Name ______________________ Class ______________ Date ______________

CHAPTER 1 The World of Life Science

SECTION 1

Asking About Life

BEFORE YOU READ

After you read this section, you should be able to answer these questions:

- What is life science?
- Why is life science important for everyday life?

What Is Life Science?

Imagine that it is summer. You are lying on the grass in a park watching dogs play and bees visiting flowers. An ant carries away a crumb from your lunch. Suddenly, questions pop into your head: How do ants find food? Why don't bees visit every flower? Why do dogs play? By asking these question, you are thinking like a life scientist.

Life science is the study of living things. Asking questions about the world around you is the first step in any scientific investigation. ☑

STUDY TIP

Predict As you read this section, write a list of 10 questions that a life scientist might ask.

READING CHECK

1. Identify What is the first step in a scientific investigation?

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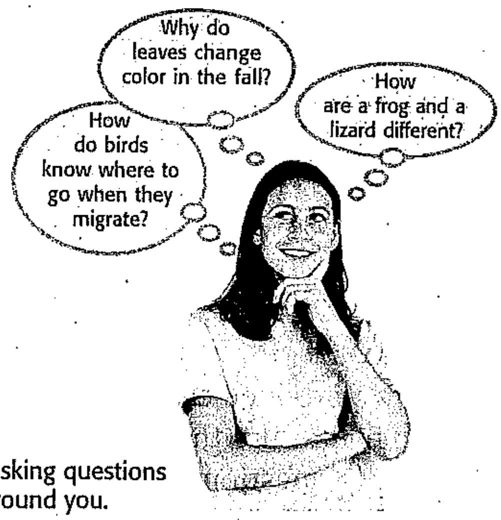

Part of science is asking questions about the world around you.

What Questions Do Life Scientists Ask?

Take a look around your home or neighborhood. Just about anywhere you go, you will find some kind of living thing. The world around us is full of an amazing diversity of life. Single-celled algae, giant redwood trees, and 40-ton whales are all living things. For any living thing, you can ask: How does it get its food? Where does it live? How does it behave? Life scientists ask questions like these to learn about the world.

What Do Life Scientists Do?

Life scientists can study many different topics. Many of these topics can affect your life. As you study life science, you will begin to see how important life science is in your life. Answering questions can help life scientists learn how to fight disease, produce food, and protect the environment.

Critical Thinking

2. Predict Aside from studying the environment, how can life scientists affect your life? Give two ways.

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FIGHTING DISEASE

Scientists have been successful at getting rid of some diseases. For example, *polio* is a disease that affects the brain and nerves. Polio can make it hard for a person to breathe or walk. Polio used to be very common, but today it is a very rare disease. This is because life scientists studied polio and learned how to keep it from spreading.

Today, scientists are looking for ways to stop the spread of the virus that causes *acquired immune deficiency syndrome* (AIDS). By studying how this virus affects the body and causes AIDS, scientists hope to find a cure.

Abdul Lakhani is a life scientist who studies the AIDS virus. He is trying to find a cure for the disease.

PRODUCING FOOD

How can we produce enough food to feed everyone? How can we make sure that foods are safe to eat? To answer these questions, some scientists design experiments to learn what makes plants grow larger or faster. Other scientists look for ways to preserve foods better so that they will last longer. ☑

READING CHECK

3. Identify Give one question about producing food that life scientists are trying to answer.

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PROTECTING THE ENVIRONMENT

Many environmental problems are caused by people misusing natural resources. Life scientists try to understand how we affect the world around us. We can use this information to find solutions to environmental problems.

Who Is a Life Scientist?

A *life scientist* is anyone who studies *organisms*, or living things. The women and men who are life scientists can live and work anywhere in the world. Some life scientists work on farms. Others study organisms in forests or in oceans. Some even work in space! ☑

Life scientists can study many different features of organisms. They may study how organisms behave and how organisms affect their environments. Some life scientists study how organisms change with time and how they pass on their features to their young. Some life scientists even study organisms that lived millions of years ago.

READING CHECK

4. Define What is a life scientist?

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Irene Duhart Long studies how space travel affects the human body.

Geerat Vermeij studies how the shells of certain animals have changed with time.

Irene Pepperberg studies whether parrots can learn human language.

TAKE A LOOK

5. Infer What questions are these scientists probably trying to answer?

Irene Duhart Long:

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Geerat Vermeij:

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Irene Pepperberg:

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Name ______________________ Class ______________ Date ______________

Section 1 Review

SECTION VOCABULARY

life science the study of living things	

1. Explain How do scientists gather information about the world?

2. Describe What is a life scientist?

3. List Give four places that a life scientist can work.

4. Identify A life scientist has just discovered an organism that no one has ever seen before. Give four questions that the scientist may ask about the organism.

5. Explain Why is polio a very rare disease today?

6. Describe How can life scientists help people protect the environment?

Name ______________________ Class ____________ Date ____________

CHAPTER 1 The World of Life Science

SECTION 2

Scientific Methods

BEFORE YOU READ

After you read this section, you should be able to answer these questions:

- What are scientific methods?
- What is a hypothesis?
- How do scientists test a hypothesis?

What Are Scientific Methods?

A group of students in Minnesota went on a field trip to a wildlife refuge. They noticed that some of the frogs they saw looked strange. For example, some of the frogs had too many legs or eyes. The frogs were *deformed.* The students wondered what made the frogs deformed. They decided to carry out an investigation to learn what happened to the frogs.

By making observations and asking questions about them, the students were using scientific methods. **Scientific methods** are a series of steps that scientists use to answer questions and to solve problems. The figure below shows the steps in scientific methods. ☑

STUDY TIP

Outline As you read this section, make a chart showing the different steps in scientific methods. In the chart, describe how the students in Minnesota used each step to investigate the deformed frogs.

