

Physics 11



Complete Workbook

- ★ Aligned with Alberta curriculum
- ★ Contains Physics 20 practice questions and answers

2020 EDITION

TABLE OF CONTENTS

Kinematics	2
Dynamics	13
Circular Motion, Work, and Energy	17
Oscillatory Motion and Mechanical Waves	26
Answer Key	35

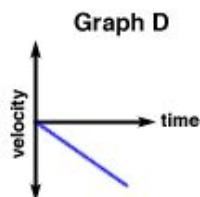
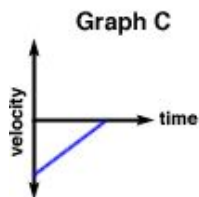
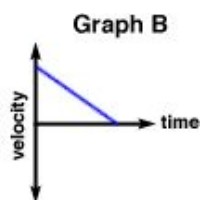
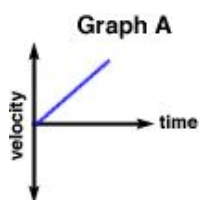
Kinematics

1. An object travelling in a straight line at 50 m/s accelerates at -4.5 m/s^2 for 8.5 s. The final velocity of the object is

A) 12 m/s
 B) 88 m/s
 C) 38 m/s
 D) 50 m/s

2.

The graphs describe objects travelling in a straight line with different accelerations.

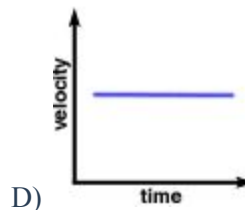
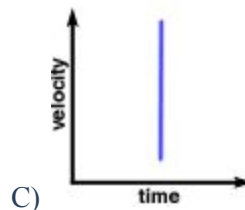
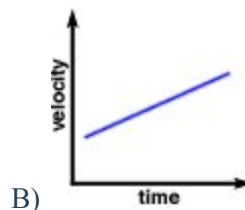
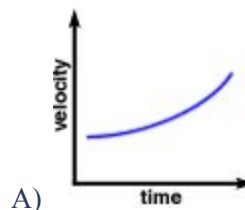


Which graphs represent objects travelling with a negative acceleration?

A) A and C
 B) B and C
 C) B and D

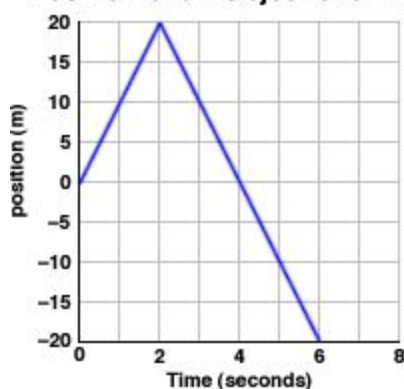
D) C and D

3. Which graph represents uniform motion?



4. A car moving at 16.2 m/s in a straight line is accelerated at 7.00 m/s^2 to a velocity of 35.4 m/s. The time taken to attain this velocity is

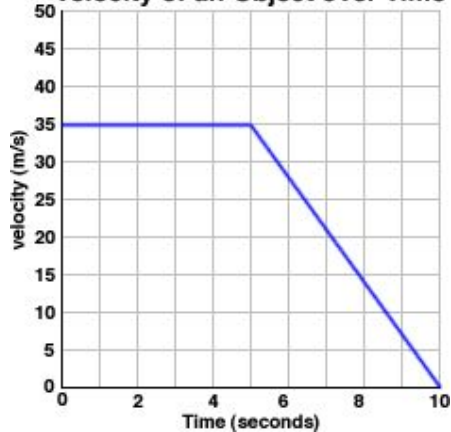
A) 7.37 s
 B) 1.96 s
 C) 5.26 s
 D) 2.74 s

Position of an Object over Time

5.

According to the graph for motion in a straight line, the average velocity during the time interval of 2.0 s to 6.0 s is

- A) 0 m/s
- B) -4 m/s
- C) -10 m/s
- D) 10 m/s

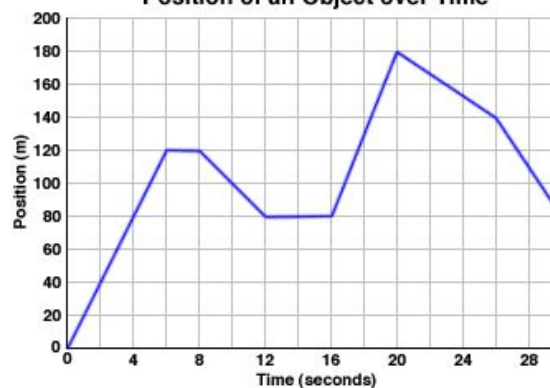
Velocity of an Object over Time

6.

In the time interval described by the graph, the total displacement of the object is

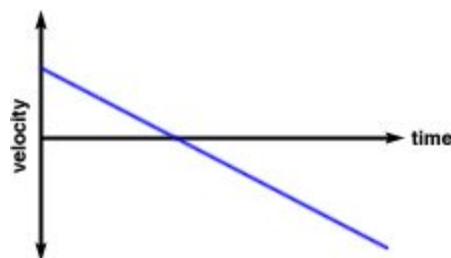
- A) 175 m
- B) 87.5 m
- C) 263 m
- D) 350 m

7.

Position of an Object over Time

The average velocity of the object between 4.0 and 14.0 seconds is

- A) 0.0 m/s
- B) 40 m/s
- C) 8 m/s
- D) 240 m/s



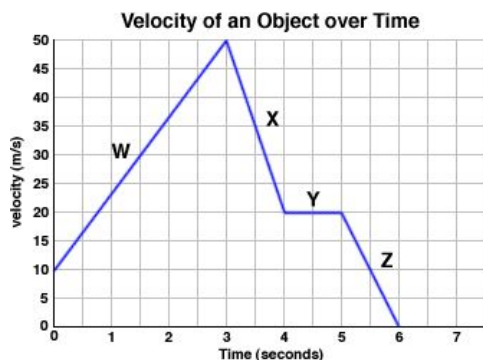
8.

According to the graph, the object could be considered to

- A) slow down then speed up.
- B) speed up then slow down.
- C) travel east, change direction, and travel west farther than the starting point.
- D) travel north, change direction, and then not make it back to its starting point.

9.

The velocity-time graph describes the motion of an object travelling in a straight line during sections W, X, Y, and Z.



As shown by the graph, the acceleration of the object during section X is

- A) -10 m/s^2
- B) -25 m/s^2
- C) -15 m/s^2
- D) -30 m/s^2

10. Refer to the information in question 9.

As shown by the graph, the acceleration of the object during section W is

- A) $+16.7 \text{ m/s}^2$
- B) $+13.3 \text{ m/s}^2$
- C) $+25 \text{ m/s}^2$
- D) $+20 \text{ m/s}^2$

11.

At the top of a 250 m cliff above a river, a hiker drops a 2.50 kg backpack over the edge.

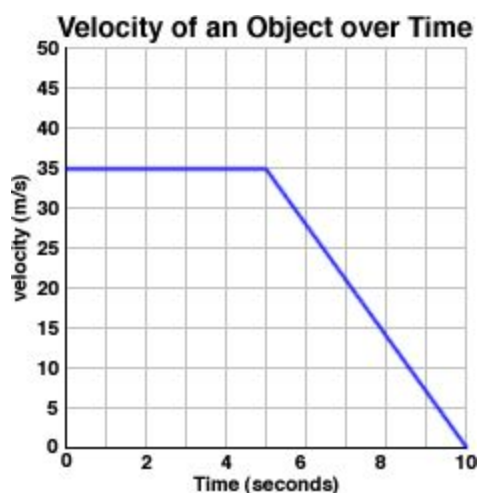
At what speed would the backpack impact the water?

- A) 49.5 m/s
- B) 78.3 m/s
- C) 70.0 m/s
- D) 35.0 m/s

12. A ball is kicked at a velocity of 35 m/s at an angle of 20° with the ground. After how long does the ball reach its greatest height?

- A) 12 s
- B) 3.6 s
- C) 3.4 s
- D) 1.2 s

13.



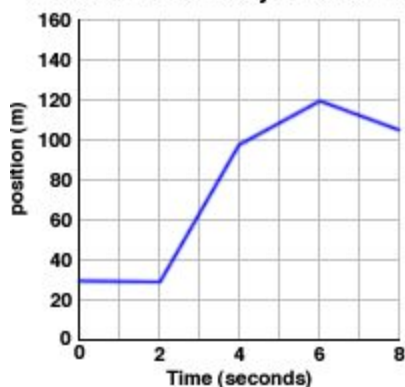
In the time interval described by the graph, the total displacement of the object is

- A) 175 m
- B) 87.5 m
- C) 263 m
- D) 350 m

14.

The graph shows the change in position of an object over a 8.0 s period.

Position of an Object over Time



According to the graph, the object is moving slowest during which one of the following time intervals?

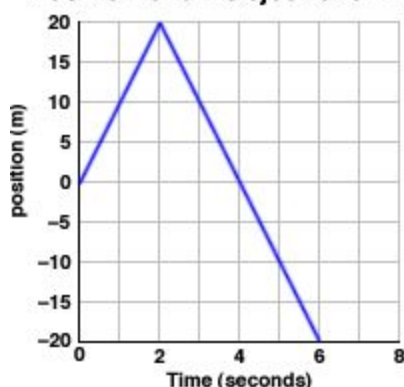
- A) 0 s to 1 s
- B) 2 s to 3 s
- C) 4 s to 5 s
- D) 6 s to 7 s

15. Two balls, A and B, are thrown off a cliff. Ball A is thrown vertically upward at a velocity of 5 m/s and Ball B is thrown vertically downward at a velocity of 5 m/s. Air resistance is neglected. On reaching the bottom of the cliff, how does the velocity of Ball A compare to the velocity of Ball B?

