

INTRODUCTIORY MATERIAL FOR A STUDY OF DARK MATTER IN THE UNIVERSE

A Unit of Instruction for Middle Level Earth Science

MINNESOTA STATE UNIVERSITY MOORHEAD
SUMMER PROJECT 2002

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Name of Unit: Dark Matter in the Universe

Subject and Grade Level: Earth Science 8th Grade

Duration of Unit: Three days

Summary: Students will learn where their existence on earth is in relationship to the universe. They will investigate how some things in our universe are intangible. Students will explore dark matter with visual aids and learning trunks.

Standards Addressed

National Science Education Standards

Earth and Space Sciences

CONTENT STANDARD D:

As a result of their activities in grades 5-8, all students should develop an understanding of earth in the solar system

-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.

-Most objects in the solar system are in regular and predictable motion. ?

Those motions explain such phenomena as the day, the year, phases of the moon, and eclipses.

-Gravity is the force that keeps planets in orbit around the sun and governs the rest of the motion in the solar system. Gravity alone holds us to the earth's surface and explains the phenomena of the tides.

Science and Technology

CONTENT STANDARD E:

As a result of activities in grades 5-8 all students should develop understanding about science and technology

-Scientific inquiry and technological design have similarities and differences. Scientists propose explanations for questions about the natural world, and engineers propose solutions relating to human problems, needs, and aspirations. Technological solutions are temporary; technologies exist within nature and so they cannot contravene physical or biological principles; technological solutions have side effects; and technologies cost, carry risks, and provide benefits.

Science as Inquiry

CONTENT STANDARD A:

As a result of activities in grades 5-8, all students should develop

- Abilities necessary to do scientific inquiry]
- Understandings about scientific inquiry

North Dakota Standards and Benchmarks

Standard 1: UNIFYING CONCEPTS

Students understand unifying concepts and processes of science.

Benchmark 8.1.2

Understand how models can be used to explain scientific principles.

Standard 5: EARTH AND SPACE SCIENCE

Students understand the basic concepts and principles of earth and space science.

Benchmark 8.5.7

Understand the structure and features of our solar system and the universe and the relations between them.

Standard 6: SCIENCE AND TECHNOLOGY

Students understand connections and relationships between science and technology.

Benchmark 8.6.1

Design a solution, using science and technology, to a problem related to human needs or wants.

Knowledge, Skills and Understandings

KNOWLEDGE

1. There are nine known planets in our solar system, but what we know about them varies by planet.
2. Much matter exists beyond our solar system.
3. Most of the matter of the universe does not transmit electromagnetic waves and is therefore referred to as “dark matter.”

SKILLS

1. Students will accurately label the names of the planets from our solar system and place them in the correct order starting at the sun.
2. Students will compare the sizes of the planets to each other.
3. Student will use appropriate tool and techniques to gather, analyze and interpret data and information about our solar system and dark matter.

UNDERSTANDINGS

1. The instruments used to collect data about planets limits what we know about them.
2. What we know about the planets is limited and many questions about planets remain to be discovered.
3. Our solar system is a heliocentric system with the sun at the center and the planets orbit the sun.
4. Most of the matter that makes up the universe has not be identified as of 2003.

INSTRUCTIONAL ACTIVITIES

1. Students will learn the names and positions of the nine planets in our solar system.
2. Students will describe for each planet its size and rotational direction.
3. Students will build a model of the solar system to scale using clay models for the planets.
4. Students will be able to read and understand a selected set of articles on dark matter.
5. Students will use a school computer to search for and find two articles on dark matter.
6. Students will prepare a list of questions they have about dark matter and present them to class for discussion and further exploration.

