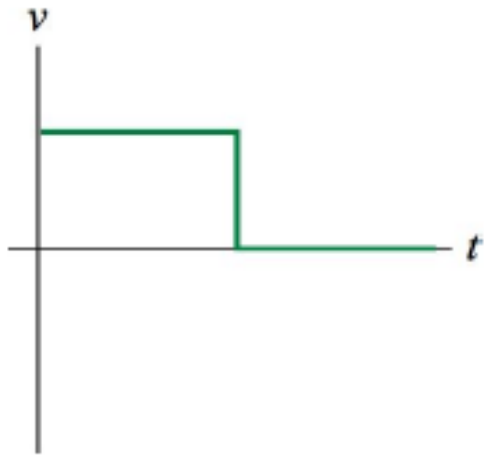
PH201
End of Term Review

Conceptual Questions

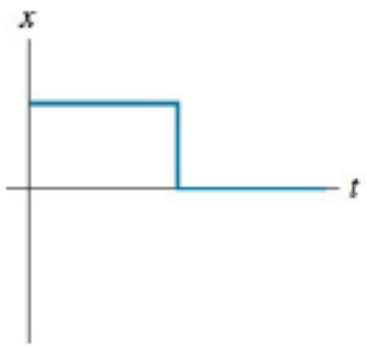
Overview of PH 201

- Motion:
  - Kinematics – linear motion, projectile motion
  - Uniform circular motion
  - Rotational motion (with angular acceleration)
- Newton's Laws predicting motion:
  - Linear and angular cases
  - Forces, including
    - Gravity
    - Tension
    - Friction
    - Normal
    - Restoring force
  - Torque
- Conservation Laws
  - Linear Momentum
    - Impulse, collisions
  - Energy
    - Kinetic Energy
    - Gravitational Potential Energy
    - Elastic Potential Energy
    - Thermal Energy
    - Energy added or removed to system through Work

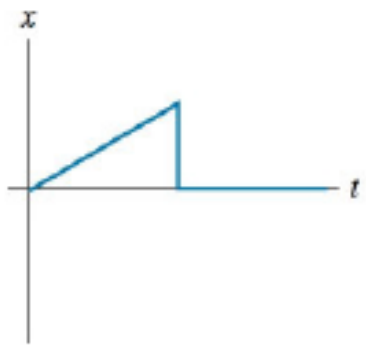
A graph of velocity versus time for a hockey puck shot into a goal appears like so:



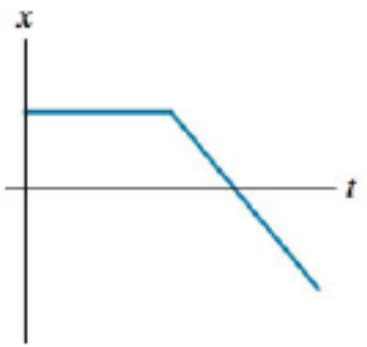
Which of the following position graphs matches the above velocity graph?



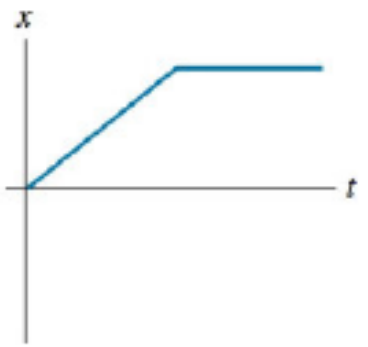
A.



B.



C.



D.

Sample kinematics problem

Part a: Find average acceleration of a skier who, starting from rest, reaches a speed of 8.0m/s when going down a slope for 5.0s.

