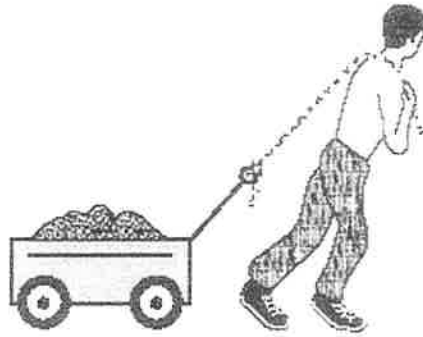


* Answer Key *

Newton's Laws Test

1. The diagram below shows a worker using a rope to pull a cart. The worker's pull on the handle of the cart can best be described as a force having



- a) both magnitude and direction
b) magnitude, only
c) neither magnitude nor direction
d) direction, only

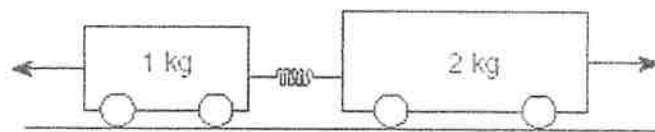
2. If the sum of all the forces acting on a moving object is zero, the object will

- a) accelerate uniformly
b) slow down and stop
c) change the direction of its motion
d) continue moving with constant velocity

3. Which object has the most inertia?

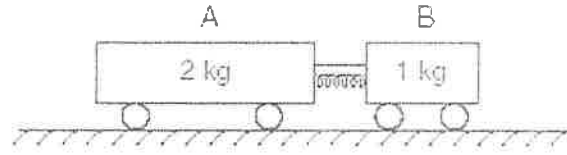
- a) a 10.-kg sled at rest
b) a 0.1-kg baseball traveling at 20 m/s
c) a 5-kg bowling ball traveling at 3 m/s
d) a 0.001-kg bumblebee traveling at 2 m/s

4. Two carts are pushed apart by an expanding spring, as shown in the diagram below. If the average force on the 1-kg cart is 1 newton, what is the average force on the 2-kg cart?



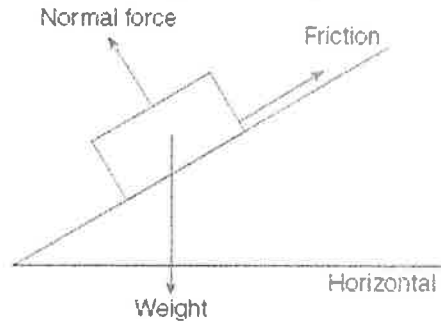
- a) 0.5 N
b) 4 N
c) 1 N
d) 0.0 N

5. The diagram shows a compressed spring between two carts initially at rest on a horizontal frictionless surface. Cart A has a mass of 2 kilograms and cart B has a mass of 1 kilogram. A string holds the carts together. What occurs when the string is cut and the carts move apart?



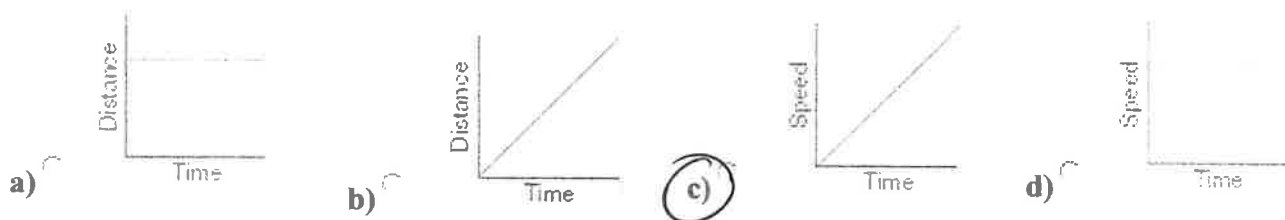
- a) The magnitude of the acceleration of cart A is one-half the magnitude of the acceleration of cart B.
- b) The magnitude of the force exerted on cart A is one-half the magnitude of the force exerted on cart B.
- c) The length of time that the force acts on cart A is twice the length of time the force acts on cart B.
- d) The magnitude of the acceleration of cart B is one-half the magnitude of the acceleration of cart A.

