Physics 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 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 summary sheets.

I wrote this curriculum to be used in the grammar stage (4^{th}-5^{th} grade). It is designed to be done in 20-25 minute session 5 times a week or in two 40-50 minute sessions 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, experiments and activities planned for the week. If you are using these plans with a 4^{th} grader I recommend that you require them to do all their own writing as they complete 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 almost 70 pictures for 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 projects are designed to be done over several weeks. Each unit has its own coordinating project, when possible. The directions for these projects are included on the unit overview sheet in this guide and in the ongoing project section of the student workbook. These projects include making a potato clock, making a gumdrop castle and making a newspaper stool. The ongoing projects are time consuming, which is why I have scheduled a day for you to work on them each week. I have also split the work up over several weeks so that your student won't be overwhelmed. These projects will add greatly to your students understanding and enjoyment of the principles of physics, so I highly recommend investing the time it takes to do them.

Experiments:

Experiments are easy to do, use common household items and they are the core of this program! You will be doing one experiment a week that will be written up. The

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

purpose of the experiment 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 your own picture and glue it in the box. All the pages you need are included in the student workbook.

I have also scheduled an additional optional experiment each week for those using the 5 day a week schedule. You can choose whether or not to have your student do a write-up for these experiments. If you decide to assign these additional experiments as write-ups, have your student use the template provided in the Appendix.

Summary Sheets (narrations):

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 on the pages they read, then repeat until you finish the assigned pages. Next glue the picture of what you studied (if your student is artistic you could let them draw this on their own). All the pages and pictures you need are included in the student workbook. Review the summary sheets monthly so that your student gets a review of what they have been learning.

Vocabulary:

Your student will be making their own dictionary of 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 this guide on the unit overview sheet. 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.

Memory Work:

Each unit has coordinating memory work assignments on the unit overview sheet. The assignments include poems and lists of facts. The memory work poems are written by the author, unless otherwise noted. They are not literary works; instead they are simply tools to aid your student in memorizing key facts from the unit. The memory work assignments are designed to reinforce what your student has learned.

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 "Optional Experiment & Want More?" box on each of the plan sheets. They are designed to give you ideas for more activities and additional readings within the planned books.

- You will also notice that Day 5 of the 5 day a week 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*.
- 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!

Quizzes:

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

Coordinating Resources:

The following program is sold separately from Elemental Science. It coordinates with Physics for the Grammar Stage and is designed to enhance your study of physics.

- ✓ *Lapbooking through Physics:*

  Lapbooking through Physics leads your student through a survey of the principles of physics. It includes plans for 13 lapbooks along with reading assignments for your younger and older students. Lapbooking through Physics also includes all the templates and pictures that you need to complete the lapbooks.

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 too 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.

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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: Inventor, Scientist, and Teacher (*Sower Series) *(Christian option)*
- *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
- PEC—*Physics Experiments for Children*

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 from the field of physics this year.
- Summary sheets: These will have a picture (if possible) and student's summary of what they 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 Unit
  (Project: Hovercraft)
- Week 5: Scientist Biography: Isaac Newton
- Week 6-8: Motion Unit
  (Project: K'nex Education Gears Kit)
- Week 9-10: Simple Machines Unit
  (Project: Continue to work with your Gears Kit and Scientist Biography Report)
- Week 11-12: Heat Unit
  (Project: Continue working with your Gears Kit)
- Week 13-14: Friction Unit
  (Project: Friction Block)
- Week 15-17: Gravity Unit
  (Project: Egg drop carrier)
- Week 18-19: Light Unit
  (Project: Kaleidoscope)
- Week 20: Scientist Biography: Thomas Edison
- Week 21-23: Sound Unit
  (Project: Work on Scientist Biography Report)
- Week 24-26: Balance Unit
  (Project: Gumdrop Castle)
- Week 27-29: Spin Unit
  (Project: Newspaper Stool)
- Week 30-32: Magnets & Electricity Unit
  (Project: Potato Clock)
- Week 33-35: Energy Unit
  (Project: Catapult)
- Week 36: Rocket Launch

