BATTLE CREEK AREA
Mathematics & Science Center

Student Journal

3PS1

Changes in Motion

A Third Grade Unit
supporting the
Michigan Science K-7 Content Expectations

Name: _____

Name: _____

Date: _____

ACTIVITY

Observations of Motion

1

Record your observations of the moving toy car below.

Write a list of what you observed as the toy car moved across the table or floor.

_____

_____

_____

_____

_____

_____

ACTIVITY

Observations of Motion (cont.)

Name: _____

Date: _____

1

1. What question is your group investigating?

_____

_____

_____

2. What variable is your group changing?

_____

_____

3. Record the data from your investigation.

4. What can you conclude from your investigation?

_____

_____

_____

_____

Name: _____

Date: _____

J O U R N A L

Observations of Motion (cont.)

1

1. Draw a picture of the motion of your car in your investigation.

2. Describe the motion of your car using the terms in the word bank.

speed fast slow straight curved direction

3. Write what you learned from your investigation. Use your data in your answer.

ACTIVITY

How Do We Describe Motion?

Name: _____

Date: _____

2

Motion can be described in terms of the type of motion, the direction of the moving object, and the speed of the moving object. Use the class list and ideas of your own to complete the chart.

Describing Motion Chart

Motion Words	Direction Words	Speed Words

Name: _____

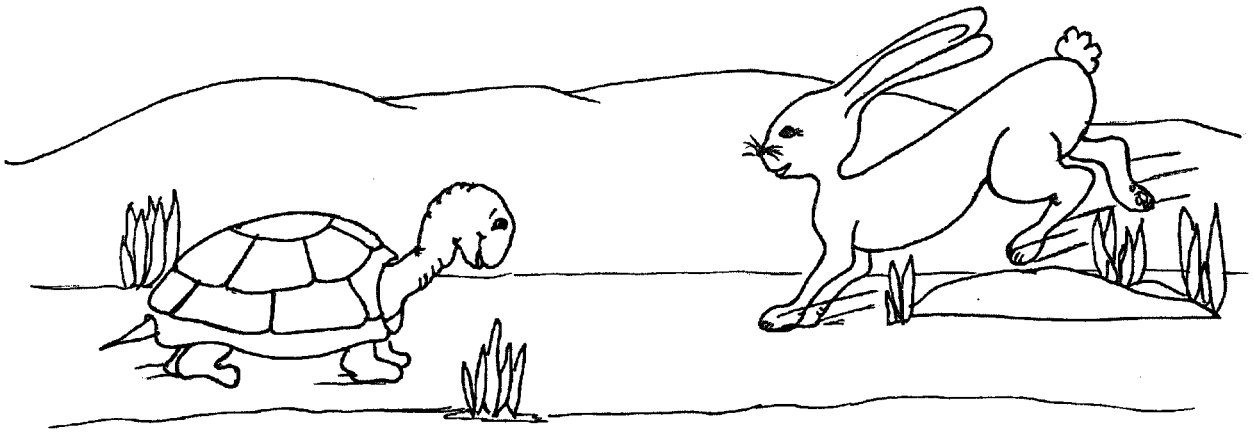
Date: _____

JOURNAL

How Do We Describe Motion? (cont.)

2

Look at the picture of the turtle and the hare. Use the words from your *Describing Motion Chart* to write about the motion of each animal. Include at least one motion word, one speed word, and one direction word in your writing.



Compare the motion of the turtle and the hare.

ACTIVITY

Cotton Balls and Jumping Frogs

Name: _____

Date: _____

3

1. Mark a starting line using the masking tape and place the cotton ball on the starting line.

2. Decide as a group how you will collect your data and observations of the movement of the cotton ball. What will you measure, record, and how many trials?

3. Take turns using your own straw to move the cotton ball off the starting line with one blow. Record your observations and data.

4. Repeat the procedure with the jumping frog.

Name: _____

Date: _____

Write a statement that compares the motion of the cotton ball and the motion of the jumping frog. Tell how they are alike and how they are different.

J O U R N A L

What Is Force?

Name: _____

Date: _____

4

1. Draw and write about a time when you used a pulling force to change the way something was moving. How did you know it changed?

2. Draw and write about a time when you used a pushing force to change the way something was moving. How did you know it changed?

Name: _____

Date: _____

ACTIVITY 5

Friction

1. Rub your hands across your desk in a circle motion. Write a word that describes how your hand moves.

_____

_____

2. Record your observations on the chart below.

Material Tested	Predict easier/harder	Actual easier/harder	Description of Movement
marbles			
pebbles			
straws			
sandpaper			
liquid soap			

J O U R N A L

Friction (cont.)

Name: _____

Date: _____

5

Write a story about a day you arrived home and found your house didn't have any friction.

Name: _____

Date: _____

ACTIVITY

Friction Investigation

6

In this investigation you will be finding out which kind of surface (wood, rubber bands, sandpaper, or wax paper) requires the least force to start the block moving. To find this out, you will change the surface of the block of wood by adding other types of surfaces to it and find out the number of washers it takes to overcome the force of friction in order to move the block.