Part b:How far does the skier go in this time?

x_i x_f v_i v_f a Δt

Equations of Kinematics:

$$v_f = v_i + a\,\Delta t$$

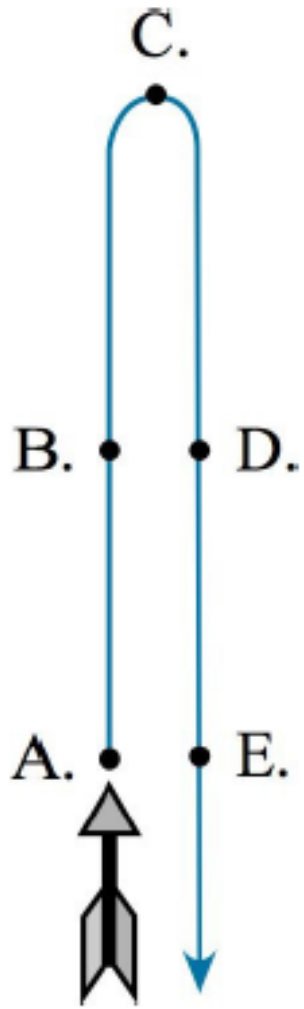
$$x_f = x_i + v_i\,\Delta t + \tfrac{1}{2}\,a\,\Delta t^2$$

$$v_f^2 = v_i^2 + 2a\,\Delta x$$

$$\Delta x = \tfrac{1}{2}\,(v_f + v_i)\,\Delta t$$

An arrow is launched vertically upward. It moves straight up to a maximum height, then falls to the ground. The trajectory of the arrow is noted.

Which choice below best represents the arrow's acceleration at the different points?



