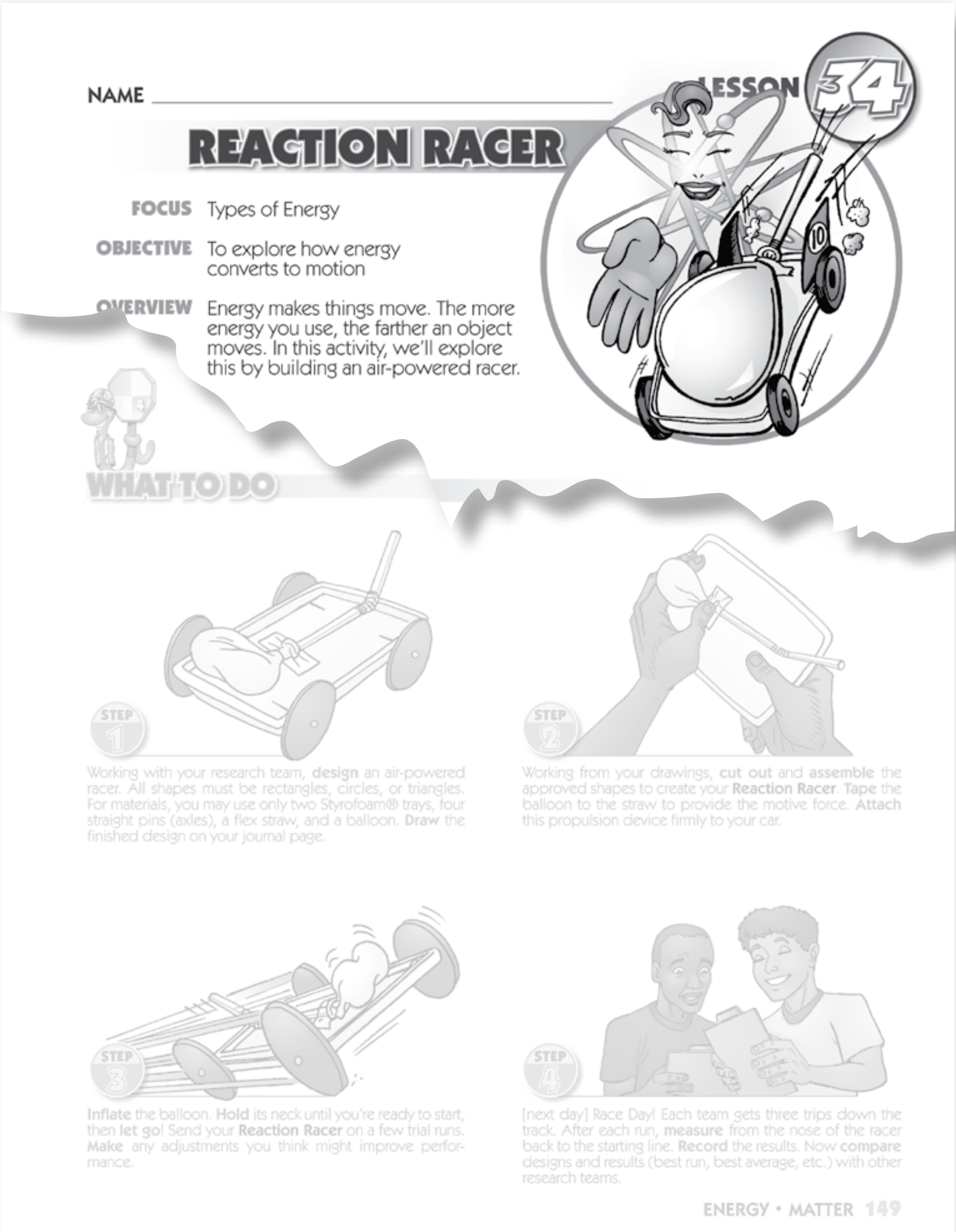

NAME ______________________

LESSON 34

REACTION RACER

FOCUS Types of Energy

OBJECTIVE To explore how energy converts to motion

OVERVIEW Energy makes things move. The more energy you use, the farther an object moves. In this activity, we'll explore this by building an air-powered racer.

WHAT TO DO

STEP 1
Working with your research team, **design** an air-powered racer. All shapes must be rectangles, circles, or triangles. For materials, you may use only two Styrofoam® trays, four straight pins (axles), a flex straw, and a balloon. **Draw** the finished design on your journal page.

STEP 2
Working from your drawings, **cut out** and **assemble** the approved shapes to create your **Reaction Racer**. **Tape** the balloon to the straw to provide the motive force. **Attach** this propulsion device firmly to your car.

