

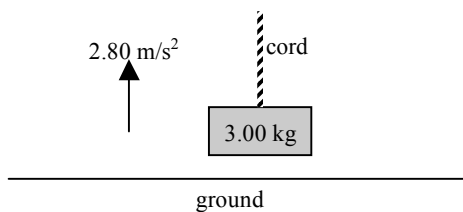
Unit 2: Vector Dynamics

Multiple Choice Portion

1. Which one of the following best describes the motion of a projectile close to the surface of the Earth? (Assume no friction)

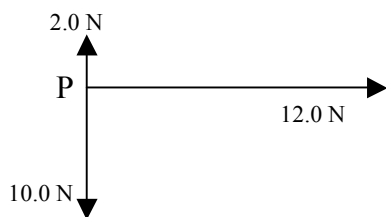
	Vertical Acceleration	Horizontal Acceleration
a.	constant	constant
b.	constant	changing
c.	changing	constant
d.	changing	changing

2. A 3.00 kg object is being accelerated vertically upwards at 2.80 m/s^2 , as shown.



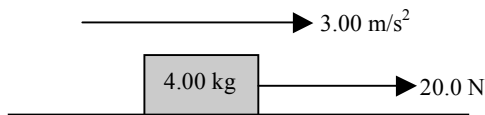
What is the tension in the cord?

- a. 8.40 N
 b. 21.0 N
 c. 29.4 N
 d. 37.8 N
3. Three forces act at point P at the same time, as shown on the force vector diagram below.



What is the magnitude of the resultant force vector?

- a. 14.4 N
 b. 17.0 N
 c. 20.0 N
 d. 24.0 N
4. A 4.00 kg block is accelerated along a level surface at 3.00 m/s^2 . The applied force is 20.0 N.



What is the coefficient of friction between the block and the surface?

- a. 0.20
 b. 0.31
 c. 0.51
 d. 0.67

5. A ball is rolled off a horizontal roof at 16 m/s. After leaving the roof, how long will the ball take to reach a speed of 18 m/s?

- a. 0.20 s
 b. 0.84 s
 c. 1.8 s
 d. 2.5 s

6. Which one of the following is a vector quantity?

- a. time
 b. speed
 c. energy
 d. displacement

7. Unless acted on by an external net force, an object will stay at rest or

- a. come to rest.
 b. decelerate at a constant rate
 c. slow down from a given speed.
 d. continue to move in a straight line at a constant speed

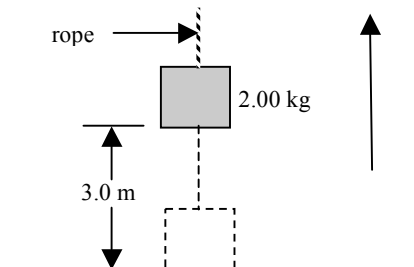
8. A car is travelling at a constant speed of 26.0 m/s down a slope, which is 12.0° to the horizontal. What is the vertical component of the car's velocity?

- a. 5.41 m/s
 b. 9.80 m/s
 c. 25.4 m/s
 d. 26.0 m/s

9. A 65.0 kg block is being accelerated along a level surface. The applied force is 500 N and the friction force is 300 N. What is the coefficient of friction between the block and the surface?

- a. 0.31
 b. 0.47
 c. 0.78
 d. 1.30

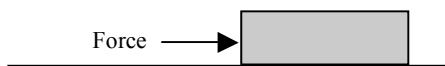
10. A 2.00 kg object, initially at rest on the ground, is accelerated vertically by a rope, as shown. The object reaches a height of 3.00 m in 1.50 s.



What is the tension in the rope during the acceleration?

- a. 5.33 N
 b. 14.3 N
 c. 23.6 N
 d. 24.9 N

11. A constant force is applied to an object on a frictionless surface, as shown in the diagram below.



The resulting motion has

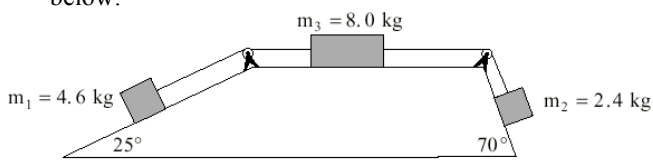
- a. constant velocity.
 b. constant momentum.
 c. constant acceleration.
 d. constant kinetic energy.
12. If friction is negligible, which of the following is true for the velocity components of projectiles?