Physics Experiment Supply List At a Glance

Week	Supplies needed
1	baby bottle, yardstick, tin can, string, sand or rice, candle
2	2 books, 2 balloons, sheet of paper, string
3	Jar, water, pot, piece of cardboard, ice cubes
4	egg, glass, water, salt, tack, pencil
5	**No experiment supplies needed this week**
6	1 qt. plastic soda bottle, tape, two 12 ft. pieces of string, two 6 pack plastic ring holders, construction paper and ribbon for decoration
7	Paper, stapler, chopstick, rubber band
8	Tape, straw, plastic bag, streamer, 25 ft. string, long, tube shaped balloons
9	Pennies, metal hanger, spool, string, 2 small paper boxes
10	2 rulers of different lengths, rubber band, books, toy car, paper, pencil
11	3 bowls, hot, lukewarm & cold water, small pot, large pan, two thermometers
12	Saucer, water, small pot, ice cube, sugar, candle wax
13	Pushpin, cork, thumbtacks, pipe cleaner, paper clip, broom handle
14	Marbles, 2 jar lids (one slightly larger than the other), modeling clay, plastic plate, snacks
15	Pencil, cereal box, scissors, corrugated cardboard, markers, hole punch, string, metal nut, 4 beads, needle, glue
16	wire binding from a notebook, broom handle, scissors, plastic 6 pack holder, cereal box, markers, tape, paper clip, pennies, stapler, straw
17	2 Styrofoam plates, Styrofoam bowl, Styrofoam cup, straw, glue
18	glass of water, sheet of white paper, tray of water, mirror, prism or cut glass bottle, flashlight
19	glass of water, pencil, book
20	**No experiment supplies needed this week**

21	clothesline or blind cord, two straws of different lengths, yardstick, paper clips, fork, dry cereal kernels (ie. puffed rice), hanger, string, rubber band
22	fork, spoon
23	2 empty bottles, water
24	Pencil, old CD, cereal box, scissors, markers, construction paper, glue, bead eyes (opt.), copy of *Gizmos and Gadgets* pg. 72, markers, cardboard, string, 2 full 1 qt. bottles
25	Modeling clay, large round balloon
26	(students will scavenge the house to find what they need)
27	jar lid or old CD, cardboard, scissors, rubber band, pennies, pencil
28	Scissors, poster board, tape, small bowl, toothpicks, egg carton, push pin, smooth jar lid, cardboard, pencil, two buttons, thread
29	plastic deli containers, cord or string, carrot, eraser, ping-pong ball, spool of thread or toilet paper tube
30	magnet (bar, u-shaped or horseshoe), tacks, nails, paper clips, drinking glass, paper, dish of water, tin can, piece of wool
31	battery (at least a C or D cell), length of copper wire, 3 feet of insulated wire, compass, iron filing (if you can't find these, you could use shavings from a soup can)
32	flashlight bulb & socket, 4 feet of insulated copper wire, various testing materials (ie. paper clips, fork, key, coin, nail, pins, piece of cloth, wood, glass, rubber band, chalk), 2 lengths of bare iron wire (picture frame wire is good), pencil, two nails, glass bottle, cork to fit the bottle
33	soup can, two old CD's, duct tape, paper clip, rubber band
34	small cardboard box, construction paper, 2 rubber bands
35	cardboard egg carton, scissors, marbles, tape, lid, dominoes
36	Build-your-own rocket kit, paint (if not already included in your kit)