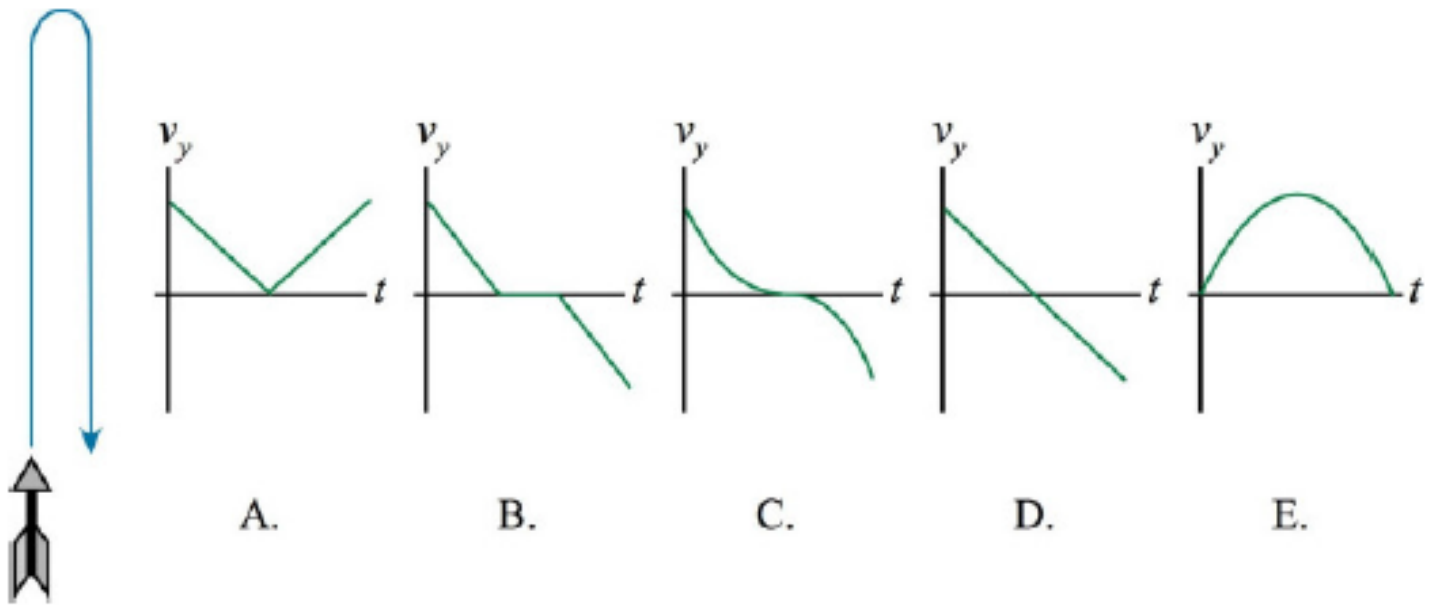
A. $A = E > B = D; C = 0$

B. $E > D > C > B > A$

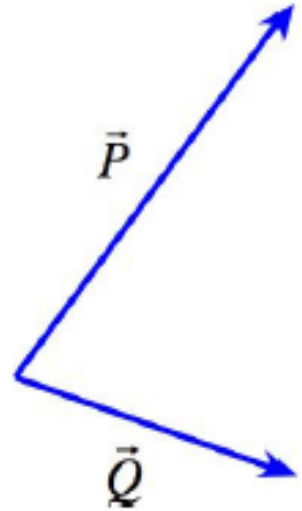
C. $A = B = C = D = E$

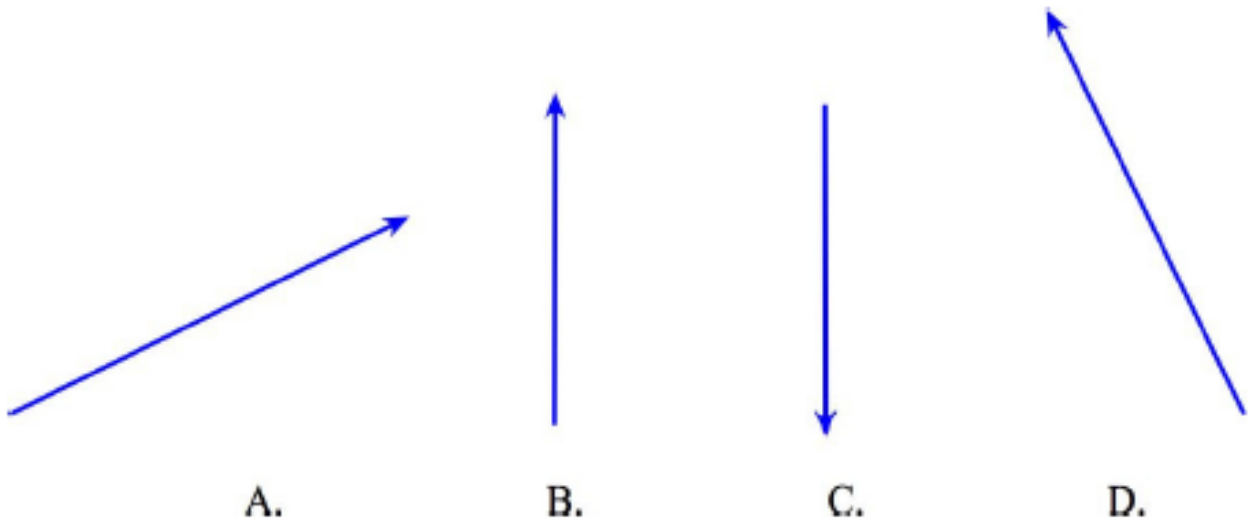
D. $A > B > D > E; C = 0$

An arrow is launched vertically upward. It moves straight up to a maximum height, then falls to the ground. The trajectory of the arrow is noted. Which graph best represents the vertical velocity of the arrow as a function of time? Ignore air resistance; the only force acting is gravity.



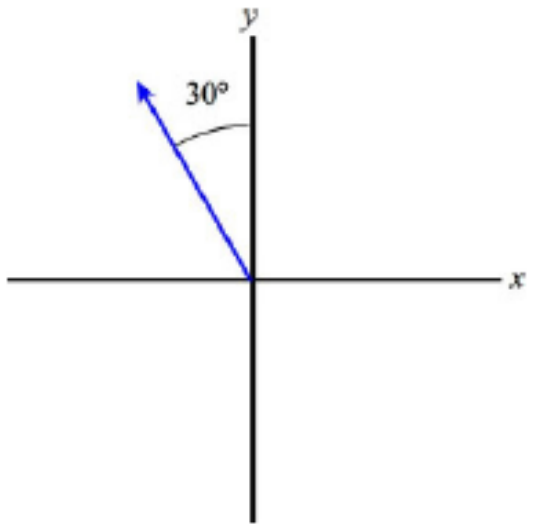
Which of the vectors below best represents the vector sum $P + Q$?