	Horizontal Velocity Component	Vertical Velocity Component
a.	constant	constant
b.	constant	changes
c.	changes	constant
d.	changes	changes

13. At what speed must a ball be thrown upwards to reach a maximum height of 25 m?
 a. 2.6 m/s
 b. 22 m/s
 c. 2.5×10^2 m/s
 d. 3.1×10^3 m/s

14. What is the frictional force due to air resistance on a 0.50 kg object falling vertically with an acceleration of 8.5 m/s^2 ?
 a. 0.65 N
 b. 4.3 N
 c. 4.9 N
 d. 9.2 N

15. Three masses connected by a light string are arranged on frictionless surfaces, as shown in the diagram below.



The strings pass over frictionless pulleys. Determine the direction and magnitude of the acceleration of m_1 .

	Direction of m_1	Acceleration (m/s^2)
a.	Up incline	0.20
b.	Down incline	0.20
c.	Up incline	0.43
d.	Down incline	0.43

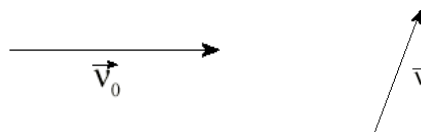
16. An object is sliding down a smooth incline. If friction is negligible, the object has
 a. constant velocity.
 b. constant momentum
 c. constant acceleration.
 d. constant displacement.

17. Which of the following is not a vector?
 a. mass
 b. impulse
 c. velocity
 d. momentum

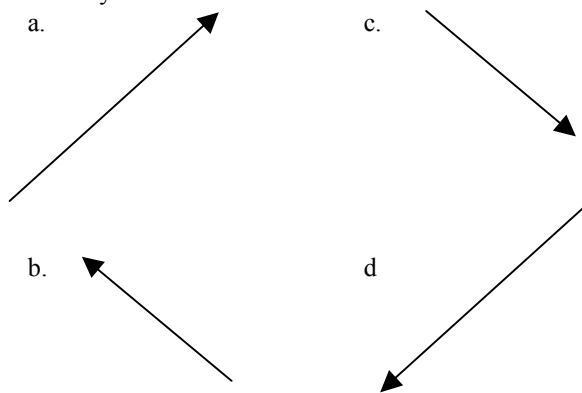
18. A passenger jet needs to reach a speed of 100 m/s on the runway for takeoff. If the runway is 2.5×10^3 m long, what minimum average acceleration from rest is needed?
 a. 0.040 m/s^2
 b. 2.0 m/s^2
 c. 4.0 m/s^2
 d. 10 m/s^2

19. Which of the following is a vector quantity?
 a. work
 b. speed
 c. acceleration
 d. kinetic energy

20. Initial velocity vector \mathbf{V}_0 and final velocity vector \mathbf{V}_f are shown below.

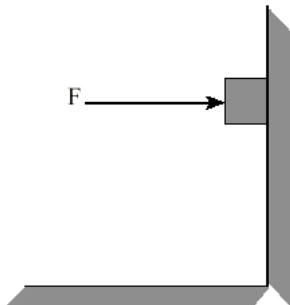


Which of the following represents the change in velocity $\Delta \mathbf{v}$?

