What are atoms?

Concepts:

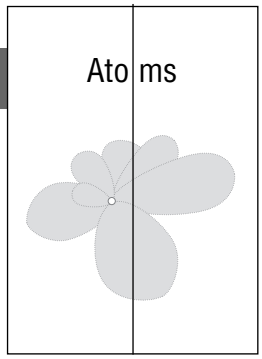
- Atoms are the building blocks of matter.
- Atoms have three parts: protons, neutrons and electrons.
- Protons have a positive charge, are heavy, and move slowly.
- Neutrons have no charge.
- The nucleus is the center of an atom and consists of neutrons and protons packed together.
- Electrons have a negative charge. These particles attract each other and keep the atom together.

Vocabulary Words: protons neutrons electrons nucleus *subatomic

Construct and Read: *Lots of Science Library Book #3.*

Activities:

Atoms – Graphic Organizer

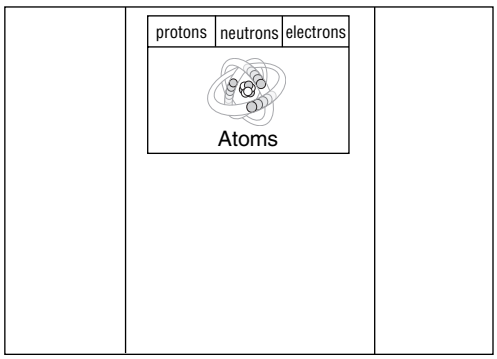


Focus Skill: categorizing characteristics
Paper Handouts: a copy of Graphics 3A-E two 8.5" x 11" sheets of paper
12" x 18" sheet of paper
Graphic Organizer: Make a Desktop Project from the construction paper. Cut Graphic 3A on the dotted line and glue it on the cover of the Desktop Project. Title it *Atoms*.

Cut out Graphics 3B-E, stack them in order, and staple on the left side. Label the left tab *protons*, the middle tab *neutrons*, and the right tab *electrons*.

✎ On the *protons* page, color the protons red. On the *neutrons* page, color the neutrons blue. On the *electrons* page, color the electrons yellow.

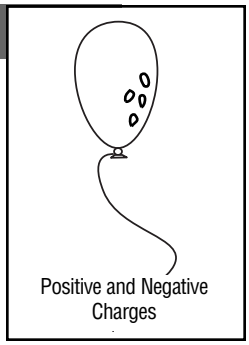
✎✎ Complete ✎. Write clue words about each part of an atom. protons: *in nucleus, positively charged, heavy, move slowly*. neutrons: *in nucleus, no charge.* electrons: *negatively charged, orbit nucleus in shells or levels.*



✎✎✎ Describe each part of an atom on the appropriate page.

Glue the 3 Top Tab Book on the top, middle section in the Atoms Desktop Project. Store for future use.

Positive and Negative Charges - Investigative Loop - Lab 3-1


Positive and Negative Charges

Focus Skill: demonstrating a concept
Lab Materials: balloon paper hole punch
Paper Handouts: 8.5" x 11" sheet of paper copy of Lab Graphic 3-1 Lab Book
Graphic Organizer: Make a Large Question and Answer Book. Glue it side-by-side to the Lab Book. Glue Graphic 3-1 to the left tab.
Question: Do like charges attract or repel?
Research: Read *Lots of Science Library Book #3.*
Procedure: Punch holes in the paper and spread the paper circles on a table. Rub an inflated balloon on your head several times. Hold the balloon close to the paper circles, but do not touch them. The paper circles are drawn to the balloon.
Observations: How did the paper circles react to the balloon? **The paper was attracted to the balloon.**
Record the Data: On the inside top section under the tab; write or draw your observations of the lab. **Teacher's Note: Your students may not know the charges that were created in this lab but may be aware that unlike charges caused the attraction. Explain the lab if needed: *When you rub the balloon on your hair, it gives the balloon extra negative charges, by rubbing the electrons off of the hair. The positive charge in the paper is attracted to the negative charge on the balloon.***
Communicate the Conclusions: Demonstrate this lab to someone who did not participate in it with you. Ask him/her to predict what will happen to the paper circles before you put the balloon near them. Explain the conclusions of this lab.
Conclusion: What does this tell us about charges?
Spark Questions: Discuss any questions sparked by this lab.
New Loop: Choose one question to investigate further.
Design Your Own Experiment: Select a topic based upon experiences in the Investigative Loop. See page vii for more details.

