

## Physics for the Grammar Stage

Susan Wise Bauer says in her book *The Well Trained Mind* that the goal of grammar stage science instructions is to “foster enthusiasm for science and to expose the child to basic facts about each field”<sup>1</sup>. My goal in writing this curriculum was to provide a hands-on science curriculum that would challenge your child and instill a love of science at an early age. I also wanted to provide you with the tools to give your grammar stage child exposure to the principles of physics so that they will have a knowledge base for future use. For this reason, I have included ongoing projects, experiments every week and journal pages.

I wrote this curriculum to be used in the grammar stage (3<sup>rd</sup>-5<sup>th</sup> grade). It is designed to be done in 20-25 minute session 5 times a week. Usually you will spend 2 days reading and narrating, 2 days on experiments followed by a day wrapping things up and working on an ongoing project. You can adjust the plans to two 45-50 min days a week by doing one of the reading days and one of the experiment days on each of the two days and spreading out the work of Day 5 over the two days. Finally, 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, experiments and activities planned for the week. If you are using these plans with a 4<sup>th</sup> grader I recommend that you require them to do all their own writing as they complete the narrations and experiments.

### **Ongoing Projects:**

These projects are designed to be done over several weeks. As much as possible, each unit has its own coordinating project. You can choose to order a kit or make your own using the instructions provided in the lesson plans. The projects include making a potato clock, making a gumdrop castle and make a newspaper stool. These projects are time consuming, which is why I have split the work up over several weeks. The projects will add greatly to your students understanding and enjoyment of the principles of physics.

### **Experiments:**

Experiments are easy to do, use common household items and they are the core of this program! You will be doing more than one experiment a week, both are scheduled to be written up, but if you find this to be too much for your student just have them write up one a week. The purpose of the write ups is to give your student a beginning look at what the scientific method is and how a scientific test works. Any time you see a box for a picture of your experiment you can have your student draw what is there or you can take a picture and glue it in the box. All the pages you need are included in the student workbook.

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

## Journal Pages (narration sheets):

These are designed to be a record of what your student has studied. They are to be completed after they have done the daily reading for a particular topic. Your student will write 2-4 sentences about what they have learned from the reading. If they are having difficulty getting started, ask them to write one thing they learned from one of the sections read, then repeat until you finish the pages they read. Next glue the picture of what you studied (if your student is artistic you could let them draw this on their own) or fill in the definitions from the week. All the pages and pictures you need are included in the student workbook. Review the journal pages monthly so that your student gets a review of what they have been learning.

## Other Features:

- You will also find that I have included an overview of the study, a list of materials needed by week and a list of topics studied by week.
- 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 readings within the planned books.
- You will also notice that Day 5 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*.
- At the back of this guide I have included blank versions of the narration page and the experiment page in case your student wants to do more!

## Coordinating Resources:

This teacher’s guide is designed to be used in conjunction with two other resources put together by Elemental Science...

### 1. Student Workbook:

The student workbook 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 almost 70 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.

### 2. Quiz Book:

Although this resource is not essential, it is extremely helpful in assessing how much your student is retaining. It is a separate resource in the eBook package, but in the printed version it is at the back of the teacher’s guide.

## 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 use the following books instead...

- Kingfisher Science Encyclopedia—this encyclopedia is written at a higher level and would be more appropriate for older children

- Usborne Illustrated Dictionary of Physics—this dictionary is an excellent resource for your older children

Have your older child look up the corresponding section in their encyclopedia or dictionary and read it. Then find an additional book or article on the topic from the library or from the web. 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 the younger student participate in the experiments, but don't require them to write them up on their own.

### **Final Thoughts**

This curriculum is **very** hands on and is full of projects and experiments. If you only get to half of it, your student will learn **a lot** about physics. So don't stress, enjoy your year exploring the world of physics! As the author and publisher of this curriculum I encourage you to contact me with any questions or problems that you might have concerning Physics for the Grammar Stage. I will be more than happy to answer them as soon as I am able. I hope that you will enjoy Physics for the Grammar Stage! You can email me at [info@elementalscience.com](mailto:info@elementalscience.com).