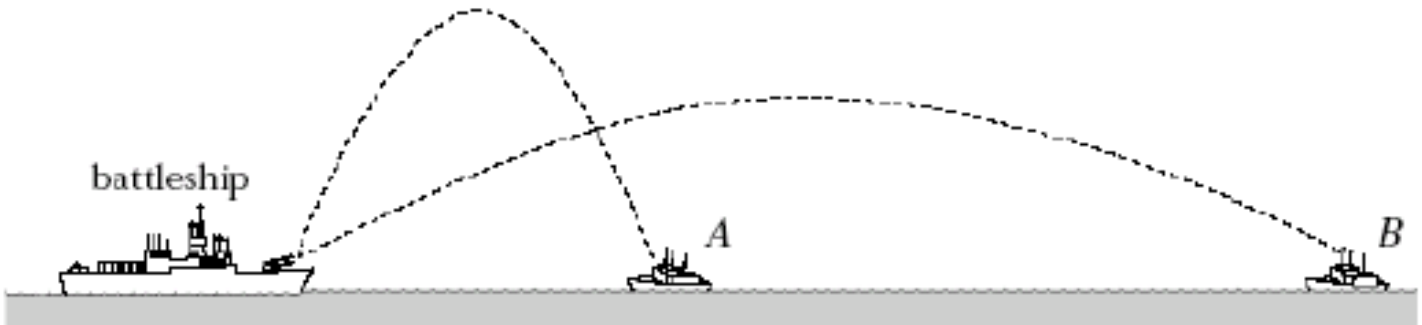
A. B. C. D.

This vector has a length 4.0 units. What are the *x*- and *y*-components of the vector?



A. 3.5, 2.0
B. −2.0, 3.5
C. −3.5, 2.0
D. 2.0, −3.5
E. −3.5, −2.0

A battleship simultaneously fires two shells at enemy ships. If the shells follow the parabolic trajectories shown, which ship gets hit first?



1. *A*
2. *B*
3. both at the same time
4. need more information

ship shell trajectory

A 40-car train travels along a straight track at 40 mph.

A skier speeds up as she skis downhill. On which is the net force greater?

A. The train.
B. The skier.
C. The net force is the same on both.
D. There's not enough information to tell.

Consider a person standing in an elevator that is accelerating upward. The upward normal force N exerted by the elevator floor on the person is

1. larger than
2. identical to
3. smaller than

the downward weight W of the person.

elevator

10-year-old Sarah stands on a skateboard. Her older brother Jack starts pushing her backward and she starts speeding up. The force of Jack on Sarah is

A. greater than the force of Sarah on Jack.
B. equal to than the force of Sarah on Jack.
C. less than the force of Sarah on Jack.

When a ball on the end of a string is swung in a circle, the ball is accelerating because

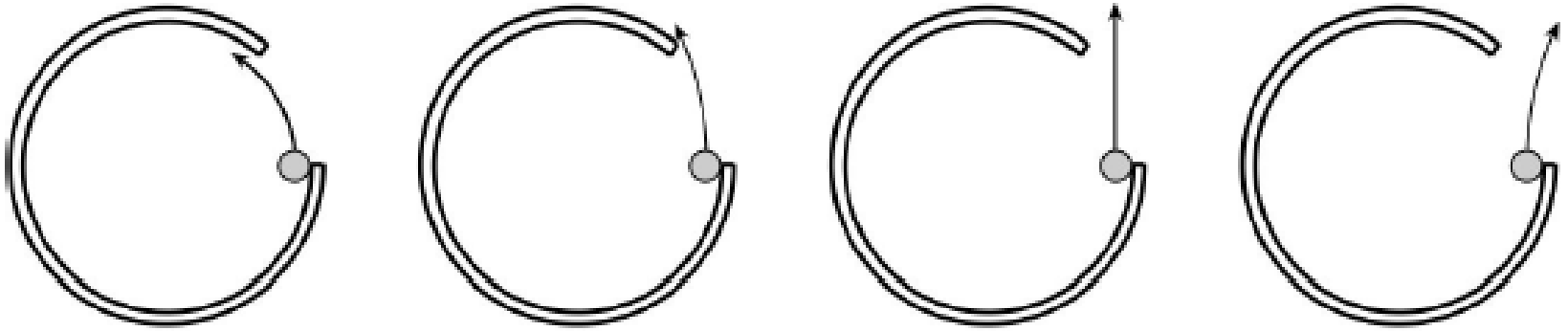
A. the speed is changing.
B. the direction is changing.
C. the speed and the direction are changing.
D. the ball is not accelerating.