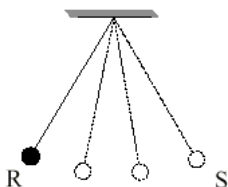


21. A projectile is launched over level ground with a speed of 240 m/s at 35° to the horizontal. If friction is negligible, what is the height of the projectile 17 s after launch?
 a. 9.2×10^2
 b. 1.9×10^3 m
 c. 2.7×10^3 m
 d. 5.5×10^3 m

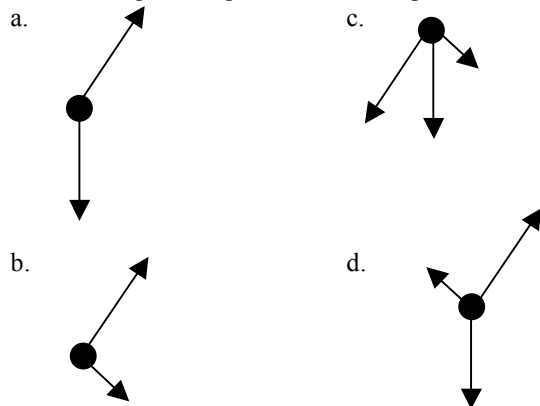
22. What minimum horizontal force F will just prevent the 5.0 kg block from sliding if the coefficient of friction between the wall and the block is 0.65?



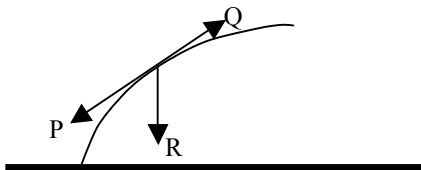
- a. 6.4 N
 b. 32 N
 c. 49 N
 d. 75 N
23. A pendulum is swinging freely between points R and S as shown in the diagram below.



Which of the following diagrams best represents the forces acting on the pendulum bob at point R?

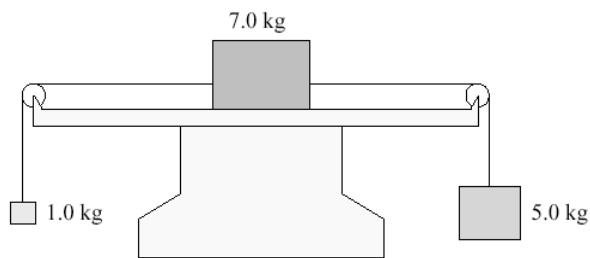


24. The projectile shown below has an acceleration which is



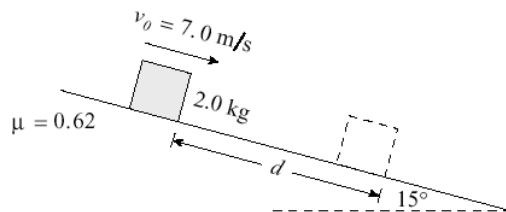
- a. zero.
 b. in the direction of P
 c. in the direction of Q.
 d. in the direction of R.

25. Which of the following is not a statement of one of Newton's laws of motion?
- For every action force, there is an equal and opposite reaction force.
 - If no net force acts on an object, the object will remain at rest, or continue to move at a constant velocity.
 - The acceleration of freely falling objects is proportional to their mass.
 - If a net force does act on an object, the object will accelerate in the direction of the net force.
26. An object is launched at 65° to the horizontal with an initial speed of 25 m/s. What is the maximum height reached by this object?
- 5.7 m
 - 26 m
 - 32 m
 - 150 m
27. Three blocks have masses 1.0 kg, 7.0 kg and 5.0 kg as shown. The horizontal surface is frictionless.



What is the magnitude of the acceleration of the system?

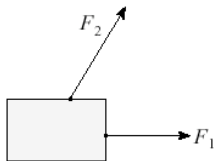
- 3.0 m/s^2
 - 3.8 m/s^2
 - 6.5 m/s^2
 - 7.8 m/s^2
28. A 2.0 kg block is sliding down a 15° incline. The coefficient of friction is 0.62. At some position the block has a speed of 7.0 m/s.



What distance d will this block move before coming to rest?

