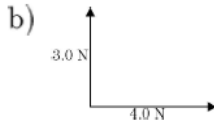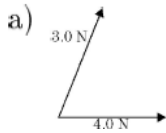1. Which of the following is a vector quantity?
   a) distance   b) time   c) mass   d) velocity

2. A 3.0 N force and a 4.0 N force act concurrently on a point. In which diagram shown would the orientation of these forces produce the greatest net force on the point?

   a) 3.0 N / 4.0 N   b) 3.0 N / 4.0 N   c) 3.0 N / 4.0 N   d) 4.0 N / 3.0 N
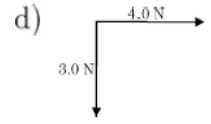
3. In the diagram shown, surface A of the wooden block has twice the area of surface B. If it takes x newtons to keep the block moving a constant speed across the table when it slides on surface A, what force is needed to keep the block moving at a constant speed when it slides on surface B?
   a) x   b) 2x   c) 0.5x   d) 4x
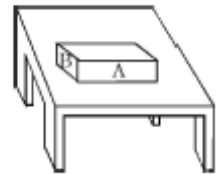
4. A cart rolls down an inclined plane with a constant speed as shown in the diagram. Which arrow represents the direction of the frictional force?
   a) A   b) B   c) C   d) D
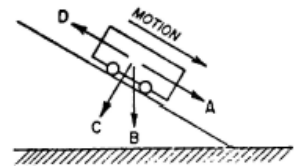
5. The diagram represents a car resting on a hill. Which vector best represents the weight of the car?
   a) A   b) B   c) C   d) D
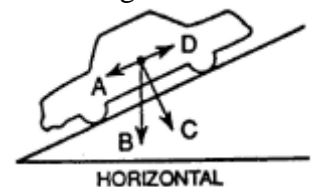
Use the following information for #6, 7, and 8:
A cannon fires a projectile at an angle with the horizontal. The horizontal component of the projectile's initial velocity is 866 m/s and its initial vertical component is 500 m/s. (Neglect air resistance.)

6. What is the shape of the path that the projectile will follow?
   a) circular   b) straight   c) hyperbolic   d) parabolic

7. After 5.00 seconds, what is the vertical component of the projectile's velocity?
   a) 549 m/s   b) 500 m/s   c) 451 m/s   d) 49.0 m/s

8. The maximum height to which the projectile rises is approximately:
   a) 2.50 a 10^3 m   b) 1.27 x 10^4 m   c) 1.54 x 10^4 m   d) 4.42 x 10^4 m

9. A ball is fired vertically upward at 5.0 m/s from a cart moving horizontally to the right at 2.0 m/s. Which vector best represents the resultant velocity after the ball was fired?

a) ⟶ v   b) ↑ v   c) ⌐ v   d) ↗ v
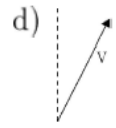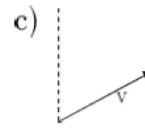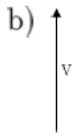
10. A projectile is fired with a velocity of 150 m/s at an angle of 30° with the horizontal. What is the magnitude of the vertical component of the velocity at the time the projectile is fired?
a) 75.0 m/s   b) 130 m/s   c) 150 m/s   d) 225 m/s

11. A block is at rest on an inclined place as shown in the diagram. As angle θ is increased, the component of the block's weight parallel to the plane
a) decreases   b) increases   c) remains the same

12. The diagram shown represents a ball being kicked and rising at an angle of 30° from the horizontal. The ball has an initial velocity of 5.0 m/s. (Neglect friction.)
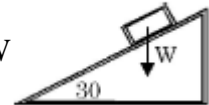
As the ball rises, the vertical component of its velocity
a) decreases   b) increases   c) remains the same

13. In the diagram, the weight of a box on a plane inclined at 30° is represented by the vector W. What is the magnitude of the component of the weight (W) that acts parallel to the incline?
a) W   b) 0.50 W   c) 0.87 W   d) 1.5 W

