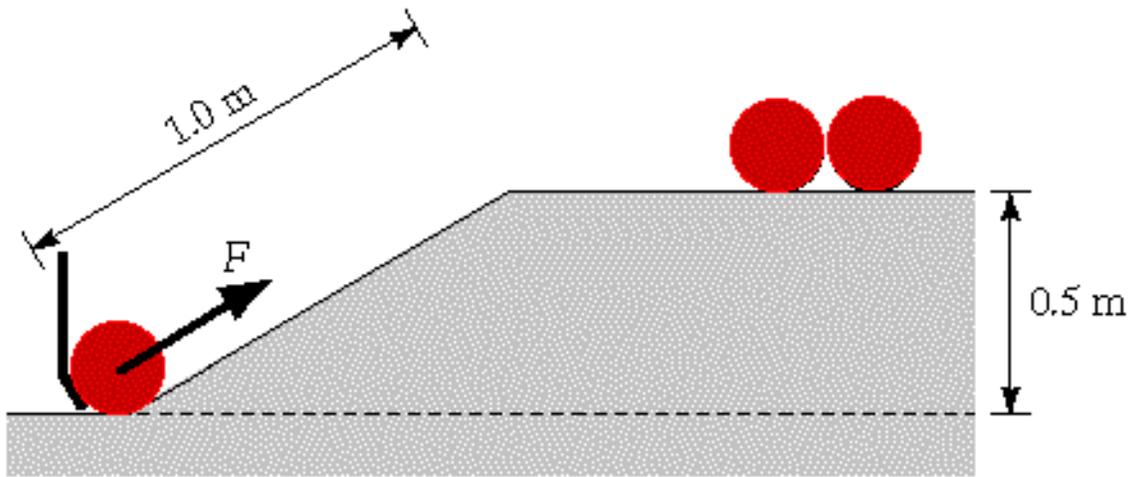


CPS lesson
Work and Energy
ANSWER KEY

1. A ball feeder slowly pushes a bowling ball up a 1-m ramp to a height of 0.5 m above the floor. Neglecting friction, what constant force must be exerted on the 5-kg ball to do this?



- A. 200 N
- B. 50 N
- * C. 25 N
- D. 5 N

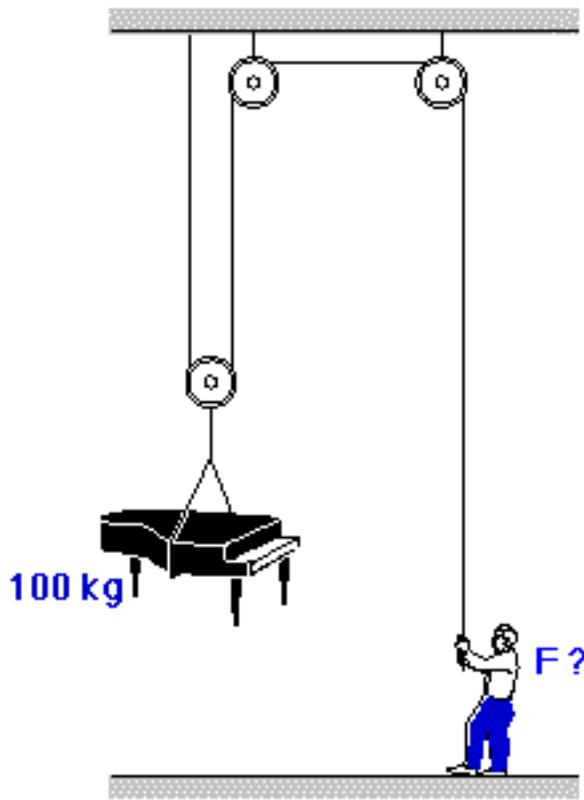
2. Two marbles, one twice as heavy as the other, are dropped to the ground from the roof of a building. Just before hitting the ground, the heavier marble has:

- A. the same kinetic energy as the lighter one
- * B. twice as much kinetic energy
- C. half as much kinetic energy
- D. four times as much kinetic energy

3. Two paths lead up a hill, one twice as long but half as steep as the other. Neglecting friction and assuming you go up slowly, the average force you would exert on the longer path is:

