Changes in Materials for *Motion and Design*

The STC Program™

Since publication of the *Motion and Design* Teacher's Guide and Student Investigation book, metal eyelets have replaced the brass eyelets used to assemble the propeller units. This change in materials affects Lessons 11, 17, and Additional Assessment 2 of the *Motion and Design* unit and requires minor revisions to the instructions in the unit's printed materials.

This errata set includes the following:

- For the *Motion and Design* Teacher's Guide Second Edition, Section 3: Materials Management and Safety—revised page 5
- For the *Motion and Design* Teacher's Guide Second Edition, Section 4: Unit Investigations and Blackline Masters—revised pages 102–105, and 153
- For the *Motion and Design* Teacher's Guide Second Edition, Section 5: Student Assessment, Additional Assessment 2—revised page 21

- For the *Motion and Design* Student Investigation book—revised page 48

Photocopy and distribute these replacement pages as needed.

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*.

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Materials List

This Materials List chart is a cross-reference guide for the materials supplied in the *Motion and Design* unit kit (Item Number 97-3001). It gives the description of each item as it is listed in the lessons of the Teacher's Guide, and provides the cross-reference description of the item as it appears on the kit's packing list, which you will find in the *Motion and Design* unit kit box(es). Please note that the metric and English equivalent measurements in this unit are approximate. For additional information about the materials in this unit kit, please contact Carolina at 800-227-1150 or www.carolina.com.

Item Description in Teacher's Guide	Item Description on Packing List	Lesson Number (Quantity Used)
Adding machine tape, at least 80 m (262½ ft)	Adding machine paper roll	7 (40 m), 10 (40 m)
Black permanent marker	Fine-point black permanent marker	1 (1), 2 (1), 14 (1)
Blocks of wood, 5 × 8 × 9 cm (2 × 3 × 3½ in)	Pack of 20 blocks of wood	4 (20), 5 (20), 15 (5)
Box of jumbo paper clips	Box of 100 jumbo paper clips	3 (20), 4 (20 + box), 5 (box), 15 (box), 17 (box), Assessment 2 (box)
Buckets and lids	1-gal plastic pail Lid for 1-gal plastic pail	1 (11), 2 (11), 5 (10), 9 (10), 10 (10), 11 (11), 12 (10), 13 (10), 15 (11), 16 (11), 17 (11), Assessment 2 (11)
Circle templates	Pack of 10 circle templates	2 (10), 5 (10), 9 (10), 14 (6), 16 (10), 17 (10), Assesment 2 (10)
Eyelets	Pack of 25 metal eyelets	11 (20), 15 (8), 17 (22), Assessment 2 (22)
Large metal washers	Pack of 30 large metal washers	3 (10), 5 (30), 15 (pack), 17 (pack), Assessment 2 (pack)
Large rubber bands, No. 64	Pack of 40 #64 rubber bands	11 (30), 12 (9), 15 (12), 17 (pack), Assessment 2 (pack)
Measuring tapes, 100 cm (39 in)	Pack of 10 metric measuring tapes	1 (10), 3 (1), 4 (1), 5 (1), 15 (6), 17 (10), Assesment 2 (6)
Pieces of cardboard, 21.5 × 28 cm (8½ × 11 in)	Pack of 10 8½×11in sheets of fine cardboard	3 (10), 4 (10), 5 (10), 9 (10), 15 (5), 17 (10)
Screw hooks, 0.3 cm (⅛ in) diameter	Pack of 11 screw hooks	11 (10), 15 (4), 17 (11), Assessment 2 (11)
	Pack of assorted dots	
Self-stick blue dots	60 ¾in blue dots	7 (30), 10 (30)
Self-stick green dots	30 ¾in green dots	7 (30)
Self-stick red dots	60 ¾in red dots	7 (30), 10 (30)
Sets of colored pencils	Set of colored pencils	2 (10), 4 (10), 5 (10), 9 (10), 14 (6), 16 (10), 17 (10), Assessment 2 (10)
Sheets of three-hole, 10 mm (¼ in) graph paper with light blue lines, 21.5 × 28 cm (8½ × 11 in)	Pack of 300 three-hole graph sheets	1 (300)
Small bookends with nonslip base, 13h × 12w × 13d cm (5h × 4¾w × 5d in), about 141 g (5 oz)	Small bookend with nonslip base	3 (10), 4 (10), 5 (10)
Small metal washers	Pack of 220 No. 10 steel washers	3 (160), 4 (160), 5 (160), 15 (pack), 17 (pack), Assessment 2 (pack)
Small plastic cups, 30 mL (1 oz)	Pack of 10 1-oz plastic cups	3 (10)