6. Three forces act on a box on an inclined plane as shown in the diagram below. [Vectors are not drawn to scale.] If the box is at rest, the net force acting on it is equal to

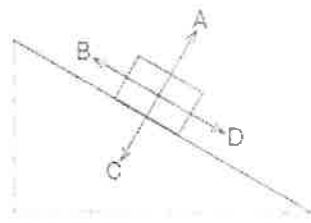


- a) zero
- b) the normal force
- c) the weight
- d) friction

7. Which graph best represents the motion of an object that has an unbalanced force acting on it as it travels along a straight line?

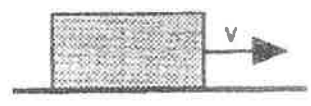


8. The diagram below represents a block sliding down an incline. Which vector best represents the frictional force acting on the block?



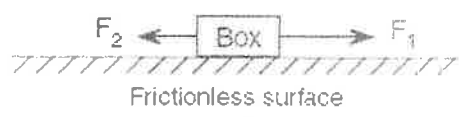
- a) C **b) B** c) D d) A

9. A box decelerates as it moves to the right along a horizontal surface, as shown in the diagram at the right. Which vector best represents the force of friction on the box?



- a)** ← b) ↑ c) → d) ↓

10. In the diagram below, a box is on a frictionless horizontal surface with forces F_1 and F_2 acting as shown. If the magnitude of F_1 is greater than the magnitude of F_2 , then the box is

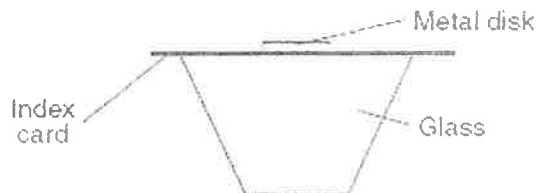


- a) moving at constant speed in the direction of F_2 **c) accelerating in the direction of F_1**
 b) accelerating in the direction of F_2 d) moving at constant speed in the direction of F_1

11. The magnitude of the force that a baseball bat exerts on a ball is 50. newtons. The magnitude of the force that the ball exerts on the bat is

- a) 50. N** b) 10. N c) 5.0 N d) 250 N

The next two questions refer to the diagram below. The diagram below shows a 1.0-newton metal disk resting on an index card that is balanced on top of a glass.



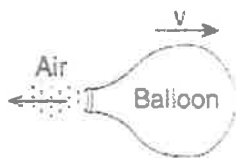
12. What is the net force acting on the disk?

- a) 1.0 N b) 2.0 N c) 0 N d) 9.8 N

13. When the index card is quickly pulled away from the glass in a horizontal direction, the disk falls straight down into the glass. This action is a result of the disk's

- a) shape b) inertia c) temperature d) charge

14. As shown in the diagram below, an inflated balloon released from rest moves horizontally with velocity v . The velocity of the balloon is most likely caused by



- a) centripetal force b) action-reaction c) rolling friction d) gravitational attraction

15. A carpenter hits a nail with a hammer. Compared to the magnitude of the force the hammer exerts on the nail, the magnitude of the force the nail exerts on the hammer during contact is