- A) Less than Ball B
- B) One half of Ball B
- C) Equal to Ball B
- D) Twice that of Ball B

16. A ball is thrown straight up into the air with a velocity of +23.5 m/s. After 4.5 s, the velocity of the ball is

- A) -44.1 m/s
- B) -20.6 m/s
- C) +44.1 m/s
- D) +20.6 m/s

Position of an Object over Time

17. According to the graph for motion in a straight line, the average velocity during the time interval of 2.0 s to 6.0 s is
- 0 m/s
 - 4 m/s
 - 10 m/s
 - 10 m/s
18. A ball rolls on top of a lab table at a constant velocity of 2.5 m/s and then falls off the edge. After 0.45 s of free fall, the vertical velocity of the ball is
- 4.4 m/s
 - 6.9 m/s
 - 8.8 m/s
 - 2.5 m/s
19. What is the acceleration of a truck travelling in a straight line at 28.5 m/s that is slowed down to 4.0 m/s in 6.00 s?
- 4.08 m/s²
 - 5.42 m/s²
 - 1447 m/s²
 - 9.81 m/s²
20. An airplane takes off at 220 km/h, angling upwards 38° from the runway. The airplane is gaining altitude initially at a speed of
- 357 km/h
 - 135 km/h

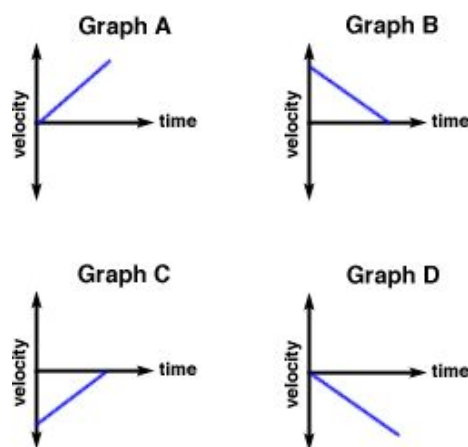
C) 173 km/h

D) 220 km/h

21. An airplane flies at 450 km/h with a heading of 70° south of east as a 80 km/h wind blows from the west. The actual magnitude of the velocity (ground velocity) of the plane is
- 423 km/h
 - 154 km/h
 - 577 km/h
 - 483 km/h

22.

The graphs describe objects travelling in a straight line with different accelerations.

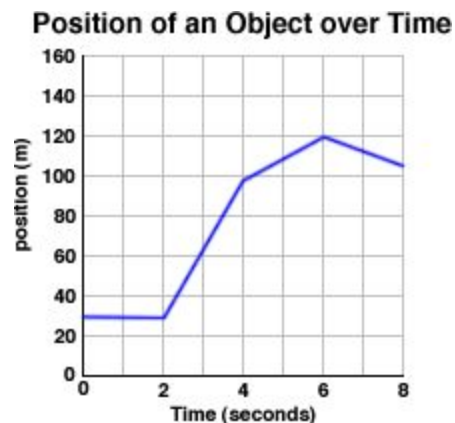


Which graphs represent objects decreasing in speed?

- A and B
- A and D
- B and C
- C and D

23.

The graph shows the change in position of an object over a 8.0 s period.



According to the graph, the object is moving slowest during which one of the following time intervals?

- A) 0 s to 1 s
- B) 2 s to 3 s
- C) 4 s to 5 s
- D) 6 s to 7 s

24. Which of the following quantities is a *vector* quantity?

- A) speed
- B) kinetic energy
- C) power
- D) velocity

25. Which of the following quantities is a scalar quantity?

- A) acceleration
- B) velocity

- C) work
- D) force

26. In still water, a person can swim at a speed of 1.4 m/s. She swims perpendicularly across a 62 m wide river, landing 45 m downstream. In crossing the river, what was her displacement?

- A) 62 m
- B) 45 m
- C) 77 m
- D) 107 m

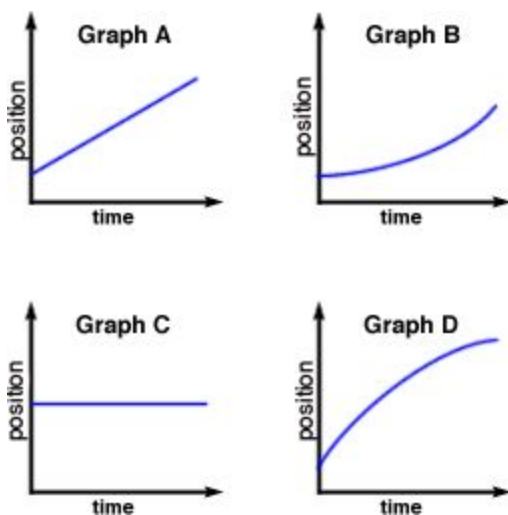
27. A rock falls from the top of a building 50 m high. The time needed for it to fall to the ground below is

- A) 5.1 m
- B) 3.2 s
- C) 2.3 m
- D) 10 m

28. A person on a speedboat travelling east at 40 km/h measures the velocity of the wind. From their perspective, the wind appears to be blowing from the north at 18 km/h. The actual velocity of the wind is

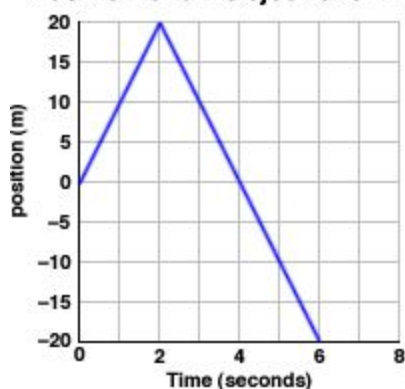
- A) 7.6 km/h, 66° N of W
- B) 44 km/h, 24° S of E
- C) 44 km/h, 24° N of W
- D) 7.6 km/h, 66° S of E

29.



Which graph represents the motion of an object that is increasing its velocity?

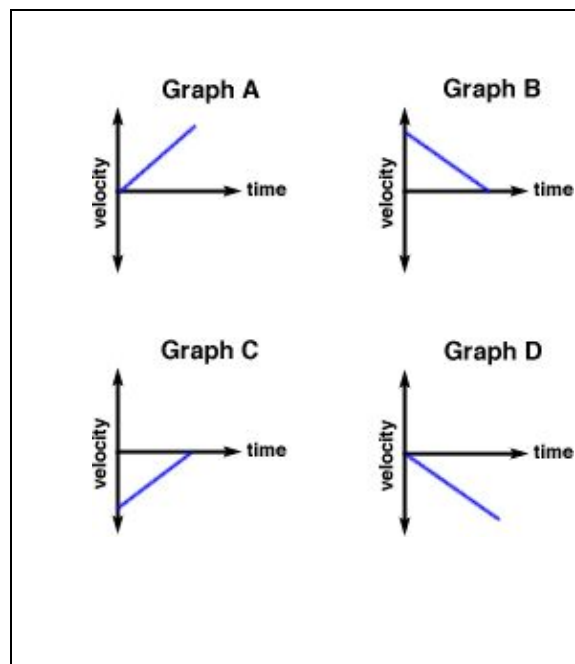
- A) A
B) B
C) C
D) D
30. A parked truck slips out of gear and rolls over a cliff of height h . When the truck hits the base of the cliff, what is its velocity? Neglect the truck's velocity at the beginning of the fall.
- A) $2gh$
B) mgh
C) $(2gh)^{0.5}$
D) $0.5mv^2$
31. A person standing on top of a building throws a ball with a horizontal velocity of 14 m/s. If the ball strikes the ground 65 m from the base of the building, how high is the building?
- A) 106 m
B) 211 m
C) 22.7 m
D) 45.5 m
32. A ball rolls on top of a lab table at a constant velocity of 2.5 m/s and then falls off the edge. After 0.45 s of free fall, the vertical velocity of the ball is
- A) 4.4 m/s
B) 6.9 m/s
C) 8.8 m/s
D) 2.5 m/s
33. A ball is hit with a velocity of 32.0 m/s at an angle of 28.0° with the ground. How far from where it was hit does the ball strike the ground?
- A) 28.4 m
B) 86.5 m
C) 43.3 m
D) 52.0 m
34. At the top of a 250 m cliff above a river, a hiker drops a 2.50 kg backpack over the edge. At what speed would the backpack impact the water?
- A) 49.5 m/s
B) 78.3 m/s
C) 70.0 m/s
D) 35.0 m/s
35. From the top of a cliff 40 m high, a ball is thrown horizontally at a velocity of 15 m/s. What distance from the base of the cliff does the ball hit the ground?
- A) 2.9 m
B) 40 m
C) 43 m
D) 122 m
36. An object is thrown up from the roof of a building at 22.0 m/s and falls over the side of the building. It strikes the ground 6.00 s after being thrown. The height of the building is
- A) 44.4 m
B) 177 m
C) 132 m
D) 103 m

Position of an Object over Time

37. According to the graph for motion in a straight line, the average velocity during the time interval of 0.0 s to 2.0 s is
- A) 0 m/s
 - B) 5 m/s
 - C) 10 m/s
 - D) 20 m/s
38. Refer to the information in question 7. According to the graph for motion in a straight line, the average velocity during the time interval of 2.0 s to 6.0 s is
- A) 0 m/s
 - B) -4 m/s
 - C) -10 m/s
 - D) 10 m/s

39.