When a ball on the end of a string is swung in a circle:
What is the direction of the acceleration of the ball?

A. Tangent to the circle, in the direction of the ball's motion
B. Toward the center of the circle

Checking Understanding:
Circular Motion Dynamics

When the ball reaches the break in the circle, which path will it follow?



A. B. C. D.

Two cars are traveling at the same speed of 27m/s on a curve that has a radius of 120m. Car A's mass is 1100kg and Car B's mass is 1600kg.

Without doing any calculations…

Which car has the greatest centripetal acceleration?

A) Car A

B) Car B

C) They're the same

A car goes over a hill which is approximately circular.

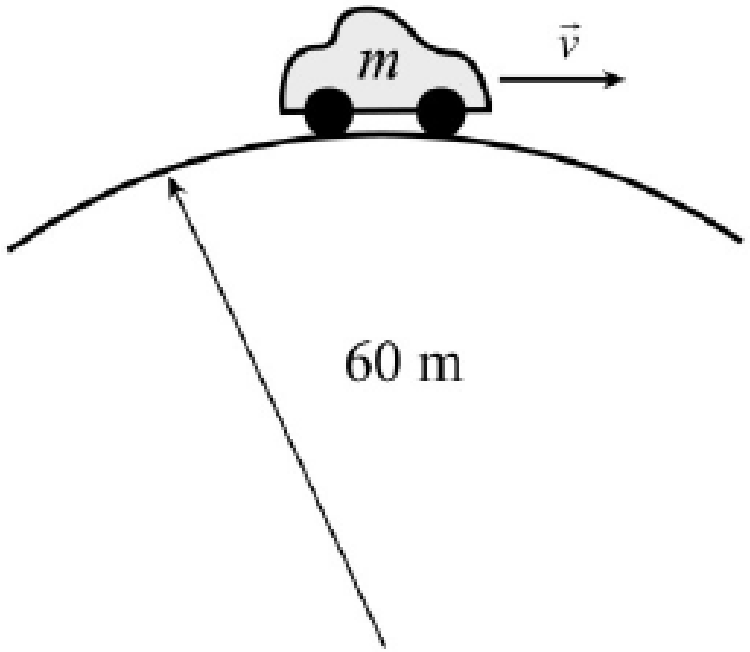
When the car is at the highest point of the hill, the force of gravity on the car is

