

For the Family

Gravity can be mean sometimes.


Scommancray


First of all thank you very much for choosing to use this book with your family. You will not be disappointed! I have been asked by several families the same question, "Who are you and why are you doing this?" Without going into great detail, E=McQ is owned, operated and stressed over by me. Yep... little o' me. I am an educator by profession and began working with homeschool families several years ago while offering free programs to area families to explore various concepts in science. I guess I can't stop doing what I love!

This product is the fruit of my eleven-year labor in science education. Having worked with homeschool families over these years I have gained an appreciation for your needs, struggles and wants. I could not make this curriculum any simpler for your child to master the concepts of science. It is completely reusable, relatively cheap (I tried to keep it under the cost of a tank of gas), adaptable to various needs at home and as fun as humanly possible.

Like I said, I am an "army of one". I have no problem with you using this one copy for your entire family. However, if you give or loan this book out to another family you are putting a lot of pressure on me. If this happens too often, I may not be able to continue producing this curriculum. I am not telling you to keep this curriculum a secret, but I have provided some options for you should another family wish to use this curriculum:

- If your friends are asking to borrow your copy to use throughout the year, please ask them to read this copyright page and go to my website: www.eequalsmca.com so that they may purchase their own book!
- If you are reselling this curriculum please be aware that its value will diminish if many people are selling it for a lower amount of money. This, too, puts pressure on little o' me. If this is the path you choose, I hope you (or the buyer) will consider providing a small contribution to support my continued work. I know it is impossible to regulate this, but I am certain you will do the right thing!
- If you are part of a CO-OP or other similar group of homeschool families, you may purchase licensing/copying rights for use in your classrooms at a MUCH reduced rate. Please contact me at mrq@eequalsmcq.com for details.

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## Thank you so much for purchasing this copy of Classic Science: Elementary Physical Science!

I am so grateful for all of the work you do for your children and I am honored that you have chosen to bring this curriculum into your home. I am certain it will provide your child a complete background into the various concepts of earth science. Here is how this curriculum has been prepared for you:

## Timeline

This is a 36 -week curriculum for children of ages 7-12. The weekly curriculum has been arranged into four-week units. Each week has been broken down into three separate days to make it easier for you to set up a schedule:

The first day of each week contains a reading assignment and worksheet review for your child.
The second and third days contain hands-on activities to reinforce each weekly reading! Don't worry about expensive materials for these activities! Most equipment can be found around the home or at a local store.

## Tests

You will find a Unit Test and its answer key at the end of each unit (the end of each unit can be found in Chapters 4, 8, 12, 16, 20, 24, 28, 32 and 36) inside the Parent Copy.

## Gasp! "Science fair projects"

In addition, you will find several weekly activities that are entitled "ESP Activities". These are inquiry-based activities that require a child to set up an experiment and collect data. In essence, these are mini-science fair projects. Before you start to cringe at the thought of doing many "science fair projects" I have provided a method for you to use. It is called the Exploring Scientific Procedures (ESP) Method and has been included in this book on pages 5-20.

Many people have found it to be an easy, step-by-step guide for you and your child to approach these inquiry-based projects! DON'T PANIC! They are not as hard as you may imagine. Think of it this way, at the end of this year, your child will have completed several science fair projects! This is many times more inquiry-based projects than the average public school student...and your child is only beginning! All you have to do is read these pages a couple of times before working with your child! You will not be disappointed!

## Future books

Next year, a fourth book will be available: Elementary Chemistry. This book will follow the same classical approach to learning with a detailed look at the chemical concepts of our lives! Until then, check out my website (www.eequalsmcq.com) and sign up for my monthly LabNotes for activities you can do with your family!

I am honored that you have chosen this curriculum but I am eternally grateful for your time, patience and willingness to educate your child in the sciences. I can only hope that your children will attain the passion I have for this field. Thank you for all you are doing to help shape tomorrow!

Above all else....Keep asking questions and keep searching for the answers! And if you get stuck, I'm only a click away mrq@eequalsmcq.com

Take care,

## Scott McQuerry



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## Chapter 1

Drinking straw
Paper plate
Cotton balls

## Chapter 2

10 inch square piece of cardboard
Four pieces of string (3 feet long)
Small paper cup
Clock
Pencil
Two or three eggs
One bed sheet

## Chapter 3

A chair with wheels
A ball to toss (i.e. a tennis ball)
Lightweight plastic kitchen garbage-can liners

## Scissors

Ruler
(12) 20-inch lengths of light string

3 plastic sandwich bags

## Chapter 4

Four food products of differing viscosities (i.e. ketchup, yogurt, corn syrup, cooking oil, etc.)
Funnel with at least $\frac{1}{2}{ }^{\prime \prime}$ opening.
Drinking glass
Clock with second hand or stopwatch
Measuring cup

## Chapter 5

Several sheets of notebook/typing paper
Masking tape
Several books
Plastic drinking cup
Scissors
Water

## Chapter 6

Plastic lid
Paper punch (optional)
2 feet of string
Tape
20 large washers
2 large sheets of sandpaper
Paper clip
Table top
Two small paperback books

## Chapter 7

10-15 quarters
Smooth counter top
Toy car and passenger (i.e. sponge, doll, etc. )
Ramp (made from rulers, wood, cardboard, etc.)
Brick or stack of books
Ruler

## Chapter 8

Racquetball
Utility knife
Scissors
Tennis balls, basketballs, etc.
10-20 paper/plastic drinking cups
Several small books

## Chapter 9

1-2 Broom handles at least 2-3 feet long
Rope, strong, 25 feet long
Three people
Three or four large potatoes
Cutting knife
Two feet of $1 / 2^{\prime \prime}$ PVC pipe
Wooden dowel rod (>2 feet long; must slide into PVC tube)
Chapter 10
Pencil
Scissors
5-6 books
Ruler
1/2L - 2L bottle (and cap) filled with one cup of water Rubber bands

## Chapter 11

Two film canisters
Book, piece of wood, etc.
Water
Clock
Tape
Old tin can
Two paperclips
2-3 flexible drinking straws
Tape
String
Small weighted object
Ruler

## Chapter 12

Quarter
Ruler
Potato
Knife
Stick of room temperature butter

## Chapter 13

Basketball and tennis ball
Yardstick
Tape
One drinking straw
Four pennies
Two paper clips
String (thin)
Two pencils
Scissors

## Chapter 14

Chewing gum
Two film canisters
Glue
Wood plank, books, (to be used as a ramp)
Clock with a second hand
Tape
Twelve or more similar-sized balls
(i.e. tennis balls)

One box or plastic tub
(large enough to easily hold the balls with room to spare)
Chapter 15
Empty pop bottle
Sand, gravel, pennies, etc...
(small objects to fill the pop bottle)
String
Paperclip
Nail
Tape
Clock
2 plastic film cans
Handful of coins
2 pieces of metal wire, each about 8 inches
String about 3 feet long
2 chairs

## Chapter 16

Small bag of unsalted, mixed nuts
A cork
A needle
Foil square (about 12 inches)
Matches/lighter
Clock with a second hand
Outdoor or well-ventilated area
McDonald's Happy Meal
Blender
Measuring cups for liquid (clear)
Sauce pan
Tall skinny and clear container
(i.e. olive container)

## Chapter 17

Two Large Baggies (Gallon-size works well)
Vegetable shortening (enough to fill a large baggie)
Bucket of ice water
Two small sealable baggies
(sandwich or quart-size works fine)
Thermometer
Small objects to be used as weights
(to keep the baggies submerged under water)
Several household objects made of wood, metal, glass and plastic
Thermometer

## Chapter 18

One Styrofoam cup
Three metal spoons
Thermometer
Hot water
Scissors
String
Tape
Lamp with light bulb

## Chapter 19

Pan with lid
Bag of microwave popcorn
Hot air popcorn popper
Popcorn
Oil
Two plastic/glass cups
Two identical thermometers
Sunny window
Piece of white and black paper
Tape
Water
Chapter 20
Microwave oven
Cheese
Cheese grater
Plate
Calculator
One small hobby motor
(1.5-3 volts; Radio Shack \#273-223)

Two AA batteries
One AA battery clip for two batteries
(Radio Shack \# 270-382)
Two wires with alligator clip leads
(Radio Shack \# 278-001)
One inch piece of dowel rod with small hole drilled in one end
One fishing swivel
Three feet of braided string
(old shoestring works well)
Staple gun or thumb tack
Chapter 21
$15-20$ vanilla wafers
White icing
Spoon
Food coloring
(red, blue \& yellow)
Plastic knives or craft sticks
1-3 Dinner plates
Paper towels
white surface
(i.e. painted wall, poster board, etc.)

One red, green, and blue light bulbs or flood lamps,
3 light sockets of any type that will hold the light bulbs
Any solid object such as a pencil, ruler, finger, etc.

## Chapter 22

Three $6 \times 6$ inch mirrors (Plastic mirrors are safest, glass mirror tiles can be found at hardware stores)
Duct tape
A piece of light cardboard (such as a file folder)
Silver Christmas tree balls
A box with sides higher than the diameter of the balls.
A sheet of styrofoam large enough to cover the bottom of the box
Black construction paper
(enough to cover the Styrofoam)

## Chapter 23

Mini-MagLite or penlight
4 to 6 glue sticks
(must be the clear ones used in glue guns)
Sheet of white paper
Clear packaging tape
Compact Disc
Flashlight
(the Maglite from the previous activity would work great)
Piece of white paper

## Chapter 24

Masking tape
Few sheets of white paper
Large cardboard box (you'll need a foot of headroom inside the box as it rests on your shoulders)
Utility knife
Scissors
Aluminum foil
Duct tape
Push pin
Dark sweatshirt/towel
Pencil
Chapter 25
1-2 feet of string
One toothpick
One small paper cup
Water
750 ml plastic water bottle
$\frac{1}{2}$ cup liquid dish soap
$\frac{1}{2}$ teaspoon Light Kayo Syrup or Glycerin
Water
Black film canister
Small dish
Sharp pencil

## Chapter 26

8 feet of $\frac{1}{2}$ inch PVC
Saw
Permanent marker
Lots of friends
Drinking straw
Scissors

## Chapter 27

Two AA batteries
One AA battery clip for two batteries
(Radio Shack \# 270-382)
Two wires with alligator clip leads
(Radio Shack \# 278-001)
Battery operated buzzer (Radio Shack \#273-053)
10 feet of rope
An old sock
String
Metal forks and spoons
Scissors
Chapter 28
Blindfold
Several friends
5-7 small common household items
5-7 black film canisters
Chapter 29
Plastic ruler
Wool or other cloth
4 in strip of paper
Tape
Yardstick or measuring tape
A plastic item (i.e. pvc tubes, plastic rulers, pens, etc.)
A piece of wool cloth or fur
Piece of white paper
Tablespoon of salt and pepper mixed together

## Chapter 30

9-volt battery and clip (Radio Shack \#270-324)
Standard light socket
Wire stripper
8 inches insulated wire (Radio Shack \#278-1219)
Wood (8"x12")
Wood screws (4)
100-watt light bulb
Grocery bag
Hammer
Screwdriver
3-volt flashlight bulb with threaded base (Radio Shack
\#272-1124)
Threaded socket for flashlight bulb
(Radio Shack \#272-357)
12 small soft balls
(i.e. tennis balls, ping pong balls, etc.)

## Chapter 31

Scissors and tape
20 inches wire, 18 or 20 gauge (Radio Shack \#278-1219)
Wire strippers
Aluminum foil
2 tablespoons table salt
1 quart of water
Pitcher or bowl with a spout
5 plastic cups
6 alligator-clip leads (RadioShack \#278-001)
Light-emitting diode (LED) (RadioShack \#276-330)
Vinegar
Cardboard shoe box lid
8 brass paper fasteners (aka-"brads")
Pen or pencil
2 feet insulated wire (Radio Shack \#278-1219)
Small flashlight bulb (Radio Shack \#272-1124)
Chapter 32
Balloon
Steel wool
Tape
Two wire leads with alligator clips
(RadioShack \#278-001)
9 volt battery
Stryofoam dinner plate
A piece of wool cloth
Disposable aluminum pie pan
A Styrofoam cup
Masking tape
Chapter 33
Total® brand cereal, or other high iron content breakfas $\dagger$ cereal
Water
Zip type bags
One metal paperclip
Three identical magnets
(Super-strong craft magnets found in most large craft stores would work)

## Chapter 34

One large nail
Wire ( 1 m long)
D-size battery
Several paperclips
Tape
Wire stripper or knife
3 ft insulated wire (Radio Shack \#278-1219)
Steel bolt
Audio cable (headphones)(Radio Shack \#HA-10FC)
*Small radio (Radio Shack \#12-467)
*Portable tape cassette player with speaker (Radio Shack
\#CX-CD248)
*Any portable music player will work in this activity, as will any cassette player! Don't spend a lot of money!

## Chapter 35

One super-strong craft magne $\dagger$
(found in most large craft stores)
A needle or straightened paper clip
Piece of cork, small flat piece of Styrofoam or plastic lid
from a milk jug
A pie pan with about one inch of water in it
1 paper grocery bag
1 D-size battery
2 ceramic donut magnets (Radio Shack \#64-1888)
Masking tape
Marker or thick pen
Magnetized needle or straightened paper clip
(from "Create a Compass")
1 foot of string

## Chapter 36

One super-strong craft magne $\dagger$
(found in most large craft stores)
One AA or AAA battery
One screw or nail
Five-six inches of copper wire with ends stripped
40-50 inches wire, 18 or 20 gauge
(Radio Shack \#278-1219)
A disposable ball point pen
Lantern battery, 6 volts or more
The largest iron nail that will fit inside the pen (loosely)
Wire stripper or knife

## Explorling <br> Sclentilic Procedures

Exploring Scientific Procedures (ESP) is a method of introducing the concepts of scientific inquiry to children which include:

Independent/Independent Variables


Hypothesis building
Constructing data tables
and
Graphing

begin to see how the independent/dependent variables, hypothesis, data tables and graphs are all related to the process of effective scientific inquiry.


ESP is a method to integrate the process of scientific inquiry into your regular science curriculum

ESP encourages problem-solving strategies for children and adults

ESP is low cost !!!
ESP is a discipline that requires time and patience

ESP should be used repetitively, in short amounts, over a long period of time (similar to learning multiplication tables!!!)

## Definition:\#1



ESP is not a script to be read

ESP is not a curriculum to be memorized, but a method towards scientific literacy

ESP does not have a standardized timeline

ESP is not exclusively for children
ESP is not a long list of definitions found within a massive textbook
(two definitions are all you need.....)

## Independent Variable

What "I" change in the experiment
To make life easier for your children, you may want this "change" to be measurable - i.e. weight, mass, volume, height, etc..

## Dependent Variable

The result from the change you made
This variable, also known as data, "depends" on your independent variable and, again, should be measurable.

The independent and dependent variables are close relatives and can be found throughout the following steps of scientific inquiry:


Let's start with a...


Does the $\qquad$ affect the $\qquad$ $?$ (Independent Variable)
(Dependent Variable)

Now that you've asked a QUESTION, it is time to change it into a...


If the $\qquad$ is $\qquad$
(Independent Variable)
(increased/decreased)
then the $\qquad$ will $\qquad$ .
(Dependent Variable)
(increase/decrease)

All data that is collected within an experiment must be in an easy format for future study. The following data table should remain the same throughout each of your child's experiments. With practice, they will become very proficient in recording data that can be easily analyzed.

| Independent <br> Variable | Dependent Variable |  |  |  |
| :--- | :---: | :---: | :--- | :--- |
|  | Trial One | Trial Two | Trial Three | Average |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |



While analyzing the data in an experiment, you are typically looking for patterns and relationships between what you are changing
(the INDEPENDENT
VARIABLE) and your data (the DEPENDENT VARIABLE).


A GRAPH can help visualize the data in a way that is easier to see any of these possible relationships.

The TITLE of any GRAPH should restate the HYPOTHESIS of the experiment....
....this helps the person who is reading your graph to easily identify what the data is all about!!!

## Title

Dependent Variable

Independent Variable

The effect of the
(Independent Variable) on the $\qquad$ .
(Dependent Variable)

# Children must see the independent variable and the dependent variable in the... 



## Let's try an example...

 Does the distance a rubber band is pulled back affect the distance a rubber band can travel?

Can you identify the Independent and Dependent variables?
IV = ...distance a rubber band is pulled back
DV = ...distance a rubber band can travel

## LOOK FOR THESE PHRASES THROUGHOUT THE EXAMPLE!!!

If the distance a rubber band is pulled back is increased, then the distance a rubber band can travel will decrease.

## DATA TABLE

| Distance a <br> rubber band is <br> pulled back | Distance a rubber band can travel |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
|  | Trial One | Trial Two | Trial Three | Average |
|  |  |  |  |  |
|  |  |  |  |  |

The effect of the distance a rubberband is pulled back on the distance a rubberband can travel

Distance a rubber band can travel

Distance a rubber band is pulled

## The phrases...

"distance a rubber band is pulled back" and "distance a rubber band can travel"

## YOU NEVER CHANGE THE PHRASES...

Therefore, the child will easily see the relationships between the:


Have your child explore one activity a week. At first, provide them with a question, a hypothesis a data table and a graph...
...after a few weeks, ask your child to start writing their own hypothesis from your question. In addition, have them set up their own data table and graph before starting the experiment. With weekly repetition, children will be able to effectively set up, run and analyze the results of a scientific experiment!



More importantly, each experiment can be used to reinforce the scientific concept your child is currently learning.

## For example.... .

If your child is learning about how energy can be transferred from potential to kinetic, you can use the rubber band experiment to reinforce this concept....
...and while they are learning about the transfer of potential energy to kinetic energy, they are also practicing effective scientific inquiry procedures!

Once your child becomes more proficient at this model....

## You can really start having fun with them!



## Have the child list:

All of the materials used in the experiment (i.e. ruler, rubberband, etc.)
and
All of the possible ways the materials could have been changed (each of which is a "SOE") (i.e. size, shape, color of rubber band, angle of the launch, presence of wind, etc...

All materials in an
 experiment must remain CONSTANT

The possible changes in materials identify sources of error (SOE) that could alter the results of an experiment.

Constants are very important because you only want to change ONE variable in your experiment!!!!

Why do you only want to change ONE thing in your experiment?
So that you can identify what variable is altering the results in your experiment.....
....if you changed two variables, how would you know which one is affecting the results???

Constants share their importance with another factor in experiments..


# The control is a trial within your experiment that is used to identify any unknown SOE's that may be affecting your data 

For example...

If your child wishes to see the effects of salt water on the growth rate of plants, the CONTROL in this experiment would be to use ordinary water with their plants to gauge the normal growth rate. Along with this CONTROL, the child will grow other plants with varying levels of salt water...

If all the plants die, with the exception of the CONTROL, you may assume that the salt is the culprit!!! If even the CONTROL perishes, you may have an unknown SOE in the water that needs to be identified.

The CONTROL is the normal expectation of what is to happen

Typically, you tend to already know what to expect with your CONTROL, but you run the trials anyway...just to be certain there are no hidden SOE's that could affect your results.


# So what do you do when your child is very comfortable with setting up, running and analyzing the results from an experiment??? 



# The QMS stands for: <br> Question Method Solution 

Consider the QMS Strategy as the "challenge phase" of this method.....
Up to this time, you have been providing your child with the Question to solve in their experiments

Now, let's change the procedure a bit...

Instead of providing the question to your child, now provide the Method (a procedure) or Results (a data table or graph) for them to follow....

- For example -

By providing a completed graph to your child, or perhaps a procedure, your child can be asked to determine the experimental


By providing a graph such as this:


The Independent and Dependent Variables can be identified......
.... and can be used to create a question and a hypothesis such as these:

## Question:

Does the time of day affect its temperature?
Hypothesis:
If the time of day is increased, then the temperature will increase/decrease ....and a data table such as this:

| Time of <br> day | Temperature |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
|  | Trial One | Trial Two | Trial Three | Average |
| 8 am |  |  |  |  |
| Noon |  |  |  |  |
| 4 pm |  |  |  |  |

The QMS Strategy forces the child to look at an experiment from a more practical way...
as a PROBLEM to solve!!!

You really cannot be "wrong" In running a scientific experiment...as long as you can defend your data.

It does not matter if your data supports or does not support the hypothesis; each experiment should set the stage for further experiments to explore.



The Metric System



1. Read the text
2. Review the text with your child
3. Complete the student worksheets
4. Find the following materials for Days Two and Three:

DRINKING STRAW<br>PAPER PLATE<br>COTTON BALLS

## You and your child(ren) will be covering the following Science Standards this week:

Tools help scientists make better observations, measurements, and equipment for investigations. They help scientists see, measure, and do things that they could not otherwise see, measure, and do.
Metric System
a way scientists measure many different things in the world
Weight
("wayt"); a measurement of how heavy an object is
("tem-pur-ah-chur"); a measurement of how much energy is in an object

## Length

distance of an object or its motion

Meter
("meet-er"); the metric unit of length

## Gram

Degree Celsius
the metric unit of weight
("dee-gree sell-cee-us"); the metric unit of temperature

# Sample Questions to ask after your child finishes their reading for Day One: 

What are the metric units for weight, temperature and length?
Grams, Degree Celsius and the Meter

Which is larger: one meter or 10 centimeters?
One meter is longer than 10 centimeters.
Which weighs more: 10 grams of gold or 10 grams of water?
They both weigh the same!
What would be a comfortable temperature for us in Celsius?
A temperature in the 20's should be comfortable for most people.
Which is smaller: one kilometer or one millimeter? Millimeters are much smaller than kilometers.

## Answers to worksheet questions for Week One:

Page 1:
All vocabulary words should be circled
Page 2:

1. $B$
2. $C$
3. $A$
4. $A$
5. $C$

Page 3:

1. Metric system
2. Length
3. Degree Celsius
4. Temperature
5. Gram
6. Meter
7. Weight


Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "Metric Scavenger Hunt"

The metric system is a way scientists measure many different things in the world. Unlike the English units of measurements (i.e. inches, yards, etc.), the metric system allows scientists to communicate specific measurements of items regardless of their location on the planet.

## Metric Scavenger Hunt

Children will identify the metric measurements of simple objects.

Materials:<br>Metric Worksheet (attached)<br>Metric Ruler (attached)

## Activity:

1. Provide the Metric Worksheet to the children.
2. Instruct them to list five examples of each measurement $(5 \mathrm{~cm}, 10 \mathrm{~cm}, 15 \mathrm{~cm}$. 20 cm and 30 cm ) on the worksheet.
3. They may choose any item in your home to measure!

## Explanation:

Learning how to utilize the metric system can be a difficult task without a lot of practice. The purpose of this activity to have children become aware of the metric measurements of everyday objects they see in their home. The use of the metric system is invaluable in science, especially in more advanced practice as conversions of units will be required!

# Cut out the metric ruler on the next page. List five (5) items in your home that have the following lengths: 

## 5 Centimeters

$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
10 Centimeters
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
15 Centimeters
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$

## Cut out this metric ruler to use for your experiment!

|  |  |  | \|||||||| |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  |  |



Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "Metric Olympics"

The ability to estimate is extremely important for scientists. The metric system can take time to master, but with practice, anyone will understand how easy it is to use!

## Metric Olympics

How closely can a child match his/her metric estimate with an actual measurement?

Materials:
Olympic Scorecard (attached)
Metric Ruler (from "Metric Scavenger Hunt")
Drinking straw
Paper plate
Cotton ball

## Activity:

Have the child perform the following three "Olympic" events:

## Paper Straw Javelin Throw

1. Place feet on starting line.
2. Throw "javelin".
3. Estimate the distance (in centimeters) that you threw the "javelin".
4. Measure the distance from the starting line to the position of the straw. Record the distance on the Olympic Scorecard.

## Paper Plate Discus

1. Place feet on starting line.
2. Throw the "discus".
3. Estimate the distance (in centimeters) that you threw the "discus".
4. Measure the distance from the starting line to the position of the paper plate. Record the distance on the Olympic Scorecard.

## Cotton Ball Shot Put

1. Place feet on starting line.
2. Throw the "shot".
3. Estimate the distance (in centimeters) that you threw the "shot".
4. Measure the distance from the starting line to the position of the cotton ball. Record the distance on the Olympic Scorecard.

## Explanation:

After all three stations have been completed, the child should be able to find his/her score. This is the difference between the estimates and the actual measurement for each event. The score should be entered in the last column. If more than one child is participating, the winner is the one with the lowest score. You may wish to discuss how a low score is more accurate than a high score!

# Olympic Scorecard 

| Event | Estimate | Actual | Score (Difference) |
| :---: | :---: | :---: | :---: |
| Paper Plate Discus | centineters | centineters |  |
| Paper Straw Javelin | centimeters | Centimeters |  |
| Cotton Ball Shot Put | Catimeters | centimeters |  |
|  |  | Total $=$ |  |

##  <br> Eorce and Motion




## Today, you and your child will:

1. Read the text
2. Review the text with your child
3. Complete the student worksheets
4. Find the following materials for Days Two and Three:

$$
\begin{gathered}
10 \text { INCH SQUARE PIECE OF CARDBOARD } \\
\text { FOUR PIECES OF STRING ( } 3 \text { FEET LONG) } \\
\text { SMALL PAPER CUP } \\
\text { CLOCK } \\
\text { PENCIL } \\
\text { TWO OR THREE EGGS } \\
\text { ONE BED SHEET }
\end{gathered}
$$

## You and your child(ren) will be covering the following

 Science Standards this week:The position of an object can be described by locating it relative to another object or the background.

An object's motion can be described by tracing and measuring its position over time.

The position and motion of objects can be changed by pushing or pulling. The size of the change is related to the strength of the push or pull.

The motion of an object can be described by its position, direction of motion, and speed.

Force
Motion
Reference point
a push or a pull
("mow-shun"); occurs when the distance between two objects is changing.
("reff-fren-sss"); areas used to determine if an object is in motion
("stay-shun-air-ee"); objects that do not move on their own
("rev-o-loo-shun"); movement of an object around another object
("roe-tay-shun"); spinning movement of an object
the motion of an object as seen by a reference point

## Sample Questions to ask after your child finishes their reading for Day One:

If you are writing your name on a piece of paper, are you using force?
Yes, the pushing and pulling of a pencil across the paper requires force.

## How do you know if something is in motion?

If the distance between two objects is changing, then one or both of the objects are in motion.

What is the importance of a reference point? A stationary reference point helps to determine if an object is in motion or not.

What is the difference between rotation and revolution?
When an object rotates, it spins like a top. When an object revolves, it moves around another object.

## What is the definition of relative motion?

The motion of an object as seen by a reference point is called relative motion.

## Answers to worksheet questions for Week Two:

Page 1:
Answers will vary. However, they should include the use of a stationary reference point to identify that they are, in fact, moving around the house.

Page 2:


Page 3:

1. Reference point
2. Force
3. Motion
4. Rotation
5. Revolution
6. Relative motion
7. Stationary


Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "ESP: Centrifugal Water"

When an object rotates, it spins like a top. When an object revolves, it moves around another object. A revolving object experiences
a force called centrifugal force which keeps the object traveling in a circular path.

## ESP: Centrifugal Water

How do you keep water upside down without pouring onto your head?
Materials:
10 inch square piece of cardboard
Four pieces of string (3 feet long)
Small paper cup
Clock
Pencil

## Activity:

1. Use the pencil to punch four holes through each corner of the cardboard square. To each hole, one of the pieces of string will be attached. The strings are to come together and will need to be tied about 12 inches from the square. The remaining string will contain knots at approximately 24 inches and 36 inches from the square.
2. Place the paper cup onto the square and fill it, halfway, with water. Carefully begin to swing the tray in circular fashion. The water will not be spilled!
3. Ask the child to practice swinging the water-filled cup.
4. The instructor will need to be a timekeeper and will be responsible to count out loud for the child. The child will be responsible for swinging the tray in one circular rotation per second.
5. At this time, the child will need to hold onto the knot that is 12 inches away from the tray. (You may allow the children to practice this activity for a short period of time before placing the water-filled cup on the tray!)
6. The children will record whether or not the centrifugal force is strong enough to keep gravity from spilling the water.
7. For experimentation, change the distance of the swinging tray by holding onto the different knots.

## Explanation:

As the tray rotates, the water-filled cup does not spill because of centrifugal force. Centrifugal force can be seen within a washing machine. A force pushes the clothing to the outer walls of the washing machine as it goes through its spin cycle. All objects traveling in a circle experience this force, which is known as the centrifugal force. The strength of this force depends on several factors, including its distance from the center of the rotational orbit. Children may have difficulty keeping the water in the cup as this distance is increased as the amount of centrifugal force is decreased the farther the knot is held from the tray.

It is important to note that although it is quite easy to keep the water from spilling while in motion, the children may have difficulty in stopping the tray as the centrifugal motion will be quickly reduced.

Independent Variable: Length of the string
Dependent Variable: Amount of spilled water Hypothesis:

If the LENGTH OF THE STRING is (increased/decreased), then the AMOUNT OF SPILLED WATER will (increase/decrease).


Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "Egg-ing your Bed"

When an object is put into motion it stays in motion until an outside force acts against it.
This outside force is commonly the force of gravity. However, anything that slows down or changes the direction of a moving object provides the "outside force" acting against this motion.

## Egg-ing your Bed

Children will predict what will happen when an egg is thrown into a sheet.
Materials:
Two or three eggs
One bed sheet
Two helpers

## Activity:

Have both helpers hold the sheet at each
 corner. Let one side of the sheet hang down, then curve up the bottom to make it $j$-shaped. If they hold onto all four corners in this way, the egg will have a soft channel to fall into.

Predict what will happen when a raw egg is thrown into the sheet.
From a distance of 15 feet (or further) hurl the egg towards the center of sheet. Make sure you hit the sheet!

Did your data support your prediction?

## Explanation:

When an object is put into motion it stays in motion until an outside force acts against it. The egg is put into motion. It wants to stay in motion but the sheet acts as an outside force to stop it. The key question is how "quickly" is the egg stopped? The sheet, unlike a brick wall, has some give to it. So the egg is cushioned as it hits the sheet. The sheet actually is put into motion and energy is transferred from the eggs motion to the motion of the sheet. This actually spreads the force out over a long time.



1. Read the text
2. Review the text with your child
3. Complete the student worksheets
4. Find the following materials for Days Two and Three:

> A CHAIR WITH WHEELS A BALL TO TOSS (LIKE A TENNIS BALL)
> LIGHTWEIGHT PLASTIC KITCHEN GARBAGE-CAN LINERS
> SCISSORS
> RULER
> (12) $20-$ INCH LENGTHS OF LIGHT STRING 3 PLASTIC SANDWICH BAGS

## You and your child(ren) will be covering the following

 Science Standards this week:The motion of an object can be described by its position, direction of motion, and speed. That motion can be measured and represented on a graph.

An object that is not being subjected to a force will continue to move at a constant speed and in a straight line.

| Speed | the distance an object moves <br> over a period of time |
| :---: | :--- |
| Velocity | ("vee-loss-eh-tee"); a <br> measurement of the speed and <br> direction of an object |
| Cardinal Directions | ("card-in-all"); common directions <br> that can be used throughout the <br> world; north, south, east and <br> west |

North Pole

South Pole

Acceleration

Deceleration
the most northern spot on the planet
the most southern spot on the planet
("ak-cell-er-ay-shun"); change in motion of an objects velocity (speed or direction)
("dee-cell-er-ates"); a decrease in an object's velocity

## Sample Questions to ask after your child finishes their reading for Day One:

How is speed related to distance and time?
Speed is the distance an object travels over time. When speed increases, time decreases and vice versa.

What is the difference between speed and velocity? Both measure the distance an object travels over time; however, velocity also includes the direction the object is traveling.

The distance of an object would be measured in what kind of unit?
Meters

## What are the four cardinal directions? <br> North, south, east and west

If you slow down when you are riding your bike up a hill, are you accelerating or decelerating?
When you slow down, your velocity decreases. Therefore, you are decelerating as you ride your bike up the hill.

## Answers to worksheet questions for Week Three:

## Page 1:

Compare
Both are used to measure motion, speed and direction.

## Contrast

Acceleration deals with the speeding up of an object. Deceleration deals with the slowing down of an object.

## Page 2:

1. Acceleration
2. Speed
3. North pole
4. South pole
5. Velocity
6. Cardinal directions

## Page 3:

Whenever the speed of an object increases, the time it takes to reach the goal will decrease. Another way to say this is that when time increases, speed decreases and when time decreases, speed increases.
But you never stay moving at the same speed. Sometimes, the speed of an object changes. For example, the speed of an object will decelerate when it moves up a hill because it slows down. It will accelerate again when it moves down the hill because it will go faster!


Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "Ballistics Chair"

An object will continue to travel at the same speed and direction until an outside force acts upon it. Objects in motion that are only being pulled by a single force are called projectiles and are typically in both a horizontal and vertical motion.

## Ballistics Chair

Children will explore the force and motion of a projectile.

## Materials:

A chair with wheels
A ball to toss (like a tennis ball) or a water gun
Any toy that will shoot a harmless object 1-2 feet into the air will work as well!

## Activity:

1. Explain to the child that he/she will be throwing a ball (or squirting a water gun) into the air while sitting in a moving chair. Have him/her predict what will happen to the ball or water. Will it fall behind the child, in front or on top of the child?
2. Have a child sit in the chair.
3. Practice throwing the object straight into the air and catch it numerous times with their eyes closed!
4. Push the chair at a constant speed. This may take a little practice.
5. Have the child throw the ball straight into the air and catch it with their eyes closed.
6. If the chair is pushed at a constant speed, the object that is tossed into the air will land directly onto the child (as long as there is no wind.)

## Explanation:

A projectile is an object upon which the only force acting is gravity. Many projectiles not only undergo a vertical motion, but also undergo a horizontal motion. That is, as they move upward and downward they are also moving horizontally.

