Cathode Ray Experiments

Use with Chapter 4, Section 4.2

A voltage source is applied to a cathode ray tube, creating charged particles. These particles are then accelerated through a hole in the cathode, entering a gas at low pressure. The charged particles are detected at the anode.

In image B, a magnet is used to deflect the charged particles, demonstrating their electric charge.

In image C, charged plates are used to influence the path of the charged particles, further illustrating their charged nature.

The diagrams A, B, and C together show how cathode rays are used to study the properties of charged particles.
1. What is a cathode ray?

2. What do the experiments in A, B, and C have in common?

3. Examine the cathode ray experiment in A. Describe the path of the cathode ray from its origin to its termination.

4. Compare the experimental setup in B with the setup in C. How do the two setups differ? What do both experiments show in terms of the cathode ray’s charge?

5. Examine the cathode ray experiment in B. What does this experiment show?

6. Examine the cathode ray experiment in C. Explain why the cathode ray bends.
Understanding Rutherford’s Gold Foil Experiment

Diagram A

Diagram B
1. What kind of particles do the arrows represent? What is the charge of the particles?

2. Which diagram depicts the plum pudding model of an atom?

3. Which diagram depicts Rutherford’s actual results from his gold foil experiment? How did the actual results differ from the expected results?

4. What did Rutherford conclude from the results of his experiment?

5. Explain why Rutherford expected the alpha particles to pass through the plum pudding model of the atom with little or no deflection.
Isotopes

Potassium-39 19 20 19
Potassium-40 19 21 19
Potassium-41 19 22 19

Protons Neutrons Electrons

19p 20n 19e
19p 21n 19e
19p 22n 19e
Isotopes

1. What do the following symbols represent?
   a. \( e^- \) ________________
   b. \( n^0 \) ________________
   c. \( p^+ \) ________________

2. Which subatomic particles are found in an atom’s nucleus?

3. Which subatomic particle identifies an atom as that of a particular element?

4. Explain why atoms are neutral even though they contain charged particles.

5. What do the numbers 39, 40, and 41 after the element name potassium refer to?

6. Write the symbolic notation for each of the following isotopes.
   a. potassium-39 ________________
   b. potassium-40 ________________
   c. potassium-41 ________________

7. Write an equation showing the relationship between an atom’s atomic number and its mass number.

8. Lithium has two isotopes: lithium-6 and lithium-7. Draw a diagram, like those shown on the transparency, for each lithium isotope. Label the protons, electrons, neutrons, and electron cloud in each diagram.