- 2.5 m
- 4.0 m
- 4.2 m
- 7.4 m

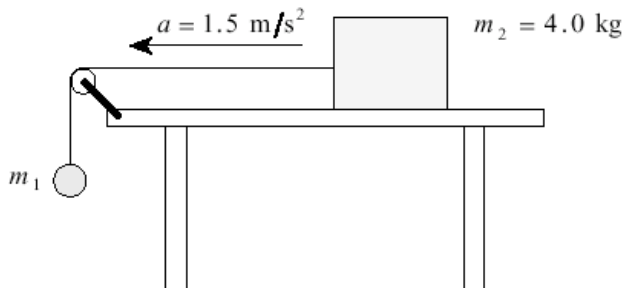
29. Which of the following statements concerning vector and scalar quantities is incorrect?
- All scalar quantities have direction.
 - All vector quantities have direction.
 - All scalar quantities have magnitude.
 - All vector quantities have magnitude.
30. Two forces act on an object as shown in the diagram.



Which of the following best shows the resultant R of these forces?

- a. c.
- b. d.

31. Which list contains three vector quantities?
- force, mass, speed
 - force, speed, velocity
 - acceleration, mass, velocity
 - acceleration, momentum, velocity
32. When a 2.0 kg rock is dropped from a cliff it hits the beach at 24 m/s. At what speed would a 4.0 kg rock, dropped from the same cliff, hit the beach? Ignore friction.
- 12 m/s
 - 24 m/s
 - 34 m/s
 - 48 m/s
33. The 4.0 kg block shown accelerates across a frictionless horizontal table at 1.5 m/s^2 .

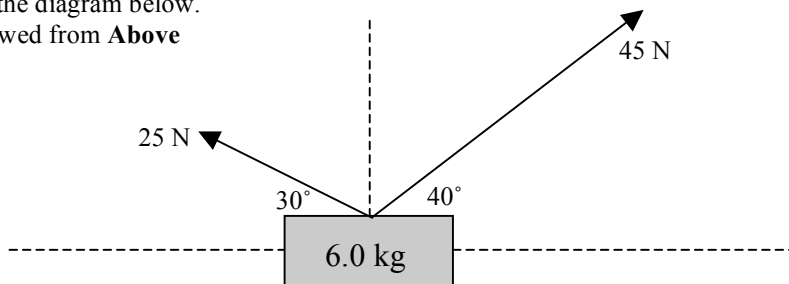


Find the mass of object m_1 .

- 0.61 kg
 - 0.72 kg
 - 6.0 kg
 - 26 kg
34. Pamela swims at 2.8 m/s relative to the water, heading west. The current flows south at 1.2 m/s. Find Pamela's resultant direction.
- 23° S of W
 - 25° S of W
 - 23° N of W
 - 25° N of W

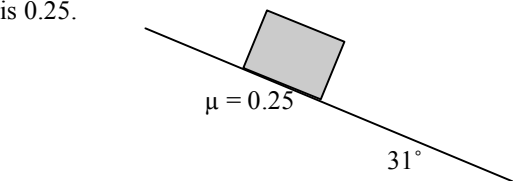
Written Portion:

1. A 6.0 kg block is held at rest on a horizontal, frictionless air table. Two forces are pulling on this block in the directions shown in the diagram below.
Table Viewed from **Above**



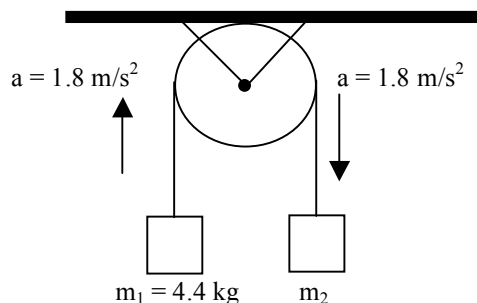
What will be the magnitude of the acceleration on the 6.0 kg block at the moment it is released?

2. An 87 kg block slides down a 31° as shown in that diagram below. The coefficient of friction between the block and the surface is 0.25.

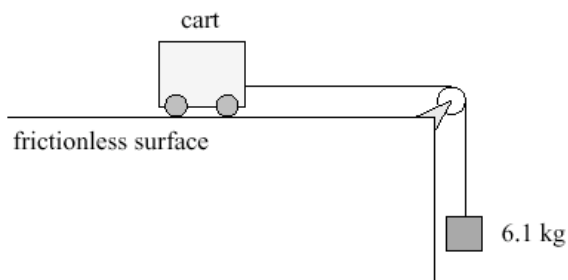


What is the acceleration of the block?

