

SCIENCE

Student Book

▶ **4th Grade** | Unit 4

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SCIENCE 404

MACHINES

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MACHINES

King Solomon had a great Temple built many years before Jesus was born. In the Bible in the book of 1 Kings chapters 5 and 6, you can read about the Temple. The stones were cut and fitted into place. The workmen built the Temple in seven years. Buildings are constructed in a much shorter time today. Solomon's workers had no electricity or big machines to help them. They used simple machines. In this LIFEPAC® you will read about the kinds of machines they used. You will find out that you use the same type of machines today!

Objectives

Read these objectives. The objectives tell you what you will be able to do when you have successfully completed this LIFEPAC. Each section will list according to the numbers below what objectives will be met in that section. When you have finished this LIFEPAC, you should be able to:

1. Define *work*.
2. Tell the meaning of gravity and friction.
3. Explain about the two forms of energy.
4. Name four kinds of energy.
5. Explain why simple machines are needed to do work.
6. Name six simple machines.
7. Give an example of each simple machine.
8. Tell how each simple machine makes work easier.
9. Tell the meaning of simple and complex machines.
10. Name four complex machines.

1. MACHINES ARE NEEDED

In this first section of this LIFE PAC, you will learn why you need machines to help you to do work. Solomon's men did not have many **machines**, but they did have some machines to help them lift heavy rocks as they built the Temple. They had machines to help them fasten wooden boards together. They had machines to help them carry stones to the Temple. Do you use a machine to fasten two boards together? Do you use a machine to carry the family to the ballgame? Do you use only four fingers to fasten parts of a toy together? Read this section to find how machines help you to do work.

Objectives

Review these objectives. When you have completed this section, you should be able to:

1. Define *work*.
2. Tell the meaning of gravity and friction.
3. Explain about the two forms of energy.
4. Name four kinds of energy.
5. Explain why simple machines are needed to do work.

Vocabulary

Study these new words. Learning the meanings of these words is a good study habit and will improve your understanding of this LIFEPAC.

energy (en' ur jē): The ability to do work.

energy in action (en' ur jē in ak' shun): Energy that is being used to move something.

force (fôrs): Power, strength.

friction (frik' shun): A rubbing of one thing against another.

gravity (grav' u tē): The natural force that causes objects to move or tend to move toward each other.

machine (mu shēn'): A device for applying power.

stored energy (stôrd en' ur jē): Energy at rest.

streamlined (strēm līnd): A shape that offers the least resistance to air or water.

work (wèrk): A force moving an object.

Note: All vocabulary words in this LIFEPAC appear in **boldface** print the first time they are used. If you are unsure of the meaning when you are reading, study the definitions given.

Pronunciation Key: hat, āge, cāre, fār; let, ēqual, tērm; it, īce; hot, ōpen, ôrder; oil; out; cup, pūt, rüle; child; long; thin; /TH/ for then; /zh/ for measure; /u/ or /ə/ represents /a/ in about, /e/ in taken, /i/ in pencil, /o/ in lemon, and /u/ in circus.

Work

Solomon's builders pushed and pulled the heavy stones toward the Temple. When they pushed or pulled, they were doing **work**. Anytime you force something to move it, you are doing work. Did you push or pull the door open to come into the classroom today? If you did, you were doing work.

Force is another name for the push or pull needed to do work. Force moves things. What was the force used when you opened the door? _____ Yes, your muscles were the force that pushed on the door.

When Solomon's men moved the big stones for the Temple, would their job have been easier if they had moved the stones uphill or downhill? _____ Yes, downhill would be easier. Why? _____

The reason that the stones were easier to move downhill is that **gravity** pulls things

toward the center of the earth. Downhill would be toward the earth's center.

Gravity makes it safe for you to live on the earth. Everything is pulled by gravity. Roots of plants grow down. Your feet walk solidly on the ground. When you fall, you fall down instead of up. Water runs downhill. A ball tossed into the air always falls back down to the ground.

Since gravity pulls down, work is needed to move anything up, against the pull of gravity. Lifting the heavy stones for the Temple was hard work. The men used **machines** to help them.

Gravity pulled on the stones that the men would have to push uphill. The work would have been harder than pushing the stones downhill. If the men had been going downhill, gravity would have pulled on the stones, and the work would have been easier. Gravity would have helped the men.



Look up the facts! A man named Galileo was born in Pisa, Italy, in the sixteenth century. He became the first real scientist of modern times. Read about Galileo in an encyclopedia, or find a good story of his life. Try to find the answers to these questions.

