Hands-On Experiments

LIFE SCIENCE – Biology

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Introduction

In order to become active learners, students must learn to describe things, pose questions, acquire knowledge, explain phenomena of nature, test explanations in various ways, and communicate thoughts and ideas with others.

In addition to traditional lecture and textbook reading, students need to develop the skills of scientific inquiry if they are to develop true scientific literacy. The activities presented in this book are both 'hands-on' and 'minds-on' in that they are inquiry-oriented.

Scientific inquiry describes the various ways to study the natural world and suggest explanations based on evidence gathered during in inquiry. It includes making observations; asking questions; examining publications to discover what is already known; creating and executing investigations; casting evidence against know information; gathering, analyzing, and interpreting data; suggesting solutions, explanations, and predictions; and communicating results with others. Critical thinking, recognizing assumptions, and considering alternative solutions is also emphasized.

Although not all inquiry-based science activities include every component of inquiry, the goal is to present enough varied experience so that students will be repeatedly exposed to the full experience of inquiry over time.

Standards-based learning should integrate cumulative knowledge within a subject with other academic disciplines. The extension activities in this book are specifically designed to meet this goal by encouraging the teacher to infuse science within other subject areas hereby linking and reinforcing content areas. The activities not only measure students' ability to analyze, solve problems, and synthesize information but also indicate their mastery of knowledge and skills.

To The Teacher

The activities included in *Life Science Biology* have been selected especially for use with elementary and middle grade students. The activities provide teachers and students with interesting, easy-to-do science investigations. The necessary materials are commonly found around the house and in school supply closets or resource centers. Because the materials are readily available, the activities can be conducted at home. A caution statement, suggesting adult supervision, is included on all activity sheets that require lighting a match, working near a hot plate, using dry cell batteries, etc. Health and Safety lessons, which discuss proper use of the materials, can be integrated when presenting these science demonstrations in the classroom. A form letter is provided which may be reproduced and sent home to inform parents of the science activities and encourage their participation when activities are assigned for homework.

When these activities are presented to lower elementary students at the preconceptual or awareness level, the emphasis is on the sensory-motor, observation, and communication skills. In the upper elementary and lower intermediate grades (after the students have developed readiness for a particular concept through awareness level activities), a formal classroom lesson that involves using comparison and organization skills may be presented. Upper intermediate and middle school students can be involved in the activities at the mastery and reinforcement level. This level requires them to relate the concept to new or untested experiences, hypothesize, test variables, and use other high level thinking skills.

Suggestions for Using Materials

- The activity book can be placed in the school library and made available for students to use at home.
- The materials can be placed in the Media Center and used by teachers as a resource prior to presenting activities in the classroom.
- Assign to a cooperative learning group for sharing with the rest of the class.
- Students can use some of the suggested extension activities for Science Fair projects.
- The letter to parents may be attached to selected activities and sent home. Encourage students to involve parents in setting up and conducting the experiments.

Although many of the concepts can be keyed to grade level objectives, the *Hands-On Experiments* series has been developed to be used as a supplement to the basic grade level program. It is designed to give students opportunities to perform meaningful science investigations that focus on concepts that are applicable to everyday life situations.

Create A Science Tool Box

Creating a well-equipped science tool box will make the classroom management of science experiments more efficient because many of the experiments use the same materials and equipment.

If possible, use a hinge-lid 'banker's box' or a box with a removable lid such as a copy paper box.

You Will Need:

- *Containers*

  small plastic dishpan
  one-gallon glass jar with lid
  disposable cups
  small glass or enamel saucepan
  three small (baby food) jars
  two medium (pickle) jars
  one quart (mayonnaise) jar

- *Measurement*

  100ml graduated cylinder
  measuring cups
  measuring spoons
  12-inch ruler
  stopwatch or watch/clock with second hand

- *Utensils*

  wooden spoon
  disposable plastic spoons
  * paring knife
  * razor blade or artist's knife
  blunt table knife
  * scissors
  pliers
  disposable plastic straws
  (cut into thirds to form mouthpieces)
  * electric hot plate
  * ice pick
  eyedropper

- *Miscellaneous*

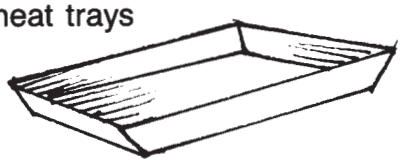
  paper towels
  * matches
  string
  liquid soap
  cellophane tape
  plastic packaging tape
  white glue
  red and blue food coloring
  cotton swabs
  toothpicks

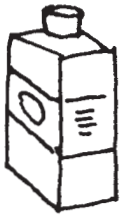
* NOTE: Depending on the age and maturity of your students, these potentially dangerous items should be kept securely out of children's reach and used with adult supervision.

