

Chemistry for the Grammar Stage

The authors of *The Well Trained Mind* say in their book that the goal of grammar stage science instruction is to “foster enthusiasm for science and to expose the child to basic facts about each field”¹. My goal in writing this curriculum was to provide a hands-on science curriculum that would challenge your student and instill a love of science at an early age. I also wanted to provide you with the tools to give your grammar stage student exposure to the principles of chemistry so that they will have a knowledge base for future studies. For this reason, I have included ongoing projects, experiments each week, definitions and summary pages.

I wrote this curriculum to be used in the grammar stage (3rd -4th grade). It is designed to be done in 15-20 minute session 5 times a week or two 30-40 min days a week. Also, if you desire, you could set aside an hour and a half a week to be your science day in which you do all the readings, narrations, and activities planned for the week. If you are using these plans with a 3rd grader I recommend that you work towards having them to do all their own writing for the narrations and experiments.

Student Workbook:

This teacher’s guide was designed to be used in conjunction with the student workbook. It is sold separately and is critical to the success of this program. It contains all the pages you will need to complete the narrations, experiments and most of the projects. It also includes over 100 pictures for use to use with the narration sheets. The student workbook gives you the tools to create a lasting memory of your studies along with your student.

Ongoing projects:

These are designed to be done over several weeks. First, your student will complete their own periodic table by adding the groups as you study them. Also, your student will read two scientist biographies and write a short report on each. The pages you need to complete these projects are found in the student workbook.

Experiments:

Experiments are easy to do and use common household items. They are the core of this program! Chemistry is best learned hands on at this age. Most experiments will be written up so that your student will begin to understand the basics of the scientific method and how a scientific test works. Although you can certainly choose do fewer write-ups than are scheduled if your student is writing phobic. At this stage it is not necessary to ask your student to predict the outcome of the experiment as they have no knowledge base to

¹ Susan Wise Bauer & Jessie Wise, *The Well Trained Mind: A Guide to Classical Education at Home*, (W.W. Norton & Company, 1999) 375

determine what the answer should be. However, if your student enjoys predicting, you can feel free to let them do so. All the pages you need are included in the student workbook.

Generally, each experiment write-up page includes four sections, the materials list, the procedure, the results and the conclusion. The “materials list” section is for you to write the materials that you used when completing the experiment. The “procedure” section is for you to write a brief description of what you did for the experiment. The “results” section is for you to write down what your student observed during the experiment. Finally, the “conclusion” section is for you to write down what your student learned from the experiment. Any time you see a box for a picture of your experiment you can have your child draw what is there or you can take a picture and glue it in the box. At this point I recommend you have your student work towards writing on their own for the experiment pages.

You may want to get a chemistry set with beakers and graduated cylinders. Then have your student measure from these when doing the experiments so that they feel more like a chemist!

Summary Pages:

These are designed to be a record of what your student has been learning. After you read the assigned pages have your student write down their narration on these pages. You may need to begin with having them copy their narration, and then move towards dictating their narration to them. Your goal is to have them writing their own narrations by the end of the year. If you find this to be too much for your student, please tailor your goals to their abilities. The summary pages are found in the student workbook and are to be completed as assigned. You can choose to use the pictures provided or have your student draw their own.

Definitions:

Your student will be making their own dictionary of chemical terms through the course of this study. Most definitions can be found in the *Usborne Science Encyclopedia's* glossary of terms; all the definitions are in the readings. It's up to you to choose how you want your student to find the definitions. Possible answers are included for you in the teacher's guide. A box for the picture is included in the student workbook next to the space for the definition. The pictures are designed to aid in memory recall. You can choose to use the pictures provided or have your student draw their own.

Other Features:

- You will also find that I have included an overview of the study, a list of materials needed by week and a poem that you can use to help your student memorize facts about the periodic table. This poem is included as a resource for you to enhance your students learning.

- You will find the “Want More?” boxes on each of the plan sheets. These are designed to give you ideas for more activities and additional reading within the planned books.
- You will also notice that Day 5 of the 5 day schedule is usually planned to be rather light. This is so you can easily fit in additional activities/ projects or use the time for nature study. I recommend using the *Handbook of Nature Study*.
- In the appendix of this guide I have included blank versions of the definition page and the experiment page in case your student wants to do more!

