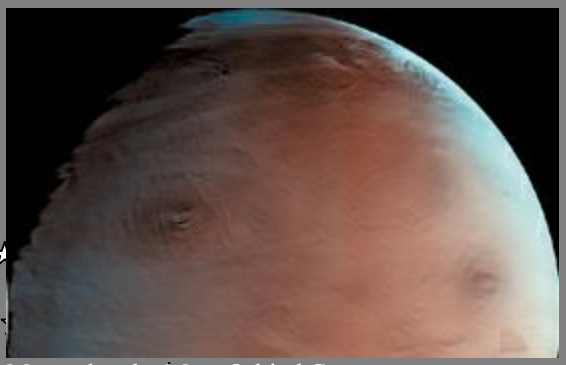
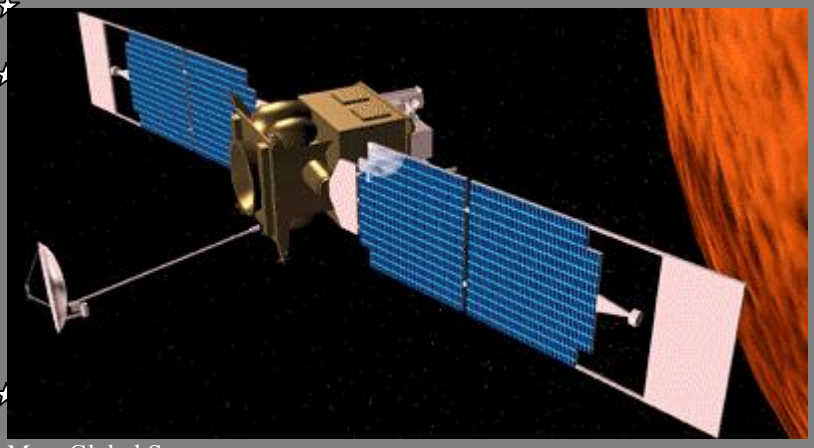
Mars and Beyond!



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 5
The Electromagnetic Spectrum

Objectives:

1) Students will discover very small numbers and how they relate to the wavelengths
2) Students will write the wavelengths in scientific notation
3) Students will sort small and large numbers according to size
4) Students will learn about the Electromagnetic Spectrum.

Materials Needed:

1) Set of index cards for each group with the words: thousands, millions, billions, trillions, quadrillions, quintillions, sextillions, septillions, octillions, nonillions, decillions, undecillion, duodecillion, tredecillion, quattuordillion, quindecillion, sexdecillion, septendecillion, octodecillion, novemdecillion and vigintillion
2) Bowl of water in a clear flat container.
3) Overhead projector
4) Glass Prism
5) Rope or string.
6) Worksheet Lesson 5
7) There are several web sites that clearly explain the electromagnetic spectrum.

Opening Activity:

Sort through the set of index cards on your table. Place them in order from smallest number to largest number.

Activity:

1) Place the clear flat container of water on the overhead projector. Make sure the water is still.

2) Read the directions on Worksheet Lesson 5.

3) Drop a marble in the middle. Have the students record what they see. Read question 1 on Worksheet Lesson 5.

4) Have one student hold the end of a rope. Move the rope to make wavelengths. Have the students answer question 2 on Worksheet Lesson 5.

5) Go over the remainder of the worksheet for Lesson 5. On problem 5, put the glass prism on the overhead so that students may see the various colors.

Closure:

Students may share their visual aides with the class.

Mars and Beyond
Worksheet Lesson 5
The Electromagnetic Spectrum

Name _____ Period _____

Directions:

You know some very large numbers and you know very small lengths such as nanometer, micrometer and picometer. The smallest numbers are often used to describe the lengths of the waves for electromagnetic radiation. The heat that the sun sends to the Earth is sent on electromagnetic waves. They are, in a way, the carrier for energy. Depending on the length of the wave, you will know what kind of electromagnetic radiation it is. Imagine what the water looks like when a rock is thrown in a lake. The waves that are made in the water, are similar to the waves that we do not see in the air. There are many types of waves. When you turn on the a radio, you hear radio waves. When you break a bone, the technician uses x-ray waves to take a picture of your bone. Visible wavelengths are the colors that we see. Microwaves cook your food.

