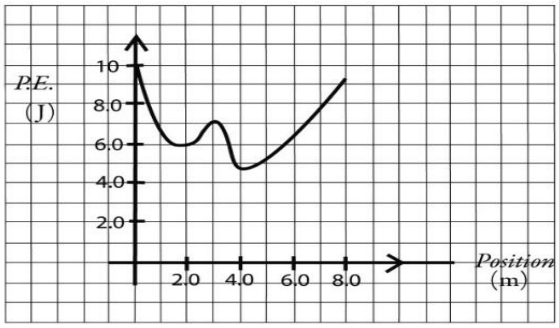
Problem Set 4

Potential Energy and Conservation of Mechanical Energy

Select the correct answer

1. Is it possible for a system to have negative potential energy?
a) Yes, as long as the kinetic energy is positive.
b) Yes, as long as the total energy is positive.
c) Yes, since the choice of the zero of potential energy is arbitrary.
d) No, because the kinetic energy of a system must equal its potential energy.
e) No, because this would have no physical meaning.

2. A 2.0-kg object is moving without friction along the x-axis. The potential energy curve as a function of position is shown in the figure, and the system is conservative. If the speed of the object at the origin is 4.0 m/s, what will be its speed at 7.0 m along the $+x$-axis?



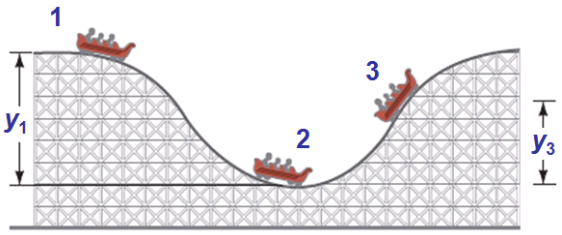
a) 4.0 m/s b) 4.2 m/s c) 4.4 m/s d) 4.6 m/s e) 9.8 m/s

Problems

1. A spring has a spring constant k of 82.0 N/m. How much must this spring be compressed to store 35.0 J of potential energy?

2. A stone is thrown straight upward with an initial velocity of 20.0 m/s. Find the maximum height the stone can reach by applying the principle of conservation of mechanical energy.

3. Assuming the height of the hill y_1 shown in Figure is 40 m, and the roller-coaster car starts from rest at the top, calculate:



a) the speed of the roller-coaster car at the bottom of the hill

b) At what height it will have half this speed. Take y = 0 at the bottom of the hill.

c) Work done by the gravitational force from position 1 to position 2

4. The launching mechanism of a toy gun consists of a spring of unknown spring constant. When the spring is compressed 0.120 m, the gun, when fired vertically, is able to launch a 35.0-g projectile to a maximum height of 20.0 m above the position of the projectile before firing. Find the spring constant.