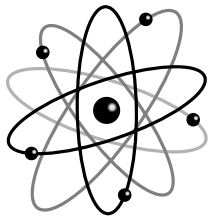
Name _____ Date _____ Class _____

CHAPTER 4

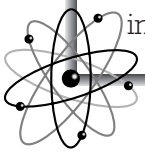
CRITICAL THINKING WORKSHEET

Incredible Shrinking Scientist!



You have received the following E-mail from a friend:

You'll never believe what happened today! My boss, Professor Pat Pending, was accidentally shrunk by her own invention, the "shrinking ray." In order to return her to her normal size, I tried to find her by using a super-high-powered microscope. I found the professor near the nucleus of an oxygen atom. Luckily, she was wearing a specially designed suit that carries an electrical charge. As I watched, I noticed something strange: The professor seemed to be traveling outward, as if she were being pushed away from the nucleus. Her lab notebook mentioned that contact must be made with a carbon-14 isotope to reverse the shrinking process. I'll write you tomorrow with an update.



Understanding Concepts

1. What was the charge on the professor's suit when she was moving away from the nucleus? How do you know?

2. If the professor had lacked movement toward or away from the nucleus, what would the charge on her suit have been?

3. How might other forces inside the atom affect the professor? Explain your answer.

Name _____ Date _____ Class _____

Comprehending Ideas

4. How could Professor Pending identify a carbon atom at the subatomic level?

5. How can Professor Pending use the concept of mass number to identify a carbon-14 isotope?

6. How many electrons would be needed to make the carbon-14 isotope a negatively charged ion?

Making Comparisons

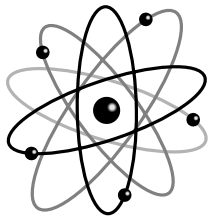
7. The Earth and moon have a relationship that could be compared with the nucleus and electron of a simple atom. Describe the similarities and differences between these relationships. Write your answers in your ScienceLog. Discuss your answers in groups.

Name _____ Date _____ Class _____

CHAPTER 4

CRITICAL THINKING WORKSHEET

Incredible Shrinking Scientist!



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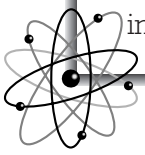

Understanding Concepts

1. What was the charge on the professor's suit when she was moving away from the nucleus? How do you know?

Because the nucleus is positively charged, the suit also must have been positively charged to create this repulsion.

2. If the professor had lacked movement toward or away from the nucleus, what would the charge on her suit have been?

Her suit would have had a neutral charge.

3. How might other forces inside the atom affect the professor? Explain your answer.

Answers will vary according to the forces students discuss. Sample answer: If her suit were positively charged, then the electromagnetic force would pull her toward the electrons in the atom.

Name _____ Date _____ Class _____

Comprehending Ideas

4. How could Professor Pending identify a carbon atom at the subatomic level?

Knowing that the atomic number of carbon is six, Professor Pending could look for an atom with six protons in its nucleus.

5. How can Professor Pending use the concept of mass number to identify a carbon-14 isotope?

An atom's mass number is equal to its protons plus its neutrons. All carbon atoms have six protons. Carbon-14 would have six protons and eight neutrons. Professor Pending could use this characteristic to identify the correct atom.

6. How many electrons would be needed to make the carbon-14 isotope a negatively charged ion?

A negatively charged ion has more electrons than protons. Therefore, the ion would require at least seven electrons.

Making Comparisons

7. The Earth and moon have a relationship that could be compared with the nucleus and electron of a simple atom. Describe the similarities and differences between these relationships. Write your answers in your ScienceLog. Discuss your answers in groups.

Answer to item 7:

The orbit of the moon can be compared with the movement of an electron. They both travel around objects with greater mass. They differ with respect to the forces that cause their motion. The moon orbits Earth because of gravity. The motion of an electron around a nucleus is a result of electromagnetism.