The projectile motion of the ball launched from the ballistics chair is such that it always lands back on the child as long as the speed of the chair is the same. This demonstrates the independence of horizontal and vertical velocities in projectile motion.


Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "Airborne Eggs"

An object that is falling through the air will continue to accelerate until the resistance it experiences from the wind slows it down. When this happens, the object will decelerate until it maintains a constant speed.

## Airborne Eggs

Children will create parachutes to protect their falling eggs.

## Materials:

Lightweight plastic kitchen garbage-can liners
Scissors
Ruler
12 20-inch lengths of light string
3 plastic sandwich bags
3 raw eggs

## Activity:

1. From a lightweight plastic kitchen garbage-can liner, cut out three squares. Make one square $10^{\prime \prime} \times 10^{\prime \prime}$, a second square $20^{\prime \prime} \times 20^{\prime \prime}$, and a third square 30 " by 30 ".
2. Make a parachute out of each square by tying a piece of string to each corner of the square, then attaching the other ends of the strings to a plastic sandwich bag.
3. Place a raw egg in each of the sandwich bags.
4. Ask the child to predict which egg has the best chance of surviving a drop from about ten feet from the floor.
5. Have the child drop each egg parachute from a height of ten feet, and then determine whether or not his/her predictions were confirmed.

## Explanation:

Review with the child that the force of gravity pulled the parachutes downward. Each of the parachutes accelerated until the air resistance equaled the force of gravity. When this happened, the parachutes no longer accelerated but moved at a constant speed until they reached the ground. The bigger parachutes created more air resistance than the smaller ones, so the bigger parachutes stopped accelerating much faster.

Force and Motion in the Earth and Your Body

## MAN. I WENT TO

 THE DOCTOR THE OTHER DAY. ALL THIS GLIY DID WAS SLICK BLOOD OLT OF MY NECK.I TOLD YOU NOT TO GO TO DR. ACLLA!



## Today, you and your child will:

1. Read the text
2. Review the text with your child

## 3. Complete the student worksheets

4. Find the following materials for Days Two and Three:

FOUR FOOD PRODUCTS OF DIFFERING VISCOSITIES
(I.E. KETCHLP, YOGURT, CORN SYRLP, COOKING OIL, ETC.) FLINNEL WITH AT LEAST $\frac{1}{2}{ }^{\prime \prime}$ OPENING DRINKING GLASS CLOCK WITH SECOND HAND OR STOPWATCH MEASURING CLIP

## You and your child(ren) will be covering the following

 Science Standards this week:The position of an object can be described by locating it relative to another object or the background.

An object's motion can be described by tracing and measuring its position over time.
The position and motion of objects can be changed by pushing or pulling. The size of the change is related to the strength of the push or pull.

The motion of an object can be described by its position, direction of motion, and speed. That motion can be measured and represented on a graph.

| Arteries | ("r-tur-eez"); tubes used to move blood <br> out of your heart |
| :---: | :--- |
| Capillaries | ("cap-ill-air-eez"); small tubes that <br> transport blood throughout all tissues in <br> the body |
| Veins | ("vanes"); tubes that are used to move <br> blood back into your heart |
| Blood Pressure | the force of blood pressing against an <br> artery |
| Heart Rate | how fast your heart is beating |
| Crust | a thin layer of solid rock that surrounds <br> the entire planet |
| Mantle | thick layer of Earth underneath the crust |

## Sample Questions to ask after your child finishes their reading for Day One:

What is the main job of the heart?
The main job of the heart is to pump blood throughout the body.
What are the three tubes that help move blood throughout your body?
Veins, capillaries and arteries
What is the speed of your blood to travel around your body?
It takes 60 seconds for a single drop of blood to travel completely around the human body. The average speed is about 4 meters per second.

What is the name of Earth's layer that we are standing on?
The crust
How fast are the tectonic plates moving?
The tectonic plates all move at different velocities. On average they travel around 2-7 centimeters per year.

## Answers to worksheet questions for Week Four:

Page 1:

1. $C$
2. $B$
3. $C$
4. A
5. $C$

## Page 2:

All vocabulary words should be circled

## Page 3:



## Answers to Unit 1 Review:



## Unit 1 Exam

## Match the definitions with the words on the back of this page

1. $\qquad$ areas used to determine if an object is in motion
2. $\qquad$ a measurement of how much energy is in an object
3. $\qquad$ the most northern spot on the planet
4. $\qquad$ large pieces of crust
that float on top of the mantle and fit together like a puzzle
5. $\qquad$ commondirections that can be used throughout the world; north, south, east and west
distance of an object or its motion
the distance an
object moves over a period of time
6. $\qquad$ spinning movement of an object
7. $\qquad$ change in motion of an objects velocity (speed or direction)
the force of blood pressing against an artery
8. $\qquad$ the motion or of an object as seen by a reference point
9. $\qquad$ thick layer of Earth underneath the crust
10. 
11. $\qquad$
the metric unit of weight
occurs when the distance between two objects is changing
12. $\qquad$ melted rock
13. $\qquad$ the metric unit of length
small tubes that transport blood throughoutall tissues in the body
a push or a pull
$\qquad$
14. $\qquad$ tubes that are used to move blood back into your heart
15. $\qquad$ the most southern spot on the planet
a measurement of the speed and direction of an object
how fast your heart is beating
a thin layer of solid rock that surrounds the entire planet
objects that do not move on their own
a measurement of how heavy an object is

| weight | reference point | north pole | crust |
| :--- | :--- | :--- | :--- |
| temperature | stationary | south pole | mantle |
| length | relative motion | acceleration | magma |
| meter | rotation | capillaries | tectonic plates |
| gram | speed | veins |  |
| force | velocity | blood pressure |  |
| motion | cardinal directions | heart rate |  |

## Fill in the blanks with the correct letter. The definitions below will provide a clue.



1. thick layer of Earth underneath the crust
2. objects that do not move on their own
3. change in motion of an objects velocity (speed or direction)
4. movement of an object around another object
5. the metric unit of weight
6. a measurement of how much energy is in an object
7. large pieces of crust that float on top of the mantle and fit together like a puzzle
8. the metric unit of temperature
9. a way scientists measure many different things in the world
10. the distance an object moves over a period of time
11. areas used to determine if an object is in motion
12. a measurement of how heavy an object is
13. small tubes that transport blood throughout all tissues in the body
14. spinning movement of an object
15. a push or a pull
16. tubes used to move blood out of your heart
17. the motion or of an object as seen by a reference point
18. the most northern spot on the planet
19. the force of blood pressing against an artery
20. the most southern spot on the planet
21. occurs when the distance between two objects is changing
22. a thin layer of solid rock that surrounds the entire planet
23. tubes that are used to move blood back into your heart
24. distance of an object or its motion
25. melted rock

## Which one is right? Circle the correct answer.

1. Water freezes at which temperature?
a. Zero degrees Celsius
b. Five degrees Celsius
c. Ten degrees Celsius
2. What is the missing word in this sentence: Speed is the an object moves over a period of time.
a. distance
b. time
c. velocity

## 3. Which of the following is true?

a. When the speed of an object increases, time increases
b. When the speed of an object decreases, time increases
c. When the speed of an object decreases, time decreases
4. Velocity is a measurement of...
a. speed
b. time and distance
c. speed and direction
5. Which of the following would make a good reference point?
a. A moving car
b. A house
c. A running child

## Unit 1 Exam Answer Key

## Page One:

1. Reference point
2. Temperature
3. North pole
4. Tectonic plates
5. Cardinal directions
6. Length
7. Speed
8. Rotation
9. Acceleration

Page Two:

1. Mantle
2. Stationary
3. Acceleration
4. Revolution
5. Gram
6. Temperature
7. Tectonic plates
8. Degree Celsius
9. Metric system
10. Blood pressure
11. Relative motion
12. Mantle
13. Gram
14. Motion
15. Magma
16. Meter
17. Capillaries
18. Force
19. Veins
20. South pole
21. Velocity
22. Heart rate
23. Crust
24. Stationary
25. Weight
26. Speed
27. Reference point
28. Weight
29. Capillaries
30. Rotation
31. Force
32. Arteries
33. Relative motion
34. North pole
35. Blood pressure
36. South pole
37. Motion
38. Crust
39. Veins
40. Length
41. Magma

Page Three:

1. $A$
2. $A$
3. $B$
4. $C$
5. B


Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "Slimy sliding Substances"

The motion of fluids can be affected by the force of gravity. The speed in which a fluid will move depends upon several factors. One of these factors is how closely the atoms of the fluid are bonded together. A more dense or viscous fluid will flow at a much slower rate than a less dense fluid. This is because it requires more energy to set a dense fluid in motion as compared to a less dense fluid.

## Slimy Sliding Substances

Children will record the time it takes for different fluids to flow.

## Materials:

Four food products of differing viscosities (i.e. ketchup, yogurt, corn syrup, cooking oil, etc.)
Funnel with at least $\frac{1}{2}$ " opening.
Drinking glass
Clock with second hand or stopwatch
Measuring cup

## Activity:

1. Make a prediction: Which food product has the most viscosity? Viscosity is the resistance of a fluid to flow very easily.
2. Place the funnel into the drinking glass to catch the running liquids.
3. Place one measuring cup of a food product into the funnel.
4. Time how long it takes for the food product to travel through the funnel and reach the bottom of the glass.
5. Repeat this three times for each food product.
6. Record the time for each trial in a chart.

## Explanation:

Because viscosity is defined as the resistance to flow, those food items that flow the slowest have the highest viscosities. Viscosity is very important to the study of fluids such as blood or lava. In the Earth, lava can be found in three different types- basaltic, andesitic, and rhyolitic. Each of these types of lava contains different amounts of silica $\left(\mathrm{SiO}_{2}\right)$ and dissolved gases. They have different viscosities based on the amount of silica they contain. Lowsilica lavas are less viscous and travel faster than higher-silica lavas, which are more viscous and travel slower. Viscous lavas sometimes cool before they travel very far, which is why they are often less hazardous.


Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "Speeding up your Heart Rate"

With exercise or physical activity, the heart rate increases to supply the muscles with more oxygen to produce extra energy. This oxygen is carried by the red blood cells through the veins, capillaries and arteries of the body. The heart can beat up to 200 times per minute with extreme exercise. The brain sends nerve signals to the heart to control the rate. The body also produces chemical hormones, such as adrenaline, which can change the heart rate. When we are excited, scared, or anxious our heart gets a signal to beat faster.

## Speeding Up Your Heart Rate

Children will measure the speed of their heart rate.

## Materials:

Clock with second hand or stopwatch

## Activity:

1. Help the child locate their pulse points either on their wrists or necks. Ask them to place their right index and middle finger on the palm side of their left wrist. On the neck, the pulse point is located beneath the ear and jawbone.
2. Count the number of beats in 15 seconds. Multiply this number by four. This is how many times the heart beats in one minute. (A child's pulse rate at rest will vary between 60-110 beats per minute.)
3. Instruct the child to do some exercise such as running in place, jumping jacks, or other exercise for one minute. Stop and check their pulse again over 15 seconds. Calculate the heart rate once again. How high did it go up this time?

## Explanation:

During each heartbeat, the muscles of the heart contract causing a wave of pressure which forces blood through the arteries. This wave of pressure is known as a pulse. There is one pulsation for each heartbeat. The normal pulse rate varies with age.

With exercise or physical activity, the heart rate increases to supply the muscles with more oxygen to produce extra energy. The heart can beat up to 200 times per minute with extreme exercise. The brain sends nerve signals to the heart to control the rate. The body also produces chemical hormones, such as adrenaline, which can change the heart rate. When we are excited, scared, or anxious our heart gets a signal to beat faster.

## When

## Gravity and Force

Cartoon law \#232

ANY BODY SUISPENDED IN SPACE WILL REMAIN IN SPACE UNTIL MADE AWARE OF ITS SITUATION.


##  <br> Today, you and your child will:

1. Read the text
2. Review the text with your child
3. Complete the student worksheets
4. Find the following materials for Days Two and Three:

SEVERAL SHEETS OF NOTEBOOK/TYPING PAPER MASKING TAPE SEVERAL BOOKS<br>PLASTIC DRINKING CUP SCISSORS WATER

## You and your child(ren) will be covering the following Science Standards this week:

An object's motion can be described by tracing and measuring its position over time.
The position and motion of objects can be changed by pushing or pulling. The size of the change is related to the strength of the push or pull.

| Newton | the metric unit of force |
| :---: | :--- |
| Gravity | a force that pulls two <br> objects together |
| Net Force | the difference of all forces <br> acting on an object at once |
| Unbalanced Forces | two or more forces that are <br> acting with or against each <br> other; the larger force will <br> decide the direction the <br> object will move |
| Balanced Forces | two or more forces that are <br> acting with or against each <br> other that are equal in <br> strength |

# Sample Questions to ask after your child finishes their reading for Day One: 

## What is the force that pulls two objects together? Gravity

How do scientists measure force like velocity or acceleration?
Not only do they measure how many Newtons of pushing and pulling are going on, they also measure the direction of the force too.

How does an unbalanced force cause an object to move? The object using the stronger force will move the object with the weaker force.

Why do balanced forces not cause any motion?
With balanced forces, all of the force pushing or pulling in one direction is equal to the force pushing or pulling in the opposite direction.

What is the net force of an object?
The difference of all forces acting on an object.

## Answers to worksheet questions for Week Five:

## Page One:

Answers will vary. Be certain their response includes the proper use of the vocabulary words "Newton" and "Net Force".

Page Two:


Page Three:

1. Balanced forces
2. Unbalanced forces
3. Newton
4. Net force
5. Gravity


## Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "ESP: How does one recycle a building?"

The use of columns to support massive loads is not uncommon in building practices. Columns are capable of supporting significant amounts of weight as compared to their own miniscule size. As long as the weight is evenly distributed, the columns will be able to support the balanced force of the weight. If one column begins to take on too much weight, the structure will not last very long because of the unbalanced forces!

# ESP: How does one recycle a building? 

Children will support large amounts of weight with lightweight pillars.

Materials:<br>Several sheets of notebook/typing paper<br>Masking tape<br>Several books

## Activity:

1. Roll and tape four sheets of paper into tubes that are eight and a half inches long and approximately two inches in diameter.
2. Stand the tubes on end and stack as many books as possible on these pillars.
3. Record the number of books that could be stacked on the pillars.
4. Create pillars of different diameters for experimentation.

## Explanation:

The use of columns to support massive loads is not uncommon in building practices. These paper pillars are capable of supporting significant amounts of weight as compared to their own miniscule size. As long as the weight is evenly distributed, all four pillars will work in unison to distribute the load evenly throughout its area. If one side begins to take on too much weight, the structure will not last very long!

Independent variable: Diameter of the pillars
Dependent variable: Amount of books the pillars can hold Hypothesis:

If the DIAMETER OF THE PILLARS is (increased/decreased), then the AMOUNT OF BOOKS THE PILLARS CAN HOLD will (increase/decrease).


Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "Weightless Water"

On Earth, objects that are falling accelerate downwards due to gravity. So if you hold onto a water-filled cup with a hole in it, the water will be pulled downwards through the hole and end up on the floor.

If you let go of this same cup however, the cup and the water are both accelerating towards the ground at the same rate. This means that if you drop them both together they will both fall at the same speed and so the water won' $\dagger$ fall out.

## Weightless Water

Children will support large amounts of weight with lightweight pillars.

## Materials:

Plastic drinking cup
Scissors
Water

## Activity:

1. You will need to be outside for this activity. Describe the following activity to the child. Ask them to predict what will happen to the water in the cup.
2. Use the nail scissors to cut a small hole in the bottom of the cup using the nail scissors. The hole should be a little smaller than your finger.
3. Put your finger over the hole and fill the cup with water.
4. Rest the cup on the finger over the hole, and stabilize it with your other hand.
5. Drop the cup by pulling your finger downwards as fast as possible.
6. You should find that the water stays inside the cup as it is falling even though there is a big hole in the bottom.

## Explanation:

On Earth, objects that are falling accelerate downwards due to gravity. So if you hold onto the cup with a hole in it, the water will be pulled downwards through the hole and end up on the floor.

As the cup is falling, the cup and the water are both accelerating towards the ground at the same rate. This means that if you drop them both together they will both fall at the same speed and so the water won't fall out.

## WNEN MBT Eriction



##  <br> Today, you and your child will:

## 1. Read the text

2. Review the text with your child

## 3. Complete the student worksheets

4. Find the following materials for Days Two and Three:

PLASTIC LID<br>PAPER PUNCH (OPTIONAL)<br>2 FEET OF STRING<br>TAPE<br>20 LARGE WASHERS<br>2 LARGE SHEETS OF SANDPAPER

## You and your child(ren) will be covering the following

 Science Standards this week:The position and motion of objects can be changed by pushing or pulling. The size of the change is related to the strength of the push or pull.

The motion of an object can be described by its position, direction of motion, and speed. That motion can be measured and represented on a graph.

If more than one force acts on an object along a straight line, then the forces will reinforce or cancel one another, depending on their direction and magnitude. Unbalanced forces will cause changes in the speed or direction of an object's motion.

| Friction | ("frick-shun"); a force <br> between two objects when <br> they rub against each other |
| :---: | :--- |
| Static Friction | friction that takes place <br> when one of the two rubbing <br> objects is not in motion |
| Sliding Friction | the force that is created <br> between two objects that <br> are sliding against each <br> other |

Rolling Friction

## Friction that takes place

 when an object rolls across a surfaceFluid Friction
friction that takes place when an object slides across a fluid

## Sample Questions to ask after your child finishes their reading for Day One:

How does friction act on a moving snow sled?
As your sled slides across the surface of the snow you are creating unbalanced forces between friction and gravity.

What force causes a snow sled to move? What force causes it to stop?
The force of gravity causes a snow sled to slide down a hill. The force of friction causes it to stop.

Which type of friction involves an object that is not in motion?
Static friction takes place when one of two rubbing objects are not in motion.
Why do balanced forces not cause any motion?
With balanced forces, all of the force pushing or pulling in one direction is equal to the force pushing or pulling in the opposite direction.

What is the net force of an object?
The difference of all forces acting on an object.

## Answers to worksheet questions for Week Six:

Page 1:
Answers will vary. All four types of friction must be provided and at least one example for each.

Static friction - moving a pencil, opening a door, etc...
Sliding friction -any sliding motion (i.e. a carpet, the dog, etc...)
Rolling friction - any rolling motion (i.e. a toy car, skateboard, etc...)
Fluid friction - any motion that requires lubrication (i.e. oil in the car)

## Page 2:

Be certain all words are circled.

## Page 3:

1. Rolling friction
2. Sliding friction
3. Static friction
4. Friction
5. Fluid friction


## Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "ESP: Slip, Sliding Away!"

An object that is sliding on a surface is typically affected by the forces of gravity and friction. If the friction between two objects is high, the sliding object will slow down faster. The force of friction can be reduced if the two objects that are rubbing against each other are lubricated with a fluid or if a rolling device is placed on one (or both) of the objects.

## ESP: Slip, Sliding Away!

The use of sandpaper will help to understand the concept of friction.

## Materials:

Plastic lid<br>Paper punch<br>(optional)<br>2 feet of string

Tape
20 large washers
2 large sheets of
sandpaper

## Activity:

1. Punch a hole into the side of the plastic lid or simply tape the end of the string onto the lid itself. Tie the paperclip to the end of the other string.
2. Place the plastic lid onto a table with the string hanging over the edge.
3. Hook washers onto the paperclip until the plastic lid is pulled off the table onto the floor. Record the number of washers it took for the lid to fall. Repeat two more times.
4. Tape a large sheet of sandpaper onto the table, place the lid onto the sandpaper and repeat the experiment three times.
5. Repeat it three more times after cutting and taping a disk of sandpaper onto the bottom of the lid. In this experiment, be certain to have lid on the surface of a piece of sandpaper as well.

## Explanation:

Friction occurs when two objects rub against each other. The nature of the surfaces determine the amount of friction that occurs. As the amount of sandpaper is increased from none, to the table, and to both the table and the lid the amount of friction will increase. As the level of friction is increased, the amount of washers needed to make the lid move will increase as well.
Independent variable: Amount of sandpaper
Dependent variable: Number of washers

## Hypothesis:

If the AMOUNT OF SANDPAPER is (increased/decreased), then the NUMBER OF WASHERS will (increase/decrease).


Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "Phonebook Friction"

As the size of two objects that are rubbing together increase, the amount of friction between them will increase as well.

Therefore, the relatively small amount of force between two pieces of paper may produce a very small amount of friction: however, the greater the stack of papers, the greater the friction between them.

## Phone Book Friction

The force of friction will be explored using recyclable items.

## Materials:

Two paperback books (i.e. phonebooks, catalogs, etc.) that contain at least 100 pages
Two people

## Activity:

1. Place the books on a table. Ask the child if they think they can do work on both of the paperback books. This should not be a problem at all! All that has to be done is to move them in some way.
2. Now shuffle ten pages from each of the two books so that their pages overlap each other.
3. Ask the child if they can separate the books from each other.
4. Repeat this procedure by shuffling more and more pages on top of each other. Eventually, the child will not be able to pull the books apart.

## Explanation:

The ability to move one the books across the table requires the child to use enough force to overcome the static friction of the book on the table. The amount of static friction increases as more and more pages are stacked on top of each other. In order to overcome the static friction of ten pages stacked together, the amount of force required will need to be increased by ten times! Twenty pages would require twenty times the amount of force and so on!

Newton's Eirst Law



1. Read the text
2. Review the text with your child
3. Complete the student worksheets
4. Find the following materials for Days Two and Three:

10-15 QLARTERS<br>SMOOTH COUNTER TOP<br>TOY CAR AND PASSENGER (I.E. SPONGE, DOLL, STLIFFED ANIMAL, ACTION FIGURE, ETC.)<br>RAMP (MADE FROM RULERS, WOOD, CARDBOARD, ETC.)<br>BRICK OR STACK OF BOOKS<br>RULER

You and your child(ren) will be covering the following Science Standards this week:

An object that is not being subjected to a force will continue to move at a constant speed and in a straight line.

| Mass | a measurement of the <br> amount of matter in an <br> object |
| :---: | :--- |
| Matter | the basic building blocks of <br> all solids, liquid and gases |
| Sir Issac Newton | famous scientist who <br> discovered many laws about <br> force and motion |
| Newton's First Law | an object at rest will remain <br> at rest, and an object in <br> motion will remain in motion <br> unless an unbalanced force <br> acts on the object in motion |
| Inertia | ("in-er-sha"); the desire of <br> an object to remain at rest <br> or to keep moving in a <br> straight line |

# Sample Questions to ask after your child finishes their reading for Day One: 

## What two things affect gravity?

Mass and distance
How does the larger mass of the Earth compared to the moon affect gravity?
Earth has more mass and therefore has a stronger force of gravity than the moon.

## What is Newton's First Law of Motion?

An object at rest will remain at rest, and an object in motion will remain in motion unless an unbalanced force acts on the object in motion

## Can a law be created after one experiment?

No, scientists must run dozens of experiments on a single discovery and all of the results must support the same discovery before a law is created.

## How does a seatbelt protect you from inertia?

Because of inertia, you will keep moving towards the front of the car when the car stops until the force of the seatbelt pulls you back. Without the seatbelt, you would keep moving forward into the car.

## Answers to worksheet questions for Week Seven:

Page 1:
Compare
Both are forms of measurements and both are measured in grams. Contrast
Mass deals with how much matter is in an object... weight deals with how much gravity is pulling on an object

Page 2:


Page 3:

1. Inertia
2. Sir Issac Newton
3. Newton's First Law
4. Matter
5. Mass

6. Review Day One with the information found below.
7. Run the activity "ESP: A Pile of Money"

The Law of Inertia states that an object at rest, like a stack of coins, will stay at rest. When a coin is flicked towards the stack, the moving coin is full of energy and transfers its energy to the bottom coin at contact. However, the greater the mass, the greater the inertia of the stack of coins. Therefore, the more coins that are placed into the stack, the more difficult it will be to move the stack of coins.

## ESP: A Pile of Money

Inertia will be explored using a few coins.

## Materials:

10-15 quarters
Smooth counter top

## Activity:

1. Stack 3 quarters onto the smooth counter top.
2. Flick a quarter into the bottom of the stack trying to remove the very bottom quarter leaving the rest of the stack intact.
3. Record whether or not the stack was disturbed when the bottom quarter is removed.
4. Increase the number of quarters in the stack for experimentation.

## Explanation:

The Law of Inertia states that an object at rest, like the stack of coins, will stay at rest. When a coin is flicked towards the stack, the moving coin is full of energy and transfers its energy to the bottom coin at contact. However, the greater the mass, the greater the inertia of the stack of coins. Therefore, the more coins that are placed into the stack, the more difficult it will be to move the stack of coins.

Independent variable: Number of quarters
Dependent variable: The ability of the stack to remain undisturbed Hypothesis:
If the NUMBER OF QUARTERS is (increased/decreased), then the ABILITY OF THE STACK TO REMAIN UNDISTURBED will (increase/decrease).


Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "ESP: Buckle up"

Newton's First Law of Motion states that an object not being pushed or pulled by a force will either remain still or continue moving in its same path at the same speed. The tendency for an object to continue moving in the same path at the same speed is called inertia. For example, if you were to try to quickly stop from running very quickly, you may be able to stop your legs, but the inertia of your upper body would continue to move you forward.

## ESP: Buckle Up

The importance of seatbelts will be modeled in this activity.

## Materials:

Toy car and passenger (i.e. sponge, doll, stuffed animal, action figure, etc.)
Ramp (made from rulers, wood, cardboard, etc.)
Brick or stack of books
Ruler
Books

## Activity:

1. Construct the ramp using a single book for height. Place brick at the end of the ramp.
2. Place car with passenger onto ramp. Release the car.
3. Record the distance between the brick and where the passenger landed
4. Increase the ramp height using books for experimentation.

## Explanation:

This activity restates the importance of seatbelts. As the car and "passenger" strikes the brick, the energy of the car is overpowered by the inertia of the brick (don't forget - all objects have inertia, even those that are at rest...and the greater the mass of the object, the greater the inertia!!!) and, therefore, is stopped immediately. However, since the passenger is not attached to the car, the inertia of the brick cannot stop it from traveling at the same speed and at the same direction. The inertia of the passenger continues to move itself at the same speed and in the same direction until gravity and friction forces the object to slow down.
Independent variable: Height of the ramp
Dependent variable: Distance between the brick and the passenger. Hypothesis:

If the HEIGHT OF THE RAMP is (increased/decreased), then the DISTANCE BETWEEN THE BRICK AND THE PASSENGER will (increase/decrease).

## Whenc racded

## Newton's Second and Third Laws.

## DOES ANYONE KNOW WHAT A NEWTON IS?



## Today, you and your child will:

1. Read the text
2. Review the text with your child
3. Complete the student worksheets
4. Find the following materials for Days Two and Three:

RACQUETBALL
LITILITY KNIFE SCISSORS
TENNIS BALLS, BASKETBALLS, ETC. SEVERAL SMALL BOOKS 10-20 PAPER/PLASTIC DRINKING CUPS

## You and your child(ren) will be covering the following Science Standards this week:

An object that is not being subjected to a force will continue to move at a constant speed and in a straight line.

If more than one force acts on an object along a straight line, then the forces will reinforce or cancel one another, depending on their direction and magnitude. Unbalanced forces will cause changes in the speed or direction of an object's motion.

Momentum

## ("moe-men-tum"); mass in

 motionNewton's Second Law

Newton's Third Law
acceleration depends on an object's mass and the net force acting on the object
for every action there is an equal and opposite reaction

Action Force
any force that is acted on any object
created when an object pushes against an action force

## Sample Questions to ask after your child finishes their reading for Day One:

## Acceleration is a measurement of what two things? Speed and direction

## What is Newton's Second Law of Motion?

Acceleration depends on an object's mass and the net force acting on the object
The amount of momentum which an object has depends on what two things?

Mass and velocity

## What is Newton's Third Law of Motion?

For every action there is an equal and opposite reaction.
Why do you not feel the Earth pushing up against you every time you take a step?
The Earth's inertia is much greater than you are. Therefore, your step (action force) is much smaller compared to the Earth pushing back against you (reaction force).

## Answers to worksheet questions for Week Eight:

Page 1:

1. $A$
2. $A$
3. $C$
4. B
5. $A$

Page 2:
Be certain all vocabulary words have been circled.
Page 3:


## Answers to Unit 2 Review:

1. Mass
2. Newton's First Law
3. Sir Issac Newton
4. Newton's Second Law
5. Inertia
6. Gravity
7. Matter
8. Net force
9. Action force
10. Balanced forces
11. Static friction
12. Rolling friction
13. Friction
14. Momentum
15. Sliding friction
16. Newton
17. Newton's Third Law
18. Reaction force
19. Unbalanced forces
20. Fluid friction

## Unit 2 Exam

Place the answers to the following clues in the boxes below. Each box should contain one letter.


ACROSS
3. the desire of an object to remain at rest or to keep moving in a straight line
4. the basic building blocks of all solids, liquid and gases
6. the force that is created between two objects that are sliding against each other
9. two or more forces that are acting with or against each other that are equal in strength
11. for every action there is an equal and opposite reaction

## DOWN

1. a force between two objects when they rub against each other
2. a force that pulls two objects together
3. the difference of all forces acting on an object at once
4. a measurement of the amount of matter in an object
5. any force that is acted on any object
6. the metric unit of force
7. mass in motion
8. friction that takes place when one of the two rubbing objects is not in motion

Fill in the blanks with the correct letter. The definitions below will provide a clue.

1. $S_{R} R_{-} S_{-} C_{-} H_{-}$
2. _ _UID _ _ _ C_I_ _ _
3. $I_{\text {_ _ _ _ }}$ IA

4. $A_{\sim} I_{-} I_{-} F_{-} C E$
5. $U_{-} \__{-} A_{-} E_{-} F_{-} R_{-} S_{-}$

6. _ _ _ TO _
7. $\mathrm{NE} \__{-} \__{-} C_{-}$

8. _ _ _ _ON_ _ _T_I_D_L_W
9. G_A _ _ _Y
10. $M O_{\ldots} \quad$ _ _ $M$
11. _ _ _ - _ _ _ _RICT_ _N
12. _ AS _
13. _ $\left.{ }^{A}\right]^{T}$ _ _
14. $\mathrm{FR}_{-} \mathrm{C}_{-}-{ }_{-}$
15. $\mathrm{E}_{-} \mathrm{TIO}_{-} \mathrm{H}_{-} \mathrm{O}_{-} \mathrm{E}$
16. _ $\mathrm{E}_{\text {_ _ _ }} \mathrm{N}^{\prime} \mathrm{S}_{\text {_ _ }} \mathrm{I}_{-} \mathrm{S}_{\text {_ _ _ _ }} \mathrm{W}$

17. famous scientist who discovered many laws about force and motion
18. friction that takes place when an object slides across a fluid
19. the desire of an object to remain at rest or to keep moving in a straight line
20. friction that takes place when an object rolls across a surface
21. any force that is acted on any object
22. two or more forces that are acting with or against each other; the larger force will decide the direction the object will move
23. acceleration depends on an object's mass and the net force acting on the object
24. the metric unit of force
25. the difference of all forces acting on an object at once
26. two or more forces that are acting with or against each other that are equal in strength
27. for every action there is an equal and opposite reaction
28. a force that pulls two objects together
29. mass in motion
30. the force that is created between two objects that are sliding against each other
31. a measurement of the amount of matter in an object
32. the basic building blocks of all solids, liquid and gases
33. a force between two objects when they rub against each other
34. created when an object pushes against an action force
35. An object at rest will remain at rest, and an object in motion will remain in motion unless an unbalanced force acts on the object in motion
36. friction that takes place when one of the two rubbing objects is not in motion

## Unit 2 Exam Answer Key

## Page One:



## Page Two:

1. Sir Issac Newton
2. Fluid friction
3. Inertia
4. Rolling friction
5. Action force
6. Unbalanced forces
7. Newton's Second Law 15. Mass
8. Newton
9. Net force
10. Balanced forces
11. Newton's Third Law
12. Gravity
13. Momentum
14. Sliding friction
15. Mass
16. Matter

## 17. Friction

18. Reaction force
19. Newton's First Law
20. Static friction


## Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "Hopper Popper"

Energy can be neither created nor destroyed, but it can be converted from one form to another and it can be transferred from one object to another. This can be witnessed when one is studying Newton's Third Law.

## Hopper Popper

Children will explore the conservation of energy with this simple device.
Materials:
Racquetball
Utility knife

Tennis balls, basketballs, etc.
Table

Scissors
Strip of cardboard (4 inches wide and at least 1 foot long)

## Activity:

1. Use the utility knife to cut the racquetball in half.
2. Turn one of the halves inside out and carefully trim all the way around the outer edge.
3. Test your cuts often by dropping the $1 / 2$ racquet ball (turned inside out) on the floor or table. When it springs back higher than your dropping point you have a working hopper popper.
4. If the $1 / 2$ racquet ball will not stay in the inside out configuration, you have trimmed away too much rubber and you must start over.
5. Hold down few inches of the cardboard onto the edge of a table.
6. Turn the racquet ball inside out and place it on the end of the cardboard strip that is hanging above the floor. When the hopper flies into the air, the cardboard strip should be forced downward.

## Explanation:

Energy can be neither created nor destroyed, but it can be converted from one form to another and it can be transferred from one object to another. During a collision, energy is usually transferred from one object to another. The energy used to turn the racquetball inside out is stored in the racquetball half. This racquetball half is storing energy much like a spring. When the racquetball half collides with the cardboard strip, it is lifted into the air. At the same time, the energy from the hopper drives the cardboard strip downward. This demonstrates Newton's Third Law that for every action there is an equal and opposite reaction.


Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "ESP: Bed of Nails"

Naturally, the force from a book will easily crush a small object like a paper cup. However, the force of a book on top of several cups spread out over a greater area does not produce the same effect. The amount of force provided by the book is spread out throughout each of the cups.

