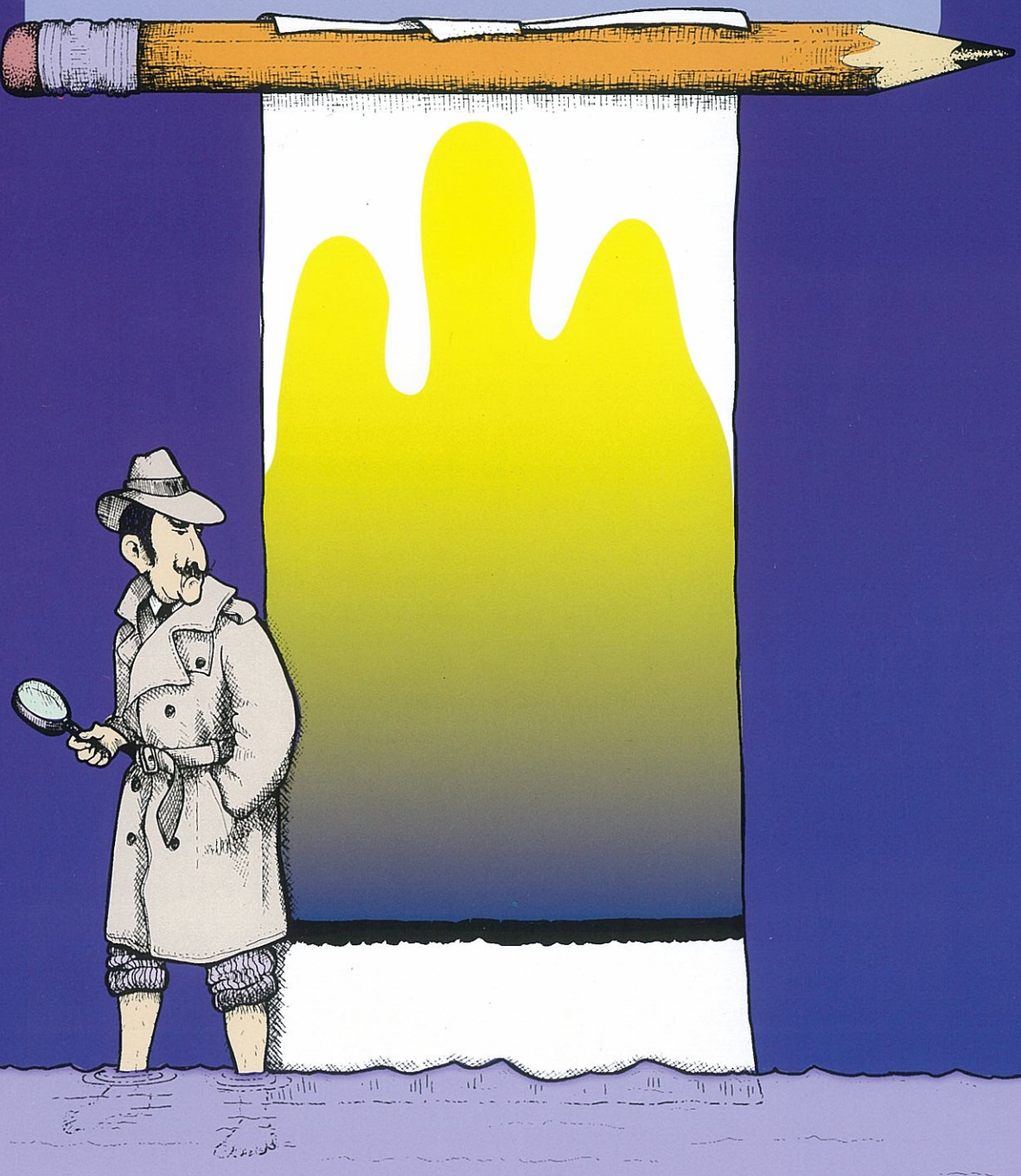
Lawrence Hall of Science • University of California at Berkeley

NEW GEMS™

Crime Lab Chemistry

Solving Mysteries with Chromatography

GEMS® Teacher's Guide for Grades 4–8



What You Need for the Whole Unit

The quantities below are based on a class size of 32 students. You may, of course, require different amounts for smaller or larger classes. This list gives you a concise "shopping list" for the entire unit. Please refer to the "What You Need" and "Getting Ready" sections for each individual activity, which contain more specific information about the materials needed for the class and for each team of students.

Options for gathering your classroom materials for this unit:

- Some teachers prefer to gather materials needed to teach a GEMS unit themselves at local stores.

- Others prefer to purchase a ready-made GEMS Kit®.