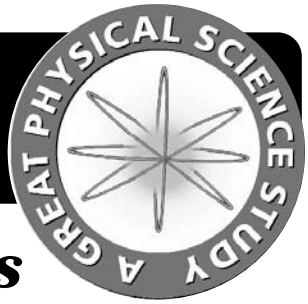
Experiences, Investigations, and Research

Select one or more of the following activities for individual or group enrichment projects. Allow your students to determine the format in which they would like to report, share, or graphically present what they have discovered. This should be a creative investigation that utilizes your students' strengths.

1. Research the Nobel Prize. Make a Four Door Book and report on the "what, when, who, and why" of the Nobel Prize. Make a timeline of Nobel Prize winners.

2. *Who's Who* Add John Dalton and J.J. Thomson to the Who's Who Book.

3. Research, sketch, and report on changes in the atomic model since it was first conceptualized by Democritus as an uncuttable atom.



Lots of Science Library Books

Each *Lots of Science Library Book* is made up of 16 inside pages, plus a front and back cover. All the covers to the *Lots of Science Library Books* are located at the front of this section. The covers are followed by the inside pages of the books.

How to Photocopy the *Lots of Science Library Books*

As part of their *Great Science Adventure,* your students will create *Lots of Science Library Books.* The *Lots of Science Library Books* are provided as consumable pages which may be cut out of the *Great Science Adventures* book at the line on the top of each page. If, however, you wish to make photocopies for your students, you can do so by following the instructions below.

To photocopy the inside pages of the *Lots of Science Library Books:*

1. Note that there is a "Star" above the line at the top of each *LSLB* sheet.

2. Locate the *LSLB* sheet that has a Star on it above page 16. Position this sheet on the glass of your photocopier so the side of the sheet which contains page 16 is facing down, and the Star above page 16 is in the left corner closest to you. Photocopy the page.

3. Turn the *LSLB* sheet over so that the side of the *LSLB* sheet containing page 6 is now face down. Position the sheet so the Star above page 6 is again in the left corner closest to you.

4. Insert the previously photocopied paper into the copier again, inserting it face down, with the Star at the end of the sheet that enters the copier last. Photocopy the page.

5. Repeat steps 1 through 4, above, for each *LSLB* sheet.

To photocopy the covers of the *Lots of Science Library Books:*

1. Insert "Cover Sheet A" in the photocopier with a Star positioned in the left corner closest to you, facing down. Photocopy the page.

2. Turn "Cover Sheet A" over so that the side you just photocopied is now facing you. Position the sheet so the Star is again in the left corner closest to you, facing down.

3. Insert the previously photocopied paper into the copier again, inserting it face down, with the Star entering the copier last. Photocopy the page.

4. Repeat steps 1 through 3, above, for "Cover Sheets" B, C, D, E, and F.

How to assemble the *Lots of Science Library Books*

Once you have made the photocopies or cut the consumable pages out of this book, you are ready to assemble your *Lots of Science Library Books*. To do so, follow these instructions:

1. Cut each sheet, both covers and inside pages, on the solid lines.

2. Lay the inside pages on top of one another in this order: pages 2 and 15, pages 4 and 13, pages 6 and 11, pages 8 and 9.

3. Fold the stacked pages on the dotted line, with pages 8 and 9 facing each other.

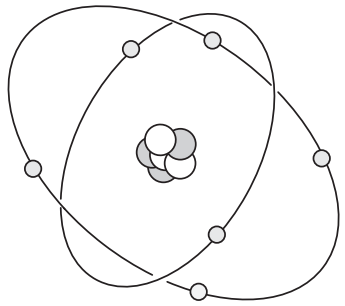
4. Turn the pages over so that pages 1 and 16 are on top.

5. Place the appropriate cover pages on top of the inside pages, with the front cover facing up.

6. Staple on the dotted line in two places.

You now have completed *Lots of Science Library Books*.