## ESP: Bed of "Nails"

Students will explore Newton's Third Law by spreading out a force across a greater distance.

## Materials:

Several small books
Several small paper/plastic drinking cups

## Procedure:

1. Place the mouth of one drinking cup on the floor or on a sturdy table.
2. Balance one small book on top of the book. Continue adding books until the cup is crushed under the weight.
3. Record the number of books.
4. Increase the number of cups to support the books. Make certain you place the cups in the same location every time and that you follow the same order of books to add to the cups.

## Explanation:

Naturally, the force of a few books will cause the cups to be crushed. However, the force of the books resting on several cups is spread out over a greater area. Therefore, the amount of force each cup experiences is less than a cup by itself. Since multiple cups will spread out the force on the books (Remember: Every action has an equal and opposite reaction - the force pushing on the cups causes the cups to push back), the books will not be easily crushed when using multiple cups. This is the same concept that is used by magicians in the infamous "Bed of Nails" trick!

Independent variable: Number of cups
Dependent variable: Number of books Hypothesis:

If the NUMBER OF CUPS is (increased/decreased), then the NUMBER OF BOOKS will (increase/decrease).

## Wiend Nowie

## Work and Simple Machines




## Today, you and your child will:

1. Read the text
2. Review the text with your child
3. Complete the student worksheets
4. Find the following materials for Days Two and Three:

> 1-2 BROOM HANDLES AT LEAST 2-3 FEET LONG ROPE, STRONG, 25 FEET LONG THREE PEOPLE
> THREE OR FOUR LARGE POTATOES
> CUTTING KNIFE

TWO FEET OF $1 / 2^{\prime \prime}$ PVC PIPE
WOODEN DOWEL ROD IIT SHOULD BE OVER TWO FEET LONG AND WIDE ENOUGH TO SLIDE THROUGH THE PVC TUBE)

## You and your child(ren) will be covering the following

 Science Standards this week:Tools help scientists make better observations, measurements, and equipment for investigations. They help scientists see, measure, and do things that they could not otherwise see, measure, and do.

People continue inventing new ways of doing things, solving problems, and getting work done. New ideas and inventions often affect other people.

Science and technology have greatly improved food quality and quantity, transportation, health, sanitation, and communication. These benefits of science and technology are not available to all of the people in the world.

| Work |
| :---: |
| Machine |

the movement of an object
a tool
a machine that reduces the amount of effort to do work; a machine with only one or no moving parts

## Sample Questions to ask after your child finishes their reading for Day One:

Do you do "work" when you write your name on a piece of paper?
Yes. By moving your hand and a pencil across a paper, you are doing work
What makes a simple machine so "simple"?
Simple machines have no more than one moving part.
How are force and distance related to each other?
Force and work are related by how much work needs to be done. As force is increased, distance decreases and vice versa.

What is the \#1 rule of simple machines?
Simple machines spread out the amount of force needed to get work done over a greater distance.

## Answers to worksheet questions for Week Nine:

Page 1:
Answers may vary. A list of machines in your home and what they are used to move is to be completed.

Page 2:

1. Simple machines
2. Work
3. Machines

Page 3:

1. Work
2. Machine
3. Simple machines


## Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "Block and Tackle Pulley"

The general rule for simple machines is this: As force decreases, distance increases.

In a block and tackle pulley system, the effort needed to move an object is determined by the number of support ropes that are wrapped around the object being moved. The more times a rope is wrapped around the object to be moved, the easier it is for the puller to move the object. The trade off for the pulley, like all simple machines, is a greater distance for the puller to have to move.

## Block and Tackle Pulley

This simple pulley system will explain the usefulness of a block and tackle pulley.

## Materials:

1-2 Broom handles at least 2-3 feet long
Rope, strong, 25 feet long
Three people


## Procedure:

1. Two people will need to hold onto the broom-handles while the other will be the rope puller. If this is not possible, use a stationary pole (like a light pole outside) in place of the man in the middle of the image above.
2. Have the two broom-handle holders stand about 5 to 6 feet apart and extend their arms to hold the broom handles parallel to the floor at waist level.
3. Tie one end of the rope to the middle of one of the broom handles.
4. Wrap the rope around the middle of the other broom handle and back around the first broom handle again several times as seen in the picture. Give the free end to the rope puller who will be standing according to the picture.
5. Have the two broom handle holders try as hard as they can to prevent the broom handles from coming together as the rope puller gently pulls on the rope. They will not be able to keep from moving together.

## Explanation:

Pulleys are used extensively when heavy objects need to be lifted, especially in cranes in shipping and construction areas. The advantage of a pulley is its ability to change the number of "ropes" lifting an object. This gives a lifter a greater ability to spread the force needed to get work done. For a block and tackle pulley system, the effort needed to move an object is determined by the number of support ropes that are lifting the object Therefore, the more times the rope is wrapped around the broom handles, the easier it is for the puller to move the people. The trade off for the pulley, like all simple machines, is a greater distance


1. Review Day One with the information found below.
2. Run the activity "Potato Cannon"
for the puller to have to move. The general rule for simple machines is this: As force decreases, distance increases.

Although not a simple machine, a potato launcher does generate work by projecting an object in motion due to the increased air pressure created inside the "cannon".

## Potato Cannon

A flame-free potato launcher is always a good time!

## Materials:

Three or four large potatoes
Cutting knife
Two feet of $1 / 2^{\prime \prime}$ PVC pipe
Wooden dowel rod (it should be over two feet long and wide enough to slide through the PVC tube)

## Procedure:

1. Carefully cut the potatoes into $1^{\prime \prime}$ thick slices.
2. Place a slice of the potato on the ground. Take the PVC pipe and stab it through a potato slice so a plug is created on one end.
3. Place another potato slice on the ground and repeat for the other end of the PVC.
4. Hold the launcher in one hand and the wooden dowel in the other.
5. Aim the launcher towards an open area - never in the direction of a person.
6. Use the dowel to quickly push one end of the potato plug up towards the other.
7. The potato on the opposite end should propel through the air.

## Explanation:

The potato launchers work due to the concept that air takes up space. Once you create a potato plug on each end, you have trapped air inside the PVC pipe. When you push one potato plug with the wooden dowel, the air inside the pipe has to go somewhere. There is enough pressure created to push the opposite potato plug out of the pipe and into the air.

Rampe Wedge and Screw



1. Read the text
2. Review the text with your child
3. Complete the student worksheets
4. Find the following materials for Days Two and Three:

PENCIL<br>SCISSORS<br>5-6 BOOKS<br>RULER<br>1/2L - 2L BOTTLE (AND CAP) FILLED WITH ONE CLIP OF WATER RUBBER BANDS

## You and your child(ren) will be covering the following Science Standards this week:

The position of an object can be described by locating it relative to another object or the background.

Tools help scientists make better observations, measurements, and equipment for investigations. They help scientists see, measure, and do things that they could not otherwise see, measure, and do.

| Ramp | a simple machine made up of a <br> sloping surface that helps you <br> move things to a higher area |
| :--- | :--- |
| Wedge | a simple machine that is thick on <br> one end and gets thinner towards <br> the other end and helps you move <br> things farther apart |
| Screw | a simple machine made up of both <br> a ramp and a wedge; it is used to <br> join two objects together |

## Sample Questions to ask after your child finishes their reading for Day One:

Which would make you use more work - a set of stairs or a ladder?
Both of them would allow you to do the same amount of work.
How is a wedge like a ramp?

Both are simple machines; however, the shape of a wedge is exactly like a ramp that is turned on its side.

What is the difference in work that is done by the wedge and the ramp?
A ramp helps to move things to a higher level while the wedge moves things farther apart.

How is the screw like the ramp and the wedge?
The pointy end of a screw acts like a wedge, and the thread of metal that winds around the screw is a ramp.

Which screw would be easier to turn - a screw with many threads or fewer threads?
The screw with many threads would be easier to turn; however, it would take many more turns to drive this screw into your wood than the screw with fewer threads.

## Answers to worksheet questions for Week Ten:

Page 1:
Compare
Both are simple machines and are used to do work.

## Contrast

The wedge is designed to move things apart. The ramp is used to move things to a higher level.

Page 2:

1. Wedge
2. Ramp
3. Screw

Page 3:

1. Ramp
2. Screw
3. Wedge


## Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "A "Simple" Puzzle"

The ramp, wedge and screw are all closely related. A ramp and a wedge are nearly identical, with the placement of each machine (either on its horizontal or vertical position) determining the type of work it will perform.
The screw is a simply a ramp that is wound around an object which contains a wedge at one end.

## A "Simple" Puzzle

Children will demonstrate their understanding of three simple machines.

## Materials:

Two triangle cut outs (see attached)
Pencil
Scissors

## Procedure:

1. Cut out both objects from the attached page.
2. Instruct the child to use one or both of these objects to demonstrate the function of a wedge, a ramp and a screw. (A pencil will be needed to demonstrate the screw.)

## Explanation:

This activity could be used as a follow up exercise to review the concept of the wedge, ramp and screw. In contrast, this activity could also be used to introduce these three simple machines with proper guidance from an adult. Regardless of which method is taken, the following pictures should assist you in the successful completion of this "puzzle".


Ramp


Wedge


Screw

## Cut out both objects to complete the project.




Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "Lifting or sliding? You Decide!"

A ramp spreads out the force needed to move an object to a certain height over a greater area. This is the trade-off with all simple machines. You can easily see this by measuring the distance it would take to move up a ramp versus pulling an object straight up to the top of the ramp.

## Lifting or Sliding? You Decide!

Children will learn that a ramp can make it easier to do work.

## Materials:

5-6 books
Ruler
1/2L-2L bottle (and cap) filled with one cup of water
Rubber bands

## Activity:

1. Stack the books. Lean one of the books against the stack to make a ramp.
2. Cut rubber band and insert one end into the bottle. Seal the bottle with its cap.
3. Holding one end of the rubber band, lift the bottle straight up to the top of the books.
4. Measure the length of the stretched rubber band from where you are holding the rubber band to where it is attached to the bottle.
5. Put the bottle on its side onto the ramp.
6. Hold the end of the rubber band and slowly pull the bottle up the ramp.
7. Measure the length of the stretched rubber band when the bottle reaches the top of the ramp.

## Explanation:

More effort will be needed to lift the bottle straight up. This is why the rubber band stretches farther during your first measurement. The ramp spreads out this force over a greater area which is why the rubber band did not stretch as far during the second measurement. However, the amount of force to lift the bottle to the top of the ramp remains the same in both trials! This is because the ramp has a much longer length to reach its top. This is opposed to lifting the bottle straight up from the bottom of the ramp.

##  Wheel and Axle, Lever and Pulley




## Today, you and your child will:

1. Read the text
2. Review the text with your child
3. Complete the student worksheets
4. Find the following materials for Days Two and Three:

TWO FILM CANISTERS<br>BOOK, PIECE OF WOOD, ETC.<br>WATER<br>CLOCK<br>TAPE<br>OLD TIN CAN

TWO PAPERCLIPS<br>2-3 FLEXIBLE DRINKING STRAWS<br>TAPE<br>STRING<br>SMALL WEIGHTED OBJECT RULER

## You and your child(ren) will be covering the following

 Science Standards this week:The position of an object can be described by locating it relative to another object or the background.

Tools help scientists make better observations, measurements, and equipment for investigations. They help scientists see, measure, and do things that they could not otherwise see, measure, and do.

| Lever | a simple machine made up of a <br> rod resting on a fulcrum; used <br> to move objects to a higher <br> point |
| :---: | :--- |

Fulcrum
("full-krum"); a object used to balance a lever
("ax-el"); a simple machine made up of a wheel that rotates around a post
a simple machine made up of a wheel and axle with a groove in the wheel; a rope is placed inside the groove to move around the pulley

## Sample Questions to ask after your child finishes their reading for Day One:

How do you use a lever to move heavy objects?
By moving the fulcrum closer to the object, you can move it with much less effort.
What is the trade-off in using a lever?
By moving the fulcrum closer to the object that is to be lifted, the distance you have to reach for the other end of the lever increases.

How is a doorknob like a wheel and axle?
The handle of the doorknob are the wheels. The metal rod that attaches both doorknobs together is the axle.

What force helps to move an object when using a pulley?
The force of gravity helps to pull down on a rope attached to a pulley.

## What would happen if you attached several pulleys to move an object?

The more pulleys you use to lift an object, the farther you will have to pull on the rope to get the work done.

## Answers to worksheet questions for Week Eleven:

Page 1:

1. B
2. $A$
3. $A$
4. $C$
5. B

Page 2:
Be certain that all vocabulary words are circled.

Page 3:



1. Review Day One with the information found below.
2. Run the activity "ESP: Motion Pictures?"

Speed is directly related to both mass and momentum. An object will accelerate faster down a hill if its mass is increased.

## ESP: Motion Pictures?

Children will create a simple vehicle to transport items to the bottom of a hill.

## Materials:

Two film canisters
Glue
Book, piece of wood, etc. (to be used as a ramp)
Water
Clock
Tape

## Activity:

1. Glue the bottom of two film canisters together.
2. Add identical amounts of water into the canisters, seal them with their lids, and place them at the top of the ramp.
3. Place a strip of tape approximately three feet from the ramp. This will be the finish line.
4. Release the canisters and record their time to reach the end of a finish line. The water that is placed into the canisters can be easily increased/decreased for experimentation.

## Explanation:

By increasing the amount of water in the canisters, this simple car intensifies its momentum as it runs down the ramp. Speed is directly related to both mass and momentum and, it too, will increase with the additional mass in the canisters.

## Independent variable: Mass of the canisters

Dependent variable: Time for the car to reach the finish line Hypothesis:
If the MASS OF THE CANISTERS is (increased/decreased), then the TIME FOR THE CAR TO REACH THE FINISH LINE will (increase/decrease).


Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "Homemade Wheel and Axle"

The wheel and axle allows you to move objects greater distances; however, there is always a trade-off.

## Homemade Wheel and Axle

Children will create a working model of a wheel and axle.

## Materials:

Old tin can
Two paperclips
2-3 flexible drinking straws
Tape
String
Small weighted object
Ruler

## Activity:

1. Tape one end of each paperclip onto the top of the tin can. Position the paperclips on opposing sides of the can, allowing for a hoop of metal to be extending from the top of the can.
2. Insert the flexible straw through the hoops on top of the can. Bend the flexible portion of the straw. This end will be your wheel.
3. On the longer end of the straw that is extended from the paperclip hoops, tape a long piece of string. This area will be your axle.
4. Attached the end of the string to a small weighted object.
5. By rotating the flexible straw arm (wheel), you will rotate your axle which will cause the small weighted object to be pulled off the ground.
6. Record the distance the object is moved from the ground by counting the number of times the wheel is completely rotated.
7. Add a second straw to the end of the "wheel". This will make the wheel much larger. Repeat Step \#6 and notice the change.

## Explanation:

By increasing the size of the wheel, you can increase the distance the small weighted object is lifted off the ground as compared to the number of rotations by the wheel. For example, let's say you rotated the smaller wheel three complete times and the object was raised a total of 20 cm . However, when you repeated this activity using a wheel that was much larger, three complete rotations lifted the object much higher. This activity is designed to help the child identify that the distance around the wheel is an important part of understanding how simple machines get work done. Distance is always the tradeoff when working with simple machines.

## Wienancirnicrie <br> simple Machiness of the Body

Machines should

## work, people

should think!


1. Read the text
2. Review the text with your child
3. Complete the student worksheets
4. Find the following materials for Days Two and Three:

QUARTER<br>RULER<br>POTATO<br>KNIFE<br>STICK OF ROOM TEMPERATURE BUTTER

## You and your child(ren) will be covering the following Science Standards this week:

The position of an object can be described by locating it relative to another object or the background.

Tools help scientists make better observations, measurements, and equipment for investigations. They help scientists see, measure, and do things that they could not otherwise see, measure, and do.


## Sample Questions to ask after your child finishes their reading for Day One:

What is the function of your tendons?
Tendons attach muscle to bone and help bones to act as levers for the body.

## What acts as a fulcrum for bones?

Joints in your bones act as the fulcrum for bones.
How do your teeth act like simple machines? Sharp front teeth called incisors act as wedges for the food we eat.

If a fishing rod is a lever, where would you find the fulcrum?
A person's elbow would act as the fulcrum to a fishing rod.
Where would you find a wedge on a fishing lure? The pointy end of a fishing hook would act as a wedge.

## Answers to worksheet questions for Week Twelve:

## Page 1:

Ramp - a simple machine made up of a sloping surface that helps you move things to a higher area

Lever - a simple machine made up of a rod resting on a fulcrum; used to move objects to a higher point

Pulley - a simple machine made up of a wheel and axle with a groove in the wheel
Screw - a simple machine made up of both a ramp and a wedge; it is used to join two objects together

Wheel and axle - a simple machine made up of a wheel that rotates around a post Wedge - a simple machine that is thick on one end and gets thinner towards the other end and helps you move things farther apart

## Page 2:

Be certain that all vocabulary words are circled.

## Page 3:



## Answers to Unit 3 Review:

1. Screw
2. Wheel and Axle
3. Pulley
4. Joints
5. Bicep
6. Work
7. Incisors
8. Machine
9. Simple machines
10. Ramp
11. Tendons
12. Lever
13. Wedge
14. Fulcrum

## Unit 3 Exam

Place the answers to the following clues in the boxes below. Each box should contain one letter.


## ACROSS

1. a large muscle in your upper arm
2. a simple machine made up of both a ramp and a wedge; it is used to join two objects together
3. a simple machine made up of a rod resting on a fulcrum; used to move objects to a higher point
4. a tool
5. a object used to balance a lever
6. areas in your body where two bones meet
7. sharp front teeth
8. a simple machine made up of a wheel that rotates around a post

## DOWN

2. a simple machine made up of a wheel and axle with a groove in the wheel; a rope is placed inside the groove to move around it
3. the movement of an object
4. a machine that reduces the amount of effort to do work; a machine with only one or no moving parts
5. a simple machine made up of a sloping surface that helps you move things to a higher area
6. tough cables in your body that attach your muscles to your bones
7. a simple machine that is thick on one end and gets thinner towards the other end and helps you move things farther apart

## Match the definitions with the words on the bottom of this page



## Which one is right? Circle the correct answer.

1. How does the lever spread out the amount of force needed to get work done over a greater distance?
a. moving the fulcrum closer to an object helps to move it easier
b. keeping the fulcrum in the middle of the lever helps to move it easier
c. moving the fulcrum farther away from an object helps to move it easier
2. As force increases, $\qquad$ decreases.
a. Work
b. Force
c. Distance

## 3. Which of the following is true?

a. A wedge is a combination of a screw and a ramp
b. A screw is a combination of a wedge and a ramp
c. A ramp is a combination of a wedge and a screw

## 4. Why are simple machines called "simple"?

a. Because they are used to move objects
b. Because they are used to do work
c. Because they have no more than one moving part
5. Your teeth act just like which simple machine?
a. Wedges
b. Levers
c. Pulleys

## Unit 3 Exam Answer Key

Page One:

Page Two:

1. Fulcrum
2. Ramp
3. Joints
4. Lever
5. Pulley
6. Bicep
7. Wheel and axle
8. Machine
9. Wedge
10. Tendons
11. Work
12. Screw
13. Incisors

## Page Three:

1. A
2. $C$
3. $B$
4. $C$
5. $A$


## Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "ESP: Reflex"

The reason you can catch items thrown at you is your ability to generate a force in your arm that reacts much faster than the force of an object moving towards you.

## ESP: Reflex

Children will use the force in their arm to race gravity.

## Materials:

Quarter
Ruler

## Activity:

1. Bend arm so that palm of hand is up. Place quarter on forearm and measure the distance between the quarter and your elbow.
2. Straighten arm while trying to catch the quarter in your hand.
3. Record whether or not the quarter was caught.
4. Increase the distance between the quarter and your elbow for experimentation.

## Explanation:

The reason you can easily catch the coin is due to your ability to generate a force in your arm that reacts much faster than the force of gravity on the coin. When you move your forearm, the coin immediately responds to the force of gravity and begins to descend. However, the force you place in your arm to snap around is traveling faster than the coin. Therefore, you can easily catch the coin. As the coin is moved away from your elbow, it becomes more difficult for your hand to align itself with the coin. Naturally, this distance will be different for all participants.

Independent variable: Distance between the quarter and your elbow Dependent variable: Ability to catch the quarter

## Hypothesis:

If the DISTANCE BETWEEN THE QUARTER AND YOUR ELBOW is (increased/decreased), then the ABILITY TO CATCH THE QUARTER will (increase/decrease).


Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "Butter Wedgie"

The sharp edge of a wedge is a simple machine used to push two objects apart. The trade-off for this simple machine is that the farther you
would like an object to be split apart, the farther you have to drive your wedge through!

## Butter Wedgie

Children will learn how a wedge can move things apart.
Materials:
Potato
Knife
Stick of room temperature butter
Ruler

## Activity:

1. Carefully cut a raw potato into several different wedge shapes. For example:
2. Slowly insert the "pointed" end of the potato wedges into the butter.
3. Have the child measure the distance of the "cut" made in the butter.
4. Have the child name two ways that the distance can be made larger. (You could either drive the wedge deeper into the butter or you could use a larger wedge.)
5. Experiment with different size wedges and continue recording the results.

## Explanation:

A wedge is a simple machine used to push two objects apart. A wedge is made up of two inclined planes. These planes meet and form a sharp edge. This edge can split things apart.

For an extension activity, have the child try to eat a cookie without using their teeth and without breaking apart the cookie with their fingernails (both wedges!).

##  <br> Energy and Power




## Today, you and your child will:

1. Read the text
2. Review the text with your child
3. Complete the student worksheets
4. Find the following materials for Days Two and Three:

BASKETBALL<br>TENNIS BALL<br>YARDSTICK<br>TAPE<br>ONE DRINKING STRAW<br>SCISSORS<br>FOUR PENNIES<br>TWO PAPER CLIPS<br>STRING (THIN)<br>TWO PENCILS<br>SCISSORS

You and your child(ren) will be covering the following Science Standards this week:

Energy is a property of many substances and is associated with heat, light, electricity, mechanical motion, sound, nuclei, and the nature of a chemical. Energy is transferred in many ways.

| Energy | the ability to make things <br> happen |
| :---: | :--- |
| Power | a measure of how much energy <br> is being used over a certain <br> amount of time |
| Kinetic Energy | ("kin-et-ick"); the energy of <br> motion |
| Potential Energy | ("poe-ten-shul"); the stored <br> energy of an object |

## Sample Questions to ask after your child finishes their reading for Day One:

When work is done, an object is moved. What is passed into an object that is moved?
Energy is passed into an object that is moved.
What is "power" a measurement of?
Power is a measurement of the amount of energy used over a period of time.
When power increases, what decreases?
Time
All moving objects have what kind of energy? Kinetic

An object that is held over your head has what kind of energy?
Potential

## Answers to worksheet questions for Week Thirteen:

Page 1:
Compare
Both are types of energy and both have the ability to do work on an object. Contrast
Potential energy is stored energy while kinetic is energy of motion.
Page 2:
Be certain that all vocabulary words are circled.

## Page 3:




## Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "ESP: Energy a Go-Go"

By holding an object over the ground, you are increasing the potential energy of the object. When the object is released, the potential energy shifts to kinetic energy (energy of motion) until it strikes the ground. At this time, kinetic energy is once again transformed into potential energy.

## ESP: Energy a Go-Go

Children will explore Newton's laws by transferring energy from one object to another.

Materials:
Basketball
Tennis ball
Yardstick

## Activity:

1. Place the tennis ball onto the basketball and drop the two from different heights.
2. Measure the varying height of the tennis ball.
3. Change the height of the basketball/tennis ball combo for experimentation.
4. NOTE-Drop the balls from small heights (under two feet) and give yourself plenty of room! You may find this activity is best done outside!!!

## Explanation:

By holding the basketball/tennis ball over the ground, you are increasing the potential energy of both balls. When they are released, the potential energy shifts to kinetic energy (energy of motion) until the basketball strikes the ground. At this time, the basketball deforms as it pushes down on the floor (like a compressed spring!). When you place a small object on top of a compressed spring and let go - the energy from the spring is placed into the small object! This is why the tennis ball flies off the basketball at a much greater height!

Independent variable: Height of the balls
Dependent variable: Distance the tennis ball travels Hypothesis:
If the HEIGHT OF THE BALLS is (increased/decreased), then the DISTANCE THE TENNIS BALL TRAVELS will (increase/decrease).


Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "Dancing Pendulums"

The transfer of energy between two attached pendulums can be easily determined when placed into motion. Potential energy is transferred into kinetic and back again into potential over and over again.

## Dancing Pendulums

Children will transfer energy between two pendulums.
Materials:
Tape
One drinking straw
Scissors
Four pennies
Two paper clips
String (thin)
Two pencils
Scissors

## Activity:

1. Tape the two pencils onto the surface of a table with approximately half of their length hanging over the edge. They should be about $1-2 \mathrm{~cm}$
 closer together than the length of the drinking straw.
2. Cut two 6 -inch $(15 \mathrm{~cm})$ pieces of string and attach a paper clip to the end of each string.
3. Attach the loose ends of the strings to each pencil so that they both hang freely and at the same length.
4. Cut small slits into both sides of the straw. Slide the strings into these slits about one inch ( 3 cm ) below the pencils.
5. Attach two pennies to each of the paperclips.
6. Pull one pendulum (paperclip with two pennies) toward you a short distance and let go. Notice that after a few swings, the second pendulum will begin to swing back and forth, with the same frequency as the first pendulum.
7. With each swing, the second pendulum will increase the height of its swing. Eventually, the pendulums will swing in unison - the second pendulum will swing in resonance with the first one.

## Explanation:

The pendulums transfer their energy back and forth through the straw in this activity. As one pendulum slows down, the other begins to speed up and so on. Every time the pendulum swings, it pulls on the string and gives the other pendulum a small tug. This transfer of potential to kinetic energy as the pendulum moves continues until it delivers all of its energy into the second pendulum. However, the process is reversed as the kinetic energy of the now moving second pendulum is transferred back into the first pendulum. This process will continue until friction from the air keeps both pendulums from moving.

## When <br> Different Kinds of Energy




## Today, you and your child will:

1. Read the text
2. Review the text with your child
3. Complete the student worksheets
4. Find the following materials for Days Two and Three:

CHEWING GUM<br>TWO FILM CANISTERS GLLE<br>WOOD PLANK, BOOKS, ANYTHING TO BE USED AS A RAMP CLOCK WITH A SECOND HAND<br>TAPE<br>TWELVE OR MORE SIMILAR-SIZED BALLS (I,E. TENNIS BALLS)<br>ONE BOX OR PLASTIC TUB<br>(LARGE ENOUGH TO EASILY HOLD THE BALLS WITH ROOM TO SPARE)

## You and your child(ren) will be covering the following Science Standards this week:

Energy is a property of many substances and is associated with heat, light, electricity, mechanical motion, sound, nuclei, and the nature of a chemical. Energy is transferred in many ways.

## Mechanical Energy

Atom

## Thermal Energy

Electrical EnergyChemical Energy
Molecule
Nuclear Energy
Electromagnetic Energy
("mee-can-ick-al"); all of the kinetic and potential energy of an object

## the smallest piece of matter

the measurement of kinetic energy of atoms in motion
("eee-leck-trick-al"); energy created from the movement of electrons around an atom
a measurement of energy that holds a molecule together
a collection of two or more atoms joined together
("nuke-lee-er"); the amount of energy that holds an atom together

> ("eee-leck-tro-mag-net-ick");
energy that moves in waves

## Sample Questions to ask after your child finishes their reading for Day One:

Mechanical energy is the combination of which two types of energy?
Mechanical energy is the combination of both the kinetic and potential energy of an object.

What happens to the kinetic energy of an object as it gets hotter?
The hotter an object gets the more kinetic energy it has.
Would an electron have kinetic energy? Why or why not? Electrons are small parts of an atom that are always rotating around an atom. Therefore, they always have kinetic energy since they are always in motion.

What type of energy holds a molecule together? Chemical energy holds molecules together.

> What type of energy is used in microwaves to warm our food?

Electromagnetic energy is used by microwaves to create thermal energy in our food.

## Answers to worksheet questions for Week Fourteen:

Page 1:

1. $B$
2. $C$
3. $C$
4. $C$
5. $A$

Page 2:
Page 3:

1. Mechanical energy
2. Electrical energy
3. Electromagnetic energy
4. Atom
5. Chemical energy
6. Nuclear energy
7. Thermal energy
8. Molecule



## Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "ESP: Unbalanced Rollers"

Potential energy is needed to get an object rolling down a ramp. Once in motion, this potential energy is converted to kinetic energy. More specifically, this rolling motion would be called mechanical energy and it is influenced not only by the mass of the object but how the mass is distributed throughout the object.

## ESP: Unbalanced Rollers

The relationship between mass and kinetic energy will be explored.
Materials:
Chewing gum
Two film canisters
Glue
Wood plank, books, anything to be used as a ramp
Clock with a second hand
Tape

## Activity:

1. Glue the bottoms of the film canisters together.
2. Construct a ramp and create a finishing line with tape approximately 2-3 feet from the ramp.
3. Roll the film canisters down the ramp and record the amount of time it takes for it to reach the finishing line.
4. Chew one piece of gum until it is soft and pliable. Divide it in half and place the pieces in identical places in both canisters. Roll the canisters down the ramp and record the time.
5. Increase the amount of chewing gum for experimentation.

## Explanation:

Potential energy is needed to get the canisters rolling down the ramp. Once in motion, this potential energy is converted to kinetic energy. It is important to note, however that how the mass of an object is distributed determines how fast it can travel. If the gum is placed on the bottom of each canister, its speed will be increased. However, should the gum be placed on the walls of the canisters, it will take more potential energy to get the canister rolling. With more energy being used to start the rolling process, less energy will be provided for the canister to gain speed.

Increasing the mass of gum may or may not alter the speed of the canisters as it depends entirely on its location within the canisters!

Independent variable: Mass of the gum
Dependent variable: Time to reach the finish line Hypothesis:
If the MASS OF THE GUM is (increased/decreased), then the TIME TO REACH THE FINISH LINE will (increase/decrease).


Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "Changing Your State with Spheres"

The atomic theory of matter tells us that all objects are made up of tiny particles called atoms which are constantly in motion. Adding heat energy to a solid causes its atoms to move faster and slide around each other as with a liquid. Adding a lot of heat energy will separate these atoms completely and will turn a liquid into a gas!

## Changing your State with Spheres

The changing states of matter will be discovered by this simple activity.

## Materials:

Twelve or more similar-sized balls (i.e. Styrofoam, tennis balls, etc.)
One box or plastic tub (large enough to easily hold the balls with much room to spare)

## Activity:

1. Place the balls into the container.
2. Inform the child that each ball represents one atom. Then ask if all these atoms that are connected together represent a solid, liquid or gas. They should say that it resembles a solid since the atoms are not moving around.
3. Gently shake the container. The balls should be sliding around each other easily. Ask the child if this represents a solid, liquid or gas. The correct answer is a liquid. The atoms are in motion, but they are still loosely attached to each other.
4. Now violently (within reason!) shake the container so that some or all of the balls bounce around the walls of the box and out of the container. When asked what state of matter the atoms are in, the correct answer is a gas!

## Explanation:

The atomic theory of matter tells us that a gas is made up of tiny particles called atoms which are constantly in motion, smashing into each other and the walls of their container. Adding heat energy (simulated by your shaking) to a solid increases its energy, causing its atoms to move faster and slide around each other as with a liquid. Adding a lot of heat energy will separate these atoms and will cause them to strike the walls of their container more often, creating an increase in pressure. You may choose to "cool the gas", by slowing down the shaking and gently tossing the balls back into the container. By removing energy from the balls, a gas can be converted into a liquid (condensation) and further back into a solid (freezing).

##  <br> Transformation of Energy




## Today, you and your child will:

1. Read the text
2. Review the text with your child
3. Complete the student worksheets
4. Find the following materials for Days Two and Three:

EMPTY POP BOTTLE
SAND, GRAVEL, PENNIES, ETC..(SMALL OBJECTS TO FILL THE POP BOTTLE)
PAPERCLIP
NAIL
TAPE
CLOCK
2 PLASTIC FILM CANS
HANDFLL OF COINS
2 PIECES OF METAL WIRE, EACH ABOUT 8 INCHES
STRING ABOLT 3 FEET LONG
2 CHAIRS

## You and your child(ren) will be covering the following Science Standards this week:

Energy is a property of many substances and is associated with heat, light, electricity, mechanical motion, sound, nuclei, and the nature of a chemical. Energy is transferred in many ways.

Transformed

Single Transformations

Multiple
Transformations
("tranz-formed"); to change
transformation of energy that only needs one step to get work done
("mull-tih-pull"); transformation of energy that only needs two or more steps to get work done

## ("con-sur-vay-shun"); energy

 cannot be created or destroyed, only changed
## ("pen-juu-lum"); a swinging object

 used to study the Law ofConservation of Energy

## Sample Questions to ask after your child finishes their reading for Day One:

The most common transformation of energy is between which two different kinds of energy?

Kinetic and potential energy

## What is a good example of single transformation of energy?

Answers may vary. Examples include: A cell phone transfers electrical energy into electromagnetic energy. A boiling pan of water transfers thermal energy into the air. A microwave oven transforms electrical energy into thermal energy.

## What is the Law of Conservation of Energy?

Energy cannot be created or destroyed, only changed.

## A pendulum is pulled back towards the ground by what force? <br> Gravity always pulls objects closer to the Earth.

What energy changes are taking place in the use of a microwave?
You use mechanical energy to push a button on your microwave. This energy is transferred into electrical energy inside the wires of the machine and is transformed into electromagnetic energy. This form of energy is transformed into thermal energy which heats your soup!