Physics Unit Projects Supply List At a Glance

Unit Projects	Supplies needed
Matter Unit Project	Scissors, 2 plastic soda bottles, 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
Motion, Simple Machines and Heat Unit Project	K'nex Education: Intro to Simple Machines: Gears Kit
Friction Unit Project	one 3 ft. section of a 2x6 board, one 1x2x4 block (average sized wooden block), 1 sheet of sandpaper, washcloth (won't be damaged, so you can use your own from home ☺), several large books to prop up your board, timer
Gravity Unit Project	a raw egg (or eggs depending on how many break ☺), various shock absorbing materials, such as cotton balls, newspaper, packing peanuts or fabric, 1 quart plastic container (what fruit is typically packed in), masking tape
Light Unit Project	Paper towel tube cut eight inches (20 centimeters) long, Clear plastic report cover, Ruler, Pen or marker, Paring knife or art utility knife, Four-inch (ten-centimeter) squares (one each) of black construction paper, plastic wrap, and waxed paper, Scissors, Rubber band, Clear tape, Colored transparent beads, small sequins, and shiny confetti, Stickers and wrapping paper
Balance Unit Project	Bag of gumdrops, toothpicks, paper plate
Spin Unit Project	Lots of newspaper, masking tape
Magnets & Electricity Unit Project	2 potatoes, 2 galvanized nails, 3 alligator clip/wire assemblies (this means an alligator clip attached to a wire), two pieces of heavy copper wire, a simple low-voltage LED battery powered clock unit
Energy Unit Project	two 2 quart plastic soda bottles, 2 pencils, 3 rubber bands, scissors, hole punch, tape, index card or small box, dried beans, marshmallows, other building materials depending on what your student designs ☺

Friction Unit Overview (Weeks 13-14)

Friction Unit Memory Work:

Friction helps us
Get a grip
This force slows us down
So that we don't slip

Experiment Supplies Needed for the Unit

13	Pushpin, cork, thumbtacks, pipe cleaner, paper clip, broom handle
14	Marbles, 2 jar lids (one slightly larger than the other), modeling clay, plastic plate, snacks

Vocabulary Definitions:

These are a guide. Your student's definitions don't need to be word for word.

- friction: the force that tends to slow down moving objects that are touching
- gravity: the force that attracts objects together
- lubricant: a substance used to reduce friction

Friction Block Project Details:

In this project your student will examine how different types of materials create more or less friction. The student will also examine how gravity affects friction, which will be done by using differing angles of the board (the higher the top of your board, the higher the effect of gravity). Your student will have two weeks to explore the principles of gravity and friction using their Friction Block. Be sure to have them fill out the notebook page found in the Student Workbook on pg. 17-20 after each week.

Supplies Needed:

- ✓ one 3 ft. section of a 2x6 board
- ✓ one 1x2x4 block (average sized wooden block)
- ✓ 1 sheet of sandpaper
- ✓ washcloth (won't be damaged, so you can use your own from home ☺)
- ✓ several large books to prop up your board
- ✓ timer

Steps to complete project:

1. Prop up your board so that the top is 18 inches higher than the bottom.
2. Send the block down the board, record the time it takes to get to the bottom.

3. Cover the block with the washcloth.
4. Send the washcloth covered block down the board, record the time it takes to get to the bottom.
5. Cover the block with the sandpaper.
6. Send the sandpaper covered block down the board, record the time it takes to get to the bottom.
7. Prop up your board so that the top is 9 inches higher than the bottom.
8. Repeat Steps 2-6.
9. Prop up your board so that the top is 27 inches higher than the bottom.
10. Repeat Steps 2-6.

Physics Lesson Plans Week 13

(Friction Unit 1st Week)

Day 1	Day 2	Day 3	Day 4	Day 5
Experiment: *Gizmos and Gadgets* *pg. 28-29* *"Jitter Critter"* Write up on SG pg. 121-122	Read *Gizmos and Gadgets* *pg. 30 & 32* About Friction	Read *Gizmos and Gadgets* *pg. 34-35* More on Friction	Project: *Friction Block* Examining the effects of friction	• Complete the Optional Experiment • Give Physics Week 13 Quiz
	Summary sheet on SW pg. 75 Picture on SW pg. 165	Add to Summary sheet one SW pg. 75 and Define friction & gravity on SW pg. 54, pictures on SW pg. 165		

Experiment: Jitter-Critter

Begin by reading pg. 28 in *Gizmos and Gadgets*. Then do the experiment on pg. 29 which will demonstrate the effects of friction for your student. Then read the section titled "Stop the Drop" on pg. 30 for an explanation of the experiment.