Quizzes:

After the appendix in this guide I have included quizzes that you can use every week. Although they are not essential, they are helpful in assessing how much your student is retaining or to use as a review of what you have studied during the past week. You can choose to give these orally or copy them for your student to fill out.

What if I have an older student? How do I include them?

If you want your older student to work along with your other students and you feel the resources are to “easy” for them. Simply used the following books instead...

- Kingfisher Science Encyclopedia—this encyclopedia is written at a higher level and would be more appropriate for older children
- The Usborne Illustrated Dictionary of Chemistry—this resource is a glossary of chemical terms with a bit more explanation

Have your older child look up the corresponding section in their encyclopedia and read it, then look up the websites if applicable. (I have included a topical index in this guide to aid you in this.) Next have them write about the topic. If you want more than just a simple narration, have them write a mini-report (one to two paragraphs) on a separate sheet and paste the picture to that. You could also have your older student be in charge of running all the experiments and explaining the principles behind them.

What if I have a younger student? How do I include them?

If you want your younger student use this curriculum along with an older brother or sister, simply cut down on what you require them to do. In other words, read the encyclopedia to them and then have them orally narrate the section back to you. If you find that the *Usborne Internet-linked Science Encyclopedia* is too much for them, try using the *Usborne First Encyclopedia of Science*. It won't contain every topic, but your younger student may find it more on their level. Be sure to have them participate in the experiments, but don't require them to write them up on their own.

Final Thoughts

Chemistry is very near and dear to my heart, so my hope is that this program will help you to impart a love of chemistry to your student. As the author and publisher of this curriculum I encourage you to contact me with any questions or problems that you might

have concerning Chemistry for the Grammar Stage. I will be more than happy to answer them as soon as I am able. You can email me at info@elementalscience.com. You may also get additional help at our yahoo group (http://groups.yahoo.com/group/elemental_science/). I hope that you will enjoy Chemistry for the Grammar Stage!

Sample
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Book List

The following are the books that I used while planning out this curriculum. I would recommend that you purchase these. However you could easily get the biographies at your local library since they will only be used for a week.

Experiment Books:

- *Fizz, Bubble, Flash: Element Explorations & Atom Adventures* (20 weeks)
- *Adventures with Atoms and Molecules: Book 1* (14 weeks)

Encyclopedia:

- *Usborne's Internet-linked Science Encyclopedia* (all 36 weeks)

Biographies (if you're going to purchase these, here's what I recommend):

- *Marie Curie's Search for Radium* by Beverly Birch (1 week)
- *Pasteur's Fight Against Microbes* by Beverly Birch (1 week)

I chose not to include a list of other resources because every library is different. If you want to supplement this curriculum with other books by all means, do! Your local librarian is an excellent resource and can point you in the direction of some excellent books about the subjects studied.

Weekly Supply List at a Glance

Week	Supplies needed
1	Heavy cream, Milk, Sugar, Vanilla, 1 quart size and 1 gallon size zip-locking plastic bag, Crushed ice, Dish towel or oven mitt, Rock salt
2	No experiment
3	Two paper cups, Salt
4	Ruler, Two 8" pieces of insulated copper wire, Four alligator clips, Small glass jar, Two pencil leads, Tape 9-volt batteries, Salt
5	Spinach, Small jar or plastic cup, Rubbing alcohol, Metal spoon, Aluminum foil, Scissors, Coffee filters, Tape
6	Marker, Measuring cups, 2 plastic cups, Plaster of paris powder, 2 straws, Liquid soap
7	8 thin wine glasses(lead crystal), water, small bowl
8	Red cabbage, bowl, water, strainer, jar with lid, clear plastic cups, measuring cups and spoons, baking soda, lemon juice, marker, eye dropper or plastic straws
9	Butter, Several long objects: such as a wooden spoon, a metal spoon and plastic ruler Blue gel glue, 2 plastic cups, Water, Plastic spoon, Measuring spoons, Borax laundry detergent, Jar, Small plastic bag
10	Facial tissues, Balloon, Antistatic dryer sheet
11	No experiment
12	1 TBSP sugar, Small water bottle, Warm water, Yeast packet, Small balloon
13	Knife, Head of cabbage, Saucepan, Water, Slotted spoon
14	Permanent marker, 2 eggs, Fluoride toothpaste, Warm water, Glass jar, White vinegar, Aluminum foil
15	Knife, Potato, Break, Cooked pasta, Apple, Lettuce, Plastic plate, Sugar, Iodine tincture or betadine solutions
16	Camera (not digital), Roll of print film (not slide), Lamp with incandescent bulb, Lamp with fluorescent bulb
17	2 lemons, Plastic cup, 10-20 dull pennies, Salt, 2 iron nails, Steel wool, Watch with a second hand, Antiperspirant stick, Aluminum foil, Ruler, Glass or metal bowl, Water, Ice
18	iron-fortified cereal, plastic bag, rolling pin, white paper, magnet
19	3 clear drinking glasses, Water, Rubbing alcohol, Clear corn syrup, Masking tape, Marker, 3 pencils
20	Dollar bill, Magnet, 32 bite-sized candies
21	Hair dryer, Smoke detector, Bath powder (cornstarch based)
22	No experiment

