

Changes in Materials for *Measuring Time*

Since publication of the *Measuring Time* Teacher's Guide and Student Activity Book, small stainless steel washers have replaced small brass washers. This change in materials affects Lessons 7, 8, and 9 of the *Measuring Time* unit and requires minor revisions to the instructions in the unit's materials. The revisions are as follows:

Teacher's Guide, Materials List, page 4

Revision is in bold:

60 **small stainless steel** washers, 9 mm
(3/4") diameter

Teacher's Guide, Lesson 7, page 68,
Materials, *For every two students*

Revision is in bold:

3 **small stainless steel** washers, 9 mm
(3/4") diameter

Teacher's Guide, Lesson 7, page 68,
Procedure Step 6

Revision is in bold:

"Now ask students to use a piece of aluminum
foil and the **small stainless steel** washers to
construct a sinking water clock. Challenge
them to "

Teacher's Guide, Lesson 8, page 76,
Materials, *For every two students*

Revision is in bold:

3 **small stainless steel** washers, 9 mm (3/4") diameter

Teacher's Guide, Lesson 8, page 76,
Materials, *For the class*

Revision is in bold:

15 **small stainless steel** washers, 9 mm
(3/4") diameter

Teacher's Guide, Lesson 9, page 88,
Materials, *For every two students*

Revision is in bold:

3 **small stainless steel** washers, 9 mm (3/4") diameter

Teacher's Guide, Lesson 9, page 88,
Materials, *For groups varying the weight
of the container*

Revision is in bold:

3 additional **small stainless steel** washers, 9 mm
(3/4") diameter

(continued on the next page)

Changes in Materials for *Measuring Time*

The **STC** Program™

Student Activity Book, Lesson 7, page 27,
Materials, *For you and your partner*

Revision is in bold:
3 **small stainless steel** washers, 9 mm
(3/4") diameter

Student Activity Book, Lesson 8, page 33,
Materials, *For you and your partner*

Revision is in bold:
3 **small stainless steel** washers, 9 mm
(3/4") diameter

Student Activity Book, Lesson 9, page 35,
Materials, *For you and your partner*

Revision is in bold:
3 **small stainless steel** washers, 9 mm
(3/4") diameter

Student Activity Book, Lesson 9, page 35,
Materials, *For groups varying the weight
of the container*

Revision is in bold:
3 additional **small stainless steel** washers, 9 mm
(3/4") diameter

If you have questions about these changes or about the module in general, call Carolina's product information staff at 800-227-1150 (8 a.m.–5 p.m. ET, M–F), or email stc@carolina.com.

Materials List

Below is a list of materials needed for the *Measuring Time* unit. Please note that the metric and English equivalent measurements in this list and in the lessons are approximate.

- | | | | |
|-----|---|----|---|
| 1 | <i>Measuring Time</i> Teacher's Guide | | |
| 15 | <i>Measuring Time</i> Student Activity Books | 15 | wooden dowels, 1 cm × 60 cm ($\frac{3}{8}$ × 24") |
| 15 | cardboard pieces, 7.5 cm (3") square | 15 | C-clamps, 5 cm (2") |
| 15 | metric tape measures, 100 cm long | 1 | roll of aluminum foil |
| 1 | roll of braided nylon casting line, 12-lb test, 55 m (60 yd) long | 1 | clock with a sweep second hand |
| 45 | plastic clothespins | 1 | AA alkaline battery |
| 180 | large washers, 4.5 cm ($1\frac{3}{4}$ ") diameter | 8 | sponges |
| 60 | small stainless steel washers, 9 mm ($\frac{3}{4}$ ") diameter | 3 | buckets |
| 16 | D-cell batteries | 1 | roll of waxed paper |
| 8 | flashlights | 8 | white plastic beads, 18 mm ($\frac{3}{4}$ ") diameter |
| 5 | medium funnels | 8 | rubber bands, no. 16 |
| 5 | bead-tubes (no bead) | 30 | jumbo paper clips |
| 5 | bead-tubes (orange), 3-mm ($\frac{1}{8}$ ") hole | 1 | roll of adding machine paper |
| 5 | bead-tubes (green), 2-mm ($\frac{1}{12}$ ") hole | 30 | sheets of white construction paper, 22.8 cm × 30.5 cm (9 × 12") |
| 15 | bead-tubes (yellow), 4-mm ($\frac{1}{8}$ ") hole | 8 | toothpicks |
| 15 | plastic flex tanks, 4 liters (1 gal) | 5 | small funnels |
| 15 | square bases | 15 | large funnels |
| 15 | end caps, 3.9 cm ($1\frac{1}{2}$ ") diameter | | * Metric rulers |
| 60 | barrel connectors | | * Science notebooks |
| 15 | rods, orange, 13 cm ($5\frac{1}{2}$ ") long | | * Markers |
| 30 | rods, red, 26 cm ($10\frac{1}{4}$ ") long | | * Masking tape |
| 45 | rods, green, 18 cm (7") long | | * Calculators |
| 90 | rods, yellow, 7.5 cm (3") long | | * Glue or paste |
| 45 | wheels, 5 cm (2") diameter | | * Calendar |
| | | | * Newsprint |

***Note:** These items are not included in the kit but are commonly available in most schools or can be brought from home.