1. What question are you asking?

_____

_____

_____

2. What materials did you use?

For every group of four students:

- 1 block of wood, with sandpaper attached, and eye hook
- 1 plastic cup with handle
- 1 piece of string
- 1 piece of wax paper
- 2 rubber bands
- washers
- 2 books (teacher provides)

Friction Investigation (cont.)

Name: _____

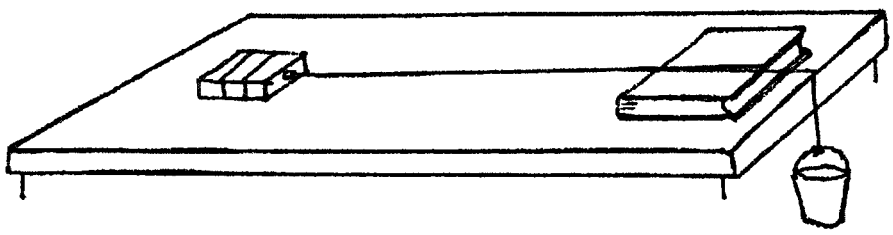
Date: _____

3. Observations and Data Table

Before you begin the actual procedure, you and the other group members will need to make a rough draft data table on another sheet of paper to record the data collected. The data table should have the following:

- a column for types of surfaces (This is the *type of surface* column.)
- a column for you to write in how many washers you **think** it will take to move the block with its different surfaces (This is the *prediction* column.)
- a column for how many washers it actually did take to move the block with each type of surface attached (This is the *actual* column.)

4. Set up the test area as shown in the picture. Begin with the wood side of the block touching the tables.



Name: _____

Date: _____

5. Adding mass to moving objects - Data Table

6. What have we learned?

J O U R N A L

Friction Investigation (cont.)

Name: _____

Date: _____

6

1. Using your data, write a conclusion that explains what you found out in your investigation about the force necessary to move the block of wood with different surfaces.

2. Using your data, write a conclusion that explains what you found out in your investigation about the force necessary to move the block of wood with added mass across different surfaces.

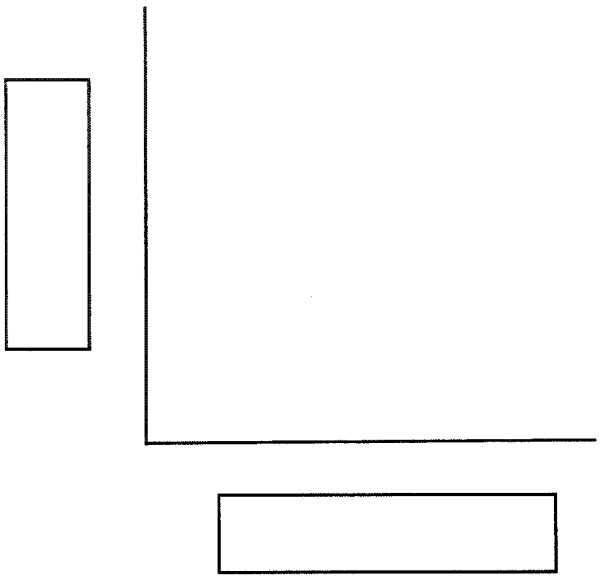
Name: _____

Date: _____

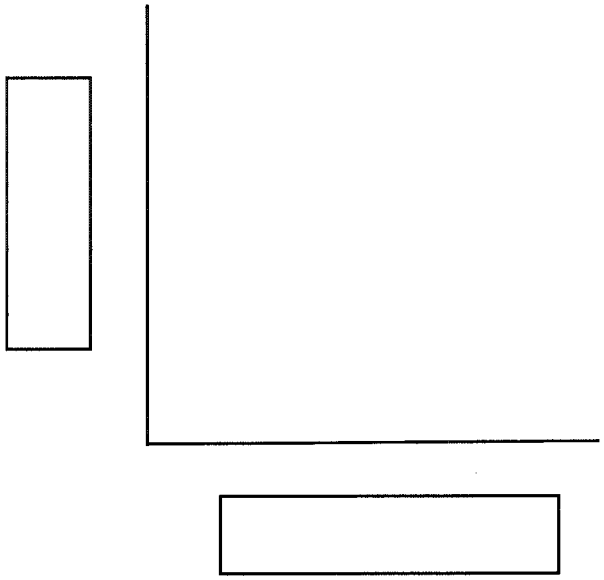
ACTIVITY 7

Making Sense of Friction Data

Friction Graph Without Added Mass



Friction Graph With Added Mass



J O U R N A L

Making Sense of Friction Data (cont.)

Name: _____

Date: _____

7

1. The surface that allowed the least force to start the block moving was:

_____

_____

2. The force to start the block moving comes from:

_____

_____

3. What does the data in your table show?

_____

_____

_____

_____

4. Compare the bar graph from your data of the wood block without added weight and with added weight. Write what you conclude from your data.

_____

_____

_____

_____

_____

_____

Name: _____

Date: _____

JOURNAL

What Goes Up, Must Come Down!