Figure 11-1

Looking at a propeller

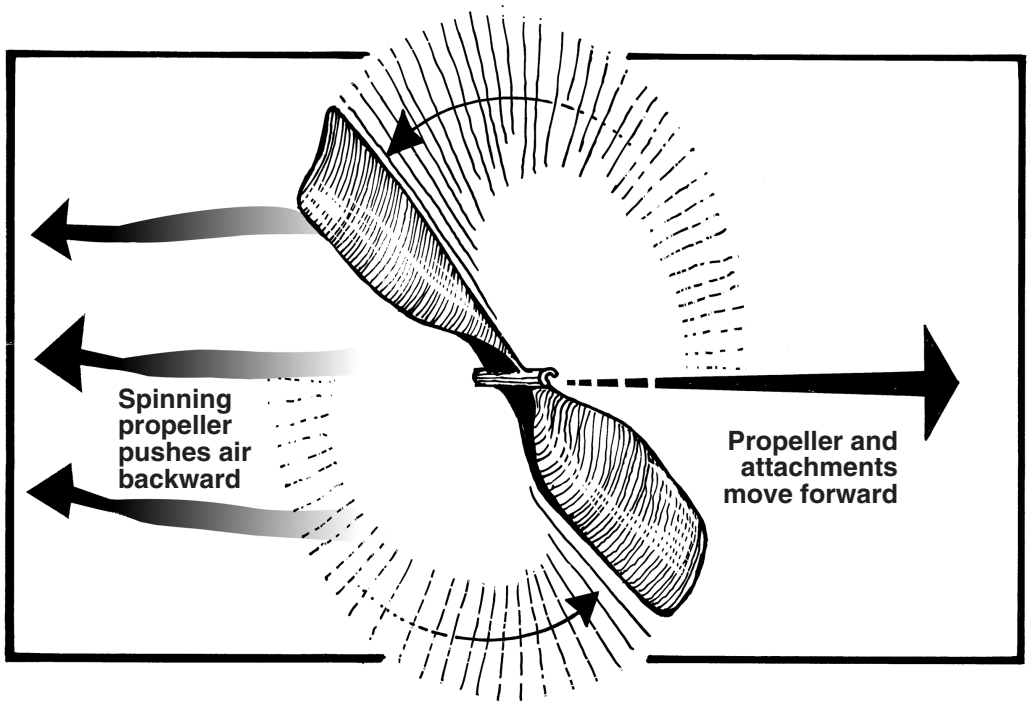
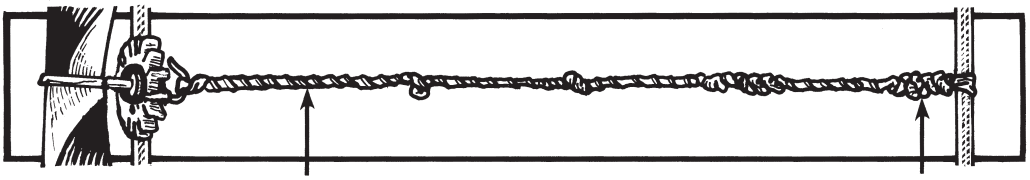


Figure 11-2

Storing energy in a rubber band



the vehicle might move with a burst of speed. This is because the rubber band is at its maximum tension. When first released, the rubber band produces the greatest force and therefore the highest propeller speed.

