

Exploring

The

BUILDING BLOCKS

of

SCIENCE

Book 6

TEACHER'S MANUAL



REBECCA W. KELLER, PhD



Materials at a Glance

Experiment 1	Experiment 2	Experiment 3	Experiment 4	Experiment 5
<p>an old digital camera, cell phone, radio, computer, or other small electronic device that is no longer needed</p> <p>small tools such as screwdriver, tweezers, pick</p> <p>rubber gloves, 1-2 pairs</p> <p>library or internet resources</p> <p>chemical glass etching kit</p> <p>glass items for etching (if needed, may be obtained at a thrift store)</p> <p>Optional</p> <p>safety goggles</p>	<p>10 ml glass graduated cylinder</p> <p>glass eyedropper</p> <p>60 ml (1/4 cup) water</p> <p>60 ml (1/4 cup) rubbing alcohol</p> <p>60 ml (1/4 cup) vegetable oil</p> <p>waterproofing substance, such as car wax, floor wax, silicone spray, or Scotch-Gard (small amount)</p> <p>additional water and vegetable oil (small amount)</p> <p>Optional</p> <p>disposable glass tube</p> <p>Goo Gone or similar cleaner</p>	<p>red cabbage, 1 head</p> <p>distilled water, about 1 liter (1 quart)</p> <p>various solutions, such as:</p> <p>ammonia</p> <p>vinegar</p> <p>clear soda pop</p> <p>milk</p> <p>mineral water</p> <p>large saucepan</p> <p>knife</p> <p>several small jars</p> <p>white coffee filters</p> <p>eyedropper</p> <p>measuring cup</p> <p>measuring spoons</p> <p>marking pen</p> <p>scissors</p> <p>ruler</p> <p>See experiment for list of suggested natural materials for <i>Just For Fun</i> section</p>	<p>red cabbage indicator (from Experiment 3)</p> <p>household ammonia</p> <p>vinegar</p> <p>large glass jar</p> <p>measuring spoons</p> <p>measuring cup</p> <p>household solutions chosen by students (to test for acidity and basicity)</p>	<p>tincture of iodine</p> <p>a variety of raw foods, including:</p> <p>pasta</p> <p>bread</p> <p>celery</p> <p>potato</p> <p>banana (ripe)</p> <p>other fruits</p> <p>1 unripe (green) banana</p> <p>liquid laundry starch (or equal parts borax and corn starch mixed in water)</p> <p>absorbent white paper</p> <p>eye dropper</p> <p>cookie sheet</p> <p>marking pen</p> <p>knife</p>

Experiment 6	Experiment 7	Experiment 8	Experiment 9	Experiment 10
<p>plastic petri dishes*</p> <p>dehydrated agar powder*</p> <p>distilled water</p> <p>K-12 safe <i>E. coli</i> bacterial culture*</p> <p>inoculation loop*</p> <p>candle or gas flame</p> <p>cooking pot</p> <p>mixing spoon</p> <p>oven mitt or pot holder</p> <p>measuring spoons</p> <p>measuring cup</p> <p>black permanent marker</p> <p>red marker</p> <p>rubber gloves, 2 pairs</p> <p>* (See experiment for product sources.)</p>	<p>microscope with 4X, 10X, 40X objective lenses. A 100X objective lens is recommended but not required.*</p> <p>glass microscope slides*</p> <p>glass microscope cover slips*</p> <p>immersion oil (if using 100X objective lens)*</p> <p>Samples:</p> <p>piece of paper with lettering</p> <p>strands of hair</p> <p>droplet of blood</p> <p>insect wing</p> <p>* (See experiment for information about how to choose a microscope and for supply sources.)</p>	<p>microscope with a 10X objective*</p> <p>microscope depression slides*</p> <p>10 or more eyedroppers</p> <p>fresh pond water or water mixed with soil (small amount)</p> <p>protozoa study kit *</p> <p>methyl cellulose*</p> <p>measuring cup and measuring spoons</p> <p>baker's yeast</p> <p>distilled water</p> <p>Eosin Y stain*</p> <p>*(See experiment for product sources.)</p>	<p>dehydrated agar powder*</p> <p>distilled water</p> <p>cooking pot</p> <p>measuring spoons</p> <p>measuring cup</p> <p>plastic petri dishes*</p> <p>permanent marker</p> <p>oven mitt or pot holder</p> <p>jar with lid (big enough to hold 235 ml (about 1 cup) liquid)</p> <p>1 slice of bread, preferably preservative free</p> <p>small clear plastic bag</p> <p>white vinegar</p> <p>bleach</p> <p>borax</p> <p>mold or mildew cleaner</p> <p>1-2 pairs rubber gloves</p> <p>*(See experiment for product sources.)</p>	<p>One electronic circuit kit (see Experiment 10 for recommendations)</p>
				<p>Experiment 11</p> <p>several glass marbles of different sizes</p> <p>several steel marbles of different sizes</p> <p>cardboard tube, .7-1 meter [2.5-3 ft] long</p> <p>scissors</p> <p>black marking pen</p> <p>ruler</p> <p>letter scale or other small scale or balance</p>

Experiment 12	Experiment 13	Experiment 14	Experiment 15	Experiment 16
<p>stopwatch compass an open space large enough to run (park, schoolyard, playground, backyard, etc.) 5 markers of students' choice to mark distances blank paper a group of friends</p>	<p>pencil or pen marking pen thumbtack or pushpin 3 pieces of string — approximate sizes: 10 cm [4 in.]; 15 cm [6 in.]; 20 cm [8 in.] tape ruler (metric) large piece of white paper (bigger than 30 cm [12 in.] square (can be several pieces of paper taped) firm surface at least as large as the paper and that a thumbtack can be pinned into</p>	<p>pencil, pen, colored pencils compass a small jar or container with a lid small items to place in jar (student selected treasure) garden trowel (optional)</p>	<p>computer with internet access (a program that unzips files may be needed) Optional printer and paper colored pencils</p>	<p>Some suggestions for student chosen model making materials: modeling clay of different colors marble or steel ball ingredients to make various colored cakes materials for making paper mache Styrofoam balls</p>