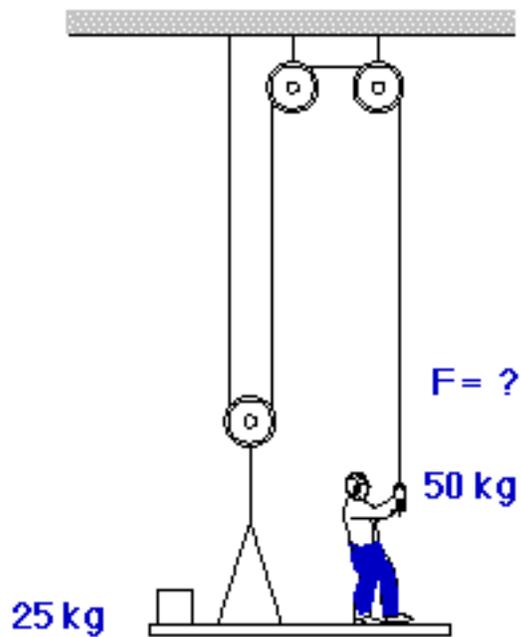
- A. four times smaller than on the shorter path
- * B. half as small
- C. equal either way
- D. it depends on how much time each path took

4. A mover raises a 100 kg piano at a constant rate using a frictionless pulley system. With approximately what force is he pulling on the rope?



- A. 2000 N
- B. 1000 N
- * C. 500 N

5. A 50 kg man stands on a 25 kg platform. He raises himself at a constant rate using a frictionless pulley system. With approximately what force is he pulling on the rope?



- A. 750 N
- B. 500 N
- C. 375 N
- * D. 250 N
- E. 125 N

6. A block initially at rest slides down a frictionless ramp and attains speed v at

the bottom. To achieve speed $2v$ at the bottom, how many times higher must a new ramp be?

- A. 1
- B. 2
- C. 3
- * D. 4

7. A spring-loaded gun shoots a dart straight upward to a maximum height of 24 m. If the spring is only compressed half as far, how far will the dart go up?

- A. 24 m
- B. 12 m
- * C. 6 m
- D. 3 m

8. A sports car accelerates from 0 to 30 mph in 1.5 s. If the engine power were independent of velocity, how long would it take to accelerate from 0 to 60 mph?

- A. 3 s
- B. 4.5 s
- * C. 6 s
- D. 9 s

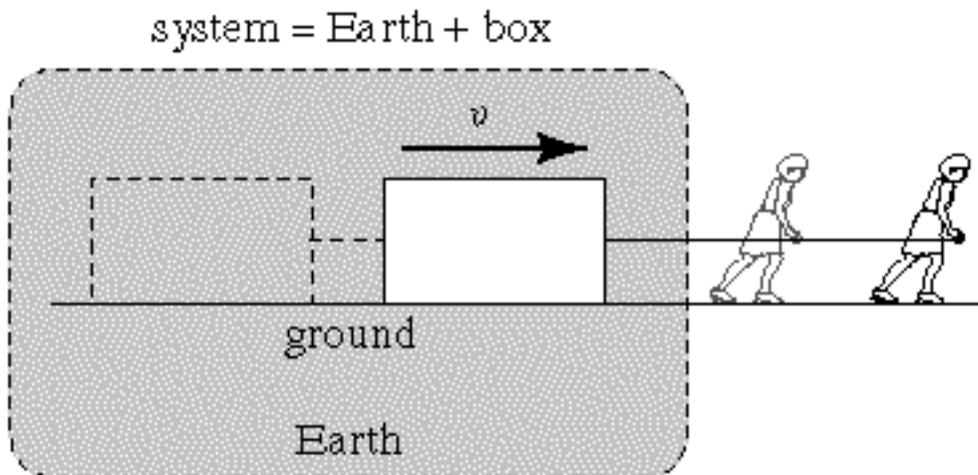
9. An aircart is moving at 0.5 m/s when the air is abruptly switched off. The cart comes to rest after traveling 1 m. If the experiment is repeated when the cart is moving 1 m/s, it will travel:

- A. 1 m
- B. 2 m
- C. 3 m
- * D. 4 m

10. If you drop a 1 kg rock from a height of 5 m, with approximately what force will it strike the ground?

- A. 5 N
- B. 10 N
- C. 50 N
- * D. impossible to determine

11. What is the net external force on the system if v is constant?

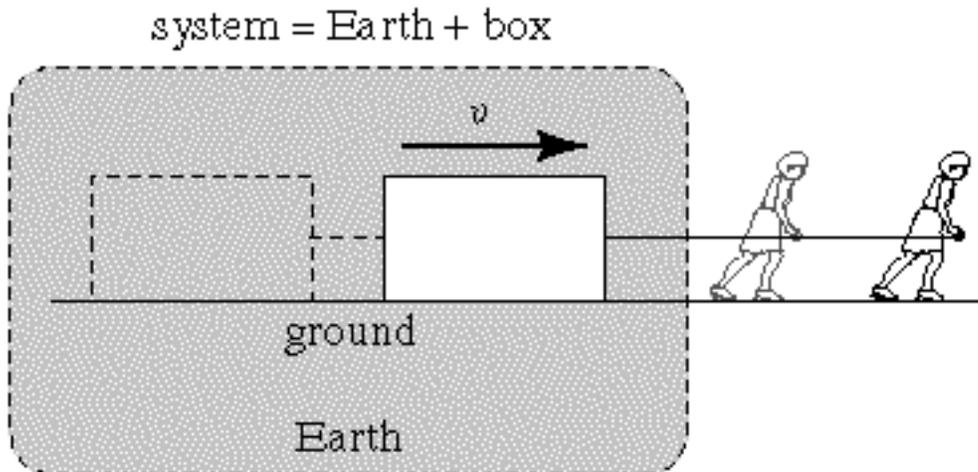


- A. Zero because the system is isolated.
- B. Nonzero because the system is not isolated.

- * C. Zero even though the system is not isolated.
- D. Nonzero even though the system is isolated.
- E. None of the above.

12.

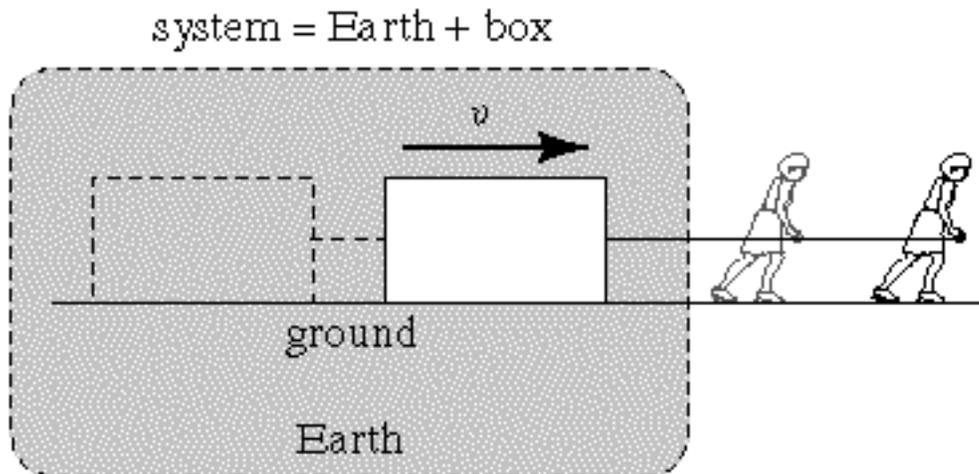
What is the net force the person exerts on the system if v is constant?



- * A. zero
- B. nonzero
- C. Not enough information to answer.

13.

How much work does the person do on the system if v is constant?



- A. zero
- * B. nonzero
- C. Not enough information to answer.

14.

A stone is thrown straight upward. If we INCLUDE the effects of air drag, the time taken to reach the maximum height is:

- A. larger than the time taken to fall back down from the top
- B. equal to the time taken to return to the ground
- * C. smaller than the time on the way down

15. A block slides down a rough inclined plane. Which of the following forces does NOT affect the kinetic energy it gains?

- A. weight
- B. friction

- * C. normal force
- D. All of these forces affect the gain in kinetic energy.

16. A block slides down a rough inclined plane.
Which of the following forces is associated with a potential energy?

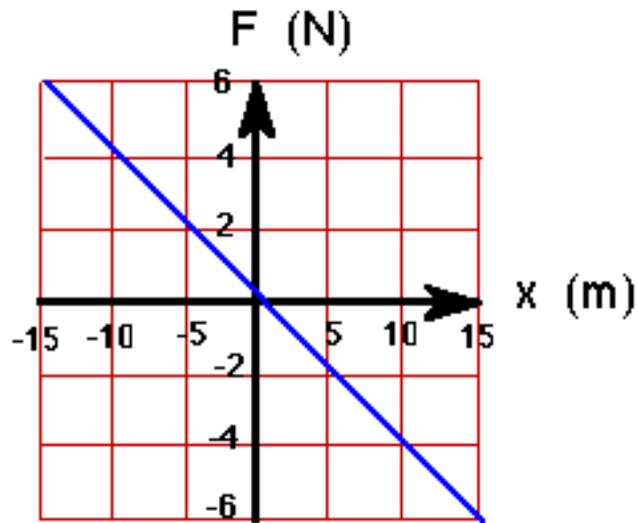
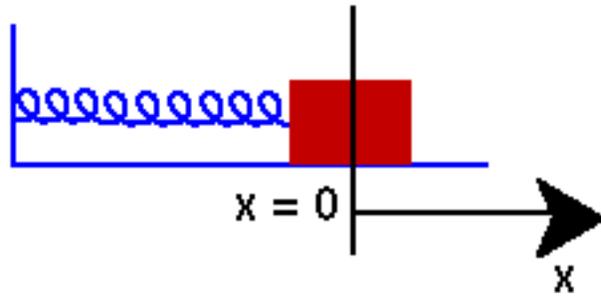
- * A. weight
- B. friction
- C. normal force
- D. None of these forces are.