The graphs describe objects travelling in a straight line with different accelerations.



Which graphs represent objects decreasing in speed?

- A) A and B
 - B) A and D
 - C) B and C
 - D) C and D
40. A ball is thrown straight up into the air with a velocity of +23.5 m/s. After 4.5 s, the velocity of the ball is
- A) -44.1 m/s
 - B) -20.6 m/s
 - C) +44.1 m/s
 - D) +20.6 m/s
- 41.

The graph shows the change in position of an object over a 8.0 s period.



According to the graph, the object is moving fastest through which one of the following time intervals?

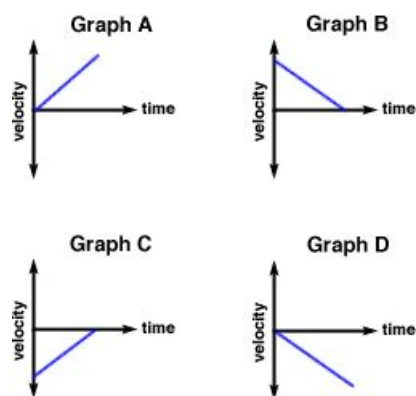
- A) 0 s to 1 s
- B) 2 s to 3 s
- C) 4 s to 5 s
- D) 5 s to 6 s

42. A ball is hit with a velocity of 40.0 m/s at an angle of 32.0° with the ground. What is the maximum height reached by the ball?
- A) 21.9 m
 - B) 45.8 m
 - C) 22.9 m
 - D) 58.6 m
43. Which of the following quantities is a scalar quantity?
- A) acceleration
 - B) velocity

- C) work
- D) force

44.

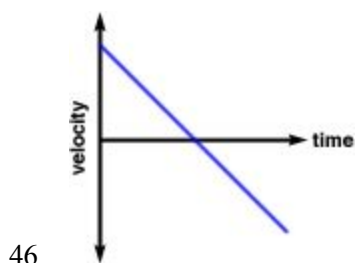
The graphs describe objects travelling in a straight line with different accelerations.



Which graphs represent objects decreasing in speed?

- A) A and B
- B) A and D
- C) B and C
- D) C and D

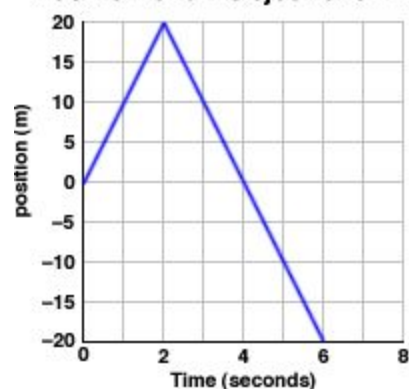
45. A person on a speedboat travelling east at 40 km/h measures the velocity of the wind. From their perspective, the wind appears to be blowing from the north at 18 km/h. The actual velocity of the wind is
- A) 7.6 km/h, 66° N of W
 - B) 44 km/h, 24° S of E
 - C) 44 km/h, 24° N of W
 - D) 7.6 km/h, 66° S of E



The graph above describes the velocity of an object that has been thrown vertically into the air. Which graph represents the displacement of the object?

- A)
- B)
- C)
- D)

Position of an Object over Time



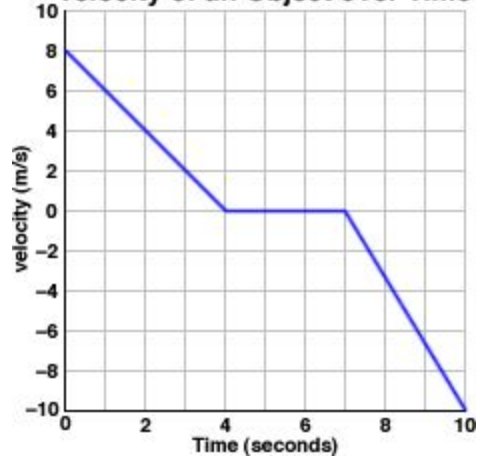
47.

According to the graph for motion in a straight line, the average velocity during the time interval of 2.0 s to 6.0 s is

- A) 0 m/s
B) -4 m/s
C) -10 m/s
D) 10 m/s

48.

Velocity of an Object over Time

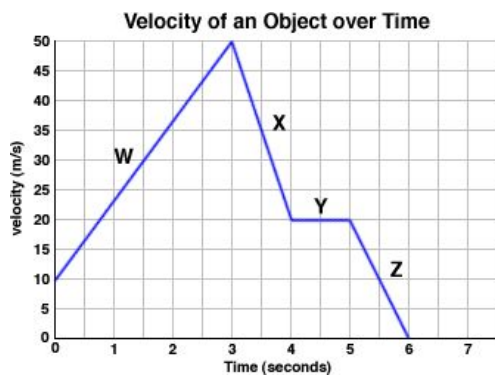


For an object in linear motion, what is the acceleration from 7.0 to 10.0 s?

- A) 3.3 m/s^2
B) 0.0 m/s^2
C) -10.0 m/s^2
D) -3.3 m/s^2

49.

The velocity-time graph describes the motion of an object travelling in a straight line during sections W, X, Y, and Z.



As shown by the graph, during which sections is the object accelerating?

- A) Y and Z only
- B) X and Y only
- C) X, Y, and Z only
- D) W, X, and Z only

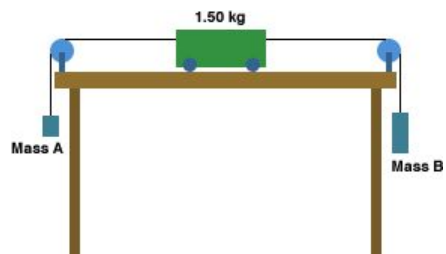
50. An object travelling in a straight line at 50 m/s accelerates at -4.5 m/s^2 for 8.5 s. The final velocity of the object is
- A) 12 m/s
 - B) 88 m/s
 - C) 38 m/s
 - D) 50 m/s

Dynamics

- The mass of an object can be defined as the
 - force of attraction on the object by gravity.
 - measure of the inertia of the object.
 - density of material in the object.
 - amount of volume taken up by the object.
- A block of mass 17.0 kg is raised along a frictionless ramp which is 7.00 m long and 2.00 m high. What applied force is required to move the block up the incline at constant velocity?
 - 160 N
 - 47.6 N
 - 607 N
 - 167 N
- One newton (N) may be defined as the
 - mass of an object accelerating at 9.8 m/s^2 .
 - acceleration of an object with a mass of 1.0 kg.
 - force on an object when undergoing free-fall.
 - force on a 1.0 kg mass accelerating at 1.0 m/s^2 .
- A $3.20 \times 10^3 \text{ kg}$ truck starts from rest and accelerates for 27.0 s. If the truck travels with constant acceleration for a distance of 280 m, what force is exerted on the truck during this time interval?
 - $2.46 \times 10^3 \text{ N}$
 - $6.63 \times 10^4 \text{ N}$
 - $1.23 \times 10^3 \text{ N}$
 - $3.47 \times 10^3 \text{ N}$

5.

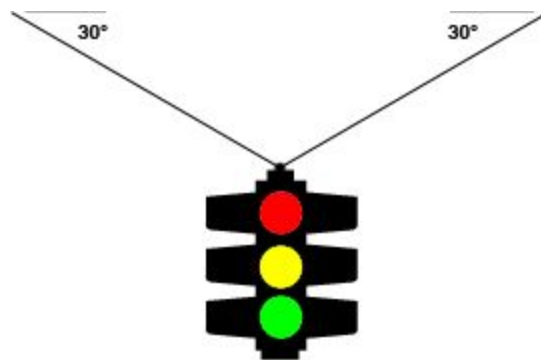
The diagram shows a 1.50 kg cart on top of a table attached to two masses by strings going over frictionless pulleys. The coefficient of kinetic friction between the cart and the table is 0.160.



If the mass of A is 2.00 kg and the mass of B is 4.0 kg, what is the acceleration of the cart?

- 2.3 m/s^2
- 11.5 m/s^2
- 8.16 m/s^2
- 9.81 m/s^2

6. A student weighing 450 N stands on a lab scale in a moving elevator. At one point during the experiment the reading on the scale is 800 N. What inference can be made about the motion of the elevator?
- A) The elevator is accelerating upwards.
 B) The elevator is accelerating downwards.
 C) The elevator is stationary.
 D) The elevator is moving at constant velocity downwards.
7. A 62 kg student rides up in an elevator with an acceleration of 2.0 m/s^2 . During the time of this acceleration, what is his apparent weight?
- A) 124 N
 B) 732 N
 C) 608 N
 D) 484 N
8. Three 30.0 kg kids slide down a snowy hill at an angle of 28.0° to the horizontal. If the coefficient of friction between the snow and the sled is 0.300, what is their acceleration?
- A) 9.81 m/s^2
 B) 2.01 m/s^2
 C) 1.66 m/s^2
 D) 4.61 m/s^2
9. A 15.0 kg stop light is hanging by two cables. The cables make an angle of 30.0° with the horizontal as shown.



