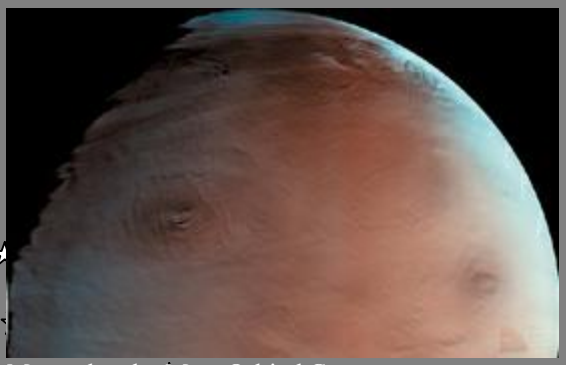
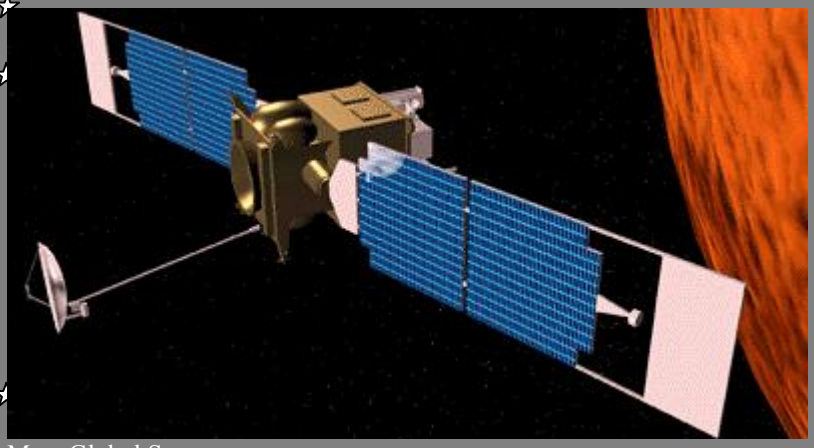
Mars and Beyond!



Mars taken by Mars Orbital Camera

Family Portrait of Jupiter's Great Red Spot and the Galilean Satellites



Mars Global Surveyor

By Nancy Wilkinson

Mars and Beyond
Lesson 2
The Metric System

Objectives:

1) Students will learn about the metric system including large and small numbers.
2) Students will use patterns to explore place value with negative exponents.
3) Students will analyze the relationship between positive exponents and negative exponents in addition to its' place value.

Materials Needed:

1) Worksheet Lesson 2
2) Rulers

Opening Activity:

Ask the students what metric words they might already know. Some common ones are liter, gram and kilometer. Ask the students if they know what these words mean.

Activity:

Go over Worksheet Lesson 2 with the students. This worksheet is self-explanatory. The students can do the worksheet on their own, or you might want to do it as a class.

Closure:

Students may share their posters with the class.

Launched March 17, 1958, Vanguard 1 was a small earth-orbiting satellite designed to test the launch capabilities of a three-stage launch vehicle and the effects of the environment on a satellite and its systems in Earth orbit. It also was used to obtain geodetic measurements through orbit

Mars and Beyond
Worksheet Lesson 2
The Metric System

Name _____ Period _____

Directions: In order to understand information about space, we must first understand the metric system. Most scientists use the metric system.


Ranger 1 launched 8/23/1968

The metric system is based on the number ten. Each larger measurement is ten times greater.

1) List below the various units to measure weight. In the metric system, the root word gram is used. One gram is about the weight of a dime.

2) Brainstorm on some measurements for volume. In the metric system, the root word is liter. One liter is slightly more than a quart (1 liter = 33.8 oz).

3) What are some measurements we use for measuring distance? The metric system uses the root word meter. A meter is about 39 inches.

When the metric system was invented, the mathematicians and scientists needed to have smaller and larger measurements than just meter, gram and liter. They decided to add a prefix to each word to describe the size. Therefore, the metric system is made of prefixes and root words.

