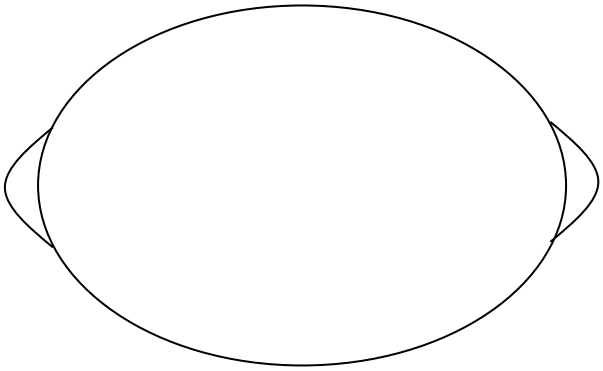
(E) Teacher Resource. Farmer's Solar System Key

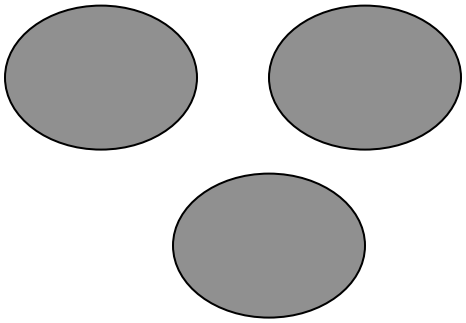
Planet	Object	Justification
Mercury	Peppercorn	
Venus	Grape	
Earth	Grape	
Moon	Peppercorn	
Mars	Macadamia Nut	
Jupiter	Honeydew	
Saturn	Cantaloupe	
Neptune	Lemon	
Uranus	Lime	
(Pluto)	Peppercorn	

(F) Teacher Resource. Farmer's Market Solar System, Low-cost Cutouts (1 of 3)