8

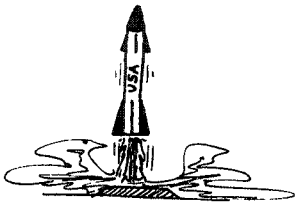
Choose a favorite activity. Then draw and write a story that tells what it would be like without any gravity.

Name: _____

Date: _____

9

Shuttle Mission 51-D



Gravity's downward pull greatly affects the motion of toys on Earth. It is hard to imagine the motion of a familiar toy in weightless conditions.

During the broadcast of *TOYS in Space*, students observe the motion of familiar toys in an orbiting spacecraft.

TOYS is an acronym for *Testing of Youth Science*. The TOYS in Space Project began on April 12, 1985, at 7:59 CST. The Space Shuttle Discovery transported eleven familiar motion toys into the weightless environment of beyond the Earth. In turn, a set of questions concerning each toy was submitted by curious children, teachers, and parents and carried by the astronauts who would test those toys.

The toy cargo included the following items: gyroscope, push-top, paddle ball, "Rat Stuff" the flipping mouse (and mascot for the mission), wind-up car, Wheelo, magnetic marbles, Slinky, ball-n-jacks, and paper airplane.

Each crew member was assigned a specific toy to play with and to note the action of the toy in the shuttle environment. Before the flight, the crew noted each toy's actions on the Earth. They then had a control group to which they could compare the reactions of their toy from the orbiting space shuttle.

In the shuttle, a video was made of each member's toy experiment. Comparing the behavior of the toy in an apparent lack of gravity to that of the control group on Earth added to the scientific knowledge of living and working on the space shuttle.

The Discovery crew consisted of seven members. Pilot Donald Williams tested "Rat Stuff," the flipping toy mouse. Dr. Jeffery Hoffman worked with the magnetic marbles. Dr. Rhea Seddon checked the ball-n-jacks. Senator Jake Garn (from Utah) tested the paper airplane. Other toys were also tested.

This information is adapted from materials issued with the video, *Toys in Space: Shuttle Mission 51-D*. The National Aeronautics and Space Administration (NASA) has given permission for the use of these materials.

Name: _____

Date: _____

Paper Airplane Observations

1. Make a paper airplane.
2. Test the paper airplane on Earth where there is gravity.
   a. Aim the airplane at the wall. What happens when it hits the wall?

_____

   b. Try to fly the airplane backwards. Describe what happens.

_____

   c. Fly your airplane in an open area where it can complete its flight. Describe what happens.

_____

3. After making observations of the paper airplanes on Earth, write one question you have about how the airplanes will move in the space ship.

_____

_____

4. After watching the test of the paper airplane in the space shuttle, answer the following questions:
   a. What happened when the paper airplane hit the wall in the spacecraft?

_____

   b. How was the flight of the paper airplane in the spacecraft different from the flight of the paper airplane on Earth?

_____

   How was it similar?

_____

   c. Did the paper airplane fly backwards in the space shuttle? _____

   Describe what happened.

_____

_____

_____

Name: _____

Date: _____

9

Ball-n-Jacks

1. To play jacks, let the jacks drop in a group and then bounce the ball. Grab one or two jacks and catch the ball in the same hand as the jacks before the ball bounces a second time. Repeat the procedure until you have captured all the jacks in the same manner.
2. Record observations of the game of jacks on Earth.
   a. What is the most difficult part of the game?

_____

Do you think it will be as difficult on the spacecraft? _____

   b. What happened to the jacks after you dropped them on the table or floor?

_____

   c. What happened to the ball when you tossed it in the air?

_____

3. After making observations of the Ball-n-Jacks on Earth, write one question you have about how the ball and jacks will move on the spacecraft.

_____

4. Another fun game with the jacks is to spin the jack like a top. Spin the jack on a table or the floor.
   a. Describe what happens to the jack after you get it to spin.

_____

   b. Write one question you have about how the spinning jack will move on the spacecraft.

_____

5. After watching the test of the Ball-n-Jacks in the space shuttle, answer the following questions:
   a. What happened to the jacks when the astronaut tried to place them on a table or floor?

_____

   b. How was the Ball-n-Jacks game different in space than on Earth?

_____

   c. What happened to the spinning jack in the space shuttle?

_____

Name: _____

Date: _____

ACTIVITY

Motion of Toys (cont.)

9

Magnetic Marbles

1. Hold one marble in one hand and add marbles one at a time so that they hand down freely to make a string of marbles. Observe the marbles as they attract and repel each other.

2. Observe the motion and attraction of magnetic marbles on Earth.
   a. How many marbles will hang together in a chain before it breaks? _____
   b. What happens when you roll one magnetic marble into a group of other marbles?

_____

3. After observing the motion and action of magnetic marbles on Earth, write one question about how marbles will move in space.

_____

_____

4. How many marbles did the astronaut get to hang before the string of marbles broke?

_____

5. What happened in the space shuttle when one marble was gently pushed into a string of marbles?

_____

6. How was the motion of the marbles different in space than on Earth?

_____

_____

How was the motion similar?