17. Which of the following statements is false?

- A. Only external forces can change the kinetic energy of a system.
- * B. Work is a vector.
- C. It is possible for a force to act on a system without it doing any work on the system.
- D. All of the above statements are true.

18. The graph shows the force exerted by the spring on the block.

How much work does the spring do on the block as it moves from 0 to 15 m?



- A. 0
- B. +0.4 N/m
- C. -0.4 N/m
- D. +45 N m
- * E. -45 N m

19.
Which of the following statements is false?

- A. Power is a scalar.
- B. Power is the rate at which work is done.
- C. Power is equal to the dot product of force and velocity.

D. Power has units of J/s.

* E. All of the above statements are true.

20.

Two masses move at the same speed. If $m_1 = 2m_2$ then:

* A. $KE_1 = 2 KE_2$

B. $KE_1 = KE_2/2$

C. $KE_1 = 2^{1/2} KE_2$

D. $KE_1 = KE_2/2^{1/2}$

21.

Two bodies are at rest on a frictionless surface. Equal forces are applied to them over equal distances. If block 1 has twice the mass of block 2, then the final kinetic energy of block 1 will be:

A. greater than that of block 2

* B. the same as block 2

C. less than that of block 2

22.

A 2 kg block moves along the x-axis with a velocity of -3 m/s. Its kinetic energy is:

A. +6 J

B. -6 J

* C. +9 J

D. -9 J

23.

Which of the following statements is false?

A. The PE of a system depends on the relative positions of the objects in the system.

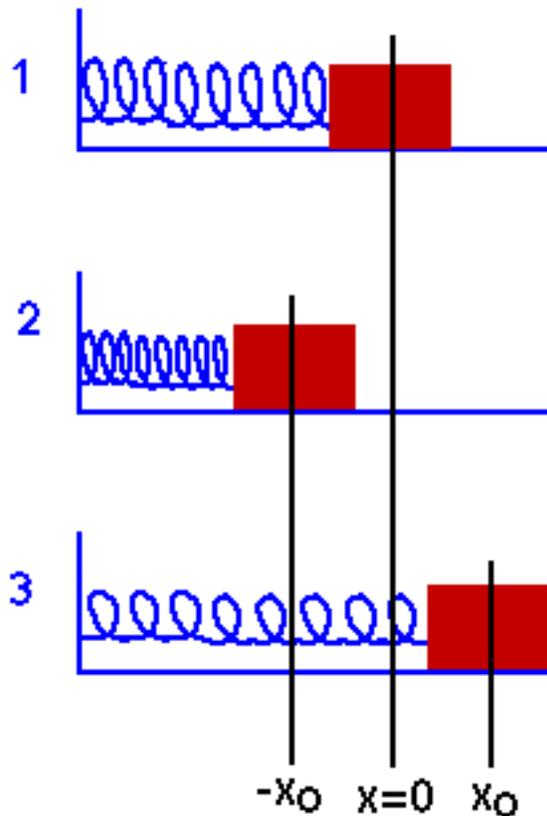
* B. For the earth-sun system, the PE is greatest when the earth is closest to the sun.

C. The earth-skier system has more PE when the skier is at the top of the hill than at the bottom.

D. All of the above statements are true.

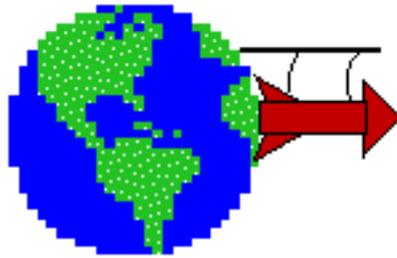
24.

The elastic potential energy is smallest for which figure?