Propellers must be strong enough to withstand high speeds and great force. Airplane designers must carefully match the size, shape, and number of blades with the aircraft and its engine to ensure top performance and safety. As each group observes its propeller-driven vehicle in this lesson, encourage them to look at how they mounted the propeller on the vehicle and to discuss why it is positioned in this way. For example, students may notice that the propeller is mounted high so the blades can turn freely without hitting the table below. Initial observations like these will help students prepare for Lesson 12, in which they evaluate specific design features of the propeller-driven vehicle and compare the vehicle's design with that of the axle-driven vehicle.

Materials

For each student

1 science notebook
Safety goggles

For each group of three students

1 propeller unit (includes propeller, screw hook, eyelets, and white connector)
1 bucket of building pieces
3 No. 64 rubber bands, connected

For the class

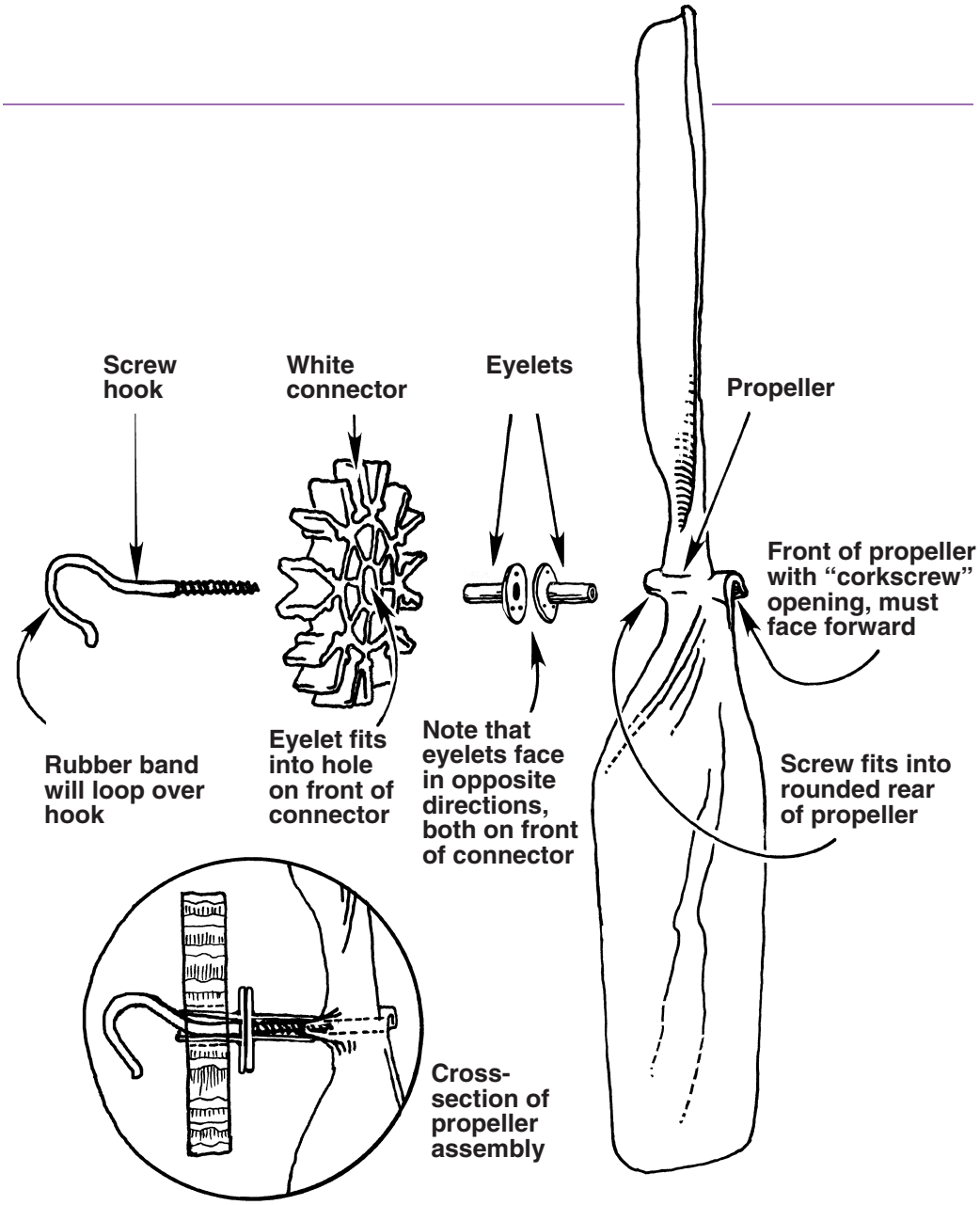
Materials for teacher to assemble propeller units:
10 propellers
10 hooks
20 eyelets
10 white connectors (from students' buckets or class bucket)
Bucket of extra building pieces
1 sheet of newsprint
Assorted colored markers
Masking tape
Trade books, photographs, or illustrations showing propeller-driven vehicles