## Answers to worksheet questions for Week Fifteen:

Page 1:
Answers will vary. All of the following types of energy should be listed along with an example for each.

Kinetic Energy
Potential Energy
Mechanical Energy
Thermal Energy

Electrical Energy
Chemical Energy
Nuclear Energy
Electromagnetic Energy

## Page 2:

Answers will vary. Be certain that three examples from the previous worksheet are listed and an example of how these items transfers energy from one form into another.

Page 3:

1. Multiple transformations
2. Pendulum
3. Single transformations
4. Law of Conservation of Energy
5. Transformed


## Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "ESP: A-Mass the Situation"

A pendulum consists of a mass suspended from a fixed point that can freely swing in an arc. It is a classic piece of scientific equipment that demonstrates the transfer of energy. The arc of the pendulum is determined by its momentum and the force of gravity, but not its weight!

## ESP: A-Mass the Situation

## Children will identify if weight can affect the swing of a pendulum.

## Materials:

Empty pop bottle
Sand, gravel, pennies, etc...(small objects to fill the pop bottle)
String
Paperclip
Nail
Tape
Clock

## Activity:

1. Use the nail to poke a small hole into the cap of the pop bottle.
2. Attach the string to the paperclip and thread it through the cap so that, when the cap is fastened to the pop bottle, the paperclip will be secured within the bottle.
3. Tape the string onto the surface of a table so that the pop bottle (pendulum) hangs freely.
4. Pull the pendulum back to the bottom of the table surface and let go. Record the amount of times the pendulum swings back to its original starting point (frequency) within one minute.
5. For experimentation, add pennies to the pop bottle.

## Explanation:

A pendulum consists of a mass suspended from a fixed point that can freely swing in an arc. The arc of the pendulum is determined by its momentum and the force of gravity. Common sense may tell you that by increasing the weight of the pendulum, its period (the time in which a pendulum swings back and forth one time) will be affected. However, as Galileo noticed, a pendulum is not dependent on its weight. The time it takes for the pendulum to make one complete swing should remain the same regardless of its weight.

Independent variable: Number of pennies
Dependent variable: Frequency of the pendulum

## Hypothesis:

If the NUMBER OF PENNIES is (increased/decreased), then the FREQUENCY OF THE PENDULUM will (increase/decrease).


Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "A Pair of Pendulums"

Everything in the world is connected together. This applies to all objects in motion. When two pendulums are placed together on a moveable string, the energy from each pendulum can be transferred through the string and into each other as they swing freely in an arc.

## A Pair of Pendulums

Children will explore how energy can be transferred between two pendulums.

## Materials:

2 plastic film cans
Handful of coins
2 pieces of metal wire, each about 8 inches
String about 3 feet long
2 chairs

## Activity:

1. Stretch and secure the string between two chairs, door knobs, etc. about 20 to 30 inches apart.
2. Bend one end of the wire into the shape of a hook.
3. Insert the other end of the wire through a hole in the lid of the film can.

You will be placing the lid back onto the film can so you do not want this hook to fall out. Therefore, bend the wire that will be inside the film can a little so that the hook will not fall out.
4. Be certain that both hooks are close to the same length.
5. Add equal amounts of coins to each can and attach the lids.
6. Hang the pendulums so that they are about equally spaced from each other and from the chairs.
7. Gently pull one pendulum back a short distance and let it go. As it swings back and forth, notice that the other pendulum also begins to move, picking up speed with each swing.
8. The initial pendulum will slow down with each swing and will stop. However, the second pendulum will continue to move.
9. The process will begin to reverse. Soon the first pendulum will be swinging again while the second one has stopped.
10. The pendulums will repeatedly transfer the motion back and forth between them as long as they continue to swing.

## Explanation:

Every pendulum has a frequency, which is the number of times the pendulum swings back and forth per second. The frequency depends on the pendulum's length. Longer pendulums have lower frequencies.

Every time the first pendulum swings, it pulls on the string and gives the second pendulum a small tug. This transfers some of its energy to the second pendulum. As soon as the second pendulum starts to swing, it starts pulling back on the first pendulum.

Eventually, the first pendulum transfers all of its energy to the second pendulum. But now the first pendulum is in a position to begin stealing energy back from the second. And so it goes, the energy repeatedly switching back and forth until friction and air resistance finally steal all of it away from both pendulums.

## Wisiscpanisu

## The Energy in our Food




## Today, you and your child will:

1. Read the text
2. Review the text with your child
3. Complete the student worksheets
4. Find the following materials for Days Two and Three:

SMALL BAG OF UNSALTED, MIXED NUTS
A CORK
A NEEDLE
FOIL SQUARE (ABOUT IZ INCHES)
MATCHES/LIGHTER
CLOCK WITH A SECOND HAND
OUTDOOR OR WELL-VENTILATED AREA MCDONALD'S HAPPY MEAL BLENDER
MEASURING CUPS FOR LIQUID (CLEAR)
SALLCE PAN
TALL SKINNY AND CLEAR CONTAINER (I.E. OLIVE CONTAINER)

## You and your child(ren) will be covering the following

 Science Standards this week:Energy is a property of many substances and is associated with heat, light, electricity, mechanical motion, sound, nuclei, and the nature of a chemical. Energy is transferred in many ways.


## Sample Questions to ask after your child finishes their reading for Day One:

What do we call stored chemical energy we use to do work? Food

How is your body always using mechanical energy?
Energy is required for all functions in our body (i.e. breathing, eating, heart beating, etc.)

What is the definition of a calorie?
The calorie is the unit of measurement for the amount of energy in food.
What happens if you eat more calories than your body needs?
Your body transforms the extra chemical energy (food) and stores it as fat.
Can fat be removed from the body?
Yes. When we need more mechanical energy to do work, our bodies transform our fat into mechanical energy.

## Answers to worksheet questions for Week Sixteen:

## Page One:

Answers will vary. Be certain that a daily list of foods the child consumes is listed along with all of the calories for each item. The recommended daily intake of calories for young children can be between 1,600 and 3,000.

Page Two:

1. Calorie
2. Fat
3. Food

## Page Three:

1. Fat
2. Calorie
3. Food

Answers to Unit 4 Review:


## Unit 4 Exam

## Match the definitions with the words on the back of this page

1. $\qquad$ a collection of two or more atoms joined together
2. $\qquad$ energy cannot be created or destroyed, only changed
3. $\qquad$ a measure of how much energy is being used over a certain amount of time
4. $\qquad$ a swinging object used to study the Law of Conservation of Energy
5. $\qquad$ energy created from the movement of electrons around an atom
6. $\qquad$
7. $\qquad$
8. $\qquad$ transformation of energy that only needs one step to get work done
9. $\qquad$ the stored energy of an object
10. $\qquad$ transformation of energy that only needs two or more steps to get work done
11. $\qquad$ the energy of motion
12. $\qquad$ created from extra calories inside your body
13. $\qquad$


Fill in the blanks with the correct letter. The definitions below will provide a clue.

1. $A T_{-}$
2. $E_{-} C_{-} \sim_{-} A_{-} E_{-} E_{-}{ }_{-}$
3. $M_{-} E_{-} L_{-}$
4. $S_{-}{ }_{-} L_{-} T R_{-} N_{-} n_{-} A T I_{-} \quad-$
5. $T_{\_} \__{-} A L_{-} E N_{-} \quad{ }_{-}$
6. $\mathrm{IN}_{-} \mathrm{IN}_{-} \mathrm{C}_{-} \mathrm{N}_{-}{ }_{-} \mathrm{Y}$

7. $M_{-} \mathrm{CH}_{-} \mathrm{H}_{-} \mathrm{L}_{-} \mathrm{E}_{-} \mathrm{R}_{-} \mathrm{Y}$
8. $F_{-}$
9. _ _ _ _I_AL_NE _ _
10. _ _ WE _
11. $P_{-} \__{-} L_{-} M$
12. $E_{-} Z_{-} Y$
13. _ $\mathrm{UL}_{-}{ }^{\mathrm{P}} \mathbf{-}_{-} \mathrm{TR}_{-} \mathrm{SFO}_{-} \mathrm{K}_{-} \mathrm{T}_{-} \mathrm{K}_{-}$
14. $C A_{-} I_{-}$
15. _ $\mathrm{O}_{-} \mathrm{n}_{-} \mathrm{TI}_{-} \mathrm{L}_{-} \mathrm{N}_{-} \mathrm{R}_{-}$
16. _OO

17. _ _ _ _SFOR _ _ _
18. $\mathrm{NUCL}_{-} \mathrm{R}_{-} \ldots_{-} \mathrm{G}_{-}$
19. the smallest piece of matter
20. energy created from the movement of electrons around an atom
21. a collection of two or more atoms joined together
22. transformation of energy that only needs one step to get work done
23. the measurement of kinetic energy of atoms in motion
24. the energy of motion
25. energy that moves in waves
26. all of the kinetic and potential energy of an object
27. created from extra calories inside your body
28. a measurement of energy that holds a molecule together
29. a measure of how much energy is being used over a certain amount of time
30. a swinging object used to study the Law of Conservation of Energy
31. the ability to make things happen
32. transformation of energy that only needs two or more steps to get work done
33. unit of measurement for the amount of energy in food
34. the stored energy of an objec $\dagger$
35. stored chemical energy
36. energy cannot be created or destroyed, only changed
37. to change
38. the amount of energy that holds an atom together

## Which one is right? Circle the correct answer.

1. The measurement of kinetic energy of atoms in motion is called...
a. Thermal energy
b. Kinetic energy
c. Electromagnetic energy
2. Mechanical energy is a combination of which kinds of energy?
a. Kinetic and Electrical
b. Potential and Chemical
c. Potential and Kinetic
3. When power increases, $\qquad$ decreases.
a. Energy
b. Power
c. Time
4. Which of the following is not a type of energy?
a. Chemical
b. Atomic
c. Thermal
5. Potential energy can be stored as...
a. Atoms
b. Kinetic Energy
c. Fat

## Unit 4 Exam Answer Key

## Page One:

1. Molecule
2. Law of Conservation of Energy
3. Power
4. Pendulum
5. Electrical energy
6. Transformed
7. Food
8. Single transformation
9. Potential energy
10. Multiple transformations
11. Kinetic energy
12. Fat
13. Atom
14. Mechanical energy
15. Calorie
16. Nuclear energy
17. Electromagnetic energy
18. Chemical energy
19. Energy
20. Thermal energy

## Page Two:

1. Atom
2. Electrical energy
3. Molecule
4. Single
transformation
5. Thermal energy
6. Kinetic energy
7. Electromagnetic energy

## Page Three:

1. $A$
2. $C$
3. $C$
4. Mechanical energy
5. Fat
6. Chemical energy
7. Power
8. Pendulum
9. Energy
10. Multiple transformations
11. Calorie
12. Potential energy
13. Food
14. Law of Conservation of Energy
15. Transformed
16. Nuclear energy
17. B
18. $C$


## Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "ESP: Peanut Power"

Just about everything has potential energy stored within it, even our food. The chemical energy stored in food, known as calories, are transformed in our bodies into energy we can use to do work.

## ESP: Peanut Power

Hidden chemical energy within food will be converted to heat energy.
Materials:
Small bag of unsalted, mixed nuts
A cork
A needle
Foil square (about 12 inches)
Matches/lighter
Clock with a second hand
Outdoor or well-ventilated area

## Activity:

1. Carefully push the eye of the needle into the smaller end of the cork.
2. Gently push the pointed end of the needle onto a small nut.
3. Place the cork/peanut onto the metal foil. (You may want to weigh down the foil with misc. objects).
4. Ignite the nut with the match/lighter and begin recording how long it burns. BE VERY CAREFUL WITH THIS STEP. THE NUT WILL BURN FOR A LONG TIME. BE CERTAIN TO PROVIDE THE NECESSARY SAFETY PRECAUTIONS WITH THIS EXERIMENT.
5. Change the size of the nut for experimentation.

## Explanation:

Just about everything has potential energy stored within it. The energy stored in food (such as a nut) is typically released within our bodies to do work. Mixed nuts contain stored chemical energy which is released when it is burned into heat energy.

Independent variable: Size of the nut
Dependent variable: Time for the nut to burn
Hypothesis:
If the SIZE OF THE NUT is (increased/decreased), then the TIME FOR THE NUT TO BURN will (increase/decrease).


Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "How 'Happy' is Your Meal?"

A small amount of fat in our diet is healthy. It provides the necessary chemical energy/calories for our body to do work. Too many calories, though, is never healthy!

## How "Happy" is Your Meal?

Children will identify how much fat is in a common restaurant meal.

## Materials:

McDonald's Happy Meal
Blender
Measuring cups for liquid (clear)
Sauce pan
Tall skinny and clear container (i.e. olive container)

## Activity:

1. Break up the burger and fries (not the toy!) into small pieces and blend on high until the mixture is well pulverized.
2. Scoop 2 tablespoons of the mixture into the sauce pan and add two cups of water.
3. Boil the mixture gently for 15 minutes.
4. Fill the tall/skinny container with the mixture.
5. Refrigerate overnight.
6. Remove the mixture from the refrigerator and measure the amount of fat that will be found on top of the mixture.

## Explanation:

The fat will form a layer at the top of the mixture and will turn into a solid as it cools. You can calculate the percent of fat in the meal by dividing the total amount of fat (in cups or milliliters) from 2 cups (or 474 milliliters) and multiplying by 100. For example, if you find $\frac{1}{2}$ cup (118 milliliters) of fat floating in your mixture, you can say that the total amount of fat in the Happy Meal is $25 \%$.

FYI-The translucent white material floating on the top is saturated fat. The thin orange near the top is trans-fat. All nutrients show up as a dark brown at the bottom.

## Heat and Temperature

What did the thermometer say to the graduated cylinder?



## Today, you and your child will:

1. Read the text
2. Review the text with your child
3. Complete the student worksheets
4. Find the following materials for Days Two and Three:

TWO LARGE BAGGIES (GALLON-SIZE WORKS WELL)
VEGETABLE SHORTENING (ENOUGH TO FILL A LARGE BAGGIE)
BLICKET OF ICE WATER
TWO SMALL SEALABLE BAGGIES (SANDWICH OR QUART-SIZE WORKS FINE) THERMOMETER
SMALL OBJECTS TO BE LISED AS WEIGHTS
(TO KEEP THE BAGGIES SUBMERGED UNDER WATER)
SEVERAL HOUSEHOLD OBJECTS MADE OF WOOD, METAL, GLASS AND PLASTIC
THERMOMETER

## You and your child(ren) will be covering the following Science Standards this week:

Heat moves in predictable ways, flowing from warmer objects to cooler ones, until both reach the same temperature.

Heat can be produced in many ways, such as burning, rubbing, or mixing one substance with another. Heat can move from one object to another by conduction.
the transfer of thermal energy from a hotter object to a colder object
("ka-pass-eh-tee"); the amount of thermal energy an object can hold onto

## Temperature

the average amount of kinetic energy of the atoms of an object
Conductor

Insulator

("kon-duck-tor"); an object that transports the kinetic energy between two objects
("in-soo-late-orz"); an object that does not have its atoms lined up very well which does not allow for the transfer of energy very well

## Sample Questions to ask after your child finishes their reading for Day One:

What is the difference between heat and heat capacity? Heat is the transfer of thermal energy from a hotter object to a colder object. The heat capacity of an object is the amount of thermal energy an object can hold onto.

What is the difference between temperature and thermal energy?
Temperature is the average amount of kinetic energy of the atoms of an object. Thermal energy is the total amount of kinetic energy of the atoms in an object.

## How does mass affect the thermal energy of an object?

The greater the mass, the greater the thermal energy.
What do scientists call objects that transfer heat easily? Conductors

Why are insulators not able to transfer energy very well?
Insulators do not have their atoms lined up very well and cannot transfer thermal energy very well at all.

## Answers to worksheet questions for Week Seventeen:

## Page 1:

When you pulled your pizza out of the oven, the crust and the sauce was at the same temperature. This is because you pulled them both out of the same oven at the same time!

What you may not know is that the sauce has a much higher heat capacity than the crust! So, even though both the crust and the sauce are at the same temperature, the sauce has more thermal energy inside it!

When you bite into the pizza, thermal energy is transferred between the pizza (higher temperature) and your mouth (lower temperature). While the pizza is in your mouth, both the crust and the sauce are transferring heat in your mouth. However, the sauce has much more thermal energy to give off so it burns you!

## Page 2:



## Page 3:

1. Heat
2. Insulator
3. Heat capacity
4. Conductor
5. Temperature


## Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "ESP: Pinching an Inch on a Polar Bear"

Fat is a good insulator which helps to keep the body warm by trapping heat inside. This is very helpful for cold-weather organisms who do not want their body heat to be released into the environment.

## ESP: Pinching an inch on a polar bear

Children will measure how a layer of "blubber" can insulate an animal from the cold.

## Materials:

Two Large Baggies (Gallon-size works well)
Vegetable shortening (enough to fill a large baggie)
Bucket of ice water
Two small sealable baggies (sandwich or quart-size works fine)
Thermometer
Small objects to be used as weights (to keep the baggies submerged under water)

## Activity:

1. Fill one of the large baggies with vegetable shortening and seal it tightly.
2. Seal the other large baggie.
3. Submerge both bags in the bucket of ice water for five minutes.
4. Place the thermometer into a small baggie, seal it tightly and place it into the large baggie that is submerged under the ice. (You may need a small weight to keep the baggies submerged.) Record the temperature each minute for a total of three minutes.
5. Remove the thermometer and allow it to come to room temperature.
6. While holding onto the end of the thermometer (not the end with all of the mercury!), place your hand into the small, dry baggie and insert your bagged hand into the larger, shortening-filled baggies in the ice water. Record the temperature each minute for a total of three minutes.

## Explanation:

The shortening in the baggie does not allow heat energy to escape into the ice water as easily as the empty baggie. The shortening acts as an insulator, trapping the heat energy generated from your hand and keeping it from conducting through the plastic. The empty plastic bag allows your heat to escape very quickly as plastic is a poor insulator and will feel very cold!!!!

Independent variable: Time of being submerged Dependent variable: Temperature of the baggie Hypothesis:

If the TIME OF BEING SUBMERGED is (increased/decreased), then the TEMPERATURE OF THE BAGGIE will (increase/decrease).


Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "Hot, Cold or...?"

Metal objects are good conductors of heat.
Therefore, if you were to touch a metal object at room temperature, heat would flow from your hand into metal object and conducted rapidly away into the metal. This would leave the metal surface and your skin surface relatively cool. That's why metal feels cool even though it is really at room temperature.

## Hot, Cold or...?

Children will learn that their hands may not be the best thermometer.

## Materials:

Several household objects made of wood, metal, glass and plastic Thermometer

## Activity:

1. Inform the child to place their hands on every item. Ask them to take note of the temperature of each item.
2. Have the child place the items in order of warmest to coldest.
3. Place the thermometer on each item and record the results. Every item should be the same temperature.

## Explanation:

Poor conductors of heat, like Styrofoam, wood and plastic, absorb heat from your hand and warm its surfaces. Because this heat is not conducted away quickly, the surface of the Styrofoam soon becomes as warm as your hand, so little or no additional heat leaves your hand.

Metal objects are good conductors of heat. Heat flows from your hand into the metal and then is conducted rapidly away into the metal, leaving the metal surface and your skin surface relatively cool. That's why metal feels cool.

the birds have to use pothotders to pull worms out of the ground
farmers are feeding their chickens crushed ice to keep them from laying hard-boiled eggs
you learn that a seat belt makes a pretty good branding iron
the 4 seasons are: toterable, hot, really hot, and ARE YOU KIDDING ME>>!!
you realize that asphalt has a liquid state

##  <br> Today, you and your child will:

## 1. Read the text

2. Review the text with your child
3. Complete the student worksheets
4. Find the following materials for Days Two and Three:

ONE STYROFOAM CUP<br>THREE METAL SPOONS<br>THERMOMETER<br>HOT WATER<br>SCISSORS<br>STRING<br>TAPE<br>LAMP WITH LIGHT BULB

## You and your child(ren) will be covering the following Science Standards this week:

Heat moves in predictable ways, flowing from warmer objects to cooler ones, until both reach the same temperature.

Heat can be produced in many ways, such as burning, rubbing, or mixing one substance with another. Heat can move from one object to another by conduction.

| Conduction | ("kon-duck-shun"); transfer of <br> kinetic energy between two <br> objects that are touching |
| :---: | :--- |
| Vibrate | ("vi-bray-t"); to shake <br> matter that can be poured; gases <br> or liquids |
| Convection | ("kon-veck-shun"); the transfer of <br> thermal energy through the <br> movement of fluids |
| Density | the amount of atoms that are <br> found in an object |
| Helium | ("hee-lee-um"); a gas that is less <br> dense than air |

## Sample Questions to ask after your child finishes their reading for Day One:

What happens to the atoms of solids when they are heated?
The atoms that make up solids vibrate when they are heated.
How does this vibration cause energy to be transferred?
Since atoms are like building blocks, they are all attached to each other.
You can't vibrate one atom in a conductor without shaking all of the atoms it is attached to!

What does thermal energy move through during convection?
Thermal energy is transferred through fluids during convection.
How does density affect convection?
Warm air is less dense than cold air, therefore it rise upwards.
What must happen before conduction can take place?
Two objects must be touching in order for heat to be transferred between them. This is known as conduction.

## Answers to worksheet questions for Week Eighteen:

Page 1:
Compare
Both are methods of transferring thermal energy and kinetic energy between two objects.
Contrast
Conduction takes place (mostly) in solids and requires two or more objects to be touching. Convection, however, requires fluids in which to transfer thermal energy.

## Page 2:

Be certain that all vocabulary words have been circled.

## Page 3:




# Today, you and your child will: 

1. Review Day One with the information found below.
2. Run the activity "ESP: Caution... Contents May Be Hot!!!"

Energy is easily conducted, in the form of electrical, thermal or sound energy within solids faster than other states of matter.

## ESP: Caution... Contents May Be Hot!!!

The conduction of heat through metal objects will be explored.
Materials:
One Styrofoam cup
Three metal spoons
Thermometer
Hot water

## Activity:

1. Heat water on the stove to boiling.
2. Place a thermometer into the cup and fill it three-quarters full (you will want to measure this amount!)
3. Record the temperature every 15 seconds until the temperature begins to level off.
4. Empty the water, insert a spoon and fill the cup with the same amount of hot water once again.
5. Record the temperature once again.
6. For experimentation, add more spoons to the cup.

## Explanation:

Energy (in the form of heat) is transferred from the water into the spoon. The metal within the spoon not only can conduct electricity, but it can also conduct heat as well. When the water is added to the cup, you should observe that the temperature does not reach as high as the cup without the spoon. Heat is conducted through the metal. You can use the conduction of heat for any hot liquid. For example, if your coffee is too hot, placing a metal spoon in the liquid will cool it at a faster rate than by allowing it to sit by itself.
Independent variable: Number of spoons
Dependent variable: Temperature of the water
Hypothesis:
If the NUMBER OF SPOONS is (increased/decreased), then the TEMPERATURE OF THE WATER will (increase/decrease).


Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "Spiraling through Convection"

Convection currents are the transfer of heat energy through a fluid. Heating air causes the air molecules to travel
farther apart, thereby making the air less dense. Less dense air will always rise above dense air. As this pocket of warm less-dense air rises, its heat energy can be transferred into mechanical energy in order to do work!

## Spiraling through Convection

Children will notice how convection currents in motion.

## Materials:

Spiral cutout (see attached)
Scissors
String
Tape
Lamp with light bulb

## Activity:

1. Cut out the spiral from the attached sheet.
2. Tape one end of the string to the middle of the spiral.
3. Inform the child that you will be holding the spiral at least one foot above a light bulb that has been turned on for at least thirty minutes. Ask them to predict what they believe will happen.
4. Place the spiral over the heat source and notice that the spiral begins to rotate.
5. If the light source is not causing the spiral to rotate, you can repeat this activity over a kitchen range. Be cautious not to burn the spiral if you choose this extension!

## Explanation:

Convection currents are the transfer of heat energy through a fluid. Air and water are both considered fluids. In this activity, the light bulb in the lamp heated the surrounding air. Heating air causes the air molecules to travel farther apart, thereby making the air less dense. Less dense air will always rise above dense air.

As the warm, lighter, air rises upwards the paper spiral begins to spin. The process keeps working because the force of the moving air is transferred into mechanical energy in the spiral.

Chapter 18: Page 203


## Radiation

Three men were in a NASA conference room to decide how to spend $\$ 10$ billion. "I think we should put our men on Mars!" said the first man.
"Ooh, good idea," said the other two.
"I think we should put our men on Venus!" said the second man.
"Ooh, good idea," said the other two.
"I think we should put our men on the Sun!"
"How are you going to do that?" "Easy. We go at night."

## Today, you and your child will:

1. Read the text
2. Review the text with your child
3. Complete the student worksheets
4. Find the following materials for Days Two and Three:

> PAN WITH LID
> BAG OF MICROWAVE POPCORN HOT AIR POPCORN POPPER POPCORN
> OIL
> TWO PLASTIC/GLASS CUPS
> TWO IDENTICAL THERMOMETERS
> SUNNY WINDOW
> PIECE OF WHITE AND BLACK PAPER TAPE
> WATER

## You and your child(ren) will be covering the following

 Science Standards this week:Heat moves in predictable ways, flowing from warmer objects to cooler ones, until both reach the same temperature.

Heat can be produced in many ways, such as burning, rubbing, or mixing one substance with another. Heat can move from one object to another by conduction.

The sun is a major source of energy for changes on the earth's surface. The sun loses energy by emitting light. A tiny fraction of that light reaches the earth, transferring energy from the sun to the earth. The sun's energy arrives as light with a range of wavelengths, consisting of visible light, infrared, and ultraviolet radiation.

| Radiation | ("ray-dee-a-shun"): method of heat <br> transfer that does not need any <br> solid, liquid or gas to transfer <br> thermal energy |
| :---: | :--- |
| Infrared Waves | ("in-fra-red"); type of radiation <br> waves that transfer heat |
| Absorbed | ("ab-zorb-d" ); taken in |

## Sample Questions to ask after your child finishes their reading for Day One:

Where can the largest source of radiation be found? The sun is our largest source of radiation.

How is radiation different from conduction and convection?
Unlike conduction and convection, radiation does not need any solid, liquid or gas to transfer thermal energy.

## Is all radiation dangerous?

No. The danger of radiation depends on the strength of the radiation, the type of radiation and how long we are being exposed to the radiation.

How do all objects give off infrared radiation?
All atoms are always vibrating. That means that all objects give off infrared waves!

How could you increase the amount of infrared radiation given off by an object?
The hotter the object, the stronger the vibration of atoms. So, the stronger the vibrations, the more infrared waves will be created!

## Answers to worksheet questions for Week Nineteen:

Page 1:
Conduction
Since our camp fire is resting on the ground, all of the soil around the fire (and under the fire) is getting very hot! This is because all of these areas are touching the fire.
Convection
Convection is heating up the atoms in the air above the fire.
This causes the air to become less dense and float away!
Radiation
Infrared radiation will be easily felt as the camp fire will warm your body.

## Page 2:

1. Infrared waves
2. Radiation
3. Absorbed

## Page 3:

1. Infrared waves
2. Radiation
3. Absorbed


## Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "Transferring Heat with a Tasty Treat"

The transfer of heat can be accomplished through conduction (touching of two solid objects), convection (through fluids) or by radiation. Unlike the first two, radiation does not require a medium in which to transfer its
heat.

## Transferring Heat with a Tasty Treat

Children will review heat transfer through the use of popcorn.

## Materials:

Pan with lid
Bag of microwave popcorn
Hot air popcorn popper
Popcorn
Oil

## Activity:

Ask the child to predict which of the following three steps uses radiation, convection and conduction to heat the popcorn:

Step 1: Put oil in the bottom of a pan. Cover the bottom of the pan with popcorn kernels. Place the pan on the stove and turn on the burner to medium heat. Cover the pan with a lid. Periodically shake the pan so the kernels move around in the oil.

Step 2: Obtain a popcorn popper. Place the popcorn kernels in the popper. Plug in/turn on the popper. Hot air will transfer heat to the kernels, making them expand and pop.

Step 3: Microwave a bag of microwave popcorn.

## Explanation:

Step 1: Conduction. Conduction is heat transfer through matter. In this step, heat is transferred by direct contact from the pan, to the oil, to the kernels of popcorn.

Step 2: Convection. Convection is the transfer of heat that takes place in fluids. In this step, the hot air transfers the heat to the cooler kernels, and when enough hot air heats the kernels they pop.

Heat gained by conduction or radiation from the sun is moved about the planet by convection. The radiation from the sun heats the air of the atmosphere, but the heating of the Earth is not even. This is because the amount of sunlight an area receives depends upon the time of day and the time of year. In general, regions near the equator have hotter air. This hot air rises, allowing cooler air to move in underneath the warm air. In our popcorn example this relates to \#2.

Step 3: Radiation does not require motion of molecules like air or water to move heat. Step 3 uses microwave radiation to heat the kernels. As the kernels heat up they give off more heat to the kernels surrounding it and making it even more warm inside the bag.


Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "ESP: Ebony and Ivory"

Radiation from the sun is more readily absorbed by objects that are black in color. White objects tend to reflect the radiation away from its surface, thereby keeping the surface cooler.

## ESP: Ebony and Ivory

Radiated energy from the sun will be explored in this activity.

## Materials:

Two plastic/glass cups
Two identical thermometers
Sunny window
Piece of white and black paper
Tape
Water

## Activity:

1. Tape the white paper over one of the cups and the black paper around the other cup.
2. Fill both cups with equal amounts of water, place the thermometers in each cup and record the temperature (after a minute or so).
3. Place both beakers on a sunny window sill for five minutes and record the temperature.
4. Reduce the amount of black paper on the cup for experimentation. You will need to allow the thermometer to come to room temperature prior to reinserting them in the cups.

## Explanation:

Radiation from the sun is more readily absorbed by objects that are black in color. Therefore, you would expect the black cup to heat up much faster. White objects tend to reflect the radiation away from its surface, thereby keeping the surface cooler. The radiated energy within the black paper is more easily transferred to the water than the white paper. The partial removal of the black paper should reduce the amount of radiated energy imparted into the water.

Independent variable: Amount of black paper
Dependent variable: Temperature of the water Hypothesis:

If the AMOUNT OF BLACK PAPER is (increased/decreased), then the TEMPERATURE OF THE WATER will (increase/decrease).

## Wien

## Kinds of Radiation



##  <br> Today, you and your child will:

## 1. Read the text

2. Review the text with your child

## 3. Complete the student worksheets

4. Find the following materials for Days Two and Three:
microwave oven
CHEESE
CHEESE GRATER
PLATE
CALCULATOR
ONE SMALL HOBBY MOTOR (1.5-3 VOLTS; RADIO SHACK \#273-223) TWO AA BATTERIES
ONE AA BATTERY CLIP FOR TWO BATTERIES (RADIO SHACK \# 270-382)
TWO WIRES WITH ALLIGATOR CLIP LEADS (RADIO SHACK \# 278-001)
ONE INCH PIECE OF DOWEL ROD WITH SMALL HOLE DRILLED IN ONE END ONE FISHING SWIVEL
THREE FEET OF BRAIDED STRING (OLD SHOESTRING WORKS WELL) staple gin or thlmb tack

## You and your child(ren) will be covering the following

 Science Standards this week:The sun is a major source of energy for changes on the earth's surface. The sun loses energy by emitting light. A tiny fraction of that light reaches the earth, transferring energy from the sun to the earth. The sun's energy arrives as light with a range of wavelengths, consisting of visible light, infrared, and ultraviolet radiation.

Photon
("fo-taun"); package of energy that makes up radiation

Electromagnetic Spectrum

## Wavelength

Radio Waves

Microwaves

Invisible

## Visible Waves

("viz-ah-bull"); the only waves in the electromagnetic spectrum that we can see

## Ultraviolet Waves

("ul-trah-vi-o-let"); powerful waves that cause us to be sunburned
("eee-leck-tro-mag-net-ick specktrum"):scientific name for all the different kinds radiation waves
the distance between the tops of waves
("ray-dee-oh"); longest and weakest waves in the electromagnetic spectrum
("my-crow-waves"); waves that are a little shorter and more powerful than radio waves; used to heat our food
("in-viz-ah-bull" ); unable to be seen

| Ozone | ("oh-zone"): gas in our atmosphere that blocks <br> harmful ultraviolet radiation |
| :---: | :--- |
| X-Ray Waves | waves of radiation that easily pass through <br> muscle and skin, but not bone |
| Gamma Ray <br> Waves | the shortest and most powerful wave in the <br> electromagnetic spectrum |

# Sample Questions to ask after your child finishes their reading for Day One: 

## Define a "photon"?

A photon is a tiny package of energy that makes up radiation which, when combined with billions of other photons, moves like a wave.

Does a longer wavelength of photons increase or decrease its energy?
The longer the wavelength of photons, the lower the energy it has.
Which has a longer wavelength - a microwave or an X-Ray? Which has more energy?
The microwave has a longer wavelength and therefore a lower amount of energy than the X-Ray.

What type of radiation causes us to get sunburned?
Ultraviolet radiation causes us to get sunburned.
What are the only kind of radiation waves you can see?
Visible waves are the only radiation waves that humans can see.

## Answers to worksheet questions for Week Twenty:

Page 1:

1. Gamma Ray Waves
2. X-Ray Waves
3. Ultraviolet Waves
4. Visible Waves

## Page 2:

1. Electromagnetic spectrum
2. Invisible
3. Ozone
4. Photon
5. Gamma ray waves
6. Wavelength
7. Infrared Waves
8. Microwaves
9. Radio Waves

## Answers to Unit 5 Review:

1. Invisible
2. Infrared waves
3. Ozone
4. Absorbed
5. Conduction
6. Fluids
7. Gamma ray waves
8. Temperature
9. Conductor
10. Radio waves
11. X-ray waves
12. Convection
13. Microwaves
14. Wavelength
15. Heat capacity
16. Helium
17. Vibrate
18. Heat
19. Ultraviolet waves
20. Photon
21. Visible waves
22. Insulator
23. Density
24. Radiation
25. Electromagnetic spectrum

## Unit 5 Exam

Place the answers to the following clues in the boxes below. Each box should contain one letter.