a. >

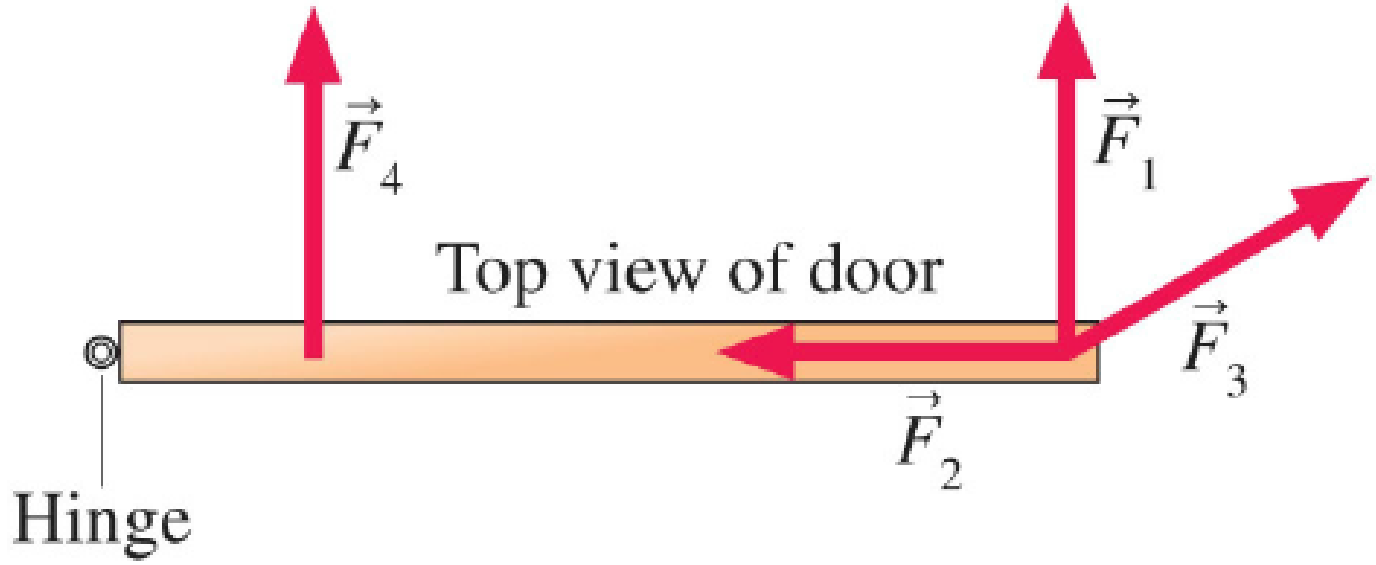
b. <

c. =

the normal force of the road on the car.



The four forces shown have the same strength. Which force would be most effective in opening the door?



A. Force F_1
B. Force F_2
C. Force F_3
D. Force F_4
E. Either F_1 or F_3

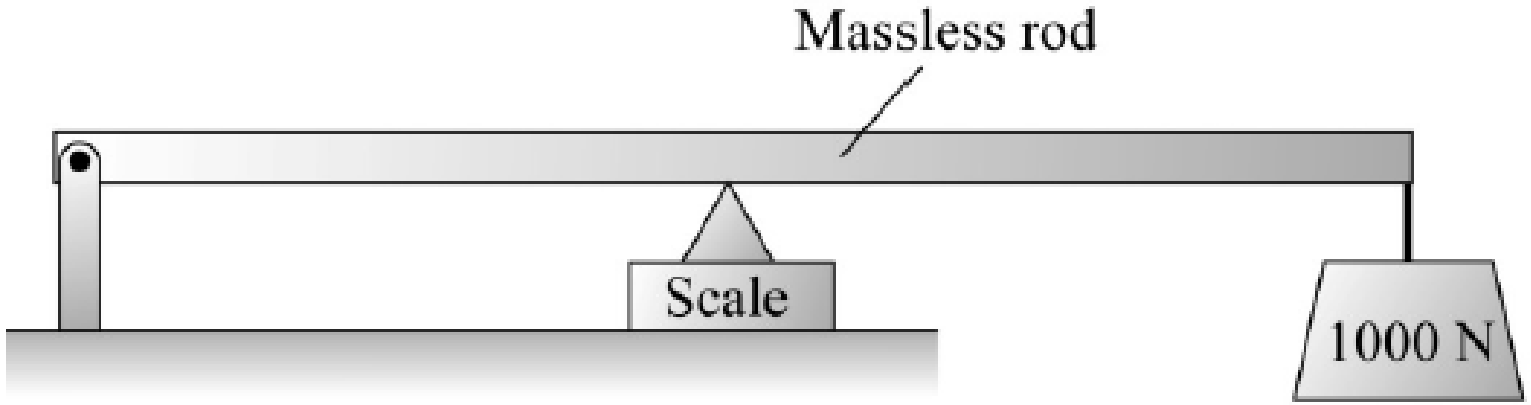
Suppose a ping-pong ball and a bowling ball are rolling toward you. Both have the same momentum, and you exert the same force to stop each. How do the time intervals to stop them compare?

1. It takes less time to stop the ping-pong ball.
2. Both take the same time.
3. It takes more time to stop the ping-pong ball.

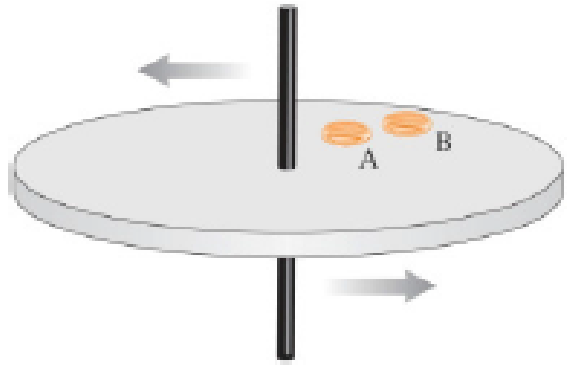
time to stop

What does the scale read?