What are atoms?



Lots of Science Library Book #3

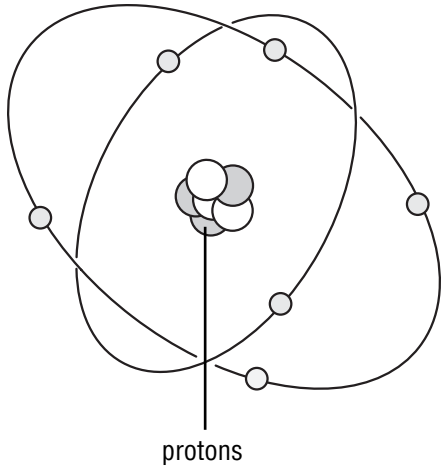
protons
neutroms
electrons
nucleus

*** subatomic**

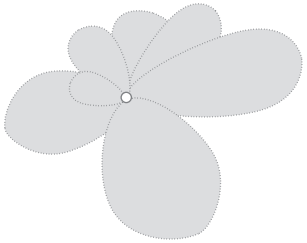
Electrons travel at an average distance from the nucleus, depending on their energy. These distances are referred to as energy levels.

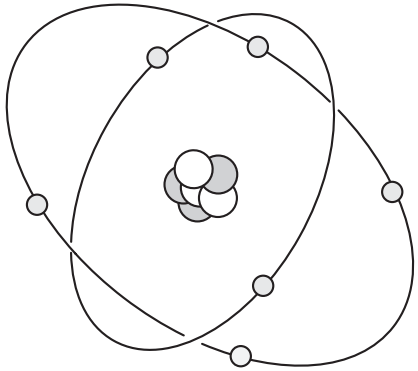
Atoms are the building blocks of matter. A British chemist, John Dalton, first introduced the term "atom" when he presented his atomic theory in 1807. At that time, Dalton's theory stated that all matter was made up of tiny particles called atoms.

In 1906 the British scientist J.J. Thomson won the Nobel Prize in Physics for his work in discovering electrons in atoms. Thomson made the first model of the atom.

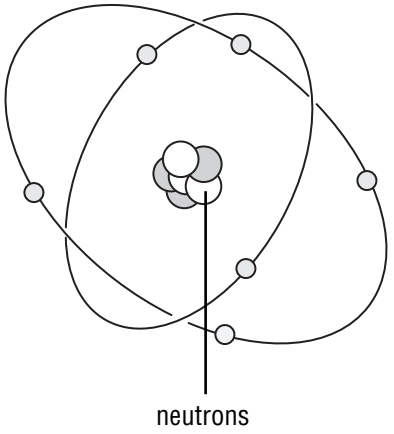


By 1926, scientists developed the electron cloud model of the atom used today.



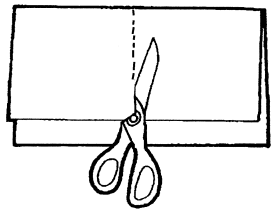


Since the nucleus is positively charged and the electrons are negatively charged, these particles attract each other keeping the atom together. Also, these opposite charges neutralize the atom so that the atom has no electrical charge itself.



