

★Reading: chapter 7.

- Last time:

$$E = K + U, \quad K = \frac{1}{2}mv^2$$

is the conserved energy, it doesn't change with time (unless work is done on the system, transferring energy to or from outside). Conservative forces can be written in terms of their potential energy,

$$\vec{F} = -\nabla U = -\left(\hat{i}\frac{\partial}{\partial x} + \hat{j}\frac{\partial}{\partial y} + \hat{k}\frac{\partial}{\partial z}\right)U.$$

Examples are $U = mgy$ for gravity or $U = \frac{1}{2}kx^2$ for springs.

- Consider the spring case some more. $F = -\frac{d}{dx}\left(\frac{1}{2}kx^2\right) = -kx$, good. Picture force as downward pull in potential $U(x)$ plot. Draw picture of $E = K + U$ for the spring. Use energy conservation to relate, for example, the maximum velocity to the amplitude.

- Bungee jumping example.

- Example of skateboarding on frictionless ramp, use E conservation to find instantaneous normal force right at bottom instant to be triple the weight.

- Friction is nonconservative. Suppose that the instantaneous at bottom happens to be only double the weight. How much work was done by friction?

- Draw examples of other potential diagrams. For example qualitative plot of $U(r)$ for motion of earth around the sun, or moon around the earth. We'll discuss this in more detail at the end of the quarter.