23	Marshmallows, Toothpicks, Food coloring, Balloon, Vanilla extract
24	Food coloring, Hot/cold water, Tape, Felt pen, Hot water, Sugar, Measuring cup (1 cup and 2 cup)
25	Two identical bottles of soda, Balloon, Bottle opener, Pan of hot water, Baking soda, Vinegar, Balloon, Teaspoon, Measuring cup, Empty soda bottle
26	Baking soda, Vinegar, Large plastic pail, Meter stick, Two grocery bags, Five pieces of string, Rubber band
27	Two paper cups, Water & oil, Measuring cup plastic ballpoint pen, bowl, wax paper, water, oil
28	Small bowl, Paper towel, Green food coloring, Scissors, Water, Two paper cups, Apple cider vinegar, White vinegar, Measuring cup, Tape, Felt pen
29	Two identical rubber balls, Freezer, Oil, Water, Dishwashing liquid, Measuring cup, Tall slender jar with tight-fitting lid, Tablespoon
30	Dry glass, Ice cubes, water, plate, water, dishwashing liquid, pepper, Baking Soda, Vinegar, Sink, Measuring cup, Bubble liquid and ring
31	Corn syrup, Cooking oil, Water, Tablespoon & measuring cup, Food coloring, Clear glass, Two jars with lids, Warm water, Bar of pure soap, Tablespoon and measuring cup, Epsom salt
32	Water, Salt, Two paper cups, Freezer, Teaspoon & tape, Two new, shiny pennies, One old brown penny, Aluminum foil, Metal cookie sheet, Oven & pot holder
33	Soap bubble liquid and a ring, Balloon, 6-volt lantern battery, 6-volt light bulb, Two paper clips, A jar of water, Two pieces of wire, Salt
34	Winter-o-green lifesaver (lifesaver is a registered trademark of Lifesaver, Inc), Plastic bag, pliers, aluminum foil, oven, metal cookie sheet, sugar, teaspoon and pot holder
35	An overripe banana, Two green tomatoes, Shoe box, An apple, Lemon juice, Knife & plate, A bowl of cold water
36	Heavy cream, Milk, Sugar, Vanilla, 1 quart size and 1 gallon size zip-locking plastic bag, Crushed ice, Dish towel or oven mitt, Rock salt

Chemistry Scope and Sequence

Ongoing activities:

- Periodic Table: As you study the periodic table you will add the group to this chart, if you decide not to do this project or if you would like a wonderful example of the periodic table, I highly recommend to the table found at this website, www.periodictable.com
- Definition Pages: Define key words and concepts used in experiments
- Summary Pages: Picture when possible and student's summary of what learned
- Experiment Pages: Fill out an experiment page for each experiment performed
- Scientist Biographies: You will choose to study two scientists and their contributions, afterwards your student will write a ½ to 1 page summary

Books used:

- *Fizz, Bubble, Flash: Element Explorations & Atom Adventures*
- *Adventures with Atoms and Molecules: Book 1*
- *Usborne's Internet-linked Science Encyclopedia*
- *Marie Curie's Search for Radium*
- *Pasteur's Fight Against Microbes*