STEP 3
Inflate the balloon. **Hold** its neck until you're ready to start, then **let go**! Send your **Reaction Racer** on a few trial runs. **Make** any adjustments you think might improve performance.

STEP 4
[next day] Race Day! Each team gets three trips down the track. After each run, **measure** from the nose of the racer back to the starting line. **Record** the results. Now **compare** designs and results (best run, best average, etc.) with other research teams.

ENERGY • MATTER 149

Category

Physical Science
Energy/Matter

Focus

Types of Energy

Objective

To explore how energy converts to motion

National Standards

A1, A2, B1, B2, B3, E1, E2, F5, G1, G2

Materials Needed

Styrofoam® tray
straight pins - 4
flex straw
balloon
ruler
scissors
tape

Safety Concerns

4. Sharp Objects
Remind students to exercise caution with scissors and pins.

Additional Comments

Occasionally the pins need some kind of "hubcap" to keep them from slipping into or through the Styrofoam®. A tiny bit of plastic cut from a soda straw works well for this. Monitor teams to make sure this remains a group project.

Overview

Read the overview aloud to your students. The goal is to create an atmosphere of curiosity and inquiry.

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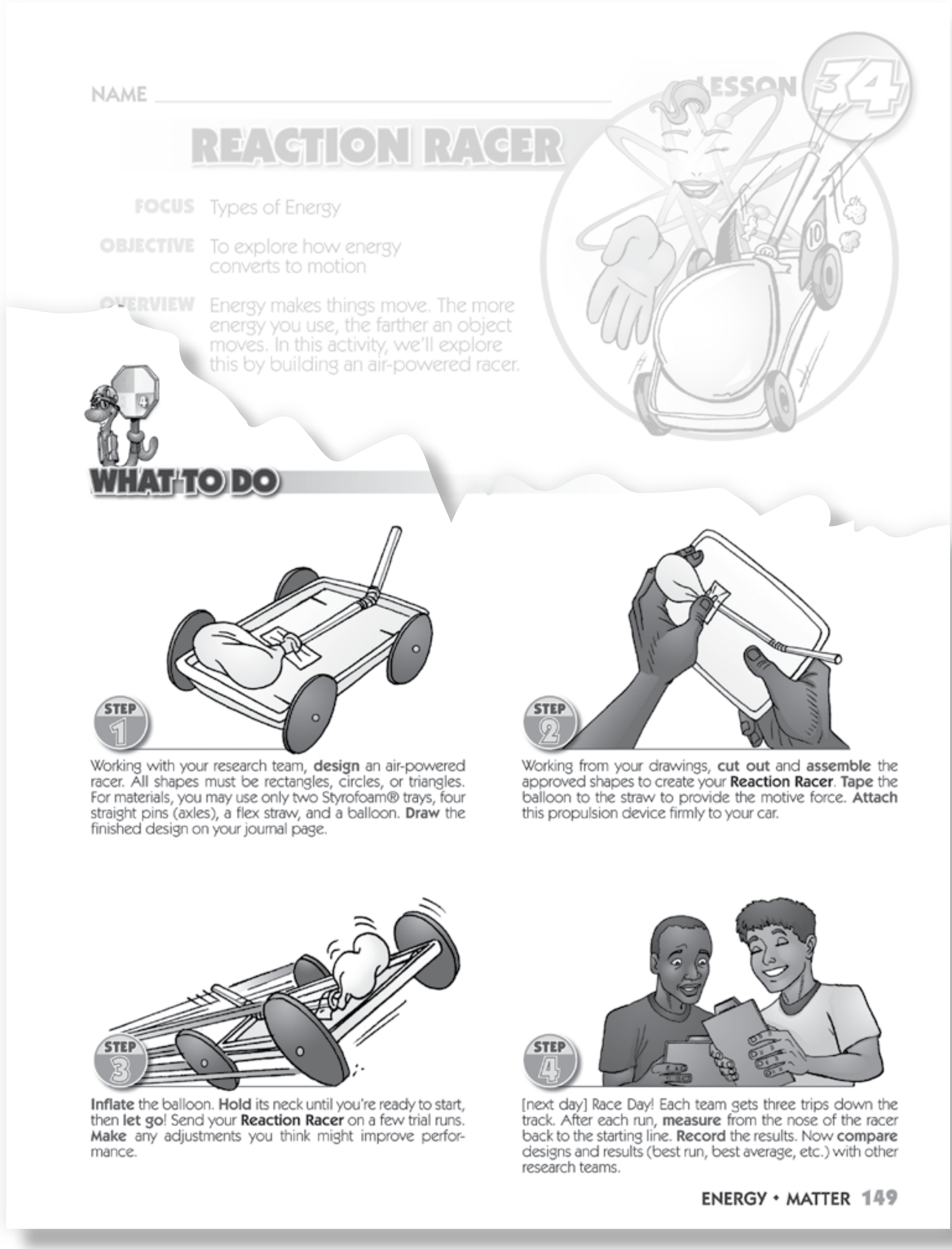
WHAT TO DO

Monitor student research teams as they complete each step.



NAME ______________________ LESSON 34

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Teacher to Teacher

This activity is rich in concepts!

First, it demonstrates all three of Newton's Laws.

Second, it supports the concept of trial and error design.

Third, it offers inherent lessons about the relationship of form and function.

Opportunities to expand these concepts are almost limitless.

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WHAT JUST HAPPENED?

Your **Reaction Racer** demonstrated two types of **energy** — potential and kinetic.

Potential (stored) **energy** was present in the inflated balloon. Examples of potential energy include the charge in a battery, the gasoline in a car, the food in your refrigerator, a rock on the edge of a cliff, etc. **Kinetic** (moving) **energy** came into play as your car raced down the track. Examples of kinetic energy include a falling rock, a swinging bat, a rolling wheel, and so forth.

Movement requires energy, and energy leads to movement. As we saw in this activity, energy can take either of these two primary forms, and can be **converted** (changed) from one type to another. For example, the food you ate for lunch can be used as fuel to make you run faster, or stored in the form of fat for energy you need later.

MORE ABOUT ENERGY . . .

In physics, energy is defined as the capacity of a physical system to do work. This can be measured by the amount of work done. Scientists often relate this to the amount of force needed to move an object of a given mass a given distance.

For example, if you inflated your balloon to a diameter of two inches, your racer wouldn't have moved very far. The energy available could only move it a few feet. But if you inflated your balloon to a diameter of six inches, there was a lot more energy available, and your racer would have moved much farther and faster!

There are many sources of potential energy in our world. They include fossil fuels (like petroleum and coal), bodies of water (which may be used for hydroelectric applications), radioactive materials (which can produce nuclear reactions), and solar radiation (which can power solar heaters and photovoltaic systems), just to name a few.

Engineers have developed many ways to change potential energy into kinetic energy. Something as simple as placing a dam across a river can create a deep lake filled with potential energy. Open the gates in that dam, and the falling water becomes a strong source of kinetic energy (where it is often used to generate hydroelectric power).

Common categories of kinetic energy include mechanical, thermal, electrical, chemical, and nuclear. Each of these kinds of energy can be transferred from one form to another, making the energy more available for use in specific applications.

For example, the atomic reactions inside a power plant (nuclear) can turn water into steam (thermal) which then spins a turbine (mechanical) producing alternating current (electrical) that is then carried through power lines to your living room. That's a lot more practical that having a nuclear power plant in your basement!

DIGGING DEEPER:

Research and discuss one specific application of energy technology (hydroelectric dam, solar collector, internal combustion engine, etc.). How does this device change potential energy into kinetic energy? What kind of "work" is done? Be sure to share your findings with the rest of the class.

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WHAT WE LEARNED:

1. What are the two primary types of energy. How are they similar? How are they different?

a) potential and kinetic

b) similar: both primary forms of energy

c) potential is stored energy; kinetic is moving energy

2. How was energy converted from one form to another in this activity? Be specific.

potential energy in the balloon was converted to kinetic energy when the balloon was released

3. Based on what you've learned, give three examples of potential energy and three examples of kinetic energy.

potential energy: charge in a battery, gasoline in a car, food in a refrigerator, etc.

kinetic energy: a falling rock, a swinging bat, a rolling wheel; etc.

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What Happened

Review the section with students. Emphasize bold-face words that identify key concepts and introduce new vocabulary.

*Your Reaction Racer demonstrated two types of **energy** — potential and kinetic.*

***Potential** (stored) **energy** was present in the inflated balloon. Examples of potential energy include the charge in a battery, the gasoline in a car, the food in your refrigerator, a rock on the edge of a cliff, etc. **Kinetic** (moving) **energy** came into play as your car raced down the track. Examples of kinetic energy include a falling rock, a swinging bat, a rolling wheel, and so forth.*

***Movement** requires energy, and energy leads to movement. As we saw in this activity, energy can take either of these two primary forms, and can be **converted** (changed) from one type to another. For example, the food you ate for lunch can be used as fuel to make you run faster, or stored in the form of fat for energy you need later.*

More About . . .

Have students read this section as you would a traditional science text — or use cooperative learning techniques to allow students the opportunity to work on the material collaboratively.

Digging Deeper

(Optional) Challenge teams to reseach and discuss practical applications of the lesson concepts. Encourage them to share their findings with the rest of the class.

What We Learned

Answers will vary. Suggested responses are shown at left.

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Conclusion

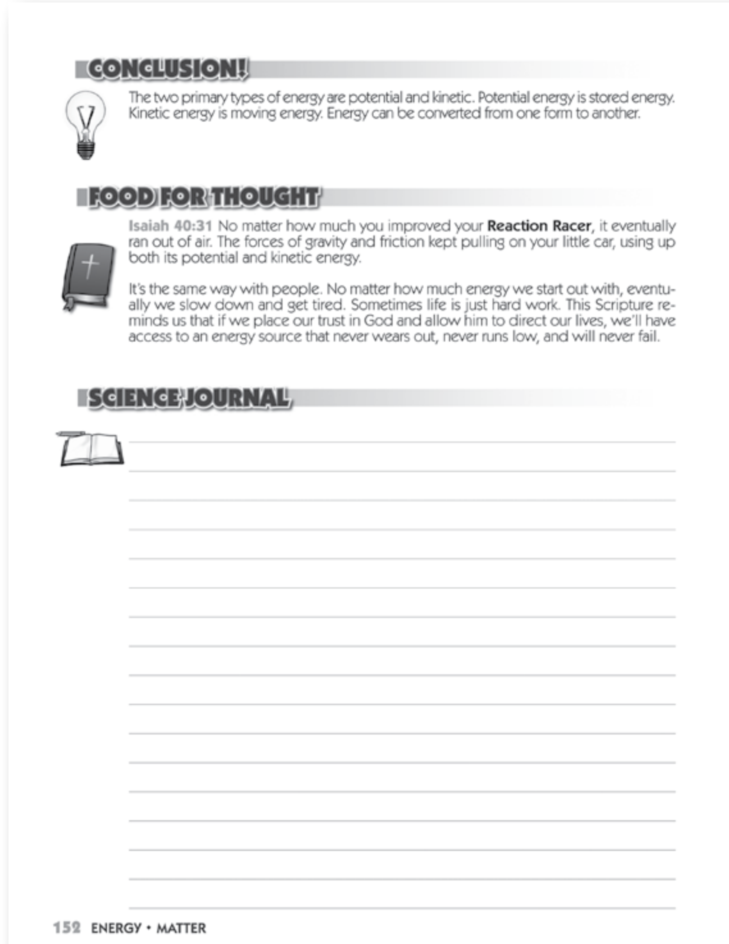
Read this section aloud to the class to summarize the concepts learned in this activity.

Food for Thought

Read the Scripture aloud to the class. Talk about times when we are emotionally and mentally drained. Discuss how God provides a never-ending source of power for our lives.

Science Journal

If time permits, have a general class discussion about notes and drawings various students added to their journal pages. Discuss correct and incorrect predictions, and remind students that this “trial and error” process is part of the scientific process.


CONCLUSION!

The two primary types of energy are potential and kinetic. Potential energy is stored energy. Kinetic energy is moving energy. Energy can be converted from one form to another.

FOOD FOR THOUGHT

Isaiah 40:31 No matter how much you improved your **Reaction Racer**, it eventually ran out of air. The forces of gravity and friction kept pulling on your little car, using up both its potential and kinetic energy.

It's the same way with people. No matter how much energy we start out with, eventually we slow down and get tired. Sometimes life is just hard work. This Scripture reminds us that if we place our trust in God and allow him to direct our lives, we'll have access to an energy source that never wears out, never runs low, and will never fail.

SCIENCE JOURNAL

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Extended Teaching

1. Repeat this activity using different size racers and balloons. Have students compare the results with the original activity. How were they similar? How were they different?

2. Discuss ways friction might be reduced to make a Reaction Racer go further. Think in terms of the racing surface, axle lubricants, wheel thickness, etc. Have students test their hypotheses.

3. Using the Internet, have teams research how the shape of a race car affects its speed and efficiency. Challenge each team to create a poster showing a specific car and how this principle is applied.

4. Take a field trip to a racing shop. Find out how vehicles are designed to work with or overcome various forces (gravity, friction, wind resistance, etc.). Have students write a paragraph about one thing they learn.

5. Invite a motorcross racer to visit your classroom. Ask him/her to bring equipment, and to discuss the physical forces that affect this sport. Have students write a paragraph about one thing they learn.

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