1.1 What did Galileo teach about the value of observing and experimenting?

1.2 What did Galileo's ideas have to do with the law of gravity? _____

Have you ever ridden a sled down a snowy hill at a rapid speed? At the bottom of the hill you suddenly hit a bare spot of sidewalk with no snow on it. What happened? _____
 _____ Gravity helped pull you downhill. What made you stop? _____

Another force was at work to stop you. **Friction** makes things stop. Friction is the name of the force that is present when two things rub against each other. The sled runners and the snow were smooth, so very little friction slowed your slide downhill. The sidewalk was rough, so more friction resulted.

Without friction you would have a hard time moving about without slipping and sliding. You could not go anywhere in a car or on a bicycle because the wheels would spin around in one spot. Friction helps you by pushing against the wheels to make them turn. Even the air pushing against you causes friction. Airplanes are **streamlined** to lessen friction. Friction, like gravity, can be a help to you.



Think about things! Write your answer on the blank line. Lift a sheet of paper in one hand and a book in the other. Now let them fall.

- 1.3** Which hits the floor first? _____
- 1.4** Which one is slowed by air friction? _____
- 1.5** Do you think they would fall with equal speed if there were no friction from the air? _____
- 1.6** Why? _____
 (If you're not sure of your answer to "why?" look back at what you learned about Galileo and falling objects.)
- 1.7** Why are airplanes streamlined with rounded instead of square wings and bodies? Write your idea in one or two sentences. _____

- 1.8** Does your idea have anything to do with the friction caused by moving through the air? _____

Energy

Energy is the ability to do work. Energy makes it possible to push or pull. When Solomon's builders pushed the stones with their shoulders, they used the energy in their bodies.

Many kinds of energy can be used to do work. Light, sound, heat, and electricity are four kinds of energy. Whatever kind of energy is used to do work, all energy comes from the sun.

At a baseball game, you watch the pitcher hold the ball before he throws it. Then you see him throw the ball. You have seen two forms of energy. As the pitcher stands with the ball, you see **stored energy**. As he throws the ball the stored energy becomes **energy in action**.

Energy is needed to make force. When force moves things, work is done. If you can't move something with your own force, you can use a machine to help you. Using a machine will make the work easier for you.



| Stored energy becoming energy in action



Think about things! Write your answer on the lines.

- 1.9** Your energy comes from the life within you. Think about where your life starts. Read Job 33:4. Write the verse on the lines. _____

- 1.10** Can you use your energy as a force to do work? _____
- 1.11** When do you store energy? _____
- 1.12** When does stored energy become energy in action? _____

EXPERIMENT

Try this experiment. Answer the questions as you do each step.

- 1.13** Rub your hands together, long and hard. What do you feel? _____
 The heat you feel is caused by friction. Friction happens when two things are rubbed together.
- 1.14** **Think:** When a shuttle enters the atmosphere, it needs a “heat shield” to keep it from burning up. This is because friction from the air has caused _____.



Look up the facts!

- 1.15** In your encyclopedia or online, look up James Watt. Find out how he put the steam engine to work. Write a short paragraph about his experiments on a sheet of paper.



Teacher check:

Initials _____ Date _____



Solve the word puzzle:

1.16

Some words have the same sound in them, but the words are spelled differently. Sometimes *au*, *aw*, and *ou* have the same sound, the sound of *aw* in *saw*. Hints are given to help you to think of words to fill in the puzzle. Each word that you use has either an *aw*, *au*, or *ou* that sounds like the *aw* in *saw*. The first letter in each word is given for you.

Nouns

- a. **j** _____
- b. **s** _____
- c. **a** _____
- d. **a** _____
- e. **d** _____

Verbs

- f. **y** _____
- g. **c** _____
- h. **t** _____
- i. **b** _____
- j. **f** _____

Adjectives

- k. **r** _____
- l. **l** _____
- m. **h** _____
- n. **n** _____
- o. **n** _____

Hints

Nouns

- a. Samson used this as a weapon
- b. Your father uses this to cut wood smoothly
- c. You ride in it nearly every day
- d. Another name for it is *fall*
- e. A child, but not a son

Verbs

- f. You do it when you are sleepy
- g. What you did to the fish in the frying pan
- h. Your teacher did this to you
- i. The way your father got a new car
- j. Both boys had black eyes from doing this

Adjectives

- k. Not cooked
- l. Within the rules or laws
- m. A scary house, full of frightening sounds
- n. Anything to do with the sea
- o. Bad enough to be punished



Study about syllables.

1.17

In a word when the vowel is followed by *-cle*, the word is divided into syllables between the vowel and *-cle* as in *icicle* (*i ci cle*). In a word when the vowel is followed by *-dge*, the vowel and *-dge* are in the same syllable as in *ledge*.

Divide the following words into syllables following the rule for *-cle* and *-dge*. Draw a slanted line (/) between each syllable in each word. Beside the word, write the number of syllables in each word.

- | | | | |
|------------|-------|------------|-------|
| a. bicycle | _____ | e. miracle | _____ |
| b. bridge | _____ | f. monocle | _____ |
| c. edge | _____ | g. ridge | _____ |
| d. fudge | _____ | h. sludge | _____ |



Think about machines.