READING CHECK

1. Define What are scientific methods?

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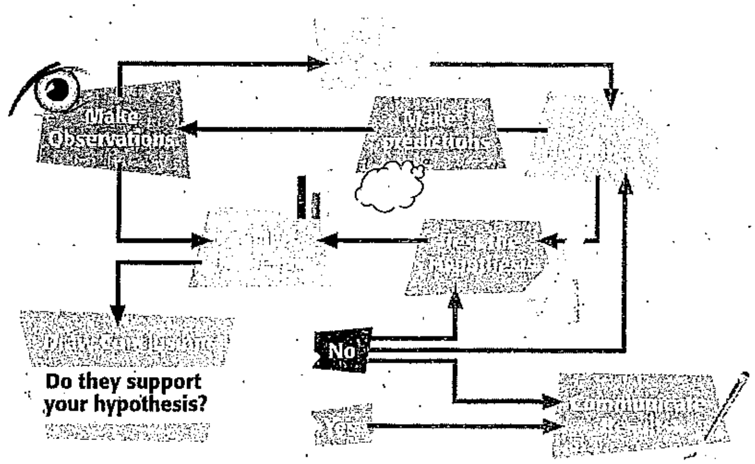

TAKE A LOOK

2. Use Models Starting with "Ask a question," trace two different paths through the figure to "Communicate results." Use a colored pen or marker to trace your paths.

As you can see, the order of steps in scientific methods can vary. Scientists may use all of the steps or just some of the steps during a certain investigation. They may even repeat some of the steps. The order depends on what works best to answer a certain question.

Why Is It Important to Ask a Question?

Asking a question helps scientists focus their research on the most important things they want to learn. In many cases, an observation leads to a question. For example, the students in Minnesota observed that some of the frogs were deformed. Then they asked the question, "Why are some of the frogs deformed?" Answering questions often involves making more observations. ☑

READING CHECK

3. Explain Why do scientists ask questions?

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How Do Scientists Make Observations?

The students in Minnesota made careful observations to help them answer their question. The students caught many frogs. Then they counted how many normal and deformed frogs they caught. They photographed, measured, and described each frog. They also tested the water the frogs were living in. The students were careful to record their observations accurately.

Like the students, scientists make many different kinds of observations. They may measure length, volume, time, or speed. They may describe the color or shape of an organism. They may also describe how an organism behaves. When scientists make and record their observations, they are careful to be accurate. Observations are useful only if they are accurate.

Critical Thinking

4. Explain Why is it important for observations to be accurate?

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TAKE A LOOK

5. Identify Give three kinds of observations that can be made with the tools in the picture.

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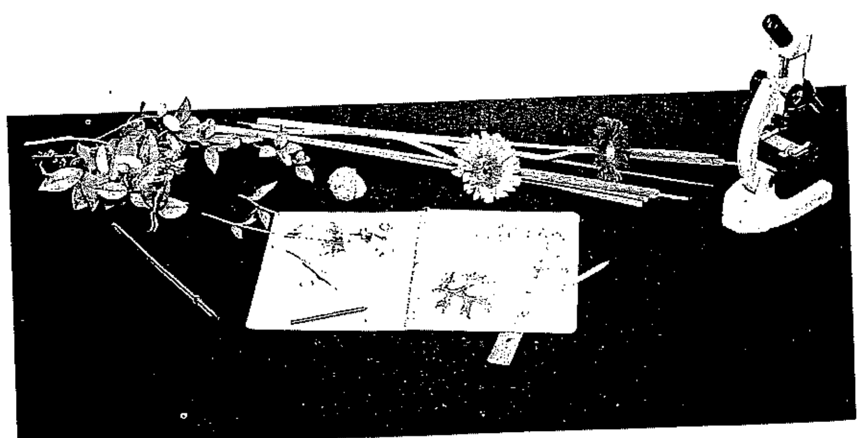

Scientists use many different tools, such as microscopes, rulers, and thermometers, to make observations.

What Is a Hypothesis?

After asking questions and making observations, scientists may form a hypothesis. A **hypothesis** (plural, *hypotheses*) is a possible answer to a question. A good hypothesis is based on observations and can be tested. When scientists form a hypothesis, they base it on all of the observations and information that they have. ☑

A single question can lead to more than one hypothesis. The students in Minnesota learned about different things that can cause frogs to be deformed. They used this information to form three hypotheses to answer their question. These hypotheses are shown in the figure below.

READING CHECK

6. Define What is a hypothesis?

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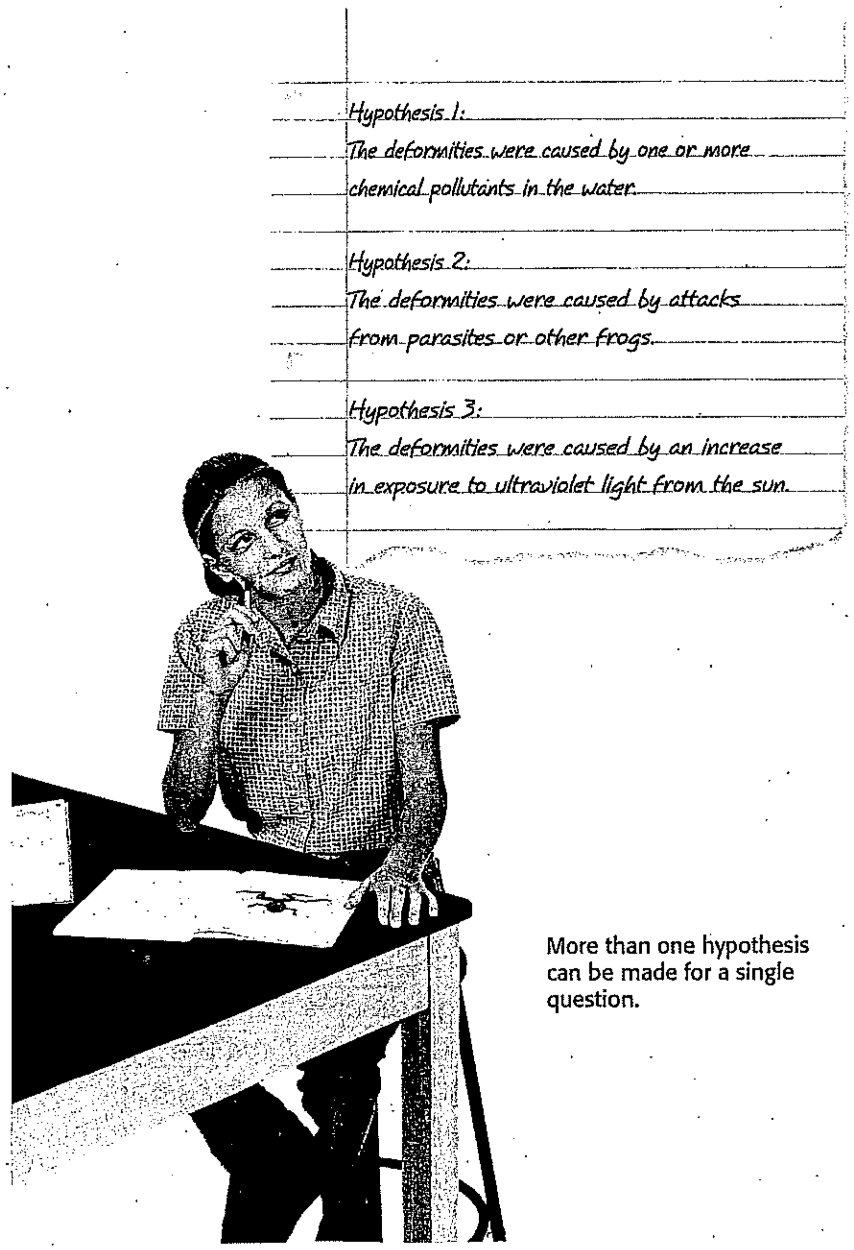

More than one hypothesis can be made for a single question.

Say It

Discuss In a group, talk about some other possible hypotheses that the students could have come up with.

TAKE A LOOK

7. Describe What are two things that all of the hypotheses have in common?

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PREDICTIONS

Before a scientist can test a hypothesis, the scientist must make predictions. A *prediction* is a statement that explains how something can cause an effect. A prediction can be used to set up a test of a hypothesis. Predictions are usually stated in an if-then format, as shown in the figure below. More than one prediction may be made for a hypothesis.

Critical Thinking

8. Make Connections What is the connection between hypotheses and tests in an investigation?

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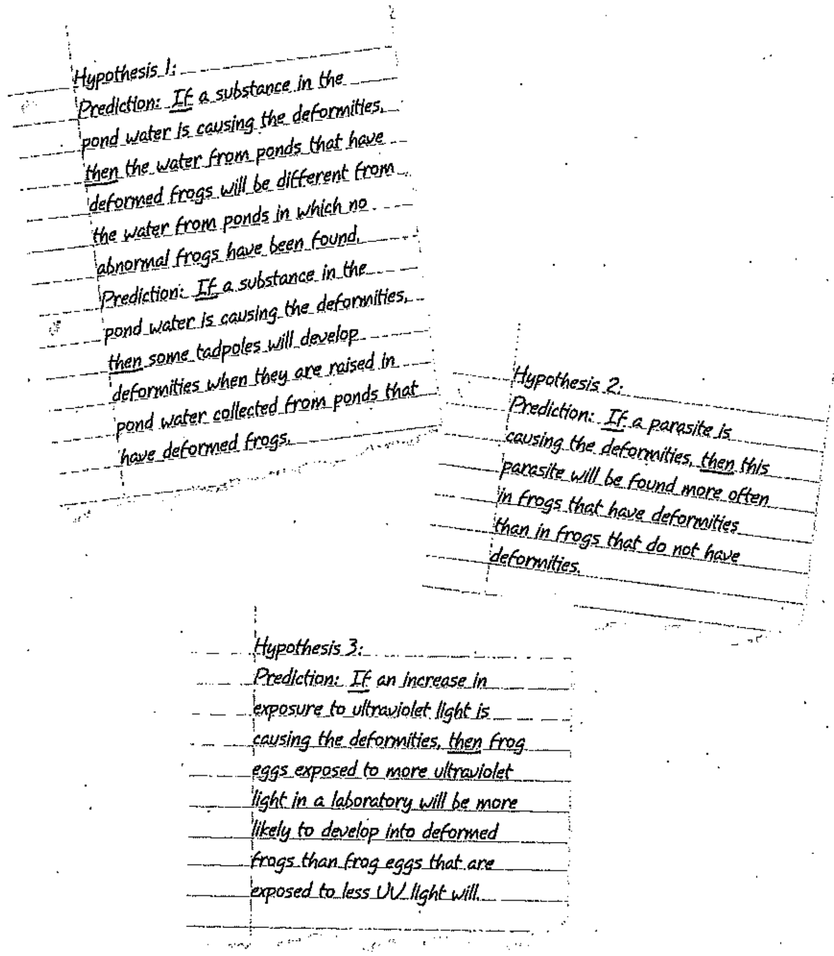

More than one prediction may be made for a single hypothesis.

TAKE A LOOK

9. Explain What kind of tests could the students do to test the prediction for Hypothesis 2?

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Scientists can perform experiments to test their predictions. In many cases, the results from the experiments match a prediction. In other cases, the results may not match any of the predictions. When this happens, the scientist must make a new hypothesis and perform more tests.

How Do Scientists Test a Hypothesis?

Scientists perform experiments to show whether a certain factor caused an observation. A *factor* is anything in an experiment that can change the experiment's results. Some examples of factors are temperature, the type of organism being studied, and the weather in an area. ☑

To study the effect of each factor, scientists perform controlled experiments. A **controlled experiment** tests only one factor at a time. These experiments have a control group and one or more experimental groups.

The factors for the control group and the experimental groups are the same, except for the one factor being tested. This factor is called the **variable**. The variable is different in each experimental group. Any difference in the results between the control and experimental groups is probably caused by the variable. ☑

READING CHECK

10. Define What is a factor?

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READING CHECK

11. Compare How are control groups and experimental groups different?

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DESIGNING AN EXPERIMENT

Experiments must be carefully planned. Every factor should be considered when designing an experiment. It is also important for scientists to use ethical guidelines when they design and carry out experiments. These guidelines help to make sure that the scientists do not cause unnecessary harm to the organisms in the experiment.

The table below shows an experiment to test whether UV light can cause frogs to be deformed. This experiment has one control group and two experimental groups. All the factors between these groups are the same except the amount of UV light exposure. The control group receives no UV light. The number of days that the frog eggs are exposed to UV light is different between the experimental groups. Therefore, exposure to UV light is the variable.

		Control Factors			**Variable**
Group	**Tank**	Kind of frog	Number of eggs	Temperature of water (°C)	UV light exposure (days)
#1	A	leopard frog	50	25	0
	B	leopard frog	50	25	0
#2	C	leopard frog	50	25	15
	D	leopard frog	50	25	15
#3	E	leopard frog	50	25	24
	F	leopard frog	50	25	24

TAKE A LOOK

12. Apply Concepts Which group (1, 2, or 3) is the control group? Explain your answer.

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COLLECTING DATA

Scientists often try to test many individuals. For example, in the UV light experiment, a total of 300 frogs were tested. By testing many individuals, scientists can account for the effects of normal differences between individuals in each group. They can be more certain that differences between the control and experimental groups are caused by the variable. ☑

Scientists will often repeat an experiment to determine if it produces the same results every time. If an experiment produces the same results again and again, scientists can be more certain that the results are true.

The figure below shows the setup of the UV light experiment. It also shows the results of the experiment.

READING CHECK

13. Explain Why do scientists try to use many individuals in their experiments?

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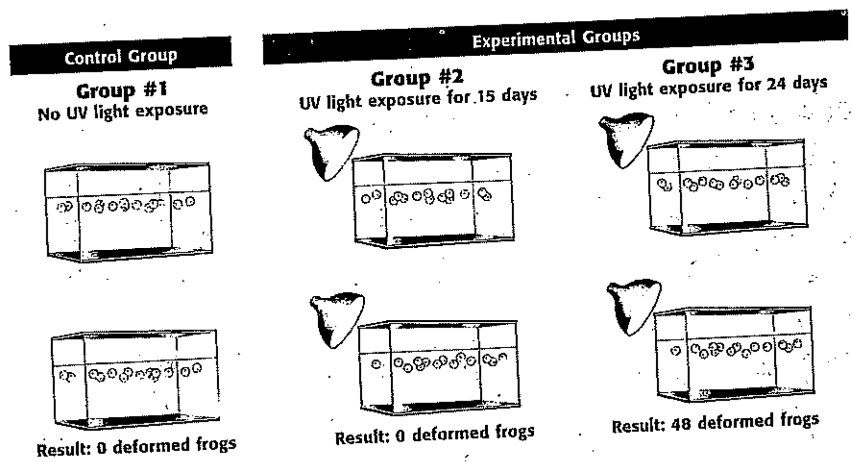


How Do Scientists Analyze Results?

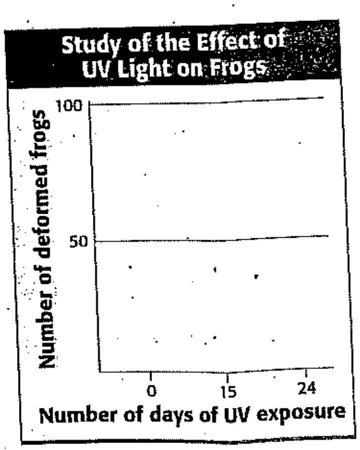
When scientists finish an experiment, they must analyze the results. The information they collect during the analysis helps them explain their observations.

To organize their data, scientists often make tables and graphs. Scientists study the organized data to learn how the variable affected the experiment. The data from the UV light experiment is shown in the table below. This table shows that frogs that were exposed to 24 days of UV light developed deformities.

Number of days of UV exposure	Number of deformed frogs
0	0
15	0
24	48

Math Focus

14. Make a Graph Use the information in the table to fill in the bar graph below.



What Are Conclusions?

After analyzing results from experiments, scientists must decide if the results support the hypotheses. This is called *drawing conclusions*. Finding out that a hypothesis is not true can be as valuable as finding out that a hypothesis is true.

Sometimes, the results do not support the hypothesis. When this happens, scientists may repeat the investigation to check for mistakes. Scientists may repeat experiments hundreds of times. Another option is to ask another question and make a new hypothesis.

The UV light experiment showed that UV light can cause frogs to be deformed. However, this does not mean that UV light definitely caused the frog deformities in Minnesota. Many other factors may affect the frogs. Some of these factors may be things that scientists have not even thought of yet.

Questions as complicated as the deformed frogs are rarely solved with a single experiment. The search for a solution may continue for many years. Finding an answer doesn't always end an investigation. In many cases, the answer begins another investigation. In this way, scientists continue to build knowledge.

Critical Thinking

15. Infer How can finding out that a hypothesis is not true be useful for a scientist?

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Why Do Scientists Share Their Results?

After finishing a study, scientists share their results with others. They write reports and give presentations. They can also put their results on the Internet.

Sharing information allows others the chance to repeat the experiments for themselves. Data from new experiments can either support the original hypothesis, or show that it needs to be changed.

Communicating the results of experiments is an important step in scientific methods.

TAKE A LOOK

16. Describe Why is it important for scientists to share their results?

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Name ______________________ Class ______________ Date ______________

Section 2 Review

SECTION VOCABULARY

controlled experiment an experiment that tests only one factor at a time by using a comparison of a control group with an experimental group

hypothesis a testable idea or explanation that leads to scientific investigation

scientific methods a series of steps followed to solve problems

variable a factor that changes in an experiment in order to test a hypothesis

1. Describe In a controlled experiment, how are the control and experimental groups the same? How are they different?

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2. Infer Why might a scientist need to repeat a step in scientific methods?

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3. Identify What are two ways that scientists can share the results of their experiments?

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4. Define What is a prediction?

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5. Explain Why might a scientist repeat an experiment?

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6. Describe What can scientists do if the results of an experiment do not support a hypothesis?

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Name ______________________ Class ____________ Date ____________

CHAPTER 1 The World of Life Science

SECTION 3

Scientific Models

BEFORE YOU READ

After you read this section, you should be able to answer these questions:

- How do scientists use models?
- What are scientific theories and laws?

What Are Models?

You need a microscope to see inside most cells. How can you learn about the parts of a cell if you don't have a microscope? One way is to use a model. Scientists use models to learn about things that they cannot see or touch.

A **model** is something scientists use to represent an object or event to make it easier to study. Scientists study models to learn how things work or are made in the natural world. However, you cannot learn everything by studying a model, because models are not exactly like the objects they represent. Some types of scientific models are physical models, mathematical models, and conceptual models. ☑

STUDY TIP

Learn New Words As you read, underline words you don't know. When you figure out what they mean, write the words and their definitions in your notebook.

READING CHECK

1. Explain Why can't you learn everything about an object or event by studying a model?

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PHYSICAL MODELS

A toy rocket and a plastic skeleton are examples of physical models. *Physical models* are models that you can see or touch. Many physical models look like the things they represent. The figure shows students using a model of a human body to learn how the body works. However, because the model is not alive, the students cannot learn exactly how the body functions.

TAKE A LOOK

2. Compare Give one way that the model is like a person and one way the model is not like a person.

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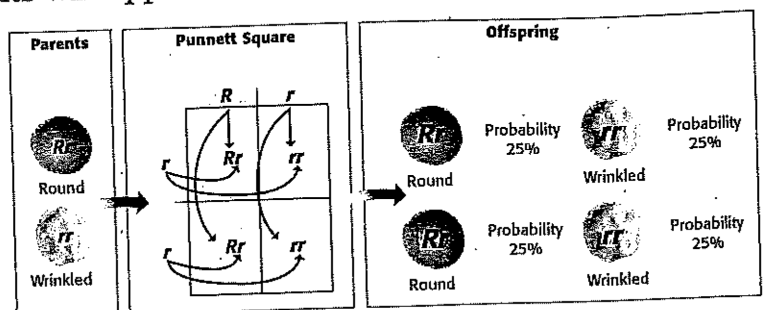
MATHEMATICAL MODELS

A *mathematical model* is made up of mathematical equations and data. Some mathematical models are simple. For example, a Punnett square is a model of how the traits of parents can be combined in their offspring. Using this model, scientists can predict how often certain traits will appear in the offspring of certain parents.



Scientists use Punnett squares to predict the features of living things.

Math Focus

3. Calculate What percentage of the offspring in the figure are round?

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Some mathematical models are more complicated than the Punnett square. Scientists may use computers to help them interpret more complicated models. Computers work faster and make fewer mistakes than people do.

CONCEPTUAL MODELS

A *conceptual model* is a description of how something works or is put together. Some conceptual models represent ideas. Others connect things that we know to things that we are unfamiliar with. For example, scientists use conceptual models to classify the ways that animals behave. Scientists can use these models to predict how an animal will act in a certain situation.

WHY SCIENTISTS USE MODELS

Scientists use models to study things that are too difficult or dangerous to study in real life. Scientists use models to study very small things, such as atoms, or very large things, such as the Earth. Some scientists use models to predict things that haven't happened yet, or to study events that happened long ago. For example, scientists use computers to produce models of dinosaurs. These models can show how dinosaurs may have looked and moved. ☑

READING CHECK

4. Explain Why do scientists use models?

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How Does Scientific Knowledge Grow?

Science is always changing. Two scientists can study the same data and make different conclusions. When new technology is developed, scientists often review old data and come to new conclusions. By observing patterns in the world, scientists can create scientific theories and laws.

A scientific **theory** is a scientific explanation that connects and explains many observations. Scientific theories are based on observations. They explain all of the observations about a topic that scientists have at a certain time. Theories are conceptual models that help organize scientific thinking. They are used to explain and predict situations.

A scientific **law** is a statement or equation that can predict what will happen in certain situations. Unlike theories, scientific laws do not explain why something happens. They only predict what will happen. Many people think that scientific theories become scientific laws, but this is not true. Actually, many scientific laws provide evidence to support scientific theories.

Name	What it is
	an explanation that connects and explains evidence and observations
	a statement or equation that predicts what will happen in a certain situation

How Do Scientific Ideas Change?

Scientists are always discovering new information. This new information may show that a theory is incorrect. When this happens, the theory must be changed so that it explains the new information. Sometimes, scientists have to develop a totally new theory to explain the new and old information.

Sometimes, more than one new theory is given to explain the new information. How do scientists know that a new theory is accurate? They use scientific methods to test the new theory. They also examine all the evidence to see if it supports the new theory. Scientists accept a new theory when many tests and pieces of evidence support it.

Critical Thinking

5. Infer Why can two scientists study the same data, but come to different conclusions about it?

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TAKE A LOOK

6. Identify Fill in the blank boxes in the figure with the terms *scientific law* and *scientific theory*.

Say It

Investigate Use the Internet or the library to learn about a scientific idea that interests you. Study how the idea has changed with time. Share your findings with your class.

Name ______________________ Class ______________ Date ______________

Section 3 Review

SECTION VOCABULARY

law a descriptive statement or equation that reliably predicts events under certain conditions

model a pattern, plan, representation, or description designed to show the structure or workings of an object, system, or concept

theory a system of ideas that explains many related observations and is supported by a large body of evidence acquired through scientific investigation

1. Identify How are scientific theories related to observations and evidence?

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2. Explain Why do scientists use models?

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3. Explain How do scientists know that a new theory is accurate?

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4. Describe What effect can new observations have on a scientific theory?

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5. Identify Give three types of models and an example of each type.

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6. Compare How is a scientific theory different from a scientific law?

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Name ______________________ Class ______________ Date ____________

CHAPTER 1 The World of Life Science

SECTION 4

Tools, Measurement, and Safety

BEFORE YOU READ

After you read this section, you should be able to answer these questions:

- How do tools help scientists?
- How do scientists measure length, area, mass, volume, and temperature?

What Tools Do Scientists Use?

Scientists can use technology to find information and to solve problems. **Technology** is the application of science for practical purposes. New technology can allow scientists to get information that was not available before.

STUDY TIP

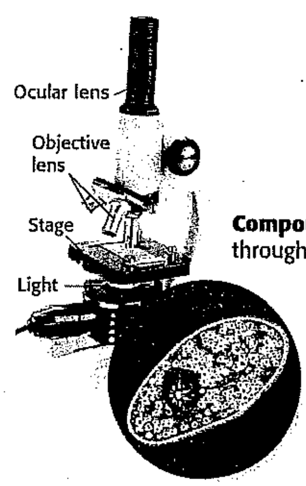
Compare As you read this section, make a table comparing how scientists measure length, area, mass, volume, and temperature. Include the tools and units that scientists use for each type of measurement.

CALCULATORS AND COMPUTERS

Scientists analyze, or examine, data using many different tools. Computers and calculators can help scientists do calculations quickly. Computers are also very important tools for collecting, storing, and studying data.

COMPOUND LIGHT MICROSCOPES

Scientists use microscopes to see things that are very small. One kind of microscope is a compound light microscope. A **compound light microscope** is a tool that magnifies small objects. It has three main parts: a stage, a tube with two or more lenses, and a light. Items are placed on the stage. Light passes through them. The lenses help to magnify the image.



Compound Light Microscope Light passes through a specimen and produces a flat image.

TAKE A LOOK

1. Identify What are the three main parts of a compound light microscope?

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Name ______________ Class ______________ Date ______________

ELECTRON MICROSCOPES

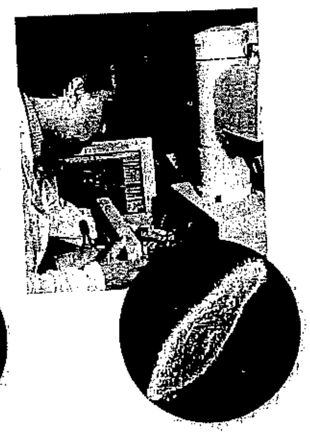
Electron microscopes use tiny particles called *electrons* to produce magnified images. Electron microscopes make clearer and more detailed images than light microscopes do. However, unlike light microscopes, electron microscopes cannot be used to study things that are alive.

Critical Thinking

2. Identify A scientist wants to look at a living cell. Should the scientist use a compound light microscope or an electron microscope? Explain your answer.

Transmission Electron Microscope Electrons pass through the specimen and produce a flat image.

Scanning Electron Microscope Electrons bounce off the surface of the specimen and produce a three-dimensional (3-D) image.



How Do Scientists Measure Objects?

Scientists make many measurements as they collect data. It is important for scientists to be able to share their data with other scientists. Therefore, scientists use units of measurement that are known to all other scientists. One system of measurement that most scientists use is called the International System of Units.

THE INTERNATIONAL SYSTEM OF UNITS

The *International System of Units*, or *SI*, is a system of measurement that scientists use when they collect data. This system of measurement has two benefits. First, scientists around the world can easily share and compare their data because all measurements are made in the same units. In addition, SI units are based on the number 10. This makes it easy to change from one unit to another.

It is important to learn the SI units that are used for different types of measurements. You will use SI units when you make measurements in the science lab.

Critical Thinking

3. Predict Consequences What could happen if all scientists used different systems of measurement to record their data?

LENGTH

Length is a measure of how long an object is. The SI unit for length is the *meter* (m). Centimeters (cm) and millimeters (mm) are used to measure small distances. There are 100 cm in 1 m. There are 1,000 mm in 1 m. Micrometers (µm) are used to measure things that are very small, such as cells. There are 1 million µm in 1 m. Rulers and metersticks are used to measure length.

Length tools: ruler or meterstick	SI Unit: meter (m) kilometer (km) centimeter (cm) millimeter (mm)	1 km = 1,000 m 1 cm = 0.01 m 1 mm = 0.001 m 1 µm = 0.000001 m

TAKE A LOOK

4. Identify What is the SI unit for length?

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AREA

Area is a measure of how much surface an object has. For most objects, area is calculated by multiplying two lengths together. For example, you can find the area of a rectangle by multiplying its length by its width. Area is measured in square units, like square meters (m^2) or square centimeters (cm^2). There are 10,000 cm^2 in 1 m^2. ☑

There is no tool that is used to measure area directly. However, you can use a ruler to measure length and width. Multiply these measurements to find area.

READING CHECK

5. Explain How can you find the area of a rectangle?

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Area tool: ruler (to measure lengths)	square meter (m^2) square centimeter (cm^2)	1 cm^2 = 0.0001 m^2

VOLUME

Volume is the amount of space an object takes up. You can find the volume of a box-shaped object by multiplying its length, width, and height together. You can find the volume of objects with many sides by measuring how much liquid they can push out of a container, as shown in the figure on the next page. You can measure the volume of a liquid using a beaker or a graduated cylinder. ☑

Volume is often measured in cubic units. For example, very large objects can be measured in cubic meters (m^3). Smaller objects can be measured in cubic centimeters (cm^3). There are 1 million cm^3 in 1 m^3. The volume of a liquid is sometimes given in units of liters (L) or milliliters (mL). One mL has the same volume as one cm^3. There are 1,000 mL in 1 L. There are 1,000 L in one m^3.

READING CHECK

6. Define What is volume?

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Volume tools: graduated cylinder, beaker	cubic meter (m^3) cubic centimeter (cm^3) liter (L) milliliter (mL)	1 cm^3 = 0.000001 m^3 1 L = 0.001 m^3 1 mL = 1 cm^3

LENGTH

Length is a measure of how long an object is. The SI unit for length is the *meter* (m). Centimeters (cm) and millimeters (mm) are used to measure small distances. There are 100 cm in 1 m. There are 1,000 mm in 1 m. Micrometers (µm) are used to measure things that are very small, such as cells. There are 1 million µm in 1 m. Rulers and metersticks are used to measure length.

Length tools: ruler or meterstick	SI Unit: meter (m) kilometer (km) centimeter (cm) millimeter (mm)	1 km = 1,000 m 1 cm = 0.01 m 1 mm = 0.001 m 1 µm = 0.000001 m

TAKE A LOOK

4. Identify What is the SI unit for length?

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AREA

Area is a measure of how much surface an object has. For most objects, area is calculated by multiplying two lengths together. For example, you can find the area of a rectangle by multiplying its length by its width. Area is measured in square units, like square meters (m^2) or square centimeters (cm^2). There are 10,000 cm^2 in 1 m^2. ☑

There is no tool that is used to measure area directly. However, you can use a ruler to measure length and width. Multiply these measurements to find area.

Area tool: ruler (to measure lengths)	square meter (m^2) square centimeter (cm^2)	1 cm^2 = 0.0001 m^2

READING CHECK

5. Explain How can you find the area of a rectangle?

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VOLUME

Volume is the amount of space an object takes up. You can find the volume of a box-shaped object by multiplying its length, width, and height together. You can find the volume of objects with many sides by measuring how much liquid they can push out of a container, as shown in the figure on the next page. You can measure the volume of a liquid using a beaker or a graduated cylinder. ☑

Volume is often measured in cubic units. For example, very large objects can be measured in cubic meters (m^3). Smaller objects can be measured in cubic centimeters (cm^3). There are 1 million cm^3 in 1 m^3. The volume of a liquid is sometimes given in units of liters (L) or milliliters (mL). One mL has the same volume as one cm^3. There are 1,000 mL in 1 L. There are 1,000 L in one m^3.

Volume tools: graduated cylinder, beaker	cubic meter (m^3) cubic centimeter (cm^3) liter (L) milliliter (mL)	1 cm^3 = 0.000001 m^3 1 L = 0.001 m^3 1 mL = 1 cm^3

READING CHECK

6. Define What is volume?

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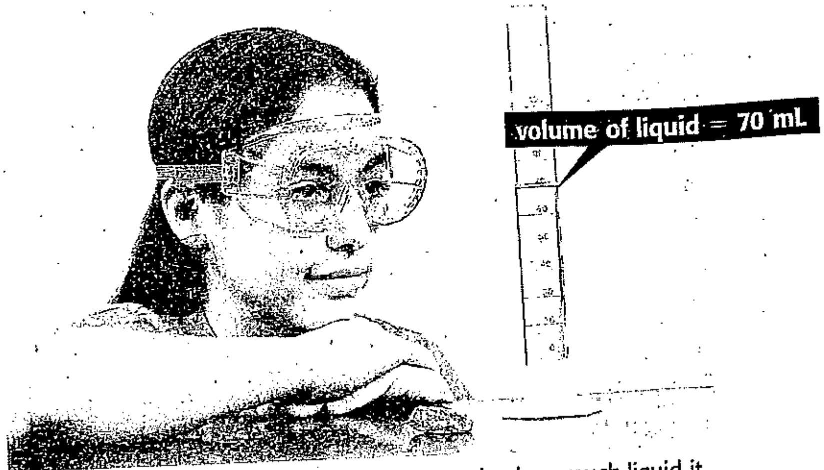
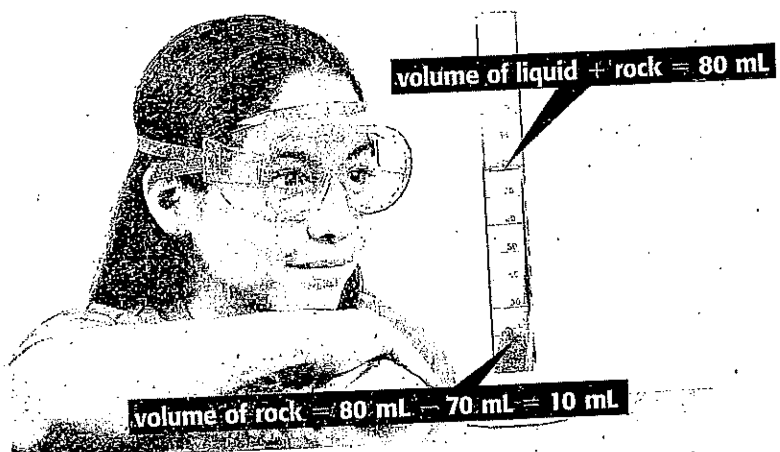


You can find the volume of this rock by measuring how much liquid it pushes out of the way. The graduated cylinder has 70 mL of liquid in it before the rock is added.



The rock made the volume of material in the cylinder go up to 80 mL. The rock pushed 10 mL of liquid out of the way. The volume of the rock is 10 mL. Because 1 mL = 1 cm^3, the volume of the rock can also be written as 10 cm^3.

TAKE A LOOK

7. Explain How do you know that the rock in the figure has a volume of 10 mL?

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MASS

Mass is a measurement of the amount of matter in an object. The SI unit for mass is the kilogram (kg). The masses of large objects, such as people, are measured using kg. The masses of smaller objects, such as an apple, are measured in grams (g) or milligrams (mg). There are 1,000 g in 1 kg. There are 1 million mg in 1 kg. Balances are used to measure mass.

Math Focus

8. Convert How many mg are there in 1 g?

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Mass tool: balance	SI Unit: kilogram (kg) gram (g) milligram (mg)	1 g = 0.001 kg 1 mg = 0.000001 kg

TEMPERATURE

Temperature is a measure of how hot or cold an object is. The SI unit for temperature is the Kelvin (K). However, most people are more familiar with other units of temperature. For example, most people in the United States measure temperatures using degrees Fahrenheit (°F). Scientists often measure temperatures using degrees Celsius (°C). Thermometers are used to measure temperature. ☑

Temperature tool: thermometer	SI Unit: kelvin (K) degrees Celsius (°C)	0°C = 273 K 100°C = 373 K

READING CHECK

9. Define What is temperature?

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It is easy to change measurements in °C to K. To change a temperature measurement from °C to K, you simply add 273 to the measurement. For example, 200 °C = 200 + 273 = 473 K. It is more complicated to change measurements in K or °C into °F. That is why scientists do not measure temperatures in °F. ☑

READING CHECK

10. Explain Why do scientists measure temperature in K or °C instead of °F?

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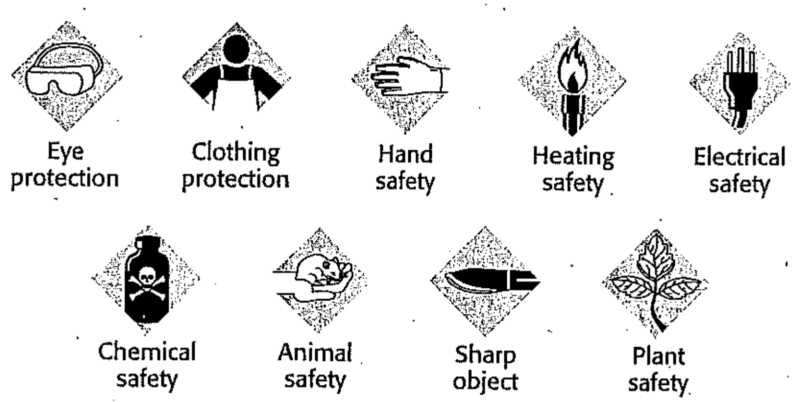
How Can You Stay Safe in Science Class?

Science can be exciting, but it can also be dangerous. In order to stay safe while you are doing a science activity, you should always follow your teacher's directions. Read and follow the lab directions carefully, and do not take "shortcuts." Pay attention to safety symbols, such as the ones in the figure below. If you do not understand something that you see in a science activity, ask your teacher for help.

Safety Symbols



TAKE A LOOK

11. Investigate Look around your classroom for safety symbols like the ones in the figure. Give two examples of places where safety symbols are found in your classroom.

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Name _______________ Class _______________ Date _______________

Section 4 Review

SECTION VOCABULARY

area a measure of the size of a surface or a region

compound light microscope an instrument that magnifies small objects so that they can be seen easily by using two or more lenses

electron microscope a microscope that focuses a beam of electrons to magnify objects

mass a measure of the amount of matter in an object

technology the application of science for practical purposes; the use of tools, machines, materials, and processes to meet human needs

temperature a measure of how hot (or cold) something is; specifically, a measure of the average kinetic energy of the particles in an object

volume a measure of the size of a body or region in three-dimensional space

1. **Describe** You can find the volume of a box-shaped object by multiplying its length, width, and height together. How can you measure the volume of an object if it is not shaped like a box?

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2. **Identify** Fill in the table to show the tool you would use to carry out each measurement.

Task	Tool
Looking at something that is very small	
Measuring how tall your friend is	
Measuring how much water is in a glass	

3. **Identify** What are two units that scientists use to measure temperature?

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4. **Explain** How can you stay safe while doing a science activity? Give three ways.

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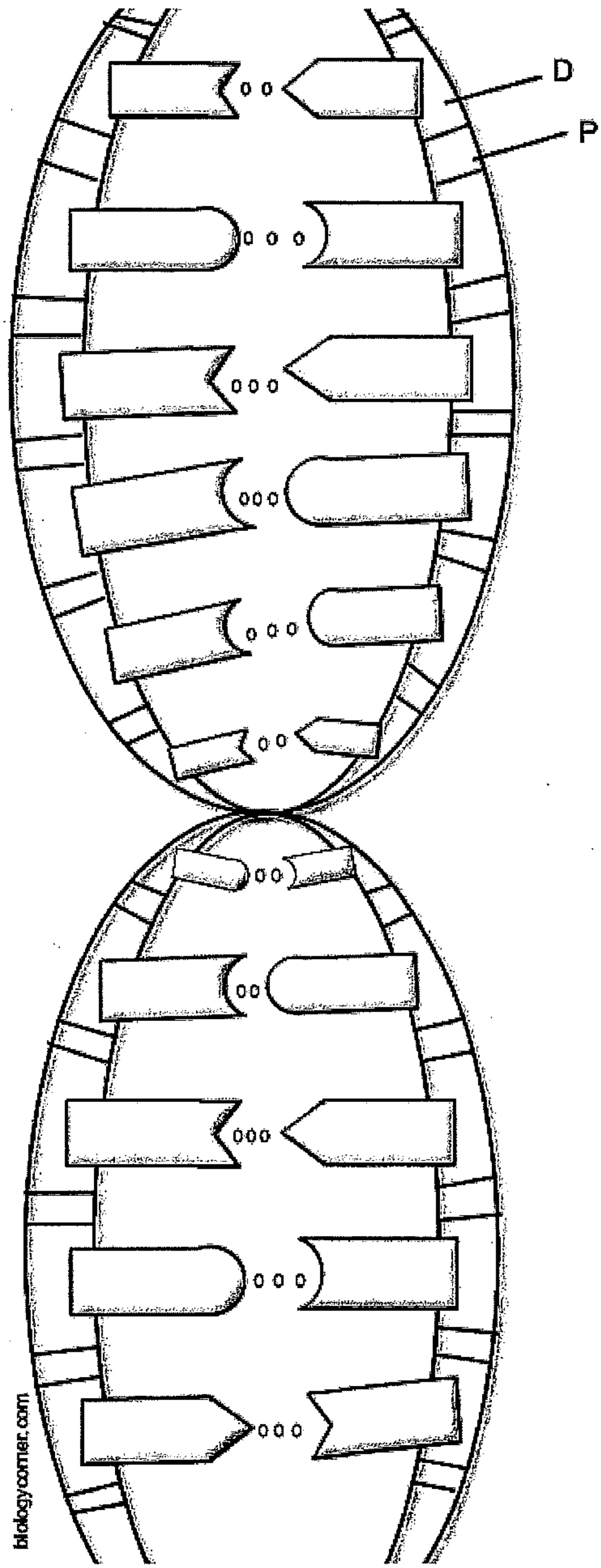
NAME:______________________________ TOC #_______



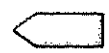
Step 1:

Color Each Deoxyribose sugar RED

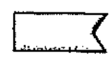
Color Each Phosphate group BLUE

Step 2:

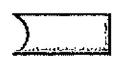
Color the thymines ORANGE.



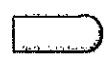
Color the adenines GREEN.



Color the guanines PURPLE.



Color the cytosines YELLOW.



Step 3:

Color the _____ hydrogen bonds between A and T BLACK

Learve the ____ hydrogen bonds between G and C WHITE

Destiny's Odyssey

Personal Interests Worksheet

I am happiest when I am:

My idea of a perfect day:

Five things I really enjoy doing:

1.

2.

3.

4.

5.

Three things I like to do every day:

1.

2.

3.

Answer the following questions.

What are the three activities that you most love to do?

1.

2.

3.

How often do you do them?

If you would like to do them more often, what is stopping you?

What specific changes would you need to make in order to engage in these activities more frequently?