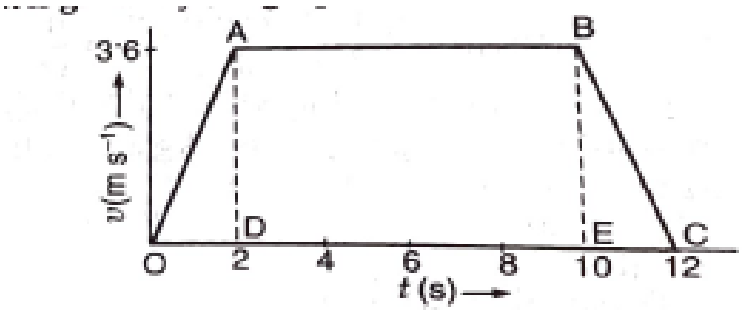

Fig. 1.30

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33. Is force needed to keep a body moving with uniform velocity ?

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34. What is inertia?

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

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36. Why a fan continues to rotate for sometime even after it is switched off ?

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

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38. Define the term momentum. Give its SI unit.

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39. A bullet fired from a rifle is more dangerous than an air molecule hitting a person through both of them have atmost the same speed. Explain.

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

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41. Is Newton's second law $(F = Ma)$ always valid. Give an example in support of your answer.

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42. The rate of change of momentum of a body is $5kgms^{-1}$. What is the force acting on the body?

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43. Give and state SI unit of force.

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44. What is the difference between mN and nm ?

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

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46. What is impulsive force?

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

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48. Which is greater-the attraction of 10 kg mass for earth or the earth's attraction for 10 kg mass ?

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49. A body is moving along a circular path such that its speed always remains constant. Should there be a force acting on the body ?

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50. State principle of conservation of momentum.

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

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52. Can a body remain in state of rest, when external forces are acting on it ? Explain your answer.

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53. A body is acted upon by a number of external forces. Can it remain at rest ?

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

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55. Name physical situation, where the mass of body changes with time.

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56. When are the two bodies said to posses equal masses ?

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57. Is a bus moving along a circular track, an inertia frame of reference ?

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58. what can be said about the motion of the vehicle if a plumb line hanging from its roof drops vertically ?

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59. The assertion mad by the Newton's first law of motion that every body continues in its state of uniform motion in the absence of external force appears to be contradicted in everyday experience. Why ?

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60. According to Newton's first law of motion, a body moving with a uniform speed along a stright line should continue moving. In practice, a body in motion stops after some time. Explain the reason.

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

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62. Why do we fall forward, when a moving body suddenly stops ? Explain, stating the law required.

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63. Why the passengers fall in backward direction when a bus suddenly starts moving from the rest position.

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64. A stone when thrown on a glass window smashes the window pane to pieces, but a bullet from the gun passes through making a clean hole. Why ?

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

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66. Why are shockers used in scooter and cars ? Explain.

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67. A man suspends a fish from the spring balance held in his hand and the balance reads 9.8 N. While shifting the balance to his other hand, the balance slips and falls down.

What will be the reading of the balance during the fall ?

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68. A spring weighing machine inside a stationary lift reads 50 kgf, when a mans stands on it. What would happen to the scale reading, if the lift is moving upward with constant velocity ?

Watch Video Solution

69. A spring weighing machine inside a stationary lift reads 50 kgf, when a mans stands on it. What would happen to the scale reading, if the lift is moving upward with constant acceleration ?

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70. In which case will a rope have the greater tension : two men pull the ends of the rope with forces F equal in magnitude but opposite in direction.

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71. In which case will a rope have the greater tension :(a) One end of the rope is fastened to a fixed support and the other is pulled by a man with a force 2F.(b) Two men pull the ends of the rope with forces F equal in magnitude but opposite in direction.

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72. A rope passes over a pulley, which is sufficiently high. Two monkeys of equal weights climb the rope from opposite ends, one of then climbing quickly than the other, relative to the rope. Which of the monkeys will reach the top first ? Assume that pulley is weightless, while the rope is weightless as well as inextensible.

