

2D Kinematics and Dynamics - Master Item List - Active Items

August 4, 2025

1 Two Dimensional Kinematics and Dynamics Assessment

Problem 1: (K2-1-V2EC)

An object has a constant negative velocity in the x -direction from time $t = 0$ s to time $t = 10$ s. The object's displacement at $t = 10$ s is D .

At what time will the object's displacement be one-half of D ?

- A. exactly $t = 5$ s
- B. some $t < 5$ s
- C. some $t > 5$ s

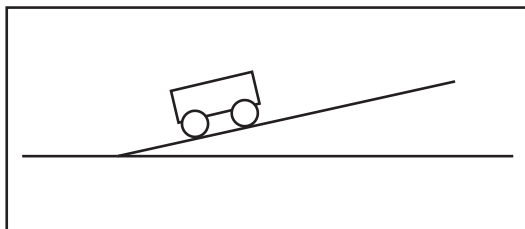
Problem 2: (K2-2-V2EC)

An object has a positive velocity in the x -direction and a constant positive acceleration in the x -direction from time $t = 0$ s to time $t = 10$ s. The object's displacement at $t = 10$ s is D .

At what time will the object's displacement be one-half of D ?

- A. exactly $t = 5$ s
- B. some $t < 5$ s
- C. some $t > 5$ s

Problem 3: (K2-4-V2JS)



The figure above shows a cart traveling along an inclined plane. The cart has been pushed and released, so it rolls up the plane. Before the cart reaches the top of the plane, it rolls back down the plane.

Select the response which best describes the net force on the cart as it travels up the plane.

- A. There is a constant net force down the inclined plane.
- B. There is a net force down the plane which decreases as the cart travels up the inclined plane.
- C. There is a constant net force up the inclined plane.

D. There is a net force up the plane which decreases as the cart travels up the inclined plane.

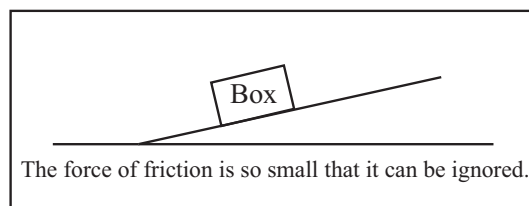
Problem 4: (K2-5-V2EC)

An object is thrown straight upward. The object travels upward until it reaches a maximum height and then falls downward until it hits the ground.

As the object travels upward, but before it reaches its highest point, what is the net force on the object? Air resistance is negligible.

- A. The net force is zero.
- B. The net force is downward and approximately constant.
- C. The net force is downward and decreasing.
- D. The net force is downward and increasing.
- E. The net force is upward and approximately constant.
- F. The net force is upward and decreasing.
- G. The net force is upward and increasing.

Problem 5: (K2-6-V2JS)



The figure above shows a box sliding along a very slippery ramp. The box has been pushed to the right and released. It slides to the right up the ramp until it reaches its highest point, and then slides down the ramp. The force of friction is very small and can be ignored. Air resistance is also negligible.

Select the response which best describes the velocity and the net force on the box at the highest point of its motion.

- A. The net force and velocity are zero.
- B. The net force is down the ramp and the velocity is zero.
- C. The net force is up the ramp and the velocity is zero.
- D. The net force and non-zero velocity are down the ramp.
- E. The net force is down the ramp and the non-zero velocity is up the ramp.
- F. The net force and non-zero velocity are up the ramp.

G. The net force is up the ramp and the non-zero velocity is down the ramp.

Problem 6: (K2-7-V1JS)

Two objects are dropped from rest at the same time from the same height. The objects are the same shape. Object A is twice as heavy as Object B. Air resistance is negligible and may be ignored.

When do the objects reach the ground?

- A. Object A reaches the ground first.
- B. Object B reaches the ground first.
- C. Both objects reach the ground at the same time.

Problem 7: (K2-8-V2EC)

A ball is dropped so it falls straight down. Air resistance is negligible and may be ignored.

Select the response that best describes the ball's speed as it falls before it reaches the ground.

- A. The ball quickly reaches a maximum speed and then falls at a constant speed.
- B. The ball's speed constantly increases because the downward force of gravity increases as the ball gets closer to the earth.
- C. The ball's speed continuously increases because of an approximately constant downward force of gravity.
- D. The ball's speed continuously increases because of an approximately constant downward force of gravity and a downward force from the air.