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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, with the exception of the biographies which you could easily get from your local library.

## Experiment Books:

- *Physics Experiments for Young Children*
- *Gizmos and Gadgets: Creating Science Contraptions that Work (& Knowing Why)*

## Encyclopedia:

- *Usborne's Internet-linked Science Encyclopedia*

**Biographies** (if you're going to purchase these, here's what I recommend, \*be sure to read the Amazon reviews to help you make your decision):

- *Isaac Newton: Giants of Science (secular option)* by Kathleen Krull *OR Isaac Newton and the Laws of Motion (Christian option)* by Andrea Gianopoulos
- *Who Was Thomas Alva Edison* by Margaret Frith

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.

## Abbreviations used:

- SW—Student Workbook

# Overview

## **Ongoing activities:**

- Projects: these will take several weeks and will coordinate with the unit you are studying
- Scientist Biographies: your student will study 2 scientists this year
- Journal Pages: Picture (if possible) and student's summary of what was learned
- Experiment Pages: Fill out an experiment page for each experiment performed
- End of the Year Rocket Launch

## **Sequence for Study:**

- Week 1-4: Matter (Project: Hovercraft)
- Week 5: Scientist Biography: Isaac Newton
- Week 6-8: Motion (Project: K'nex Education Gears Kit)
- Week 9-10: Simple Machines (Project: Continue to work with your Gears Kit and Scientist Biography Report)
- Week 11-12: Heat (Continue working with your Gears Kit)
- Week 13-14: Friction (Project: Friction Block)
- Week 15-17: Gravity (Project: Egg drop carrier)
- Week 18-19: Light (Project: Kaleidoscope)
- Week 20: Scientist Biography: Thomas Edison
- Week 21-23: Sound (Project: Work on Scientist Biography Report)
- Week 24-26: Balance (Project: Gumdrop Castle)
- Week 27-29: Spin (Project: Newspaper Stool)
- Week 30-32: Magnets & Electricity (Project: Potato Clock)
- Week 33-35: Energy (Project: Catapult)
- Week 36: Rocket

# Physics Lesson Plans Week 1

## (Matter Unit Week 1)

Day 1	Day 2	Day 3	Day 4	Day 5
Read <i>Usborne Science Encyclopedia</i> pg. 16-17 Solids, Liquids, Gases	<i>Physics Experiments for Children</i> pg. 6 "Can you fill an empty bottle?" Write up on SG pg. 61	Read <i>Usborne Science Encyclopedia</i> pg. 62-63 Air	<i>Physics Experiments for Children</i> pg. 8 "Which is heavier, hot or cold air" Write up on SG pg. 62	<ul style="list-style-type: none"> <li>• Finish your work from the week</li> <li>• Give Physics Week 1 Quiz</li> <li>• Begin working on your hovercraft project</li> </ul>
Journal Page on SW pg. 25 Picture on SW pg. 125		Add to Journal Page and fill out definitions section on SW pg. 25		

**Journal Pages:** These are a record of what your student has learned. For the first day of reading have your student summarize what they read in 2-4 sentences and write this down. Then have them paste in the large picture at the top. For the second day of reading have your student summarize what they read in 2-4 sentences and write this down. Next have them look up the definitions either in the *Usborne Science Encyclopedia* or in your dictionary, then fill in the definitions on the journal page and add the pictures. You can also choose to assign one definition per day of reading if this works better for your student. Follow this pattern for the remainder of the year.

**Experiment Write-ups:** These are records of your experiment. Have your student fill in the sections and paste in or draw a picture of their experiment.

**Experiment (Day 2):** Can you fill an empty bottle?  
 See *Physics Experiments for Children* pg. 6. In this experiment your student will see that air takes up space.

Supplies Needed:

- ✓ empty soda bottle
- ✓ funnel
- ✓ clay

**Experiment (Day 4):** Which is heavier, hot or cold air?

See *Physics Experiments for Children* pg.8. In this experiment your student will determine which is heavier, hot or cold air.