Sequence for Study:

- Week 1-10
Periodic Table part 1 (alkali metals, alkaline earth metals, main group metals & metalloids)
- Week 11
Scientist biography
- Week 12-21
Periodic Table part 2 (non-metals, halogens, noble gases, transition metals, lanthanides & actinides)
- Week 22
Scientist biography
- Week 23-35
Experiments found in *Adventures with Atoms and Molecules*
- Week 36
Review

Chemistry Lesson Plans Week 3

Day 1	Day 2	Day 3	Day 4	Day 5
<i>Fizz, Bubble, Flash</i> Pg. 12 Introduce Alkali Metals	<i>Usb. Science</i> Pg. 32 Alkali section	<i>Fizz, Bubble, Flash</i> Pg. 17-20 Sodium	Experiment: <i>Don't Freeze!</i> <i>FBF pg. 18</i> Write up on (SW pg. 67-68)	<i>Usb. Science</i> Pg. 46-47 Hydrogen
Fill out top Alkali Metal Summary Sheet (SW pg. 39) and Definitions #13-14 (SW pg. 21, picture on pg. 121)	Add to Alkali Metal Summary Sheet (SW pg. 39, picture on pg. 129) Follow internet link #2	Fill out narration for sodium (SW pg. 39, picture on pg. 129)		Definitions #15 (SW pg. 21, picture on pg. 121), Follow internet link #5 & give Week 3 quiz

Summary Sheet:

- Day 1: Some possible answers are...(add to this list on day 2)
 - Most reactive
 - When exposed to air they burst into flames
 - All are metals except hydrogen
- Day 2: Fill out Sodium section of the Alkali Metal Summary sheet. If your student doesn't know what to write, ask them to share two things that they learned about the element.

Experiments—Begin by reading through the materials used and procedure. Then fill in the materials, procedure sections of the experiment sheet. Complete the experiment then fill in the results and conclusions of the experiment sheet. The boxes provided are for the student either draw a picture of the experiment or paste pictures they have taken there. These experiments chosen will help the student to understand chemistry much better.

- Day 4: "Don't Freeze!" *Fizz, Bubble, Flash* pg. 18—this experiment will help your student to see how salt keeps water from freezing. (**This experiment needs to be checked every 30 mins. for 3 hours, be prepared to allow the time for that**)

Supplies Needed:

- Two paper cup
- Salt

Vocabulary Definitions (these are a guide, your students definitions don't need to be word for word):

13. Malleable: used to describe metals that can be shaped by hammering
14. Reactive: tendency of a substance to react with other substances
15. Chemical bond: a force that holds together two or more atoms

Want More?

- Follow the additional internet links found in the Usborne readings
- Try the see for yourself activities found in the *Usborne Science Encyclopedia* pg. 46
- Look up more about the Natron Valley in Egypt where sodium was first discovered
- Try one of the projects listed in *Fizz, Bubble, Flash* on pg. 20

Chemistry Lesson Plans Week 3 (2-day)

	Day 1	Day 2
Readings	<i>Fizz, Bubble, Flash</i> Pg. 12 Introduce Alkali Metals & <i>Usb. Science</i> Pg. 32 Alkali section	<i>Fizz, Bubble, Flash</i> Pg. 17-20 Sodium
Assignments	Fill out top Alkali Metal Summary Sheet (SW pg. 39) and Definitions #13-14 (SW pg. 21, picture on pg. 121)	Fill out narration for sodium (SW pg. 39, picture on pg. 129)
Additional Assignments	Work on the Periodic poem (<i>FBF</i> pg. 11) & Follow internet link #2	Experiment: <i>Don't Freeze!</i> <i>FBF</i> pg.18 Write up on (SW pg. 67-68) & Give Week 3 quiz

Summary Sheet:

- Day 1: Some possible answers are...
 - Most reactive
 - When exposed to air they burst into flames
 - All are metals except hydrogen
- Day 2: Fill out Sodium section of the Alkali Metal Summary sheet. If your student doesn't know what to write, ask them to share two things that they learned about the element.

Experiments—Begin by reading through the materials used and procedure. Then fill in the materials, procedure sections of the experiment sheet. Complete the experiment then fill in the results and conclusions of the experiment sheet. The boxes provided are for the student either draw a picture of the experiment or paste pictures they have taken there. These experiments chosen will help the student to understand chemistry much better.

