Virtual Learning

Physics

Conservative Forces & Potential Energy

May 20, 2020

Physics

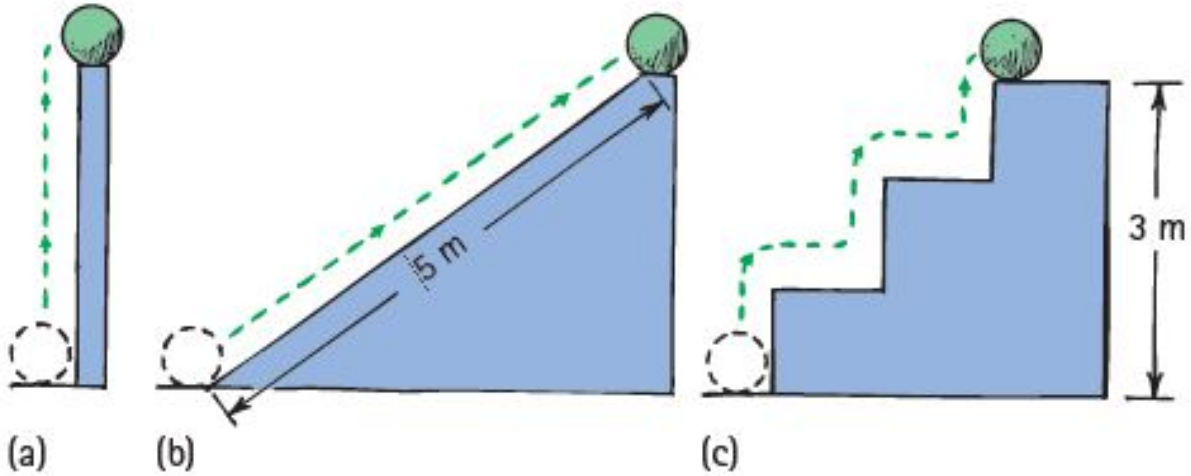
Conservative Forces and PE: May 20,2020

Objective/Learning Target:

Students will examine gravitational potential energy and how it transforms then use it to solve various problems.

Quick Review #1

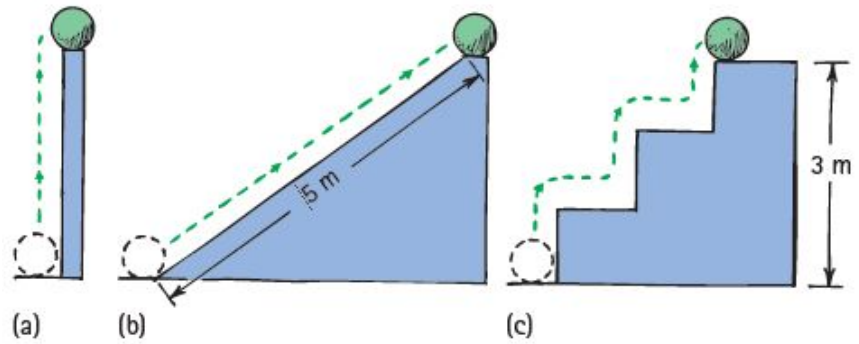
Ignoring friction, rank from greatest to least the amount of gained gravitational potential energy for each of the following situations.



Quick Review #1

The potential energy of the 10-N ball is the same (30 J) in all three cases because the work done in elevating it 3 m is the same whether it is (a) lifted with 10 N of force, (b) pushed with 6 N of force up the 5-m incline, or (c) lifted with 10 N up each 1-m stair. No work is done in moving the ball horizontally (if we ignore friction).