- * A. 1
- B. 2
- C. 3

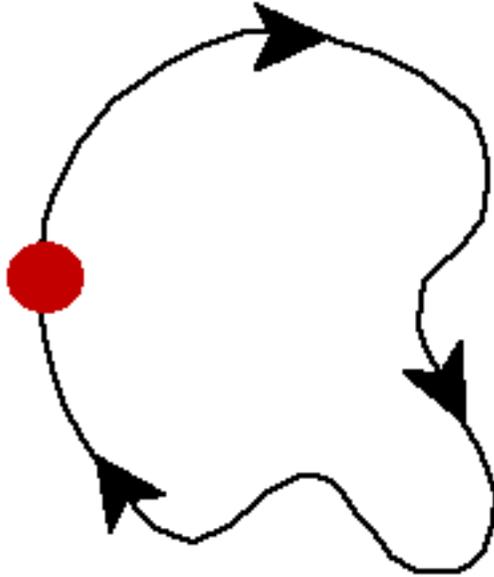
25.
If the gravitational PE is zero when the rocket is far from the earth, what is the PE when the rocket is on the launch pad?



Potential Energy
of system on
Launch Pad = ?

- A. positive
- B. zero
- * C. negative
- D. More information is needed to answer.

26.
A conservative force acts on an object while it moves once around the indicated path. The work done by that force is:



- A. negative
- * B. zero
- C. positive
- D. More information is needed to answer.

27. A horizontal spring does -15 J of work on a moving block. Suppose we include both the spring and block in the system. What is the change in elastic PE during the block's motion?

- A. -15 J
- B. zero
- * C. $+15\text{ J}$
- D. More information is needed to answer.

28.
Which of the following statements is false?

- A. Mechanical energy is the sum of KE and PE.
- B. If mechanical energy is conserved, then KE is constant.
- C. If mechanical energy is conserved, then PE is constant.
- * D. More than one statement is false.

29. The mechanical energy of an isolated system is 200 J. If internal nonconservative forces act between the parts of the system, then its mechanical energy at a later time will be:

- A. more than 200 J
- B. 200 J
- C. less than 200 J
- * D. Any of the above answers could be correct.

30. The mechanical energy of an isolated system is 200 J. If purely conservative forces act internally between the parts of the system, then its mechanical energy at a later time will be:

- A. greater than 200 J
- * B. 200 J
- C. less than 200 J
- D. Any of the above answers could be correct.

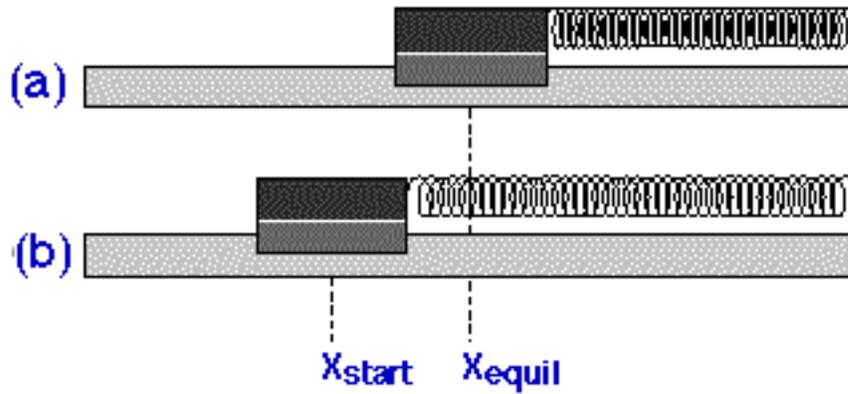
31. A heavy mass on a spring is stretched downward until it is just barely above some eggs. If it is then released from rest, is it possible for it to smash into the eggs during any of its subsequent oscillations?



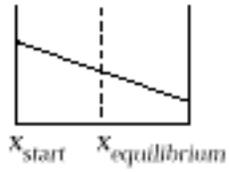
A. Yes

* B. No

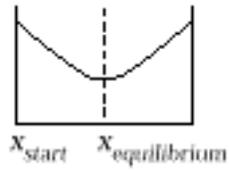
32. The air cart is pulled to the left and released from rest. Which graph shows the PE vs x ?



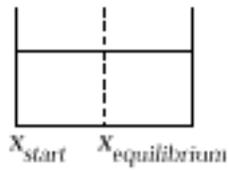
A.



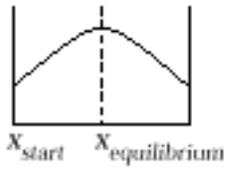
* B.