Supplies Needed:

- ✓ pushpin
- ✓ cork
- ✓ thumbtacks
- ✓ pipe cleaner
- ✓ paper clip
- ✓ broom handle

Project: Friction Block

Today your student will build and test their friction block. They will examine the varying effects of friction by using several different materials. Have them do Steps 1-6 from their Friction Unit Project Sheet. This friction block will be used for testing for the rest of the unit, so be sure to save it.

Supplies Needed:

- ✓ one 3 ft. section of a 2x6 board
- ✓ one 1x2x4 block (average sized wooden block)
- ✓ 1 sheet of sandpaper
- ✓ washcloth (won't be damaged, so you can use your own from home ☺)
- ✓ several large books to prop up your board
- ✓ timer

Optional Experiment

- **Stop and Gobot:** *Gizmos and Gadgets pg. 33* which will show friction in action to your student. Then read the section titled "Stop Right There" on pg. 34 for an explanation of the experiment.
  Supplies Needed: small cardboard box, paper straws, toilet paper tube, foil, 2 index cards, tape , string

Want More?

- Work on memorizing the friction poem.
- Do the "Mini juggler" activity found on pg. 31 of *Gizmos and Gadgets.*
- Do the "Take a brake" activity found on pg. 34 of *Gizmos and Gadgets.*

Physics Lesson Plans Week 13 (2 day)

(Friction Unit 1st Week)

	Day 1	Day 2
Reading Assignments	Read *Gizmos and Gadgets* *pg. 30 & 32* About Friction	Read *Gizmos and Gadgets* *pg. 34-35* More on Friction
Writing Assignments	Summary sheet on SW pg. 75 and Define friction & gravity on SW pg. 54, pictures on SW pg. 165	Add to Summary sheet on SW pg. 75 and Give Physics Week 13 Quiz
Experiments & Projects	Experiment: *Gizmos and Gadgets* *pg. 28-29 "Jitter Critter"* Write up on SG pg. 121-122	Project: *Friction Block* Examining the effects of friction

Experiment: Jitter-Critter

Begin by reading pg. 28 in *Gizmos and Gadgets*. Then do the experiment on pg. 29 which will demonstrate the effects of friction for your student. Then read the section titled "Stop the Drop" on pg. 30 for an explanation of the experiment.

Supplies Needed:

- ✓ pushpin
- ✓ cork
- ✓ thumbtacks
- ✓ pipe cleaner
- ✓ paper clip
- ✓ broom handle

Project: Friction Block

If you do not wish to complete the unit project, do the optional experiment on this day instead.

Today your student will build and test their friction block. They will examine the varying effects of friction by using several different materials. Have them do Steps 1-6 from their Friction Unit Project Sheet. This friction block will be used for testing for the rest of the unit, so be sure to save it.

Supplies Needed:

- ✓ one 3 ft. section of a 2x6 board
- ✓ one 1x2x4 block (average sized wooden block)
- ✓ 1 sheet of sandpaper
- ✓ washcloth (won't be damaged, so you can use your own from home ☺)
- ✓ several large books to prop up your board
- ✓ timer

Optional Experiment

- **Stop and Gobot:** *Gizmos and Gadgets pg. 33* which will show friction in action to your student. Then read the section titled "Stop Right There" on pg. 34 for an explanation of the experiment.
  Supplies Needed: small cardboard box, paper straws, toilet paper tube, foil, 2 index cards, tape , string

Want More?