## ACROSS

1. an object that transports the kinetic energy between two objects
2. longest and weakest waves in the electromagnetic spectrum
3. transfer of kinetic energy between two objects that are touching
4. a gas that is less dense than air
5. gas in our atmosphere that blocks harmful ultraviolet radiation
6. to shake
7. unable to be seen
8. waves that are a little shorter and more powerful than radio waves; used to heat our food
9. the average amount of kinetic energy of the atoms of an object

DOWN
2. the transfer of thermal energy through the movement of fluids
4. the amount of atoms that are found in an object
6. the transfer of thermal energy from a hotter object to a colder object
8. matter that can be poured; gases or liquids
10. taken in

## Match the definitions with the words on the back of this page

1. $\qquad$ the amount of thermal energy an object can hold onto
2. $\qquad$ matter that can be poured; gases or liquids
3. $\qquad$ the amount of atoms that are found in an object
4. $\qquad$ type of radiation waves that transfer heat
5. $\qquad$ transfer of kinetic energy between two objects that are touching
6. $\qquad$ taken in
7. $\qquad$ a gas that is less dense than air
8. $\qquad$ an object that transports the kinetic energy between two objects
9. $\qquad$ waves that are a little shorter and more powerful than radio waves; used to heat our food
a package of energy that makes up radiation
longest and weakest waves in the electromagnetic spectrum
to shake
10. $\qquad$ unable to be seen
11. $\qquad$ the shortest and most powerful wave in the electromagnetic spectrum
12. $\qquad$ gas in our atmosphere that blocks harmful ultraviolet radiation
13. $\qquad$ the distance between the tops of waves
14. $\qquad$ the transfer of thermal energy from a hotter object to a colder object
15. $\qquad$ scientific name for all the different kinds radiation waves


## Which one is right? Circle the correct answer.

1. Which of the following can transport kinetic energy between two objects very well?
a. Absorber
b. Conductors
c. Insulators
2. Which of the following contains the best group of insulators?
a. Plastic cup, metal nail, glass rod
b. Glass rod, Plastic cup, metal rod
c. Plastic cup, Glass rod, plastic nail
3. What is the best way to transfer heat through fluids?
a. Conduction
b. Convection
c. Radiation
4. Waves of radiation are caused by...
a. Vibrating atoms
b. Movement of the ocean waves
c. The sun
5. Which of the following is true?
a. Longer wavelengths = Higher energy
b. Shorter wavelengths = Higher energy
c. Shorter wavelengths = Lower energy

## Unit 5 Exam Answer Key

## Page One:

## Page Two:



1. Heat capacity
2. Fluids
3. Density
4. Infrared waves
5. Conduction
6. Absorbed
7. Helium
8. Conductor
9. Microwaves

Page Three:

1. B
2. $C$
3. $B$
4. $B$
5. $A$
6. Electromagnetic spectrum
7. Temperature
8. Visible waves
9. Convection
10. Insulator
11. Radiation
12. Ultraviolet waves
13. X-ray waves


## Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "Measuring the Speed of Light"

The same general principles that govern our universe are at work in everything we do and use in our life! The use of waves to generate thermal energy may not be easy to see without a little experimentation, but they are still there!

## Measuring the Speed of Light

Children will measure the speed of light using their microwave oven.

## Materials:

Microwave oven
Cheese
Cheese grater
Plate
Calculator

## Activity:

1. Grate enough cheese to cover the plate to a depth of about $\frac{1}{4}$ inch. Take the glass turntable and any roller mechanism out of the microwave and put the plate of cheese in.
2. Turn the heat to full power for 20 seconds. When you take the plate out, you will see two lines of melted cheese.
3. Measure the distance between these two lines of melted cheese in inches, multiply that number by two and multiply this new number by .00002 to give you the wavelength of radiation (in miles) running through your microwave. Write this number (wavelength) down.
4. Look on the back of the oven to find a label that tells you the frequency the oven operates at. An average frequency on microwaves is around 2450 MHz , or 2450 million waves per second. Write this number (frequency) down.
5. Now, simply multiply the first number (wavelength) and the second number (frequency) to receive the speed of light in miles per second.
6. If you have done your math correctly, you should have a number that is close to 186,000.

## Explanation:

Your microwave has a component on one side of the oven which sends out energy as a wave - the same sort of wave as a radio wave or a light wave. This wave is perfectly even and regular. Where the wave is at its highest and lowest points, it is reinforced by the waves that are bouncing around inside the oven so that two hot spots are created a half-wavelength apart. You multiply the distance between the melted cheese by two to identify one complete wavelength.

Most microwaves have a stationary emitter and the food is revolved on a turntable to rotate it evenly through the hotspots. Some microwave ovens have a rotating emitter. The plate in these ovens stands still and the hot spots move. If your microwave doesn't have a turntable, it won't be possible to do this experiment.

The speed of light is 186,000 miles per second. At that speed you could run around the equator of the Earth seven times per second! The use of math to reinforce scientific concepts is essential for every branch of science.


Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "Handheld Wave Machine"

The understanding of wave formations is vital to the understanding of how different kinds of energy travels in our universe. The more handson activities you can do to see and control waves in motion, the stronger your understanding of physical science will become!

## Handheld Wave Machine

Children will create a handheld device to measure waves.

## Materials:

One small hobby motor (1.5-3 volts; Radio Shack \#273-223)
Two AA batteries
One AA battery clip for two batteries (Radio Shack \# 270-382)
Two wires with alligator clip leads (Radio Shack \# 278-001)
One inch piece of dowel rod with small hole drilled in one end
One fishing swivel
Three feet of braided string (old shoestring works well)
Staple gun or thumb tack

## Activity:

1. Press the dowel down onto the motor shaft so that the shaft fits into the hole. It should be a tight fit. Note: Do not try to push the motor shaft down into the dowel-you are likely to pop the motor right out of its casing.
2. Staple or tack one end of the string onto the end of the wooden dowel.
3. Tie the other end of the string onto the fishing swivel.
4. Connect the wires between the battery clip and the motor while holding the motor and fishing swivel apart. (This may require another set of hands!)
5. Change the distance between the motor and the swivel to watch different wave patterns emerge in the string.

## Explanation:

The wave formation in your string machine depends on a number of factors, including the frequency with which the string shaken and the tension in the string. If any of these factors is changed, then the wave pattern changes.

The simplest wave that you produced was the fundamental or first harmonic, and consisted of one-half of a whole wave, was made up of only one node. The second standing wave you made, the one with three nodes, is a second harmonic wave, and it is a whole wavelength. The third wave you made, with four nodes, is a third harmonic wave, which is one-and-a-half wavelengths.


## Waianchiand <br> Visible Light and Waves.




## Today, you and your child will:

1. Read the text
2. Review the text with your child
3. Complete the student worksheets
4. Find the following materials for Days Two and Three:

| 15-20 VANILLA WAFERS | WHITE SURFACE |
| :---: | :---: |
| WHITE ICING | (I,E, PAINTED WALL, POSTER BOARD, ETC.) |
| SPOON | ONE RED, GREEN, AND BLLLE |
| FOOD COLORING | LIGHT BLLBS OR FLOOD |
| (RED, BLLLE + YELLOW) | LAMPS, |
| PLASTIC KNIVES OR CRAFT | STICKS |

## You and your child(ren) will be covering the following

 Science Standards this week:The sun is a major source of energy for changes on the earth's surface. A tiny fraction of that
light reaches the earth, transferring energy from the sun to the earth. The sun's energy arrives as light with a range of wavelengths, consisting of visible light, infrared, and ultraviolet radiation.

Light travels in a straight line until it strikes an object. Light can be reflected by a mirror, refracted by a lens, or absorbed by the object.

Light interacts with matter by transmission (including refraction), absorption, or scattering (including reflection). To see an object, light from that object--emitted by or scattered from it--must enter the eye.

| Transparent Material | ("tranz-pair-ent"); material which <br> allows photons of light to travel <br> through them without bouncing around |
| :--- | :--- |
| Translucent Material | ("tranz-loo-cent"); material which <br> bounces photons around as they pass <br> through |
| Opaque Material | ("o-pay-k"); material which does not <br> allow photons to pass through |
| Primary Colors | bounced off <br> green) that can combine to make any <br> other color we can see |
| Secondary Colors | the mixture of two primary colors <br> Pree colors of light (red, blue and |
| Pigments | chemicals used to add color to objects |
| Cyan | ("sigh-ann"); a light blue pigment |
| Magenta | ("ma-jen-ta"); a reddish purple <br> pigment |

## Sample Questions to ask after your child finishes their reading for Day One:

## Why do all materials on the planet react to light

 differently?Everything in the planet is made up of different arrangements of atoms. So, when photons of visible light strike these objects, the photons can react in different ways.

How are transparent and translucent materials similar? Both allow photons of visible light to pass through them.

What two things can happen to photons when they strike an opaque object?
Photons can be absorbed into an opaque object or reflected away.

## A red shirt absorbs which color(s) of visible light?

A red shirt reflects red photons of light and absorbs all other photons of color.
What two colors can be mixed together to get yellow light? Red light and green light combine to form yellow light.

## Answers to worksheet questions for Week Twenty-One:

Page 1:

1. $C$
2. $B$
3. $A$
4. $A$
5. B

Page 2:
Be certain that all vocabulary words are circled.

## Page 3:

1. Translucent material
2. Primary colors
3. Transparent material
4. Secondary colors
5. Magenta
6. Cyan
7. Opaque material
8. Reflected
9. Pigments


## Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "Edible Color Wheel"

The three primary pigments of red, blue and yellow are not to be confused with the three primary colors of red, blue and green. Colors pertain to the primary photons of visible light our eyes can see. Pigments are chemicals used to add color to objects.

## Edible Color Wheel

Children will review the three primary pigments.
Materials:
$15-20$ vanilla wafers
White icing
Spoon
Food coloring (one bottle of red-blue-yellow)
Plastic knives or craft sticks
1-3 Dinner plates
Paper towels

## Activity:

1. Place spoonful of icing into three piles on a dinner plate and add a few drops of red, blue and yellow food coloring. Mix well. You should have three "stock" containers of the three primary pigments.
2. Have the child frost 3 cookies with each of the three available colors. Place them in a triangle on a dinner plate.
3. Instruct the child to mix equal amounts of 2 Primary Colors (Red and Blue; Red and Yellow; Blue and Yellow) and frost 3 more cookies with each of these icings.
4. Have the child place them in between the two colors that were used to create them.
5. Instruct the child to mix the 6 Intermediate or Tertiary Colors (Green and Red; Green and Blue; Orange and Red; Orange and Yellow; Purple and Blue; Purple and Yellow).
6. The frosted cookies are to be placed in between the Primary and Secondary Color used to mix each Intermediate color.

## Explanation:

The three primary pigments of red, blue and yellow are not to be confused with the three primary colors of red, blue and green. These colors pertain to the primary photons of visible light our eyes can see. Pigments are chemicals used to add color to objects.


Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "Colored Shadows"

Colors, like pigments, can be mixed together to form different colors too!

## Colored Shadows

Children will learn that not all shadows are grey or black.
Materials:
White surface (i.e. painted wall, poster board, etc.)
Red, green, and blue light bulbs or flood lamps, one of each color 3 light sockets of any type or arrangement that will hold the light bulbs Any solid object such as a pencil, ruler, finger, etc.

## Activity:

1. Set up the bulbs in the order of red, green then blue in front of the white surface in such a way that the light from all three bulbs falls on the same area of the screen and all bulbs are approximately the same distance from the screen.
2. Turn off all lights in the room.
3. Turn on all three colored lights
4. Place a narrow opaque object, like a pencil, fairly close to the screen. Adjust the distance from the screen until you see three distinct colored shadows.
5. Remove the object, turn off one of the colored lights, and notice how the color on the screen changes.
6. Replace the object in front of the screen and notice the color of the shadows.
7. Move the object close to the screen until the shadows overlap.
8. Notice the color of these combined shadows.
9. Repeat the previous step with a different light turned off while the other two remain on, and then a third time so you have tried all combinations.

## Explanation:

The retina of the human eye has three receptors for colored light. One type of receptor is most sensitive to red light, one to green light, and one to blue light. With these three color receptors we are able to perceive more than a million different shades of color.

When all three primary colors of red light, a blue light, and a green light are all shining on the screen, the screen looks white because these three colored lights stimulate all three color receptors on your retinas equally.

With these three lights you can make shadows of seven different colors: blue, red, green, black, cyan (blue-green), magenta (a mixture of blue and red), and yellow (a mixture of red and green).

If you block two of the three lights, you get a shadow of the third color. For example, if you block the red and green lights, you get a blue shadow. If you block all three lights, you get a black shadow. And if you block one of the three lights, you get a shadow whose color is a mixture of the two other colors.

## 

## Mirvors

## WHAT DID ONE WAVE SAY TO THE OTHER WAVE?



## I'M SICK AND TIRED OF YOUR INTERFERENCE!



1. Read the text
2. Review the text with your child
3. Complete the student worksheets
4. Find the following materials for Days Two and Three:

| THREE $6 \times 6$ INCH MIRRORS | A BOX WITH SIDES HIGHER THAN |
| :---: | :---: |
| (PLASTIC MIRRORS ARE SAFEST, GLASS | THE DIAMETER OF THE BALLS. |
| MIRROR TILES CAN BE FOUND AT | A SHEET OF STYROFOAM LARGE |
| HARDWARE STORES) | ENOUGH TO COVER THE |
| DUCT TAPE | BOTTOM OF THE BOX |
| A PIECE OF LIGHT CARDBOARD | BLACK CONSTRUCTION PAPER |
| (SUCH AS A FILE FOLDER) | (ENOUGH TO COVER THE STYROFOAM) |

## You and your child(ren) will be covering the following

## Science Standards this week:

The sun is a major source of energy for changes on the earth's surface. The sun loses energy by emitting light. A tiny fraction of that light reaches the earth, transferring energy from the sun to the earth. The sun's energy arrives as light with a range of wavelengths, consisting of visible light, infrared, and ultraviolet radiation.

Light travels in a straight line until it strikes an object. Light can be reflected by a mirror, refracted by a lens, or absorbed by the object.

Light interacts with matter by transmission (including refraction), absorption, or scattering (including reflection). To see an object, light from that object--emitted by or scattered from it--must enter the eye.

## Mirror

## Plane Mirror

## Concave Mirror

Convex Mirror
tool used to reflect light
a flat sheet of glass that has silvercolored paint on one side; used to reflect photons of light; the resulting image is the same size and shape as the original object
("kon-kave"); a mirror that is curved, like the inside of a bowl; this type of mirror can produce two different kinds of reflections
("kon-vecks"); A mirror with a surface that is curved outward; this mirror always produces a reflected image that is smaller than the object

# Sample Questions to ask after your child finishes their reading for Day One: 

What is another name for a flat mirror?
A plane mirror

## How is a plane mirror made?

A plane mirror is made of a flat sheet of glass that has silver-colored paint on one side. Most of the time, the silver paint is found on the back of the glass to keep it from getting scratched. When light strikes the glass, it is the silver paint that causes the photons to be reflected.

What is reversed in an image formed in a plane mirror?
The left and right sides of an image are reversed in a plane mirror.

## What does the kind of reflection you see from a concave mirror depend upon?

The kind of reflection you see in a concave mirror depends on how close you are standing to the mirror.

What happens to the size of a reflected image when you use a convex mirror?

The reflected image is always smaller in a convex mirror.

## Answers to worksheet questions for Week Twenty-Two:

Page 1:
Compare
Both are mirrors that act to reflect an image. Both have the ability to make the reflected image smaller than it really is.

## Contrast

Concave mirrors can produce smaller and larger reflections and cause the image to be upside down. Convex mirrors can only produce images that are smaller than the actual object.

## Page 2:

1. Concave mirror
2. Convex mirror
3. Plane mirror

Page 3:

1. Convex mirror
2. Mirror
3. Plane mirror
4. Concave mirror


## Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "Real Mirrors"

Not only is everything in the world connected together, everything we see is a matter of perspective. The reflected image we see in a mirror is not the same perspective that everyone else sees in the real world. A "real"
mirror can help you see this new form of perspective.

## Real Mirrors

Children will see themselves the way others see them.

## Materials:

Three $6 \times 6$ inch mirrors (Plastic mirrors are safest, but glass mirror tiles are readily available at most home supply stores)
Duct tape
A piece of light cardboard (such as a manila file folder)

## Activity:

1. Use the duct tape to tape two of the mirrors together along one edge. Put the tape on the back side of the mirror, making a hinge that opens and closes easily. Be sure the mirrors can move freely from 0 degrees to 180 degrees.
2. Close your right eye and look at a single mirror straight on. Notice that the left eye of the image is closed.
3. Now close your right eye and look at two mirrors that form a 90-degree angle. Notice that the right eye of this image is closed.
4. Now rest the two mirrors (still in a 90-degree angle) on the third mirror, so that the three mirrors form a half cube.
5. Close one eye and stare right at the corner where the three mirrors join.
6. Move your head and notice that the pupil of your open eye always falls right at the corner. Open both eyes and look at the corner. One eye may appear to be closer to the corner than the other. This is your dominant eye.

## Explanation:

When you put an object between the two hinged mirrors, light from the object bounces back and forth between the mirrors before it reaches your eyes. An image is formed each time the light bounces off a mirror. When this happens, you see a reflected image which is how everyone actually sees you! Try brushing your hair while looking into the seam of the two mirrors. It is not what you are used to seeing!


Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "Spherical Mirrors"

Not all mirrors reflect an image that is the normal size of an object. A curved mirror, such
as a convex mirror, curves out toward the source of light. This allows a convex mirror to reflect images that are smaller than life-sized.

## Spherical Mirrors

Children will observe life through a curved mirror.

## Materials:

Silver Christmas tree balls
A box with sides higher than the diameter of the balls.
A sheet of styrofoam large enough to cover the bottom of the box
Black construction paper to cover the styrofoam

## Activity:

1. Cut the styrofoam to fit the bottom of the box.
2. Cover the styrofoam or oatmeal with a piece of black construction paper cut to size.
3. Lay the balls in the box in a single layer, packed as closely as possible.
4. Gently but firmly push the stem end of each ball into the styrofoam so that the stem is held securely.
5. Look at the spherical mirrors from various angles. Notice that the image in each mirror is a little different from the image in the neighboring mirrors. That's because each mirror "sees" the world from a slightly different vantage point. Notice that if you point your finger at one sphere, the image of your finger in all the other mirrors will point at the chosen mirror.
6. Also notice that your image is very small in the mirrors, and that it appears quite far away.

## Explanation:

Each Christmas tree ball is a convex mirror - a mirror that curves out toward the source of light. Convex mirrors reflect images that are smaller than life-sized.

Lenses



## 1. Read the text

## 2. Review the text with your child

3. Complete the student worksheets
4. Find the following materials for Days Two and Three:

MINI-MAGLITE OR PENLIGHT
4 TO 6 GLLIE STICKS (MLST BE THE CLEAR ONES USED IN GLLE GUNS)
SHEET OF WHITE PAPER
CLEAR PACKAGING TAPE
COMPACT DISC
FLASHLIGHT (THE MINI-MAGLITE FROM THE PREVIOUS ACTIVITY WOULD WORK GREAT) PIECE OF WHITE PAPER

## You and your child(ren) will be covering the following

## Science Standards this week:

The sun is a major source of energy for changes on the earth's surface. The sun loses energy by emitting light. A tiny fraction of that light reaches the earth, transferring energy from the sun to the earth. The sun's energy arrives as light with a range of wavelengths, consisting of visible light, infrared, and ultraviolet radiation.

Light travels in a straight line until it strikes an object. Light can be reflected by a mirror, refracted by a lens, or absorbed by the object.

Light interacts with matter by transmission (including refraction), absorption, or scattering (including reflection). To see an object, light from that object--emitted by or scattered from it--must enter the eye.

| Refraction | ("ree-frack-shun"); the change in direction of photons of light in different states of matter |
| :---: | :---: |
| Rainbow | the refraction of white light through a raindrop which causes each wavelength of visible light to be bent in different amounts |
| Convex Lens | a lens with the shape of the outline of a football; all photons of light that pass through this lens converge in front of the lens itself |
| Converge | ("kon-vurj"); move towards each other |
| Concave Lens | lens that is skinny in the middle, but thicker at the ends; photons that pass through this lens diverge beyond the lens |
| Diverge | ("die-vurj"): spread out |

## Sample Questions to ask after your child finishes their reading for Day One:

## What happens to photons of light when they pass through different states of matter?

Photons change their direction in different states of matter.

# What causes a photon's change in direction as it passes through solids, liquids and gases? 

The speed of a photon changes (refracts) as it passes through the different states of matter. This change in speed causes the photons to change their direction as well.

## What causes a rainbow?

When white light enters a raindrop, the different photons of visible light bend through the water because of refraction. However, each wavelength of visible light is refracted, or bent, in different amounts. Red bends only so far, orange bends a little farther and so on.

## How does a magnifying lens work?

Any photons of light that enter a magnifying lens (convex lens) are refracted and converge in front of the lens.

How do binoculars work?
Any photons of light that enter a pair of binoculars (a concave lens) are refracted and diverge from the lens.

## Answers to worksheet questions for Week Twenty-Three:

## Page 1:

Answers will vary. Be certain the story includes a photon's ability to be reflected, refracted and absorbed into an object.

Page 2:


Page 3:

1. Rainbow
2. Concave lens
3. Diverge
4. Converge
5. Convex lens
6. Refraction


## Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "Why is the Sky Blue?"

The scattering of light waves through the sky runs on the same principles in every object. The high energy blue photons of light will always scatter more readily than the lower energy red photons of light.

## Why is the Sky Blue?

Children will explain why the sky is blue and the sunrise/sunsets are red.

## Materials:

Mini-MagLite or penlight
4 to 6 glue sticks (must be the clear ones used in glue guns)
Sheet of white paper
Clear packaging tape

## Activity:

1. Turn off all lights in the room.
2. Shine the Maglite into one end of a glue stick and hold the other end of the glue stick approximately one centimeter from the white background.
3. The end of the glue stick closer to the Mini-MagLite should be a different color than the other end. Notice the color of the circle on the white paper.
4. Tape two glue sticks together end to end with the clear tape.
5. Repeat the investigation with the Mini-MagLite, and notice any difference in the colors along the glue sticks and in the colored circle on the white paper.
6. Continue to attach more glue sticks with the clear tape and to notice the changes in color and intensity along the glue sticks and in the colored circle.

## Explanation:

The glue stick scatters the blue light out of the white MagLite beam more than the yellow or the red light. Because of this, the end of the glue stick nearest the MagLite appears blue and the other end is yellow to yellow-orange. As more glue sticks are joined together, more yellow light is scattered. So, the colored circle on the white paper changes to an orange color.
During the day, the sky is blue because blue light is most readily scattered from sunlight in the atmosphere, just as blue light was most readily scattered from white light in the glue sticks. At sunset, light travels through a greater thickness of atmosphere before reaching your eyes than it does when the sun is higher in the sky. This is modeled by the increasing length of the glue sticks. As more red light was visible with longer glue sticks, our atmosphere looks redder because the light from the sun travels a greater distance through our atmosphere.


Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "Household Rainbows"

Since light moves in the form of waves, these waves sometimes crash into each other which causes interference. As these waves interfere with each other, sometimes they combine, making certain colors brighter, and sometimes they cancel each other out, taking certain colors away.

## Household Rainbows

Children will create a rainbow with simple materials.

## Materials:

Compact Disc
Flashlight (the Mini-Maglite from the previous activity would work great) Piece of white paper

## Activity:

1. Turn out the lights and shine your flashlight at the CD. Hold your piece of white paper so that the light reflecting off the CD shines onto the paper.
2. The reflected light will make rainbow colors on your paper.
3. Tip the $C D$ and see how that changes the reflections. Change the distance from the CD to the paper and notice the color change.

## Explanation:

Compact disks are made of aluminum coated with plastic. The colors that you see on the $C D$ are created by white light reflecting from ridges in the metal.

Like water drops in falling rain, the CD separates white light into all the colors that make it up. The colors you see reflecting from a CD are interference colors, like the shifting colors you see on a soap bubble or an oil slick.

You can think of light as being made up of waves-like the waves in the ocean. When light waves reflect off the ridges on your CD, they overlap and interfere with each other. Sometimes the waves add together, making certain colors brighter, and sometimes they cancel each other, taking certain colors away. Human Vision



## Today, you and your child will:

1. Read the text
2. Review the text with your child
3. Complete the student worksheets
4. Find the following materials for Days Two and Three:

MASKING TAPE
FEW SHEETS OF WHITE PAPER
LARGE CARDBOARD BOX YOU'LL
NEED A FOOT OF HEADROOM INSIDE THE
BOX AS IT RESTS ON YOUR SHOULDERS) LITILITY KNIFE

SCISSORS ALLIMINLM FOIL DUCT TAPE
PUSH PIN
DARK SWEATSHIRT/TOWEL PENCIL

## You and your child(ren) will be covering the following

## Science Standards this week:

The sun is a major source of energy for changes on the earth's surface. The sun loses energy by emitting light. A tiny fraction of that light reaches the earth, transferring energy from the sun to the earth. The sun's energy arrives as light with a range of wavelengths, consisting of visible light, infrared, and ultraviolet radiation.

Light travels in a straight line until it strikes an object. Light can be reflected by a mirror, refracted by a lens, or absorbed by the object.

Light interacts with matter by transmission (including refraction), absorption, or scattering (including reflection). To see an object, light from that object--emitted by or scattered from it--must enter the eye.

| Cornea | ("kor-nee-ah"); part of the eye that <br> acts as a convex lens that helps to <br> converge, or focus the photons of <br> light as it passes through your <br> eyeball |
| :---: | :--- |
| Pupil | ("pew-pill"); an opening in the eye <br> for photons to travel through |
| Iris | ("i-riss"); colorful muscle of the eye <br> that gets larger to cover the pupil <br> and block photons of light |
| Retina | ("reh-tin-ah"); a layer of cells that <br> are found in the back of the eyeball |
| Nearsighted | ("neer-site-ed"); the ability to see <br> things nearby, but not far away |
| Farsighted | ("far-site-ed") the ability see things <br> far away, but not nearby |

## Sample Questions to ask after your child finishes their reading for Day One:

What part of the eye does light first travel through?
Photons of light travel through the cornea first as they pass through the eye.

## What controls the size of your pupil?

The iris reduces the size of the pupil by covering part of it up when there are plenty of photons entering the cornea.

Which part of the eye is the most colorful?
The iris is the colorful part of the eye.
Our brain receives the images we see from a layer of cells in the back of our eyeball called...
The retina is a layer of cells in the back of our eyes that receives the image we see and sends it to the brain.

How do glasses or contact lenses help a nearsighted person? These objects help a nearsighted person by being able to see things that are far away.

## Answers to worksheet questions for Week Twenty-Four:

Page 1:

1. Cornea
2. Pupil
3. Retina

Page 2:
Be certain that all vocabulary words are circled.

Page 3:


## Answers to Unit 6 Review:

1. Magenta
2. Translucent material
3. Cyan
4. Mirror
5. Transparent material
6. Converge
7. Pigments
8. Nearsighted
9. Primary colors
10. Concave lens
11. Reflected
12. Farsighted
13. Retina
14. Cornea
15. Concave mirror
16. Iris
17. Plane mirror
18. Convex mirror
19. Refraction
20. Opaque material
21. Diverge
22. Pupil
23. Rainbow
24. Secondary colors
25. Convex lens

## Unit 6 Exam

Place the answers to the following clues in the boxes below. Each box should contain one letter.


## ACROSS

1. a reddish purple pigment
2. the mixture of two primary colors
3. colorful muscle of the eye that gets larger to cover the pupil and block photons of light
4. a light blue pigment
5. the ability see things far away, but not nearby
6. spread out
7. an opening in the eye for photons to travel through

## DOWN

2. material which allows photons of light to travel through them without bouncing around
3. lens that is skinny in the middle, but thicker at the ends; photons that pass through this lens diverge beyond the lens
4. a mirror that is curved, like the inside of a bowl; this type of mirror can produce two different kinds of reflections
5. bounced off
6. a lens with the shape of the outline of a football; all photons of light that pass through this lens converge in front of the lens itself
7. a layer of cells that are found in the back of the eyeball
8. tool used to reflect light

Fill in the blanks with the correct letter. The definitions below will provide a clue.

1. $P_{-} N_{-} M_{-} R_{-}$
2. $O_{\sim} \quad$ _ $A$
3. _O_ _ _ _ _LEN _
4. $R E$ _ _ _ _
5. _ _ _ R_R
6. _ON _ _ VE_ _ $E_{-}$


7. _ _ $F \_E_{-} T E$ _
8. $\mathrm{R}_{-} \mathrm{N}_{-} \mathrm{O}_{-}$
9. _ _ ${ }^{A} \__{-} I G_{-} E_{-}$
10. $C_{\sim_{-}} A_{-} E_{-} M_{-} R_{-}$
11. $\mathrm{P}_{-}$_I_
12. _ _ _ _ ERG _
13. _ _ I_ _ $\mathrm{R}_{-}$_ $\mathrm{CO} \mathrm{O}_{\mathrm{o}} \mathrm{O}$
14. _ _IS
15. _ _ _ _ _ _ HTED
16. _ _ ${ }^{\text {_ }}$ SL_ _ _ $\mathrm{N}_{-}$_ _ _ $\mathrm{E}_{-} \mathrm{I}_{-} \mathrm{L}$
17. _ _GM__ _S
18. _P _ _U _ M_TE_ _ _ _
19. $R_{-} F_{-} C_{-} I_{-}$
20. _ _GE_T_ _
21. _YA _
22. $C_{-} \mathrm{NV}_{-}$_ _MI_ _ _
23. $D_{-}$_ _RG_
24. a flat sheet of glass that has silver-colored paint on one side; used to reflect photons of light; the resulting image is the same size and shape as the original object
25. part of the eye that acts as a convex lens that helps to converge, or focus the photons of light as it passes through your eyeball
26. a lens with the shape of the outline of $a$ football; all photons of light that pass through this lens converge in front of the lens itself
27. a layer of cells that are found in the back of the eyeball
28. tool used to reflect light
29. lens that is skinny in the middle, but thicker at the ends; photons that pass through this lens diverge beyond the lens
30. material which allows photons of light to travel through them without bouncing around
31. the mixture of two primary colors
32. bounced off
33. the refraction of white light through a raindrop which causes each wavelength of visible light to be bent in different amounts
34. the ability to see things nearby, but not far away
35. a mirror that is curved, like the inside of a bowl; this type of mirror can produce two different kinds of reflections
36. an opening in the eye for photons to travel through
37. move towards each other
38. three colors of light (red blue and green) that can combine to make any other color we cansee
39. colorful muscle of the eye that gets larger to cover the pupil and block photons of light
40. the ability see things far away, but not nearby
41. material which bounces photons around as they pass through
42. chemicals used to add color to objects
43. material which does not allow photons to pass through
44. the change in direction of photons of light in different states of matter
45. a reddish purple pigment
46. a light blue pigment
47. a mirror with a surface that is curved outward; this mirror always produces a reflected image that is smaller than the object
48. spread out

## Which one is right? Circle the correct answer.

1. A red ball absorbs which color or colors?
a. All colors but red
b. Red only
c. Only red, green and blue
2. Transparent materials...
a. Do not allow photons to pass through
b. Bounces photons around as they pass through
c. Allows photons of light to pass through without bouncing around
3. The type of mirror that reflects an image with reversed left and right sides is called a...
a. Convex mirror
b. Concave mirror
c. Plane mirror
4. The bending of photons as they travel through different states of matter is known as...
a. Reflection
b. Diffraction
c. Refraction
5. Which of the following gets larger to keep photons of light from entering your eye?
a. Iris
b. Cornea
c. Retina

## Unit 6 Exam Answer Key

Page One:

## Page Two:



1. Plane mirror
2. Rainbow
3. Pigments
4. Cornea
5. Nearsighted
6. Convex lens
7. Concave mirror
8. Opaque material
9. Retina
10. Mirror
11. Concave lens
12. Pupil
13. Refraction
14. Transparent material 16. Iris
15. Magenta
16. Converge
17. Cyan
18. Convex mirror
19. Secondary colors
20. Farsighted
21. Reflected
22. Translucent material

Page Three:

1. A
2. $C$
3. $C$
4. $A$
5. $C$


## Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "Personal Theatre"

The size and sharpness of an image can be controlled through the understanding of how light travels in waves. The farther you are from an object, the harder it is for photons to be bounced off the object and reach your eye. This causes objects very far away to be blurry. By controlling the amount of photons we take in through our eyes, we can control what we see more easily.

## Personal Theatre

Children will create a (nearly) life-sized camera for them to explore.
Materials:
Masking tape
Few sheets of white paper
Large cardboard box (you'll need a foot
of headroom inside the box as it rests
on your shoulders)
Utility knife
Aluminum foil
Duct tape and Scissors
Push pin
Dark sweatshirt/towel
Pencil


## Activity:

1. Tape white paper onto the inside wall of the box as seen in the picture.
2. Cut an opening in the box that is large enough for your head to fit through but will still sit comfortably on your shoulders
3. Cut a $3^{\prime \prime}$ square in the box opposite of the white paper. This is where the pinhole will be found.
4. Cut a 4 " square of aluminum foil. Cover the 3 " square hole in your box and tape it securely to the box.
5. Place the box over your head. Cover any areas of the box that is allowing light inside with duct tape.
6. Poke a pinhole into the foil using the push pin.
7. Find a well-lit outdoor area with your head in the box.
8. Wrap the sweatshirt/towel around your neck to keep light from coming into the box.
9. Close your eyes for about 30-60 seconds to adjust to the darkness.
10. Open your eyes and move around. You should see upside down images on the screen!