Preparation

1. If you have not already done so, assemble one propeller unit for each group. Use Figure 11-3 as a guide. For each propeller unit you will need one propeller, two eyelets, one white connector, and one hook. Students will attach the three connected rubber bands to the propeller unit's hook after they build their vehicles. Note that the flared ends of the two eyelets are on the same side of the white connector. These ends rub together as the propeller spins. Make sure that the hook faces the concave (dished in) side of the propeller blades. The hub (center of the propeller) is rounded on one end and has a tiny corkscrew on the other. The hook goes into the rounded end. Turn the hook clockwise about six turns in the propeller hub. When the hook becomes very difficult to turn, it is seated. The plastic around the hook will lighten in color. Check to be sure the plastic shaft, or opening on the propeller into which the hook attaches, has not split.
2. Using the class bucket of building pieces and the technical drawing from Lesson 2 (Figure 2-2), build a standard vehicle that you will use in the **Final Activities.** Attach a connected rubber band to the axle.
3. To familiarize yourself with the building process students will engage in during this lesson, assemble a propeller-driven vehicle using the technical drawing in Figure 11-4.
4. Label the sheet of newsprint "Design Ideas for Propeller-Driven Vehicles." Date and hang the sheet.
5. Collect and display trade books, photographs, or illustrations that show propeller-driven vehicles.
6. Connect three large rubber bands. Each group needs one set of connected rubber bands.
7. Arrange the rubber bands, safety goggles, buckets of building pieces, and propeller units at the distribution center. Using an index card, label the propeller units "Take one."