Supplies Needed:

- |               |                |
|---------------|----------------|
| ✓ baby bottle | ✓ string       |
| ✓ yardstick   | ✓ sand or rice |
| ✓ tin can     | ✓ candle       |

**Hovercraft Project (Day 5):** Directions are on the following page.

**Definitions:**

- state of matter : the different forms in which a substance can exist, solid, liquid and gas
- gas: a state of matter in which a substance has no fixed shape or volume

### Want More?

- Do the see for yourself activities found in the *Usborne Science Encyclopedia* on pg. 17 & 63
- Do another experiment from *Physics Experiments for Children* for fun. Try "Does Air Take up Space?" on pg. 5 or "Does Air Weigh Anything?" on pg. 7.

# Matter Unit Project: Hovercraft

## Overview:

This is the first unit project your student will complete. It will look at using air as a means of transportation, but will also introduce the concept of friction. The instructions for making your hovercraft are contained in the *Gizmos and Gadgets* book. This project can be completed in one day, but use the following weeks to tweak your hovercraft. There are several suggestions on how to change the design which will help your student to learn more about the principles of physics. Be sure to have your student fill out the notebook page found in the Student Workbook on pg. 7 after each week.

## Supplies Needed:

- ✓ scissors
- ✓ plastic soda bottle
- ✓ disposable plastic bowl
- ✓ marker or pencil
- ✓ tape
- ✓ different containers (such as deli tubs, food trays and lids of all shapes & sizes)
- ✓ cardboard paper tube
- ✓ blow dryer
- ✓ paper
- ✓ funnel

## Steps to complete project:

1. Read *Gizmos and Gadgets* pages 45-47 to get an overview of the project.
2. Build your hovercraft by following the instructions on pg. 45 to make your hovercraft.
3. Play around with the design, using the suggestions on pg. 46-47, be sure to take pictures for your notebook.

