C6: Conservation of Energy

C6.2: The Idea of Conservation of Energy

Recall the story about Tora and Wolf and counting blocks. There is some quantity (energy) that remains constant no matter what. Energy is not "seeable" like momentum is; energy is some number that has to be calculated.

C6.3: Defining Energy

Eq. (C6.1) is a notational nightmare:

$$V(z_i) - V(z_f) = mg(z_i - z_f) \,. \tag{1}$$

- g is the acceleration of an object due to gravity near the surface of the earth. It's value is $g = 9.8 \frac{m}{s^2}$.

- Kinetic energy of an object of mass m moving at a speed v is defined to be $\frac{1}{2}mv^2$.

- Gravitational Potential energy of an object of mass m a height z above a reference position ($z = 0$) is given by $V(z) \equiv mgz$. (This conclusion isn't really reached until section C6.5.)

C6.4: Interactions and Energy; C6.6: Negative Energy

- Potential energy is the result of an interaction between two objects. It is not a property of a single object.

- The SI unit of energy is a Joule:
$$1\text{J} \equiv 1\frac{\text{kg m}^2}{\text{s}^2} \tag{2}$$

- Potential energy can be negative. All that matters physically are potential energy *differences*.

- When doing problems with gravitational potential energy, always state your reference level $(z = 0)$.

- If you use a positive value for g, then up must be positive for z.

Examples

1.
$$\frac{(\text{weight of box}) - 16\text{oz.}}{3\text{oz}} - \frac{(\text{height of water} - 6\text{in.})}{.25\text{in.}} = \text{constant} \tag{3}$$

   In the morning the box weighs 25 ounces and the height of the water is 7 inches. Tora comes home in the evening and finds that the height of the water is now 6.25 inches. How much does the box now weigh?

2. A .25 kg TAB mug is dropped the top of a 10 meter platform. What is it's speed right before it hits the ground? What is the mug's speed if it is dropped from a 20 platform? What is the speed just before impact of a .5kg plate dropped from the 10 meter platform?