Experiment 17	Experiment 18	Experiment 20	Experiment 21	Experiment 22
<p>2 liter (2 quart) plastic bottle with cap warm water matches blank paper</p>	<p>two sticks (used for marking locations) two rulers tape string, several meters long (several yards) protractor</p>	<p>8 objects of different sizes to represent the planets ruler (in centimeters) marking pen large flat surface for drawing — 1 x 1 meter (3 x 3 feet), such as a large piece of cardboard or several sheets of construction paper large open space at least 3 meters (10 feet) square push pin piece of string one meter (3 feet) long additional objects of students' choice</p>	<p>pencil colored pencils Optional blank paper, several sheets</p>	<p>computer with internet access materials as needed for project chosen by students blank paper or notebook</p>
	<p>Experiment 19 computer with internet access printer and paper flashlight Optional binoculars or telescope star map app and mobile device</p>			

Materials

Quantities Needed for All Experiments

Equipment	Foods
bottle, plastic, 2 liter (2 quart) with cap compass computer with internet access cookie sheet electronic circuit kit (see Chapter 10 for recommendations) electronic device, old-unneeded: digital camera, cell phone, radio, computer, or other small electronic device flashlight graduated cylinder, glass, 10 ml inoculation loop ¹ knife marbles, glass, several different sizes marbles, steel, several different sizes measuring cup measuring spoons microscope with 4X, 10X, 40X objective lenses. A 100X objective lens is recommended but not required. ² natural materials for <i>Just For Fun</i> section (see Exper. 2) oven mitt or pot holder pot, cooking printer and paper or mobile device protractor ruler (in centimeters) rulers, 2 saucepan, large scale: letter, or other small scale or balance scissors spoon, mixing stopwatch tools, small - such as screwdriver, tweezers, pick Optional binoculars or telescope mobile device safety goggles trowel, garden	baker's yeast banana, 1 unripe (green) bread, 1 slice, preferably preservative free cabbage, red, 1 head foods, raw-including: pasta, bread, celery, potato, banana (ripe), misc. fruits vegetable oil, somewhat more than 60 ml (1/4 cup) vinegar vinegar, white water

¹ See Experiment 6 for supply sources.

² See Experiment 7 for supply sources.

³ See Experiment 8 for supply sources.

Materials

Quantities Needed for All Experiments

Materials	Materials (continued)	Other
agar powder, dehydrated ¹ ammonia, household bag, clear plastic, small bleach blood, 1 droplet borax cleaner, mold or mildew coffee filters, white E. coli bacterial culture, K-12 safe ¹ Eosin Y stain ³ eyedropper, glass, 1-2 dozen glass etching kit, chemical glass items for etching (if needed, may be obtained at a thrift store) gloves, 4-6 pairs, rubber hair, several strands immersion oil (if using 100X objective lens) ² insect wing iodine, tincture of items, misc. small, to place in jar (student selected treasure) jar with lid (big enough to hold 235 ml (about 1 cup liquid)) jar, glass, large jar, small with lid, or small container with lid jars, small, several marker, black permanent marker, red markers, 5 items of students' choice to mark distances matches materials as needed for project chosen by students methyl cellulose ³ microscope cover slips, glass ² microscope slides, glass, depression ³ microscope slides, glass, regular ² objects of students' choice objects, 8 of different sizes to represent the planets paper with lettering, small piece paper, absorbent white	paper, blank paper, blank, or notebook paper, white (bigger than 30 cm [12 in.] square (can be several pieces of paper taped)) pen pen, black marking pen, marking pencil pencils, colored petri dishes, plastic ¹ protozoa study kit ³ pushpin or thumbtack pushpin, 1-2 rubbing alcohol, 60 ml (1/4 cup) solutions, household, chosen by students (to test for acidity and basicity) solutions, various—such as: ammonia, vinegar, clear soda pop, milk, mineral water starch, liquid laundry (or equal parts borax and corn starch mixed in water) sticks, 2 (used for marking locations) string, one meter (3 feet) long string, several meters long (several yards) string, 3 pieces — approximate sizes: 10 cm [4 in.]; 15 cm [6 in.]; 20 cm [8 in.] tape tube, cardboard, .7-1 meter [2.5-3 ft] long water, distilled, 2 liters or more water, fresh pond water or water mixed with soil (small amount) waterproofing substance, such as car wax, floor wax, silicone spray, or Scotch-Gard (small amount) student chosen model making materials, such as: clay, modeling, different colors ball, steel, or marble ingredients for various colored cakes paper mache materials balls, Styrofoam Optional Goo Gone or similar cleaner tube, glass, disposable	computer program that unzips files (may be needed) flame, candle or gas friends, several open space at least 3 meters (10 feet) square open space large enough to run (park, schoolyard, playground, backyard, etc.) resources, library or internet surface, firm, at least 30 cm [12 in.] square that a thumbtack can be pinned into surface, large, flat, for drawing: 1 x 1 meter (3 x 3 feet), such as a large piece of cardboard or several sheets of construction paper Optional star map app (Exper. 19)

¹ See Experiment 6 for supply sources.

² See Experiment 7 for supply sources.

³ See Experiment 8 for supply sources.