PRACTICE	LABS	TESTS
Unit 10 Practice Problems	Stair Power Lab	Unit 11 Test Thursday 3/8/19

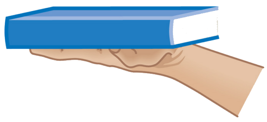
Potential Energy and the Work Done by Conservative Forces

Learning Target	Description
11.1	I can define, analyze, and solve problems involving potential energy and the work done by conservative forces.

Conservative vs. Nonconservative Forces

CONSERVATIVE FORCES	NONCONSERVATIVE FORCES
• Work is stored in the form of energy that can be released at later time.	• Work cannot be recovered later as kinetic energy. Instead, it is converted to other forms of energy.

Conservative vs. Nonconservative Forces

CONSERVATIVE FORCES	NONCONSERVATIVE FORCES
• Work is stored in the form of energy that can be released at later time.  EXAMPLES Gravity & Springs	• Work cannot be recovered later as kinetic energy. Instead, it is converted to other forms of energy.  EXAMPLES Friction, Tension, Muscles

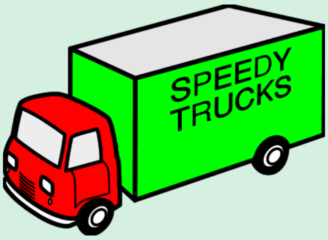
Energy

The ability to do work.

Energy and Ice Cream

Kinetic Energy

$KE = \frac{1}{2} m v^2$

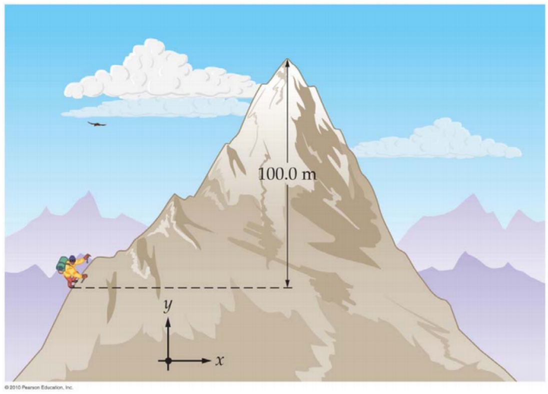


Potential Energy

PE

Potential Energy (U) is a storage system for energy.

Final Ascent



Gravitational Potential Energy

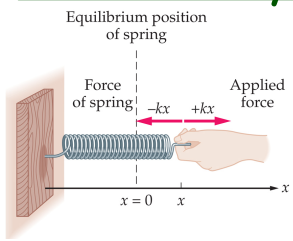
Gravitational Potential Energy depends on weight and height, h, but it is independent of horizontal position.

Energy?

Springs and Bungees

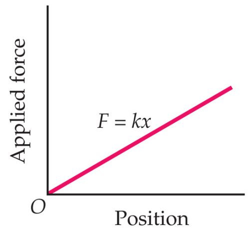
Because springs, and bungee cords, exert conservative forces, they can serve as energy storage devices.

Work Done By a Spring



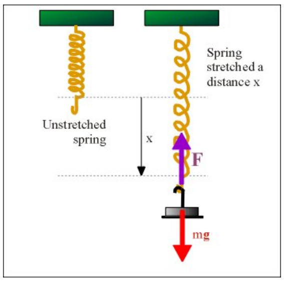
Hooke's Law

$F = k x$



Work Done by a Spring

$W = \frac{1}{2} k x^2$



Potential Energy for a Spring

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

POTENTIAL IN-CLASS PROBLEMS

1. An 82.0 kg mountain climber is in the final stage of the ascent of 4301-m-high Pikes Peak. What is the change in gravitational potential energy as the climber gains the last 100.0 m of altitude? $\Delta U = U_f - U_i = mgh_f - mgh_i$
2. Find the potential energy of a spring with force constant k = 680 N/m if it is **(a)** stretched by 5.00 cm or **(b)** compressed by 10.00 cm.
3. When a force of 120.0 N is applied to a certain spring, it causes a stretch of 2.25 cm. What is the potential energy of this spring when it is compressed by 3.50 cm?

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Pike's Peak or Bust

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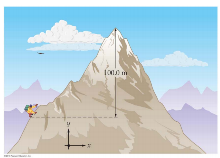


$\Delta U_g = mgh$

$\Delta U_g = (82\text{ kg})(9.8\text{ m/s}^2)(100\text{ m})$

$\Delta U_g = 80{,}400\text{ J}$

POTENTIAL IN-CLASS PROBLEMS

2. Find the potential energy of a spring with force constant k = 680 N/m if it is **(a)** stretched by 5.00 cm or **(b)** compressed by 10.00 cm.

a) $\Delta U_s = ½\, k\, x^2$

$\Delta U_s = ½\, (680\ N/m)(0.05\ m)^2$

$\Delta U_s = 0.85\ J$

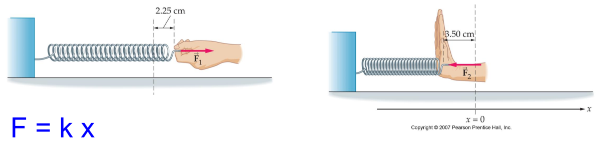
b) $\Delta U_s = ½\, k\, x^2$

$\Delta U_s = ½\, (680\ N/m)(010\ m)^2$

$\Delta U_s = 3.4\ J$

POTENTIAL IN-CLASS PROBLEMS

3. When a force of 120.0 N is applied to a certain spring, it causes a stretch of 2.25 cm. What is the potential energy of this spring when it is compressed by 3.50 cm?



$F = k\, x$

$F / x = k$

$5330\ N/m = k$

$\Delta U_s = ½\, k\, x^2$

$\Delta U_s = ½\, (5330\ N/m)(0.035\ m)^2$

$\Delta U_s = 3.26\ J$

Application