## Explanation:

This device is known as a pinhole camera. It works by letting only a small amount of photons of reflected light from an object into the box through the pinhole. Photons from the top of the object reach the bottom of the screen in your theatre box. And, photons from the bottom of the object reach the top of the theatre's screen. If you explore with this theatre you will find that the farther an object is from the pinhole, the smaller the image will be on the screen. And, by using a larger pinhole you will get a brighter image, but it will not be as sharp.


Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "Blind Spot"

The retina of the eye receives and reacts to incoming light and sends signals to the brain through an optic nerve. The optic nerve passes through a single area on your retina. In this tiny area, there are no light receptors creating a blind spot in your vision.

## Blind Spot

Children will locate where their retina's blind spot is located.

## Materials:

Dot and Cross card (see attached)

## Activity:

1. Cut out the attached card on the following page.
2. Hold the card at eye level about an arm's length away. Make sure that the cross is on the right.
3. Close your right eye and look directly at the cross with your left eye.
4. Slowly bring the card toward your face. At some point, the dot will disappear, and then reappear, as you bring the card toward your face.
5. Now close your left eye and look directly at the dot with your right eye. This time the cross will disappear and reappear as you bring the card slowly toward your face.

## Explanation:

The retina of the eye receives and reacts to incoming light and sends signals to the brain through an optic nerve. The optic nerve passes through a single area on your retina. In this tiny area, there are no light receptors creating a blind spot in your vision.

Your brain "fills in" information in this blind spot all the time. If you draw a straight line through both the dot and cross and repeat this activity, you will discover that as the dot disappears - the line will not. In fact, the line will appear to not have any gap at all where the dot should be! Your brain "fills in" this missing information which is why you do not notice your blind spot every time you look at an object!

## Cut out the following card to use for the "Blind Spot" activity



## Wiat

## sound and waves




1. Read the text
2. Review the text with your child
3. Complete the student worksheets
4. Find the following materials for Days Two and Three:

1-2 FEET OF STRING<br>ONE TOOTHPICK<br>ONE SMALL PAPER CUP WATER<br>750 ML PLASTIC WATER BOTTLE<br>$\frac{1}{2}$ CUP LIQUID DISH SOAP<br>$\frac{1}{2}$ TEASPOON LIGHT KAYO SYRUP OR GLYCERIN<br>WATER<br>BLACK FILM CANISTER<br>SMALL DISH<br>SHARP PENCIL

You and your child(ren) will be covering the following Science Standards this week:

Sound is produced by vibrating objects. The pitch of the sound can be varied by changing the rate of vibration.

Echo
("ek-ko"); the reflection of sound waves off an object
("dif-frak-shun"): the ability of sound waves to bend around objects
("in-tur-fear-enz"); the creation of a new sound wave from the bouncing of two or more waves together

## Sample Questions to ask after your child finishes their reading for Day One:

What does the movement of sound and radiation have in common?
They both travel in waves.
What does kinetic energy have to do with sound waves? Whenever a large object vibrates, like a cell phone, the vibration transfers some of its kinetic energy into the air around the phone. As the atoms of the air receive this energy, they pass some of it to the other atoms they are touching. This pattern of energy being transferred looks very much like a wave!

## Why does sound travel the fastest through solids?

In order for sound waves to move, the kinetic energy from one atom has to be transferred into another atom. Unlike liquids and gases, the atoms in a solid are joined together very closely. So, the energy from one atom can be transferred to the other very quickly.

What can sound waves do when they are moving through a solid, liquid or gas?
Sound waves can reflect off an object, diffract around an object or crash into each other causing interference.

What happens when a sound wave reflects off an object?
When sound reflects off an object it causes an echo to be formed.

## Answers to worksheet questions for Week Twenty-Five:

Page 1:
Compare
Both rely upon the movement of waves of kinetic energy. Both can carry energy through matter.

## Contrast

Some radiation does not require the use of a solid, liquid or gas to be in motion while sound waves require some media.

## Page 2:

1. Diffraction
2. Interference
3. Echo

Page 3:

1. Echo
2. Diffraction
3. Interference


## Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "The Most Annoying Sound in the World"

Vibrations of objects cause energy to be released in the form of waves. If these waves are contained inside a hollow object, the waves will bounce around inside the object until they become bigger (and louder) waves of sound!

## The Most Annoying Sound in the World

Children will create a pseudo-turkey call with some basic materials.

## Materials:

1-2 feet of string
One toothpick
One small paper cup
Water

## Activity:

1. Poke a small hole in the bottom of
 the paper cup.
2. Tie one end of the string in the middle of the toothpick. Break off the ends of the toothpick as well.
3. Thread the string through the hole in the cup as shown in the picture.
4. Wet your fingers and run them down the string as shown. If you do it correctly you should hear a very loud chirping sound.

## Explanation:

As the string slides through your fingers it begins to vibrate. The string causes the toothpick to vibrate the bottom of the cup. As the bottom of the cup vibrates, waves of compressed air (sound waves) are
 created. The shape of the cup collects and amplifies the sound waves!


Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "Interfering with a Film Can"

The creation of a new wave from the bouncing of two or more waves together is known as interference. Light that passes through the walls of a bubble change speed and direction. As they change direction, some waves of light collide with each other forming new waves that we see as changing colors.

## Interfering with a Film Can

Children will use soap bubbles to study the interference of waves.

## Materials:

750 ml plastic water bottle
$\frac{1}{2}$ cup liquid dish soap
$\frac{1}{2}$ teaspoon Light Kayo Syrup or Glycerin

Water<br>Black film canister<br>Small dish<br>Sharp pencil

## Activity:

1. Place $\frac{1}{2}$ cup liquid dish soap and $\frac{1}{2}$ teaspoon Light Kayo Syrup or Glycerin into a 750 ml water bottle and fill the bottle with water.
2. Cap the bottle and shake gently to mix.
3. Place a small amount of this liquid (bubble solution) in a shallow dish.
4. Dip the open mouth of the film canister into the soap solution, and then pull it out. In a brightly lit place, hold the canister horizontally about an inch over the white paper
5. Watch the colors form and move in the film.
6. Notice the horizontal bands of color and, after awhile that the top of the film becomes "invisible."
7. Poke a pencil point into this invisible region of the film. What happens?

## Explanation:

A soap film is a water sandwich that is made up of two layers of soap molecules trapping water inside. When the soap film is held vertically, gravity pulls the water downward, causing the top of the "sandwich" to become thinner. As the sandwich becomes thinner, the colors you see should be changing a lot. This is because the interference of light waves as they reflect off each layer of soap molecules provides alternating patterns of color. The interference is always changing as gravity pulls the water downward. This causes the "sandwich" to get smaller. As this happens, the interference of light waves cancels out all light which makes the top part of the soap film invisible.

## Wisi Loudness and Pitch




1. Read the text
2. Review the text with your child
3. Complete the student worksheets
4. Find the following materials for Days Two and Three:

8 FEET OF $\frac{1}{2}$ INCH PVC SAW<br>PERMANENT MARKER<br>LOTS OF FRIENDS<br>DRINKING STRAW SCISSORS

## You and your child(ren) will be covering the following

 Science Standards this week:Sound is produced by vibrating objects. The pitch of the sound can be varied by changing the rate of vibration.

Loudness
measurement of the strength of a sound wave

## ("dess-ah-bell"); unit of <br> measurement for the loudness of $a$ sound

## Decibel

## Pitch

| Pitch | number of waves that are created in <br> one second from a vibrating object |
| :---: | :--- |
| Larynx | "lay-urn-ex"); area in the throat <br> which contains the vocal cords |

## Sample Questions to ask after your child finishes their reading for Day One:

## Why does "loudness" depend on the person who is hearing

 the sound?Since everyone has different ears and hearing, loudness depends on the person who is hearing the sound.

What two things does the loudness of sound depend upon?
The loudness of sound depends on the amount of energy it takes to make the sound and the distance from the source of the sound.

What happens to the loudness of a sound as you move farther away from its source?

The loudness of the sound gets lower.

## Define "pitch".

Pitch is the number of waves that are created in one second from a vibrating object.

## How can you change the pitch of your voice?

When air from your lungs rushes past your vocal cords, which are found the larynx of your throat, they vibrate, which creates sound. When you stretch or relax these vocal cords, you create different pitches of sound in your voice.

## Answers to worksheet questions for Week Twenty-Six:

Page 1:
Imagine trying to spread a small amount of peanut butter onto a slice of bread.
The more bread you try to cover, the smaller the amount of peanut butter you will have on the bread. Well, when sound waves move away from their source, they get spread out too! In a short period of time, they will get so spread out that you will not be able to hear the sound at all.

Page 2:

1. Pitch
2. Loudness
3. Decibel
4. Larynx

Page 3:

1. Pitch
2. Decibel
3. Loudness
4. Larynx


## Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "Palm Pipes"

By striking the open end of a pipe against your hand, air molecules in the bottom of the tube are squeezed together. The molecules that have been squeezed together, in turn, squeeze the molecules next to them, and so on. In a sort of domino effect, the pulse of compression (highpressure air) travels up and eventually out of the tube. This wave of compressed air gives us a sound wave!

## Palm Pipes

Children will examine the pitch of plastic tubes.

## Materials:

8 feet of $\frac{1}{2}$ inch PVC
Saw
Permanent marker
Lots of friends

## Activity:

1. Cut the PVC to the measurements in the chart.
2. Mark each tube with the appropriate note with the permanent marker.
3. Grasp the pipe firmly in one hand and quickly bring it down onto the palm of the other hand, allowing the end of the pipe to strike the palm of the other hand.
4. Use the attached document to play various tunes.

## Explanation:

When you hit the open end of the pipe against your

| Note |  | Length (cm) |
| :---: | :---: | :---: |
| F1 |  | 23.6 |
| G1 |  | 21.0 |
| A1 |  | 18.7 |
| B flat 1 |  | 17.5 |
| C1 |  | 15.8 |
| D1 |  | 14.0 |
| E1 |  | 12.5 |
| F2 |  | 11.8 |
| G2 |  | 10.5 |
| A2 |  | 9.4 |
| B flat 2 |  | 9.2 |
| C2 |  | 7.9 |
| D2 |  | 7.0 |
| E2 |  | 6.2 |
| F3 |  | 5.9 | hand, air molecules in the bottom of the tube are squeezed together. The molecules that have been squeezed together, in turn, squeeze the molecules next to them, and so on. In a sort of domino effect, the pulse of compression (highpressure air) travels up and eventually out of the tube.

The length of tube affects the note that the tube produces. Because the speed of sound waves is the same in all the tubes, the length of the tube has a direct effect on the time it takes for air to move through the tube. The longer it takes for the air to move, the lower the frequency of the sound, and the lower the musical note.

## Songs for the Palm Pipes

Mary Had a Little Lamb
(Pipes C1, D1, E1, and G2 four players)
EDCDEEEDDDEGG
EDCDEEEEDDEDC

## Jingle Bells

(Pipes C1 through G2 five players)
EEEEEEEGCDE
FFFFFEEEEEDDEDG
EEEEEEEGCDE
FFFFFEEEEGGFDC
Twinkle, Twinkle, Little Star
(Pipes F2 through D2 - six players)
FFCCDDCBBAAGGF
CCBBAAGCCBBAAG
FFCCDDCBBAAGGF
My Country 'Tis of the Thee (America)
(Pipes E1 through D2 - seven players)
FFGEFAABAGFGFEF $C C C C B A B B B B A G$
ABAGFABCDBAGF

Twinkle, Twinkle, Little Star
Pipes F2 through E2-three players on melody $(M)$ and three player on harmony $(H)$
M: FFCCDDCBBAAGGF
H: CCAABBAGGFFEEC
M: CCBBAAGCCBBAAG
H: A AGGFFCAAGGFFC
M:FFCCDDCBBAAGGF
H:CCAABBAGGFFEEC


1. Review Day One with the information found below.
2. Run the activity "Straw Oboes"

The pitch of a reed instrument is changed by altering the distance sound waves move through the device. These sound waves are created by vibrations of the reed as you blow air over them.

## Straw Oboes

Children will create a reed instrument with the use of a drinking straw.

## Materials:

Drinking straw
Scissors

## Activity:

1. Flatten about one inch of the end of a drinking straw using your teeth or your fingers. Use scissors to make angular cuts as shown, on each side of the flattened end.
2. Insert the straw into your mouth with the flattened part just inside your lips and apply very light pressure with your lips. Blow through the straw. The reeds should vibrate and produce a tone.

3. You may need to move the straw around slightly to locate the best position for creating your musical note.
4. To change the pitch of your musical instrument, cut off portions of the straw to make them smaller.

## Explanation:

Blowing through the flattened area of the straw (reed) causes the both sides to vibrate together. It also causes the column of air in the straw to vibrate. This produces the pitch of the instrument which can be lowered by cutting the straw. If the distance the air travels is decreased inside the straw, the sound that is produced has a shorter wavelength and higher pitch.

Human Hearing

MY FRIEND WAS WALKING DOWN THE STREET AND HE SAID, "I HEAR MLISIC." AS IF THERE IS ANY OTHER WAY OF TAKING IT IN.


## Today, you and your child will:

1. Read the text
2. Review the text with your child

## 3. Complete the student worksheets

4. Find the following materials for Days Two and Three:

TWO AA BATTERIES
ONE AA BATTERY CLIP FOR TWO BATTERIES (RADIO SHACK \# 270-382)
TWO WIRES WITH ALLIGATOR CLIP LEADS (RADIO SHACK \# 278-OO1)
BATTERY OPERATED BLLZER (RADIO SHACK \#273-053)
10 FEET OF ROPE
AN OLD SOCK
STRING
METAL FORKS AND SPOONS
SCISSORS

You and your child(ren) will be covering the following Science Standards this week:

Sound is produced by vibrating objects. The pitch of the sound can be varied by changing the rate of vibration.

| Doppler Effect | the stacking of sound waves around the <br> source of a moving sound; the pitch of this <br> sound does not change as a result of the <br> movement |
| :---: | :--- |
| Outer Ear | part of the ear that is seen; used to collect <br> and send sound waves through the ear canal |
| Ear Canal | ("kah-nal"); part of the ear that looks like a <br> small tunnel that leads inside your head |
| Eardrum | separates the outer ear from the middle ear; <br> vibrates due to incoming sound waves |
| Middle Ear | made up of three small bones that vibrate <br> with the eardrum |
| Inner Ear | contains the cochlea; responsible for sending <br> messages about sound waves to the brain |
| Cochlea | ("coke-lee-ah"); fluid-filled opening in the <br> inner ear that is filled with tiny hairs that <br> send information about sound waves to the <br> brain |

## Sample Questions to ask after your child finishes their reading for Day One:

## What is the pitch of a sound?

The pitch of a sound is the number of waves that are created in one second from a vibrating object.

Does the Doppler Effect change the pitch of a sound? No. The Doppler Effect only states that the wavelengths of sound stack up on each other and appear to change the pitch of the sound as the source moves closer to you.

How many parts make up your ears and what are their names?
Your ears are made up of three parts: the outer, middle and inner ear.
What is the job of the outer ear?
The job of the outer ear is to collect sound waves and send them through the ear canal.

How does your cochlea send messages to your brain to figure out what you are hearing?
Along the walls of your cochlea (in your inner ear) are tiny hairs that move in the waves of fluid. Every time one of these hairs moves, it sends a message to your brain. Your brain can then figure out what it is you are hearing!

## Answers to worksheet questions for Week Twenty-Seven:

## Page 1:

The outer ear is the part of the ear that you see every day! The job of the outer ear is to collect sound waves and send them through the ear canal. This area is the part of your ear that looks like a small tunnel that leads inside your head! This "tunnel" is blocked by your eardrum which vibrates when it is hit by sound waves.
The vibrations transfer energy into your middle ear.
This part of your ear is made up of three very small bones that vibrate too. As these bones vibrate, they transfer some of their energy into your inner ear. Inside this part of your ear is an opening that is filled with fluid and is called the cochlea. Waves are created in this fluid as the vibrations transfers its energy. Along the walls of this part of your ears are tiny hairs that move in the waves of fluid. Every time one of these hairs moves, it sends a message to your brain.

## Page 2:

1. Inner ear
2. Doppler effect
3. Middle ear
4. Eardrum
5. Outer ear
6. Cochlea
7. Ear canal

## Page 3:

Be certain that all vocabulary words are circled.


## Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "Buzzing Through the Air"

The Doppler Effect is the stacking of sound waves on top of each other in such a way that an apparent change in pitch occurs. In reality, there is no change in pitch!

## Buzzing Through the Air

Children will explore the concept of the Doppler Effect.
Materials:
Two AA batteries
One AA battery clip for two batteries (Radio Shack \# 270-382)
Two wires with alligator clip leads (Radio Shack \# 278-001)
Battery operated buzzer (Radio Shack \#273-053)
10 feet of rope
An old sock

## Activity:

1. Connect the battery to the buzzer, and insert both into the sock. Tie the open end of the sock to the strong cord. MAKE SURE IT IS SECURELY TIED.
2. Go outside to complete this activity. You will need a clear, circular space having a diameter of at least 20 feet.
3. Slowly start to swing the sock with the buzzer over your head and the head of the child.
4. Ask the child to listen to the buzzer as it moves towards them and away from them and to state what is happening with the pitch of the buzzer.

## Explanation:

They should notice that the pitch of the buzzer appears to change. Remind them that the pitch is not changing; however, they are experiencing move waves of sound as the buzzer gets closer to them. This "stacking" of sound waves appears to increase the pitch but it does not! You can prove this by having them swing the buzzer themselves. As they are in the center of the flying buzzer, the pitch of the device will not change as it will be equally close to them at all times.


Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "Bells in Your Ears"

Conduction of sound works similarly to the conduction of heat or electricity. Sound travels fastest through solids, slower through liquids and slowest through gases.

## Bells in Your Ears

Children will explore how sound can travel through solids.

## Materials:

String
Metal forks and spoons
Scissors

## Activity:

1. Cut a 24 inch piece of string.
2. Tie a metal fork in the middle of the string.
3. Wrap the two ends of the string around your index finger.
4. Be certain that there is no slack in the lines between your fingers and the fork.
5. Place your fingers with the wrapped string in your ears (gently!)
6. Have a friend gently tap the fork with a metal spoon.
7. You should hear a very different sound in your ears!

## Explanation:

Sound travels through air at approximately 750 miles per hour. However, sound travels more than seven times as fast through solids like the string, the metal fork and your fingers! In fact, the more rigid a substance is, the faster sound travels through it. Thus, metals not only conduct heat and electricity very well, they also conduct sound very well too! This is due to the tightly packed and neatly arranged molecules that make up most metals. The waves of sound do not have to travel very far to pass on their energy between molecules in a metal.

## Sonar and Ultrasound



If sound does not travel in a vacuum, then why is a vacuum so noisy?


1. Read the text
2. Review the text with your child
3. Complete the student worksheets
4. Find the following materials for Days Two and Three:

BLINDFOLD<br>SEVERAL FRIENDS<br>5-7 SMALL COMMON HOUSEHOLD ITEMS<br>5-7 BLACK FILM CANISTERS

You and your child(ren) will be covering the following Science Standards this week:

Sound is produced by vibrating objects. The pitch of the sound can be varied by changing the rate of vibration.

Hertz

## Ultrasound

Echolocation

Sonar
("hurts"); unit of pitch
any sound that is above 20,000 Hertz
(eck-oh-loh-kay-shun); the use of reflected sound waves to figure out the distances of object or where they are located
("sow-nar"); the use of reflected sound waves to find objects underwater
("sahn-o-gram"); an ultrasound machine which sends sound waves through the body and measures them as they return

## Sample Questions to ask after your child finishes their reading for Day One:

## What do scientists call sounds that cannot be heard by humans? <br> Ultrasound

What pitch does a sound have in order for it to be called ultrasound?
Any sound above 20,000 Hertz cannot be heard by humans and is classified as ultrasound.

What is the difference between the sound waves that are picked up by a radio and the sound waves that we hear coming out of the radio?
Sound waves that are picked up by a radio are traveling at 30 million Hertz to 300 million Hertz. However, the speakers of a radio can only transmit sound waves between 20 and 20,000 Hertz.

How do some organisms use sound waves to locate food? Some organisms use ultrasound waves for echolocation, which is the use of reflected sound waves to figure out the distances of object or where they are located. Bats and dolphins use echolocation to find food.

## How do doctors use ultrasound?

Doctors use ultrasound machines, called sonograms, to reflect sound waves through the body. These reflected waves help to create a picture of the inside of your body.

## Answers to worksheet questions for Week Twenty-Eight:

Page 1:

1. A
2. $B$
3. $B$
4. $A$

Page 2:


Page 3:

1. Sonar
2. Hertz
3. Echolocation
4. Ultrasound
5. Sonogram

Answers to Unit 7 Review:


## Unit 7 Exam

## Match the definitions with the words on the bottom of this page

1. $\qquad$ the stacking of sound waves around the source of a moving sound; the pitch of this sound does not change as a result of the movement
2. $\qquad$ the use of reflected sound waves to find objects underwater
3. $\qquad$ contains the cochlea; responsible for sending messages about sound waves to the brain
4. $\qquad$ the ability of sound waves to bend around objects
5. $\qquad$ measurement of the strength of a sound wave
6. $\qquad$ unit of pitch
7. $\qquad$ the creation of a new sound wave from the bouncing of two or more waves together
8. $\qquad$ part of the ear that is seen; used to collect and send sound waves through the ear canal
9. $\qquad$ unit of measurement for the loudness of a sound
10. $\qquad$ the use of reflected sound waves to figure out the distances of object or where they are located
11. 
12. 
13. $\qquad$ made up of three small bones that vibrate with the eardrum
14. $\qquad$ an ultrasound machine which sends sound waves through the body and measures them as they return
15. $\qquad$ part of the ear that looks like a small tunnel that leads inside your head
number of waves that are created in one second from a vibrating object
16. $\qquad$ fluid-filled opening in the inner ear that is filled with tiny hairs that send information about sound waves to the brain separates the outer ear from the middle ear; vibrates due to incoming sound waves
17. $\qquad$ the reflection of sound waves off an object

| echo | pitch | eardrum | ultrasound |
| :--- | :--- | :--- | :--- |
| diffraction | larynx | middle ear | echolocation |
| interference | doppler effect | inner ear | sonar |
| loudness | euter ear | cochlea | sonogram |
| decibel | hertz |  |  |

Fill in the blanks with the correct letter. The definitions below will provide a clue.

1. $D_{\_} \__{-} A C_{-} I_{-}$
2. $\quad$ - HO
3. $I_{-}{ }_{-} E_{-} F_{-} E_{-} C_{-}$
4. $O_{-} n_{-}$EAR
5. $-N N_{-} E_{-}$
6. _ _ U _ N_S_
7. $E_{-} Z_{-}$
8. $C^{C O C}-{ }_{-}$
9. $E_{-} R_{-} C_{-} N_{-}$
10. $\quad A R_{-}$- -
11. _ $O_{-} G_{-} M$
12. $\quad-\quad-\quad$ R
13. $E C_{-}{ }_{-} O C_{-} T_{-}-$
14. _ $\mathrm{O}_{-} \mathrm{PL} \__{-} \mathrm{R}_{-} \mathrm{F}_{-} \mathrm{C}_{-}$
15. $\sim_{-} \mathrm{I}_{-} \mathrm{L}_{-} \mathrm{EA}$
16. $L_{-} R_{-}$-
17. _LT_ _ _O_N_
18. $\mathrm{D}_{-}$_I_ _L
19. $P_{-}-C_{-}$
20. the ability of sound waves to bend around objects
21. the reflection of sound waves off an object
22. the creation of a new sound wave from the bouncing of two or more waves together
23. part of the ear that is seen; used to collect and send sound waves through the ear canal
24. contains the cochlea; responsible for sending messages about sound waves to the brain
25. measurement of the strength of a sound wave
26. unit of pitch
27. fluid-filled opening in the inner ear that is filled with tiny hairs that send information about sound waves to the brain
28. part of the ear that looks like a small tunnel that leads inside your head
29. separates the outer ear from the middle ear; vibrates due to incoming sound waves
30. an ultrasound machine which sends sound waves through the body and measures them as they return
31. the use of reflected sound waves to find objects underwater
32. the use of reflected sound waves to figure out the distances of object or where they are located
33. the stacking of sound waves around the source of a moving sound; the pitch of this sound does not change as a result of the movement
34. made up of three small bones that vibrate with the eardrum
35. area in the throat which contains the vocal cords
36. any sound that is above 20,000 Hertz
37. unit of measurement for the loudness of a sound
38. number of waves that are created in one second from a vibrating object

## Which one is right? Circle the correct answer.

1. If the pitch of a sound increases...
a. The distance between wavelengths increase
b. The number of waves the sound creates decreases
c. The distance between wavelengths decrease
2. Sound travels the fastest through which state of matter?
a. Solids
b. Liquids
c. Gases

## 3. Which of the following is true?

a. The pitch of a sound changes due to the Doppler Effect
b. The Doppler Effect stacks wavelengths of sound on top of each other
c. It is not possible to change the pitch of a sound
4. Which of the following sends messages to your brain about the sounds you hear?
a. Cochlea
b. Middle ear
c. Ear drum
5. Which is not a way that humans have used ultrasound?
a. Echolocation
b. Sonar
c. Sonogram

## Unit 7 Exam Answer Key

## Page One:

1. Doppler Effect
2. Sonar
3. Inner ear
4. Diffraction
5. Loudness
6. Hertz
7. Interference

Page Two:

1. Diffraction
2. Echo
3. Interference
4. Cochlea
5. Ear canal
6. Eardrum
7. Middle ear
8. Larynx
9. Ultrasound
10. Outer ear
11. Inner ear
12. Loudness
13. Hertz
Page Three:
14. $C$
15. $A$
16. $B$
17. $A$
18. $A$


## Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "Modified Marco Polo"

Echolocation is to animals what radar/sonar is to humans. Through the bouncing of ultrasonic waves of sound throughout the environment, organisms are able (either naturally or mechanically) to determine the size, shape and distance of another object.

## Modified Marco Polo

Children will explore the concept of echolocation.

## Materials:

Blindfold
Several friends

## Activity:

1. Find 2-3 children and one additional child to be the "Bat".
2. Blindfold the "Bat".
3. The rest of the group will be the insects. The insects spread out within an area that is roughly the size of one half of a basketball court. This activity should be played outside and without any obstructions in the way.
4. The Bat calls out "BEEP BEEP BEEP".
5. The Insects call out "BUZZ BUZZ BUZZ".
6. The insects walk around, trying to avoid the Bat.
7. The Bat tries to tag the insects by listening for their sound.
8. A tagged insect must sit in the bat cave. The last person tagged becomes the new Bat.

## Explanation:

Unlike insects and birds, many bats rely on echolocation to fly and hunt for food. Echolocation works like the radar or sonar in planes and ships. A bat hears the echoes and its brain works out a sound picture of the object. It can tell if the object is prey or part of the landscape.


Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "Seeing the Forest through the Trees"

It is difficult for humans to determine what an object is without the use of our sight. This is not to say that this task is impossible, but we interpret much of the world through our vision.

## Seeing the Forest through the Trees

Children will understand that vision is not the only way to see the world.

## Materials:

Sound Chart (see attached)
5-7 small common household items
5-7 black film canisters

## Activity:

1. Instruct the child to use the Sound Chart provided to list what they hear as they shake each canister. Encourage them to describe the sound, not to attempt to name the objects.
2. After all canisters have been examined, have the child share his/her descriptions.
3. As they describe each object, build a list of terms on the chalkboard, paper, etc.
4. Point out that some terms describe number; some describe size; some, shape; some hardness; some mass and some composition. But all of these descriptions came solely from their sense of sound.
5. Tell the child that all the objects in the boxes are common household objects.
6. Have him/her make a prediction about what the object in each box is.
7. After discussing each canister, open them up to check their predictions.

## Explanation:

The concept of seeing with all kinds of waves, not just light, can be extended to many areas of science--i.e. seismicity and earth structure, planetary surfaces and radar, etc. In this activity, the child was able to interpret sound waves to see something hidden from view. This is how scientists explore unseen parts of our planet, like the ocean floor and hidden landforms on other planets too!

## Seeing the Forest through the Trees

|  | Are <br> there <br> many <br> objects or a <br> few? | Is the object as big as the inside of the can or Big smaller? | Is the object hard or soft? | Does it slide, tumble or roll? | Does it roll one way and tumble the other? | Does it sound like metal, glass, plastic, etc.? | Is it heavy, light or in between? |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Film can \#1 | Many Few | Big <br> Small | Hard Soft | Slide Tumble Roll | $\begin{aligned} & \text { Yes } \\ & \text { No } \end{aligned}$ |  | Heavy In-Between Light |
| Film can \#2 | Many Few | Big <br> Small | Hard Soft | Slide Tumble Roll | $\begin{aligned} & \text { Yes } \\ & \text { No } \end{aligned}$ |  | Heavy In-Between Light |
| Film can \#3 | Many Few | Small | Hard Soft | Slide Tumble Roll | $\begin{aligned} & \text { Yes } \\ & \text { No } \end{aligned}$ |  | Heavy In-Between Light |
| Film can \#4 | Many Few | Big <br> Small | Hard Soft |  | $\begin{aligned} & \text { Yes } \\ & \text { No } \end{aligned}$ |  | Heavy In-Between Light |
| Film can \#5 | Many Few | Big <br> Small | Hard Soft | Slide Tumble Roll | $\begin{aligned} & \text { Yes } \\ & \text { No } \end{aligned}$ |  | Heavy In-Between Light |
| Film can \#6 | Many Few | Big <br> Small | Hard Soft | Slide Tumble Roll | $\begin{aligned} & \text { Yes } \\ & \text { No } \end{aligned}$ |  | Heavy In-Between Light |
| Film can \#7 | Many Few | Big <br> Small | Hard Soft |  | $\begin{aligned} & \text { Yes } \\ & \text { No } \end{aligned}$ |  | Heavy In-Between Light |



## Static Electricity and the Atom

A hydrogen atom came running into a police station asking for help....


$$
\begin{aligned}
& \text { ARE YOU } \\
& \text { SURE? }
\end{aligned}
$$

##  <br> Today, you and your child will:

## 1. Read the text

2. Review the text with your child
3. Complete the student worksheets
4. Find the following materials for Days Two and Three:

PLASTIC RLLER<br>WOOL OR OTHER CLOTH<br>4 IN STRIP OF PAPER<br>TAPE<br>YARDSTICK OR MEASURING TAPE<br>A PLASTIC ITEM (I,E, PVC TUBES, PLASTIC RULERS, PENS, ETC.)<br>A PIECE OF WOOL CLOTH OR FLR<br>PIECE OF WHITE PAPER<br>TABLESPOON OF SALT AND PEPPER MIXED TOGETHER

## You and your child(ren) will be covering the following

 Science Standards this week:Electricity in circuits can produce light, heat, sound, and magnetic effects. Electrical circuits require a complete loop through which an electrical current can pass.

Electrical circuits provide a means of transferring electrical energy when heat, light, sound, and chemical changes are produced.

| Protons | ("pro-tauns"); small piece of an atom with a positive charge that sits inside the nucleus |
| :---: | :---: |
| Neutrons | ("new-trahnz"); small piece of an atom that is neutral sits inside the nucleus |
| Nucleus | ("new-klee-us"); combination of protons and neutrons within every atom |
| Neutral | ("new-trul"); objects that have no charge at all |
| Static Electricity | transfer of charges between objects |
| Static Discharge | the loss of static electricity as electrons transfer between two objects |

## Sample Questions to ask after your child finishes their reading for Day One:

What are the three objects that make up an atom? Protons, neutrons and electrons

Which of these three objects have opposite charges?
Protons have positive charges and neutrons have negative charges.
What would happen if a proton and an electron would be brought close together? What about two electrons?
Since opposite charges attract each other, a proton and an electron would attract
to each other. However, two electrons would repel each other because like charges repel each other.

## Define "electricity"?

Electricity is the movement of electrons between atoms.

What causes an electric shock?
An electric shock (static discharge) takes place with the loss of static electricity as electrons transfer between two objects.

## Answers to worksheet questions for Week Twenty-Nine:

## Page 1:

Static electricity is an example of potential energy because it is simply the buildup of a charge. No work is being done with static electricity.

## Page 2:

Be certain that all vocabulary words are circled.

## Page 3:

1. Neutrons
2. Static electricity
3. Static discharge
4. Neutral
5. Protons
6. Nucleus


## Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "ESP: Force-fed Electricity"

Electricity is the movement of electrons between atoms. When an object contains more electrons than protons, it is said to have a negative charge. The excess electrons in an object will be attracted to the protons of other objects which, if moved close enough, can create a path (spark) towards each other.

## ESP: Force-fed Electricity

Static cling is taken to a completely different level in this experiment.
Materials:
Plastic ruler
Wool or other cloth
4 in strip of paper
Tape
Yardstick or measuring tape

## Activity:

1. Connect both ends of the paper strip with tape to make a small roll (about one diameter).
2. Place the yardstick along the roll on a flat table top.
3. Move the plastic ruler towards the roll and record its distance from the roll when/if it begins to move towards the ruler
4. For experimentation, rub the plastic ruler on the cloth a known amount of times (i.e. one or two times).

## Explanation:

You should not see too much movement of the roll until the ruler is rubbed with the cloth. The mechanical energy (from your arm) is converted into static electricity on the ruler as it is rubbed against the cloth. This conversion occurs as excess electrons move from the cloth to the ruler, thereby giving the ruler a larger negative charge than the paper roll. The protons within the paper roll are attracted to these electrons and induce movement within the roll. The electrostatic energy within the ruler causes a force (a push or pull) on the paper roll.

