LESSON 11 ACTIVITY

Atomic Pudding
Models of the Atom

Name _____

Date _____ Period _____

Purpose

To compare various models of the atom that have appeared over the past two hundred years.

Part I: Using Evidence to Evaluate Models

In 1803, John Dalton proposed that atoms were simply solid spheres. In the decades that followed, chemists collected a lot of evidence suggesting that there was more to the atom. Look at the five models on the handout and read their descriptions. Then use the evidence in each box to evaluate the models.

EVIDENCE 1: It is possible to remove a negatively charged particle from an atom using electrical forces. (Thomson, 1897)

Does the evidence better support the solid sphere model or the plum pudding model? Explain your reasoning.

EVIDENCE 2: If a tiny particle is shot into the middle of an atom, it hits something dense in the center and bounces back in the direction from which it came. If a tiny particle is shot into the edges of the atom, it goes through. Most tiny particles shot at an atom will go through. (Rutherford, 1911)

Does the evidence better support the nuclear model or the plum pudding model? Explain your reasoning.

EVIDENCE 3: The farther from the center of an atom the negatively charged particles are, the easier they are to remove. (Bohr, 1913)

Does the evidence better support the solar system model or the plum pudding model? Explain your reasoning.

Part 2: Interpreting the Evidence

1. Which evidence supports the existence of each atomic part? Explain.
   a. negatively charged particles

   b. a nucleus

2. Examine the information and evidence in Part I. In what order do you suppose these models were introduced to the world of science?

3. In 1932, British physicist James Chadwick discovered that the nucleus was made up of uncharged, or neutral, particles called neutrons, in addition to the protons discovered by Rutherford. How do the three small particles found in the atom differ from one another?

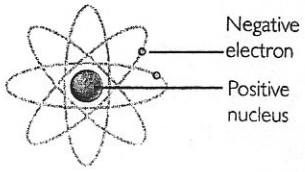
4. A helium atom has two electrons, two protons, and two neutrons.
   a. How many positive charges does the helium atom have?
   b. How many negative charges does the helium atom have?
   c. What is the charge on the helium atom? Explain your reasoning.

5. **Making Sense** Construct the best model of the atom you can. Use all the evidence given previously.

6. **If You Finish Early** Atoms are not flat. How can you revise the model you constructed in the Making Sense exercise to account for this evidence?

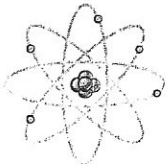
FIVE MODELS OF THE ATOM

NUCLEAR MODEL: The atom can be divided into a nucleus and electrons. The **nucleus** occupies a small amount of space at the center of the atom. The nucleus is dense and positively charged. The **electrons** circle around the nucleus. The electrons are tiny and negatively charged. Most of the atom is empty space.

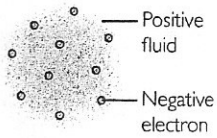


SOLID SPHERE MODEL: The atom is a **solid sphere** that cannot be divided up into smaller particles or pieces.

PROTON MODEL: The atom can be divided into a **nucleus** and **electrons.** The nucleus occupies a small amount of space at the center of the atom. The nucleus consists of **protons** that are positively charged. The electrons circle the nucleus. The electrons are tiny and negatively charged. Most of the atom is empty space.



PLUM PUDDING MODEL: The atom can be divided into a fluid (the "pudding") and electrons (the "plums"). The **fluid** spreads out in the atom and is positively charged. The **electrons** are very tiny and negatively charged. Most of the atom is made of fluid.



Electron Cloud Model: An electron cloud surrounds the nucleus. The cloud is made up of fast-moving electrons: The nucleus is made up of protons and neutrons.

SOLAR SYSTEM MODEL: The atom can be divided into a nucleus and electrons. The **nucleus** is at the center of the atom and is positively charged. The **electrons** circle around the nucleus in specified orbits. The electrons are tiny and negatively charged. Different electrons are in orbits at different distances from the nucleus. Most of the atom is empty space.