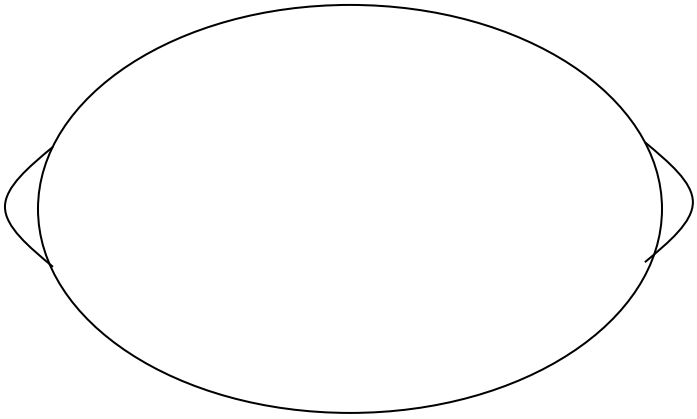


Lime

Macadamia Nut



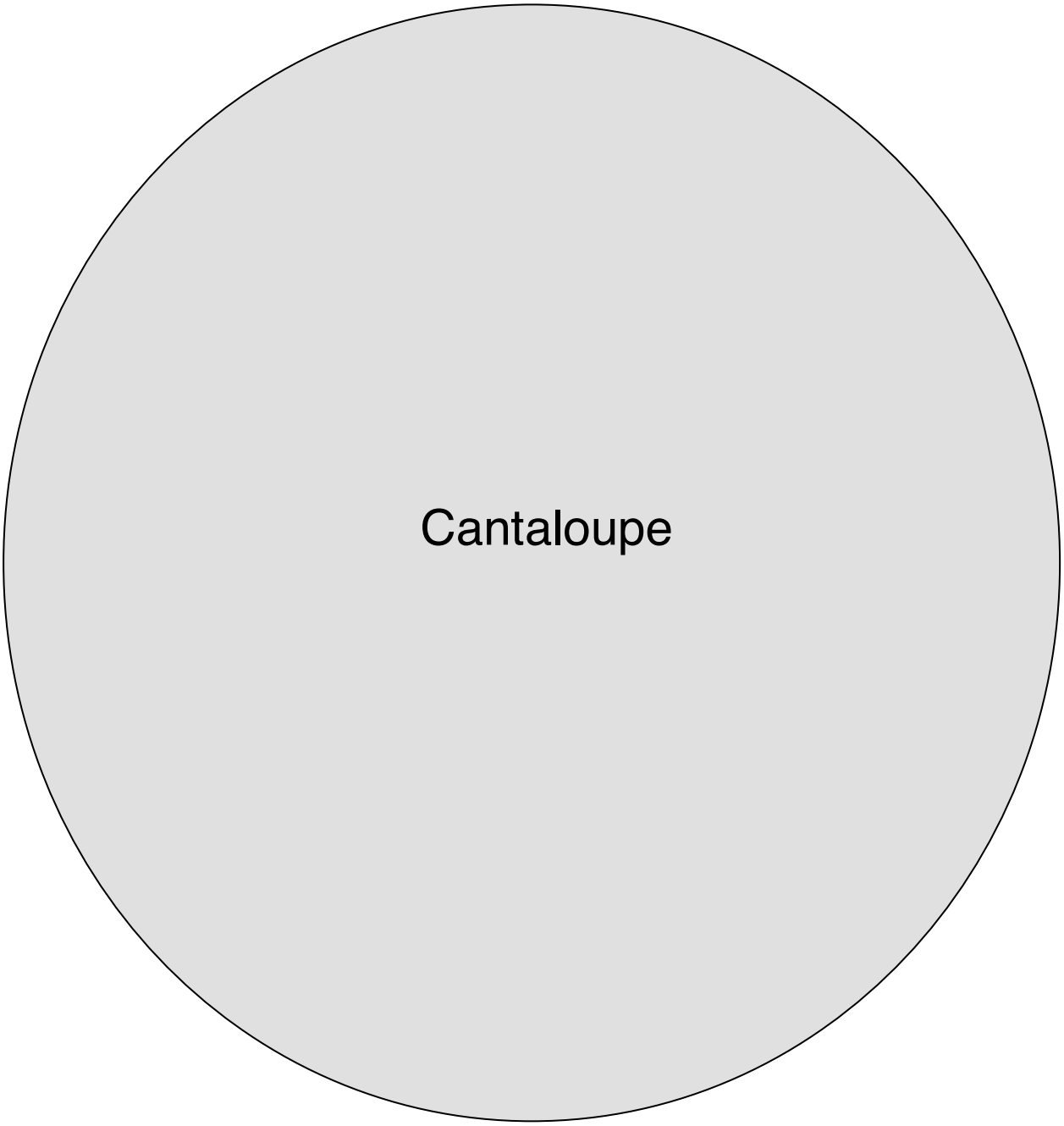
Grapes



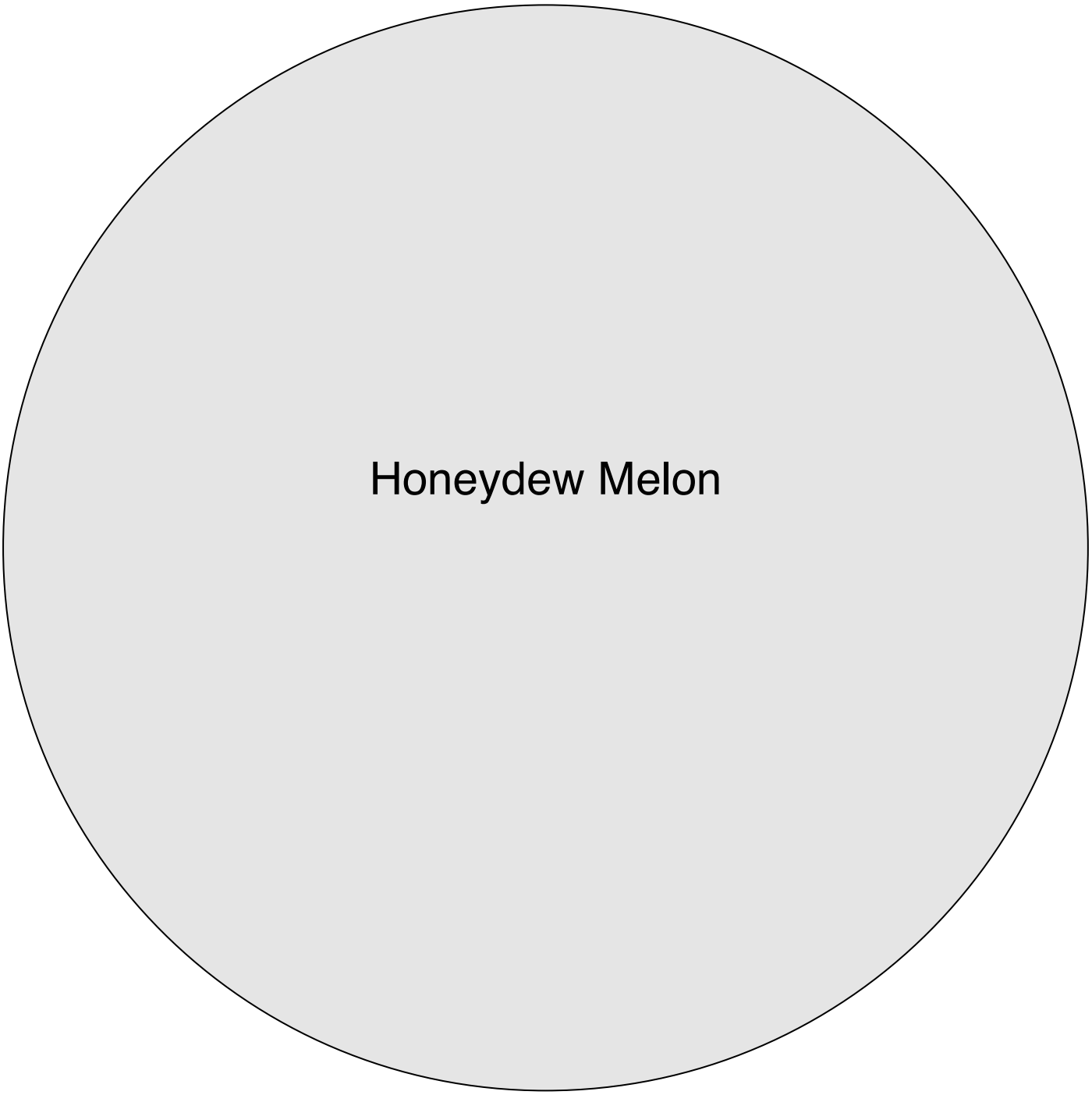
Lemon

Peppercorns

(F) Teacher Resource. Farmer's Market Solar System, Low-cost Cutouts (2 of 3)



(F) Teacher Resource. Farmer's Market Solar System, Low-cost Cutouts (3 of 3)



(G) Teacher Resource. Solar System Rubric (1 of 2)

You will know the level to which your students have achieved the **Learning Outcomes**, and thus the **Instructional Objective(s)**, by using the suggested **Rubrics** below.

Instructional Objective 1: To construct a simple model

Related Standard(s) (will be replaced when new NRC Framework-based science standards are released):

National Science Education Standards (NSES)
Systems, Order, & Organization

Grades K-12
(Partial) The natural and designed world is complex; it is too large and complicated to investigate and comprehend all at once. Scientists and students learn to define small portions for the convenience of investigation. The units of investigation can be referred to as "systems." A system is an organized group of related objects or components that form a whole. Systems can consist, for example, of organisms, machines, fundamental particles, galaxies, ideas, numbers, transportation, and education…. Prediction is the use of knowledge to identify and explain observations or changes in advance. The use of mathematics, especially probability, allows for greater or lesser certainty of predictions….