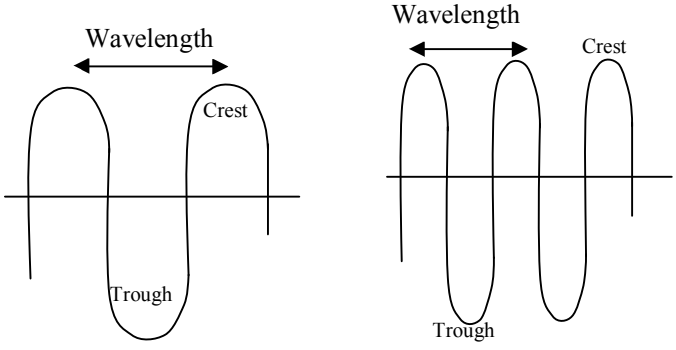
1) Your teacher will place a marble in the container of water. What do you see? Write down your responses.

_____
_____
_____

2) When the teacher moves the rope, what do you see? Write down your observations.

_____
_____
_____

What you see are like wavelengths. The top of the wavelength is call the Crest. The bottom of the wavelength is called the Trough. The frequency is how quickly the wavelength goes up and down.



Low Frequency High Frequency

3) What are the differences between the low frequency and the high frequency wavelengths? What do you notice about the length of the wave?

_____

_____

4) Wavelengths are categorized by their size. Each wavelength type has a range of sizes. The following chart shows the wavelengths and their range of sizes. Notice the scientific symbols used to represent the size of the wavelengths. Put the wavelengths in order from largest to smallest based on their size.

Wave	Smallest Wavelength	Longest Wavelength
Visible Light	400 nanometers (400 nm)	700 nanometers (700 nm)
Infrared Light	700 nanometers (700nm)	25 micrometers (25 μm)
Microwaves	25 micrometers (25μm)	1 millimeter (1 mm)
Radio Waves	1 meter	20 meters or larger
Ultraviolet Light	1 nanometer (1 nm)	400 nanometers (400 nm)
Gamma Rays	Smaller than 1 pico meter	picometer (1 pm)
X –Rays	1 picometer (1 pm)	1 nanometer (1 nm)

Wavelengths in order:

a) Longest _____ e) _____

b) _____ f) _____

c) _____ g) _____

d) _____

Visible light is the colors that you see. Each color in the spectrum has a wavelength. Look at the glass prism that your teacher placed on the overhead. What colors do you see in the spectrum? The spectrum colors and their wavelength range is shown on the chart below.

Color	Shortest Wavelength	Longest Wavelength
Red	630 nm	700 nm
Orange	590 nm	630 nm
Yellow	560 nm	590 nm
Green	480 nm	560 nm
Blue	440 nm	480 nm
Violet	400 nm	440 nm

5) Create a visual aide that shows the entire electromagnetic spectrum. Include the names of the waves and their wavelengths. Some examples of visual aides may be models, posters, books or mobiles. The chart above shows the electromagnetic spectrum and associated wavelengths.

Mars and Beyond
Worksheet Lesson 5 - Answers
The Electromagnetic Spectrum

1) Your teacher will place a marble in the container of water. What do you see? Write down your responses.

The students should notice the circular waves that come off of the marble. This is much like the wavelengths in the electromagnetic spectrum.

2) When the teacher moves the rope, what do you see? Write down your observations.

The students should notice how the rope makes a wavelength. As the rope is tightened, the wavelength is smaller and more frequent. As the rope is loosened, the wavelength is larger and less frequent.

3) What are the differences between the low frequency and the high frequency wavelengths? What do you notice about the length of the wave?

The wavelength is smaller when there is more frequency.

4) Wavelengths are categorized by their size. Each wavelength type has a range of sizes. The following chart shows the wavelengths and their range of sizes. Notice the scientific symbols used to represent the size of the wavelengths. Put the wavelengths in order from largest to smallest based on their size.