Problem 8: (K2-9-V2EC)

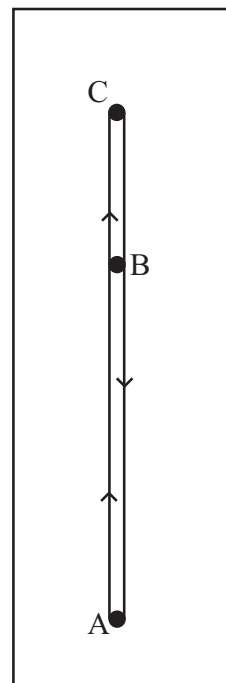
An object is thrown straight upward. Air resistance is negligible and may be ignored.

Select the response that best describes forces on the object while in the air.

- A. A steadily decreasing upward force and an approximately constant downward force of gravity.
- B. A steadily decreasing upward force as the object travels upward and an increasing downward force of gravity as the object travels downward.
- C. An approximately constant downward force of gravity and a steadily decreasing upward force as the object travels upward. An approximately constant downward force of gravity as the object travels downward.
- D. An approximately constant downward force of gravity only.

Problem 9: (K2-10-V2JS)

An object is thrown straight upward as shown in the figure to the right. It travels upward from point A, through point B. At point C, it reaches its highest point, reverses direction, and falls downward through point B then A. The object travels along the same line both while traveling upward and downward. The two paths are separated in the figure to make it easier to read. Neglect air resistance.

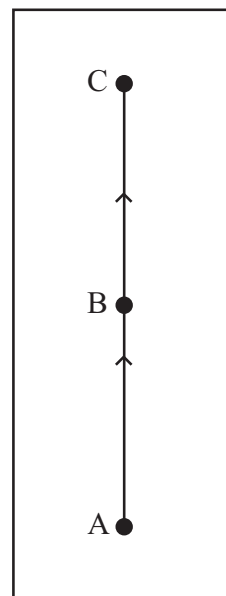


Select the response that best describes the object's speed as it passes through point B going upward and downward.

- A. The object's speed at point B is the same for both directions.
- B. The object's speed at point B is larger as it travels upward.
- C. The object's speed at point B is larger as it travels downward.

Problem 10: (K2-11-V1JS)

An object is thrown straight upward as shown in the figure to the right. It travels upward through points A and B until reaching its highest point C. The distance from point A to B is the same as the distance from point B to C. Air resistance is negligible.



Select the response that best describes the relation of the time to travel from A to B and the time to travel from B to C.

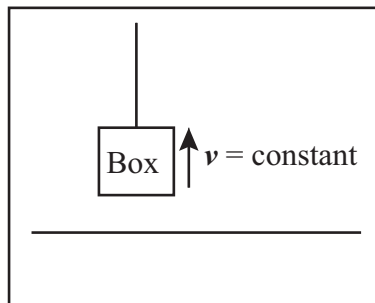
- A. The object's time to travel from A to B is **larger** than its time to travel from B to C.
- B. The object's time to travel from A to B is **smaller** than its time to travel from B to C.
- C. The object's time to travel from A to B is **approximately the same** as its time to travel from B to C.

Problem 11: (K2-12-V1JS)

A box is attached to a rope as shown to the right. The rope is pulled upward so the box is lifted with a constant velocity, \mathbf{v} . Air resistance is negligible.

Select the response that best describes the relation of the force of gravity on the box and the force exerted by the rope on the box.

- A. The downward force of gravity and the upward force exerted by the rope are **equal**.
- B. The downward force of gravity is **larger** than the upward force exerted by the rope.
- C. The downward force of gravity is **smaller** than the upward force exerted by the rope.



Problem 12: (K2-13-V1JS)

A steel cable is attached to the top of an elevator and is exerting an upward force on the elevator. All frictional effects are negligible. The elevator is moving upward and slowing down.

How does the tension in the cable compare to the force of gravity on the elevator?

- A. The tension in the cable is greater than the force of gravity on the elevator.
- B. The tension in the cable is less than the force of gravity on the elevator.
- C. The tension in the cable is equal to the force of gravity on the elevator.

Problem 13: (K2-14-V1JS)

A steel cable is attached to the top of an elevator and is exerting an upward force on the elevator. All frictional effects are negligible. The elevator is moving downward at constant speed.

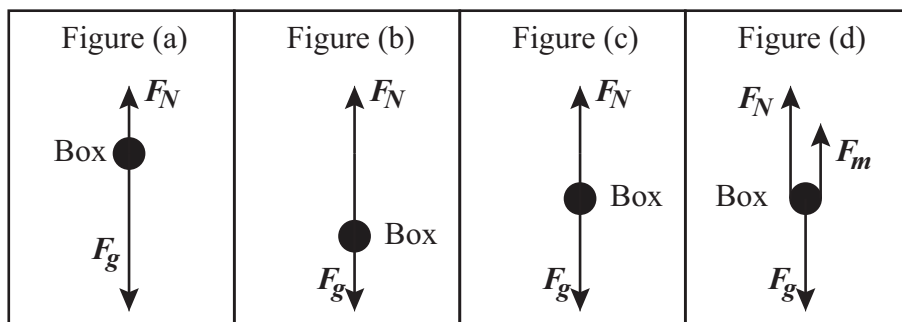
How does the tension in the cable compare to the force of gravity on the elevator?