- Day 2: “Don't Freeze!” *Fizz, Bubble, Flash* pg. 18—this experiment will help your student to see how salt keeps water from freezing. **(This experiment needs to be checked every 30 mins. for 3 hours, be prepared to allow the time for that)**

Want More?

- Follow the additional internet links found in the Usborne readings
- Look up more about the Natron Valley in Egypt where sodium was first discovered
- Try one of the projects listed in *Fizz, Bubble, Flash* on pg. 20

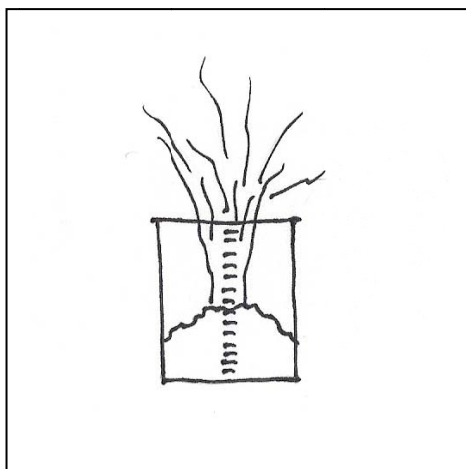
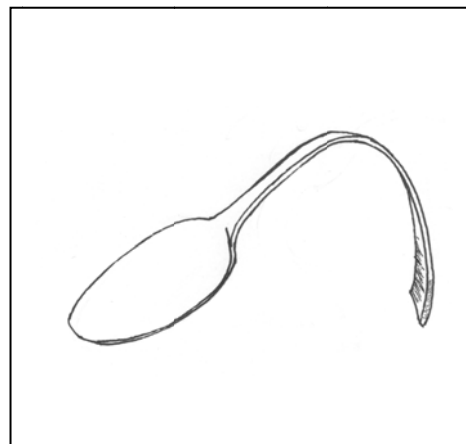
Supplies Needed:

- Two paper cup
- Salt

Vocabulary Definitions (these are a guide, your students definitions don't need to be word for word):

13. Malleable: used to describe metals that can be shaped by hammering
14. Reactive: tendency of a substance to react with other substances

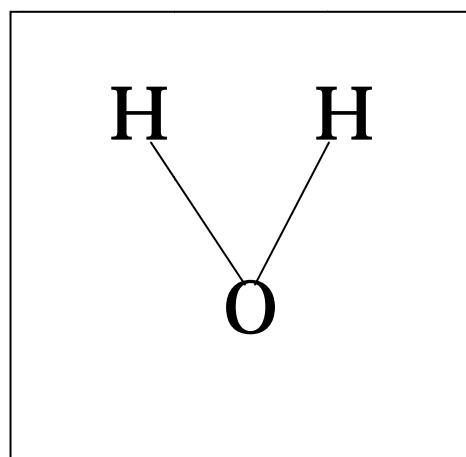
13. Malleable:



14. Reactive:

Sample from the Student Workbook:
In the actual student workbook,
pictures are separate from the
summary sheets. They are to be cut
out and placed here by the student.
They are of higher quality than what
is shown here.

15. Chemical bond:



Alkali Metals Summary Sheet

Common Properties:

Sample from the Student Workbook:
In the actual student workbook,
pictures are separate from the
summary sheets. They are to be cut
out and placed here by the student.
They are of higher quality than what
is shown here

Sodium:

11
Na
Sodium
22.99

Hydrogen:

1
H
Hydrogen
1.008

1	H	Hydrogen	1.008
3	Li	Lithium	6.041
11	Na	Sodium	22.99
19	K	Potassium	39.1
37	Rb	Rubidium	85.47
55	Cs	Cesium	132.9
87	Fr	Francium	(223)

Sample Science, Inc

What I have learned about Alkali Metals:

Sample
Elemental Science, Inc.

Name: _____

Date: _____

Don't Freeze!

Materials List:

Sample from the Student Workbook

_____	_____
_____	_____
_____	_____
_____	_____

Procedure (What we did):

Hypothesis (What I think will happen):

Cup with plain water after 1 hour...