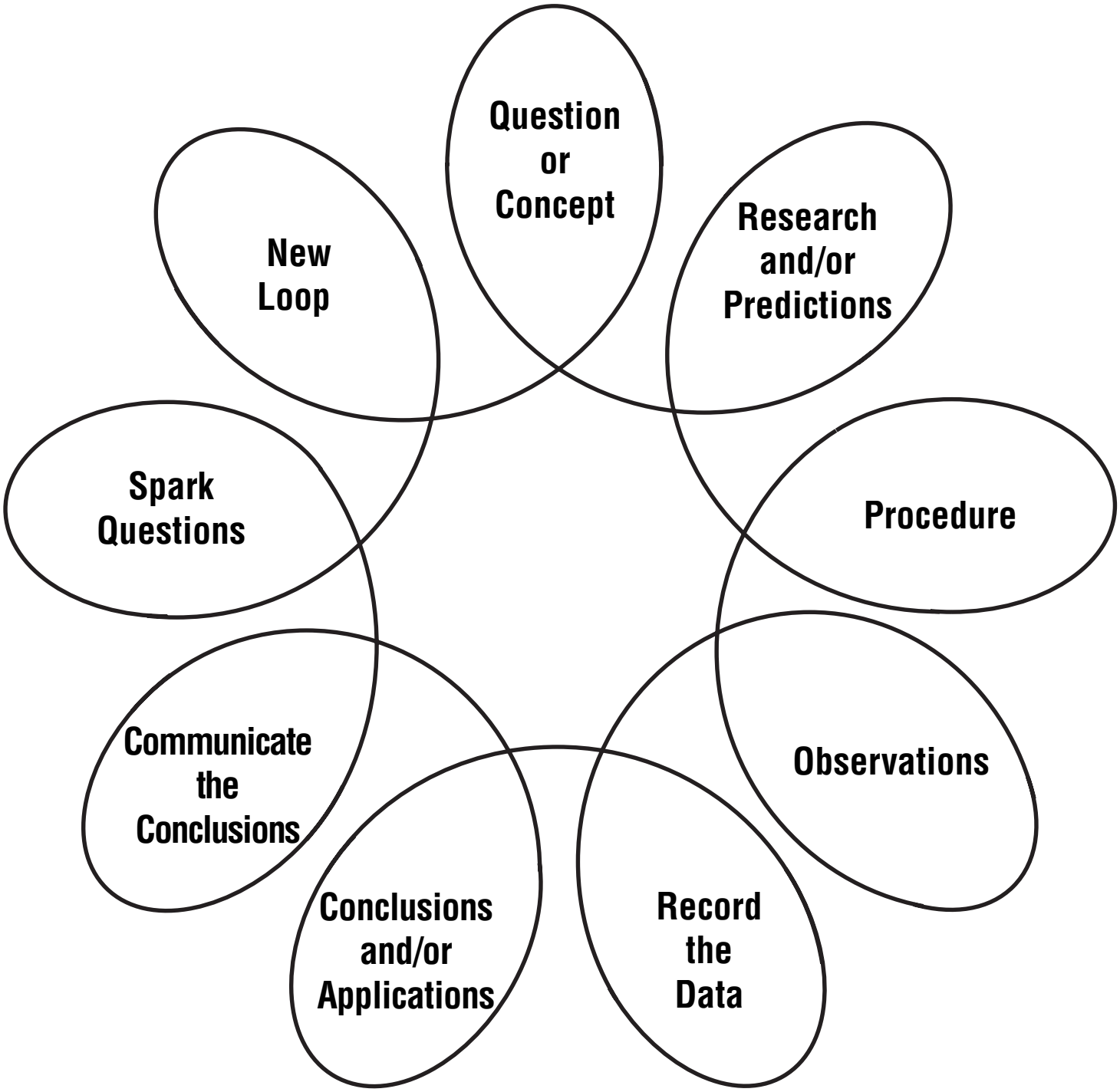
Large Question and Answer Book

1. Fold a sheet of paper in half like a Hamburger. Fold it in half again like a Hamburger. Make a cut up the Valley of the inside fold, forming two tabs.