## Independent variable: Number of rubs

Dependent variable: Distance the roll moves

## Hypothesis:

If the NUMBER OF RUBS is (increased/decreased), then the DISTANCE THE ROLL MOVES will (increase/decrease).


1. Review Day One with the information found below.
2. Run the activity "Dancing Salt and Pepper"

The buildup of a negative charge on an object can be used to generate mechanical energy in small objects. Since electrons are repelled by other electrons, a negatively-charged object can be used to move other negatively-charged
objects. It can also be used to attract positively-charged objects too!

## Dancing Salt and Pepper

Children will make salt and pepper dance using static electricity.

## Materials:

A plastic item (i.e. pvc tubes, plastic rulers, pens, etc.)
A piece of wool cloth or fur
Piece of white paper
Tablespoon of salt and pepper mixed together

## Activity:

1. Connect both ends of the paper strip with tape to make a small roll (about one diameter).
2. Place the roll on a flat table top and run the yardstick/measuring tape alongside it.
3. Move the plastic ruler towards the roll and record its distance from the roll when/if it begins to move towards the ruler
4. For experimentation, rub the plastic ruler on the cloth a known amount of times (i.e. one or two times).

## Explanation:

Both the plastic and the salt and pepper mix start out electrically neutral, having equal number of positive and negative charges. When you rub the plastic with the wool cloth, the cloth transfers electrons to the plastic. This buildup of negative charge attracts the protons in the salt and pepper. The attraction between the negative plastic and the positive charge concentrated on the top of the fleas makes the fleas jump up to the underside of the plastic.

When the salt and pepper touch the plastic, some of the plastic's electrons flows to the salt and pepper which gives them a negative charge. The negatively charged salt and pepper flakes and the negatively charged plastic repel each other strongly, which causes the grains to jump quickly back to the table.


Voltage Current and Resistance

When Thomas Edison worked late into the night on the electric light, he had to do it by gas lamp or candle. I'm sure it made the work seem that much more urgent.


1. Read the text
2. Review the text with your child
3. Complete the student worksheets
4. Find the following materials for Days Two and Three:

9-VOLT BATTERY AND CLIP (RADIO SHACK \#270-324) STANDARD LIGHT SOCKET WIRE STRIPPER
8 INCHES INSULATED WIRE (RADIO SHACK \#278-1219)
WOOD ( $\left.8^{\prime \prime} X 12^{\prime \prime}\right)$
WOOD SCREWS (4)
100-WATT LIGHT BULB
GROCERY BAG
HAMMER
SCREWDRIVER
3-VOLT FLASHLIGHT BLLB WITH THREADED BASE (RADIO SHACK \#272-1124)
THREADED SOCKET FOR FLASHLIGHT BULB (RADIO SHACK \#272-357)
12 SMALL SOFT BALLS (I,E. TENNIS BALLS, PING PONG BALLS, ETC.)
TWO CHILDREN (OR ONE CHILD AND A PARENT)

## You and your child(ren) will be covering the following

 Science Standards this week:Electrical circuits provide a means of transferring electrical energy when heat, light, sound, and chemical changes are produced.

| Voltage | ("vohl-taj"); the force needed to <br> push the current through the <br> conductor |
| :--- | :--- |

## Current

("kur-ant"); the amount of electrons that pass through a conductor

## Resistance

("ree-zis-tanz"); a measurement of how hard it is for the current to flow through the circuit

## Circuit

("sir-cut"); an unbroken path for electrons to flow

## Sample Questions to ask after your child finishes their reading for Day One:

Can electrons be shared among every kind of atom in the universe?
No. Some materials, called insulators, have electrons that are tightly bound to their atoms. Electrons do not move through these objects very well because their atoms are not lined up very well.

Define "conductor"?
Conductors are objects that allow electrons to jump from one atom to another.

What provides the force to push electrons through a circuit?
Voltage
If the resistance of a circuit is increased, what happens to the current?
As resistance is increased, the current of the circuit will decrease.

What four things cause resistance in a circuit?
Material of the conductor, length of the conductor, thickness of the conductor and the temperature of the conductor

## Answers to worksheet questions for Week Thirty:

Page 1:

1. $C$
2. $A$
3. $C$
4. B
5. $A$

Page 2:


Page 3:

1. Resistance
2. Circuit
3. Voltage
4. Current


Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "Resistance is Futile"

Temperature and electrical resistance are related to each other. When the temperature of an electrical circuit decreases, its resistance decreases too. By lowering the electrical resistance, more electrons are allowed to flow through a circuit.

## Resistance is Futile

Children will use their breath to change an electric current.

## Materials:

9-volt battery and clip (Radio Shack \#270-324)
Standard light socket
Wire stripper
8 inches insulated wire (Radio Shack \#278-1219)
Wood (8"×12")
Wood screws (4)
100-watt light bulb
Grocery bag
Hammer
Screwdriver
3-volt flashlight bulb with threaded base (Radio Shack \#272-1124)
Threaded socket for flashlight bulb (Radio Shack \#272-357)

## Activity:

1. Take the two wires from the 9-volt battery clip. Connect one wire to the large socket and the other wire to the small socket.
2. Strip one inch of insulation off of the insulated wire.
3. Connect one end of this wire to the remaining contact of the large socket. Connect the other end of this wire to the remaining contact on the small socket.
4. Place the two sockets onto the board and attach with wood screws.
5. Connect the 9-volt battery to the battery clip.
6. Remove the glass from the 100-watt bulb (Be very careful!). This must be accomplished without breaking the filament of the bulb. Put the bulb in the grocery bag, close it up and gently tap the bag with the hammer.
7. Carefully remove the bulb from the bag. The filament is very fragile! Use pliers to break off any remaining glass from the bulb.
8. Screw the broken bulb into the socket and the flashlight bulb into its socket.
9. Blow gently on the exposed filament. You should notice a change in the brightness of the flashlight bulb.

## Explanation:

By blowing on the filament, you are cooling the circuit. As the temperature decreases, electrical resistance decreases too. By lowering the electrical resistance, more electrons are allowed to flow through the flashlight bulb causing it to become brighter.


Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "Discussing Electricity"

Voltage is the force needed to push the current (an amount of electrons) through a conductor. When the electrons are allowed to move
through the power source via a conductor and back again to the power source, a circuit is created. The power of the circuit is the product of the current and voltage multiplied together.

## Discussing Electricity

The child will define concepts of electricity through a hands-on demo.

## Materials:

12 small soft balls (i.e. tennis balls, ping pong balls, etc.)
Two children (or one child and a parent)

## Activity:

1. Assign one child the role of "the battery" and the other child (or parent) the role of "the light bulb."
2. Ask, "How can the battery give energy to the light bulb to create light?
3. Provide "the battery" with a basket of balls. Explain that the balls represent the electrons of an atom. (You may need to reinforce the concept that it is the flow of electrons that generate electricity.)
4. Have "the battery" toss the balls to the light bulb. Every "electron" in motion provides energy to the light bulb so that it may stay on.
5. Once "the battery" has thrown all of the balls to "the light bulb," the supply of energy to the light bulb is gone and the bulb cannot stay lit.
6. Ask, "How can the light bulb be lit for a longer period of time?" Possible answers include:

- Use more balls. (This would work for a short period of time, at least until you run out of power.)
- The light bulb could return the balls to the battery quickly. (This answer introduces the term circuit.)

7. Ask the child, "How could the light bulb give off light that is brighter?" Possible answers include:

- Make each ball larger so it would have more energy. (In this case, it is easier to move the small, negatively charged electrons than the larger, positive protons.)
- Throw the ball harder. This introduces the term voltage.
- Throw the balls faster; send more balls to the light bulb per second. This introduces the term current.
- Throw the balls harder and faster. This introduces the equation of power.


## Explanation:

A circuit is a complete path; in this case the path is completed when the balls are returned to their starting point and can then be given more energy and used again. Voltage is the measure of pressure under which electricity flows; in this case it is the measure of how much energy or force "the battery" is giving each ball. If the same number of balls are thrown, but each ball is given more force of energy, more power will be sent to the light bulb.
Current is the movement or flow of electricity. Since the electrical current is how many electrons pass by each second, if we send twice as many electrons or balls each second, we will send twice the energy.
Power is the product of current and voltage. $P=I \times V$. In this case, the total power would be number of balls thrown multiplied by how much energy each one has.



## 1. Read the text

2. Review the text with your child
3. Complete the student worksheets
4. Find the following materials for Days Two and Three:

SCISSORS AND TAPE
20 INCHES WIRE, 18 OR 20 GALIGE (RADIO SHACK \#278-1219) WIRE STRIPPERS
ALLIMINUM FOIL
2 TABLESPOONS TABLE SALT
I QUART OF WATER
PITCHER OR BOWL WITH A SPOUT
5 PLASTIC CLPS
6 ALLIGATOR-CLIP LEADS (RADIOSHACK \#278-001)
LIGHT-EMITTING DIODE (LED) (RADIOSHACK \#276-330)
VINEGAR
CARDBOARD SHOE BOX LID
8 BRASS PAPER FASTENERS (AKA-"BRADS")
PEN OR PENCIL
2 FEET INSULATED WIRE (RADIO SHACK \#278-1219)
SMALL FLASHLIGHT BULB (RADIO SHACK \#272-1124)

## You and your child(ren) will be covering the following

 Science Standards this week:Electrical circuits provide a means of transferring electrical energy when heat, light, sound, and chemical changes are produced.


## Sample Questions to ask after your child finishes their reading for Day One:

What do you need to make a light bulb turn on?
You must connect the light bulb to a battery with a conductor (like a wire).

## Define "series circuit"?

A series circuit is a circuit in which there is only one path for the current to follow.

What are the problems with a series circuit?
If one part of the circuit is broken, the entire circuit shuts down. And, the more components you put on the circuit, current gets spread out more. This causes some components, like light bulbs, to become dimmer.

How does a parallel circuit fix the problems of a series circuit?
A parallel circuit provides an additional wire to each component so that there is always a current flowing through the circuit.

Why would it be a good idea for your house to have mostly parallel circuits?
You would not want to have to fix your electricity every time one component broke down.

## Answers to worksheet questions for Week Thirty-One:

Page 1:
Compare
Both are types of circuits that are responsible for moving electrons to do work. Both require voltage to move electrons and both deal with resistance.

## Contrast

Parallel circuits provide more than one pathway for electrons to travel and they use more conductors as secondary wires are needed to keep the circuit running.

## Page 2:

1. Parallel circuit
2. Series circuit

## Page 3:

1. Parallel circuit
2. Series circuit


## Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "Current Events in Electricity"

A battery is nothing more than two metals that are connected by some form of acid. A mildly acidic saltwater solution can be used to allow metals to share their electrons very easily. And, when electrons are moving between atoms, you have electricity!

## "Current" Events in Electricity

Children will create their own battery!

## Materials:

Scissors
20 inches wire, 18 or 20 gauge (Radio Shack \#278-1219)
Wire strippers
Aluminum foil
2 tablespoons table salt
1 quart of water
Pitcher or bowl with a spout
5 plastic cups
6 alligator-clip leads (RadioShack \#278-001)
Light-emitting diode (LED) (RadioShack \#276-330)
Vinegar

## Activity:

1. Cut the wire into five sections of 4 inches each.
2. Strip 2 inches of insulation off one end of each of the five pieces and twist the metal wire strands tightly together.
3. Strip 1 inch of insulation off the other end of each piece and separate the metal wires so that the loose strands look something like a broom. These are your copper electrodes.
4. Cut five pieces of aluminum foil, each about 4 inches $X 4$ inches. Fold each piece in half, and then again in half again so that it ends up four layers thick, with final dimensions approximately 1 inch $\times 4$ inches. These are your aluminum electrodes.
5. Add 2 tablespoons of salt to 1 quart of water and stir. This is the electrolyte solution-a liquid that can conduct electricity.
6. Fill each cup about three-quarters full of the electrolyte solution.
7. Add put one aluminum electrode and one copper electrode in each cup. The broomlike end of the copper electrode should be in the solution. Each cup and its electrodes make up one saltwater cell.
8. Connect the cells in series by clipping alligator-clip leads from the copper electrode of one cup to the aluminum electrode of the next cup, and so on, until all five cells are connected.
9. As you attach each alligator clip to an electrode, you can simultaneously clip the electrode to the top of the cup to hold it in place. When you are done, the aluminum electrode in the first cup and the copper electrode in the fifth cup should be left unconnected.
10. Adjust the two electrodes inside each cup as necessary to make sure that they do not touch each other.
11. Use alligator-clip leads to connect the aluminum electrode in the first cup to one leg of the LED and the copper electrode in the fifth cup to the other leg. Your LED should light up!

## Explanation:

Each cup, with its electrodes and the electrolyte solution, is a simple electrochemical cell. This is very similar to a battery! The two solutions share their electrons within the mildly acidic saltwater solution. And, as electrons are in motion between atoms, voltage is created. In the cells you have made, aluminum is the more active metal. Therefore, atoms of aluminum lose their electrons more easily than do atoms of copper. This voltage causes electrons lost by the atoms in the aluminum electrode to travel through the LED to the copper electrode. It is this flow of electrons in the electric current that lights the LED.


Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "Secret Circuit Board"

To have a continuous flow of electricity
there must be an unbroken path for electrons to travel through. This path is called a circuit.

## Secret Circuit Board

Children will use their knowledge of electricity to find the hidden circuits.

## Materials:

Cardboard shoe box lid
8 brass paper fasteners (aka-"brads")
Pen or pencil
2 feet insulated wire (Radio Shack \#278-1219)
Small flashlight bulb (Radio Shack \#272-1124)
Tape

## Activity:

1. Poke eight small holes through the cardboard in
 the pattern shown by the picture.
2. Place a brad through each hole.
3. Open the leaves of each brad to fasten it to the cardboard lid.
4. Number the brads 1-8 on top of the cardboard lid.
5. Cut three (3) six inch pieces of wire and strip the insulation off their ends.
6. Connect each wire to two brads on the underside of the lid.
7. Cut two 12 inch sections of wire and strip three inches off of each side.
8. Wrap one end of one wire snugly around the metal casing of the light bulb and tape the other end to the positive terminal of the battery.
9. Tape one end of the second wire to the negative terminal of the battery.
10. Have the child touch the free end of the wire from the battery to any brad on the board and the light bulb to another brad.
11. If the child completed a circuit, the light bulb will light up.

## Explanation:

To have a continuous flow of electricity there must be an unbroken path for electrons to travel through. This path is called a circuit. In this activity, there is only one path for the electrons to follow. Therefore, the child will only practice with series circuits within this activity.

## 

## Electricity in the Home




1. Read the text
2. Review the text with your child
3. Complete the student worksheets
4. Find the following materials for Days Two and Three:

BALLOON<br>STEEL WOOL TAPE

TWO WIRE LEADS WITH ALLIGATOR CLIPS (RADIOSHACK \#278-001) 9 VOLT BATTERY
STRYOFOAM DINNER PLATE
A PIECE OF WOOL CLOTH
DISPOSABLE ALLMINLIM PIE PAN
A STYROFOAM CUP
MASKING TAPE

## You and your child(ren) will be covering the following Science Standards this week:

Electrical circuits provide a means of transferring electrical energy when heat, light, sound, and chemical changes are produced.

| Power Plant | huge source of energy that is sent to <br> homes and businesses through large <br> wires |
| :---: | :--- |

Exposed
("eck-spohzd"); when wires get broken and their rubber insulating cover gets removed

## Short Circuit

Ground Wire

Fuse
unwanted path of electricity
a wire that is connects all wires in a house directly into the ground to direct any current into the Earth during a short circuit
("few-z"); a thin strip of metal that is connected to the circuits of your home; melts if too much current flows through the circuit

Circuit Breaker
a reusable fuse; does not melt if too much current passes through a circuit

## Sample Questions to ask after your child finishes their reading for Day One:

Where does most of the voltage we need to run our homes come from?
Power plants

## Why are most wires covered in a thick layer of rubber?

Rubber is a good insulator and does not allow electrons to escape the metal conductor it is covering.

## How can a short circuit harm us?

Our heartbeat, breathing and muscle movements are controlled by electricity in our bodies. When a short circuit flows through us, this new current can get in the way of our own electricity. If the current is strong enough, it can burn us very badly or cause our heart to stop beating.

How does a ground wire protect us from short circuits? If a short circuit takes place in our home, a ground wire moves the (potentially) dangerous current safely into the ground and not into our bodies.

## What is the main difference between a fuse and a circuit breaker?

Both are used to protect our homes from too much current; however, a fuse cannot be reused, unlike a circuit breaker.

## Answers to worksheet questions for Week Thirty-Two:

## Page 1:

A fuse is a thin strip of metal that is connected to the circuits of your home; melts if too much current flows through the circuit.

A circuit breaker is a reusable fuse; does not melt if too much current passes through a circuit.

You would probably want a circuit breaker instead of a fuse because you could reuse it several times.

Page 2:


Page 3:

1. Short circuit
2. Ground wire
3. Exposed
4. Fuse
5. Circuit breaker
6. Power plant

## Answers to Unit 8 Review:

1. Parallel circuit
2. Voltage
3. Fuse
4. Protons
5. Nucleus
6. Exposed
7. Short circuit
8. Ground wire
9. Neutral
10. Static discharge
11. Current
12. Static electricity
13. Circuit breaker
14. Circuit
15. Power plant
16. Series circuit
17. Resistance
18. Neutrons

## Unit 8 Exam

Place the answers to the following clues in the boxes below. Each box should contain one letter.


## ACROSS

2. objects that have no charge at all
3. combination of protons and neutrons within every atom
4. a thin strip of metal that is connected to the circuits of your home; melts if too much current flows through the circuit
5. a circuit in which there are many paths for the current of electrons to follow
6. when wires get broken and their rubber insulating cover gets removed
7. a circuit in which there is only one path for the current to follow

## Down

1. huge source of energy that are sent to homes and businesses through large wires
2. a measurement of how hard it is for the current to flow through the circuit
3. the amount of electrons that pass through a conductor
4. an unbroken path for electrons to flow
5. the force needed to push the current through the conductor
6. a wire that is connects all wires in a house directly into the ground to direct any current into the Earth during a short circuit
7. small piece of an atom with a positive charge that sits inside the nucleus

## Match the definitions with the words on the bottom of this page

1. $\qquad$
2. $\qquad$ a wire that is connects all wires in a house directly into the ground to direct any current into the Earth during a short circuit
3. $\qquad$ small piece of an atom with a positive charge that sits inside the nucleus
4. $\qquad$ when wires get broken and their rubber insulating cover gets removed
transfer of charges between objects
a circuit in which there are many paths for the current of electrons to follow
5. $\qquad$ huge source of energy that are sent to homes and businesses through large wires
6. $\qquad$ the loss of static electricity as electrons transfer between two objects
7. $\qquad$ the force needed to push the current through the conductor
8. $\qquad$ small piece of an atom that is neutral sits inside the nucleus
9. $\qquad$ a circuit in which there is only one path for the current to follow
10. $\qquad$ objects that have no charge at all
11. $\qquad$ a measurement of how hard it is for the current to flow through the circuit
combination of protons and neutrons within every atom
an unbroken path for electrons to flow
12. $\qquad$ the amount of electrons that pass through a conductor
a thin strip of metal that is connected to the circuits of your home; melts if too much current flows through the circuit
13. $\qquad$ a reusable fuse; does not melt if too much current passes through a circuit

| protons | static discharge |  |
| :--- | :--- | :--- |
| neutrons | voltage |  |
| nucleus | current |  |
| neutral | resistance | circuit |
| static electricity |  |  |


| series circuit | ground wire |
| :--- | :--- |
| parallel circuit | fuse |
| power plant | circuit breaker |
| exposed |  |
| short circuit |  |

## Which one is right? Circle the correct answer.

1. Which of the following does not affect the resistance in a circuit?
a. Length of the conductor
b. Temperature of the conductor
c. Color of the conductor
2. An electron would be repelled by which of the following?
a. Protons
b. Neutrons
c. Other electrons
3. Which kind of circuit only gives electrons one path to follow?
a. Series circuit
b. Simple circuit
c. Parallel circuit
4. Ground wires protect our homes from...
a. Circuit breakers
b. Short circuits
c. Exposed wires
5. When resistance is increased...
a. Current is decreased
b. Voltage is increased
c. Current is increased

## Unit 8 Exam Answer Key

## Page One:



## Page Two:

1. Short circuit
2. Ground wire
3. Protons
4. Exposed
5. Static electricity
6. Parallel circuit
7. Power plant
8. Static discharge
9. Voltage
10. Neutrons
11. Series circuit
12. Neutral
13. Resistance
14. Nucleus
15. Circuit
16. Current
17. Fuse
18. Circuit breaker

## Page Three:

1. $C$
2. $C$
3. $A$
4. $B$
5. $A$


## Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "Balloon Fuses"

A fuse is a thin strip of metal that is connected to the circuits of your home. It will melt if too much current flows through the circuit. Most homes do not use fuses anymore as they are not replaceable and must be changed whenever a short circuit takes place.

## Balloon Fuses

Children will create a fuse to prevent a short circuit.

## Materials:

Balloon
Steel wool
Tape
Two wire leads with alligator clips (RadioShack \#278-001)
9 volt battery

## Activity:

1. Inflate the balloon as much as possible and tie it off.
2. Remove a single thread of steel wool and tape this piece to the side of the balloon. The wire should lie flat against the balloon, with at least one inch of exposed wire on each end.
3. Connect alligator clips to each end of the thread of steel wool.
4. Hold the other ends of the leads on the opposite terminals of the battery until the balloon pops.

## Explanation:

When an electrical current passes through a wire, heat is produced as a result of electrical resistance in the wire. After a short period of time, steel wool warms up enough to make the balloon pop. The explosion breaks the thread and therefore breaks the electrical circuit. An electrical fuse breaks the circuit when the current becomes too high by melting. The strength of a fuse depends on how much current it will be allowed to receive before it melts.


Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "Portable Energy"

Electrical charges can be stored in objects if their electrons are not allowed to escape.
When given a path towards protons in a different object, these electrons will jump from their negatively-charged area into a new location which may/may not produce a spark!

## Portable Energy

Children will store up an electric charge in order to make sparks.

## Materials:

Stryofoam dinner plate
A piece of wool cloth
Disposable aluminum pie pan
A Styrofoam cup
Masking tape

## Activity:

1. Tape the Styrofoam cup to the middle of the inside of the pie plate.
2. Place the pie pan on top of the upside-down Styrofoam plate or a piece of acrylic plastic.
3. Rub the Styrofoam plate with the wool cloth for a full minute.
4. Place the pie pan on top of the charged Styrofoam plate.
5. Touch the pie pan with your finger. You may hear a snap and feel a shock.
6. Remove the pie pan using by touching only the insulating Styrofoam cup (You may have to hold the Styrofoam plate down with your other hand.)
7. The pan is now charged.
8. Discharge the pan by touching it with your finger. You will hear a snap, feel a shock, and, if the room is dark, see a spark.

## Explanation:

When you rub the Styrofoam plate with a wool cloth, you charge it negatively because the Styrofoam attracts electrons from the cloth. When the pie pan was placed on the Styrofoam, the electrons on the Styrofoam repelled the electrons on the pan. Therefore, the pan retained its neutral charge. However, if you touch the pie pan while it is near the Styrofoam, the electrons will be pushed off the pan and into you. The electrons make a spark as they jump a few millimeters through the air to reach your finger. After the electrons enter your finger, the pan has a positive charge. If you bring the positive pan near your finger again, or near any object that can be a source of electrons, the pan will attract electrons, creating a second spark.

## Force of Magnetism

## Questions you never want to hear...

Daddy... why doesn't this magnet pick up any of your CD's?


1. Read the text
2. Review the text with your child
3. Complete the student worksheets
4. Find the following materials for Days Two and Three:

TOTAL® BRAND CEREAL, OR OTHER HIGH IRON CONTENT BREAKFAST CEREAL
WATER
ZIP TYPE BAGS
ONE METAL PAPERCLIP
THREE IDENTICAL MAGNETS
(SUPER-STRONG CRAFT MAGNETS FOUND IN MOST LARGE CRAFT STORES WOULD WORK)

You and your child(ren) will be covering the following Science Standards this week:

Magnets attract and repel each other and certain kinds of other materials.

Magnet

Magnetite

Lodestone

## Repulsion

Magnetism

## Magnetic

Poles
Magnetic
Force

Magnetic
Field

Magnetic
Field Lines
any material that attracts a metal called iron
("mag-neh-tite"); mineral in the Earth that is magnetic
("lowd-stone"); any rock that contains magnetite
("ree-puhl-shun"); to push away
("mag-neh-tiz-im"); the attraction or repulsion between magnets or magnetic materials
two ends of a magnet that are attracted to each other; named "north" and "south"
attraction or repulsion between magnetic poles the entire area of force that surrounds each magnet
invisible lines of force that extend from the north pole of a magnet to the south pole; the closer these lines are to each other, the stronger the magnetic force

## Sample Questions to ask after your child finishes their reading for Day One:

What substance are magnets attracted to?
Magnets can be attracted to other magnets or anything that contains iron.
Where do magnets come from?
Magnets can be created by humans or found in the Earth.
How do the poles of a magnet react to each other?
Much like charges, similar poles of a magnet repel each other and opposite poles attract each other.

## Define "magnetic force".

Magnetic force is an attraction or repulsion between the poles of a magnet.
Do objects have to touch a magnet in order for them to be attracted or repelled?
No. There is always a magnetic force that surrounds a magnet which is called a magnetic field. It is because of the magnetic field that two magnets can be moved towards or away from each other without touching.

## Answers to worksheet questions for Week Thirty-Three:

## Page 1:

The closer these magnetic field lines are to each other, the stronger the magnetic force. That is the reason why the poles of a magnet seem to attract objects better than other areas!

Page 2:
Be certain that all vocabulary words are circled.

## Page 3:

1. Magnetic field
2. Magnetism
3. Magnetic force
4. Magnetite
5. Magnetic field lines
6. Magnet
7. Lodestone
8. Magnetic poles
9. Repulsion


## Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "What's in My Cereal!?!"

It is the iron in our blood that attracts oxygen molecules, allowing the blood cells to carry oxygen to body cells. Since red blood cells are always being replaced there is a constant need for a new supply of iron in the diet.

## What's in My Cereal?!

Children will explore the iron content of their cereal.

## Materials:

Total® brand cereal, or other high iron content breakfast cereal
Water
One super-strong craft magnet (found in most large craft $\dagger$ stores)
Zip type bags


## Activity:

1. Place a large handful of cereal into a baggie and add an equal amount of water.
2. Use your hands to crush the flakes to pin-head size pieces.
3. Squish the mixture together and let set for a few minutes until it becomes soupy.
4. Place the magnet on the outside of the baggie and swish the mixture around.
5. Particles of iron will collect inside the bag, near the magnet.

## Explanation:

The human body requires iron for the production of hemoglobin molecules in red blood cells. It is the iron in the hemoglobin that attracts oxygen molecules, allowing the blood cells to carry oxygen to body cells. Since red blood cells are always being replaced there is a constant need for a new supply of iron in the diet.

The iron in the cereal is the same iron found in nails and automobiles. It is mixed in the cereal batter along with many other additives. The small size of these pieces is very easily digested by the acids in our body.


1. Review Day One with the information found below.
2. Run the activity "Use the Force!"

Once a magnet is fully magnetized, it cannot be made any stronger - it is "saturated". In that sense, magnets are like buckets of water: once
they are full, they can't get any "fuller".

## Use the Force!

Children will explore magnetic force in this activity.

## Materials:

One metal paperclip
Ruler (see attached)
Three identical magnets (Super-strong craft magnets found in most large craft stores would work)


## Activity:

1. Ask the child if they think that by placing more magnets together the magnetic force will increase.
2. Place a paperclip on its picture found on the attached ruler.
3. Place a single magnet at the other end of the ruler.
4. Slowly slide the magnet across the ruler until the paperclip moves towards the magnet.
5. Record the distance the paperclip travels.
6. Repeat this experiment two more times and take an average.
7. Redo three more trials of this experiment using two and three magnets joined together.
8. Does the data support or not support the child's prediction?

## Explanation:

Once a magnet is fully magnetized, it cannot be made any stronger - it is "saturated". In that sense, magnets are like buckets of water: once they are full, they can't get any "fuller".

## Use this ruler to complete the "Use the Force!" activity



## How Magnets Work

MAGNETISM IS ONE
OF THE SIX
FLINDAMENTAL FORCES
OF THE LNIVERSE WITH
THE OTHER FIVE BEING
GRAVITY, DLLCT TAPE, WHINING, REMOTE CONTROL AND THE FORCE THAT PULLS
DOGS TOWARDS THE GROINS OF STRANGERS.


## Today, you and your child will:

1. Read the text
2. Review the text with your child
3. Complete the student worksheets
4. Find the following materials for Days Two and Three:

ONE LARGE NAIL<br>WIRE (I M LONG)<br>D-SIZE BATTERY<br>SEVERAL PAPERCLIPS<br>TAPE<br>WIRE STRIPPER OR KNIFE

3FT INSULATED WIRE (RADIO SHACK \#278-1219)
STEEL BOLT
ALIDIO CABLE (HEADPHONES) FOR SMALL RADIO (RADIO SHACK \#HA-IOFC)
*SMALL RADIO (RADIO SHACK \#12-467)
*PORTABLE TAPE CASSETTE PLAYER WITH SPEAKER (RADIO SHACK \#CX-CD248)
*ANY PORTABLE MUSIC PLAYER WILL WORK IN THIS ACTIVITY, AS WILL ANY CASSETTE PLAYER! DON'T SPEND A LOT OF MONEY!

## You and your child(ren) will be covering the following Science Standards this week:

Magnets attract and repel each other and certain kinds of other materials.

| Magnetic Domain | ("doe-mane"); a group of atoms <br> with their magnetic fields lined up in <br> the same direction |
| :---: | :--- |
| Temporary Magnet | ("tem-poor-air-ee"); an object that <br> is only magnetic for a short period <br> of time |

## Sample Questions to ask after your child finishes their reading for Day One:

## What causes an object to become magnetic?

Most of the magnetic fields around the atoms inside the metal have to be lined up.

## Define "magnetic domain".

A magnetic domain is a group of atoms with their magnetic fields lined up in the same direction.

## How does magnetic domain affect the strength of a magnet?

The more magnetic domains are lined up inside the object, the stronger the magnetic force.

## Can you create a magnetic domain inside an object that is not magnetic?

Yes. This is called a temporary magnet. A temporary magnet can be created when an object that contains iron is rubbed against a strong magnet. Some of the magnetic fields in the iron atoms of the object will move towards the magnet, thus causing the iron object to be a weak magnet.

## How can a magnet lose its magnetism?

Magnetism can be lost if the magnet is struck very hard or it is heated.

## Answers to worksheet questions for Week Thirty-Four:

Page 1:
The atoms and magnetic domains inside the wood and the glass would not be lined up at all. They would make good magnets. The nail is the best choice as its atoms and magnetic domains are lined up very well.

## Page 2:

1. Magnetic domain
2. Temporary magnet

Page 3:

1. Temporary magnet
2. Magnetic domain


## Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "ESP: Magnetic Attraction"

You cannot have electricity without some form of magnetism. For example, when an electric current flows through a coil of wire, magnet lines of force are created. If a nail is placed inside this coil of wire, the nail becomes magnetic.

## Magnetic Attraction

Chemical to mechanical energy will be explored through the use of electromagnets.

## Materials:

One large nail
Wire ( 1 m long)
D-size battery
Several paperclips
Tape

## Activity:

1. Wind the wire around the nail about 20 times.
2. Scrape the insulation off of the wire ends and tape them to the battery terminals.
3. Place the paperclips in a pile, and rest the nail onto this pile.
4. Pull up the nail and count how many paperclips were picked up.
5. Increase the number of wraps of wire around the nail for experimentation.

## Explanation:

When an electric current flows through a coil of wire, magnet lines of force are created. The magnetic lines of force pass through the iron nail, thus allowing it pick up the paperclips. This force should be increased with the additional coils of wire. The energy required to hold the paperclips to the nail is provided solely by the battery. When the battery is disconnected, the nail loses the energy required to hold the paperclips. Thus, the chemical energy of the battery is used to create mechanical energy through the magnetized nail.

Independent variable: Number of coils
Dependent variable: Number of paperclips held by the nail Hypothesis:

If the NUMBER OF COILS is (increased/decreased), then the NUMBER OF PAPERCLIPS HELD BY THE NAIL will (increase/decrease).


Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "Electromagnetic Music"

Magnetic lines of force are created whenever a current flows through a wire. This is the same for the wires that are connected to earphones. These magnetic lines of force can be detected by a tape player which are designed to detect small magnetic changes in cassette tapes.

## Electromagnetic Music

Children will send music through an electromagnet.

## Materials:

Wire stripper or knife
3ft insulated wire (Radio Shack \#278-1219)
Steel bolt
Audio cable (headphones) for small radio (Radio Shack \#HA-10FC)
Small radio (Radio Shack \#12-467)
Portable tape cassette player with speaker (Radio Shack \#CX-CD248)
*Any portable music player will work in this activity, as will any cassette player! Don't spend a lot of money!

## Activity:

1. Remove about $\frac{1}{2}$ inch of the insulation from each end of the 3 foot piece of insulated wire.
2. Wrap the wire tightly around the bolt, forming several layers of wire and leaving about one inch of free wire on both ends
3. Clip off the ear buds from the audio cable and strip the wires about $\frac{1}{2}$ inch off each end.
4. Wrap the two ends of the stripped audio cable to the stripped ends of the wire that is surrounding the bolt.
5. Turn on the radio and find a station with a clear signal. Adjust the volume to medium-high.
6. Plug the phone plug on the audio cable into the headphone jack on the radio.
7. Be sure there is no tape in the tape player, open the carriage and press the play button. Adjust the volume control on the tape player to medium-high.
8. Bring the wire-wrapped bolt near the head of the tape player. You should hear the sound from the radio station playing through the speaker of the tape player.

