4.5 Potential Energy

Potential Energy: Stored energy.

ex. - chemical: gasoline, food, batteries
- elastic: trampolines, springs, bow ...
- electrical: static charge

In this class, we will focus on gravitational potential energy. This is stored energy due to an object's position (height). Remember, energy can be converted into different forms by doing work.

Remember this? $W = mg\Delta h$

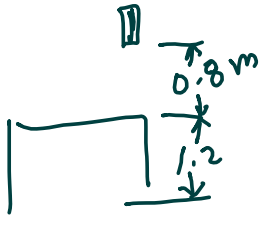
If Work is the energy needed to lift something to a certain height, then

$E_p = mgh$ *is the potential energy it has as measured relative to a reference point*

potential

ex. A 1.50 kg textbook is sitting on a 1.20 m tall table. If the book is lifted 0.80 m above the table, how much gravitational potential energy does it have:

a) relative to the table?



$E_p = mgh$
$= (1.50)(9.8)(0.80)$
$= 12 \text{ J}$

b) with respect to the floor?

$E_p = (1.50 \text{ kg})(9.8 \text{ m/s}^2)(2.0)$
$= 29 \text{ J}$

ex. An archer pulls on a bow string with an average force of 240 N while drawing the arrow back a distance of 0.320 m. Calculate the potential energy of the bow-arrow system. (Hint: the work done to the bow is all being stored as elastic potential energy.) assume no lost energy

$W = \Delta E_p = Fd = (240\,N)(0.320\,m)$
$= 48\,J$

work done is stored as potential

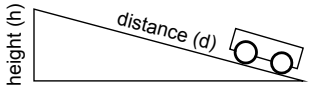
A simple machine is a mechanical device that changes the direction or magnitude of a force . In general, they can be defined as the simplest mechanisms that use mechanical advantage (also called leverage) to multiply force. ...

Ex. Lever, wheel and axle, pulley...

Ramp it Up!

Procedure: Measure the work done on a cart and its E_p at the top of the ramp

$W = Fd$ $E_p = mgh$



Trial 1:		Trial 2:		Trial 3:	
F = 1 N	m = 1.1 kg	F = 1.8 N	m = 1.1 kg	F = 2.4	m = 1.1 kg
d = 1.73m	g = 9.8	d = 1.7 m	g = 9.8	d = 1.7	g = 9.8
	h = .14 m		h = 0.29 m		h = 0.40
W = 1.73 J	E_p = 1.51	W = 3.06	E_p = 3.13	W = 4.08	E_p = 4.31

loss due to heat, sound

should have been same

How does the work done on the cart compare to its gain in potential energy?

with reliable data $W > E_p$ since Energy get lost while the work is happening (friction, sound..)

Using all the words work, height and distance explain why ramps can be useful machines. → and force

ramps are useful since we can gain potential energy while applying very little force.

practice: handout - Work #1-5

I will need to push my object a further distance (so more loss due to friction) but using less force.