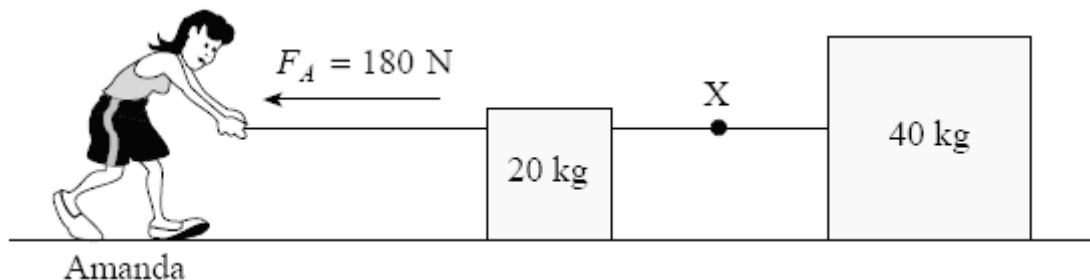
3. The diagram shows a 4.4 kg mass connected by a string to an unknown mass over a frictionless pulley. The system accelerates at 1.8 m/s^2 in the direction shown.



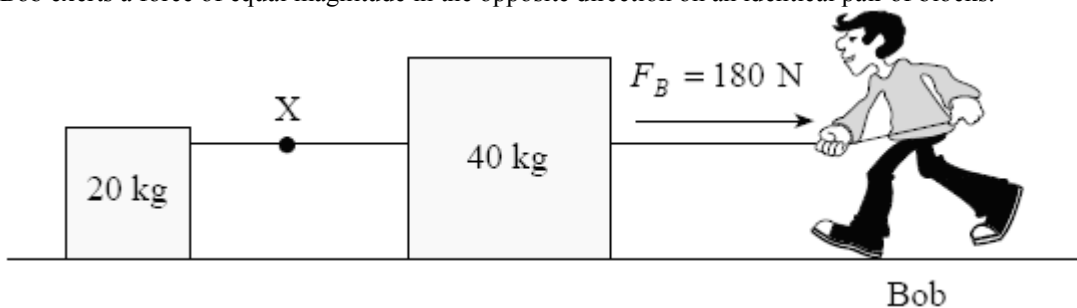
- Draw and label a free body diagram for the 4.4 kg mass.
 - Calculate the tension in the string
 - Find mass m_2
4. In the diagram shown, the tension in the cord connecting the hanging mass and cart is 43 N.



- Draw and label a free body diagram for the cart and the hanging mass.
 - Determine the mass of the cart.
5. Amanda exerts a horizontal force of 180 N on a piece of rope causing two blocks of mass 20 kg and 40 kg to accelerate. Friction on the blocks is negligible.
- Find the tension force at X in the rope joining the two blocks together.

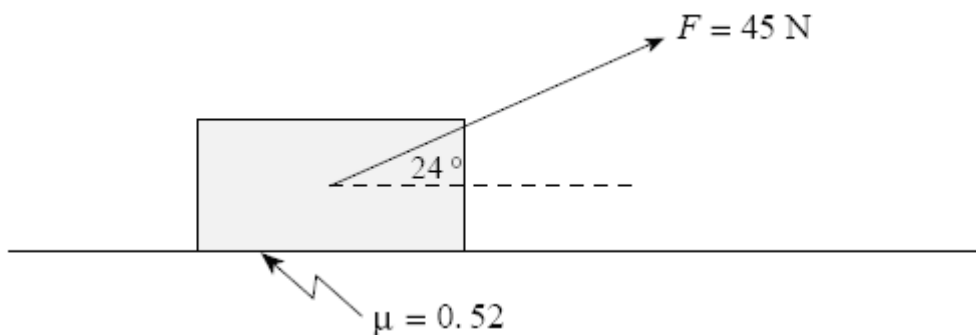


Bob exerts a force of equal magnitude in the opposite direction on an identical pair of blocks.