- Work on memorizing the friction poem.
- Do the "Mini juggler" activity found on pg. 31 of *Gizmos and Gadgets.*
- Do the "Take a brake" activity found on pg. 34 of *Gizmos and Gadgets.*

Physics Lesson Plans Week 14

(Friction Unit 2nd Week)

<table>
<tr><th>Day 1</th><th>Day 2</th><th>Day 3</th><th>Day 4</th><th>Day 5</th></tr>
<tr><td rowspan="2">Experiment:
Gizmos and Gadgets
pg. 36-37
“Lazy Susan”
Write up on
SG pg. 123-124</td><td>Read Gizmos and Gadgets
pg. 38-40
Friction Foilers</td><td>Read Usborne Science Encyclopedia
Pg. 124-125
Friction</td><td rowspan="2">Project:
Friction Block
See if height effects the amount of friction</td><td rowspan="2">• Complete the optional experiment
• Give Physics Week 14 Quiz</td></tr>
<tr><td>Summary sheet on SW pg. 76
Picture on SW pg. 165</td><td>Add to Summary sheet on pg. 76 and Define lubricant on SW pg. 54, pictures on SW pg. 165</td></tr>
</table>

Experiment: 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

Project: Friction Block

Today your student will build and test their friction block. They will examine the varying effects of friction by using several different materials. Have them do Steps 7-10 from their Friction Unit Project Sheet. This friction block will be used for testing for the rest of the unit, so be sure to save it.

Supplies Needed:

- ✓ one 3 ft. section of a 2x6 board
- ✓ one 1x2x4 block (average sized wooden block)
- ✓ 1 sheet of sandpaper
- ✓ washcloth (won’t be damaged, so you can use your own from home ☺)
- ✓ several large books to prop up your board
- ✓ timer

Optional Experiment

- **Blow & Go**: *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?

- Work on memorizing the friction poem.
- 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.*

Physics Lesson Plans Week 14 (2 day)

(Friction Unit 2nd Week)

	Day 1	Day 2
Reading Assignments	Read *Gizmos and Gadgets* *pg. 38-40* Friction Foilers	Read *Usborne Science Encyclopedia* *Pg. 124-125* Friction
Writing Assignments	Summary sheet on SW pg. 76 and Define lubricant on SW pg. 54, pictures on SW pg. 165	Add to Summary sheet on SW pg. 76 and Give Physics Week 14 Quiz
Experiments & Projects	Experiment: *Gizmos and Gadgets* *pg. 36-37 "Lazy Susan"* Write up on SG pg. 123-124	Project: *Friction Block* See if height effects the amount of friction

Experiment: 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

Project: Friction Block

If you do not wish to complete the unit project, do the optional experiment on this day instead.

Today your student will build and test their friction block. They will examine the varying effects of friction by using several different materials. Have them do Steps 7-10 from their Friction Unit Project Sheet. This friction block will be used for testing for the rest of the unit, so be sure to save it.

Supplies Needed:

- ✓ one 3 ft. section of a 2x6 board
- ✓ one 1x2x4 block (average sized wooden block)
- ✓ 1 sheet of sandpaper
- ✓ washcloth (won't be damaged, so you can use your own from home ☺)
- ✓ several large books to prop up your board
- ✓ timer

Optional Experiment

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Want More?

- Work on memorizing the friction poem.
- 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.*

Physics Week 13

1. The force that tends to slow down moving objects is called _____.

   gravity inertia friction

2. True or False: The rough tread on a sneaker is designed to increase friction.

3. The force that attracts objects together is called _____.

   gravity inertia friction

4. True or False: The more grip you have, the less friction is at work.

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

   _____
   _____
   _____
   _____
   _____
   _____

Physics Week 14

1. True or False: Bearings have no affect 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?

   _____

   _____

   _____

   _____

   _____

   _____

Student Workbook Samples

(Pictures are shown on the pages in this sample of the student workbook, but in the actual program they are on separate pages in the back of the student workbook so that they can be cut out and colored by child, and then pasted in these squares.)

Friction Unit Project: Friction Block

In this project you will examine how different types of materials create more or less friction. You will also examine how gravity affects friction by using differing angles of the board (the higher the top of your board, the higher the effect of gravity). You will have two weeks to explore the principles of gravity and friction using their Friction Block. Be sure to fill out the following notebook page after each week.