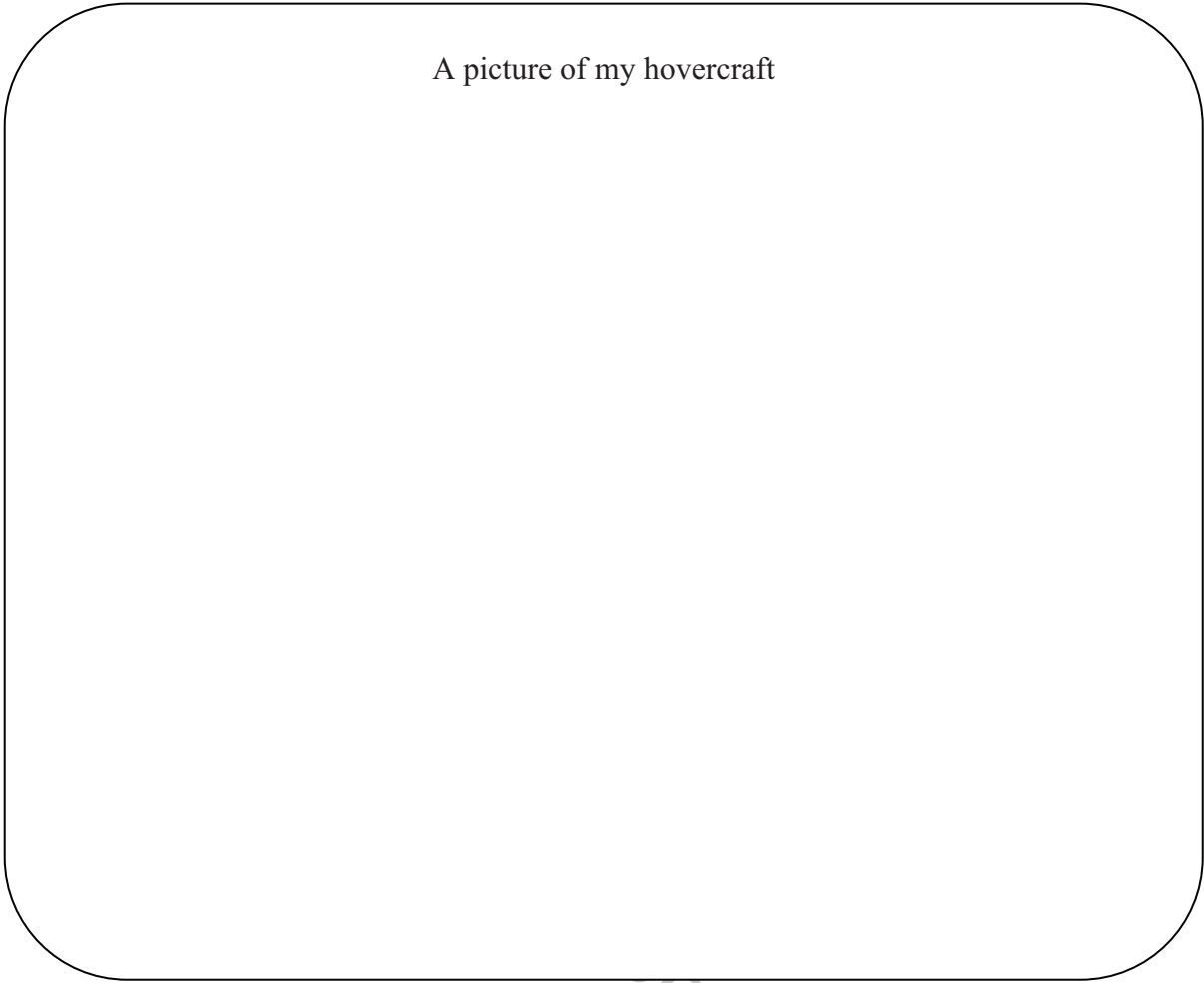
### Suggested schedule

- Week 1: Follow Steps #1-2
- Week 2: Try different containers ("Lighten up" section on pg. 46 of *Gizmos & Gadgets*)
- Week 3: Try different ways of getting air ("Get Air" section on pg. 47 of *Gizmos & Gadgets*)
- Week 4: Try different ways of delivering air ("So Simple" section on pg. 47 of *Gizmos & Gadgets*)



# Matter Unit Project: Hovercraft

A picture of my hovercraft



What I learned...

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# What I've Learned About Matter Week 1

Air				
N <sub>2</sub>	O <sub>2</sub>	He	N <sub>2</sub>	O <sub>2</sub>
CO <sub>2</sub>	N <sub>2</sub>	O <sub>2</sub>	N <sub>2</sub>	O <sub>2</sub>
N <sub>2</sub>	O <sub>2</sub>	N <sub>2</sub>	O <sub>2</sub>	Kr
N <sub>2</sub>	O <sub>2</sub>	Ar	N <sub>2</sub>	O <sub>2</sub>
N <sub>2</sub>	O <sub>2</sub>	CO <sub>2</sub>	N <sub>2</sub>	O <sub>2</sub>
N <sub>2</sub>	O <sub>2</sub>	Ne	N <sub>2</sub>	O <sub>2</sub>
N <sub>2</sub>	O <sub>2</sub>	N <sub>2</sub>	O <sub>2</sub>	CO <sub>2</sub>
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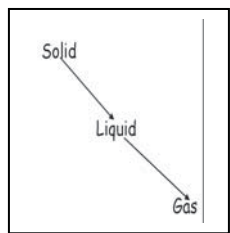
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## Definitions



States of Matter:

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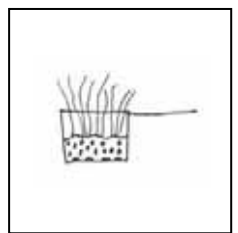
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Gas:

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Name: \_\_\_\_\_ Date: \_\_\_\_\_

## Can you fill an empty bottle?

Materials (What we used):

_____	_____
_____	_____
_____	_____
_____	_____

Procedure (What we did):

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

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Observations (What Happened):