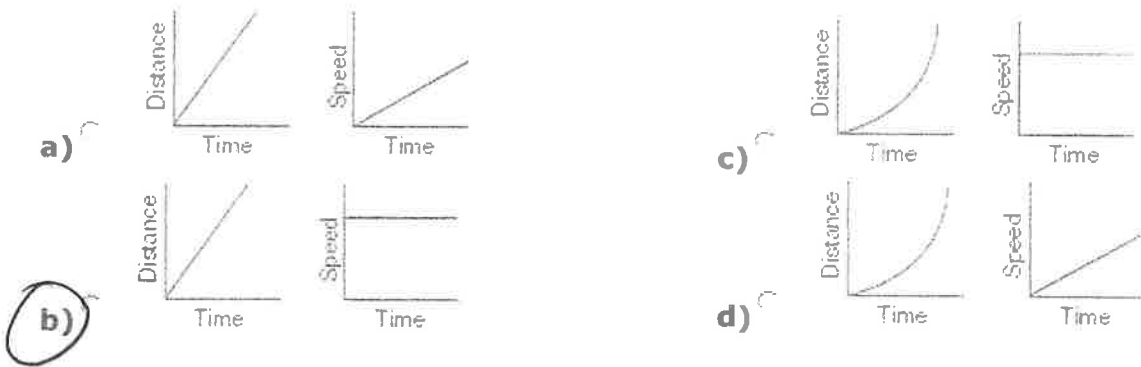
- a) greater b) the same c) less d) cannot be determined

16. In the diagram below, the upward drag force acting on a parachute is equal in magnitude but opposite in direction to the weight of the parachutist and equipment. As a result of the forces shown, the parachutist may be moving



- a) downward with decreasing speed
- b) upward with constant acceleration
- c) downward at constant speed**
- d) upward with decreasing speed

17. Which two graphs represent the motion of an object on which the net force is zero?



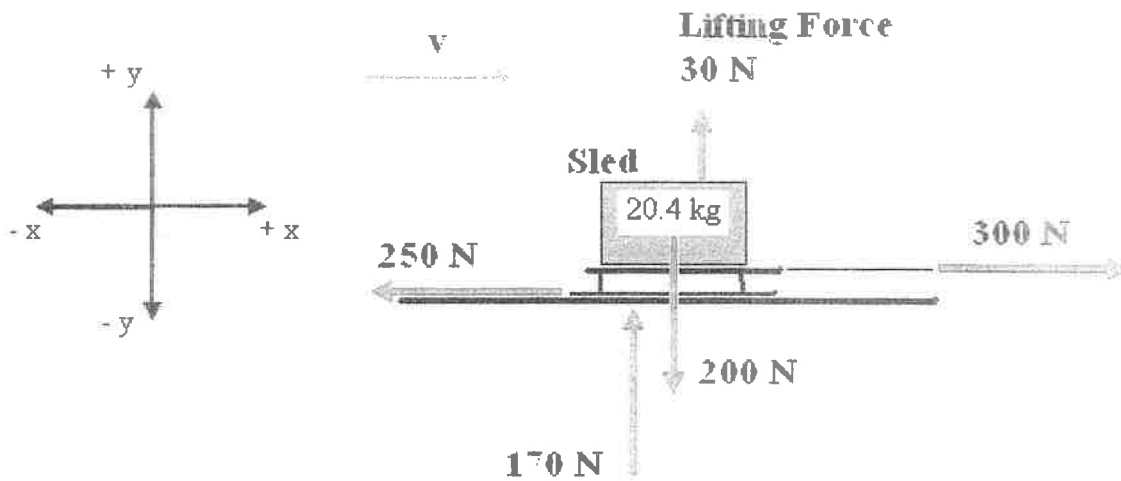
18. Which of the following causes an object to resist acceleration when a force is initially applied?

- a) inertia**
- b. unbalanced force
- c. friction
- d. velocity

19. If the net force on an object is zero, then the object is definitely

- a) at rest or moving with a constant velocity.**
- b. losing mass.
- c. being accelerated.
- d. none of the above.

The next five questions refer to the diagram below.



20. In the force diagram shown above, what is the net force **in the x-direction** (left-right) acting on the sled?

- a. 50 N c. 550 N
 b. 300 N d. -50 N

21. In the force diagram shown above, which force is the normal force?

- a. 170 N c. 30 N
 b. 200 N d. None of the above.