Evidence, models, and explanations

Grades K-12
Evidence consists of observations and data on which to base scientific explanations. Using evidence to understand interactions allows individuals to predict changes in natural and designed systems. Models are tentative schemes or structures that correspond to real objects, events, or classes of events, and that have explanatory power. Models help scientists and engineers understand how things work. Models take many forms, including physical objects, plans, mental constructs, mathematical equations, and computer simulations. Scientific explanations incorporate existing scientific knowledge and new evidence from observations, experiments, or models into internally consistent, logical statements. Different terms, such as "hypothesis," "model," "law," "principle," "theory," and "paradigm" are used to describe various types of scientific explanations. As students develop and as they understand more science concepts and processes, their explanations should become more sophisticated. That is, their scientific explanations should more frequently include a rich scientific knowledge base, evidence of logic, higher levels of analysis, greater tolerance of criticism and uncertainty, and a clearer demonstration of the relationship between logic, evidence, and current knowledge.

(G) Teacher Resource. Solar System Rubric (2 of 2)

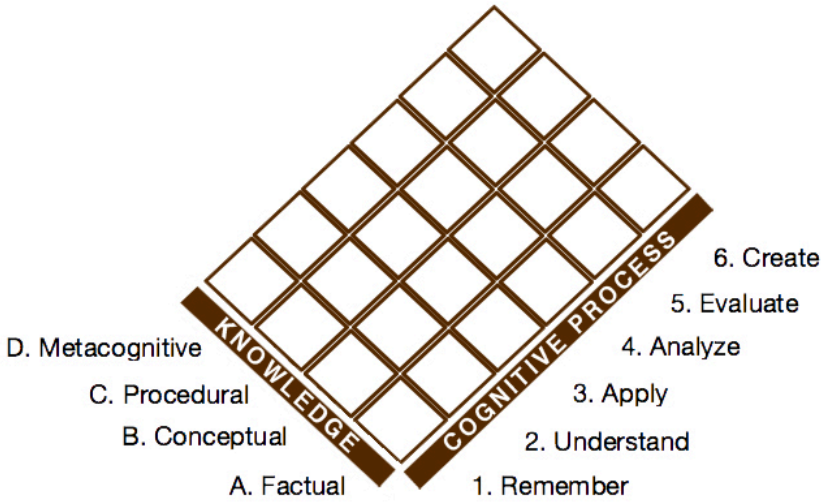
National Science Education Standards (NSES)
(D) Earth & Space Sciences