Each prefix has a meaning. There are three prefixes that make the measurement $\frac{1}{10}$, $\frac{1}{100}$ and $\frac{1}{1000}$ of the size of the root. These are:

deci which means $\frac{1}{10}$ centi which means $\frac{1}{100}$

milli which means $\frac{1}{1000}$

4) Write down the metric names for the following measurements:

a) $\frac{1}{10}$ of a meter _____

b) $\frac{1}{100}$ of a meter _____

c) $\frac{1}{10}$ of a gram _____

d) $\frac{1}{100}$ of a gram _____

e) $\frac{1}{10}$ of a liter _____

f) $\frac{1}{100}$ of a liter _____

g) $\frac{1}{1000}$ of a meter _____

h) $\frac{1}{1000}$ of a gram _____

i) $\frac{1}{1000}$ of a liter _____

The metric system also needs names for sizes that were larger than the root measurement. The prefixes for the larger measurements are:

deca which means 10 hecto which means 100

kilo which means 1000

5) Write down the metric word for the following measurements:

j) 10 meters _____

k) 100 meters _____

l) 10 grams _____

m) 100 grams _____

n) 10 liters _____

o) 100 liters _____

p) 1000 meters _____

q) 1000 grams _____

r) 1000 liters _____


Ranger 2 launched 11/18/1961

6) Use your ruler to draw a line that is 1 centimeter long.

7) Use your ruler to draw a line that is 1 millimeter long.

Did you notice that the millimeter line was $\frac{1}{10}$ the size of the centimeter line? Scientists needed sizes that were even smaller than 1 millimeter. Therefore, they invented several more prefixes for even smaller units of measurement. They are:

micro meaning $\frac{1}{1000000}$ (1 millionth)

nano meaning $\frac{1}{1000000000}$ (1 billionth)

pico meaning $\frac{1}{1000000000000}$ (1 trillionth).

8) Write down the metric word for the following units of measurement:

s) 1 millionth of a meter _____

t) 1 trillionth of a meter _____

u) 1 billionth of a meter _____

9) Rather than writing fractions, scientists and mathematicians use positive and negative exponents. This is called scientific notation. For example "10^{2}" is the same as 10 • 10 or 100. What exponent do you think is 10 •10 •10 or 1000? _____ To write fractions using exponents, we put a negative number in front of the exponent. (The small number that is raised.) This simply means one over the answer. For example, "10^{-2}" means 1 over 10 • 10 or $\frac{1}{100}$. A trick to remember what number the exponent should be is to count the zeros. If you move your decimal to the left, your exponent would be positive. if you moved your decimal to the right, your exponent would be negative. For example, 100 has two zeros so the exponential form would be 10^{2}. What do you think the scientific form would be for the following numbers?

v) $\frac{1}{1000}$ _____

w) 1000 _____

x) 1,000,000 _____

y) $\frac{1}{1000000}$ _____

10) It is easier to show small and large numbers as scientific notation using exponents. For example, the number 5,000,000 can be written as $5 \bullet 10^{6}$. Very small numbers such as .000005 can be written with a negative number such as $5 \bullet 10^{-6}$. Rewrite each number below in scientific notation: You might want to write the numbers in standard form first.

z) 3 billion _____

aa) 2 million _____

ab) 5 micrometers _____

ac) 3 nanometers _____

ad) 2 picometers _____

ae) 5 trillion _____

11) Now that you know all of the sizes, can you create a chart that shows all of the different measurements in the metric system? Fill in the blank spaces in the table below. Some places in the chart have already been filled in for you.

	10^{e}	**Meter**	**Liter**	**Gram**
1000	10^{3}		kiloliter	
100				hectogram
10		decameter		
1				gram
$\frac{1}{10}$	10^{-1}		deciliter	
$\frac{1}{100}$				centigram
$\frac{1}{1000}$			milliliter	
$\frac{1}{1000000}$		micrometer		
$\frac{1}{1000000000}$				nanogram
$\frac{1}{1000000000000}$		picometer		

12) Bonus activity: Create a poster for the classroom that explains the metric system.

Mars and Beyond
Worksheet Lesson 2 - Answers
The Metric System

1) List below the various units to measure weight.
Some examples are ounces, pounds and tons.

2) Brainstorm on some measurements for volume.
Some examples are teaspoon, tablespoon, cup, pint, quart and gallon.

3) Write down below some measurements we use for measuring distance.
Some examples are inches, feet, and miles.

4) Write down the metric names for the following measurements:

a) $\frac{1}{10}$ of a meter = *decimeter*
b) $\frac{1}{100}$ of a meter = *centimeter*
c) $\frac{1}{10}$ of a gram = *decigram*
d) $\frac{1}{100}$ of a gram = *centigram*
e) $\frac{1}{10}$ of a liter = *deciliter*
f) $\frac{1}{100}$ of a liter = *centiliter*
g) $\frac{1}{1000}$ of a meter = *millimeter*
h) $\frac{1}{1000}$ of a gram = *milligram*
i) $\frac{1}{1000}$ of a liter = *milliliter*