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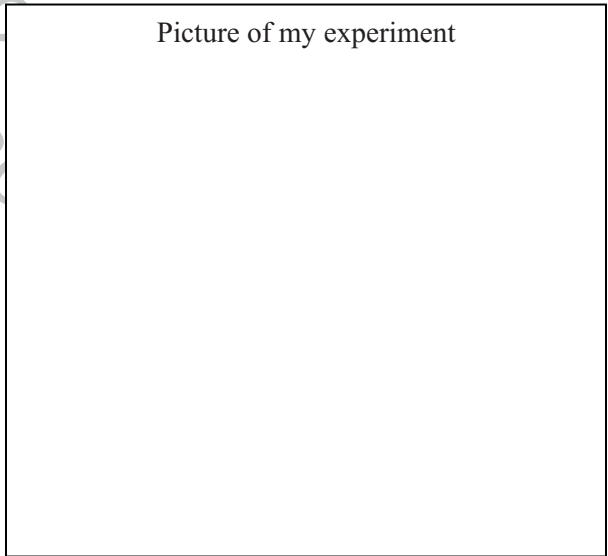
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Conclusion (What I learned):

\_\_\_\_\_

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Name: \_\_\_\_\_ Date: \_\_\_\_\_

## Which is heavier, hot or cold air?

Materials (What we used):

_____	_____
_____	_____
_____	_____
_____	_____

Procedure (What we did):

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

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Observations (What Happened):

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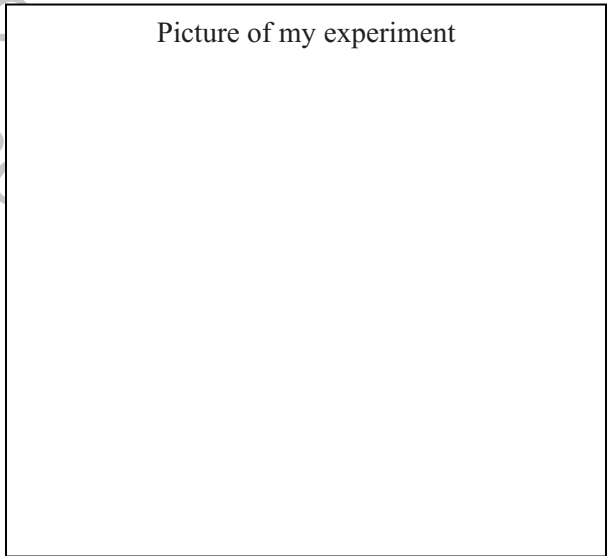
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Conclusion (What I learned):

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## Physics Week 1

1. True or False: Air does not take up space.

2. Name the three states of matter.

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3. Circle the two **main** compounds found in air.

nitrogen      helium      oxygen      carbon

4. Circle which weighs more.

hot air      cold air

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

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# Physics Lesson Plans Week 14

(Friction Unit Week 2)

Day 1	Day 2	Day 3	Day 4	Day 5
<i>Gizmos and Gadgets</i> pg. 36-37 "Lazy Susan" Write up on SG pg. 86	Read <i>Gizmos and Gadgets</i> pg. 38-40 Friction Foilers	<i>Gizmos and Gadgets</i> pg. 41-42 "Blow & Go" Write up on SG pg. 87	Read <i>Usborne Science Encyclopedia</i> Pg. 124-125 Friction	<ul style="list-style-type: none"> <li>• Finish your work from the week</li> <li>• Give Physics Week 14 Quiz</li> <li>• Continue to work on Friction Block Project</li> </ul>
	Journal Page on SW pg. 37 Picture on SW pg. 131		Add to Journal Page and fill out definitions section on SW pg. 37	

## Experiment (Day 1): Lazy Susan

See *Gizmos and Gadgets* pg. 36 which will show your student how to reduce friction. Then read the section titled "Slick Trick" on pg. 37 for an explanation of the experiment.

Supplies Needed:

- ✓ marbles
- ✓ 2 jar lids (one slightly larger than the other)
- ✓ modeling clay
- ✓ plastic plate
- ✓ snacks

## Experiment (Day 3): Blow & Go

See *Gizmos and Gadgets* pg. 41-42 which will demonstrate how sky divers use friction.