- A. The tension in the cable is greater than the force of gravity on the elevator.
- B. The tension in the cable is less than the force of gravity on the elevator.
- C. The tension in the cable is equal to the force of gravity on the elevator.

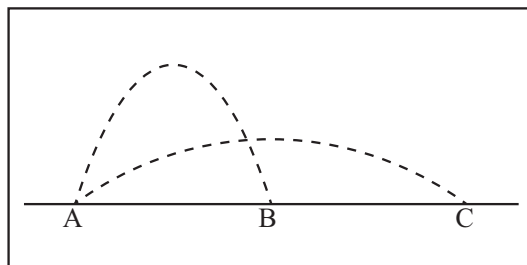
Problem 14: (K2-15-V1JS)

A person is standing in an elevator that is moving upward and slowing down. Which of the following diagrams best represents the forces acting on the person? Note that the length of the arrow is proportional to the magnitude of the force. The normal force exerted by floor of the elevator on the person is \mathbf{F}_N , the gravitational force exerted on the person is \mathbf{F}_g . There may also be a force of motion \mathbf{F}_m .

Select the figure which best shows the forces exerted on the box.



Problem 15: (K2-16-V1JS)

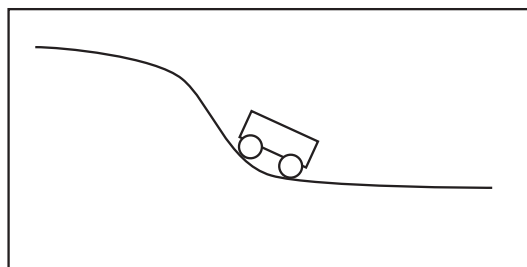


The figure above shows the path taken by two objects thrown at the same time from point A. One lands at point B and the other at point C. Air resistance is negligible and may be ignored.

Select the response which best describes when the two objects reach points B and C.

- A. They reach point B and C at the same time.
- B. The object reaches point B before the object reaches point C.
- C. The object reaches point C before the object reaches point B.
- D. There is not enough information given to determine when the object reach the two points.

Problem 16: (K2-17-V1JS)

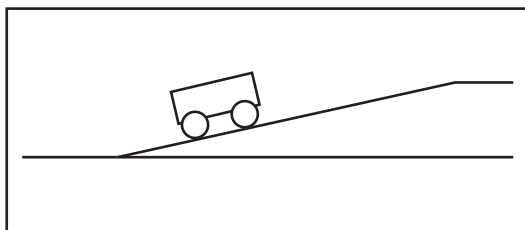


The figure above shows a cart rolling down a hill. Friction and air resistance are negligible and may be ignored.

How does the velocity and acceleration in the direction of motion change after time drawn as the cart continues to the right?

- A. The acceleration is constant and the velocity is constant.
- B. The acceleration is constant and the velocity decreases with time.
- C. The acceleration is constant and the velocity increases with time.
- D. The acceleration increases with time and the velocity is constant.
- E. The acceleration increases with time and the velocity is decreases with time.
- F. The acceleration increases with time and the velocity is increases with time.
- G. The acceleration decreases with time and the velocity is constant.
- H. The acceleration decreases with time and the velocity is decreases with time.
- I. The acceleration decreases with time and the velocity is increases with time.

Problem 17: (K2-18-V1JS)



The figure above shows a cart traveling along an inclined plane. The cart is pushed and released so it rolls up the plane. Before the cart reaches the top of the plane, it turns around, and rolls down the plane.

Select the response which best describes the velocity and acceleration of the cart at the highest point of its motion.

- A. The acceleration is not zero and the velocity is not zero.
- B. The acceleration is not zero and the velocity is zero.
- C. The acceleration is zero and the velocity is not zero.
- D. The acceleration is zero and the velocity is zero.

Problem 18: (K2-19-V1JS)

Two objects slide off a table with the same horizontal speed. One object weighs twice as much as the other object. Air friction is negligible and can be ignored.

Select the response that best describes the relation of where the two objects hit the floor?

- A. Both objects hit the ground the same distance from the table.
- B. The heavier object hits the ground closer to the table than the lighter object.
- C. The lighter object hits the ground closer to the table than the heavier object.

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