The earth is the third planet from the sun in a system that includes the moon, the sun, eight other planets and their moons, and smaller objects, such as asteroids and comets. The sun, an average star, is the central and largest body in the solar system. (Grades 5-8: D3a)

Related Rubrics for the Assessment of Learning Outcomes Associated with the Above Standard(s):

Learning Outcome	Expert	Proficient	Intermediate	Beginner
LO1a: to compare the relative size and distance of the Earth, Earth's Moon, and Mars	Answers are correct and work is shown.	Answers are correct and some work is shown.	Answers are mostly correct and some work is shown.	Answers are not correct/no work is shown.
LO1b: to use a calculated scale for establishing relative distances	Procedures are carried out correctly.	Procedures are carried out mostly correctly.	Procedures are carried out somewhat correctly.	Procedures are not carried out correctly.
LO1c to predict using a model	Prediction is logical and based on evidence from prior examinations of the model planets. Predictions show insightful interpretation of the data.	Prediction is logical and based on evidence from prior examinations of the model planets.	Prediction is logical and uses some evidence from prior examinations of model planets.	Prediction is not logical or based on evidence from prior examinations of the model planets.
LO1d to explain scientific processes (scale, use of models	Answer is thoughtful and complete.	Answer is complete.	Answer is somewhat complete.	Answer is not complete.

(H) Teacher Resource. Placement of Instructional Objective and Learning Outcomes in Taxonomy (1 of 3)