_____

_____

Name: _____

Date: _____

Wind-up Flip Toy - "Rat Stuff"

1. Wind up the toy (being careful not to wind it too much) and set it on the floor or table.

2. Observe and record the motion of the wind-up toy on Earth.

   a. Describe the motion of the toy.

_____

_____

   b. Wind up the toy and place it in the palm of your hand. Describe the force of the toy on your hand.

_____

_____

3. After observing the motion of the toy on Earth, write one question you have about the motion of the wind-up toy in space.

_____

_____

4. What was the biggest problem in getting this toy to work in space?

_____

5. What happened to the wind-up toy in the space shuttle when the astronauts wound it and placed the feet of the toy on the wall?

_____

6. How was the motion of the wind-up toy in space different from the motion on Earth?

_____

How was it similar?

_____

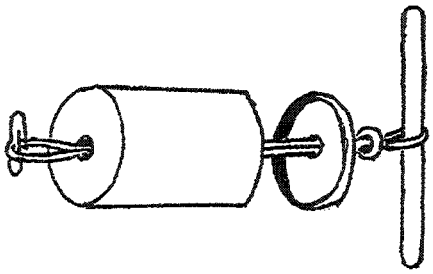
Name: _____

Date: _____

ACTIVITY

A Moving Experience

10



1. Record your observations of the motion of the "science mobile."

2. Write a list of the forces you observe that make the "science mobile" move.

ACTIVITY

A Moving Experience (cont.)

Name: _____

Date: _____

10

1. What question is your group investigating?

_____

_____

2. What variable are you changing on the "science mobile?"

_____

_____

3. What materials will you use?

4. What do you think will happen to the motion of the "science mobile?"

_____

_____

_____

_____

Name: _____

Date: _____

ACTIVITY 10

A Moving Experience (cont.)