Supplies Needed:

- ✓ one 3 ft. section of a 2x6 board
- ✓ one 1x2x4 block (average sized wooden block)
- ✓ 1 sheet of sandpaper
- ✓ washcloth (won't be damaged, so you can use your own from home ☺)
- ✓ several large books to prop up your board
- ✓ timer

Steps to complete project:

Week 1:

11. Prop up your board so that the top is 18 inches higher than the bottom.
12. Send the block down the board, record the time it takes to get to the bottom.
13. Cover the block with the washcloth.
14. Send the washcloth covered block down the board, record the time it takes to get to the bottom.
15. Cover the block with the sandpaper.
16. Send the sandpaper covered block down the board, record the time it takes to get to the bottom.

Week 2:

17. Prop up your board so that the top is 9 inches higher than the bottom.
18. Repeat Steps 2-6.
19. Prop up your board so that the top is 27 inches higher than the bottom.
20. Repeat Steps 2-6.

A picture of my Friction Block

My Results…

Week 1	Time (in seconds) to get to the bottom of the board Raised 18 inches
Block	
Washcloth covered Block	
Sandpaper covered Block	

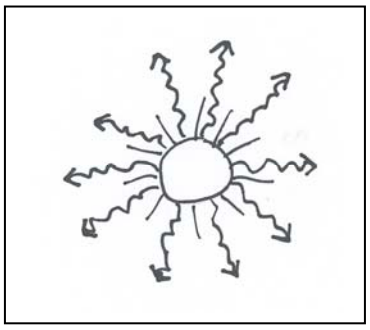
What I learned…

My Results…

Week 2	Time (in seconds) to get to the bottom of the board	
	Raised 9 inches	Raised 27 inches
Block		
Washcloth covered Block		
Sandpaper covered Block		

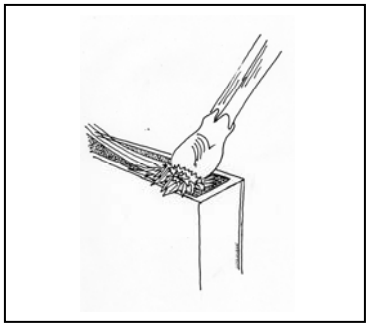
What I learned…

Infrared Radiation

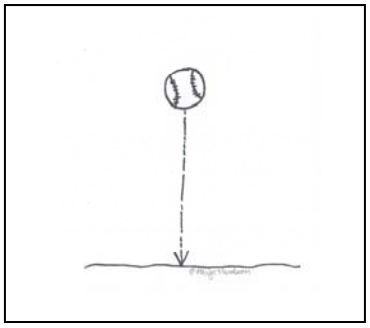


Friction Unit Vocabulary

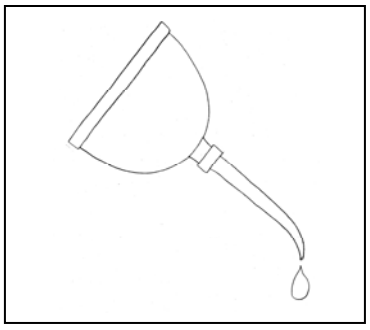
Friction:



Gravity:



Lubricant:

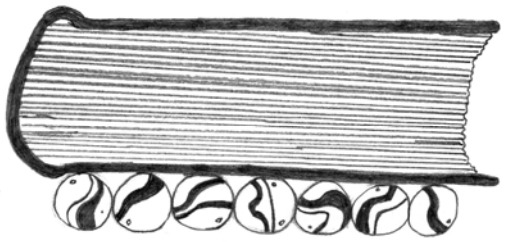


What I've Learned About Friction Week 1

Friction

What I've Learned About Friction Week 2

Friction Foilers



Name: _____ Date: _____

Jitter Critter

Materials (What we used):

_____ _____

_____ _____

_____ _____

_____ _____

Procedure (What we did):

_____

_____

_____

_____

_____

_____

_____

_____

Picture of my experiment

Observations (What Happened):

Conclusion (What I learned):

Name: _____ Date: _____

Lazy Susan

Materials (What we used):

_____ _____

_____ _____

_____ _____

_____ _____

Procedure (What we did):

_____

_____

_____

_____

_____

_____

_____

_____

Picture of my experiment

Observations (What Happened):

Conclusion (What I learned):