Figure 11-3

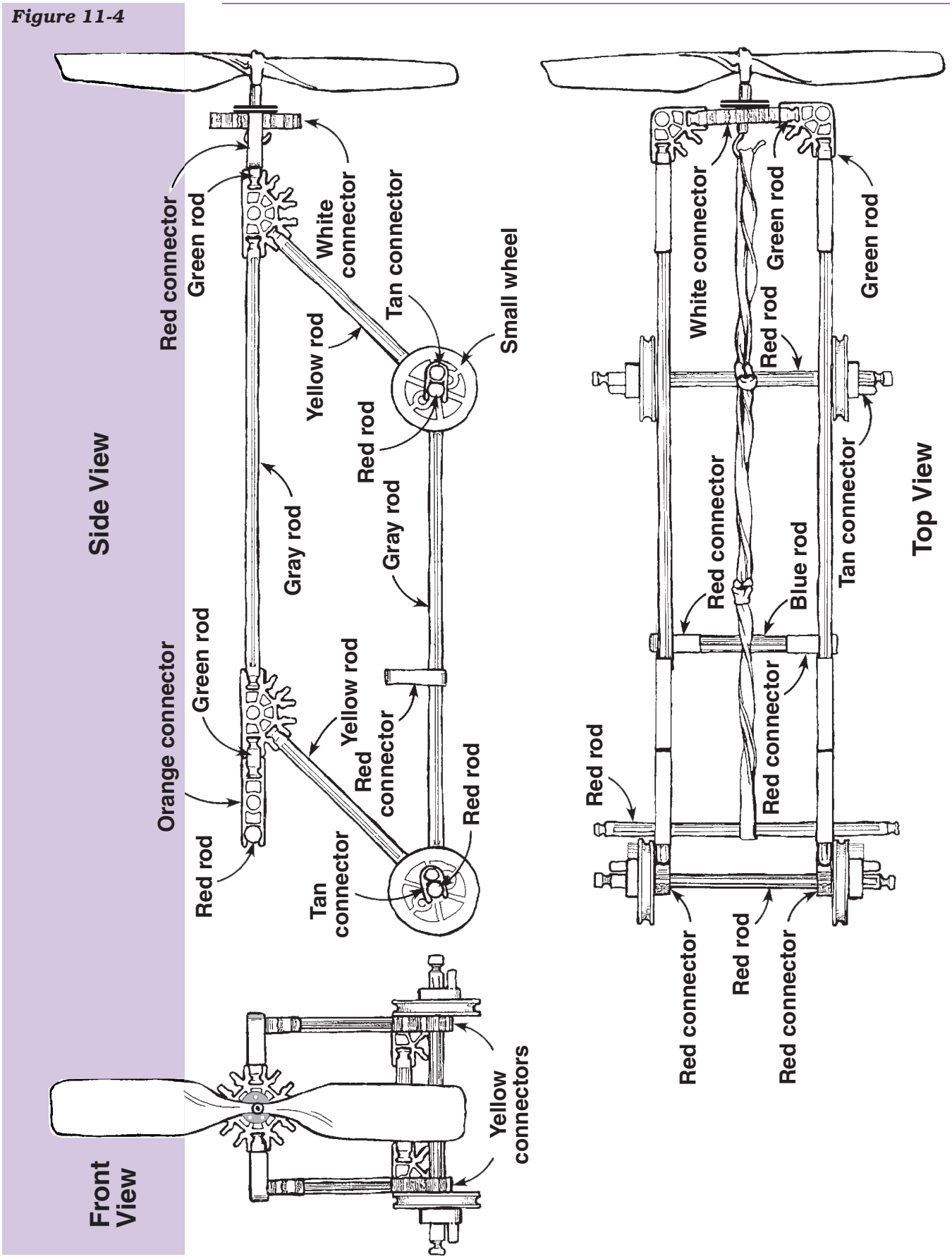
Preparing the propellers



Procedure

1. Involve students in a brainstorming session in which they describe what they know about propeller-driven vehicles. Let students know that they will use a technical drawing to build a propeller-driven vehicle in this lesson. They will analyze its design features in Lesson 12.
2. Focus students' attention on one of the assembled propeller units. Point out the white connector and how the connected rubber bands attach to the propeller hook. Ask students to think about how the white connector could be used to attach the propeller to the vehicle and where on the vehicle the rubber band could be connected.
3. Ask students to think about vehicle design features that might be necessary to move their vehicles with a propeller. Encourage them to share their ideas. For example, students might say the propeller must be high in the air so it will not hit the ground as it spins. Others might suggest that the propeller must be in the front or that the rubber band must be taut and connected straight across from the propeller. List their design ideas on the sheet of newsprint titled "Design Ideas for Propeller-Driven Vehicles."