5. Draw and write the steps you followed.

6. Record your observations.

7. Draw and write what you found out. (conclusion) Tell what evidence you observed to support your conclusion.

ACTIVITY

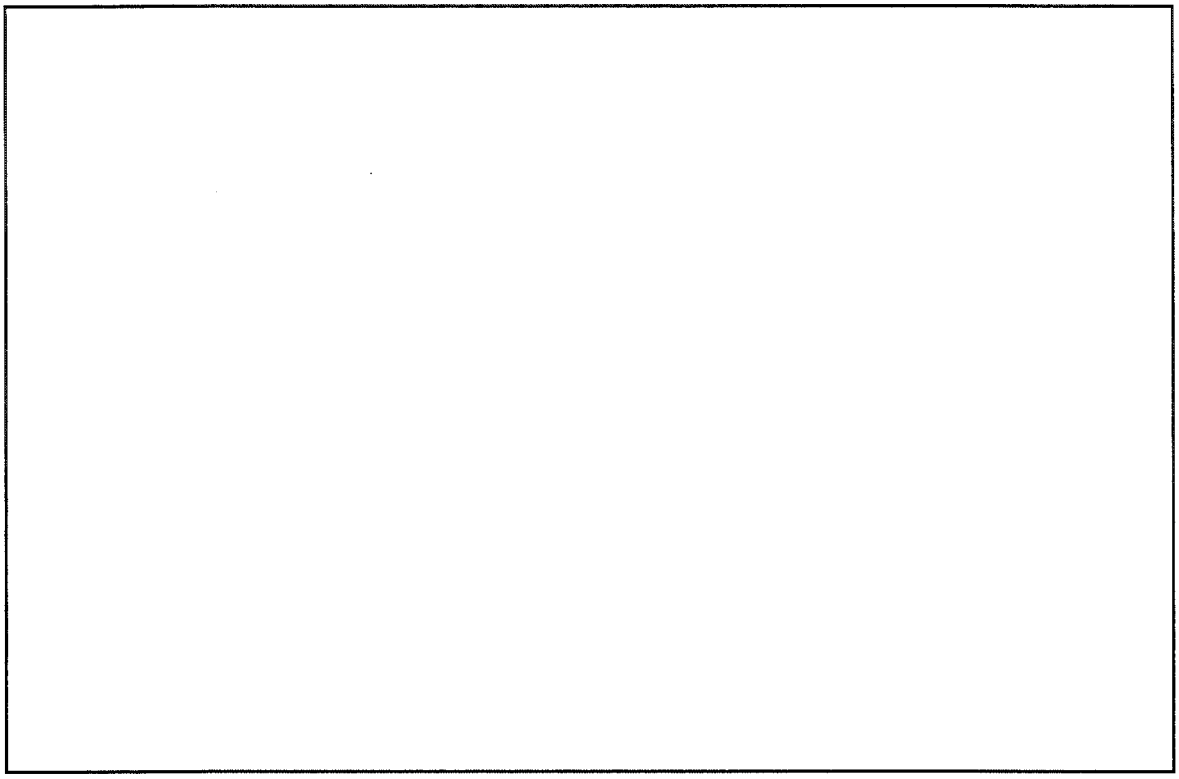
Moving In Air Investigation

Name: _____

Date: _____

11

1. Draw a picture of your spinner.



2. Write your observations.

_____

_____

_____

_____

_____

_____

_____

_____

Name: _____

Date: _____

ACTIVITY 12

Newton's First Law: First Part

1. Observe the washer for motion. Write your observations.

_____

_____

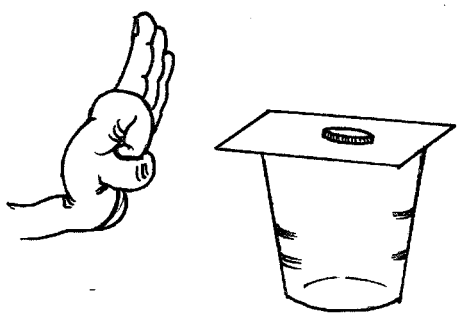
_____

_____

2. Follow the directions to observe the motion of the washer.

a. Hold the cup with one hand.

b. With the other hand, flick the side of the card with a sharp force. (See illustration.)



c. Discuss and record your observations with your partner.

_____

_____

_____

_____

d. Repeat the activity by switching roles.

e. Take turns repeating the activity using different amounts of force against the card.

JOURNAL

Newton's First Law: First Part

Name: _____

Date: _____

12

1. Draw a picture of the cup, index card, and washer before you flicked on the card.

2. Draw a picture of the cup, index card, and washer after you flicked on the card.

3. Write what happened to the card and washer.

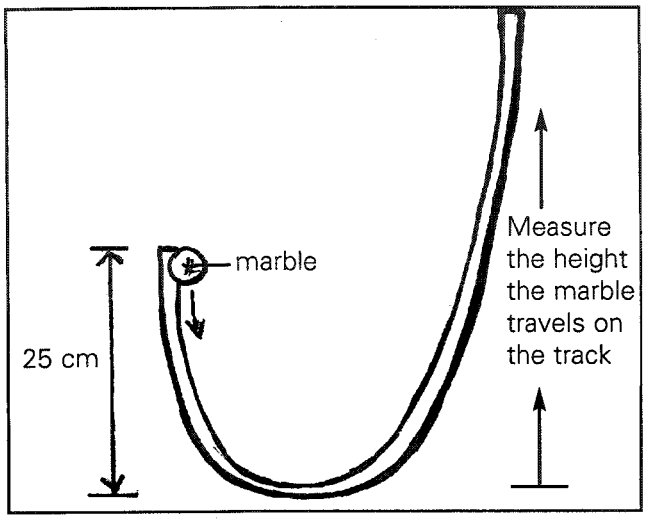
Name: _____

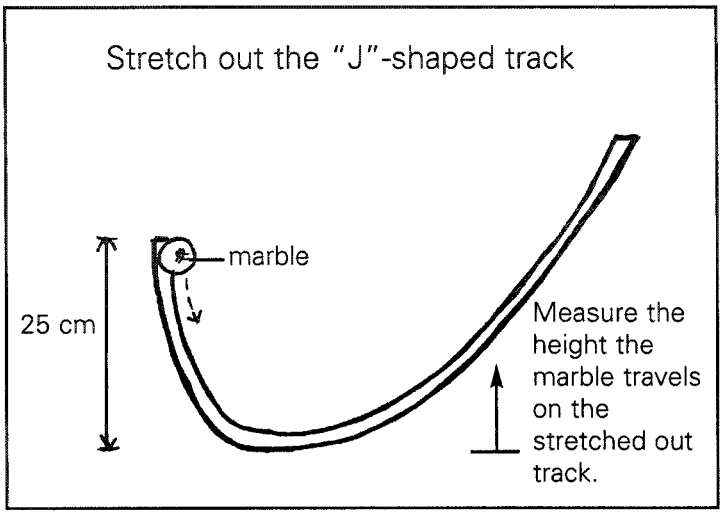
Date: _____

ACTIVITY

The Second Half of Newton's First Law of Motion

13





1. Within your group, decide who will hold the short end of the "J", the long end of the "J", measure the height the marble travels, and start the marble down the track at the short end.
2. Drop the marble down the short end of the "J."
3. Measure the height the marble traveled up the long end of the "J."
4. Record the measurement in the data table below.
5. Repeat the procedure until you have completed 3 trials.

J O U R N A L

The Second Half of Newton's First Law of Motion (cont.)

