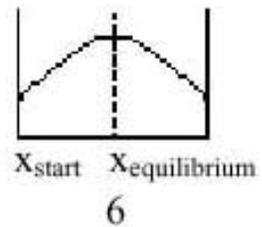
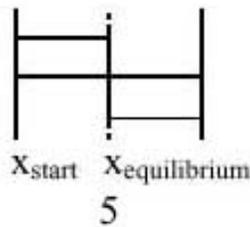
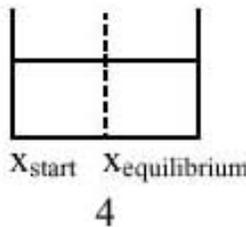
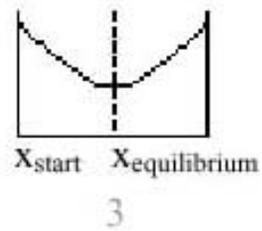
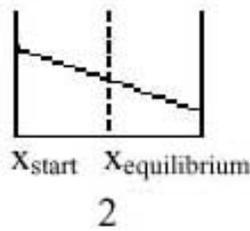
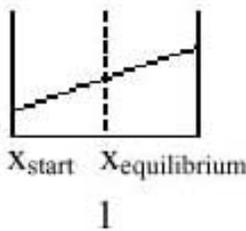
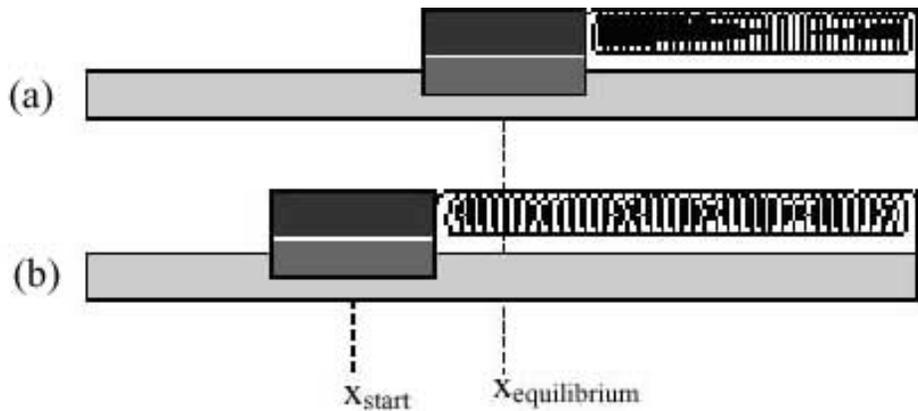


1. In part (a) of the figure, an air track cart attached to a spring rests on the track at the position $x_{equilibrium}$ and the spring is relaxed. In (b), the cart is pulled to the position x_{start} and released. It then oscillates about $x_{equilibrium}$. Which graph correctly represents the potential energy of the spring as a function of the position of the cart?



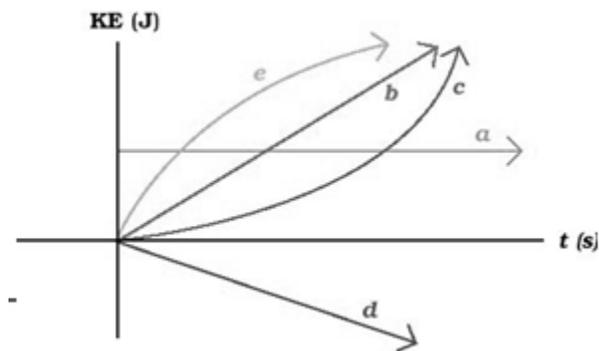
2. A ball dropped from rest reaches a speed of 3 m/s just before it hits the ground. If the ball is thrown downward from the same height with a speed of 4 m/s, its speed just before hitting the ground is

1.3 m/s

2.5 m/s

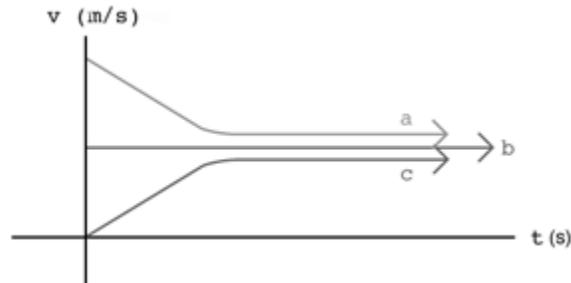
3.7 m/s

3. An object is dropped to the earth from a height of 10m. Which of the following sketches best represent the kinetic energy of the object as it approaches the earth (neglect friction).



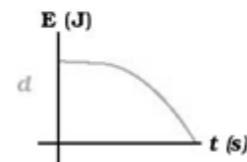
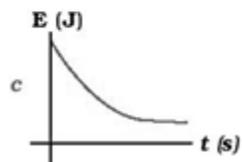
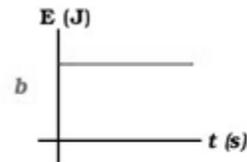
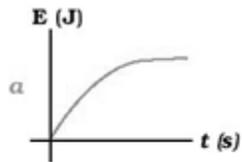
1. a
2. b
3. c
4. d
5. e

4. A ball is dropped into a jar of corn oil. Which of the following sketches best represent the speed of the ball as a function of time? (Assume it is released from the top of the column of corn oil)



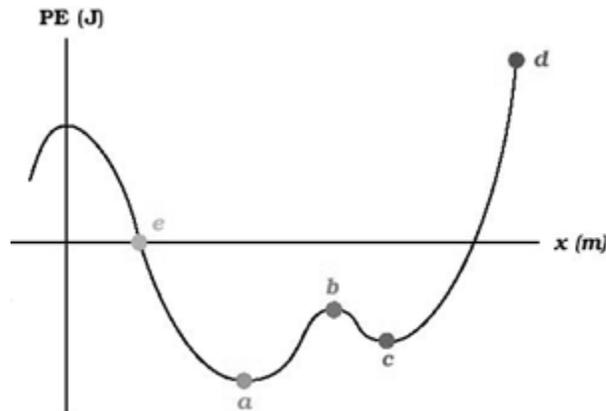
1. a
2. b
3. c

5. Which of the following curves best represents a sketch, in the previous problem, of the potential and kinetic energy of the ball and earth system as a function of time?



