Objectives

- **Explain** that science involves asking questions.
- **Describe** the relationship of matter and energy to physical science.
- **Explain** what scientific methods are.
- **Explain** how scientific methods are used to answer questions.
- **Describe** how a hypothesis is formed and tested.
- **Identify** methods that are used to analyze data.
- **Explain** how a conclusion can support or disprove a hypothesis.
- **List** methods of communicating data.

That’s Science!

- **What Is Science?** Science is a process of gathering knowledge about the natural world.

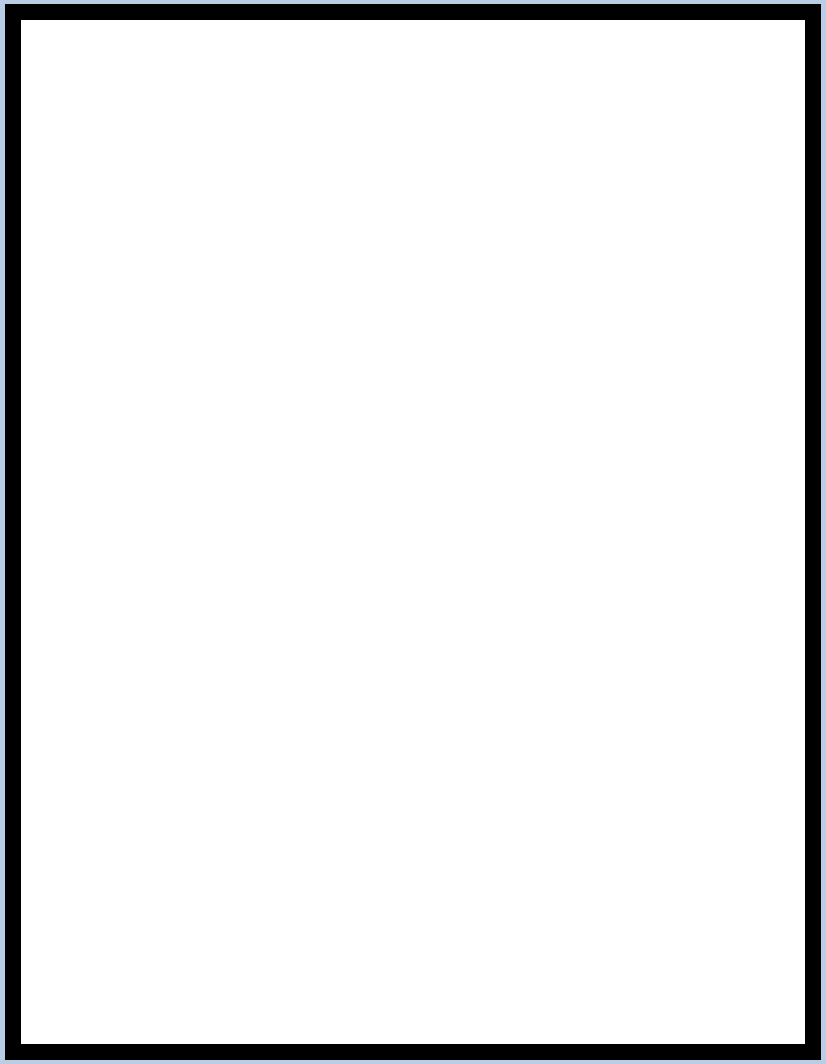
- **Everyday Science** Everyday actions such as timing the microwave popcorn and using the brakes on your bicycle use your knowledge of science. You learned how to do these things by making observations and asking questions.

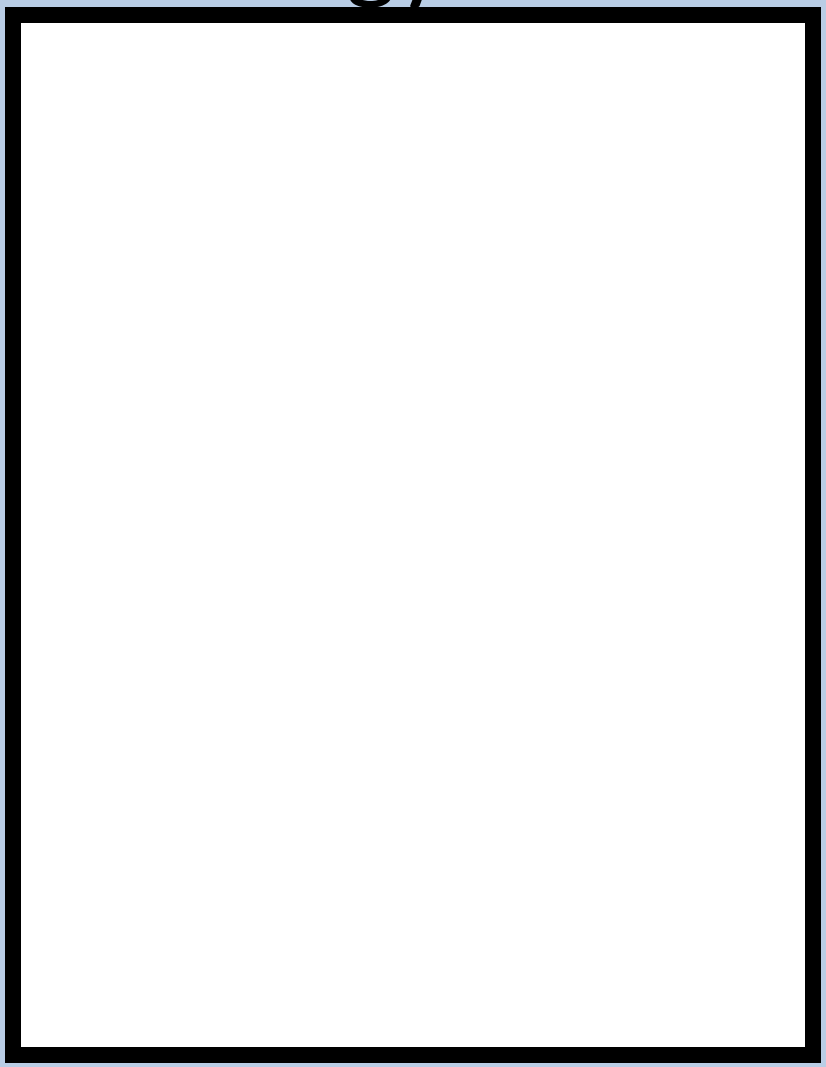
I. What is Physical Science?

A. The World of Physical Science Physical science is the study of matter and energy.

B. **A Study of Matter and Energy** Physical science is also often divided into two categories: chemistry and physics.

Critical Thinking Time
Matter Versus Energy





II. Branches of Physical Science

A. Chemistry—A Matter of Reactions! Chemistry is the study of all forms of matter, including how matter interacts with other matter. Chemistry looks at the structure and properties of matter.

B. **Physics—A Matter of Energy** Like chemistry, physics deals with matter. But physics looks mostly at energy and the way that energy affects matter.

III. Physical Science: All Around You

A. Meteorology The study of Earth's atmosphere, especially in relation to weather and climate, is called meteorology.

B. **Geology** The study of the origin, history, and structure of Earth is called geology.

C. **Biology** Students are often surprised that life science and physical science are related. But chemistry and physics explain many things that happen in biology.

Cloud Types Based on Form and Altitude

Cumulus clouds look like piles of cotton balls.

Stratus clouds are not as tall as cumulus clouds, but they cover more area.

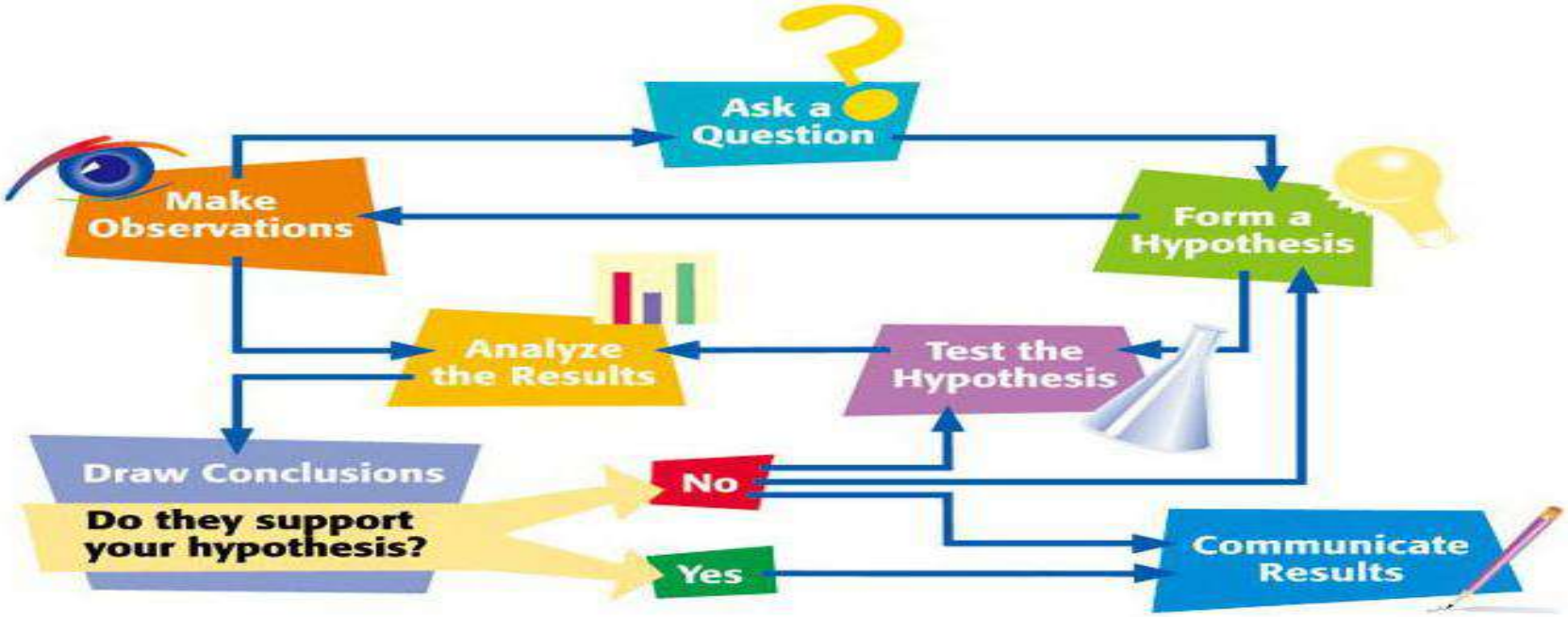
Cirrus clouds are made of ice crystals.

Nimbostratus clouds are dark and produce rain.

Cumulonimbus clouds are large and capable of producing thunderstorms.

IV. What Are Scientific Methods?

A. Follow the Steps Scientific methods are the ways in which scientists follow steps to answer questions and solve problems. The next slide shows how scientific methods work.



V. Asking a Question

A. A Real World Question Czarnowski and Triantafyllou are engineers, scientists who put scientific knowledge to practical use. Czarnowski and Triantafyllou studied the efficiency of boat propulsion systems.

B. **The Importance of Boat Efficiency** Czarnowski and Triantafyllou asked a question: How more efficient can boat propulsion systems be made?

VI. Forming a Hypothesis

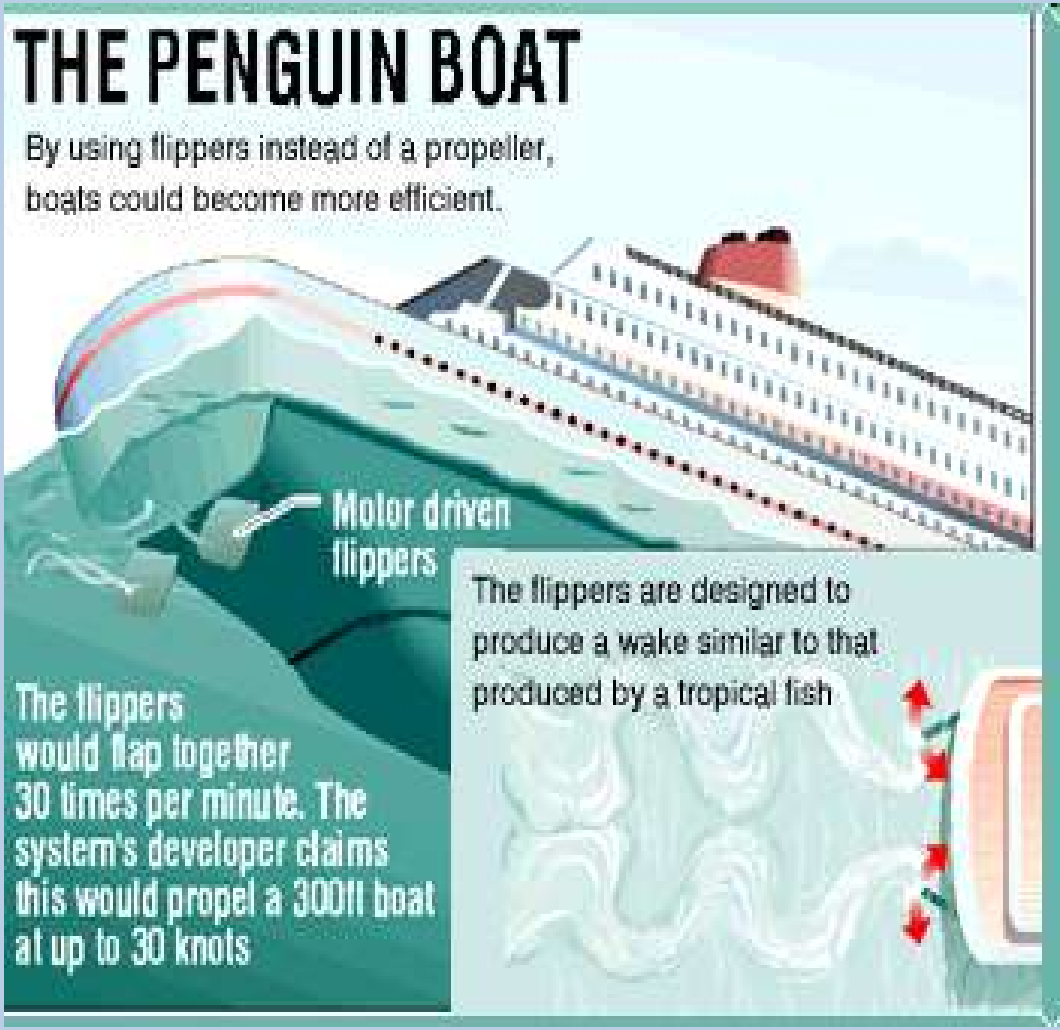
A. A Possible Answer from Nature Czarnowski observed that penguins, like boats, have a rigid body. These observations led to a hypothesis: A propulsion system that imitates the way that a penguin swims will be more efficient than a propulsion system that uses propellers.

B. **Making Predictions** Before scientists test a hypothesis, they often predict what they think will happen when they test the hypothesis.

VII. Testing the Hypothesis

A. Controlled Experiments A controlled experiment compares the results from a control group with the results from experimental groups.

B. **Testing *Proteus*** Czarnowski and Triantafyllou took *Proteus* out into the open water of the Charles River in Boston when they were ready to collect data.



VIII. Analyzing the Results

A. Does the Data Support the Hypothesis? After you collect and record your data, you must analyze them. You must find out if the results of your test support the hypothesis.

B. **Analyzing *Proteus*** Czarnowski and Triantafyllou used the data for input energy and output energy to calculate *Proteus*'s efficiency for different flapping rates.

IX. Drawing Conclusions

A. Decide Whether the Hypothesis Was Correct At the end of an investigation, you must draw a conclusion.

B. **The *Proteus* Conclusion** Czarnowski and Triantafyllou concluded that their hypothesis was supported, which led to more questions.

X. Communicating Results

A. Let the World Know One of the most important steps in any investigation is to communicate your results. You can write a scientific paper, make a presentation, or create a Web site.

B. **Communicating About *Proteus*** Czarnowski and Triantafyllou published their results in academic papers, science magazines, and newspapers. They also displayed the results of their project on the Internet. These reports allow other scientists to conduct additional research about *Proteus* .

Critical Thinking
An Experimental Procedure

- Write an experiment to test the following:
- Adding salt to water will change the temperature at which water boils.
- Identify the controlled factors and the variable in the experiment.