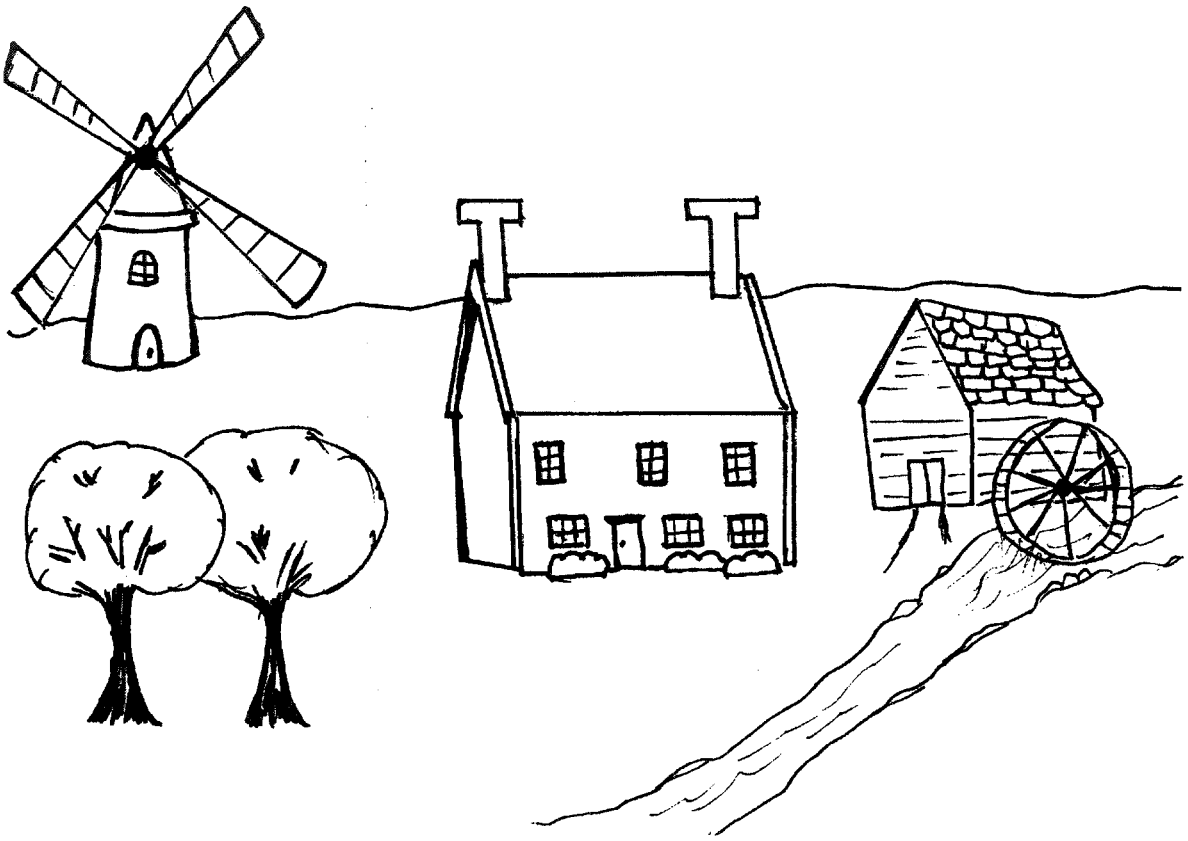
Name: _____

Date: _____

13

Isaac Newton and His First Law of Motion

Read the story of Isaac Newton and his First Law of Motion. Illustrate the story by drawing pictures on the final two pages that explain the first and second part of Newton's First Law. Write a caption for your illustrations.



Isaac Newton grew up in Gratham, England where he could observe the motion of windmills and waterwheels. He made models and improvements.

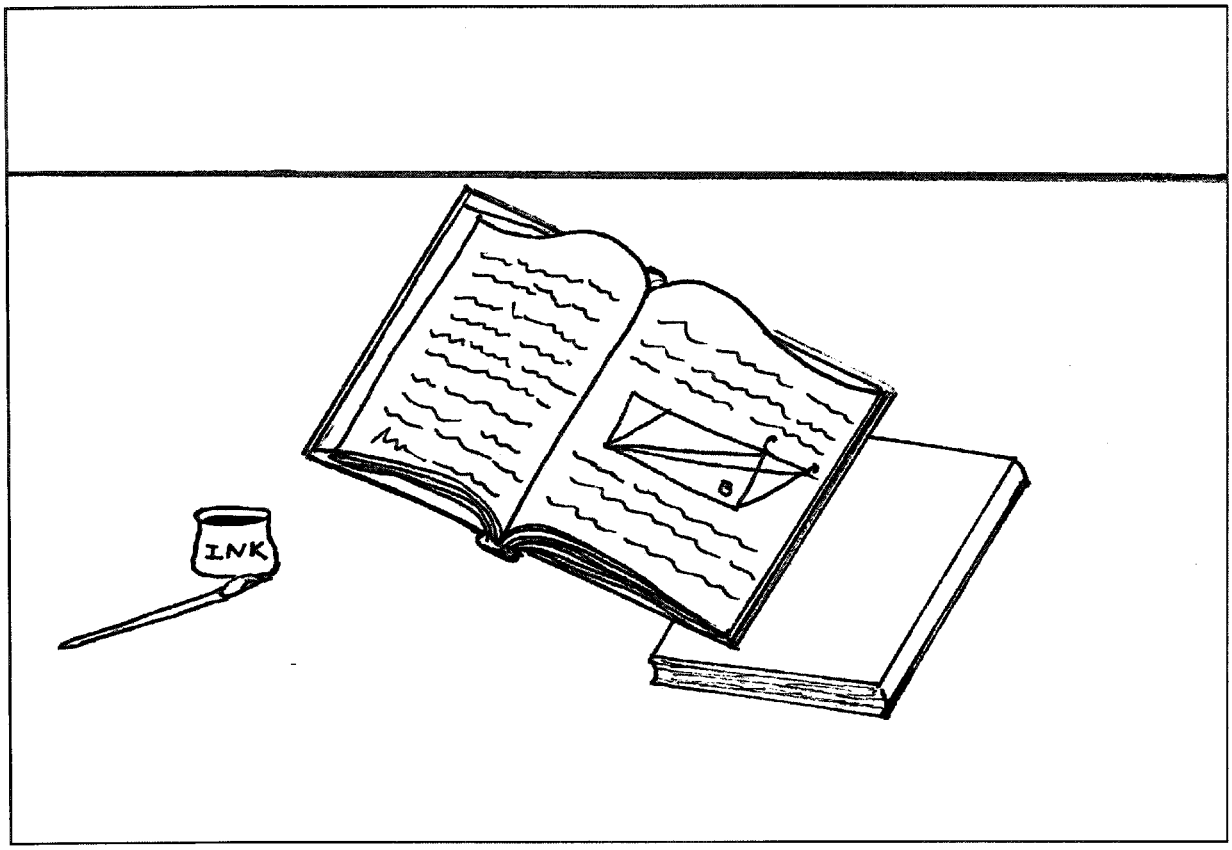
At a young age, Isaac Newton was interested in how machines worked, especially if there were moving parts involved. He built windmills, waterwheels, and clocks driven by dripping water.