22. In the force diagram shown above, what is the net force **in the y-direction** (up-down) acting on the sled?

- a. 400 N c. 370 N
 b. 170 N d. 0 N

23. In the force diagram shown above, in which direction or directions will the sled accelerate?

- a. + x and + y c. + y
 b. + x d. - x and + y

24. In the force diagram shown above, what is the **ACCELERATION in the x-direction** (left-right)?

- a. 0.25 m/s^2 c. 50 m/s^2
 b. 2.45 m/s^2 d. 50 N

25. According to Newton's second law, when the same force is applied to two objects of different masses,

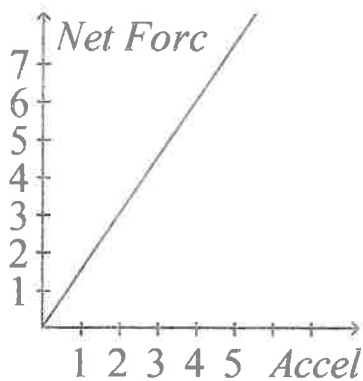
- a. the object with smaller mass will experience a greater acceleration.
- b. the acceleration of the objects is not related to their masses.
- c. the object with smaller mass will experience a smaller acceleration.
- d. the objects will both experience the same acceleration.

26. A net force of 30 N accelerates a 120 kg scooter across a level parking lot. What is the scooter's acceleration?

- a. 0.5 m/s^2
- b. 0.25 m/s^2
- c. 0.69 m/s^2
- d. 3.2 m/s^2

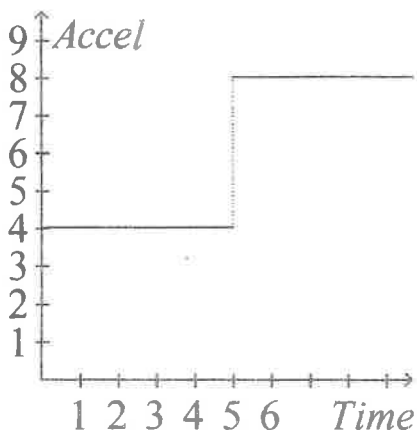
27. Which statement about the acceleration of an object is correct?

- a. The acceleration of an object **increases** as the net force decreases.
- b. The acceleration of an object **decreases** as the net force decreases.
- c. The acceleration of an object is not related to net force.
- d. The acceleration of an object **remains constant** as the net force decreases.



28. According to the **above** graph, when net force increases, acceleration

- a. changes randomly.
- b. increases.
- c. decreases.
- d. remains constant.



29. According to the **above** graph, if the net force remains constant, the doubling of acceleration at 5 sec must be caused by

- a. cutting the mass by half. c. tripling the mass of the object.
 b. doubling the mass. d. none of the above.

