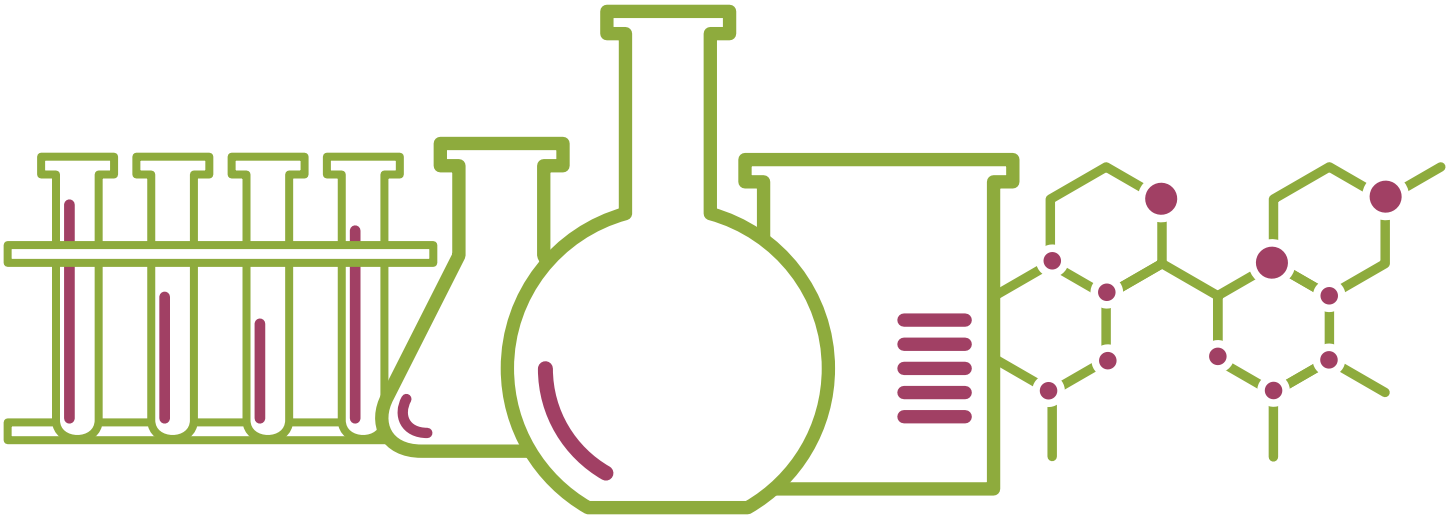
EXPERIENCE CHEMISTRY

STUDENT GUIDEBOOK

Luke & Trisha Gilkerson



LESSON 4

THE AMAZING ATOM

Throughout the years, scientists have created models to represent their observations and theories. Atomic models have continued to change as we have improved technology and are better able to observe the world around us down to the smallest atomic particles.

Vocabulary

Atomic theory
Chemical change
Combustion
Conductivity
De-excited electrons
Ductility
Energy level
Excited electrons
Ground state
Malleability
Orbitals
Oxidation
Physical change
Scientific model

OUTLINE & NOTES
LESSON 4A:

I. Scientific Models

A. Made to _____ and _____ complex objects, ideas, or systems

B. Make sense of _____ and _____

C. Help us make _____

D. May _____

E. They are not _____

II. Atomic models that shaped chemistry

A. Democritus: Greek philosopher (c. 460 - c. 370)

1. Matter is made of _____
2. Particles called "_____," where we get the term _____
3. Democritus believed the _____ was the _____ that existed and was not made of any _____

B. John Dalton: English school teacher (1766-1844)

1. Created first _____ using _____, not just philosophy
2. Proposed the _____
   a. All substances are made of _____ , _____ called _____
   b. All atoms of the _____ have the _____ _____
   c. Atoms combine in _____ , _____ ratios to form _____
   d. Atoms are neither _____ nor _____ in _____

C. Joseph John (J.J.) Thomson: English physicist (1856-1940)

1. Used _____ to learn electron particles have a _____
2. Observations demonstrated the _____ had very little _____
3. Negative particles were named _____ by scientist _____ in 1894
4. Thomson's atomic model: _____
   a. _____ represented the "pudding" of _____
   b. _____ represented _____ plums embedded in the pudding

D. Ernest Rutherford, physicist, professor at Cambridge University (1871-1931)

1. Tested the _____ using a _____
   a. Alpha particles were aimed at a thin piece of gold foil
      (1) Many particles went _____ the foil
      (2) Some particles _____
      (3) Some particles were _____ at large angles
   b. Concluded the plum pudding model was not correct
      (1) Atoms are mostly _____
      (2) Atoms have a _____ , _____ - the _____
      (3) The nucleus has _____ in it with a _____
2. Rutherford's atomic model: _____
   a. _____ are not in the _____ but are _____ _____ with a lot of _____
   b. Elements are typically _____ because there are _____ _____