Newton was not the average learner. Although he attended school he was more interested in learning about topics that were not taught in grade school. He wanted to learn about motion, matter, time, water, and the sun. Isaac Newton learned most of what interested him on his own.

Name: _____

Date: _____

Isaac Newton and His First Law of Motion (cont.)



At Cambridge University, Newton learned about science through the philosophy of Greek scholars, such as Aristotle. Newton questioned and expanded on what Aristotle believed. Newton tested Aristotle's ideas with experiments and observations.

Newton's college experience was cut short when the University shut down because of the plague. Thousands of people became ill and died from the disease. So Isaac Newton packed his books, notes, pens, and papers and went home to continue his studies on his own. It was then that Newton focused his studies on motion and developed the first laws of motion.

J O U R N A L

The Second Half of Newton's First Law of Motion (cont.)

Name: _____

Date: _____

13

Isaac Newton and His First Law of Motion (cont.)

Isaac Newton stated his first ideas about motion and forces as his "First Law of Motion:" *An object will remain at rest or continue moving at the same speed and in the same direction unless a force acts on it.*

Newton's law can be broken into two parts. The first part states that an object at rest will remain at rest unless a force acts on it. Draw and label a picture that explains the first half of Newton's First Law of Motion.

Name: _____

Date: _____

JOURNAL

The Second Half of Newton's First Law of Motion (cont.)

13

Isaac Newton and His First Law of Motion (cont.)

The second half of Newton's First Law of Motion states that an object in motion will remain in motion at the same speed and in the same direction unless a force acts on it. Draw and label a picture that explains the second half of Newton's First Law of Motion.

Newton's First Law of Motion can be used to explain motion and start objects moving, change the speed and direction of objects, and stop the motion of objects. It was more than twenty years after he developed his laws of motion that he shared them with the world in a book called, *Mathematical Principles of Natural Philosophy.*

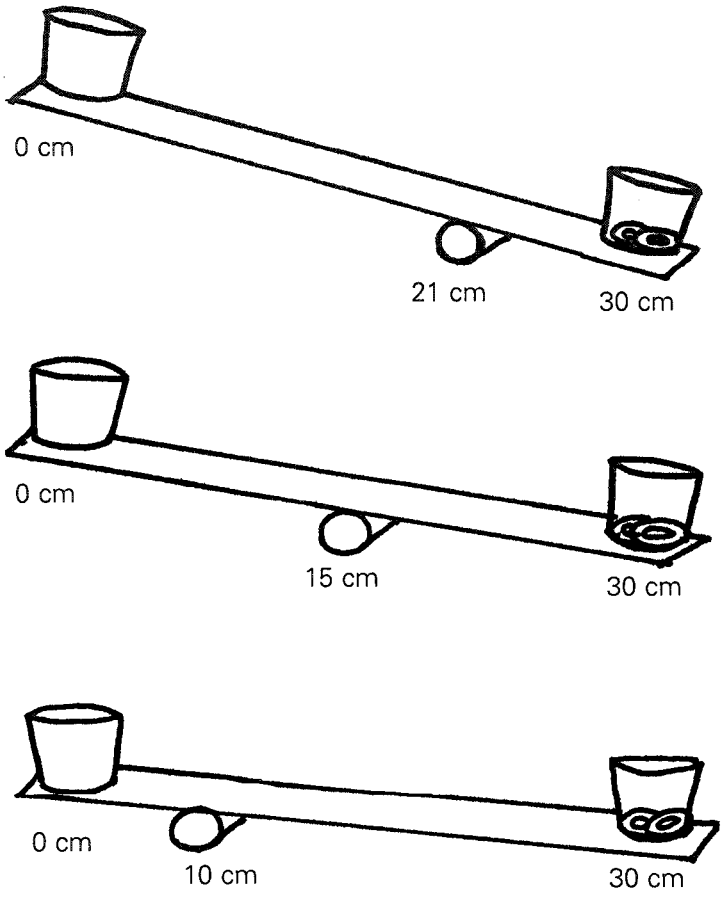
ACTIVITY

Lifting and Moving Objects

Name: _____

Date: _____

14



Number of Washers	
Prediction	Actual
_____	_____
_____	_____
_____	_____

What I found out:

_____

_____

_____

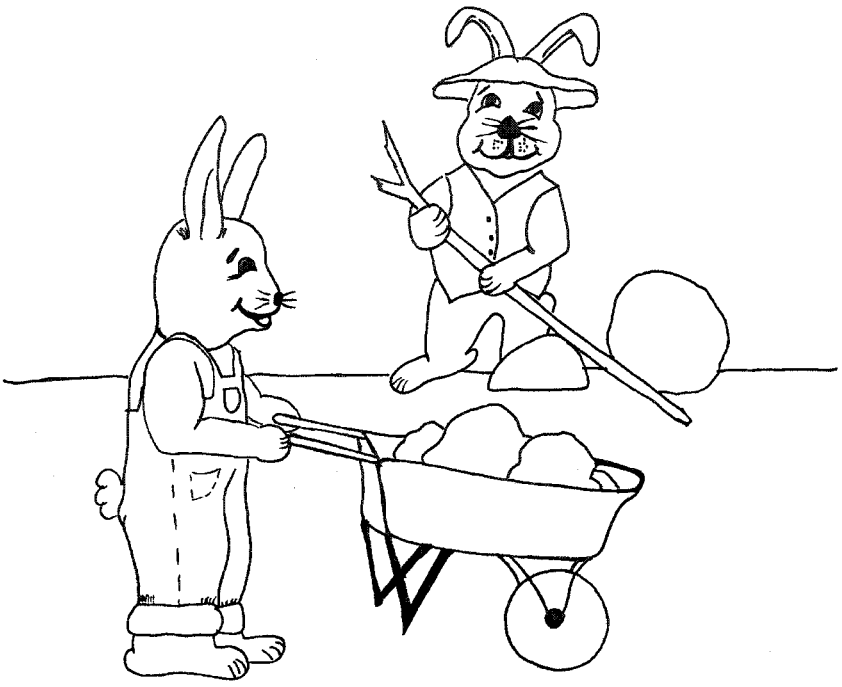
_____

_____

_____

Name: _____

Date: _____



1. Look at the picture of the rabbit lifting the rock. Label the forces involved in lifting the rock.

2. Relate the motion of the rock to Newton's first law of motion by answering the following:

   a. The rock will remain at rest unless

_____

_____

   b. The rock will continue to move in a straight line until

_____

_____

_____

Key Terms

centimeter - A centimeter is a metric unit of measure used to measure length or distance. There are 100 centimeters in one meter.

change of direction - Change of direction refers to a change in the path of a moving object.

change of motion - Change of motion refers to a change in direction, speed, or position of a moving object.

direction terms - Direction terms describe where the object is moving. Right, left, north, south, east, west, up, down, forward, and backward are direction terms.

distance - Distance is the measurement of how far an object moved from one point to another or how far apart objects are from one another.

force - A force is a push or a pull on something. A force is needed to change the motion of something.

friction - Friction is a force due to rubbing. It can change the way things move.

gravity - Gravity is a force where one object pulls on another object. Because of the gravity of the Earth, objects are pulled toward the Earth.

kilometer - A kilometer is a metric unit of measure used to measure distance. It is a metric unit of length equal to 100 meters.

mass - Mass is the amount of matter in a substance or an object.

meter - A meter is a metric unit of measure used to measure length or distance. A meter is 100 centimeters. There are 100 meters in one kilometer.

motion - Motion is any changing of position of an object.

motion terms - Motion terms describe the type of motion of an object. Roll, hop, jump, skip, bounce, fly, run, walk, and slide are motion terms.

position - Position is the way in which something is placed or arranged. Position terms include away, toward, above, below, behind, between, and through.

pull - A pull is a force or effort that moves something toward the force.

push - A push is a force or effort that moves something away from the force.

simple machine – A simple machine makes it easier to push, pull, lift, or lower objects.

speed - Speed is the measurement of how fast an object travels from one point to another. Speed is measured by distance traveled divided by the amount of time it took to travel that distance.

speed terms - Speed terms describe the amount of time it takes for an object to move a certain distance. Fast, faster, fastest, speeding up, slow, slower, slowest, and slowing down are speed terms.

time - Time is a period during which something takes place. Time is measured in seconds, minutes, hours, days, weeks, months, and years.

variables - Variables are the properties of things that can be changed in an investigation.

weight - Weight is the measurement of the force of gravity on the mass of an object.