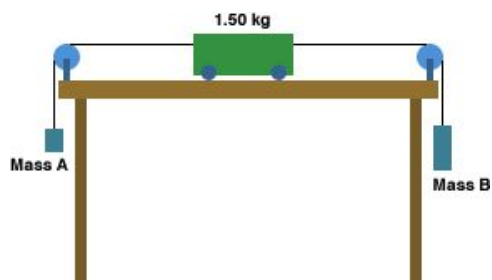
What force does each cable exert on the sign?

- A) 73.6 N
 B) 147 N
 C) 36.8 N
 D) 85.0 N
10. Which statement describes some features of Newton's second law of motion?
- A) An object will experience a larger acceleration as the net force increases or mass decreases.
 B) A force that acts on an object produces an equal and opposite net force.
 C) An object at rest tends to remain at rest unless acted on by a net force.
 D) An object in motion tends to maintain that motion unless acted on by a net force.
11. A worker pushes a lawn mower with a force of 280 N. If the handle makes an angle of 40.0° with the lawn, what is the force pushing the lawn mover forward?
- A) 280 N
 B) 180 N
 C) 366 N
 D) 214 N

12. A 62 kg student rides up in an elevator with an acceleration of 2.0 m/s^2 . During the time of this acceleration, what is his apparent weight?
- A) 124 N
B) 732 N
C) 608 N
D) 484 N
13. At the top of a 250 m cliff above a river, a hiker drops a 2.50 kg backpack over the edge. If the bag comes to a stop 3.50 m below the surface of the river, what force did the water apply to the backpack?
- A) 700 N
B) $1.75 \times 10^3 \text{ N}$
C) 25.0 N
D) $3.50 \times 10^2 \text{ N}$
14. A student driving his $1.70 \times 10^3 \text{ kg}$ car at 85.0 km/h presses on the brake and slows down to 50.0 km/h. If the average net force applied by the car's brakes during this time interval is $3.80 \times 10^3 \text{ N}$, what is the braking distance in metres?
- A) 81.6 m
B) 1057 m
C) 130.2 m
D) 98.8 m
15. A student weighing 450 N stands on a lab scale in a moving elevator. At one point during the experiment the reading on the scale is 800 N. What inference can be made about the motion of the elevator?
- A) The elevator is accelerating upwards.
B) The elevator is accelerating downwards.
C) The elevator is stationary.
D) The elevator is moving at constant velocity downwards.
16. Three 30.0 kg kids slide down a snowy hill at an angle of 28.0° to the horizontal. If the coefficient of friction

between the snow and the sled is 0.300, what is their acceleration?

- A) 9.81 m/s^2
B) 2.01 m/s^2
C) 1.66 m/s^2
D) 4.61 m/s^2
17. The diagram shows a 1.50 kg cart on top of a table attached to two masses by strings going over frictionless pulleys. The coefficient of kinetic friction between the cart and the table is 0.160.



If the mass of A is 2.00 kg and the mass of B is 4.0 kg, what is the acceleration of the cart?

- A) 2.3 m/s^2
B) 11.5 m/s^2
C) 8.16 m/s^2
D) 9.81 m/s^2

18. One newton (N) may be defined as the
- A) mass of an object accelerating at 9.8 m/s^2 .
 - B) acceleration of an object with a mass of 1.0 kg .
 - C) force on an object when undergoing free-fall.
 - D) force on a 1.0 kg mass accelerating at 1.0 m/s^2 .
19. In an experiment, a student exerts a force of 20.0 N on a 2.5 kg block of wood to keep it moving at a constant velocity on a table. What is the coefficient of friction between the block and the table?
- A) 0.82
 - B) 8.0
 - C) 1.2
 - D) 0.13
20. A 15 kg box is placed on an inclined plane that forms an 53° angle with the horizontal. Ignoring friction, the acceleration of the box down the ramp is
- A) 5.9 m/s^2
 - B) 7.8 m/s^2
 - C) 9.8 m/s^2
 - D) 0.80 m/s^2

Circular Motion, Work, and Energy

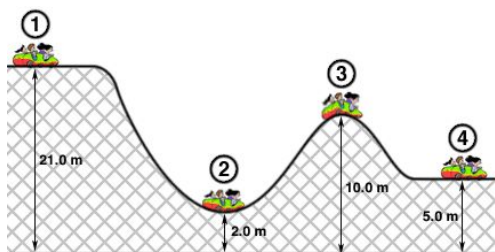
1. The Earth makes one complete revolution around the Sun in 365.3 days. If the distance between the Earth and the Sun is 1.5×10^{11} m, what is the acceleration of the Earth toward the Sun?

A) 4.4×10^7 m/s²
 B) 2.0×10^{-7} m/s²
 C) 5.9×10^{-3} m/s²
 D) 9.81 m/s²

2. Which of the following are correct units for work?

A) kg·m/s
 B) N/m
 C) kg·m/s²·m
 D) kg·m/s²

3. A 300 kg roller coaster starts at the position labelled 1, with no horizontal velocity. Assume no friction on the roller coaster until the brakes are applied after passing position 4.



When placed in order from greatest amount of kinetic energy to least, the order of the four different positions of the roller-coaster car labelled on the diagram is _____ (write your answer as a four digit number).

4. A truck with a mass of 2.00×10^4 kg is travelling at 120.0 km/h. If the driver reduces the truck's speed to 50.0 km/h,

then the truck's kinetic energy has changed by

A) 1.19×10^8 J
 B) 4.90×10^7 J
 C) 9.18×10^6 J
 D) 3.78×10^6 J

5. A bungee jumper who jumps from a 100.0 m high platform stops at a distance of 8.0 m from the ground. The energy transformations would best be described as

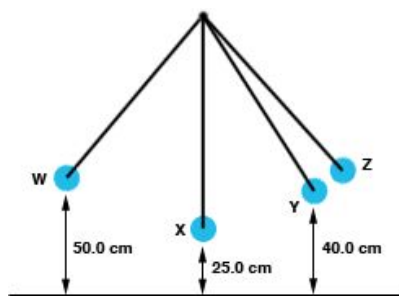
A) E_p changes to E_k , then changes to E_p with no loss of energy due to friction.
 B) E_p changes to E_{spring} with a loss of energy due to friction.
 C) E_p changes to E_k , then changes to E_{spring} with a loss of energy due to friction.
 D) E_p changes to E_k , then the final energy is 0.

6. A pendulum bob of mass 2.15 kg is raised 3.00 cm above the equilibrium position. Once released, how fast will it be travelling when it passes through the equilibrium position?

A) 7.7 m/s
 B) 77 cm/s
 C) 59 cm/s
 D) 0.43 m/s

7.

A student constructed a pendulum using a 1.0 kg ball attached to a string 70 cm long. The ball was pulled back and released from Point W. It made one swing to Point Z and is shown at various heights above a table.



The speed of the pendulum bob at point Y is

- A) 1.96 m/s
- B) 1.40 m/s
- C) 3.13 m/s
- D) 2.80 m/s

8. Refer to the information in question 7. The kinetic energy of the pendulum bob at point Z is
- A) 0 J
 - B) 2.44 J
 - C) 0.98 J
 - D) impossible to determine
9. A student was given the following observations of a truck.

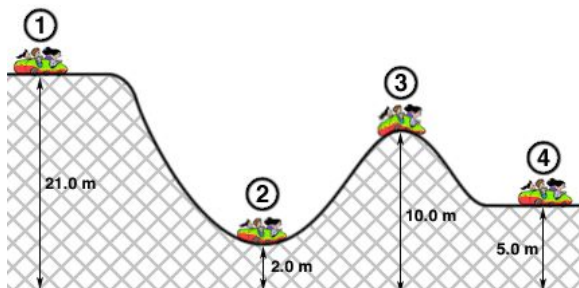
1. The truck changes speed travelling around a curve.
2. The truck coasts around a curve at a constant speed.
3. The truck decreases speed while moving in a straight line.
4. The truck coasts down an incline at constant speed.

Which observations represent acceleration?

- A) 1 and 2 only
- B) 2 and 4 only
- C) 1, 2, and 3 only
- D) 1, 2, 3, and 4

10. An object on the end of a string is whirled around with uniform circular motion in the horizontal plane. The acceleration of the object is directed toward the
- A) center of the motion in the direction of the string.
 - B) direction the object is travelling.
 - C) tangent of the curve the object is travelling on.
 - D) outside of the circle in the direction of the string.

11. A 300 kg roller coaster starts at the position labelled 1, with no horizontal velocity. Assume no friction on the roller coaster until the brakes are applied after passing position 4.



When placed in order from greatest amount of kinetic energy to least, the order of the four different positions of the roller-coaster car labelled on the diagram is _____ (write your answer as a four digit number).

12. A student rides a bicycle at 18.0 m/s around a circular track that has a radius of 100.0 m. If the mass of the student and bicycle is 120 kg, what is the centripetal force?
- A) 389 N
B) 21.6 N
C) 3.89 N
D) 156 N
13. A truck with a mass of 2.00×10^4 kg is travelling at 120.0 km/h. If the driver reduces the truck's speed to 50.0 km/h, then the truck's kinetic energy has changed by
- A) 1.19×10^8 J
B) 4.90×10^7 J
C) 9.18×10^6 J
D) 3.78×10^6 J
14. A bungee jumper who jumps from a 100.0 m high platform stops at a distance of 8.0 m from the ground. The energy transformations would best be

described as

- A) E_p changes to E_k , then changes to E_p with no loss of energy due to friction.
B) E_p changes to E_{spring} with a loss of energy due to friction.
C) E_p changes to E_k , then changes to E_{spring} with a loss of energy due to friction.
D) E_p changes to E_k , then the final energy is 0.

