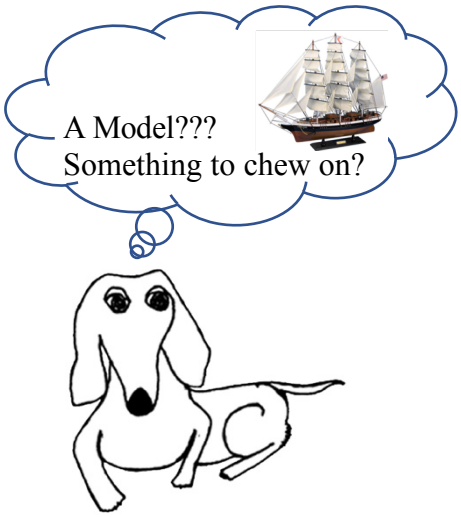
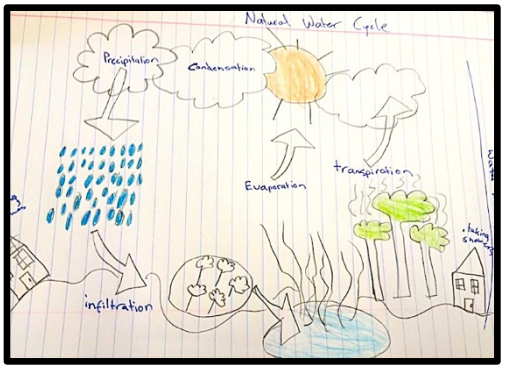
Scientific Models: An Introduction



In the Focus on Energy curriculum, students engage in building a model, a *scientific* model. A *physical* model is typically a copy of an object such as a model of a train or a water molecule. So, what is a *scientific* model?

- A scientific model is a set of ideas that you can use to describe, explain, or predict how something works.
- A scientific model includes elements that may or may not be directly observable, and rules for how those entities behave.
- A scientific model is testable, public, and subject to revision.

A scientific model can be represented in various ways, including an annotated drawing, a mathematical formula, a computer simulation, or even a list of statements. In the figure below, the familiar model of the Water Cycle is represented first as an annotated drawing and then as a list of statements.



- Water evaporates from oceans, lakes, and streams.
- Water transpires from plants.
- Water vapor condenses to form clouds.
- Water falls to the earth as precipitation.
- Water runs across the surface and sinks into the earth as groundwater.

Two ways to represent a model of the water cycle: annotated drawing and list of statements

The water cycle diagram:

1) describes the movement of water through the Earth system, and explains why Earth still has dry land, and why we still have rain, even after billions of years of precipitation.

2) includes elements that are directly observable (clouds, snow) and the processes of evaporation and transpiration, which are not directly observable.

3) is incomplete and could use revision. For example, how do plants get the water that they transpire? Someone may decide to add plant roots to the model.

A scientific model typically includes the components of the system being described (e.g., oceans, plants, and clouds), observations about how the components behave (e.g., precipitation can take the form of rain or snow falling from clouds), and rules about how the components behave even when they are not directly observable but can be inferred (e.g., water evaporates and transpires).

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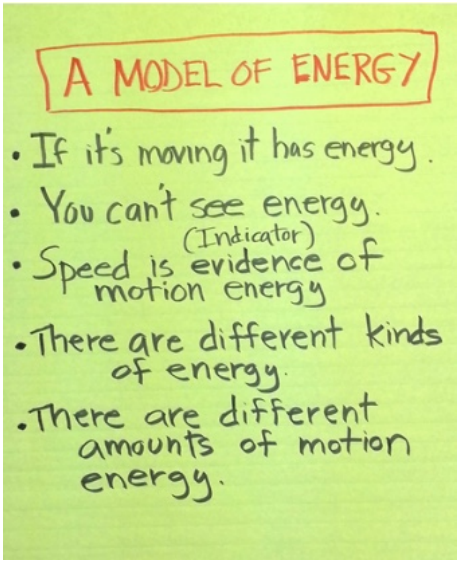
Creating and Using a Model of Energy

Developing and using scientific models is a key element of the *Focus on Energy* curriculum. The image to the right shows an early model of energy that one class developed based on their initial experiences rolling a ball along a track.



You will record students' consensus ideas about energy regularly throughout the curriculum. Sometimes you'll be recording statements that are incomplete, imprecise, or inaccurate. The class will use and test their ideas as they describe energy flow in new contexts. They will revisit the model to add new ideas and revise or eliminate elements of their model based on new experiences and their deepening understandings about energy.