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73. A massless rope is passed over a frictionless pulley. A monkey holds on to one end of the rope and a mirror having the same weight as the monkey, is attached to the other end of the rope at the monkey's level. Can the monkey get away from his image seen in the mirror by climbing up the rope.

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74. A massless rope is passed over a frictionless pulley. A monkey holds on to one end of the rope and a mirror having the same weight as the monkey, is attached to the other end of the rope at the monkey's level. Can the monkey get away from his image seen in the mirror by climbing down the rope.

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75. A massless rope is passed over a frictionless pulley. A monkey holds on to one end of the rope and a mirror having the same weight as the monkey, is attached to the other end of the rope at the monkey's level. Can the monkey get away from his image seen in the mirror by by releasing the rope ?

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76. What is inertia ? Why do we call the Newton's first law as the law of inertia ? Explain.

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

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78. What are the S.I. and C.G.S units of force? Give a relationship between them.

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

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80. Newton's second law gives the measure of

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81. State Newton's second law of motion. How it helps us to measure force ? State its CGS and SI units.

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82. State Newton's laws of motion. Hence, derive the relation $\overrightarrow{F} = M\overrightarrow{a}$, where the symbols have their usual meanings.

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

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84. State Newton's second law of motion. How it helps us to measure force ? State its CGS and SI units.

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85. State the law of conservation of angular momentum.

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

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87. Two masses 7 kg and 12 kg are connected at the two ends of a light inextensible string that passes over a frictionless pulley [Fig.

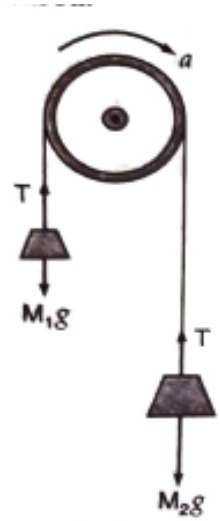

Fig. 1.16

Fig. 1.17 (a)

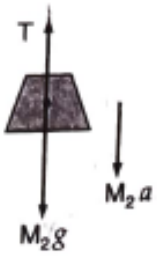

Fig. 1.17 (b)

]. Find the acceleration of the masses and the tension in the string , when the masses are released.

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88. How does the weight of a man standing in a lift changes, when the lift accelerates upwards with an acceleration a ?

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89. How does the weight of a man standing in a lift changes, when the lift accelerates downwards with an acceleration a ?

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

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91. D,E,F are mid-points of the sides of the triangle ABC, show that for any point O, the system of concurrent forces represented by $\overrightarrow{OA}, \overrightarrow{OB}, \overrightarrow{OC}$ is equivalent to the system represented by $\overrightarrow{OD}, \overrightarrow{OE}, \overrightarrow{OF}$.

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92. State Newton's second law of motion. Hence, derive the equation of motion $F = Ma$. From it, obtain the unit of force in SI.

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93. Newton's second lasw of motion is not the real law of motion.(Yes//No)

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94. Newton's second law gives the measure of

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95. State principle of conversation of momentum.

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96. State principle of conversation of momentum.

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97. State principle of conversation of momentum.

Watch Video Solution

98. State principle of conversation of momentum.

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99. State principle of conversation of momentum.

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100. State and prove the principle of conversation of linear momentum. Apply this law, to explain why a rocket goes up, when fired.

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101. State and prove the principle of conversation of linear momentum. Apply this law, to explain why the boat moves away, when a man jumps from it to the shore.

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102. A force of 128 gf acts on a mass of 490 g for 10 s. What velocity will it give to the mass ?

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103. A constant force acts for 3s on a body of mass 16 kg and then ceases to act. During the next 3s, the body covers 81m. Find the magnitude of the force.

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104. 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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105. 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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106. A motor car running at the rate of 7 m s^-1` can be stopped by its brakes in 10m.Prove that total resistance to the motion when braeks are on is one-fourth of the weight of the car.