a = b = c



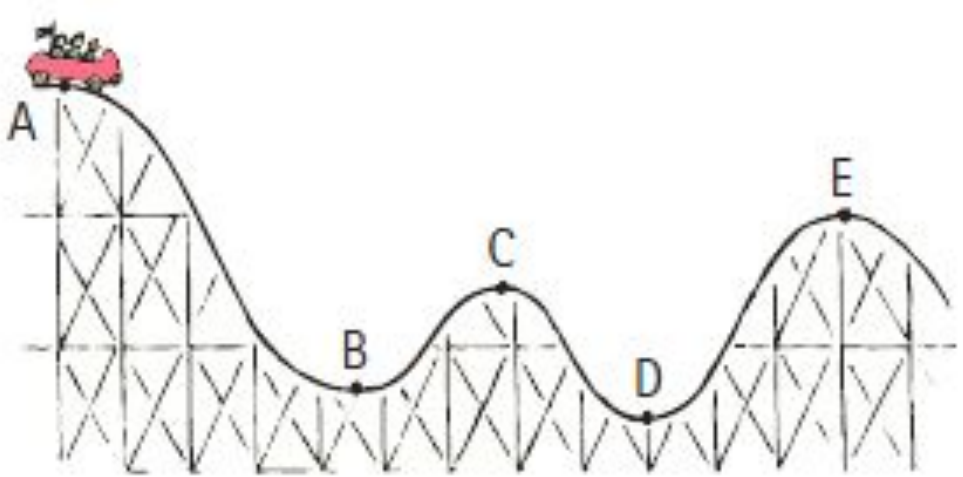
Quick Review #2

The roller coaster ride starts from rest at point A. Ignoring friction. Rank these quantities from greatest to least at each point:

a. Speed

b. KE

c. PE



Quick Review #2

a. Speed - D>B>C>E>A

b. KE - D>B>C>E>A

c. PE - A>E>C>B>D

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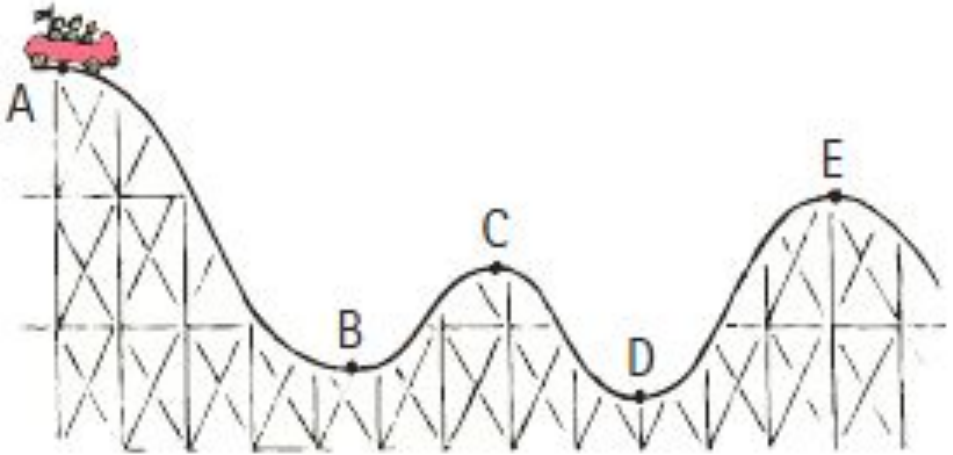
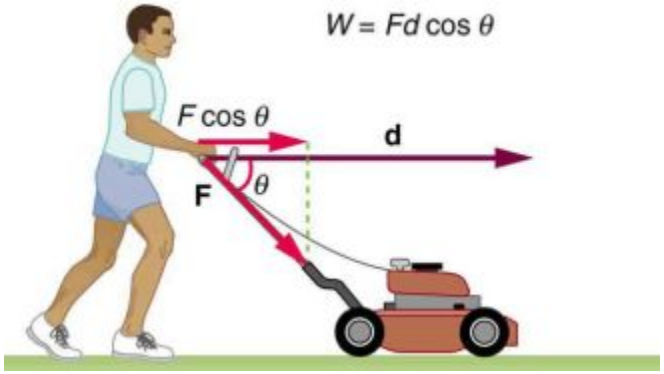


