



Mystery Planet

Grades: K-8

Prep Time: ~10 Minutes

Lesson Time: ~90 Minutes



WHAT STUDENTS DO: Explore a Model Planet to Discover New Features

In this activity, students step into the shoes of real planetary scientists and explore crustal samples from a “Mystery” planet. Using sorting/classification, students will interpret the geologic history of a region from which a sample has been collected and make inferences about past life or the potential for life on the “Mystery” planet.

NGSS CORE & COMPONENT QUESTIONS

INSTRUCTIONAL OBJECTIVES

HOW CAN ONE EXPLAIN THE STRUCTURE, PROPERTIES, AND INTERACTIONS OF MATTER?

NGSS Core Question: PS1: Matter and Its Interactions

Students will be able

IO1: to model
scientific
classification
schemes through
identifying criteria
necessary to sort
and classify
materials and
relate them to the
geologic history of
a region

HOW AND WHY IS EARTH CONSTANTLY CHANGING?

NGSS Core Question: ESS2: Earth's Systems

HOW CAN THERE BE SO MANY SIMILARITIES AMONG ORGANISMS YET SO MANY DIFFERENT KINDS OF PLANTS, ANIMALS, AND MICROORGANISMS?

NGSS Core Question: LS4: Biological Evolution: Unity and Diversity



How do particles combine to form the variety of matter one observes?

NGSS PS1.A: Structure and Properties of Matter

How do Earth's major systems interact?

NGSS ESS2.A: Earth Materials and Systems

How do living organisms alter Earth's processes and structures?

NGSS ESS2.E: Biogeology

What evidence shows that different species are related?

NGSS LS4.A: Evidence of Common Ancestry and Diversity



1.0 Materials

Required Materials

Please supply:

“Mystery” Planet Crustal Material bags (1 per pair of students)

- Coarse and fine sand (playground, river, or beach)
- Small rounded “pea” gravel pebbles (stream or gravel pit)
- Small flat “skipper” type round, round, flat, pebbles (rocky lake or ocean beach)
- Angular crushed stone (rural road, driveway, concrete, or cement mixing plant)
- Table salt
- Coarse rock salt (sidewalk melting salt or crushed water softener pellets)
- Crushed clinkers from a coal furnace
- Vermiculite or perlite (garden shop)
- Small fossil fragments (broken shells)
- Add any other rocky planet, rock fragments or synthetic materials that meet classroom needs – Make sure materials are sterile and free of bacteria
- Small, heavy duty zipper bag

For observing and sorting crustal materials (1 per pair of students)

- Hand lens
- Popsicle sticks
- Tweezers (plastic for younger students)
- Magnet (Cut up refrigerator magnets will do)
- Tray (Dissection, foam, or cafeteria tray will do)

Please Print:

From Student Guide:

- | | |
|---------------------------|--------------------------|
| (A) Sorting Graph Paper | – 1 per pair of students |
| (B) Classification Sheet | – 1 per student |
| (C) Concept Mapping Sheet | – 1 per student |

Optional Materials

From Teacher Guide:

- (D) “Mystery Planet” Assessment Rubrics
- (E) Placement of Instructional Objectives and Learning Outcomes in Taxonomy



2.0 Vocabulary

Classification	a grouping assigned to materials based on common characteristics
Compounds	composed of two or more elements
Deposition	material that is deposited or dropped from water or air
Element	a substance that cannot be separated into a simpler substance
Erosion	movement of material by water, wind or ice
Geologic History	an explanation of all of the geologic processes that have occurred in a region based on empirical evidence
Inferences	using logic and empirical evidence to establish a conclusion
Mixtures	a blend of elements and compounds
Observations	specific details recorded to describe an object
Physical Properties	distinctive characteristics or qualities that are observable
Rock Cycle	process used to describe changes to rock over time due to melting, cooling, erosion, weathering, heat, and pressure
Sedimentation	The deposition or accumulation of sediment
Weathering	mechanical and chemical processes that cause exposed rock to decompose.

3.0 Procedures

PREPARATION (~45 minutes)

Preparing the “Mystery” Planet Crustal Material bags

A. Create a mixture of the following materials:

- Coarse and fine sand (playground, river, or beach)
- Small rounded “pea” gravel pebbles (stream or gravel pit)
- Small flat “skipper” type round, round, flat, pebbles (rocky lake or ocean beach)
- Angular crushed stone (rural road, driveway, concrete, or cement mixing plant)
- Table salt
- Coarse rock salt (sidewalk melting salt or crushed water softener pellets)
- Crushed clinkers from a coal furnace
- Vermiculite or perlite (garden shop)
- Small fossil fragments (broken shells)
- Add any other rocky planet, rock fragments or synthetic materials that meet classroom needs – Make sure materials are sterile and free of bacteria

B. Scoop equal quantities of crustal materials into heavy duty zipper bags.

**Printing:**

- C. Please print handouts (A) – (C) in the Student Guide

STEP 1: ENGAGE (~10 minutes)**Sample Return Story-Telling**

Choose one of the following and read it to the students:

- A. **Fiction Story:** “A new planet has been discovered in another solar system. Scientists are curious about the history of this new planet and whether there are living creatures or once-living creatures on the planet. A rover has sent a sample of the planet back to Earth. You have a sample of the planet you will explore. Did life ever exist on this new planet? How would you know if it did?”
- B. **Non-Fiction Explanation:** Future Mars exploration includes rovers that will collect samples of the planet and return those samples back to Earth for investigation. You currently have a sample collected from Earth that could represent a sample return in the future. How do scientists learn about a planet from researching a crustal sample? How can we tell if life ever existed on the planet?



