

★Reading: chapter 7.

- As we stressed last week, energy is conserved. The total energy is $E = K + U$, where K is the kinetic energy, $K = \frac{1}{2}mv^2$ (you'll learn in physics 2d how to modify K in relativity, $K \rightarrow \sqrt{(mc^2)^2 + c^2\vec{p}^2}$), and U is the potential energy, which is this week's topic.

- We saw last week that lifting an object of mass m a height h requires work $W_{grav} = mgh$ against the force of gravity. If h is positive, the lifter does positive work, transferring positive energy from them into the lifted mass. This energy is there in the lifted mass, ready to be accessed by letting the mass fall back down. This is what's called gravitational potential energy,

$$U_{grav} = mgy.$$

Conservation of energy is the statement that

$$E = K_1 + U_1 = K_2 + U_2.$$

- A force is conservative if and only if (by definition), the work $W = \int_{path} \vec{F} \cdot d\vec{r}$ is independent of the path taken, depending only on the endpoints.

For a conservative force, $\vec{F} = -\nabla U$ (don't worry if you don't yet know what this symbol means – all it means is $F_x = -\frac{\partial U}{\partial x}$ etc.).

Gravity is an example of a conservative force. Indeed, $\vec{F}_{gravity} = -mg\hat{j} = -\frac{\partial U}{\partial y}\hat{j}$.

Friction is an example of a nonconservative force.

At a fundamental, microscopic level all forces are actually conservative. Friction just seems nonconservative because we don't keep track of the associated motion of the atoms in the material.

- Various examples to illustrate that gravity is conservative, and use of energy conservation.

- Various examples of using energy conservation, with accounting for work done against friction.