E. James Chadwick, English physicist (1891-1974)

1. Alpha particles were aimed at a plate of Beryllium
   a. _____ radiation came through the other side
   b. These _____ shot through paraffin (wax) and _____ shot out the other side
2. Concluded the existence of another kind of subatomic particle
   a. Atoms contain _____ we call _____ in the _____
   b. Neutrons are about the same _____ as a _____

NOTES

OUTLINE & NOTES
LESSON 4B:

I. Modern Atomic Model: Niels Bohr, Danish Physicist (1885-1962)

A. Bohr was interested in learning about the _____ and why it was _____

_____

B. Properties of electrons:

1. Electrons move in _____
2. Orbitals are associated with specific _____
   a. Lowest _____ for an electron is called its _____

   _____
   b. The _____ the energy level, the _____

   from the _____ the electron is
   c. _____ , having absorbed energy, move to the _____

   _____
   d. _____, having lost or released energy, move

   _____

II. Electron Orbitals & Properties

A. The electrons and their _____ determine the _____

and _____ of the substance

B. Physical properties: _____ or _____ of a substance

that are _____ without _____

1. Density: _____
2. Malleability: _____

   _____
3. Ductility: _____
4. Conductivity: _____

   _____

C. Chemical properties: the _____ of something to undergo a _____ by _____ with something else

1. Oxidation: _____
2. Combustion: _____

_____

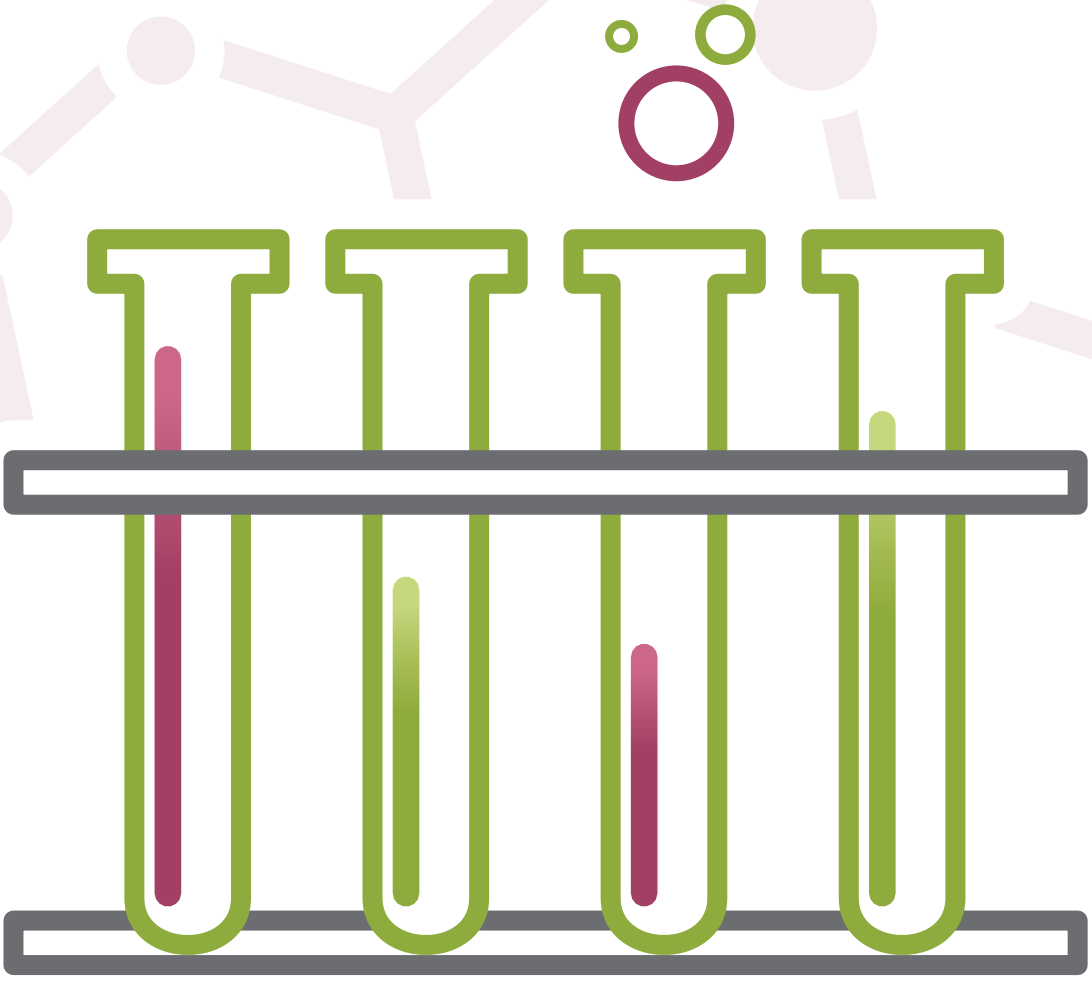
D. Physical changes

1. Changes in _____
2. They do not change the _____ or the _____
3. _____

E. Chemical changes

1. Changes the _____ of a substance
2. _____

NOTES



EXPERIENCE CHEMISTRY

STUDENT LAB GUIDE

Luke & Trisha Gilkerson

LESSON 4

REACTION IN A BAG (PART 2)

This is an extension of our first lab where we observed a reaction occur in a bag. This experiment will give us an opportunity to continue our exploration of chemical and physical properties and changes.

Supplies:

- Goggles
- Gloves
- Scale
- Weigh boats or weigh paper
- Pipette
- Scoopula
- Ziploc bag
- Sodium bicarbonate (baking soda)
- Calcium chloride
- Phenol red
- 25 or 50 mL Graduated cylinder
- Small plastic cup
- Chemical safety data sheet database

Directions

1. Read through all directions and gather supplies. Remember to follow all safety precautions and guidelines while completing the experiment.
2. Research and include any background information about the chemicals you'll be handling. Write down any SDS information about what to do if a chemical is ingested or comes in contact with your skin. What precautions should you take as you use the chemicals for this experiment?
3. After reading all directions, form a hypothesis before beginning your experiment.
4. Turn on your scale and calibrate or "tare" it out until it says the current mass is zero.
5. Grab your scoopula and gently measure out 5.0 grams of sodium bicarbonate onto your weigh paper or boat. Add or take away the chemical a little at a time until you have the right measurement on the scale.
6. On a clean weigh paper or boat, repeat the same process with calcium chloride until you have 15.0 grams on the scale. Place both weigh papers in front of you at your station.