Supplies Needed:

- ✓ paper
- ✓ tape
- ✓ scissors
- ✓ colored markers
- ✓ paper strips
- ✓ jumbo & regular sized straws
- ✓ plastic grocery bag
- ✓ thread

## Want More?

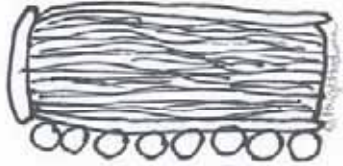
- Do the your own sledge activity found on pg. 37 of *Gizmos and Gadgets*
- Do the in search of a parachute activity found on pg. 43 of *Gizmos and Gadgets*
- Read pg. 44 of *Gizmos and Gadgets*

## Definitions:

- lubricant: a substance used to reduce friction

# What I've Learned About Friction Week 2

Friction Foilers



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## Definition

Lubricant:



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Name: \_\_\_\_\_ Date: \_\_\_\_\_

# Lazy Susan

Materials (What we used):

_____	_____
_____	_____
_____	_____
_____	_____

Procedure (What we did):

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

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Observations (What Happened):

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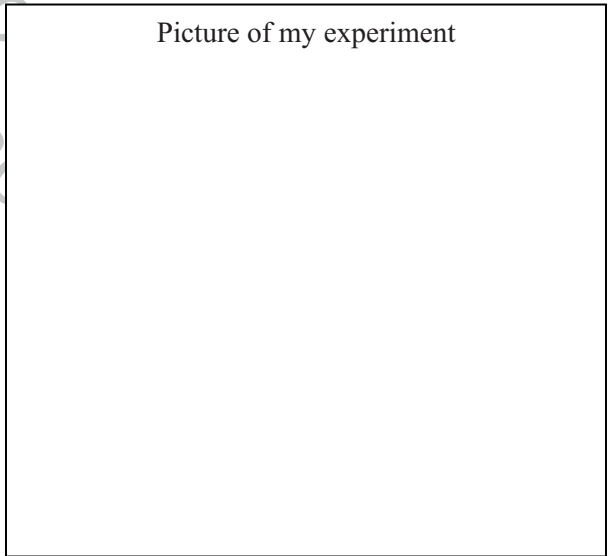
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Conclusion (What I learned):

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\_\_\_\_\_



Name: \_\_\_\_\_ Date: \_\_\_\_\_

## Blow and Go

Materials (What we used):

_____	_____
_____	_____
_____	_____
_____	_____

Procedure (What we did):

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

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Observations (What Happened):

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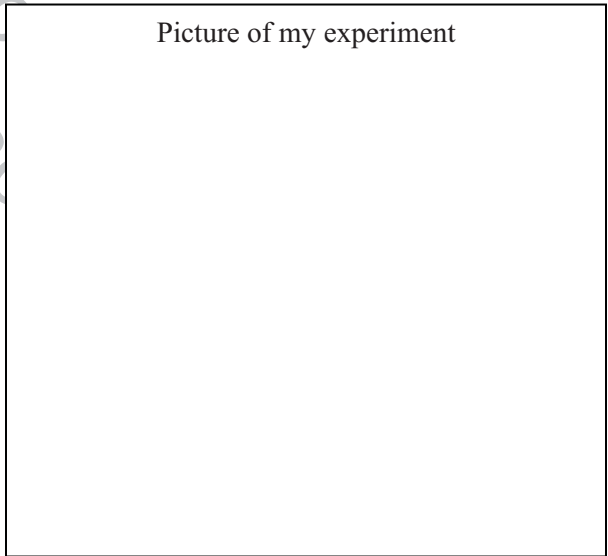
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Conclusion (What I learned):

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

## Physics Week 14

1. True or False: Bearings have no effect on friction.
2. The rougher the surfaces are and the harder two objects press together, the \_\_\_\_\_ friction there will be.

same

more

less

3. True or False: Lubricants are liquids that are used to reduce friction.

4. \_\_\_\_\_ is the force that slows a parachute down.

gravity

friction

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

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