- 1.a
- 2.b
- 3.c
- 4.d

6. Consider the following sketch of potential energy for a particle as a function of position. There are no dissipative forces or internal sources of energy.



If a particle travels through the entire region of space shown in the diagram, at which point is the particle's velocity a maximum?

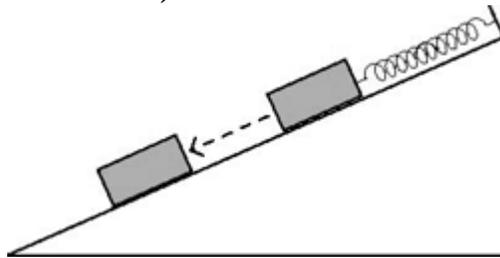
1. a
2. b
3. c
4. d
5. e

7. Suppose you want to ride your mountain bike up a steep hill. Two paths lead from the base to the top, one twice as long as the other.

Compared to the average force you would exert if you took the short path, the average force you exert along the longer path is

1. four times as small.
2. three times as small.
3. half as small.
4. the same.
5. undetermined-it depends on the time taken.

8. A block of inertia m is attached to a relaxed spring on an inclined plane. The block is allowed to slide down the incline, and comes to rest. The coefficient of kinetic friction of the block on the incline is μ_k . For which definition of the system is the change in total energy (after the block is released) zero?



1. block
2. block + spring
3. block + spring + incline
4. block + spring + incline + Earth

9. A basketball dropped (from rest) from a height of 1 meter strikes the earth and returns to a height of 1 meter. For which choice of system is energy conserved at all times?

1. the basketball by itself
2. the earth by itself
3. the basketball plus the earth
4. all of the above

10. You lift a ball at constant velocity from a height h_i to a greater height h_f . Considering the ball to be the system, which of the following statements is true?

1. The potential energy of the system increases.
2. The kinetic energy of the system decreases.
3. The earth does negative work on the system.
4. You do negative work on the system.
5. The source energy of the ball increases.
6. Two of the above.
7. None of the above.

12. You lift a ball at constant velocity from a height h_i to a greater height h_f . Considering the ball and the earth together as the system, which of the following statements is true?

1. The potential energy of the system increases.
2. The kinetic energy of the system decreases.
3. The earth does negative work on the system.
4. You do negative work on the system.
5. The source energy of the ball increases.
6. Two of the above.
7. None of the above.

13. A person lifts a 1kg cup of water 1 meter at constant velocity. Defining the system as the cup of water plus the earth, the work done on the system is:

1. 10 J

2. - 10 J

3. 0 J

4. none of the above

14. A 1kg ball falls from a height of 1 meter.
The work done on the earth-ball system is:

1.0 J

2.10 J

3.- 10 J

4.20 J

5.-20 J

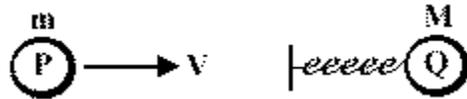
15. You lift a ball at constant velocity from a height h_i to a larger height h_f . Which of the following statements is true if you consider the ball as the system?

1. The potential energy of the system increases.
2. The kinetic energy of the system decreases.
3. The earth does negative work on the system.
4. You do negative work on the system.
5. The source energy of the ball increases.
6. Two of the above.
7. None of the above.

16. You are lifting a ball at constant velocity from a height h_i to a greater height h_f . Which of the following statements is true, if you consider the ball and the earth as the system?

1. The potential energy of the system increases.
2. The kinetic energy of the system decreases.
3. The earth does negative work on the system.
4. You do negative work on the system.
5. The source energy of the ball increases.
6. Two of the above.
7. None of the above.

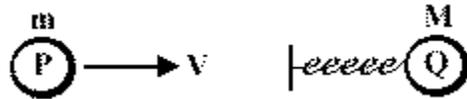
17. An object P has an initial velocity v . It strikes an initially stationary object Q which is attached to a spring, as shown.



The compression of the spring is greatest at the instant when:

1. the velocity of P is exactly zero
2. P and Q move with the same velocity
3. Q begins to move
4. Q reaches the initial velocity of P
5. All the kinetic energy of P has been transferred to the spring

18. An object P has an initial velocity \mathbf{v} . It strikes an initially stationary object Q which is attached to a spring, as shown.



Assume that P and Q have equal inertias ($m_P = m_Q$) and the inertia of the spring can be neglected. At the point of maximum compression, the energy stored in the spring is:

1. all of the initial KE of P
2. $3/4$ of the initial KE of P
3. $1/2$ of the initial KE of P
4. $1/4$ of the initial KE of P
5. none of the above

19. What fraction of the kinetic energy of the Earth-Sun system is convertible to potential energy?

1. roughly 0
2. roughly 25%
3. roughly 50%
4. roughly 75%
5. roughly 100%

20. A ball is at rest on a compressed spring oriented vertically. At time t_1 the spring is released, firing the ball at the ceiling. The ball collides inelastically with the ceiling and falls back down onto the spring, where it compresses the spring again. The spring is maximally compressed after impact at time t_2 . Define the system as the ball only. Is the work done on the system

1. >0

2. $=0$

3. <0

4. cannot be determined without knowing the coefficient of restitution for the collision