15. A pendulum bob of mass 2.15 kg is raised 3.00 cm above the equilibrium position. Once released, how fast will it be travelling when it passes through the equilibrium position?
- A) 7.7 m/s
B) 77 cm/s
C) 59 cm/s
D) 0.43 m/s
16. Mechanical energy is conserved when:
- A) the total kinetic energy before equals the total kinetic energy after
B) the sum of the kinetic and potential energy before and after are equal
C) the sum of the kinetic, potential and frictional energy before and after are equal
D) the total potential energy before equals the total potential energy after
17. A baseball is hit with a velocity of 25.0 m/s at an angle of 37.0° with the ground. When the ball reaches its maximum height, what is the horizontal distance from where it was hit?
- A) 23.1 m
B) 25.0 m
C) 30.5 m
D) 61.2 m

18. Which of the following are correct units for work?

A) $\text{kg}\cdot\text{m/s}$
 B) N/m
 C) $\text{kg}\cdot\text{m/s}^2\cdot\text{m}$
 D) $\text{kg}\cdot\text{m/s}^2$

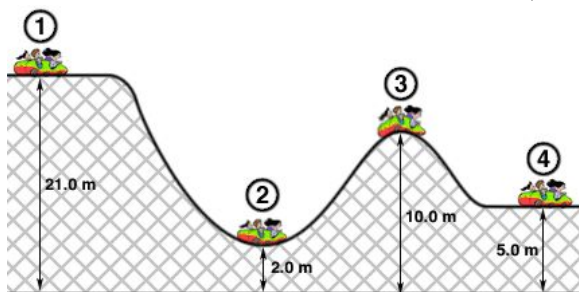
19. Which of the following are correct units for kinetic energy?

A) $0.5 \text{ kg}\cdot\text{m/s}$
 B) $\text{kg}\cdot\text{m/s}$
 C) $\text{kg}\cdot\text{m/s}^2$
 D) $\text{kg}\cdot\text{m}^2/\text{s}^2$

20. A satellite is in a stationary orbit above the Earth, which has a mass of $5.98 \times 10^{24} \text{ kg}$. If the satellite is geosynchronous, how far from the centre of the Earth would it be located?

A) $4.23 \times 10^4 \text{ km}$
 B) $3.59 \times 10^4 \text{ km}$
 C) 956
 D) $7.80 \times 10^4 \text{ km}$

21. A 300 kg roller coaster starts at the position labelled 1, with no horizontal velocity. Assume no friction on the roller coaster until the brakes are applied after passing position 4.



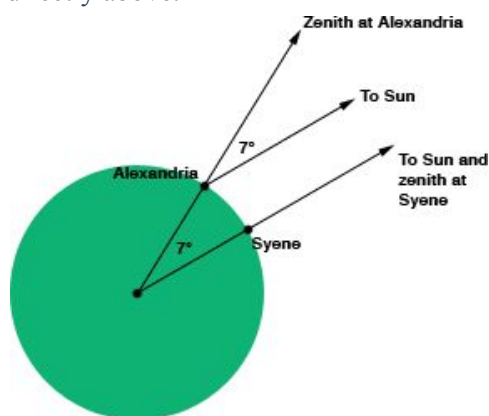
The roller-coaster car's speed at position 4, immediately before the brakes are applied, is

A) 17.7 m/s
 B) 20.3 m/s
 C) 14.7 m/s
 D) 12.1 m/s

22. Refer to the information in question 1.

When placed in order from greatest amount of kinetic energy to least, the order of the four different positions of the roller-coaster car labelled on the diagram is _____ (write your answer as a four digit number).

23. Around 200 BC, the Greek astronomer Eratosthenes described a method he used to calculate the circumference of the Earth. He measured the location of the Sun at local noon on the summer solstice in Alexandria, Egypt, and found it to be 7.00° south of the zenith. At the same time, due south at Syene, an assistant measured that the Sun shone directly above.



If the distance from Alexandria to Syene is about 830 km, what is the calculated radius of the Earth?

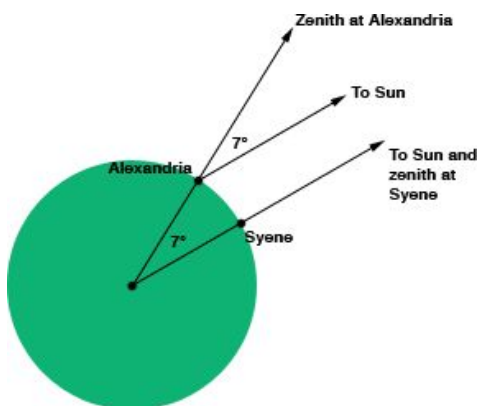
A) $6.8 \times 10^6 \text{ m}$ B) $8.3 \times 10^5 \text{ m}$

C) $8.2 \times 10^5 \text{ m}$ D) $7.2 \times 10^4 \text{ m}$

24. A woman runs at a speed of 8.00 m/s on a circular track. If she accelerates at 1.00 m/s^2 , what is the circumference of the track?
- A) 64 m
B) 128 m
C) 402 m
D) 201 m
25. A pendulum bob of mass 2.15 kg is raised 3.00 cm above the equilibrium position. Once released, how fast will it be travelling when it passes through the equilibrium position?
- A) 7.7 m/s
B) 77 cm/s
C) 59 cm/s
D) 0.43 m/s
26. A bungee jumper who jumps from a 100.0 m high platform stops at a distance of 8.0 m from the ground. The energy transformations would best be described as
- A) E_p changes to E_k , then changes to E_p with no loss of energy due to friction.
B) E_p changes to E_{spring} with a loss of energy due to friction.
C) E_p changes to E_k , then changes to E_{spring} with a loss of energy due to friction.
D) E_p changes to E_k , then the final energy is 0.
27. A roller coaster of mass 800 kg is raised to a height of 15.0 m above the ground. How much work was required (ignoring friction)?
- A) 800 J
B) $1.18 \times 10^5 \text{ J}$
C) $1.20 \times 10^4 \text{ J}$
D) $7.85 \times 10^3 \text{ J}$
28. A truck with a mass of $2.00 \times 10^4 \text{ kg}$ is travelling at 120.0 km/h . If the driver reduces the truck's speed to 50.0 km/h , then the truck's kinetic energy has changed by
- A) $1.19 \times 10^8 \text{ J}$
B) $4.90 \times 10^7 \text{ J}$
C) $9.18 \times 10^6 \text{ J}$
D) $3.78 \times 10^6 \text{ J}$
29. The Moon takes approximately 27.3 days to circle the Earth and its centre is located $3.83 \times 10^8 \text{ m}$ from the centre of the Earth. What is the Moon's acceleration?
- A) 0.230 m/s^2
B) $2.72 \times 10^{-3} \text{ m/s}^2$
C) $2.66 \times 10^{-6} \text{ m/s}^2$
D) 9.81 m/s^2
30. A parked car of mass m slips out of gear and rolls over a cliff of height h . When the car hits the base of the cliff, what is its velocity?
- A) $2gh$
B) mgh
C) $(2gh)^{0.5}$
D) $\frac{1}{2}mv^2$

31.

Around 200 BC, the Greek astronomer Eratosthenes described a method he used to calculate the circumference of the Earth. He measured the location of the Sun at local noon on the summer solstice in Alexandria, Egypt, and found it to be 7.00° south of the zenith. At the same time, due south at Syene, an assistant measured that the Sun shone directly above.



If the distance from Alexandria to Syene is about 830 km, what is the calculated radius of the Earth?

A) 6.8×10^6 m

B) 8.3×10^5 m

C) 8.2×10^5 m

D) 7.2×10^4 m

32. Refer to the information in question 1. If the distance from Alexandria to Syene is about 830 km, what is the calculated circumference of the Earth?

A) 3.6×10^4 km

B) 5.8×10^4 km

C) 5.2×10^3 km

D) 4.3×10^4 km

33. A box is pushed along a floor with a force of 32.0 N through a distance of 11.0 m. The work done on the box is

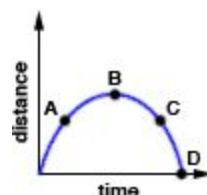
A) 35.9 J

B) 3.45×10^3 J

C) 2.91 J

D) 352 J

34. Which of the following is true of the graph?

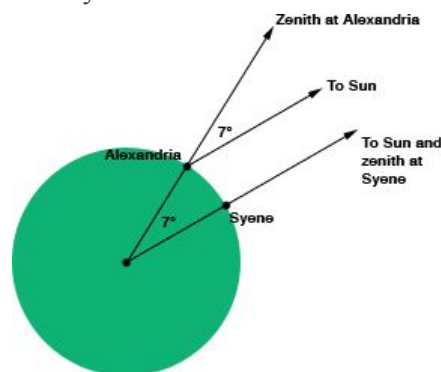


- A) The mechanical energy is greatest at point D.
 B) The mechanical energy is greatest at point B.
 C) The mechanical energy is the same at points A and C.
 D) The mechanical energy is the same at points B and C.