7. Gently pour 20 mL of phenol red into your graduated cylinder and place the cylinder along with a small plastic or paper cup next to the weigh boats.
8. Make observations about the physical properties of each chemical and write down your answers in the observation table. What color are they? Are they dry powders or wet liquids?
9. Make observations about the chemical properties and write down your answers in the properties table. Are the chemicals acidic or alkaline?
    a. Check the Chemical Safety Data Sheet under the "Physical and Chemical Properties" section to determine the pH of your chemicals.
    b. Alkaline substances are also called basic and have a pH above 7.4. Chemicals that have a pH below 7 are considered acidic. Neutral substances have a pH between 7.0 and 7.4.
10. Open your Ziploc bag. Gently pick up your sodium bicarbonate weigh boat and pour the contents into one corner of the Ziploc bag. Lay your Ziploc bag flat on the table.
11. Pick up your calcium chloride weigh boat and gently pour the contents into the other corner of the bag. Keep the bag flat and the chemicals separated.
12. Pour the phenol red into a small paper or plastic cup. Place the cup in the middle of the bag. Remove as much air as possible and seal your bag. Be careful not to knock the cup over until you are ready.
13. Gently tilt your bag from side to side until the cup falls over and all chemicals are mixed. Lay your bag flat on your station.
14. Carefully record your observations so you can include them in your lab report.
    a. What do you see and hear inside the bag?
    b. Do you feel anything when you place your hand on the plastic bag?
    c. Are these physical or chemical changes?
15. Once you have completed all of these steps clean your area and dispose of all chemicals. You may dump the contents of your bag down the kitchen sink while running the water. Wipe off all surfaces to ensure no chemicals are leftover that will react with future experiments.

Properties Table

	Sodium bicarbonate	Calcium chloride	Phenol Red
Physical Properties			
Acidic or Alkaline			

LAB NOTES

LN

LAB REPORT

LESSON 4

Write a lab report, being sure to write a hypothesis before you begin your report. Anytime you are using chemicals, be sure to include pertinent safety data sheet information in your lab report. Include any data and tables you collected along with a written description of your observations in your results section. Answer the following questions when writing your lab report.

Observation Questions

1. What did you observe when you shook everything into the middle of the bag? What did you see and hear? Are these physical or chemical changes?
2. Do you feel anything when you place your hand on the plastic bag? Is this a chemical or physical change?
3. Can you easily change the result of this experiment back to its original reactants—the sodium bicarbonate, calcium chloride, and phenol red?
4. Were all of the reactants used up or do you still see signs of the original chemicals?

Discussion questions

1. Did a chemical reaction occur in this experiment? How do you know?

LAB NOTES

LN