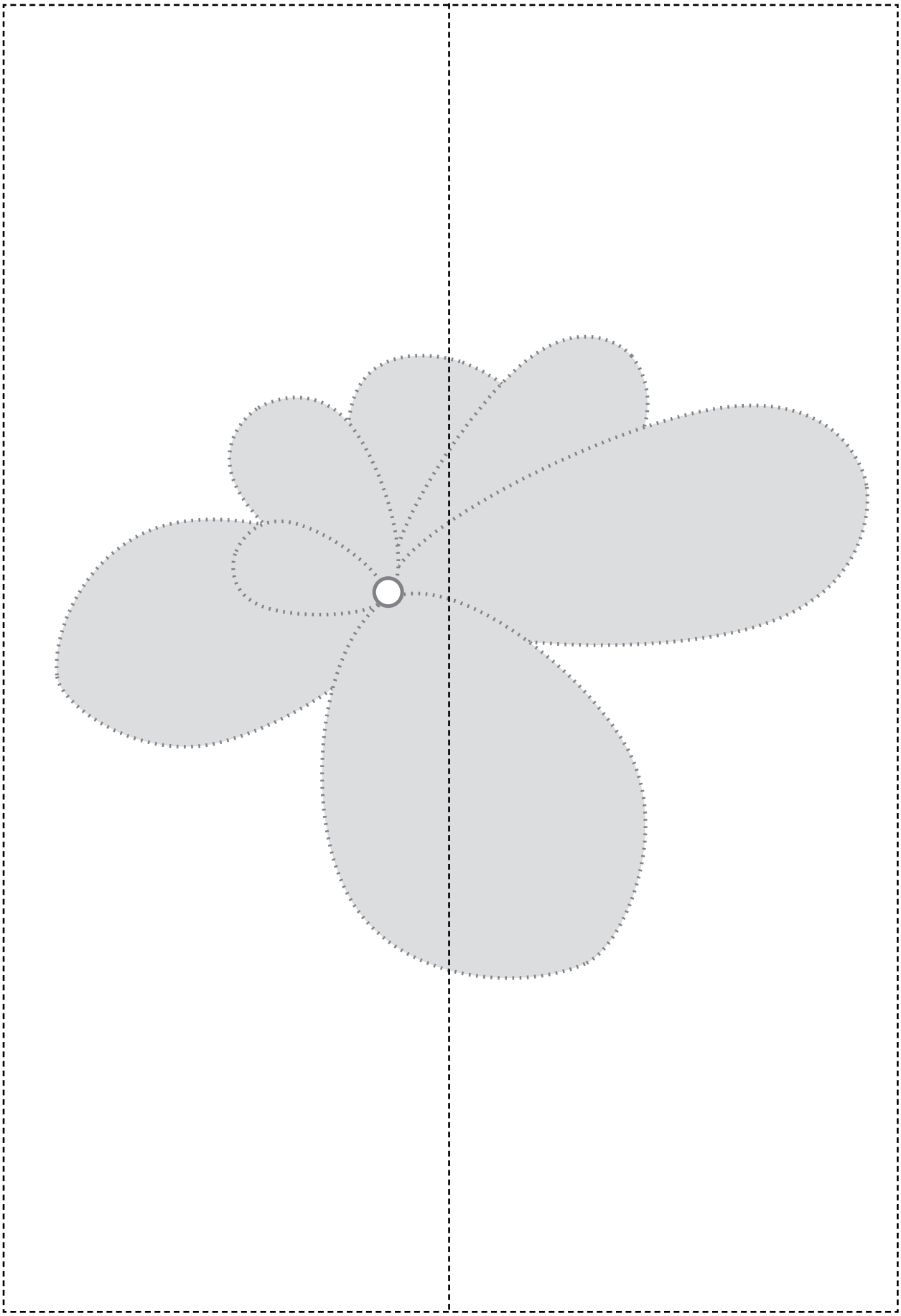


2. A larger book can be made by gluing Large Question and Answer Books “side–by–side.”

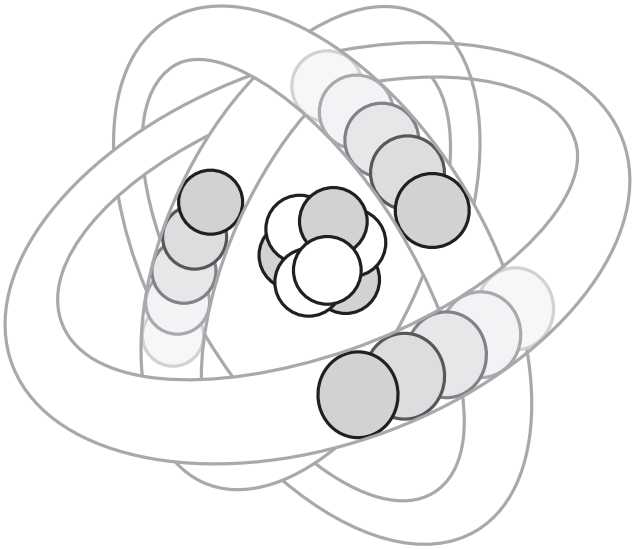
Investigative Loop™



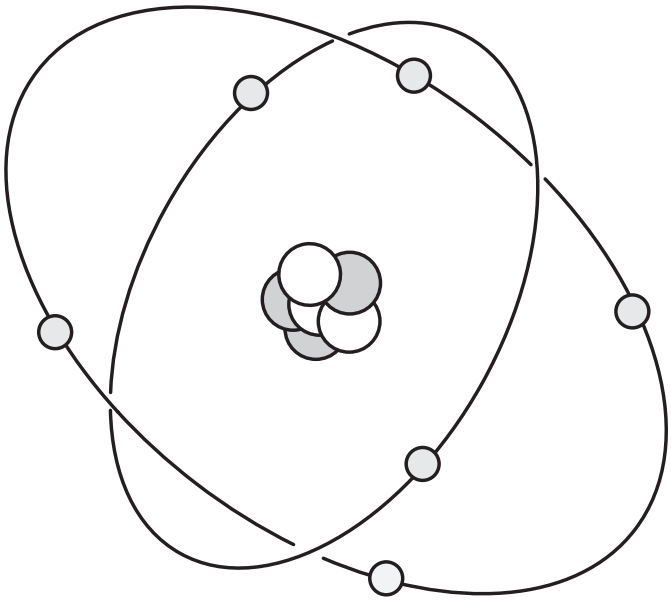
3A



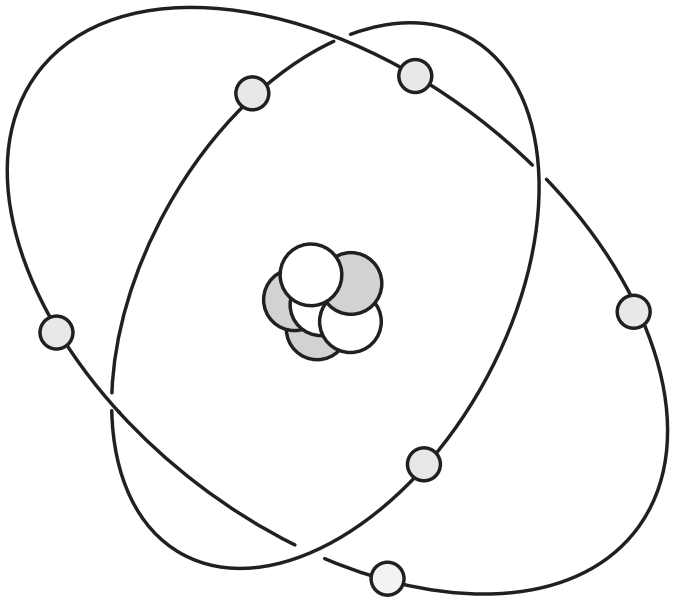
3B



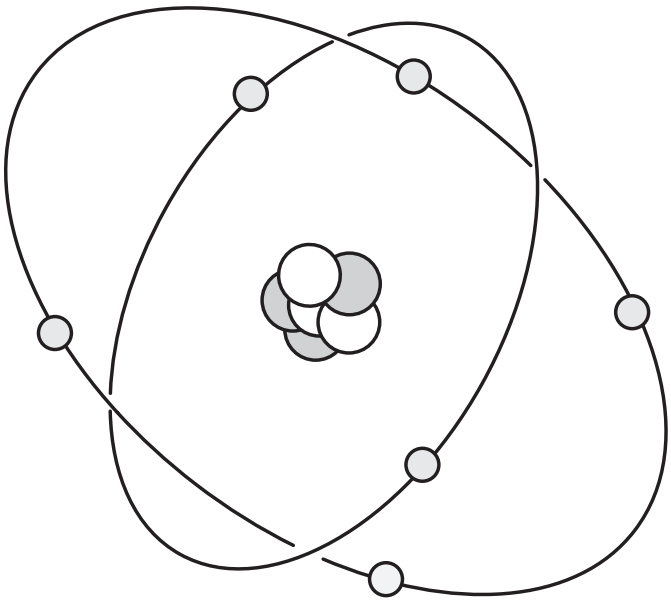
3C

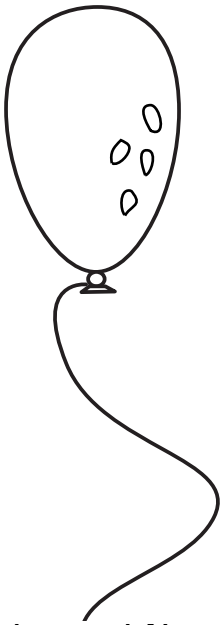


3D



3E

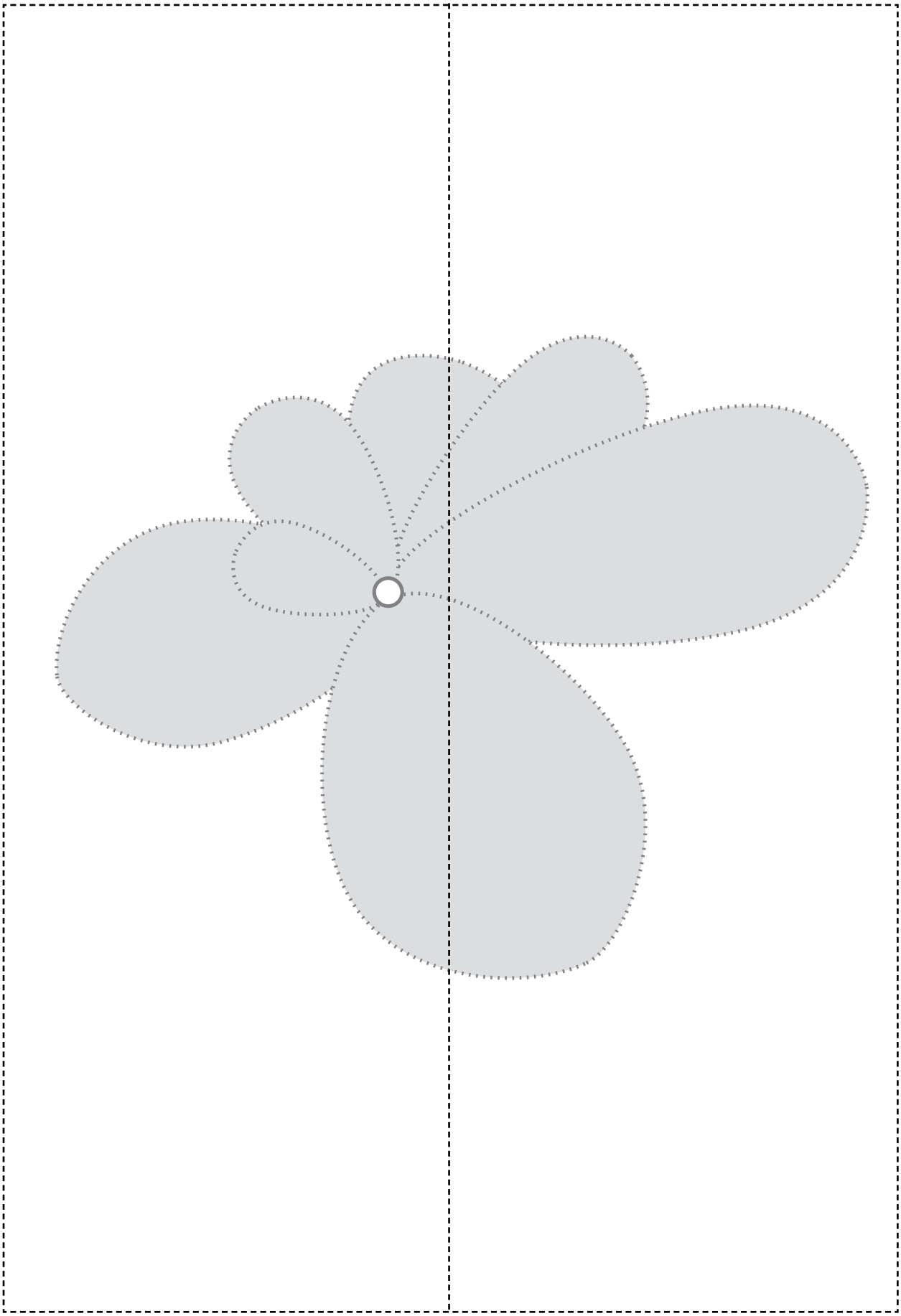


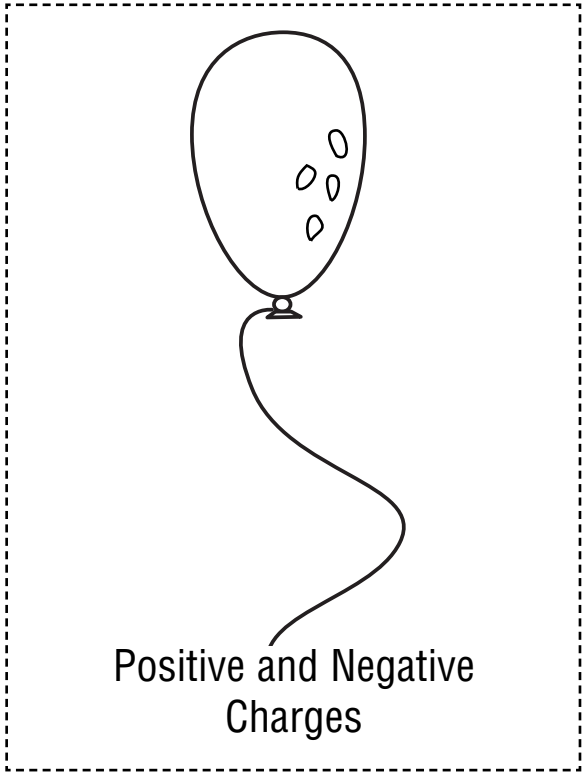


Positive and Negative Charges

Lab 3-1

3A

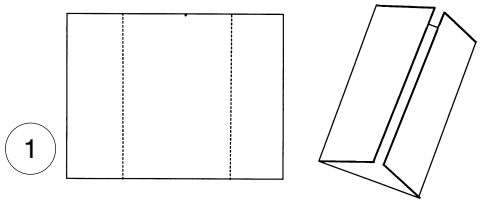




Lab 3-1