Materials*For each student*

- 1 science notebook
- 1 piece of aluminum foil, 10 cm (4") square

For every two students

- 1 plastic flex tank, 4 liters (1 gal), with water
- 3 small stainless steel washers, 9 mm ($\frac{3}{4}$ ") diameter

For the class

- 1 clock with a sweep second hand
 - 1 class list, "What We Know about Measuring Time" (from Lesson 1), and a marker of a different color from previous entries
 - 3 buckets with handles, each approx. 4 liters (1 gal)
- Several sponges
Several sheets of newsprint and marker(s)

Preparation

1. Cut one 10-cm (4") square piece of aluminum foil for each student.
2. Fill each plastic tank about three-fourths full with water. You may want to ask students to help with this task. If your classroom is not equipped with a sink, buckets with handles are one way to transport and pour water efficiently.
3. Display a clock with a sweep second hand in the classroom.

Procedure

1. Remind students to continue recording their observations of the moon for the next several weeks. The record of moon observations will be important evidence of the pattern of the moon's phases.
2. Ask students to describe some of the problems they encountered using the sun and moon to keep track of time. Here are some of the things they are likely to come up with:
 - It is impossible to tell time when it is dark or cloudy.
 - Sun clocks aren't portable.
 - It is hard to be precise.
3. Show students the "What We Know about Measuring Time" list from Lesson 1. Ask students whether the list includes ways to keep track of time without depending only on the sun or moon. Encourage them to brainstorm new ideas to add to the list.
4. Explain to students that because people had problems keeping time with the sun and moon, they began to make different types of clocks. One type—sinking water clocks—used objects sinking in water to keep track of the passage of time.
5. Ask students to discuss with their partners their ideas about how to use water to keep track of time. Have them sketch a few possible designs in their notebooks and write explanations for their sketches.
6. Now ask students to use a piece of aluminum foil and the small stainless steel washers to construct a sinking water clock. Challenge them to try to find a way to make a clock that will sink in 15 seconds. Have students use the clock on the wall to compare how long it takes their water clocks to sink. Encourage a variety of designs.

Components of Productive Experiments

Any experiment is successful if the researcher learns something in the process. Sometimes the researcher learns that a particular variable has no effect on the phenomenon being investigated, and this is a useful result. On the other hand, the researcher may learn that the variables he or she thought were unimportant are significant. The following list highlights some of the components of experiments that are likely to produce useful information. Students will practice and learn many of these components as they plan and conduct experiments in Lessons 8 through 12.

- The researcher develops a good plan and follows it.
- The researcher gathers information on the topic either through reading or talking with experts.
- The researcher manipulates only one variable at a time.
- The researcher makes careful observations over a period of time.
- The researcher increases confidence in the results by doing each experimental trial a number of times and averaging the results.
- The researcher refines the experiment by making changes in the apparatus, the procedures, or the way data is collected. Then, the researcher repeats the whole experiment.
- The researcher keeps records—accurately, honestly, and regularly.
- The researcher communicates the findings of the experiment to others.

Materials

For each student

- 1 science notebook
- 1 copy of **Record Sheet 8-B: Outlining the Team's Experiment**

For every two students

- 1 copy of **Record Sheet 8-A: Experiment Planning Sheet**
- 1 plastic tank, 4 liters (1 gal)
- 1 large funnel
- 1 bead-tube (yellow), 4-mm hole
- 3 small stainless steel washers, 9 mm ($\frac{3}{4}$ ") diameter

For the class

- 1 clock with a sweep second hand
- 1 class list of variables (from Lesson 7)
- 3 buckets with handles, 4 liters (1 gal)
- 5 sets of two funnels (1 small and 1 medium)
- 5 sets of bead-tubes (2-mm hole, 3-mm hole, and no hole)
- 15 small stainless steel washers, 9 mm ($\frac{3}{4}$ ") diameter
- Several sponges
- Several sheets of newsprint and a marker

Preparation

1. Duplicate one copy of **Record Sheet 8-A: Experiment Planning Sheet** for every two students and one copy of **Record Sheet 8-B: Outlining the Team's Experiment** for each student.

defining the scale, or writing titles. In Lessons 11 and 12, students will be asked to provide some of this information themselves.

Students who have had more experience constructing graphs should be encouraged to determine what type of graph best represents their data. If available, computer spread sheets and graphing packages could be used.

