Checklist for Today

• Things due awhile ago:
  – Read Chapters 7, 8 & 9

• Things that were due Monday:
  – Problems from Chap 7 on WebCT

• Things that are due Yesterday in Recitation
  – Chapter 8
  – Reading for Lab
The Schedule

This week: (3/3)
- Chapter 7 due in WebCT
- 5th and 6th lectures (of six) on Chapters 7, 8 & 9
- Chapter 8 in recitation

Next week: (3/10) Spring Break!!!

Following Week: (3/17)
- Chapter 8 due in WebCT
- Reading for Chapters 10 & 11
- Lecture on Chapters 10 & 11
- Chapter 9 and Exam 2 Review in recitation

Following Week: (3/24)
- Chapter 9 due in WebCT
- Exam 2 on Tuesday
- Recitation on Chapters 10 & 11
- Reading for Chapters 12 & 13 for Thursday
- Lecture 12 & 13 on Thursday
Chapters 7, 8 & 9 Cont

Before:
- Work and Energy
- The Work-Energy relationship
- Potential Energy
- Conservation of Mechanical Energy
- Conservation of Energy

This time:
- Summary
- More Problems
Law of Conservation of Energy

- Mechanical Energy \textit{NOT} always conserved
- If you’ve ever watched a roller coaster, you see that the friction turns the energy into heating the rails, sparks, noise, wind etc.
- \textit{Energy} = \textit{Kinetic Energy} + \textit{Potential Energy} + \textit{Heat} + \textit{Others}...
  - \underline{Total} Energy is what is conserved!
Law of Conservation of Energy

• Even if there is friction, *Energy* is conserved

• Friction does work
  - Can turn the energy into heat
  - Changes the kinetic energy

• *Total Energy* = *Kinetic Energy* + *Potential Energy* + *Heat* + *Others*...
  - This is what is conserved

• Can use “*lost*” mechanical energy to estimate things about friction
Roller Coaster with Friction

A roller coaster of mass $m$ starts at rest at height $y_1$ and falls down the path with friction, then back up until it hits height $y_2$ ($y_1 > y_2$).

Assuming we don’t know anything about the friction or the path, how much work is done by friction on this path?
Energy Summary

If there is net work done on an object, it changes the kinetic energy of the object (Gravity forces a ball falling from height $h$ to speed up $\rightarrow$ Work done.)

$$W_{net} = \Delta K$$

If there is a change in the potential energy, some one had to do some work: (Ball falling from height $h$ speeds up $\rightarrow$ work done $\rightarrow$ loss of potential energy. I raise a ball up, I do work which turns into potential energy for the ball)

$$\Delta U_{Total} = W_{Person} = -W_{Gravity}$$
Energy Summary

If work is done by a non-conservative force it does negative work (slows something down), and we get heat, light, sound etc.

\[ E_{\text{Heat+Light+Sound}} = -W_{\text{NC}} \]

If work is done by a non-conservative force, take this into account in the total energy. (Friction causes mechanical energy to be lost)

\[ K_1 + U_1 = K_2 + U_2 + E_{\text{Heat...}} \]

\[ K_1 + U_1 = K_2 + U_2 - W_{\text{NC}} \]
Friction and Springs

A block of mass \( m \) is traveling on a rough surface. It reaches a spring (spring constant \( k \)) with speed \( V_0 \) and compresses it a total distance \( D \). Determine \( \mu \).
A robot arm has a funny Force equation in 1-dimension

\[ F_x = F_0 \left( 1 + \frac{3x^2}{x_0^2} \right) \]

where \( F_0 \) and \( x_0 \) are constants. The robot picks up a block at \( x=0 \) (at rest) and throws it, releasing it at \( x=x_0 \).

What is the speed of the block?
Bungee Jump

You are standing on a platform high in the air with a bungee cord (spring constant $k$) strapped to your leg. You have mass $m$ and jump off the platform.

1. How far does the cord stretch, $l$ in the picture?

2. What is the equilibrium point around which you will bounce?
Coming up...

- Next week: Spring Break
- Week after Spring Break
  - Homework in WebCT Monday:
    - Chapter 8
  - Reading for Lecture:
    - Chaps 10 & 11: Momentum
  - Recitation:
    - Chap 9 and Exam review