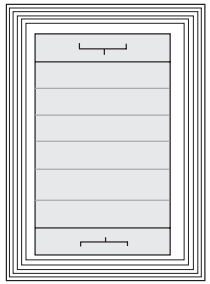
Desk Top Project

1. Fold a sheet of paper into a Shutter Fold.



Neutrons have no charge at all. Neutrons and protons are packed together in the center of the atom forming what is called the nucleus. This combination causes the nucleus to have a positive charge. The nucleus of the atom contains most of the mass.

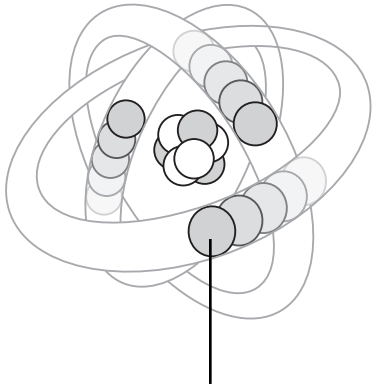
The majority of the space in an atom is empty. If the nucleus of an atom was a tiny grain of sand in the middle of a football field, the electrons would be moving around at the ends of the field.



Dalton also stated that atoms could not be made, destroyed, or divided. Dalton believed atoms of the same element were exactly alike but could be joined together to form larger particles. Dalton later suggested that an atom could be split into smaller parts and, eventually, he was proven correct.

Although scientists do not fully understand the paths of electrons new discoveries are made as more powerful microscopes are developed. Electrons move so quickly around the nucleus, it is impossible to describe their exact location in an atom.

Around the nucleus are electrons. Electrons are negatively charged and do repel each other. They orbit the nucleus, have a great amount of energy, and move very quickly in regions that are called shells, or energy levels.



Atoms have three subatomic parts: protons, neutrons, and electrons. Protons are positively charged. They are heavy and move very slowly. Even though like charged particles usually repel one another, protons are held together by a bonding energy.

Although it has been determined that electron shells are not similar to orbiting planets, these types of models are often used to easily represent a specific atom.