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107. 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?

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108. A bullet of mass 25 g strikes horizontally a block of wood with a velocity of $250ms^{-1}$ and penetrates it a distance of 1.0 m. Calculate the resistance to be uniform. How far would the

bullet have penetrated, if the speed of the bullet has been $200ms^{-1}$?

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109. A bullet moving with a velocity of $100ms^{-1}$ pierces a block of wood and moves out with a velocity of $10ms^{-1}$. If the thickness of the block reduces to one half of the previous value, what will be the emerging velocity of the bullet ?

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110. A batsman hits back a ball straight in the direction of the bowler without changing its speed of $12ms^{-1}$. If the mass of the ball is 0.15 kg, determine the impulse imparted to the ball.

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111. A force of 16 N acts on a ball of mass 80 g for 1 microsecond. Calculate the acceleration and the impulse.

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112. A bullet of mass 60 g moving with a velocity of $500ms^{-1}$ is brought to rest in 0.01s. Find the impulse and the average force of blow.

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113. A cricket ball of mass 0.2 kg moves with a velocity of 20 m/s and is brought to rest by a

player in 0.1 s. Calculate the impulse of the ball and average force applied by the player.

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114. Calcualte the impulse necessary to slope 1500 kg car travelling at $90kmh^{-1}$.

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115. A glass marbles, whose mass is 100g, falls from a height of 40m and rebounds to a

height of 10m. Find the impulse and the vaergae force between the marble and the floor, if the time during which they are in contact is 0.2 s. take $g = 9.8ms^{-2}$.

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116. A hammer of mass 1 kg strikes on the head of a nail with a velocity $10ms^{-1}$. It drives the nail 0.1m into a wooden block. Calculate the force applied by the hammer and the time of impact.

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117. A ball moving with a momentum of $15ms^{-1}$ strikes against the wall at an angle of 30° and is reflected with the same momentum at the same angle. Calculate the impulse.

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118. 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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119. A body of mass 100 kg stands on a spring weighing amchine inside a lift. The lift starts to ascend with acceleration of $2.2ms^{-2}$. What is the reading of the machine ?

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120. A woman weighing 50 kgf stands on a weighing machine placed in a lift. What will be the reading of the machine, when the lift is moving upwards with a uniform velocity of $5ms^{-1}$.

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121. A woman weighing 50 kgf stands on a weighing machine placed in a lift. What will be the reading of the machine, when the lift is

moving downwards with a uniform acceleration of $1ms^{-2}$? Take $g = 10ms^{-2}$.

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122. An elevator weighing 5000 kgf is moving upward and tension in the supporting cable is 50000 N. Find the upward acceleration. How far does it rise in a time of 10 seconds starting from rest ?

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123. A gun weighing 10 kg fires a bullet of 50 g with a velocity of $500ms^{-1}$. With what velocity does the gun recoil ? What is the resultant momentum of the gun and the bullet before and after firing ?

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124. A shell of mass 10 kg moving with a velocity of $20ms^{-1}$ explodes into two portions of 6 kg and 4 kg respectively. If the

former is just brought to rest after the explosion, find the velocity of the latter.

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125. Two bodies of mass 2 kg nd 3 kg are connected to the ends of a string of negligible mass and then passed around a frictionless pulley. Calculate the acceleration of the system.

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126. Two bodies of mass 2 kg nd 3 kg are connected to the ends of a string of negligible mass and then passed around a frictionless pulley. Calculate the tension in the string.

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

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128. A block of mass 0.8 kg is dragged along a level surface at constant velocity by a hanging block of mass 0.2 kg s shown in Fig.

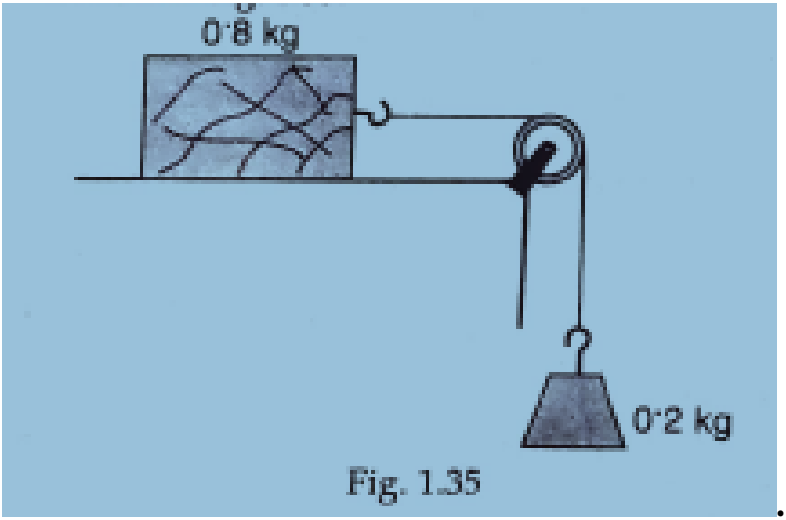

Fig. 1.35

Calculate the tension in the string and the acceleration of the system.

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129. A wooden block weighing 200 g is attached to a hanger weighing 45 g with a fine thread. The block is placed on a frictionless surface and after passing thread over a smooth pulley, hanger is allowed to pull the block. Find the acceleration of the system and tension in the string.

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

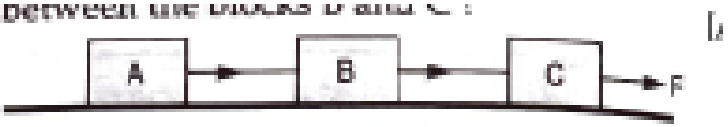

Fig. 1.36

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131. A lift is moving down with an acceleration of $3ms^{-2}$. A ball is releasd 1.7 m above the lift

floor. Assuming $g = 9.8ms^{-2}$, how long will the ball take to hit the floor ?

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132. A 20 kg cart, with a boy of mass 60 kg riding it, is moving with a speed of $2ms^{-1}$. The boy jumps off the cart. What is the change in speed of the cart, if the boy on hitting the ground is moving with the same speed as the cart ?

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133. A 20 kg cart, with a boy of mass 60 kg riding it, is moving with a speed of $2ms^{-1}$. The boy jumps off the cart. What is the change in speed of the cart, if not moving relative to the ground ?

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134. A 20 kg cart, with a boy of mass 60 kg riding it, is moving with a speed of $2ms^{-1}$. The boy jumps off the cart. What is the change

in speed of the cart, if moving with twice the initial speed of the cart in same direction ?

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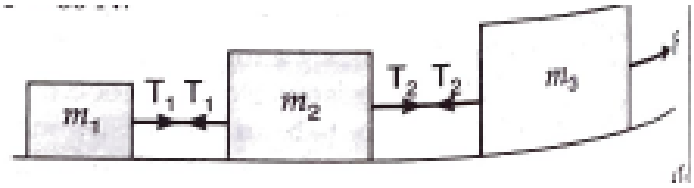
135. Three blocks of masses $m_1 = 10kg, m_2 = 20kg$ and $m_3 = 30kg$ are connected by strings on a smooth horizontal take as shown in Fig.



and pulled to the right with a force F=60N. Find

the acceleration of the system and tensions T_1 and T_2.

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136. A wooden block of mass 0.01 kg is dropped from the top of a cliff 100 m high. Simultaneously, a bullet of mass 0.01 kg is fired from the foot of the cliff upwards with a velocity of $100ms^{-1}$. Where and after what time, will they meet ?

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137. A wooden block of mass 0.01 kg is dropped from the top of a cliff 100 m high. Simultaneously, a bullet of mass 0.01 kg is fired from the foot of the cliff upwards with a velocity of $100ms^{-1}$. Where and after what time, will they meet ?

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