OBJECTIVES:

1. Introduce students to the field of nanotecnology and nanoscience.
2. Introduce students to basic nanotechnology and nanoscience.
3. Complete a pre-learning (front loading) activity.
4. Complete a case study.

ACTIVITIES

1. Classroom discussion. Review of SI and prefixes and introduction to nanotechnology and nanoscience.
2. Pre-learning (front loading) worksheet.
3. "Real life" case study.
4. Complete discussion questions in the case study.
5. Review case study discussion questions in class.
6. Watch movie (Innerspace).

LESSON PLAN:

1. After discussing atoms and molecules, chemical and physical properties, chemical and physical changes introduce the field of nanoscience and nanotechnology.
2. Complete pre-learning activity as a class.
3. Divide the class into small groups (4-5 students). Assign each student a role to play.
4. Hand out copies of "The Doctor's Disappearance".
5. Allow students time to read and discuss.
6. Conclude lesson by reviewing the discussion points and watching the movie Innerspace.

PRE-LEARNING ACTIVITY:

A. Review metric scale

1. In science we use the International System of Units. This system is based on the metric system.
    a. It is a standard of measurement. This means that scientists around the world all measure in a common way.
    b. This makes communication and sharing of information very easy.

2. To meausre mass, scientists use the unit grams.

3. To measure volume, scientists use liters if it is a liquid and cubic centimeters if it is a solid.

4. To measure length, scientists use meters.

5. Prefixes can be added to change the value of the measurement.
    a. For example, if you were measuring from Grand Forks to Fargo, you would use kilometers instead of meters.

B. The Prefixes

giga	(G-)	1 billion
	1,000,000,000	
mega	(M-)	1 million
	1,000,000	
kilo	(k-)	1 thousand
	1,000	
hecto	(h-)	1 hundred
	100	
deka	(da-)	ten
	10	
base		one
	1	
deci	(d-)	one tenth
	0.1	

centi	(c-)	one hundreth 0.01
milli	(m-)	one thousandth 0.001
micro	(☞-)	one millionth 0.0001
nano	(n-)	one billionth 0.00001

C. Introduction to the NanoWorld

1. What is nanoscience?
    a. Nanoscience is the study of atoms, molecules, and objects on the nanoscale (1-100 nanometers).

2. What does this mean----nanoscale?

    a. In order to see a nanostructure your eyes would have to be the size of a piece of hair!

3. Carbon on the nanoscale

    a. carbon in our real-life world

        1. we can use it to do things like write with it

            -carbon will form super thin sheets layered on the top of each other. This is graphite!

            -graphite is used in pencils!

                —when you write these super thin sheets are "ripped" off and deposited on paper.

        2. carbon forms diamonds

            -the carbon atoms are space evenly.

-every carbon atom is bonded to 3 other carbon atoms

—this makes diamonds VERY strong

b. carbon in the NanoWorld

1. Carbon can roll into a ball called a Buckeyball.

-it looks like a soccerball

2. Carbon can roll into tubes called nanotubes

-it looks like a straw

3. The arrangement of the carbon atoms determines their structure and their strength!

NAME_____
DATE_____ PER._____

1. What is the standard of measurement used by scientists around the world?

2. Draw a line for each of the following measurements:

   A. 10 cm

   B. 1 cm

   C. 10 mm

   D. 1 mm

3. What is the meaning of the following prefixes:

   A. Kilo-

   B. Milli-

C. Nano-

4. Define nanoscience.

5. Carbon found in different forms or structures are called allotropes. Name two allotropes of carbon that we are familiar with.

6. Carbon in the NanoWorld forms 2 distinctly different structures. What are they?

7. Buckeyballs look like soccerballs. What shapes are on the surface of a soccerball and Buckeyball?

8. What connection can you make between the 3 items found on the Doctor's desk (a pencil, a soccerball, and a large diamond)?

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