Curiosity Connection Tip: For making a connection to NASA’s Mars Rover “Curiosity,” please show your students additional video and slideshow resources at:

<http://mars.jpl.nasa.gov/participate/marsforeducators/soi/>

STEP 2: EXPLORE (~20 minutes)**Exploring Crustal Materials**

- A. Hand out crustal materials, (A) *Sorting Graph Paper*, and (B) *Classifications sheet*
- B. Students will now observe the crustal materials and begin sorting. To do this, pour the contents of the bag onto the (A) *Sorting Graph Paper*. For this stage of sorting, have students generate their own classification scheme. The (A) *Sorting Graph Paper* is also marked for size.
- Tell student to organize the substances found in the bag in any way they see fit; for example, students might organize the materials by size or color.
- C. Ask students to identify the key characteristics they used in their classification scheme. Place these key characteristics in the circles provided on the (B) *Classifications sheet*, then write the name of, or draw the crustal materials that belong in each of the classifications.



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<http://mars.jpl.nasa.gov/participate/marsforeducators/soi/>



STEP 3: EXPLAIN (~10 minutes)

Sharing Classification Schemes

- A. Ask students to share their classification criteria. Discuss any criteria that are very common in class, and those that are unique. Point out that scientists complete the same process. Refer to **Teacher Tip** for more information.

🍎 **Teacher Tip:** Mystery Planet validates and reinforces the fact that scientists can look at the same data and see different things or come to different conclusions. This is the way science works and what drives science to more questions. These types of questions also drive exploration. Landing sites on Mars, for instance, can be chosen because there is a question as to what processes formed an area. Sending a spacecraft to help answer some of those questions is one way to determine which scientific hypothesis is correct.

STEP 4: ELABORATE (~25 minutes)

Story-telling

- A. Ask students to take out a sheet of notebook paper (or teacher may hand out drawing paper).
- B. Student will write a story or draw a picture explaining(?) the geologic history of the area their crustal material might have come from.
- C. Ask students to consider what the environment may have been like, and what types of animals, plants, fungus, or bacteria might have existed. The drawing should be in comic strip form demonstrating changes over time while the story is a chronological march through the history of the area.

STEP 5: EVALUATE (~25 minutes)

Concept Mapping

- A. Hand out (C) *Concept Mapping Sheet* - 1 per student
- B. Based on classroom conversation and classification of crustal materials, have students explain what they now understand about the planet or region from where this sample came.
- C. Ask students to create a concept map diagramming their classification scheme. An example has been provided on the (C) *Concept Mapping Sheet*.



4.0 Extensions

Have students revisit their classifications to see if they can sort them into elements, mixtures, or compounds.