5) Write down the metric word for the following measurements:

j) 10 meters = *decameter*
k) 100 meters = *hectometer*
l) 10 grams = *decagram*
m) 100 grams = *hectogram*
n) 10 liters = *deciliter*
o) 100 liters = *hectoliter*
p) 1000 meters = *kilometer*
q) 1000 grams = *kilogram*
r) 1000 liters = *kiloliter*

6) ——

7) -

8) Write down the metric word for the following units of measurement:

s) 1 millionth of a meter = *micrometer*
t) 1 trillionth of a meter = *nanometer*
u) 1 billionth of a meter = *picometer*

9) 10^3 , What do you think the scientific form would be for the following numbers?

v) $\frac{1}{1000} = 10^{-3}$ w) $1000 = 10^3$

x) $1{,}000{,}000 = 10^6$ y) $\frac{1}{1000000} = 10^{-6}$

10) Rewrite each number below in scientific notation: You might want to write the numbers in standard form first.

z) 3 billion = $3 \bullet 10^9$ aa) 2 million = $2 \bullet 10^6$

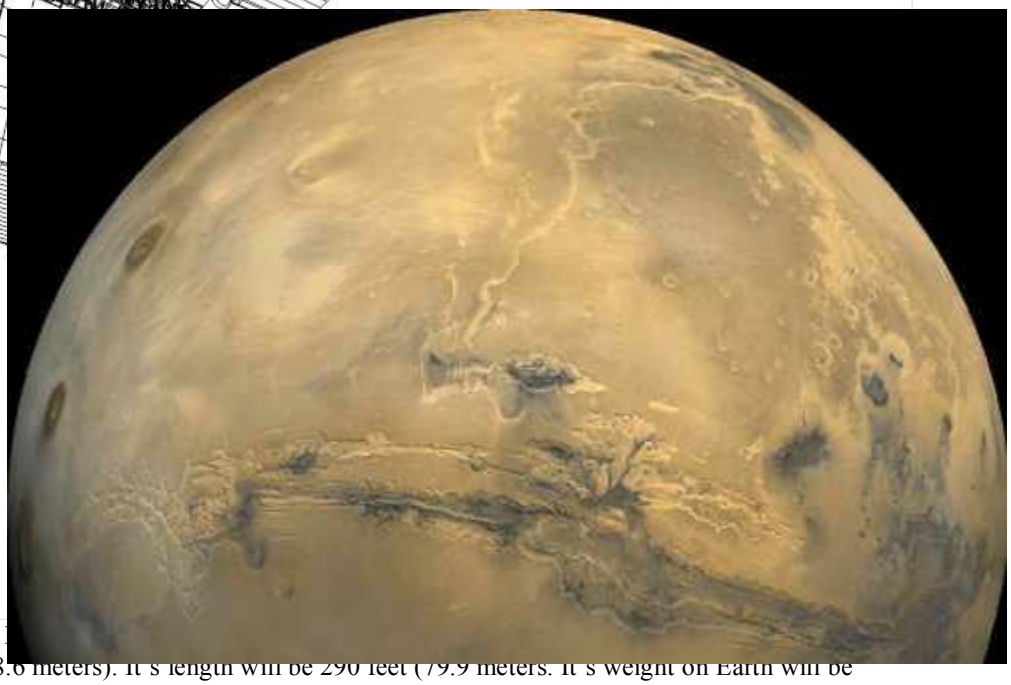
ab) 5 micrometers = $5 \bullet 10^{-6}$ ac) 3 nanometers = $3 \bullet 10^{-9}$

ad) 2 picometers = $2 \bullet 10^{-12}$ ae) 5 trillion = $5 \bullet 10^{12}$

11)

	10^e	Meter	Liter	Gram
1000	10^3	kilometer	kiloliter	kilogram
100	10^2	hectometer	hectoliter	hectogram
10	10	decameter	deciliter	decagram
1	1	meter	liter	gram
$\frac{1}{10}$	10^{-1}	decimeter	deciliter	decigram
$\frac{1}{100}$	10^{-2}	centimeter	centiliter	centigram
$\frac{1}{1000}$	10^{-3}	millimeter	milliliter	milligram
$\frac{1}{1000000}$	10^{-6}	micrometer	microliter	microgram
$\frac{1}{1000000000}$	10^{-9}	nanometer	nanoliter	nanogram
$\frac{1}{1000000000000}$	10^{-12}	picometer	picoliter	picogram

Images of Mars



The
(108.6 meters). It's length will be 290 feet (79.9 meters. It's weight on Earth will be
1,005,000 pounds (455,865 kilograms). It will exist
average (407 kilometers) above the Earth. It will ho

Olympus Mons: