Name _____

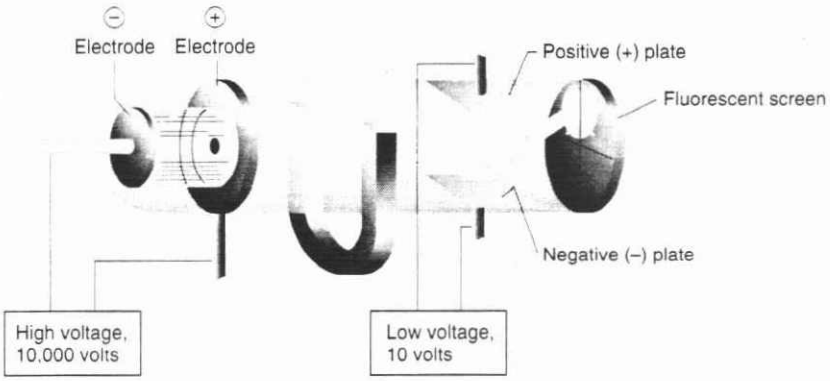
Class _____

Date _____

Composition of the Atom

A. Charged Particles

In 1897, J.J. Thomson constructed a Cathode Ray Tube like the one depicted below, filled with gas at very low pressure. When a high voltage is applied to the electrodes, a glowing beam is projected toward the fluorescent screen, creating a pinpoint glow. The position of the glow shows that the beam is deflected down when the magnet is put in place and up when a charge is applied to the plates near the fluorescent screen.



1. William Crookes had already demonstrated the deflection of the beam caused by the magnet. The deflection established an important fact about the glowing beam. Why was the deflection significant?

_____

_____

2. After passing the magnet, the beam is redirected by the field between the charged plates. What is the significance of the fact that the beam is deflected up toward the positively charged plate?

_____

_____

What is the beam composed of? _____

3. Assume that the gas in the tube is hydrogen at very low pressure. If a high voltage is applied to the electrodes, two beams will be produced. The effects of the magnet and the charged plates will be different on the new beam.

   a. In what direction will the new beam be deflected by the magnet? _____

   b. In what direction will the new beam be deflected by the charged plates? _____

   c. Will the new beam be deflected more than the original beam or less than the original beam by a magnet of equal strength? _____

   d. What is the new beam composed of? _____

   e. What is the significance of the different degree of deflection produced with the new beam?

   _____

   _____

4. The model of the atom proposed by John Dalton had to be considerably altered to account for the discoveries of J.J. Thomson. What is the major difference between Dalton's model and the model proposed by Thomson?

   _____

   _____

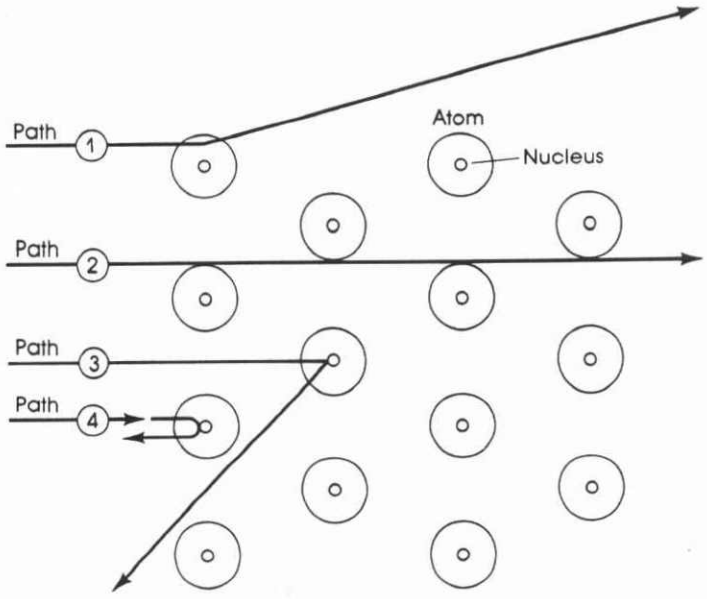
5. Thomson's model of the atom allows an atom to gain a net electrical charge. What is a charged atom called, and how does it differ from a neutral atom?

   _____

   _____

B. The Rutherford Experiment

Our modern view of atomic structure is based to a large extent on the work that British scientists Rutherford and Geiger did in 1911. In the classic experiment, positive alpha particles bombarded a sheet of gold foil. The paths followed by those particles are illustrated in the figure on page 37. Study the diagram and answer the questions that follow.



1. Which of the four paths is most common? _____
   a. 1 b. 2 c. 3 d. 4

2. Which of the four paths is least common? _____
   a. 1 b. 2 c. 3 d. 4

3. Path 2 is a straight line because of the alpha particles' _____
   a. magnetic repulsion. b. high velocity. c. distance from gold nuclei
   d. interaction with electrons

4. Path 4 will most likely _____
   a. never be observed. b. be characteristic of only the fastest-moving alpha particles.
   c. be characteristic of alpha particles that collide with a nucleus.
   d. result in an atomic reaction.

5. When Rutherford analyzed his results, he suggested that _____
   a. the atom is mostly empty space. b. the atomic center is positive in charge .
   c. the mass of an atom is mostly in a small, dense center. d. all of the above

C. Nuclear Symbols

Chemical symbols are often accompanied by notation that gives information on atomic composition. The subscript, written to the lower left of the chemical symbol, represents the atomic number. The superscript, written to the upper left of the symbol, represents the mass number, or total number of protons and neutrons. Using this information, complete the table on page 38. Assume that the mass of a neutron or the mass of a proton is 1 amu.