1 Dependency Links: Re-visited

As a group, review the system diagram below. Describe a stock-flow model you think this could represent.

- What is the stock? Include reasonable units.
- What are the flows? Include reasonable units.
- Are there factors not currently represented in this diagram that you think would have a significant impact on the value of the stock?

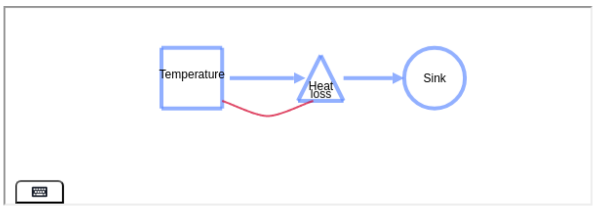

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Figure 1.1 A system diagram with a single stock, single outflow, and single dependency link.

2 Parameters in System Diagrams

Let's practice recognizing potential parameters in stock-flow models and representing them in a system diagram. For each stock-flow model below, identify any parameters you think might be present. Then create a system diagram including those parameters.

Use the interactive as needed if it is helpful to recall the various components that comprise a system diagram.

- **Stock:** Population of a community

  Flows: Births, deaths

  Add Stock Add Flow Add Rate Add Parameter Add Dependency Link
  Add Source/Sink Add Label

  Delete Last Component

  Figure: A blank space to construct a system diagram.

- **Stock:** Indoor temperature

  Flows: Furnace, heat loss

  Add Stock Add Flow Add Rate Add Parameter Add Dependency Link
  Add Source/Sink Add Label

  Delete Last Component

  Figure: A blank space to construct a system diagram.

- **Stock:** Energy in solar panels

  Flows: Sun, energy use

  Add Stock Add Flow Add Rate Add Parameter Add Dependency Link
  Add Source/Sink Add Label

  Delete Last Component

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3 Parameters and Equilibrium Values

Let's practice using parameters in equilibrium calculations. For each stock-flow model below,

- Sketch a system diagram on paper with the indicated parameters and dependency links.
- Determine the parameter value that will result in the desired equilibrium value.

1. ***Stock:*** Population of a community
Flows: Births, deaths
Parameters: Carrying capacity
Rates:

- Death rate is constant at $1,000$ individuals per year
- Birth rate (B) depends on the population (P) and the carrying capacity (C):

$$B = 0.25P\left(1 - \frac{P}{C}\right)$$

Desired Equilibrium: $P = 100,000$

2. ***Stock:*** Temperature in a greenhouse
Flows: Sun, heat loss
Parameters: Outside temperature, thickness of greenhouse material
Rates:

- Temperature rate is constant from the sun at $15°$ fahrenheit per day
- Heat loss (H) depends on the inside temperature (T), the outside temperature (A), and the thickness in milimeters of the greenhouse material (K):

$$H = \frac{6(T - A)}{K}$$

Desired Equilibrium: $T = 75°$ fahrenheit, given that the outside temperature is $65°$ fahrenheit