Wave	Smallest Wavelength	Longest Wavelength
Radio Waves	1 meter	20 meters or larger
Microwaves	25 micrometers (25μm)	1 millimeter (1 mm)
Infrared Light	700 nanometers (700nm)	25 micrometers (25 μm)
Visible Light	400 nanometers (400 nm)	700 nanometers (700 nm)
Ultraviolet Light	1 nanometer (1 nm)	400 nanometers (400 nm)
X –Rays	1 picometer (1 pm)	1 nanometer (1 nm)
Gamma Rays	Smaller than 1 pico meter	picometer (1 pm)

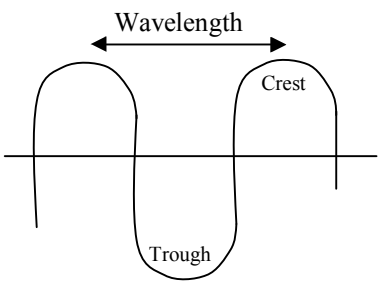
Wavelengths in order:

a) Longest - Radio Waves
b) Microwaves
c) Infrared Light
d) Visible Light
e) Ultraviolet Light
f) X –Rays
g) Gamma Rays

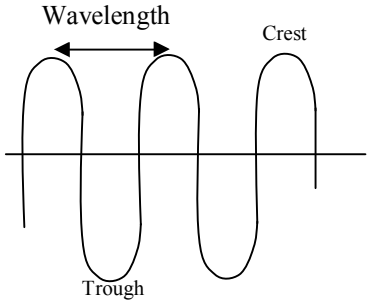
5) Create a visual aide that shown the entire electromagnetic spectrum. Include the names of the waves and their wavelengths. Some example of visual aides may be models, posters, books or mobiles. The chart above shows the electromagnetic spectrum and their equivalent wavelengths.

An example of a poster is shown on the next page.

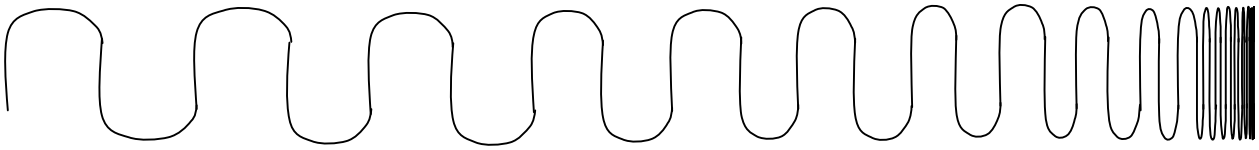
The Electromagnetic Spectrum

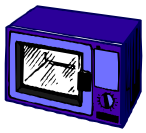
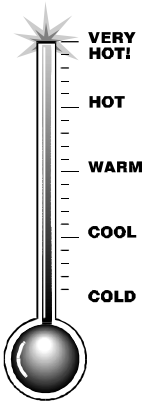
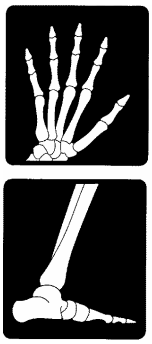
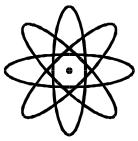


Low Frequency

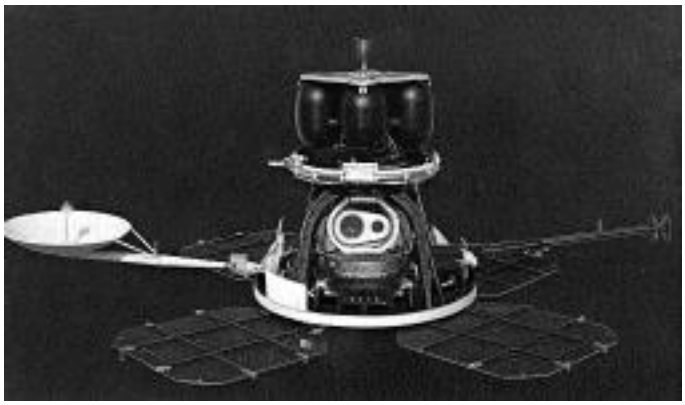


High Frequency



						
Radio	**Microwave**	**Infrared Light**	**Visible Light**	**Ultraviolet Light**	**X-rays**	**Gamma Rays**
1 meter - 20 meters or larger	25µm – 1 mm)	700nm – 25 µm	400 nm – 700 nm	1 nm – 400 nm	1 pm - 1 nm	Smaller than 1 pm

Red	630 – 700 nm
Orange	590 – 630 nm
Yellow	560-590 nm
Green	480 – 560 nm
Blue	440 – 480 nm
Violet	400 – 440 nm



Lunar Orbiter 4 – 5/8/1967 - Lunar Orbiter