30. A net force of 360 N accelerates a 90 kg cyclist up a hill. Find her acceleration.

- a. 4 N c. 32,400 m/s²
 b. 4 m/s² d. 3 m/s²

31. A wagon having a mass of 32 kg is accelerated across a level road at 2 m/s². What net force acts on the wagon?

- a. 16 N c. 64 N
 b. 2 N d. 32 N

32. Which of the following forces arises from direct physical contact between two solid objects?

- a. field force c. normal force
 b. air resistance d. gravitational force

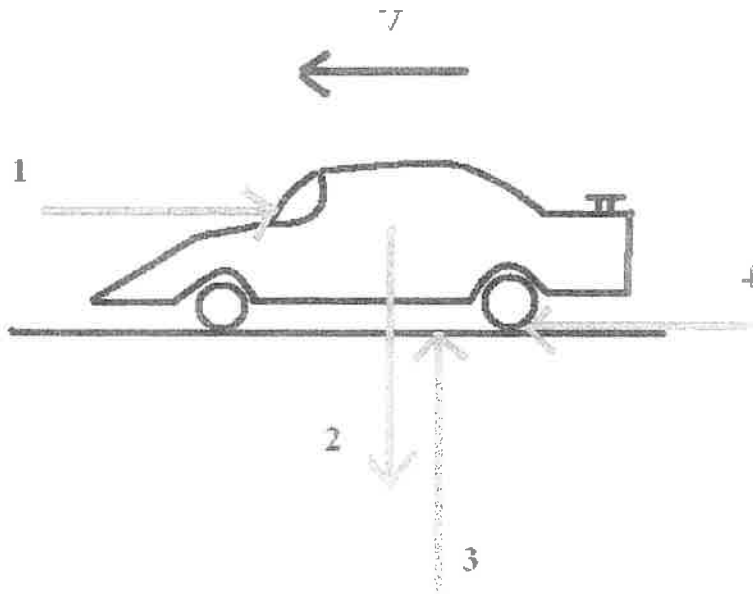
33. Newton's third law of motion involves the interactions of

- a. two objects and one force. c. one object and two forces.
 b. one object and one force. d. two objects and two forces.

34. A hockey stick hits a puck on the ice. Identify an action-reaction pair in this situation.

- a. The stick exerts a force on the puck; the puck exerts a force on the ice.
 b. The stick exerts a force on the puck; the puck exerts a force on the stick.
 c. The stick exerts a force on the ice; the ice exerts a force on the puck.
 d. The puck exerts a force on the stick; the stick exerts a force on the ice.

The next four questions refer to the diagram below.



35. In the force diagram above, which force is weight?

- | | | | |
|-----------|---|----|---|
| a. | 1 | c. | 3 |
| b. | 2 | d. | 4 |

36. In the force diagram above, which force is the tires pushing on the road?

- | | | | |
|----|---|-----------|---|
| a. | 1 | c. | 3 |
| b. | 2 | d. | 4 |

37. In the force diagram above, which force is the normal force?

- | | | | |
|----|---|-----------|---|
| a. | 1 | c. | 3 |
| b. | 2 | d. | 4 |

38. In the force diagram above, which force is air resistance?

- | | | | |
|-----------|---|----|---|
| a. | 1 | c. | 3 |
| b. | 2 | d. | 4 |

39. When a car's wheels push backward on the ground (action), the reaction force is

a.	the ground pushes the wheels backward.	c.	the ground pushes the wheels forward.
b.	the wheels push the car forward.	d.	the engine pushes the car forward.

40. What is the name for equal and opposite forces resulting from the interaction of two objects?

- | | | | |
|----|-----------------------|-----------|----------------------|
| a. | net external forces | c. | field forces |
| b. | action-reaction pairs | d. | gravitational forces |

41. Newton's 3rd Law of Motion states that

- a. no object can accelerate because all forces are balanced by forces in the opposite direction.
- b. when one object exerts a force on a second object, the more massive of the two objects exerts the larger force.
- c. any force on one object is balanced by a second force on that same object in the opposite direction, so the object cannot accelerate.
- d. when one object exerts a force on a second object, the second object exerts a force of equal magnitude on the first object, in the opposite direction.

42. Newton's 3rd law shows us that the normal force is

- a. the reaction force to an object pushing down on the ground.
- b. the reaction force to the Earth pulling down on an object.
- c. an action all its own.
- d. None of the above, because the normal force is not related to Newton's 3rd law.

43. A 1,000 kg car moving east at 10 m/s is struck from the rear by a 20,000 kg truck moving east at 25 m/s. According to Newton's 3rd law

- a. the action force of the truck pushing the car will be smaller than the reaction of the car pushing back on the truck.
- b. neither the car nor the truck will accelerate, because all action forces are balanced by equal and opposite reaction forces.
- c. the action force of the truck pushing the car will be larger than the reaction of the car pushing back on the truck.
- d. the action and reaction forces will be equal in size.

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