35. The Earth makes one complete revolution around the Sun in 365.3 days. If the distance between the Earth and the Sun is 1.5×10^{11} m, what is the acceleration of the Earth toward the Sun?
- A) $4.4 \times 10^7 \text{ m/s}^2$
 B) $2.0 \times 10^{-7} \text{ m/s}^2$
 C) $5.9 \times 10^{-3} \text{ m/s}^2$
 D) 9.81 m/s^2
36. A parked car of mass m slips out of gear and rolls over a cliff of height h . When the car hits the base of the cliff, what is its velocity?
- A) $2gh$
 B) mgh
 C) $(2gh)^{0.5}$
 D) $\frac{1}{2}mv^2$
37. An object on the end of a string is whirled around with uniform circular motion in the horizontal plane. The acceleration of the object is directed toward the
- A) center of the motion in the direction of the string.
 B) direction the object is travelling.
 C) tangent of the curve the object is travelling on.
 D) outside of the circle in the direction of the string.
38. A 3.00 kg mass is dropped from a height of 0.750 m onto a vertically oriented spring. The spring has a spring constant of 2000 N/m. How far will the spring be compressed?
- A) 2.1 cm
 B) 4.7 cm
 C) 6.7 cm
 D) 15 cm
39. A baseball is hit with a velocity of 25.0 m/s at an angle of 37.0° with the ground. When the ball reaches its maximum

height, what is the horizontal distance from where it was hit?

- A) 23.1 m
 B) 25.0 m
 C) 30.5 m
 D) 61.2 m
40. A truck with a mass of 2.00×10^4 kg is travelling at 120.0 km/h. If the driver reduces the truck's speed to 50.0 km/h, then the truck's kinetic energy has changed by
- A) $1.19 \times 10^8 \text{ J}$
 B) $4.90 \times 10^7 \text{ J}$
 C) $9.18 \times 10^6 \text{ J}$
 D) $3.78 \times 10^6 \text{ J}$
41. Around 200 BC, the Greek astronomer Eratosthenes described a method he used to calculate the circumference of the Earth. He measured the location of the Sun at local noon on the summer solstice in Alexandria, Egypt, and found it to be 7.00° south of the zenith. At the same time, due south at Syene, an assistant measured that the Sun shone directly above.



If the distance from Alexandria to Syene is about 830 km, what is the calculated radius of the Earth?

- A) $6.8 \times 10^6 \text{ m}$ | B) $8.3 \times 10^5 \text{ m}$ | C) $8.2 \times 10^5 \text{ m}$ | D) $7.2 \times 10^4 \text{ m}$

42. A baseball is hit with a velocity of 25.0 m/s at an angle of 37.0° with the ground. When the ball reaches its maximum height, what is the horizontal distance from where it was hit?

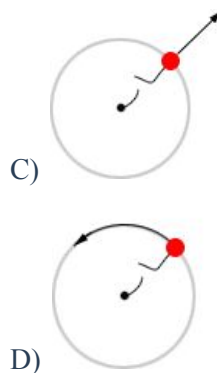
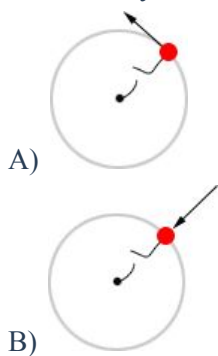
A) 23.1 m
B) 25.0 m
C) 30.5 m
D) 61.2 m

43. Mechanical energy is conserved when:
A) the total kinetic energy before equals the total kinetic energy after
B) the sum of the kinetic and potential energy before and after are equal
C) the sum of the kinetic, potential and frictional energy before and after are equal
D) the total potential energy before equals the total potential energy after

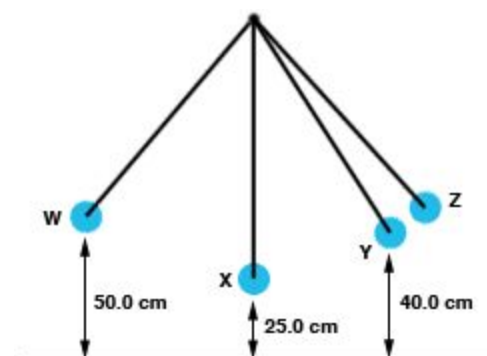
44. A 250 g rock is thrown straight down from a balcony to the street 12.0 m below. If the rock strikes the road at a speed of 30.0 m/s, what was the initial speed of the rock?

A) 0.0 m/s
B) 30.0 m/s
C) 18.2 m/s
D) 25.8 m/s

45. A ball is whirled around in a circle on the end of a string when the string breaks. Which diagram shows the direction of the ball's motion immediately afterwards?



46. A roller coaster of mass 800 kg is raised to a height of 15.0 m above the ground. How much work was required (ignoring friction)?
A) 800 J
B) 1.18×10^5 J
C) 1.20×10^4 J
D) 7.85×10^3 J
47. A student constructed a pendulum using a 1.0 kg ball attached to a string 70 cm long. The ball was pulled back and released from Point W. It made one swing to Point Z and is shown at various heights above a table.



The speed of the pendulum bob at point Y is

A) 1.96 m/s | B) 1.40 m/s | C) 3.13 m/s | D) 2.80 m/s

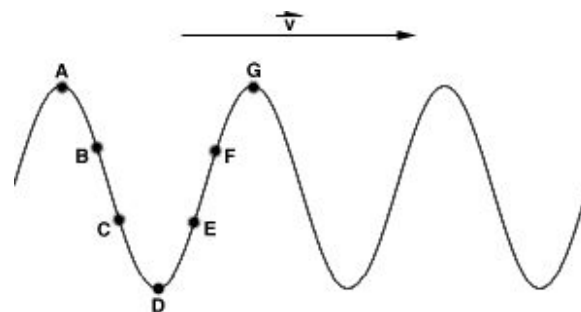
48. Refer to the information in question 7.
The speed of the pendulum bob at point X is
- A) 4.91 m/s
 - B) 2.21 m/s
 - C) 9.81 m/s
 - D) 3.13 m/s
49. Which of the following quantities is a *scalar* quantity?
- A) acceleration
 - B) velocity
 - C) work
 - D) force
50. A pendulum bob of mass 2.00 kg is raised above the equilibrium position. Once released, it travels at 120 cm/s when it passes through the equilibrium position. What was the starting height?
- A) 7.34 cm
 - B) 14.6 cm
 - C) 6.12 cm
 - D) 12.2 cm

Oscillatory Motion and Mechanical Waves

- If the wavelength of a sound wave is increased by two times, then the frequency of the same sound wave would be changed by
 - two times
 - four times
 - one half
 - one quarter
- When sending waves down a coil spring, a standing wave is sent up. The distance between the nodes is
 - λ
 - 2λ
 - $1/2\lambda$
 - $1/4\lambda$
- What is a difference between transverse waves and longitudinal waves?
 - Longitudinal waves have vibrations parallel to the direction of travel.
 - Transverse waves have vibrations parallel to the direction of travel.
 - Transverse waves have particles moving away from the source.
 - Longitudinal waves have particles moving away from the source.
- A 256 Hz tuning fork and a 272 Hz tuning fork are struck at the same time. The beat frequency is
 - 16 Hz
 - 12 Hz
 - 8 Hz
 - 26 Hz
- What is the frequency of a pendulum with a length of 0.850 m?
 - 0.541 Hz
 - 1.85 Hz

- 0.544 Hz
- 1.83 Hz

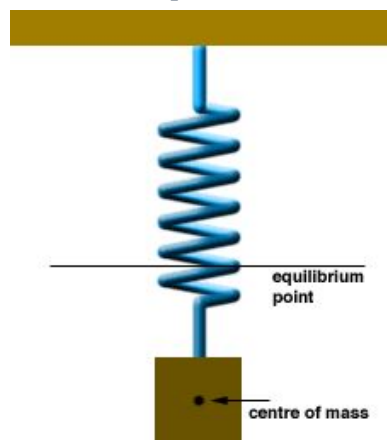
6.



Which of the following points would be moving upwards?

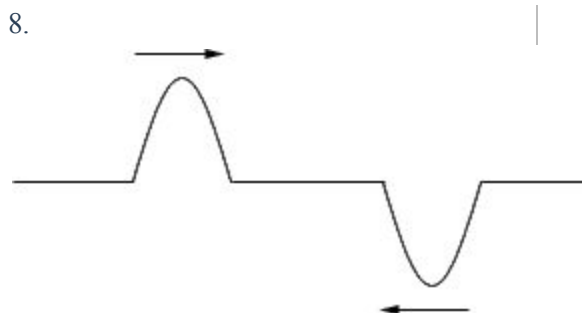
- A and G
- B and C
- E and F
- D, E, and F

7. The diagram shows a mass on a spring oscillating around its equilibrium point with simple harmonic motion. The mass has reached its maximum downward displacement.

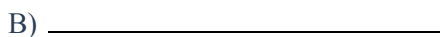
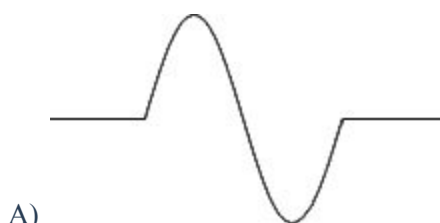


The velocity and the force on the mass are, respectively,

- maximum, minimum
- maximum, maximum
- minimum, maximum
- minimum, minimum



When the two waves pass over each other, which diagram represents the resultant wave?