Work

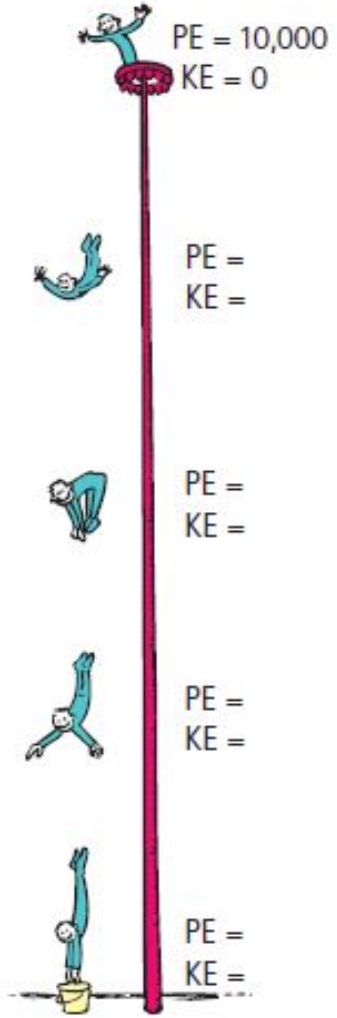


Link: [Conservative Forces and PE]

Directions:

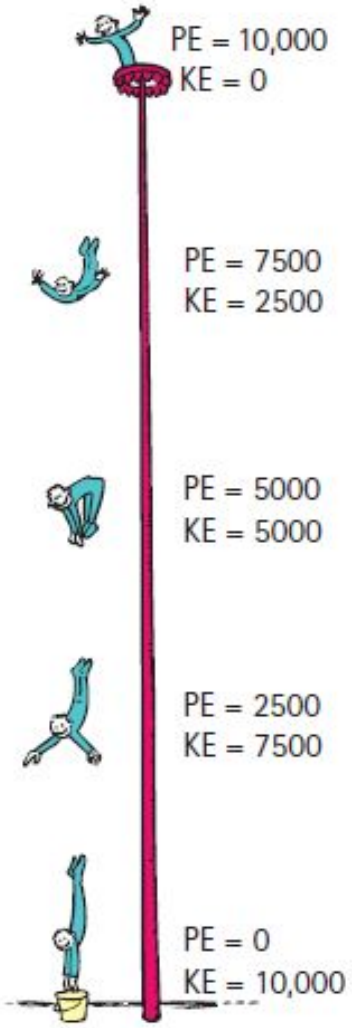
- Read through Conservative Forces and PE.
- Work through any examples on a separate piece of paper before you scroll down to the solution.
- On a separate piece of paper complete the practice problems on the following slides.
- Check your answers.
- For additional practice check out the conceptual questions and the problems and exercises in the table of contents for the online text linked above.

Practice Problem #1



Fill in appropriate values for the PE and KE as the diver plummets downward into the bucket.

Practice Problem #1 Answer



As the diver falls his gravitational potential energy is converted into kinetic energy. All along the total energy remains unchanged at 10,000 J.

Practice Problem #2

Belly-flop Bernie, who has a mass of 70 kg, dives from atop a 30 m tall cliff into the ocean below. What is Bernie's velocity as he strikes the water? Assume no air drag.

Practice Problem #2 Answer

PE at the top of the flagpole equals the amount of KE just before striking the water.