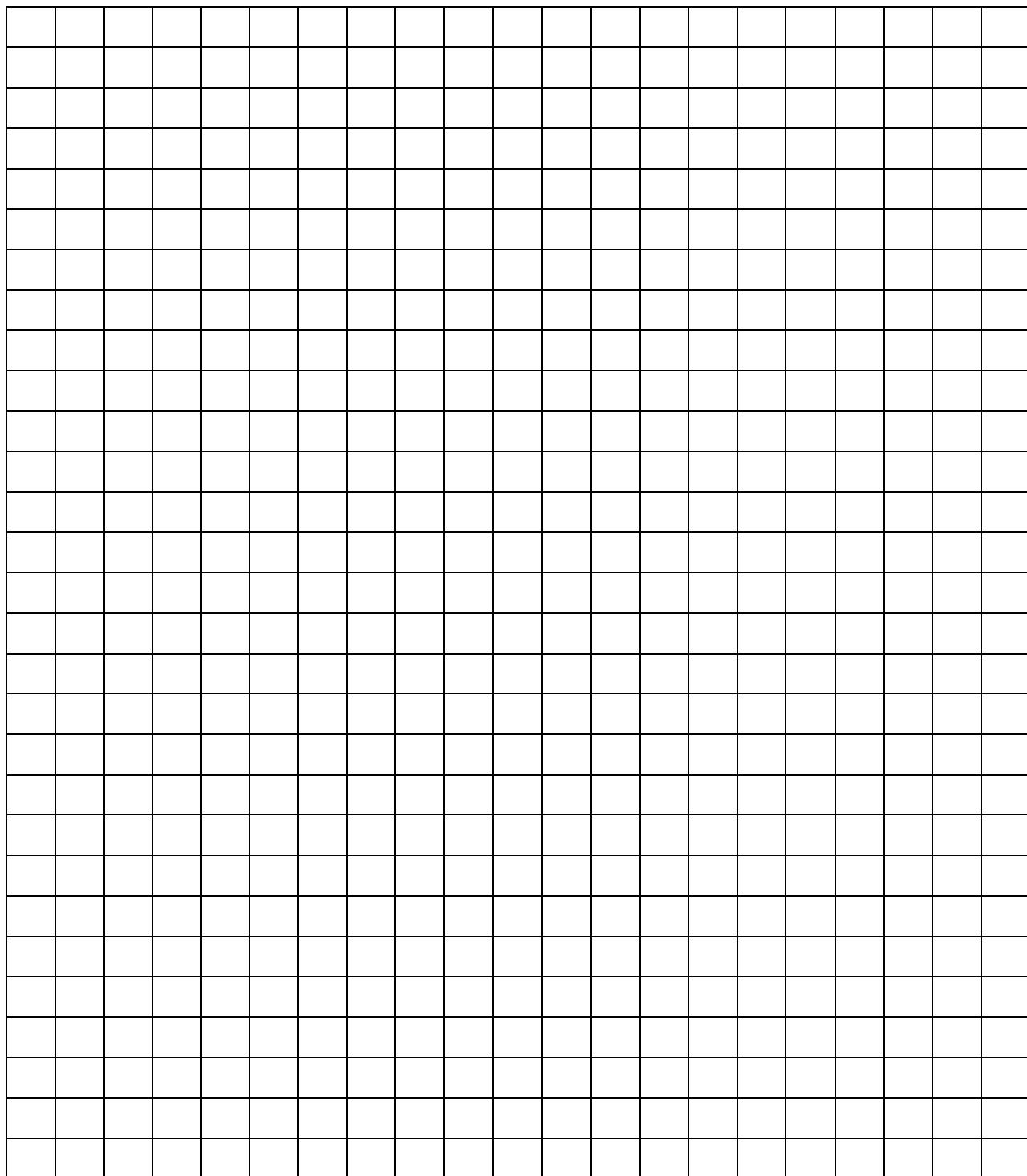
As a homework activity, ask students to follow their curiosity about Mars. Ask them to go online (with the parents, if their age suggests it), and ask “Dr. C” at least 3 questions about Mars. Have them write down the following url: <http://marsdata1.jpl.nasa.gov/DrC>

5.0 Evaluation/Assessment

Use the (D) “*Mystery Planet*” Rubric as a formative and summative assessment, allowing students to improve their work and learn from mistakes during class. The rubric evaluates the activities using National Science Education Standards.



(A) Student Resource. Sorting Graph Paper



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$\frac{1}{2}$ inch



MYSTERY PLANET

Student Guide

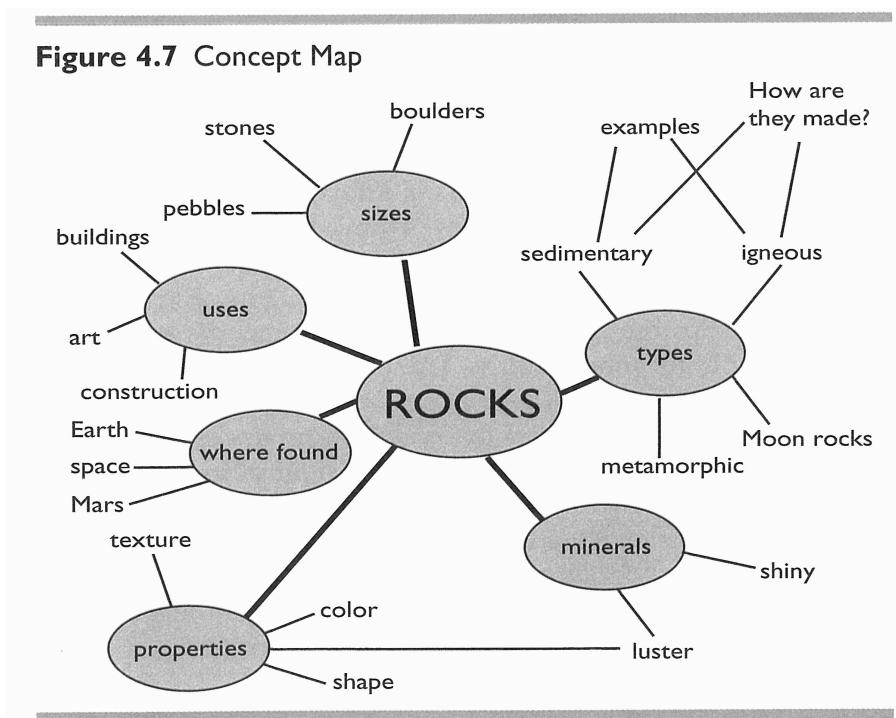
(B) Student Worksheet. Classification Sheet

NAME: _____

**MYSTERY PLANET****Student Guide****(C) Student Worksheet. Concept Mapping**

NAME: _____

Create a concept map, showing the criteria you have chosen for sorting (classifying) your Mystery Planet crustal materials. An example has been provided to get you started on your map.



*Image Credit: *Developing Visual Literacy in Science K-8*, National Science Teachers Association