The items marked with an asterisk in the list below are included in the commercial GEMS Kit for this unit as of the time of publication. Check with the kit supplier to confirm what materials are included. Please see the inside front cover for more information on purchasing GEMS Kits.
(* provided in the GEMS Kit)

Nonconsumables

* ❑ 9 or more different black felt-tip pens (see "Getting Ready" #5 on page 10)
* ❑ 1 copy of the **Teacher Script** (pages 21–22 or 24–25, depending on which mystery scenario you choose; see "Getting Ready" #1 on page 9)
* ❑ 1 copy of the **Suspect Statements** (page 23 or 26, depending on which mystery scenario you choose)
* ❑ 6–8 water troughs (plastic wallpaper-paste troughs)
❑ about 5 small rocks, any kind, from about 1"–3"
❑ about 5 styrofoam balls, about 2" in diameter
❑ about 5 styrofoam packing "peanuts" (or other lightweight items)
❑ a large fan or blow dryer
* ❑ about 25 wide-mouthed cups
❑ several pennies for crushing plant pigments onto paper strips
❑ 1 overhead transparency of each of the following:
* __ **Different Water Molecule Models** (page 27)
* __ **Model A** (page 38)
* __ **Model B** (page 39)
* __ **Model C** (page 40)
* __ **Model D** (page 41)
* __ the **Four Models** student sheet (pages 42–43)
* ❑ 1 copy each of the **Candy Coating** (page 58), **Food Coloring** (page 59), and **Plants** (page 60) **Test Substance Procedure** sheets

* ❑ *(optional)* 8–16 magnifying lenses
❑ *(optional)* an extension cord for the fan or blow dryer

Consumables

❑ water
❑ 100 *white,* institutional paper towels* (or large round white coffee filters or white household paper towels)—for Activity 1, Session 1
* ❑ about 200 4" strips of chromatography paper* (or white coffee filters cut into 1" x 4" strips)—for Activity 3
* ❑ white coffee filters
❑ different brands of white paper towel
* ❑ white cotton cloth
* ❑ white construction paper
❑ toilet paper or tissues
❑ white notebook paper
❑ at least 12 brown and green M&M's®, Reese's Pieces®, or other candies with colored coatings
* ❑ a 1 oz. squeeze** bottle of green food coloring
* ❑ a 1 oz. squeeze** bottle of red food coloring (for mixing with green to make brown)
❑ a few different vegetable leaves such as red cabbage, spinach, beet greens, or other dark green leafy vegetables
❑ a few freshly picked deep green or red leaves from trees
❑ a few freshly picked flower petals that are a deep reddish brown
❑ newspaper or plastic trash bags to cover the surface of the Test Substances station
* ❑ 1 tablespoon of baking soda
* ❑ 1 tablespoon of salt
* ❑ 1 quart or liter bottle of white vinegar
* ❑ 1 quart or liter bottle of rubbing alcohol
❑ 32 copies of the **Four Models** student sheet (pages 42–43)
❑ 32 copies of the **New Microscope Eyes Model of Chromatography** student sheet (page 44)
❑ 16 copies of the **Our Chromatography Test** sheet (page 61)
❑ 32 copies of the **Chromatography Test Report** sheet (page 62)
❑ *(optional)* chromatography paper*—for Activity 1, Session 1
❑ *(optional)* other colors of M&M's or Reese's Pieces
❑ *(optional)* additional colors of food coloring
❑ *(optional)* clear plastic wrap to cover the rubbing alcohol cups

*In Activity 1, the use of chromatography paper is optional. Chromatography paper is specifically designed for paper chromatography. It presents the col-

ors more vividly than paper towels or coffee filters, but is not necessary for Activity 1. In fact, many teachers think white paper towels or coffee filters are preferable for use with the pens in the first activity, because the process happens faster than with chromatography paper and the colors are clear enough.

However, for Activity 3 we recommend using chromatography paper, if possible, because it provides a much better separation, is more effective, and easier to interpret. Some of the subtle colors of candy coatings and plant pigments are difficult to notice without using it. Chromatography paper can be purchased from many scientific supply stores, including Carolina Biological Supply, the distributor of GEMS Kits. For more on obtaining chromatography paper, see page 85.

**If squeeze bottles of food coloring are not available, you can pour a very small amount into a cup and add a medicine dropper or a toothpick for students to use to apply the food coloring to the paper strip.

General Supplies

* ❑ 2 or more different brands of brown water-based felt-tip pens
* ❑ a variety of other colors of water-based felt-tip pens, especially green or purple
  ❑ 6 sharpened pencils for labeling paper towel strips at pen stations
* ❑ 32 pencils (or drinking straws) long enough to set across the water trough
  ❑ 32 pencils
  ❑ several sheets of white scratch paper (onto which chromatograms will be taped)
  ❑ 32 pieces of unlined paper for students to draw on (in Activity 1, Session 2)
  ❑ about 5 wadded up individual sheets of 8 $\frac{1}{2}$" x 11" paper
  ❑ a few Post-it® Notes or scratch paper to label the vegetables and other plant samples at the Test Substances station
  ❑ 1 ruler
  ❑ several pairs of scissors
* ❑ masking tape
  ❑ an overhead projector
  ❑ *(optional)* 32 blank sheets of 8 $\frac{1}{2}$" x 11" paper (for the "Questions" sheet used at end of Activity 2)
  ❑ *(optional)* a few different colored permanent pens