Materials

For each student

- 1 science notebook
- 1 completed copy of **Record Sheet 8-B: Outlining the Team's Experiment** (from Lesson 8)
- 1 copy of **Record Sheet 9-A: Graphing Sinking Water Clocks**

For every two students

- 1 completed copy of **Record Sheet 8-A: Experiment Planning Sheet** (from Lesson 8)
- 1 plastic tank, 4 liters (1 gal)
- 1 large funnel
- 1 bead-tube (yellow), 4-mm hole
- 3 small stainless steel washers, 9 mm ($\frac{3}{4}$ ") diameter

For the class

- 1 clock with a sweep second hand
 - 3 buckets with handles, 4 liters (1 gal)
- Several sponges

For groups varying the hole size

- 1 bead-tube (green), 2-mm hole
- 1 bead-tube (orange), 3-mm hole
- 1 bead-tube, no bead

For groups varying the weight of the container

- 3 additional small stainless steel washers, 9 mm ($\frac{3}{4}$ ") diameter

For groups varying the size of the container

- 1 small funnel
- 1 medium funnel

Preparation

1. Examine each group's experimental plan outline from Lesson 8. Arrange the materials so that each group has materials that match its plan.
2. Duplicate one copy of **Record Sheet 9-A: Graphing Sinking Water Clocks** for each student.

Procedure

1. Review with students the information they will be collecting as they conduct their experiments. First, ask them to read over the experimental outlines and planning sheets that they completed in Lesson 8. You may want to have students exchange and discuss their plans with another pair of students because review by a "third party" often is helpful in determining whether or not the plan makes sense.

Section II: Investigating Invented Clocks

LESSON 7

Using Water to Measure Time

Think and Wonder

You have used the cycles of the sun and the moon to measure the passage of time. But how could people tell time when it was cloudy? Today you will begin a series of activities about clocks that do not depend on natural cycles. The first is a water clock. What are some ways that you could use water to measure time?

Materials

For you

- 1 piece of aluminum foil, 10 cm (4") square

For you and your partner

- 1 plastic tank, 4 liters (1 gal)
- 3 small stainless steel washers, 9 mm ($\frac{3}{4}$ " diameter)

Find Out for Yourself

1. What do you think are some of the problems with using the sun and moon to keep track of time? Discuss your ideas with the class.
2. Look at the brainstorming list from Lesson 1. Does the list include ways to keep track of time without depending only on the sun or moon? What are some new ideas you can think of to add to the list?
3. With a partner, discuss your ideas about how to use water to keep track of time. Draw sketches of your ideas in your notebook and write explanations for your sketches.
4. Use a piece of aluminum foil and a washer to create a sinking water clock. Try to find a way to make a clock that will sink in 15 seconds. Measure how long it takes your water clock to sink by comparing it with the clock on the wall.
5. Take turns with your partner testing your sinking clocks. Talk with your partner about what you are trying to accomplish.
6. After you have completed testing your sinking water clock, return your materials and dry off your work area.

Planning an Experiment with Sinking Water Clocks

Think and Wonder

A water clock can be used to measure the passage of time. How does changing one of the **variables** affect the sinking time of the clock? Today you will plan an experiment to investigate a sinking water clock.

Materials

For you

- 1 science notebook
- 1 copy of **Record Sheet 8-B: Outlining the Team's Experiment**

For you and your partner

- 1 copy of **Record Sheet 8-A: Experiment Planning Sheet**
- 1 plastic tank, 4 liters (1 gal)
- 1 large funnel
- 1 bead-tube (yellow), 4-mm hole
- 3 small stainless steel washers, 9 mm ($\frac{3}{4}$ ") diameter

Find Out for Yourself

1. Choose three of the sinking water clock variables from the class list. Predict in your notebook how changing each of the variables separately will affect the sinking time. Include the reasons for your predictions.
2. With your partner, assemble the new sinking water clock by attaching the bead-tube and washers to the funnel.
3. Measure how long it takes the sinking clock to sink with three washers attached. Conduct several trials to see whether the sinking time is consistent.
4. Return the materials to the storage area.
5. With the class, devise a sample data table for recording and organizing information.
6. To show other groups the information you have collected, graph your data on the class line plot.

Experimenting with Sinking Water Clocks

Think and Wonder

What happens to the sinking time of the water clock when you change one of the variables? To find out, you will conduct the experiment you planned in Lesson 8.

Materials

For you

- 1 science notebook
- 1 completed copy of **Record Sheet 8-B: Outlining the Team's Experiment** (from Lesson 8)
- 1 copy of **Record Sheet 9-A: Graphing Sinking Water Clocks**

For you and your partner

- 1 copy of the **Record Sheet 8-A: Experiment Planning Sheet** (from Lesson 8)
- 1 plastic tank, 4 liters (1 gal)
- 1 large funnel
- 1 bead-tube (yellow), 4-mm hole
- 3 small stainless steel washers, 9 mm ($\frac{3}{4}$ ") diameter

For groups varying the hole size

- 1 bead-tube (green), 2-mm hole
- 1 bead-tube (orange), 3-mm hole
- 1 bead-tube, no hole

For groups varying the weight of the container

- 3 additional small stainless steel washers, 9 mm ($\frac{3}{4}$ ") diameter

For groups varying the size of the container

- 1 small funnel
- 1 medium funnel