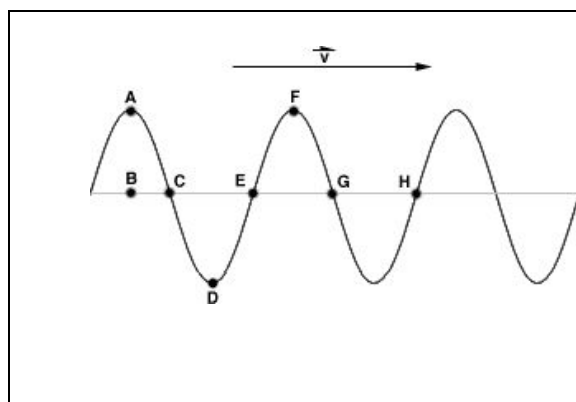


9. When sending a transverse pulse down a coiled spring that hits a wall, it would be
- transmitted through the barrier
 - absorbed by the barrier
 - reflected erect
 - reflected inverted
10. In a system, resonance occurs when an external vibration causes a vibration with a large
- velocity
 - wavelength
 - frequency
 - amplitude
11. What is the frequency of a pendulum with a length of 0.850 m?

- 0.541 Hz
- 1.85 Hz
- 0.544 Hz
- 1.83 Hz

12. When driving past a siren, the perceived pitch of the sound should be
- higher when travelling towards the siren, then lower as you pass by
 - lower when travelling towards the siren, then higher as you pass by
 - higher when travelling towards the siren, then the same as you pass by
 - lower when travelling towards the siren, then the same as you pass by

13.

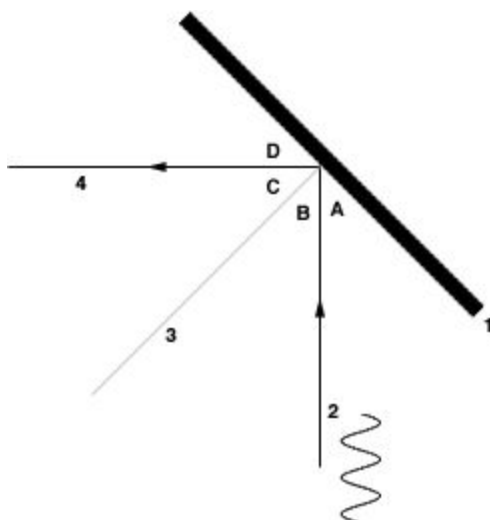


The wavelength of the wave can be found by measuring the distance between

- A and F, C and G, E and H
- B and E
- A and C, E and F, F and G
- C and E, G and H

14. When sending a transverse pulse down a coiled spring that hits a wall, it would be
- A) transmitted through the barrier
 - B) absorbed by the barrier
 - C) reflected erect
 - D) reflected inverted

15.



Which of the following angles would *always* add up to 90° ?

- A) A and D
 - B) B and C
 - C) 1 and 3
 - D) A and B
16. A pendulum swings back and forth 50 times in 1.00 min. What is the period of this motion?
- A) 0.83 s
 - B) 1.2 s
 - C) 50 s
 - D) 0.020 s

17.

Two springs, a heavy dense spring and a light spring, are attached to each other and used in an experiment.



If the light spring is attached to a wall, and a transverse pulse is sent from the heavy spring into the light spring, what will happen at the boundary between the springs?

- A) Part of the pulse will be reflected upside down and part of it will be transmitted upright.
- B) Part of the pulse will be reflected upside down and part of it will be transmitted upside down.
- C) Part of the pulse will be reflected upright and part of it will be transmitted upside down.
- D) Part of the pulse will be reflected upright and part of it will be transmitted upright.

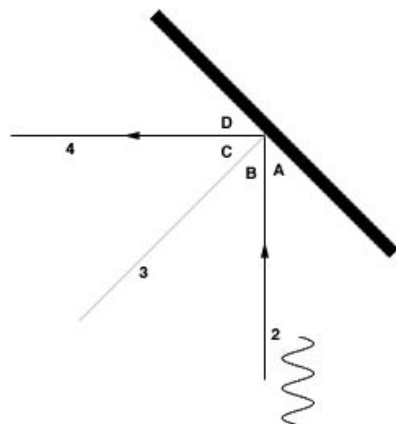
18. When an object on a spring vibrates through the equilibrium position, it has
 A) maximum velocity
 B) maximum potential energy
 C) zero velocity
 D) no energy
19. In a ripple tank, a wave travels from deep to shallow water. Which of the following would occur during this transition?
 A) The speed and wavelength of the waves would decrease
 B) The speed and wavelength of the waves would increase
 C) The frequency and wavelength of the waves would decrease
 D) The frequency and wavelength of the waves would increase
20. When sending waves down a coil spring, a standing wave is sent up. The distance between the anti-nodes is
 A) λ
 B) 2λ
 C) $1/2\lambda$
 D) $1/4\lambda$
21. In a longitudinal wave, a region of low particle density occurs as a
 A) crest
 B) rarefaction
 C) compression
 D) trough
22. What is a difference between transverse waves and longitudinal waves?
 A) Longitudinal waves have vibrations parallel to the direction of travel.
 B) Transverse waves have vibrations

parallel to the direction of travel.

C) Transverse waves have particles moving away from the source.

D) Longitudinal waves have particles moving away from the source.

23. As heard by a person at an accident scene, the pitch of an approaching police car would be
 A) the same as the police officer hears in the car
 B) lower than the police officer hears in the car
 C) higher than the police officer hears in the car
 D) lower than for a person behind the police car
24. An object vibrating at the end of a spring has maximum acceleration when
 A) the object is at the equilibrium position.
 B) the object is at the spring's maximum displacement.
 C) the object is at maximum velocity.
 D) the object is at $x = 0$.

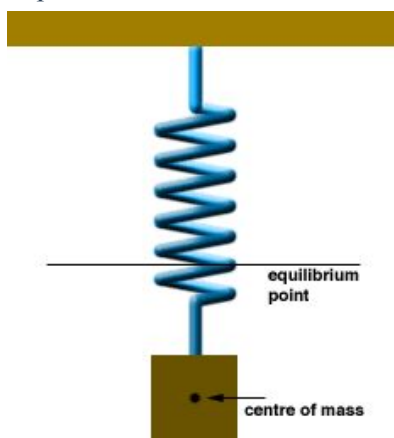


25. The normal would be represented by
 A) 3
 B) 1
 C) 2
 D) 4

26. Refer to the information in question 5. Which of the following angles would *always* equal the other?

A) A and C
B) B and C
C) B and D
D) A and B

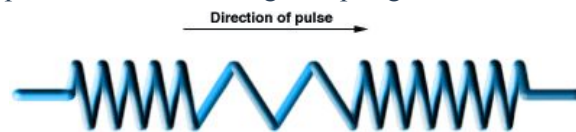
27. The diagram shows a mass on a spring oscillating around its equilibrium point with simple harmonic motion. The mass has reached its maximum downward displacement.



The velocity and the force on the mass are, respectively,

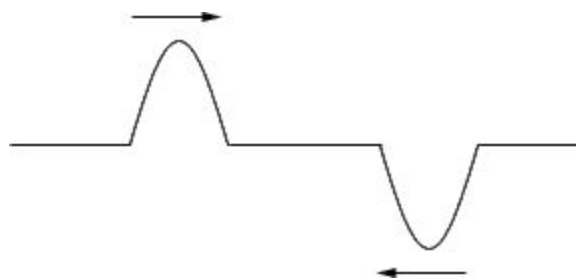
A) maximum, minimum
B) maximum, maximum
C) minimum, maximum
D) minimum, minimum

28. Which of the following describes the pulse as it moves along the spring?

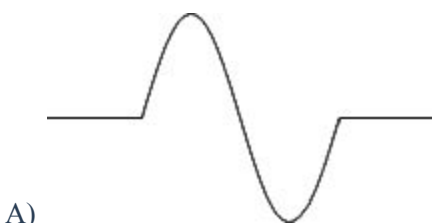


A) the amplitude changes as it moves towards the right
B) the speed of the pulse changes as it moves towards the right
C) the motion of the particles is parallel to the direction of the pulse
D) the motion of the particles is at right angles to the direction of the pulse

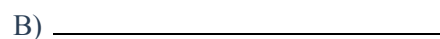
- 29.



When the two waves pass over each other, which diagram represents the resultant wave?



A)



B)

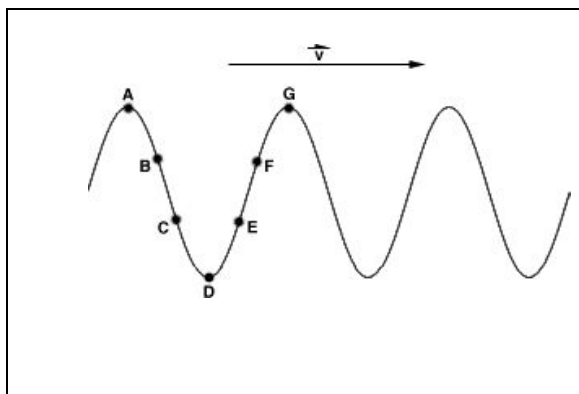


C)



D)

30.



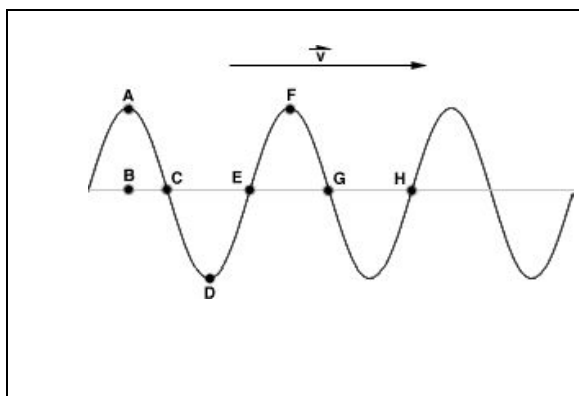
Which of the following points would be moving upwards?