ASSESSMENTS

1. Modeling clay solar system
2. Colored pencil and paper drawings
3. Written test
4. Students proposal of the whole universe

Name of Item: Clay Model Planets			
Learning Area: Scientific Concepts and Applications	Content Standard: Earth Systems	Educational Level: Middle	Submission Type: Assessment Task

Standard Specification: *Those parts of the standard that are assessed in this task are bolded.*

A student shall demonstrate understanding of the structure of earth systems, including the geosphere, hydrosphere, and atmosphere; concepts of change and constancy in the earth's history and theories of origin through evidence found in fossils, rocks and layers, land forms, and natural events; and **the relative position and motion of objects in the solar system** including moon phases and tides, seasons, eclipses, gravitational force, and planetary motion by:

- 1) formulating questions to be answered based on systematic observation;
- 2) designing and conducting investigations and field studies;
- 3) analyzing data to support or refute hypotheses by identifying patterns in data; and comparing results to known scientific theories, current models, or personal experience; and considering multiple interpretations of data;
- 4) describing how a premise is supported by scientific concepts, principles, theories, or laws; and
- 5) creating a model to illustrate a contemporary or historical concept, principle, theory, or law.

KNOWLEDGE: Students will recognize the planet names and their positions in our solar system.

SKILLS: Students will accurately label the names of the planets from our solar system and place them in the correct order starting at the sun. Students will compare the sizes of the planets to each other

UNDERSTANDING: Students will understand our solar system is heliocentric.

Evidence of Learning: *The following product(s) supply evidence of student learning.*

The students will make scale clay models of the solar system in size and distance from the sun.

Task Summary: *The following is a brief summary of this assessment task.*

Creating a model to illustrate the heliocentric solar system.

Feedback Checklist: *Items in the checklist are aligned with the standard and describe the quality criteria for each piece of evidence. Items indicate what is being assessed and how well it needs to be demonstrated.*

Task Checklist

Y = Yes

N = No Evidence Shown

Student	Type of Evidence	Teacher
_____	Marking on graphing paper the distance from the sun to the different planets in our solar system	_____
_____	Illustrate the rotations of the different planets in our solar system	_____

Design clay model in scale to the real masses of the planets

Task Description: *Includes clear, step-by-step, instructions.*

Students research to get the true measurements for the distance from the sun to the different planets in our solar system. They analyze the distances to come up with a ratio scale. Using the micro graphing paper the students mark the distance using the ratio scale for the distance from the sun to the different planets in our solar system.

Students research the rotational directions of the planets in our solar system. Using the rotational directions, students will illustrate the planets and the rotational direction. Students will use the known mass of the planets and calculate ratios using this information. From the ratios the students will use a scale and modeling clay attempting to make models of the planets in our solar system

Special Notes: *Includes any tips or special instructions.*

The smallest planet will have to be a very tiny piece of clay or you will find you will se to much clay to make the whole model.

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DATE _____

NAME _____

(1 POINT EACH – 18 POINTS TOTAL)

PLANET DISTANCE
FROM THE SUN

PLANET RADIUS

Saturn 1,426,940 KM
Earth 149,600 KM
Venus 108,200 KM
Neptune 4,497,070 KM
Pluto 5,913,520 KM
Jupiter 778,330 KM
Mars 227,940 KM
Uranus 2,870,990 KM
Mercury 57,910 KM

Jupiter 71,492 KM
Venus 6052 KM
Mercury 2439 KM
Neptune 24,764 KM
Sun 1.4 Million KM
Saturn 60,268 KM
Mars 3397 KM
Uranus 25,559 KM
Pluto 1160 KM

Using the data from the table above:

Place the **planets** in order starting **closest** to the sun going outward.

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.

Using the data from the table above:

Place the planets in order from the smallest to the largest **radius**.

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.

DATE _____ SCORE _____

NAME _____

(2 POINTS EACH - 26 TOTAL POINTS)

1. _____ is the planet that is the closest to the sun.
 2. _____ is the planet that is the farthest from the sun.
 3. _____ is the planet that has the smallest radius.
 4. _____ is the planet that has the largest radius.
 5. _____ is what makes up most of the visible matter in a galaxy.
 6. _____ is the closest star to the earth.
 7. _____ and _____ are the two main galaxy types.
- 8-9. Draw the two galaxy types below.
- A. _____ B. _____
10. Inner planets are called the _____ planets.
 11. Outer planets are called the _____ planets.
 - 12-13. The meteoroid/asteroid belt is located between what two planets?
A. _____ B. _____