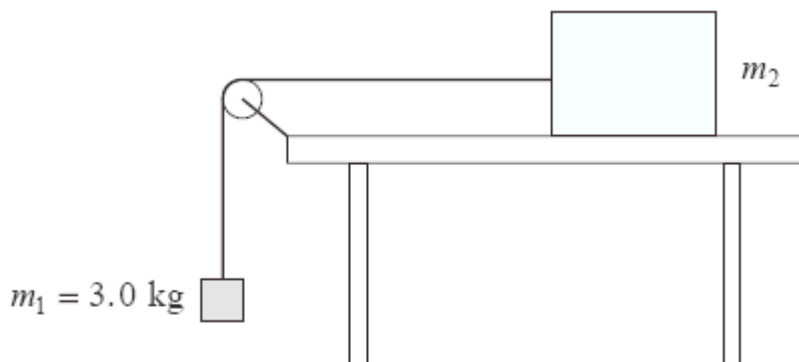
- b. How does the tension force at X compare to the value in part a)? (Circle one.)
- i) The tension force is the same.
 - ii) The tension force is greater than in a).
 - iii) The tension force is smaller than in a).
- c. Using principles of physics, explain your answer to part b).

6. A student drags a 7.0 kg carton of apples across the floor by exerting a 45 N force in the direction shown. The coefficient of friction between the carton and the floor is 0.52 .



- a. What is the magnitude of the normal force acting on the carton?
- b. What friction force acts on the carton?

7. The diagram shows two objects connected by a light string over a frictionless pulley. Object m_2 is on a frictionless horizontal table. The tension in the string is 24 N.



- a. Find the acceleration of the system.
- b. Find the mass of m_2 .

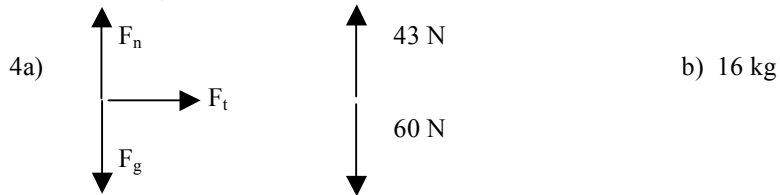
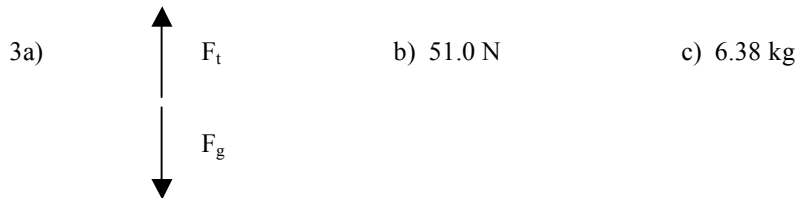
Answers to Vector Dynamic Study Pack

Multiple Choice

- | | | |
|-------|-------|-------|
| 1. a | 12. b | 23. a |
| 2. d | 13. b | 24. d |
| 3. a | 14. a | 25. c |
| 4. a | 15. a | 26. b |
| 5. b | 16. c | 27. a |
| 6. d | 17. a | 28. d |
| 7. d | 18. b | 29. a |
| 8. a | 19. c | 30. c |
| 9. b | 20. b | 31. d |
| 10. d | 21. a | 32. b |
| 11. c | 22. d | 33. b |
| | | 34. a |

Written Response

1. 7.2 m/s^2
 2. 2.9 m/s^2



- 5a) $F_t = 120 \text{ N}$ b) iii
 c) In both situations the total mass is the same so both systems accelerate at the same rate. In b) the tension must accelerate a smaller mass at the same rate hence, from Newton's second law, $F = ma$, a smaller tension force will cause this

- 6a) $F_N = 50.3 \text{ N}$ b) $F_F = 26.2 \text{ N}$ c) $a = 2.1 \text{ m/s}^2$
 7a) $a = 1.8 \text{ m/s}^2$ b) $m_2 = 13.3 \text{ kg}$