14. A bird feeder with two birds has a total mass of 2.0 kg and is supported by wire as shown in the diagram. The force in the top wire is approximately
a) 10 N   b) 14 N   c) 20 N   d) 39 N
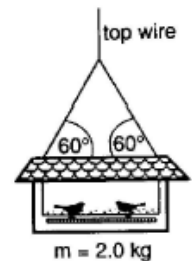
15. The diagram shows a baseball being hit with a bat. Angle θ represents the angle between the horizontal and the ball's initial direction of motion. Which value of θ would result in the ball traveling the longest horizontal distance? (Neglect air resistance.)
a) 25°   b) 45°   c) 60°   d) 90°
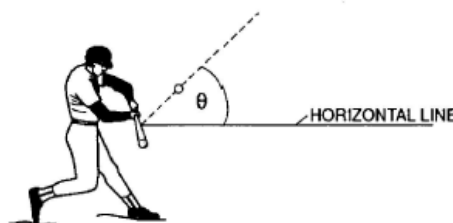
16. The handle of a lawn roller is held at 45° from the horizontal. A force, F, of 28.0 N is applied to the handle as the roller is pushed across a level lawn, as shown in the diagram. What is the magnitude of the force moving the roller forward?
   a) 7.0 N   b) 14.0 N   c) 19.8 N   d) 39.0 N
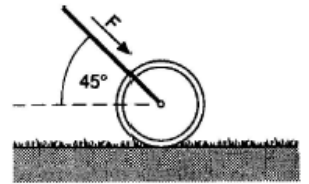
17. As the angle between a force and level ground decreases from 60° to 30°, the vertical component of the force
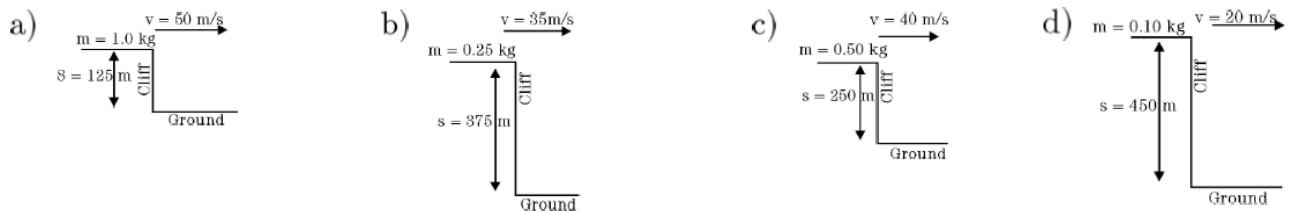   a) decreases   b) increases   c) remains the same

18. The diagram shows a person exerting a 300 N force on the handle of a shovel that makes an angle of 60° with the horizontal ground. The component of the 300 N force that acts perpendicular to the ground is approximately
    a) 150 N   b) 260 N   c) 300 N   d) 350 N
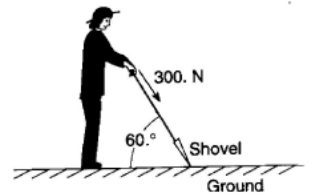
19. Four different balls are thrown horizontally off the top of four cliffs. In which diagrams does the ball have the shortest time of flight?

a) v = 50 m/s   m = 1.0 kg   S = 125 m   Ground

b) v = 35m/s   m = 0.25 kg   s = 375 m   Ground

c) v = 40 m/s   m = 0.50 kg   s = 250 m   Ground

d) m = 0.10 kg v = 20 m/s   s = 450 m   Ground

20. A 1.0 kg block is placed on each of four frictionless planes inclined at different angles. On which inclined plane will the acceleration of the block be greatest?

a) 1m / 3m   b) 1m / 2m   c) 2m / 3m   d) 1m / 1m

21. An object is placed on a flat board. The board is slowly increased until the object just starts to move. If the angle between the board and the horizontal is 29° what is the coefficient of static friction?
    a) 0.55   b) 0.48   c) 0.87   d) 0.29

22. Refer to the diagram below which shows a sign hanging from a support. What is the tension in each wire? The mass is 51 kg and θ is 62°.
    a) 500 N   b) 280 N
    c) 250 N   d) 1000 N