Figure 11-4


Side View
Red connector
Green rod
White connector
Tan connector
Small wheel
Yellow rod
Red rod
Gray rod
Gray rod
Orange connector
Green rod
Yellow rod
Red connector
Red rod
Red rod
Tan connector
Front View
Yellow connectors
Top View
White connector
Green rod
Red rod
Green rod
Red connector
Blue rod
Tan connector
Red rod
Red connector
Red connector
Red rod
Red connector

LESSON 17

Post-Unit Assessment

Overview

This post-unit assessment is matched to the pre-unit assessment in Lesson 1. By comparing individual and class responses to activities in this assessment with those from Lesson 1, you can document each student's learning over the course of the unit. In Lesson 1, students developed two lists: "What We Know about the Motion and Design of Vehicles" and "What We Want to Find Out about Motion and Design." They also designed, built, and tested their own vehicle on the basis of a set of requirements. As students revisit the class brainstorming lists and the records of the vehicle they made in Lesson 1 and compare them with those in this activity, they might realize how much they have learned about technological design and the relationships between force and motion.

Materials

For each student

- 1 science notebook (with entries from Lesson 1 and drawing from Lesson 2)
- 1 pencil with eraser
- Safety goggles

For each group of three students

- 1 bucket of building pieces (see blackline master **Building Pieces for Each Group** from Lesson 1)

For the class

- 2 class brainstorming lists, "What We Know about the Motion and Design of Vehicles" and "What We Want to Find Out about Motion and Design" (from Lesson 1)
- 1 sheet of newsprint
- 1 spool of light string
- Cardboard sails, 23 × 30 cm (9 × 12 in)
- Small rubber bands, No. 16
- Large rubber bands, No. 64
- Propeller units (includes propeller, screw hook, eyelets, and white connector)
- Strips of Masonite™, 38 × 122 × 0.6 cm (15 × 48 × ¼ in), or foamboard, 38 × 122 × 0.5 cm (15 × 48 × 3⁄16 in) (optional)
- Colored pencils
- Circle templates

Materials

For each student

1 science notebook (with graph paper)
1 pencil with eraser

For each team of six

2 buckets of building pieces
1 measuring tape, 100 cm (39 in)