## Explanation:

The radio sends an electric current through the audio cable and through the coils of wire wrapped around the bolt. The current turns the wire-wrapped bolt into an electromagnet. Because the audio signal varies in strength (it rises and falls as the music changes in pitch and volume) it causes the magnetic field of the electromagnet to vary also.

A tape player is a device for detecting very small variations in a magnetic field that are normally found in cassette tapes. In this experiment, the tape player senses the magnetic field in the coils of wire wrapped around the bolt.

## Wianch

## Earth's Magnetic Field




## Today, you and your child will:

## 1. Read the text

2. Review the text with your child
3. Complete the student worksheets
4. Find the following materials for Days Two and Three:

ONE SUPER-STRONG CRAFT MAGNET
(FOUND IN MOST LARGE CRAFT STORES)
A NEEDLE OR STRAIGHTENED PAPER CLIP
PIECE OF CORK, SMALL FLAT PIECE OF STYROFOAM OR PLASTIC LID FROM A MILK JUG
A PIE PAN WITH ABOLIT ONE INCH OF WATER IN IT 1 PAPER GROCERY BAG

I D-SIZE BATTERY
2 CERAMIC DONLT MAGNETS (RADIO SHACK \#64-1888)
MASKING TAPE MARKER OR THICK PEN
magnetized needle or straightened paper clip from "Create A COMPASS"
I FOOT OF STRING

You and your child(ren) will be covering the following Science Standards this week:

Magnets attract and repel each other and certain kinds of other materials.

Inner Core

Outer Core

Compass

Solar Wind

## Aurora

the center of our planet which is made up of a solid iron ball
a very deep layer of liquid iron that surrounds the inner core of the Earth
("kum-pass"); a magnetized needle floating in a little water; the south pole of the needle always points towards Earth's magnetic north pole
a wave of radiation that is being released by the sun all the time

> ("ah-roar-ah"); glowing region of colored lights caused by small amounts of radiation from the solar wind inside our atmosphere

Northern Lights

## Satellite

name given to an aurora in the northern part of our plane $\dagger$

$$
\begin{aligned}
& (\text { "sat-tih-light"): machines in space that } \\
& \text { circle our planet that help to send messages }
\end{aligned}
$$

## Sample Questions to ask after your child finishes their reading for Day One:

## What causes the Earth to act like a magnet?

The inner and outer core of the Earth is made up of magnetized iron. This huge magnetic domain creates our planet's magnetic field!

## How does a compass work?

A compass is a magnetized needle floating in a little water. The south pole of the needle in a compass always points towards Earth's magnetic north pole.

## Earth's magnetic field is created by the attraction between what two things?

Earth's magnetic field is created like every other magnetic field - by the attraction between the north and south poles.

## Why do you owe your life to Earth's magnetic field?

 Earth's magnetic field protects us from strong solar winds, waves of radiation that could very easily harm every living organism on our planet.
## Can a solar wind get past our magnetic field?

Sometimes. If small amounts of radiation from the solar wind reach our atmosphere, it can cause some atoms to give off light. This glowing region of colored lights gives us a very beautiful "show" called an aurora.

## Answers to worksheet questions for Week Thirty-Five:

## Page 1:

Our magnetic field does a pretty good job at standing up against the sun's solar wind which is a wave of radiation that could very easily harm every living organism on our planet if it was not blocked by our magnetic field.

Page 2:
Be certain that all vocabulary words are circled.

Page 3:



# Today, you and your child will: 

1. Review Day One with the information found below.
2. Run the activity "Create a Compass"

The Earth is a huge magnet with the south pole of the magnet in the cardinal direction of the North Pole. Basically, what we normally call the "North Pole" is really the magnetic south pole of the Earth.

## Create a Compass

Children will create a simple compass from a permanent magnet.

## Materials:

One super-strong craft magnet (found in most large craft $\dagger$ stores)
A needle or straightened paper clip


Piece of cork, small flat piece of Styrofoam or plastic lid from a milk jug
A pie pan with about one inch of water in it

## Activity:

1. Stroke the magnet along the needle/paper clip 10 or 20 times in the same direction and with the same side of the magnet.
2. Place the cork, styrofoam or plastic lid on the water so that it will float.
3. Center your magnetic needle on the float.
4. It very slowly will point toward north.

## Explanation:

Think of the Earth as having a huge magnet buried inside with the south pole of the magnet in the cardinal direction of the North Pole. By magnetizing the needle/paper clip and allowing it to move freely on the surface of the water, the north pole of your compass will attract to the south pole of Earth's magnet field which can be found in the directional North Pole. Confused yet?

Basically, what we normally call the "North Pole" is really the magnetic south pole of the Earth.


1. Review Day One with the information found below.
2. Run the activity "Hidden Poles in the Planet"

The magnetized needle of a compass can be used to detect changes in magnetic fields.
These fields may be large, like those found around our planet. Or they could be small, like the field around a household magnet.

## Hidden Poles in the Planet

Children will locate the magnetic poles in a homemade planet.

## Materials:

1 paper grocery bag
1 D-size battery
2 ceramic donut magnets (Radio Shack \#64-1888)
Masking tape
Marker or thick pen
Magnetized needle or straightened paper clip from
"Create a Compass"
1 foot of string


Fold and sandwich
together

## Activity:

## Construction of the planet

1. Take the two donut magnets and place them on top of each other.
2. Place the top magnet on the top of the battery and the bottom magnet on the bottom of the battery. Be certain not to flip either magnet over when you do this!
3. Tape the magnets in place.
4. Crumpling and fold the bag until it is very workable.
5. Place the battery/magnet device inside the bag.
6. Work the bag around the bag until it is in the shape of a sphere - your planet!
7. Secure the bag by placing a few lengths of masking tape around your planet.

Construction of the magnetometer

1. Obtain the magnetized needle/paper clip from the "Create a Compass" activity. Remember that the north pole of the magnet will be facing in the northern direction.
2. Place the needle/paper clip perpendicularly in the middle of a one inch piece of tape.
3. Place one end of the string on top of the tape/needle.
4. Sandwich the string and needle by bringing both ends of the tape together.
5. Write down which end of the needle is magnetic north and south on the masking tape.

## Identifying the magnetic poles of your planet

1. Dangle the magnetometer around your planet. The magnetometer end labeled south should dramatically point in where the magnetic north pole of your world is.
2. Locate and draw the north and south poles on your planet with the marker.

## Explanation:

The D-size batteries in this lesson are used for their steel casing. Most recycling centers that have battery recycling will gladly let you take a bagful of dead D batteries home with you for free. The battery with the donut magnets taped on create the "bar magnet" found in the core of many of the planets and moons. The donut magnets have a definite north and south pole - with the top face of the magnet being one polarity and the bottom face of the magnet being the opposite polarity.
Lines of longitude and latitude can be described using this activity. A discussion on why geographic and magnetic poles don't always line up may also be created. In addition, most planetary space missions carry magnetometer instruments. The magnetometer instrument the students built and used is just a simplification of the magnetometer instruments that get launched into space onboard spacecraft headed to Mars, Jupiter and beyond!

##  <br> Electromagnetism




## Today, you and your child will:

1. Read the text
2. Review the text with your child
3. Complete the student worksheets
4. Find the following materials for Days Two and Three:

ONE SUPER-STRONG CRAFT MAGNET (FOUND IN MOST LARGE CRAFT STORES) ONE AA OR AAA BATTERY ONE SCREW OR NAIL
FIVE-SIX INCHES OF COPPER WIRE WITH ENDS STRIPPED 40-50 INCHES WIRE, I8 OR 20 GALGE (RADIO SHACK \#278-1219)

A DISPO SABLE BALL POINT PEN
LANTERN BATTERY, 6 VOLTS OR MORE
the Largest iron nail that will fit in the tube LOOSELY WIRE STRIPPER OR KNIFE

# You and your child(ren) will be covering the following 

 Science Standards this week:Magnets attract and repel each other and certain kinds of other materials.

Solenoid

Electromagnet
("sol-eh-noyd"); a coil of wire with a current flowing through it
Electromagnet
a solenoid with a piece of iron in its center

## a large hoop of wire that is

 connected to a power source (like a battery) and is placed in a strong magnetic field
## Sample Questions to ask after your child finishes their reading for Day One:

> Whenever you run a current of electrons through a conductor, what is produced around the conductor? A magnetic field

## How can you change a magnetic field that is produced by an electric current?

Electromagnetism can be turned on or off, the direction of the magnetic field can be reversed and the strength of the field can be increased or decreased.

In order for a solenoid to attract iron objects, what do you have to do?
You must put a piece of iron through the coil of the solenoid to create a temporary magnet.

How can the force of an electromagnet be used to create mechanical energy?
If the force of the electromagnet is strong enough, it can be used to move ironcontaining objects.

How does a motor produce mechanical energy?
The magnetic fields inside the magnet and in the wire push against each other. And, if the wire is in the shape of a hoop and it is allowed to move, it will spin in a circle. This spinning motion can be used to move objects very easily.

## Answers to worksheet questions for Week Thirty-Six:

Page 1:

1. A
2. $B$
3. $C$
4. B
5. $A$

Page 2:


Page 3:

1. Motor
2. Electromagnet
3. Solenoid

## Answers to Unit 9 Review:



## Unit 9 Exam

## Match the definitions with the words on the back of this page

1. $\qquad$ mineral in the Earth that is magnetic
a group of atoms with their magnetic fields lined up in the 10 . same direction
2. $\qquad$ name given to an aurora in the northern part of our planet 11 . a solenoid with a piece of iron in its center
'5. $\qquad$ a magnetized needle floating in a little water; the south pole of the needle always points towards Earth's magnetic north pole
a very deep layer of liquid iron that surrounds the inner core of the Earth
invisible lines of force that extend from the north pole of a magnet to the south pole; the closer these lines are to each other, the stronger the magnetic force
3. $\qquad$ machines in space
that circle our planet that help to send messages
4. $\qquad$ attraction or repulsion between magnetic poles
5. 
6. $\qquad$ the center of our planet which is made up of a solid iron ball
a wave of radiation that is being released by the sun all the time
any rock that contains magnetite
two ends of a magnet that are attracted to each other; named "north" and "south" -
a coil of wire with a current flowing through it
the attraction or repulsion between magnets or magnetic materials
glowing region of colored lights caused by small amounts of radiation from the solar wind inside our atmosphere
7. to push away
8. $\qquad$
9. $\qquad$
a large hoop of wire 21
that is connected
to a power source
(like a battery) and
is placed in a strong
a large hoop of wire
that is connected
to a power source
(like a battery) and
is placed in a strong
a large hoop of wire
that is connected
to a power source
(like a battery) and
is placed in a strong
a large hoop of wire
that is connected
to a power source
(like a battery) and
is placed in a strong
a large hoop of wire
that is connected
to a power source
(like a battery) and
is placed in a strong magnetic field
an object that is 20. only magnetic for a short period of time
$\qquad$ the entire area of force that surrounds each magnet any material that attracts a metal called iron

| magnet | magnetic force | outer core | solenoid |
| :--- | :--- | :--- | :--- |
| magnetite | magnetic field | compass | electromagnet |
| lodestone | magnetic field lines | solar wind | motor |
| repulsion | magnetic domain | aurora |  |
| magnetism | temporary magnet | northern lights |  |
| magnetic poles | inner core | satellite |  |

Fill in the blanks with the correct letter. The definitions below will provide a clue.

1. _ ${ }^{A}$

2. _ _ GN_ _
3. $M_{-} G_{-} \sim_{-} C_{-} D_{-} A_{-} N$

4. _ _ _ _ _ C_RE

5. _ _ $\mathrm{RTH}_{-} \mathrm{R}_{-} \quad \mathrm{n}_{\mathrm{o}} \mathrm{G}_{-} \mathrm{T}_{-}$
6. _ _ _ N_T_SM
7. $\mathrm{COM}_{-}$_ _ -
8. _ $A G_{\_} E T_{\sim} \quad P_{~}$ _ _ _
9. _ _ $R_{\sim}$ _ $A$
10. _ _ T_ _ _ C_RE
11. $\mathrm{R}_{-} \mathrm{PU} \mathbf{Z}_{-} \mathrm{O}_{-}$
12. _ _ _ OR
13. _ $A G_{-} \quad T_{1} \quad$ _
14. _O_E_ $O N_{-}$


## 19. _ _ _ $\mathrm{E}_{-} \mathrm{OI}$

20. _ _ _ N_T_C_F_E_D

## 21. $S_{-}$_ $A R$

1. invisible lines of force that extend from the north pole of a magnet to the south pole; the closer these lines are to each other, the stronger the magnetic force
2. attraction or repulsion between magnetic poles
3. any material that attracts a metal called iron
4. a group of atoms with their magnetic fields lined up in the same direction
5. an object that is only magnetic for a short period of time
6. the center of our planet which is made up of a solid iron ball
7. a solenoid with a piece of iron in its center
8. name given to an aurora in the northern part of our planet
9. the attraction or repulsion between magnets or magnetic materials
10. a magnetized needle floating in a little water; the south pole of the needle always points towards Earth's magnetic north pole
11. two ends of a magnet that are attracted to each other; named "north" and "south"
12. glowing region of colored lights caused by small amounts of radiation from the solar wind inside our atmosphere
13. a very deep layer of liquid iron that surrounds the inner core of the Earth
14. to push away
15. a large hoop of wire that is connected to a power source (like a battery) and is placed in a strong magnetic field
16. mineral in the Earth that is magnetic
17. any rock that contains magnetite
18. machines in space that circle our planet that help to send messages
19. a coil of wire with a current flowing through it
20. the entire area of force that surrounds each magnet
21. a wave of radiation that is being released by the sun all the time

## Which one is right? Circle the correct answer.

1. What happens when you run a current through a conductor?
a. A magnetic field is created around the conductor
b. The conductor loses its magnetism
c. Mechanical energy is created
2. Which of the following is needed in order for a motor to spin?
a. Current must be flowing through a wire
b. The wire is not allowed to move
c. No additional magnets are allowed near the solenoid
3. Earth's magnetic field is created by...
a. The solar wind
b. The iron core of the Earth
c. Loadstones in the Earth
4. What must an object have in order for it to be magnetic?
a. Its magnetic domains must be lined up
b. Its atoms and magnetic domains must be lined up
c. Its atoms must be lined up
5. Wherever you find electricity, you also find $\qquad$ ?
a. Conductors
b. Insulators
c. Magnetism

## Unit 9 Exam Answer Key

## Page One:

1. Magnetite
2. Magnetic domain
3. Northern lights
4. Electromagnet
5. Compass
6. Outer core
7. Magnetic field lines

Page Two:

1. Magnetic field lines
2. Northern lights
3. Magnetic force
4. Magnetism
5. Compass
6. Magnetic poles
7. Aurora
8. Outer core
9. Repulsion
10. $A$
11. $A$
12. $B$
13. B
14. $C$
15. Magnet
16. Magnetic domain
17. Temporary magnet
18. Inner core
19. Electromagnet

## Page Three:

8. Satellite
9. Inner core
10. Solar wind
11. Lodestone
12. Magnetic poles
13. Magnetic force
14. Solenoid
15. Magnet


## Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "The World's simplest Motor"

The chemical energy inside a battery can be transformed into electromagnetic energy inside the circuit which, in turn, can be converted into the mechanical energy of a turning motor!

## The World's Simplest Motor

Children will construct a very simple motor.

## Materials:

One super-strong craft magnet (found in most large craft stores)
One AA or AAA battery
One screw or nail
Five-six inches of copper wire with ends stripped

## Activity:

1. Attach the magnet to the head of the screw.
2. Place the pointy end of the screw on the negative (-) end of the battery.
3. Now pinch one end of the wire onto the positive end $(+)$ of the battery and touch the magnet with the other end of the wire and watch the motor spin.


## Explanation:

This device is known as a homopolar motor. When you touch the wire to the side of the magnet you create an electric circuit. A current runs out of the battery, down the screw, through the magnet, the wire and finally to the other end of the battery. The force of the magnet and the electric current flowing through it cause a new force to act on the magnet. This new force drives the magnet to spin very fast!


Today, you and your child will:

1. Review Day One with the information found below.
2. Run the activity "Science Doesn't Suck..."

Any moving electric charge creates a magnetic field around it. A loop of wire with a current creates a magnetic field through the loop. And, if you place an iron object within this loop, the object will become magnetic too! The strength of the magnet can be increased if the number of loops in the wire is increased as well.

## Science Doesn't Suck, It Pushes and Pulls

Children will construct a solenoid.

## Materials:

40-50 inches wire, 18 or 20 gauge (Radio Shack \#278-1219)
A disposable ball point pen
Lantern battery, 6 volts or more
The largest iron nail that will fit in the tube loosely
Wire stripper or knife

## Activity:

1. Remove the cap and ink cartridge from the pen. You need the plastic tube only.
2. Strip about one inch of the plastic insulation from both ends of the wire.
3. Tightly wrap as many insulated coils of wire as possible around the tube.
4. Insert the nail part of the way into the coil and briefly connect the ends of the wires to the battery. (Do not leaving the wires connected too long to the battery! This will burn up your battery and cause the wire to get very hot!)
5. The nail should be drawn into the coil.
6. Ask the child what will happen if the leads to the battery are reversed.
7. Reverse the leads and see if their predictions were correct.

## Explanation:

Any moving electric charge creates a magnetic field around it. A loop of wire with a current creates a magnetic field through the loop. If you increase the number of loops in your wire, the magnetic field around the wire keeps stacking on top of itself and it gets stronger! A coil of wire with a current flowing through it is called a solenoid. The two ends of a solenoid act just like a magnet with north and south poles! But... in order for you have to do one important thing...By placing a piece of iron in the middle of the loop this solenoid can now attract pieces of iron.


Absorbed
Acceleration

## Action Force

> ("ab-zorb-d" ); taken in
("ak-cell-er-ay-shun"); change in motion of an objects velocity (speed or direction)
Action Force

## Arteries

any force that is acted on any object
("r-tur-eez"); tubes used to move blood out of your heart

Atom

Aurora
the smallest piece of matter
("ah-roar-ah"); glowing region of colored lights caused by small amounts of radiation from the solar wind inside our atmosphere

| Balanced Forces | two or more forces that are <br> acting with or against each <br> other that are equal in <br> strength |
| :---: | :--- |
| Bicep | ("by-sep"); a large muscle in <br> your upper arm |
| Blood Pressure | the force of blood pressing <br> against an artery |
| Calorie | ("kal-or-ee"); unit of <br> measurement for the amount <br> of energy in food |
| Cardinal Directions | ("cap-ill-air-eez"); small tubes <br> that transport blood <br> throughout all tissues in the <br> body |
| lirections that can be used |  |
| throughout the world; north, |  |
| south, east and west |  |


| Chemical Energy | a measurement of energy that <br> holds a molecule together |
| :---: | :--- |
| Circuit | ("sir-cut"); an unbroken path <br> for electrons to flow |
| Cochlea | a reusable fuse; does not melt <br> if too much current passes <br> through a circuit |
|  | ("coke-lee-ah"); fluid-filled <br> opening in the inner ear that is <br> filled with tiny hairs that send <br> information about sound waves <br> to the brain |
| Compass | ("kum-pass"); a magnetized <br> needle floating in a little <br> water; the south pole of the <br> needle always points towards <br> Earth's magnetic north pole |


| Concave Lens | lens that is skinny in the <br> middle, but thicker at the <br> ends; photons that pass <br> through this lens diverge <br> beyond the lens |
| :---: | :--- |
| Concave Mirror | ("kon-kave"); a mirror that is <br> curved, like the inside of a <br> bowl; this type of mirror can <br> produce two different kinds <br> of reflections |
| Conduction $C$ | ("kon-duck-shun"); transfer of <br> kinetic energy between two <br> objects that are touching |
|  | ("kon-duck-tor"); an object <br> that transports the kinetic <br> energy between two objects |

$\left.\left.\begin{array}{|c|l|}\hline \text { Convection } & \begin{array}{l}\text { ("kon-veck-shun"); the } \\ \text { transfer of thermal energy } \\ \text { through the movement of } \\ \text { fluids }\end{array} \\ \hline \hline \text { Converge } & \text { ("kon-vurj"); move towards } \\ \text { each other }\end{array}\right] \begin{array}{ll}\text { a lens with the shape of the } \\ \text { outline of a football; all } \\ \text { photons of light that pass } \\ \text { through this lens converge in } \\ \text { front of the lens itself }\end{array}\right]$


| Density | the amount of atoms that are <br> found in an object |
| :---: | :--- |
| Diffraction | ("dif-frak-shun"); the ability <br> of sound waves to bend around <br> objects |
| Diverge | ("die-vurj"); spread out <br> around the source of a moving <br> sound; the pitch of this sound <br> does not change as a result of <br> the movement |
| Ear Canal | ("kah-nal"); part of the ear <br> that looks like a small tunnel <br> that leads inside your head |
| Eardrum | separates the outer ear from <br> the middle ear; vibrates due <br> to incoming sound waves |


| Echo | ("ek-ko"); the reflection of sound waves off an object |
| :---: | :---: |
| Echolocation | (eck-oh-loh-kay-shun); the use of reflected sound waves to figure out the distances of object or where they are located |
| Electrical Energy | ("eee-leck-trick-al"); energy created from the movement of electrons around an atom |
| Electromagnet | a solenoid with a piece of iron in its center |
| Electromagnetic Energy | ("eee-leck-tro-mag-net-ick"); energy that moves in waves |
| Electromagnetic Spectrum | ("eee-leck-tro-mag-net-ick speck-trum");scientific name for all the different kinds radiation waves |


| Energy | the ability to make things happen |
| :---: | :---: |
| Exposed | ("eck-spohzd"); when wires get broken and their rubber insulating cover gets removed |
| Farsighted | ("far-site-ed"); the ability see things far away, but not nearby |
| Fat | created from extra calories inside your body |
| Fluid Friction | friction that takes place when an object slides across a fluid |
| Fluids | matter that can be poured; gases or liquids |
| Food | stored chemical energy |
| Force | a push or a pull |


| Friction | ("frick-shun"); a force between two objects when they rub against each other |
| :---: | :---: |
| Fulcrum | ("full-krum"); a object used to balance a lever |
| Fuse | ("few-z"); a thin strip of metal that is connected to the circuits of your home; melts if too much current flows through the circuit |
| Gamma Ray Waves | the shortest and most powerful wave in the electromagnetic spectrum |
| Gram | the metric unit of weight and mass |
| Gravity | a force that pulls two objects together |


| Ground Wire | a wire that is connects all <br> wires in a house directly into <br> the ground to direct any <br> current into the Earth during <br> a short circuit |
| :---: | :--- |
| Heart Rate | how fast your heart is beating <br> Henergy from a hotter object <br> to a colder object |
| Heat Capacity | ("ka-pass-eh-tee"); the <br> amount of thermal energy an <br> object can hold onto |
| Helium | ("hee-lee-um"); a gas that is <br> less dense than air |
| Hertz | ("hurts"); unit of pitch |
| Incisors | ("in-size-orz"); sharp front <br> teeth |


| Inertia | ("in-er-sha"); the desire of an <br> object to remain at rest or to <br> keep moving in a straight line |
| :---: | :--- |
| Infrared Waves | ("in-fra-red"); type of <br> radiation waves that transfer <br> heat |
| Inner Core | the center of our planet which <br> is made up of a solid iron ball |
| Inner Ear | contains the cochlea; <br> responsible for sending <br> messages about sound waves <br> to the brain |
|  | ("in-soo-late-orz"); an object <br> that does not have its atoms <br> lined up very well which does <br> not allow for the transfer of <br> energy very well |


| Interference | ("in-tur-fear-enz"); the <br> lreation of a new sound wave <br> from the bouncing of two or <br> more waves together |  |  |
| :---: | :--- | :---: | :---: |
| Invisible | ("in-viz-ah-bull" ); unable to be <br> seen |  |  |
| Iris | ("i-riss"); colorful muscle of <br> the eye that gets larger to <br> cover the pupil and block <br> photons of light |  |  |
| Joints | areas in your body where two <br> bones meet |  |  |
| Kinetic Energy | ("kin-et-ick"); the energy of <br> motion |  |  |
| L"lay-urn-ex"); area in the <br> throat which contains the <br> vocal cords |  |  |  |


| Law of Conservation of <br> Energy | ("con-sur-vay-shun"); energy <br> cannot be created or <br> destroyed, only changed |
| :---: | :--- |
| Length | distance of an object or its <br> motion |
|  | a simple machine made up of a <br> rod resting on a fulcrum; used <br> to move objects to a higher <br> point |
| Lodestone | ("lowd-stone"); any rock that <br> contains magnetite |
| Loudness | measurement of the strength <br> of a sound wave |
| Machine | a tool |
| Magenta | ("ma-jen-ta"); a reddish <br> purple pigment |
| Magma | melted rock |


| Magnet | any material that attracts a <br> metal called iron |
| :---: | :--- |
| Magnetic Domain | ("doe-mane"); a group of <br> atoms with their magnetic <br> fields lined up in the same <br> direction |
| Magnetic Field | the entire area of force that <br> surrounds each magnet |
| Magnetic Field Lines | exvisible lines of force that <br> extend from the north pole of <br> a magnet to the south pole; <br> the closer these lines are to <br> each other, the stronger the <br> magnetic force |
| Magnetic Force | attraction or repulsion <br> between magnetic poles |
| Magnetic Poles | two ends of a magnet that are <br> attracted to each other: <br> named "north" and "south" |

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| Magnetism | ("mag-neh-tiz-im"); the attraction or repulsion between magnets or magnetic materials |
| :---: | :---: |
| Magnetite | ("mag-neh-tite"); mineral in the Earth that is magnetic |
| Mantle | thick layer of Earth underneath the crust |
| Mass | a measurement of the amount of matter in an object |
| Matter | the basic building blocks of all solids, liquid and gases |
| Mechanical Energy | ("mee-can-ick-al"); all of the kinetic and potential energy of an object |
| Meter | ("meet-er"); the metric unit of length |


| Metric System | a way scientists measure many <br> different things in the world |
| :---: | :--- |
| Microwaves | ("my-crow-waves"); waves that <br> are a little shorter and more <br> powerful than radio waves; <br> used to heat our food |
| Middle Ear | made up of three small bones <br> that vibrate with the eardrum |
| Molecule | tool used to reflect light |
| a collection of two or more |  |
| atoms joined together |  |


| Motor | a large hoop of wire that is <br> connected to a power source <br> (like a battery) and is placed <br> in a strong magnetic field |
| :---: | :--- |
| Multiple <br> Transformations <br> Nearsighted | ("mull-tih-pull"); <br> transformation of energy that <br> only needs two or more steps <br> to get work done |
| Net Force | ("neer-site-ed"); the ability to <br> see things nearby, but not far <br> away |
| Neutral | the difference of all forces <br> acting on an object at once |
| ("new-trul"); objects that have |  |
| no charge at all |  |$|$| ("new-trahnz"); small piece of |
| :--- |
| an atom that is neutral sits |
| inside the nucleus |


| Newton | the metric unit of force <br> Newton's First Law <br> at rest, and an object in <br> motion will remain in motion <br> unless an unbalanced force <br> acts on the object in motion |
| :---: | :--- |
| Newton's Second Law | acceleration depends on an <br> object's mass and the net <br> force acting on the object |
| Newton's Third Law | For every action there is an <br> equal and opposite reaction |
| North Pole | the most northern spot on the <br> planet |
| Northern Lights | name given to an aurora in the <br> northern part of our planet |


| Nuclear Energy | ("nuke-lee-er"); the amount of energy that holds an atom together |
| :---: | :---: |
| Nucleus | ("new-klee-us"); combination of protons and neutrons within every atom |
| Opaque Material | ("o-pay-k"); material which does not allow photons to pass through |
| Outer Core | a very deep layer of liquid iron that surrounds the inner core of the Earth |
| Outer Ear | part of the ear that is seen; used to collect and send sound waves through the ear canal |
| Ozone | ("oh-zone"); gas in our atmosphere that blocks harmful ultraviolet raditation |



| Plane Mirror | a flat sheet of glass that has <br> silver-colored paint on one <br> side; used to reflect photons <br> of light; the resulting image is <br> the same size and shape as <br> the original object |
| :---: | :--- |
| Potential Energy | ("poe-ten-shul"); the stored <br> energy of an object |
| Power Plant | a measure of how much energy <br> is being used over a certain <br> amount of time |
| Primary Colors | Huge source of energy that <br> are sent to homes and <br> businesses through large wires |
|  | three colors of light (red, blue <br> and green) that can combine <br> to make any other color we <br> can see |


| Protons | ("pro-tauns"); small piece of an <br> atom with a positive charge <br> that sits inside the nucleus |
| :---: | :--- |
| Pulley | a simple machine made up of a <br> wheel and axle with a groove in <br> the wheel; a rope is placed <br> inside the groove to move <br> around the pulley |

Pupil

## Radiation

("pew-pill"); an opening in the eye for photons to travel through
("ray-dee-a-shun"); method of heat transfer that does not need any solid, liquid or gas to transfer thermal energy

## Radio Waves

("ray-dee-oh"); longest and weakest waves in the electromagnetic spectrum

| Rainbow | the refraction of white light <br> through a raindrop which <br> lauses each wavelength of <br> visible light to be bent in <br> different amounts |
| :---: | :--- |
| Ramp | a simple machine made up of a <br> sloping surface that helps you <br> move things to a higher area |
| Reaction Force | created when an object |
| pushes against an action force |  |$|$| Reference point | ("reff-fren-sss"); areas used |
| :--- | :--- |
| to determine if an object is in |  |
| motion |  |


| Relative motion | the motion or of an object as seen by a reference point |
| :---: | :---: |
| Repulsion | ("ree-puhl-shun"); to push away |
| Resistance | ("ree-zis-tanz"); a measurement of how hard it is for the current to flow through the circuit |
| Retina | ("reh-tin-ah"); a layer of cells that are found in the back of the eyeball |
| Revolution | ("rev-o-loo-shun"); movement of an object around another object |
| Rolling Friction | Friction that takes place when an object rolls across a surface |


| Rotation | ("roe-tay-shun"); spinning <br> movement of an object |
| :---: | :--- |
| Satellite | ("sat-tih-light"); machines in <br> space that circle our planet <br> that help to send messages |
| Screw | a simple machine made up of <br> both a ramp and a wedge; it is <br> used to join two objects <br> together |
| Secondary Colors | the mixture of two primary <br> colors |
| Series Circuit | ("seer-eez"); a circuit in which <br> there is only one path for the <br> current to follow |
| Short Circuit | Unwanted path of electricity |


| Simple Machines | a machine that reduces the <br> amount of effort to do work; a <br> machine with only one or no <br> moving parts |
| :---: | :--- |
| Single Transformations | transformation of energy that <br> only needs one step to get <br> work done |
| Sir Issac Newton | famous scientist who <br> discovered many laws about <br> force and motion |
| Sliding Friction | the force that is created <br> between two objects that are <br> sliding against each other |
| Solar Wind | a wave of radiation that is <br> being released by the sun all <br> the time |
| Solenoid | ("sol-eh-noyd"); a coil of wire <br> with a current flowing through <br> it |



| Static Friction | friction that takes place when <br> one of the two rubbing <br> objects is not in motion |
| :---: | :--- |
| Stationary | ("stay-shun-air-ee"); objects <br> that do not move on their own |
| Tectonic Plates | ("teck-taun-ick"); large pieces <br> of crust that float on top of <br> the mantle and fit together <br> like a puzzle |
| Temperature | ("tem-pur-ah-chur"); a <br> measurement of how much <br> energy is in an object |
| Temporary Magnet | the average amount of kinetic <br> energy of the atoms of an <br> object |
| ("tem-poor-air-ee"); an object |  |
| that is only magnetic for a |  |
| short period of time |  |

$\left.\left.\begin{array}{|c|l|}\hline \text { Tendons } & \begin{array}{l}\text { tough cables in your body that } \\ \text { attach your muscles to your } \\ \text { bones }\end{array} \\ \hline \hline \text { Thermal Energy } & \begin{array}{l}\text { the measurement of kinetic } \\ \text { energy of atoms in motion }\end{array} \\ \hline \hline \text { Transformed } & \begin{array}{l}\text { ("tranz-formed"); to change }\end{array} \\ \hline \text { Translucent Material } \\ \text { which bounces photons around } \\ \text { as they pass through }\end{array} \right\rvert\, \begin{array}{l|l|}\hline \text { ("tranz-pair-ent"); material } \\ \text { which allows photons of light } \\ \text { to travel through them } \\ \text { without bouncing around }\end{array}\right]$

| Unbalanced Forces | two or more forces that are acting with or against each other; the larger force will decide the direction the object will move |
| :---: | :---: |
| Veins | ("vanes"); tubes that are used to move blood back into your heart |
| Velocity | ("vee-loss-eh-tee"); a measurement of the speed and direction of an object |
| Vibrate | ("vi-bray-t"); to shake |
| Visible Waves | ("viz-ah-bull"); the only waves in the electromagnetic spectrum that we can see |
| Voltage | ("vohl-taj"); the force needed to push the current through the conductor |


| Wavelength | the distance between the tops of waves |
| :---: | :---: |
| Wedge | a simple machine that is thick on one end and gets thinner towards the other end and helps you move things farther apart |
| Weight | ("wayt"); a measurement of how heavy an object is |
| Wheel and Axle | ("ax-el"); a simple machine made up of a wheel that rotates around a post |
| Work | the movement of an object |
| X-Ray Waves | waves of radiation that easily pass through muscle and skin, but not bone |



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