1.18

Check the statements in the following group which you know to be true.

- _____ Gravity pulls things up.
- _____ Friction is greater on rough surfaces.
- _____ Men can use energy to run machines.
- _____ Men can do work without machines.

MAKE A CHART FOR I SPY

Before you start on the next two sections, you will need to do a small project. You remember that Galileo taught that a true scientist must be a good observer. In other words, he must see things exactly as they are. Then he must make an accurate record of what he sees.

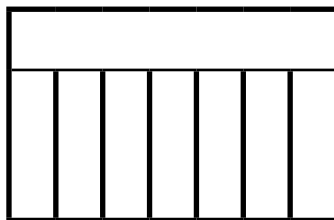
You have a chance to test yourself to see how well you can follow directions.

These supplies are needed:

- one sheet of poster board (any color)
- one meter stick (or yardstick)
- two felt tip pens (black or red)
- one sharp pencil with an eraser

Follow these directions. Use your pencil lightly to do all the lines and printing. When you have the lines and printing just right, go over your marks with a pen. Check the boxes as you do each step.

- 1. Turn your poster board sideways. Draw a line all the way across the board 10 cm from the top.
- 2. Divide the space beneath the line into seven equal columns. If you do your work carefully, your poster board should look like this.



- 3. On the long line across the board, print very neatly: **MACHINES**
- 4. At the top of each column, print the name of one simple machine in red. Print the simple machines in the order you find them on the contents page of this LIFEPAK under Machines Are Simple.
- 5. At the top of the seventh column, print the words, "Complex Machines."

You are going to play your own game of “**I Spy**” in a very special way. You will be “spying out” many different forms of simple machines which are used in everyday life. You will need to have a “**sharp eye**” like a real detective.

Hang your poster in your classroom where you can easily reach it. You will be using it each day as you complete this LIFE PAC. If you do your work carefully, you will have a useful chart.

For Sections 2 and 3 it would be more fun for you to have a partner. It is easier to do experiments and to build models when you work with someone. If you have to work alone, however, you will have no problems. Just remember to read and follow directions carefully.



Teacher check:

Initials _____ Date _____



Review the material in this section to prepare for the Self Test. The Self Test will check your understanding of this section. Any items you miss on this test will show you what areas you will need to restudy in order to prepare for the unit test.

SELF TEST 1

Answer the questions on the lines (each answer, 5 points).

1.01 What is *work*? _____

1.02 What is the difference between stored energy and energy in action?

1.03 From where does all energy come? _____

Write the correct word in each blank (each answer, 3 points).

stored energy

earth

work

energy in action

force

friction

gravity

energy

machines

1.04 Work is made easier when you use _____ .

1.05 All lifting work is done against a pull called _____ .

1.06 When an object is moved across a surface, _____ happens.

1.07 Heat, light, sound, and electricity are forms of _____ .

1.08 Gravity pulls all objects toward the center of the _____ .

1.09 The push or pull needed to do work is called _____ .

1.010 Picking up a book is an example of _____ .

Read the clues. Write the name of the person that the clues describe (each answer, 5 points).

1.011 Clues:

I lived in the sixteenth century.

I was the first real scientist of modern times.

I studied the law of gravitation.

My name is _____ .

1.012 Clues:

I was a Scotsman.

I found uses for the steam engine.

My initial or last name is on a light bulb.

My name is _____ .

1.013 Clues:

I was a very wise king.

I built a house for God.

My workmen used simple machines.

My name is _____ .

List four kinds of energy mentioned in Section 1 (each answer, 4 points).

1.014 _____

1.015 _____

1.016 _____

1.017 _____

Answer the following questions in good sentences (each answer, 5 points).

1.018 What forces would Solomon's men have used for building the Temple?

1.019 What is *energy*? _____

1.020 Why does man need simple machines? _____

Match these items by writing the correct letter in the blank (each answer, 2 points).

- | | | | | |
|--------------|-------|------------------|----|-------------------------------------|
| 1.021 | _____ | streamlined | a. | pull toward the center of the earth |
| 1.022 | _____ | gravity | b. | from the sun |
| 1.023 | _____ | force | c. | push or pull |
| 1.024 | _____ | work | d. | less air friction |
| 1.025 | _____ | friction | e. | boy ice skating |
| 1.026 | _____ | energy in action | f. | makes things stop |
| 1.027 | _____ | stored energy | g. | helps to move something |
| 1.028 | _____ | energy | h. | push or pull |
| 1.029 | _____ | machine | i. | boy sleeping |

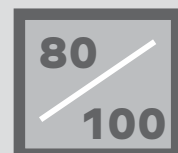


Teacher check:

Score _____

Initials _____

Date _____





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