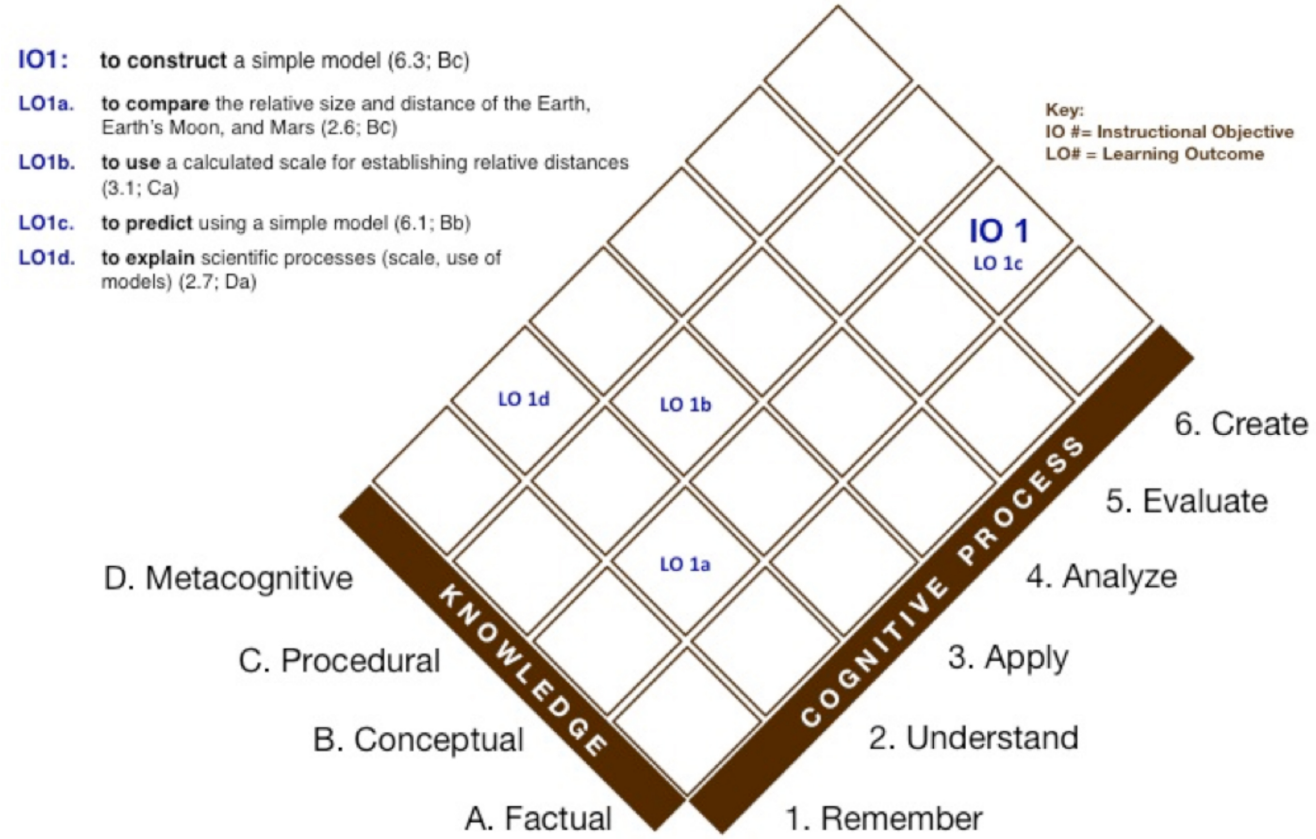


This lesson adapts Anderson and Krathwohl's (2001) taxonomy, which has two domains: Knowledge and Cognitive Process, each with types and subtypes (listed below). Verbs for objectives and outcomes in this lesson align with the suggested knowledge and cognitive process area and are mapped on the next page(s). Activity procedures and assessments are deslgned to support the target knowledge/cognitive process.

Knowledge	Cognitive Process
A. Factual **Aa:** Knowledge of Terminology **Ab:** Knowledge of Specific Details & Elements **B. Conceptual** **Ba:** Knowledge of classifications and categories **Bb:** Knowledge of principles and generalizations **Bc:** Knowledge of theories, models, and structures **C. Procedural** **Ca:** Knowledge of subject-specific skills and algorithms **Cb:** Knowledge of subject-specific techniques and methods **Cc:** Knowledge of criteria for determining when to use appropriate procedures **D. Metacognitive** **Da:** Strategic Knowledge **Db:** Knowledge about cognitive tasks, including appropriate contextual and conditional knowledge **Dc:** Self-knowledge	**1. Remember** **1.1** Recognizing (Identifying) **1.2** Recalling (Retrieving) **2. Understand** **2.1** Interpreting (Clarifying, Paraphrasing, Representing, Translating) **2.2** Exemplifying (Illustrating, Instantiating) **2.3** Classifying (Categorizing, Subsuming) **2.4** Summarizing (Abstracting, Generalizing) **2.5** Inferring (Concluding, Extrapolating, Interpolating, Predicting) **2.6** Comparing (Contrasting, Mapping, Matching **2.7** Explaining (Constructing models) **3. Apply** **3.1** Executing (Carrying out) **3.2** Implementing (Using) **4. Analyze** **4.1** Differentiating (Discriminating, distinguishing, focusing, selecting) **4.2** Organizing (Finding coherence, integrating, outlining, parsing, structuring) **4.3** Attributing (Deconstructing) **5. Evaluate** **5.1** Checking (Coordinating, Detecting, Monitoring, Testing) **5.2** Critiquing (Judging) **6. Create** **6.1** Generating (Hypothesizing) **6.2** Planning (Designing) **6.3** Producing (Constructing)

(H) Teacher Resource. Placement of Instructional Objective and Learning Outcomes in Taxonomy (2 of 3)

The design of this activity leverages Anderson & Krathwohl's (2001) taxonomy as a framework. Pedagogically, it is important to ensure that objectives and outcomes are written to match the knowledge and cognitive process students are intended to acquire.



(H) Teacher Resource. Placement of Instructional Objective and Learning Outcomes in Taxonomy (3 of 3)

The design of this activity leverages Anderson & Krathwohl's (2001) taxonomy as a framework. Below are the knowledge and cognitive process types students are intended to acquire per the instructional objective(s) and learning outcomes written for this lesson. The specific, scaffolded 5E steps in this lesson (see 5.0 Procedures) and the formative assessments (worksheets in the Student Guide and rubrics in the Teacher Guide) are written to support those objective(s) and learning outcomes. Refer to (H, 1 of 3) for the full list of categories in the taxonomy from which the following were selected. The prior page (H, 2 of 3) provides a visual description of the placement of learning outcomes that enable the overall instructional objective(s) to be met.

At the end of the lesson, students will be able

IO1: to construct a simple model
- **6.3:** to construct
- **Bc:** knowledge of theories, models, and structures

To meet that instructional objective, students will demonstrate the abilities:

LO1a: to compare size/distance in model
- 2.6: to compare
- Bc: knowledge of theories, models, and structures

LO1b: to use a calculated scale
- 3.1: to use
- Ca: knowledge of subject-specific skills and algorithms

LO1c: to predict using a model
- 6.1: to predict
- Bb: knowledge of principles and generalizations

LO1d: to explain scientific processes
- 2.7: to explain
- Da: strategic knowledge