Cup with salted water after 1 hour...

Results (What happened):

Observations		
	Plain Water	Salted Water
At beginning		
½ hour		
1 hour		
1 ½ hours		
2 hours		
2 ½ hours		
3 hours		

Conclusion (What I learned):

Sample
Elemental Science, Inc.

Chemistry Week 3 Quiz

1. Write one characteristic of an alkali metal:

2. True or False. Alkali metals are not very reactive.

3. Sodium (Na) was first discovered in the _____ of Egypt.

pyramids

Natron Valley

Nile River

4. What is the most interesting thing you learned this week?

Chemistry Lesson Plans Week 25

Day 1	Day 2	Day 3	Day 4	Day 5
<p><i>Usb. Science</i> pg.23 Gas Pressure, Temperature & Volume</p>	<p><i>Adventures in Atoms</i> pg.14&15 Experiment #5</p>	<p><i>Usb. Science</i> pg.23 Gas Pressure... Follow link #1,3,5</p>	<p><i>Adventures in Atoms</i> pg.16&17 Experiment #6</p>	<ul style="list-style-type: none"> • Work on Scientist Biography Report • Choose one of the experiments to write up using the sheet provided • Give Week 25 quiz
<ul style="list-style-type: none"> • Definition #35 (SW pg. 28, picture on pg. 123) • Fill out “What I have learned” section on SW pg. 58 	<p style="text-align: center;">Discuss the experiment orally using questions and discussion guidelines provided in the experiment</p>	<ul style="list-style-type: none"> • Definition #36 (SW pg. 28, picture on pg. 123) • Add to “What I have learned” section on SW pg. 58, picture on pg. 139 	<p style="text-align: center;">Discuss the experiment orally using questions and discussion guidelines provided in the experiment</p>	

Experiments:

- #5: “Are gas molecules farther apart than liquid?”—this experiment will help your student to see how carbonation works
- #6: “Is gas made by mixing vinegar and baking soda?”—this experiment will help your student to see one way to make carbon dioxide

Supplies Needed:

Day 2:

- Two identical bottles of soda
- Balloon
- Bottle opener
- Pan of hot water

Day 4:

- Baking soda
- Vinegar
- Balloon
- Teaspoon
- Measuring cup
- Empty soda bottle

Want More?

- Try one of the “other things to try” suggested in *Adventures in Atoms* on pg. 15 & 17
- Follow the additional internet links found in the Usborne readings
- Try the see for yourself activities found in the *Usborne Science Encyclopedia* pg. 23

Vocabulary Definitions (these are a guide, your students definitions don’t need to be word for word):

33. Gas: a state of matter in which a substance has no fixed shape or volume
34. Carbon Dioxide: a gas with one carbon atom and two oxygen atoms in each molecule

Chemistry Lesson Plans Week 25 (2-day)

	Day 1	Day 2
Readings	<i>Usb. Science</i> pg.23 Gas Pressure, Temperature & Volume & <i>Adventures in Atoms</i> pg.14&15 Experiment #5	<i>Usb. Science</i> pg.23 Gas Pressure... & <i>Adventures in Atoms</i> pg.16&17 Experiment #6
Assignments	Definition #35 (SW pg. 28, picture on pg. 123) & Fill out "What I have learned" section on SW pg. 58	Definition #36 (SW pg. 28, picture on pg. 123) & Add to "What I have learned" section on SW pg. 58, picture on pg. 139
Additional Assignments	Discuss the experiment orally using questions and discussion guidelines provided in the experiment & Work on Scientist Biography Report	Choose one of the experiments to write up using the sheet provided & Give Week 25 quiz

Experiments:

- #5: "Are gas molecules farther apart than liquid?"—this experiment will help your student to see how carbonation works
- #6: "Is gas made by mixing vinegar and baking soda"—this experiment will help your student to see one way to make carbon dioxide

Supplies Needed:

Day 1:

- Two identical bottles of soda
- Balloon
- Bottle opener
- Pan of hot water

Day 2:

- Baking soda
- Vinegar
- Balloon
- Teaspoon
- Measuring cup
- Empty soda bottle

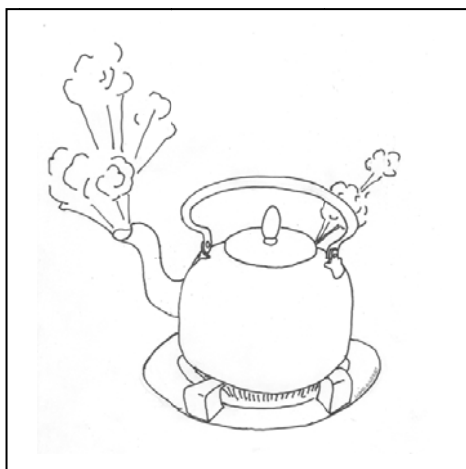
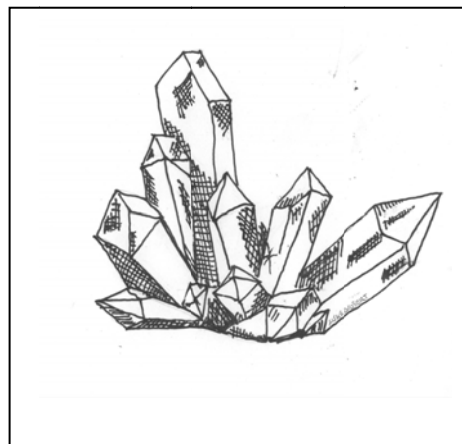
Want More?

- Try one of the "other things to try" suggested in *Adventures in Atoms* on pg. 15 & 17
- Follow the additional internet links found in the Usborne readings
- Try the see for yourself activities found in the *Usborne Science Encyclopedia* pg. 23

Vocabulary Definitions (these are a guide, your students definitions don't need to be word for word):

33. Gas: a state of matter in which a substance has no fixed shape or volume
34. Carbon Dioxide: a gas with one carbon atom and two oxygen atoms in each molecule

34. Crystal:



35. Gas:

Sample from the Student Workbook:
In the actual student workbook, pictures are separate from the summary sheets. They are to be cut out and placed here by the student. They are of higher quality than what is shown here

36. Carbon Dioxide:

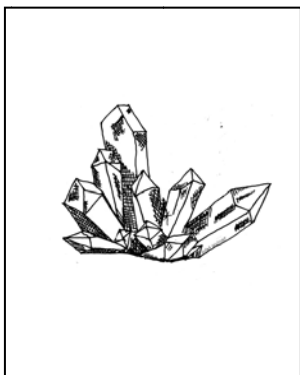
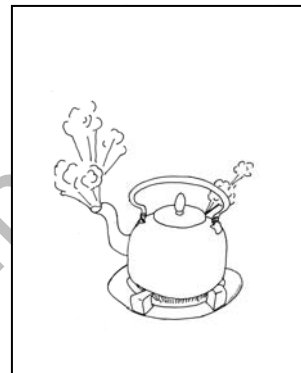
CO₂



What I have learned about molecules:

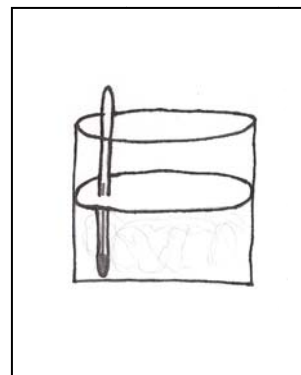
What I have learned about how gases behave:

Sample from the Student Workbook:
In the actual student workbook, pictures are separate from the summary sheets. They are to be cut out and placed here by the student. They are of higher quality than what is shown here



What I have learned about crystals:

What I have learned about how gas pressure, temperature and volume:



Name: _____ Date: _____

Experiment Title: _____

Materials (what we used):

_____	_____
_____	_____
_____	_____
_____	_____

Sample from the Student Workbook

Procedure (what we did):

Observations (what I saw):

Conclusion (What I learned):

Chemistry Week 25 Quiz

1. A change in _____ can change the way a molecule behaves.

pressure

temperature

volume

all of them

2. True or False. When you mix vinegar and baking soda; carbon dioxide is formed.

3. Carbon dioxide is a molecule with _____ carbon atom and _____ oxygen atoms.

4. What is the most interesting thing you learned this week?

Sample
Elemental Science, Inc.