A. 500 N
B. 1000 N
C. 2000 N
D. 4000 N



Two coins rotate on a turntable. Coin B is twice as far from the axis as coin A.



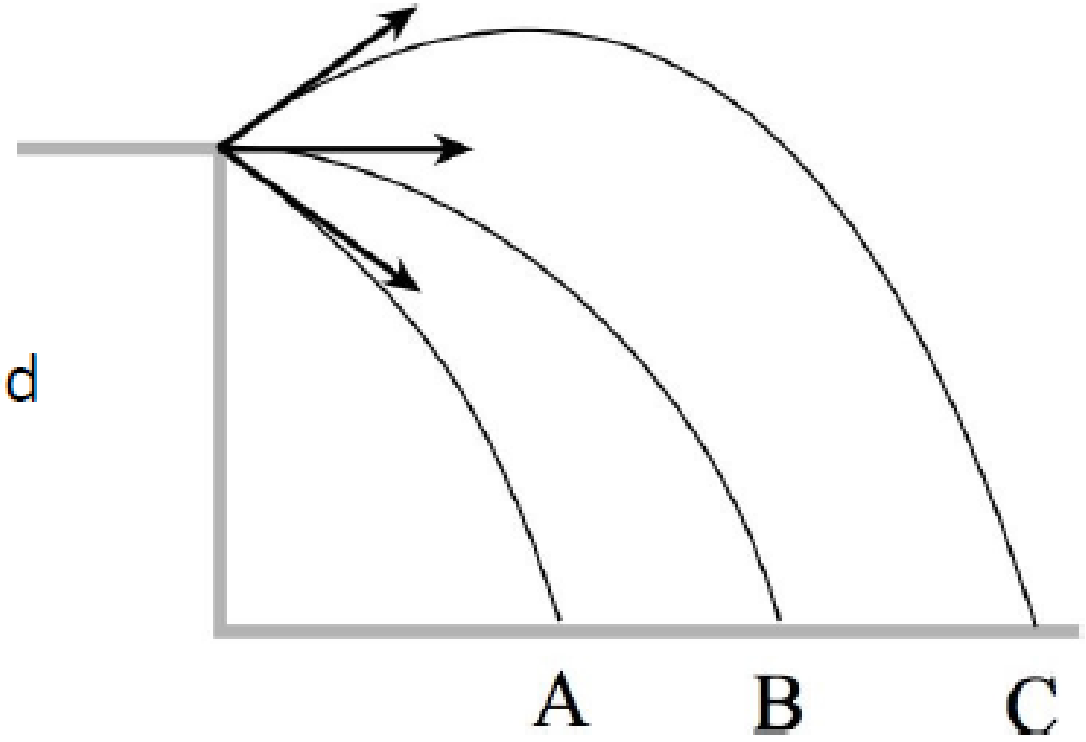
A. The speed of A is twice that of B.

B. The speed of A equals that of B.

C. The speed of A is half that of B.

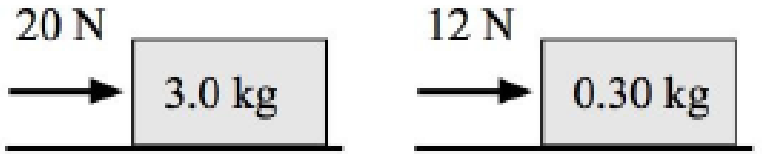
Three balls are thrown off a cliff with the same speed, but in different directions. Which ball has the greatest speed just before it hits the ground?

A. Ball A
B. Ball B
C. Ball C
D. All balls have the same speed



Each of the boxes, with masses noted, is pulled for 10 m across a level, frictionless floor by the noted force. Which box experiences the largest change in kinetic energy?

A. B. C.



D. E.

I swing a ball around my head at constant speed in a circle with circumference 3 m. What is the work done on the ball by the 10 N tension force in the string during one revolution of the ball?

A. 30 J

B. 20 J

C. 10 J

D. 0 J