$PE_{top} = KE_{bottom}$

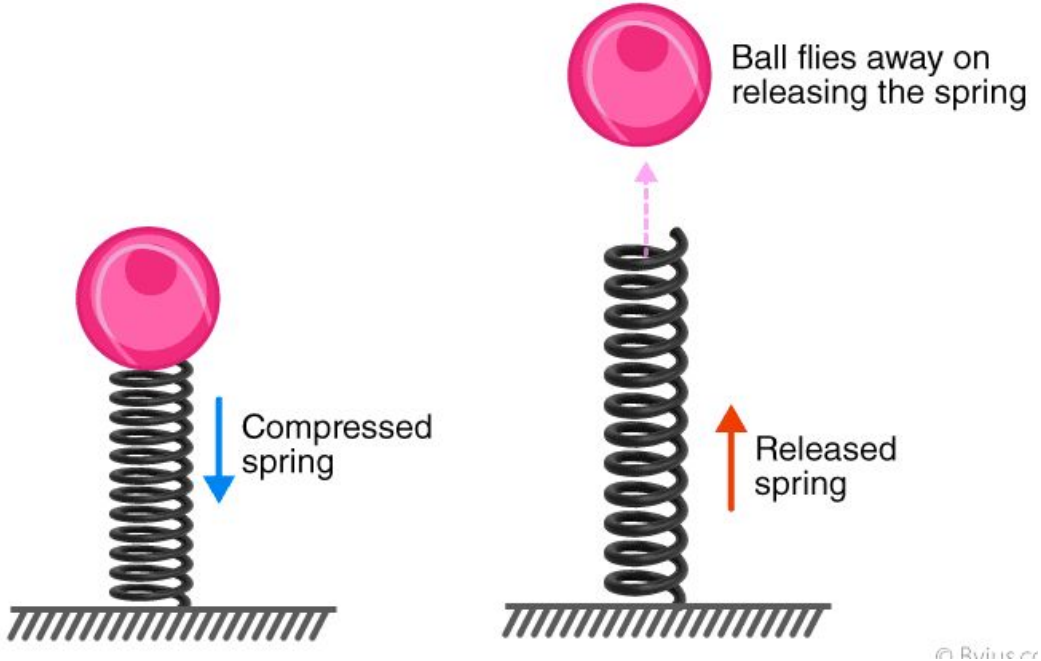
$mgh = \frac{1}{2} mv^2$

$70kg \times 9.8m/s^2 \times 30m = \frac{1}{2} 70kg \times v^2$

$v = \sqrt{(2 \times 9.8m/s^2 \times 30m)} = 24\ m/s$

Practice Problem #3

A spring whose spring constant is 850 N/m is compressed 0.40 m. What is the maximum speed it can give to a 500 g ball? (Ignore friction)



Practice Problem #3 Answer

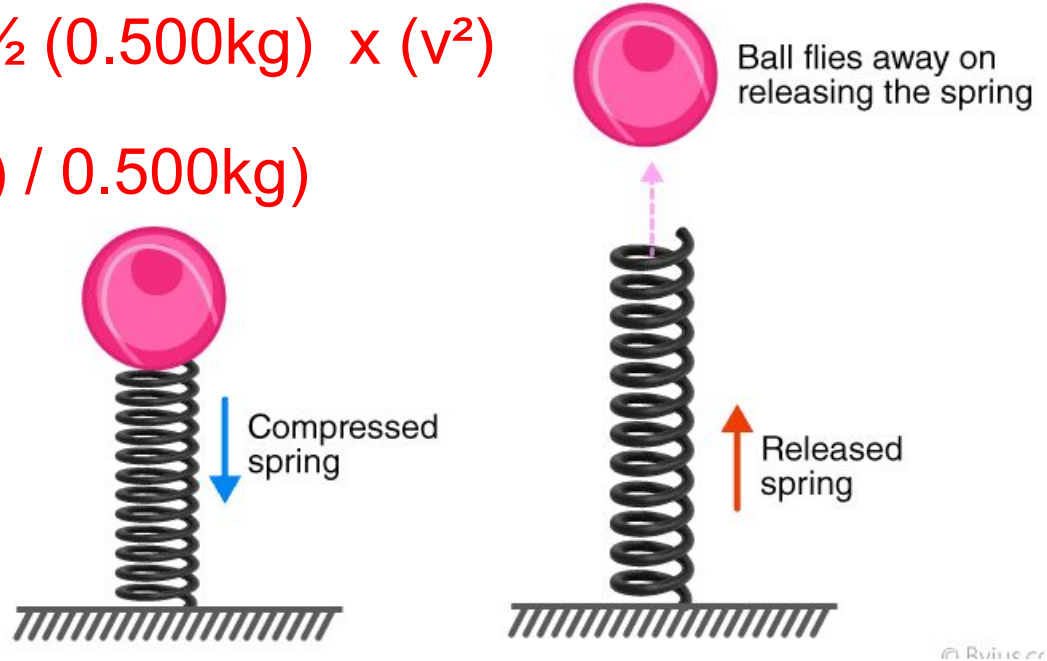
$PE_{spring} = KE_{ball}$

$\frac{1}{2} kx^2 = \frac{1}{2} mv^2$

$\frac{1}{2} (850N/m) \times (0.40m)^2 = \frac{1}{2} (0.500kg) \times (v^2)$

$v = \sqrt{((850N/m \times (0.40m)^2) / 0.500kg)}$

$v = 16.5\ m/s$



Additional Practice

For additional practice check out the conceptual questions and the problems and exercises in the table of contents from the online text linked above.