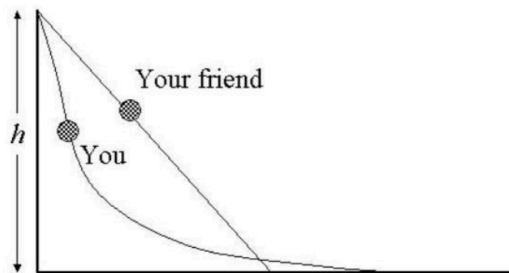


MCD Sample Questions

Energy

1. Two frictionless slides are shaped differently but start at the same height h and end at the same level as shown below. You and your friend, who has the same weight as you, slide down from the top on different slides starting from rest. Which one of the following statements best describes who has a larger speed at the bottom of the slide?



- You, because you initially encounter a steeper slope so that there is more opportunity or accelerating.
- You, because you travel a longer distance so that there is more opportunity for accelerating.
- Your friend, because her slide has a constant slope so that she has more opportunity for accelerating.
- Your friend, because she travels a shorter distance so that she can conserve her kinetic energy better.
- Both of you have the same speed.
2. You drop a ball from a high tower and it falls freely under the influence of the gravitational force. Which one of the following statements is true?
- The kinetic energy of the ball increases by equal amounts in equal times
- The kinetic energy of the ball increases by equal amounts over equal distances
- There is zero work done on the ball by the gravitational force as it falls
- The work done on the ball by the gravitational force is negative as it falls
- The total mechanical energy of the ball decreases as it falls

Forces

1. This question refers to a collision between a car and a truck.

The truck is a small pickup and is the same weight as the car.

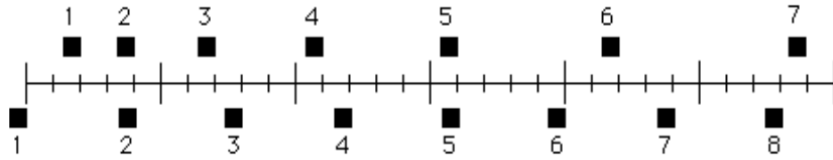


The truck is standing still when the car hits it. Which choice best describes the forces between the car and the truck?

- The truck exerts a greater amount of force on the car than the car exerts on the truck
 - The car exerts a greater amount of force on the truck than the truck exerts on the car
 - Neither exerts a force on the other; the car gets smashed simply because it is in the way of the truck
 - The truck exerts a force on the car but the car doesn't exert a force on the truck
 - Not enough information is given to pick one of the answers above
 - None of the answers above describes the situation correctly
2. A woman exerts a constant horizontal force on a large box. As a result, the box moves across a horizontal floor at a constant speed v_0 . If the woman suddenly stops applying a horizontal force to the box, then the box will:
- immediately come to a stop
 - continue moving at a constant speed for a while and then slow to a stop
 - immediately start slowing to a stop
 - continue at a constant speed
 - increase its speed for a while and then start slowing to a stop

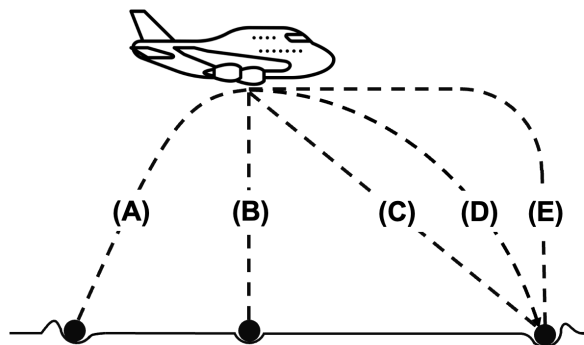
Kinematics

1. The positions of two blocks at successive 0.20-second time intervals are represented by the numbered squares in the figure below. The blocks are moving toward the right.



Do the blocks ever have the same speed?

- No
 - Yes, at instant 2
 - Yes, at instant 5
 - Yes, at instants 2 and 5
 - Yes, at some time during the interval 3 to 4
2. A bowling ball accidentally falls out of the cargo bay of an airliner as it flies along in a horizontal direction.
- As observed by a person standing on the ground and viewing the plane as in the figure at right, which path would the bowling ball most closely follow after leaving the airplane?



- A
- B
- C
- D
- E

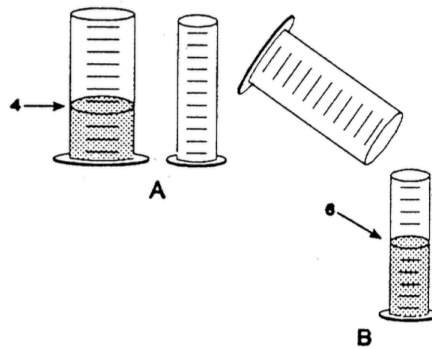
Mathematics

1. The derivative, $f'(x)$, of a function $f(x)$, is negative everywhere. We know also that $f(0)=0$. What must be true about $f(-1)$?

- $f(-1)$ is negative
- $f(-1)$ is positive
- $f(-1)$ is zero.
- Not enough information to conclude anything about $f(-1)$

2. Below are drawings of a wide and a narrow cylinder. The cylinders have equally spaced marks on them. Water is poured into the wide cylinder up to the 4th mark (see A). This water rises to the 6th mark when poured into the narrow cylinder (see B).

Both cylinders are emptied, and water is poured into the narrow cylinder up to the 11th mark. How high would this water rise if it were poured into the empty wide cylinder?



- To the $7\frac{1}{2}$ mark
- To the 9th mark
- To the 8th mark
- To the $7\frac{1}{3}$ mark
- To the 11th mark

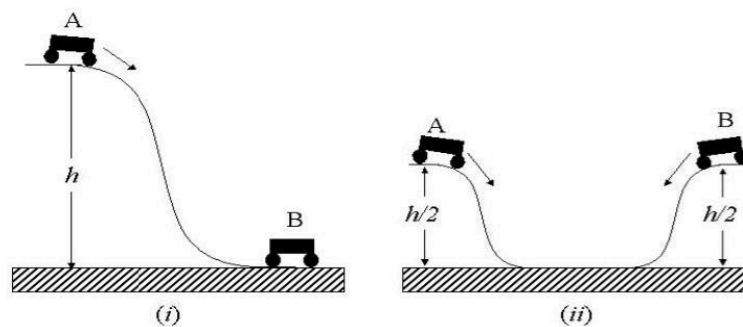
Momentum

1. Carts A and B are identical in all respects before the collision.

Figure (i): Cart A starts from rest on a hill at a height h above the ground. It rolls down and collides "head-on" with cart B which is initially at rest on the ground. The two carts stick together.

Figure (ii): Carts A and B are at rest on opposite hills at heights $h/2$ above the ground. They roll down, collide "head-on" with each other on the ground and stick together.

Which one of the following statements is true about the two-cart system just after the carts collide in the two cases?



Just after the collision,

- the kinetic energy of the system is greater in case (ii) than in case (i)
 - the kinetic energy of the system is the same in both cases
 - the momentum of the system is greater in case (ii) than in case (i)
 - the momentum of the system is non-zero in case (i) while it is zero in case (ii)
 - the momentum of the system is the same in both cases
2. The impulse of a force is defined as the product of the average force and the time interval during which the force acts.

Which one of the following statements is true concerning linear momentum?

- Momentum is a force
- The momentum of an object is always positive
- Momentum is a scalar quantity
- The SI unit of momentum is $\text{kg}\cdot\text{m}^2/\text{s}$
- Momentum and impulse have the same units