- A) A and G
- B) B and C
- C) E and F
- D) D, E, and F

31. What is the frequency of a pendulum with a length of 0.250 m?

- A) 1.00 Hz
- B) 0.997 Hz
- C) 0.160 Hz
- D) 6.25 Hz

32.



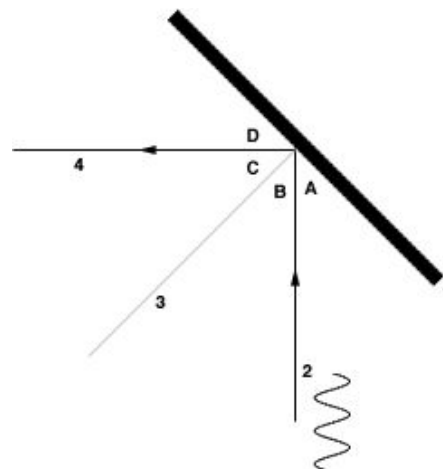
The wavelength of the wave can be found by measuring the distance between

- A) A and F, C and G, E and H

B) B and E

C) A and C, E and F, F and G

D) C and E, G and H



33.

The reflecting surface is represented by

- A) 3
- B) 4
- C) 2
- D) 1

34. Refer to the information in question 3.

Which of the following angles would *always* add up to 90° ?

- A) A and D
- B) B and C
- C) 1 and 3
- D) A and B

35. In a ripple tank, a wave travels from shallow to deep water. Which of the following would occur during this transition?

- A) The speed and wavelength of the waves would decrease
- B) The speed and wavelength of the waves would increase
- C) The frequency and wavelength of the waves would decrease
- D) The frequency and wavelength of the waves would increase

36. What is a difference between transverse waves and longitudinal waves?

- A) Longitudinal waves have vibrations parallel to the direction of travel.
- B) Transverse waves have vibrations parallel to the direction of travel.
- C) Transverse waves have particles moving away from the source.
- D) Longitudinal waves have particles moving away from the source.

37.

Two springs, a heavy dense spring and a light spring, are attached to each other and used in an experiment.



If the light spring is attached to a wall, and a transverse pulse is sent from the heavy spring into the light spring, what will happen at the boundary between the springs?

A) Part of the pulse will be reflected upside down and part of it will be transmitted upright.

B) Part of the pulse will be reflected upside down and part of it will be transmitted upside down.

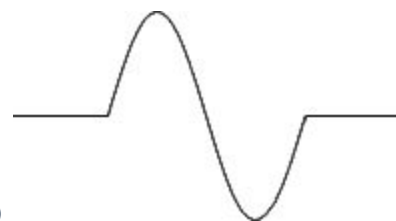
C) Part of the pulse will be reflected upright and part of it will be transmitted upside down.

D) Part of the pulse will be reflected upright and part of it will be transmitted upright.

38.

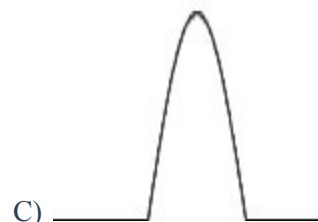


When the two waves pass over each other, which diagram represents the resultant wave?



A)

B) _____

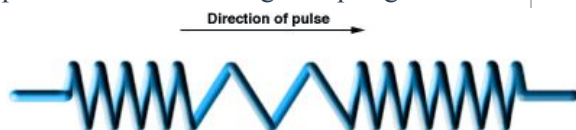


C)



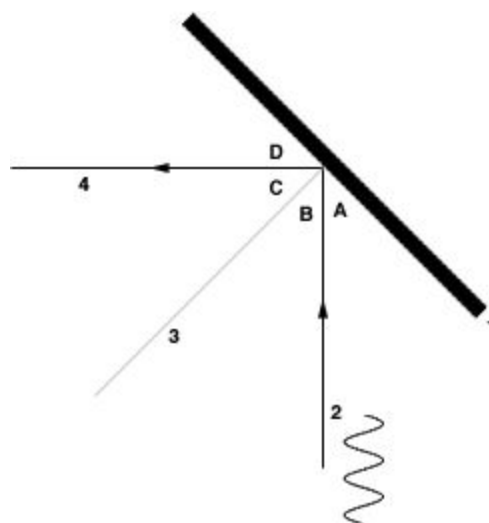
D)

39. When an object on a spring vibrates through the equilibrium position, it has
- A) maximum velocity
 - B) maximum potential energy
 - C) zero velocity
 - D) no energy
40. Which of the following describes the pulse as it moves along the spring?



- A) the amplitude changes as it moves towards the right
 - B) the speed of the pulse changes as it moves towards the right
 - C) the motion of the particles is parallel to the direction of the pulse
 - D) the motion of the particles is at right angles to the direction of the pulse
41. In diagrams of wave reflection, the normal is the
- A) line drawn parallel to the reflecting surface
 - B) line drawn perpendicular to the reflecting surface
 - C) angle from the wave to the reflecting surface
 - D) angle of the reflected wave from the surface

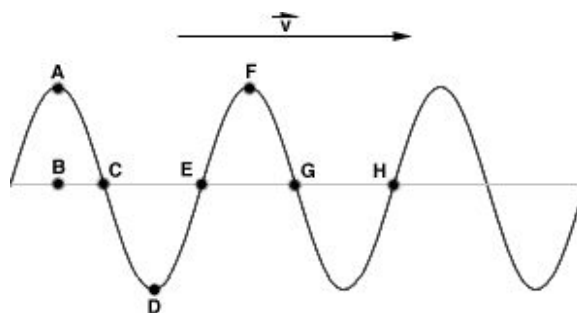
42.



The reflecting surface is represented by

- A) 3
- B) 4
- C) 2
- D) 1

43.



The amplitude of the wave can be found by measuring the distance between

- A) A and B
- B) C and D
- C) E and G
- D) A and F

44. When sending a transverse pulse down a coiled spring that hits a wall, it would be
- A) transmitted through the barrier
 - B) absorbed by the barrier
 - C) reflected erect
 - D) reflected inverted

45. If the period of a wave is 7.0 s, then its frequency is
 A) 0.14 Hz
 B) 7.0 Hz
 C) 70 Hz
 D) 14 Hz
46. The speed of a pulse in a medium depends on the
 A) properties of the medium
 B) frequency of the source
 C) wavelength of the source
 D) energy of the pulse

47.

Two springs, a heavy dense spring and a light spring, are attached to each other and used in an experiment.



If the heavy spring is attached to a wall, and a transverse pulse is sent from the light spring into the heavy spring, what will happen at the boundary between the springs?

A) Part of the pulse will be reflected upside down and part of it will be transmitted upright.

B) Part of the pulse will be reflected upside down and part of it will be transmitted upside down.

C) Part of the pulse will be reflected upright and part of it will be transmitted upside down.

D) Part of the pulse will be reflected upright and part of it will be transmitted upright.

48. When an object on a spring vibrates through the equilibrium position, it has
 A) maximum velocity
 B) maximum potential energy
 C) zero velocity
 D) no energy
49. An object vibrating at the end of a spring has maximum acceleration when
 A) the object is at the equilibrium position.
 B) the object is at the spring's maximum displacement.
 C) the object is at maximum velocity.
 D) the object is at $x = 0$.
50. An earthquake travels at a speed of 4.50×10^3 m/s. If it has a frequency of 10.5 Hz, what is the wavelength?
 A) 2.33×10^{-3} m
 B) 429 m
 C) 4.73×10^4 m
 D) 42.9 m

Answer Key

Kinematics

1. A
2. C
3. D
4. D
5. C
6. C
7. A
8. C
9. D
10. B
11. C
12. D
13. C
14. A
15. C
16. B
17. C
18. A
19. A
20. B
21. D
22. C
23. A
24. D
25. C
26. C
27. B
28. B
29. B
30. C
31. A
32. A
33. B
34. C
35. C
36. A
37. C
38. C
39. C

40. B
41. B
42. C
43. C
44. C
45. B
46. C
47. C
48. D
49. D
50. A

Dynamics

1. B
2. B
3. D
4. A
5. A
6. A
7. B
8. B
9. B
10. A
11. D
12. B
13. B
14. A
15. A
16. B
17. A
18. D
19. A
20. B

Circular Motion, Work, and Energy

1. C
2. C
3. 2431

4. C
5. C
6. B
7. B
8. A
9. C
10. A
11. 2431
12. A
13. C
14. C
15. B
16. B
17. C
18. C
19. D
20. A
21. A
22. 2431
23. A
24. C
25. B
26. C
27. B
28. C
29. B
30. C
31. A
32. D
33. D
34. C
35. C
36. C
37. A
38. D
39. C
40. C
41. A
42. C
43. B
44. D
45. A
46. B

47. B
48. B
49. C
50. A

Oscillatory Motion and Mechanical Waves

1. C
2. C
3. A
4. A
5. A
6. B
7. C
8. B
9. D
10. D
11. A
12. A
13. A
14. D
15. D
16. B
17. D
18. A
19. A
20. C
21. B
22. A
23. C
24. B
25. A
26. B
27. C
28. C
29. B
30. B
31. B
32. A
33. D
34. D

- 35. B
- 36. A
- 37. D
- 38. C
- 39. A
- 40. C
- 41. B
- 42. D
- 43. A
- 44. D
- 45. A
- 46. A
- 47. A
- 48. A
- 49. B
- 50. B