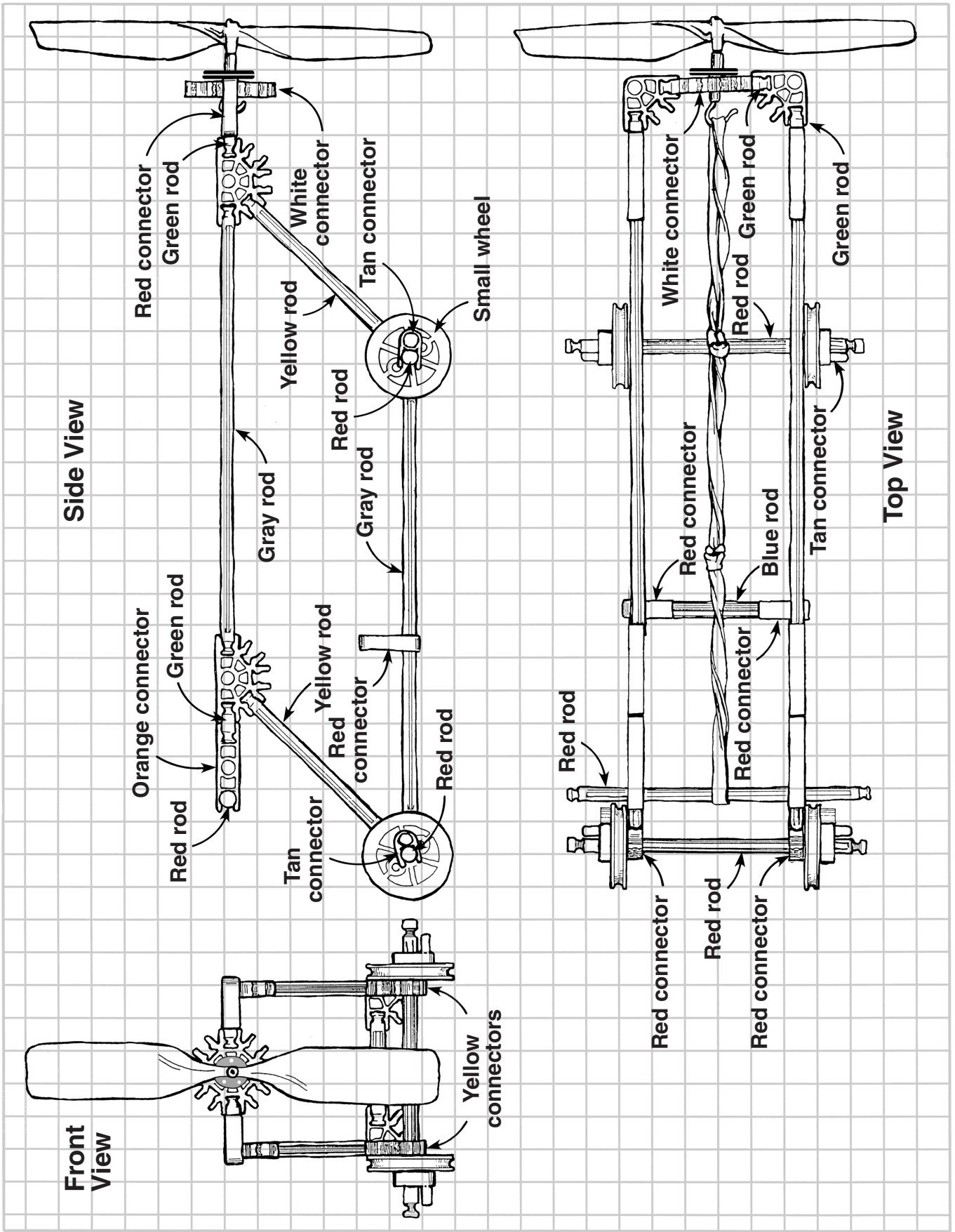
For the class

1 copy of **Building Pieces for Each Group** (blackline master, Lesson 1)
1 spool of light string
1 box of jumbo paper clips
Large washers
Small washers
Small rubber bands, No. 16
Large rubber bands, No. 64
Propeller units (includes propeller, screw hook, eyelets, and connector)
Strips of Masonite™, 38 × 122 × 0.6 cm (15 × 48 × ¼ in), or foamboard, 38 × 122 × 0.5 cm (15 × 48 × 3⁄16 in) (optional)
Scissors
Masking tape
Circle templates
Metric rulers
Colored pencils
Assorted colored markers
Index cards

Preparation

1. Decide how you will divide the class into teams of two or three students.
2. You will need one "race station" for every *two* teams of students. Because there are three kinds of race stations (falling weight, rubber band, and propeller), you will probably need to set up duplicate stations. Each falling-weight race station requires an elevated work space—either a long table or a foamboard runway placed over two desks. The rubber band and propeller race stations can use a large floor area.
3. Arrange the following materials at the race stations:
   - Falling-weight race station—small and large metal washers, string, paper clips, scissors, and two buckets of building pieces.
   - Rubber band axle-driven race station—at least six small rubber bands (connected in sets of three) and two buckets of building pieces.
   - Propeller race station—two propeller units, at least six large rubber bands (connected in sets of three), and two buckets of building pieces.
4. Use a marker and index cards or other heavy paper to make a sign for each race station.
5. Set out the rolls of masking tape in a designated area. Groups will use the tape to make start and finish lines.

Figure 11-1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Red rod
Tan connector
Front View
Yellow connectors
Top View
White connector
Green rod
Green rod
Red rod
Red connector
Blue rod
Tan connector
Red connector
Red rod
Red connector
Red connector