C.



D.



33.

A woman holds a bowling ball at rest in her outstretched arms. The work she does on the ball is:

A. positive

* B. zero

C. negative

34.

A man slides a heavy load across a rough horizontal floor. The work done by gravity on the load is:

A. positive

* B. zero

C. negative

35. A car coasting along a horizontal road slows down because of friction and drag. Let the system be the car, road, and air.

Which of the following statements is true?

A. The car's kinetic energy decreased.

B. The system warmed up.

C. The energy of the system is constant.

* D. All of the above statements are true.

36. If it takes me E amount of work to stretch a spring from 0 to 1 m, how much energy will it cost me to stretch it from 1 to 2 m?

A. E

B. $2E$

* C. $3E$

D. $4E$

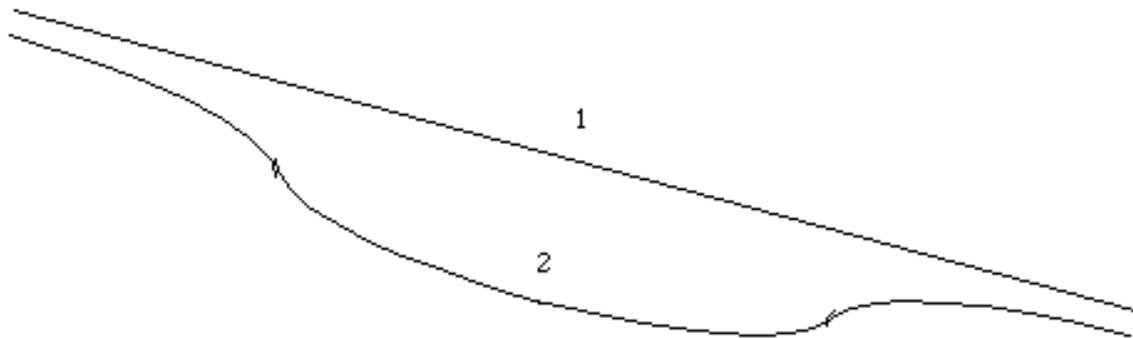
37. Two books are at rest 1 m above the ground. One freely falls straight down, while the other slides down a gentle frictionless incline. Which one reaches the ground with greater speed?

- A. The one which falls freely.
- B. The one which slides down the incline.
- * C. Both have the same final speed.
- D. It depends on the angle of the incline.
- E. It depends on which book is heavier.

38. A book slides down a frictionless incline. What is its speed when it is halfway down the incline?

- A. One-quarter of its speed at the bottom.
- B. Half of its final speed.
- * C. The speed at the bottom divided by the square root of two.
- D. The same as at the bottom.
- E. More information is needed to answer.

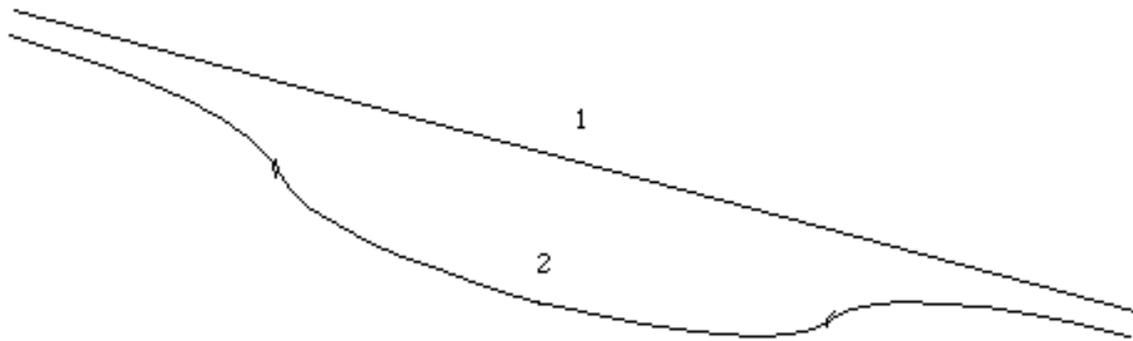
39. Two marbles are released simultaneously from rest on tracks which begin and end together, but track 2 has a dip in the middle. Which marble reaches the end first?



- A. 1

- * B. 2
- C. it's a tie
- D. whichever one is heavier

40. Two marbles are released simultaneously from rest on tracks which begin and end together, but track 2 has a dip in the middle. Which marble reaches the end with greater speed?



- A. 1
- B. 2
- * C. same for both
- D. whichever one is heavier