Sponge Garden

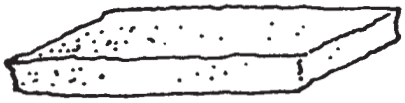
You Will Need

two styrofoam meat trays



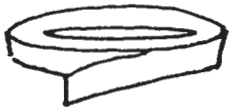


liquid plant food



two thin sponges

masking tape

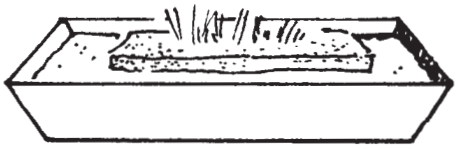


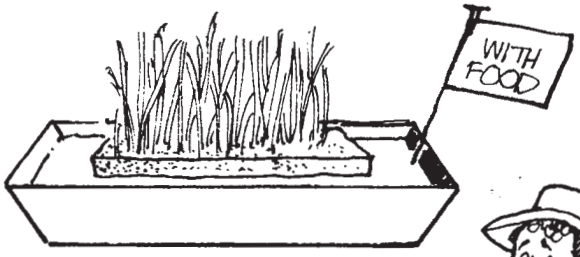
straight pin

seeds (coleus, sweet allysum, or grass)

Here's How

1. Soak each sponge in water and place one in each meat tray.
2. Make a 'flag' label by wrapping a piece of masking tape around the top of a straight pin. Write 'With Food' on the flag and stick it into the edge of one of the trays. Leave the other tray unlabeled.
3. Set the trays in the classroom out of direct sunlight. Fill each tray about one-half full of water and observe the trays for a week. Add water as it evaporates.
4. One week after the seeds have sprouted, mix liquid plant food with water as directed and replace the water in the 'With Food' tray with this solution.
5. Observe for several weeks making sure to use the plant food solution in the 'With Food' tray only.





Questions

1. How long did it take for the seeds to sprout? Did they all sprout?
2. How do the plants differ after several weeks? Why?
3. Where does the new sprout get its energy?
4. What happens after a new plant uses all its stored nutrients if there is no food available?

Sponge Garden

GENERAL INFORMATION

Seeds contain the *embryo* and stored food of a plant encased in a hard shell or other protective coating. Seeds are produced by both *angiosperms* (flowering plants) and *gymnosperms* (non-flowering plants and trees). The largest seed is that of the double coconut tree which can weigh up to 50 lbs. while the smallest seeds are almost invisible to the naked eye. Some plants produce only a few seeds at a time while other plants, like pigweed, produce millions.

Flowering angiosperms produce enclosed seeds that are covered by fleshy fruits, dry pods, or hard kernels. Gymnosperms produce naked seeds enclosed in cones. The scales of the cones provide protection for the seeds while they are developing. Some naked seeds, like pine nuts, are enclosed in a protective shell.

Seeds have three parts: embryo, food storage tissue, and seed coat. The seed coat protects the seed from injury during development. The food storage unit of angiosperms is called the *endosperm*. Gymnosperms contain *megagametophyte* food storage tissue. The tissue that eventually develops into the mature plant is stored in the embryo.

MATERIALS

You will need two styrofoam meat trays or other flat containers, two thin (about 1 inch thick when wet) sponges, liquid plant food, packet of seeds, a straight pin, and masking tape.

PROCEDURE

Follow the procedure as outlined on the student worksheet. Be sure that the sponges stay moist all the way through to ensure germination and continued growth. You may want to have the students count the seeds before and after sprouting to determine the percent of germination.

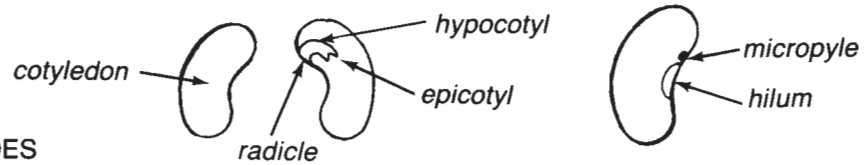
ANSWERS TO QUESTIONS

1. The sprouting time will vary with room temperature. The warmer the temperature, the faster the seeds will sprout.
2. The unfed plants will begin to die, even with adequate water, because the food and nutrients stored in the seed are gradually used up. The fed plants will flourish longer because they will have the nutrients to make more food through photosynthesis.
3. A new sprout gets its energy from the food stored in the seed.
4. A plant will die if no nutrients are provided after the stored food is used up.

EXTENSION IDEAS

1. SEED STRUCTURE

   The structure of a seed can be observed by soaking 8-10 pinto beans in water overnight and dissecting them. Place the beans in the refrigerator in a jar with enough water to cover them completely. Drain the beans on a paper towel. Peel the coat from a bean and split the bean open on the rounded side opposite the hilum. If you are very careful you can see the 'baby bean plant' inside. Keep trying until you expose a baby bean. Identify the *cotyledon* (food), *radicle* (future root), *hypocotyl* (future stem), and *epicotyl* (future leaf) of the bean interior. Use a dry bean to identify the seed coat, *hilum*, and *micropyle*. Use the encyclopedia to identify these structures.



2. GROW PLANTS FROM POTATOES

   Put several potatoes in a dark place for several days, checking every few days for the small white growths called eyes. Cut a chunk out of the potato around the eye and bury it in a jar filled with potting soil (with the eye pointing up) so that the eye is about two inches deep. Keep the soil moist, not soaking wet. It will take about two weeks for a potato stem to show above the soil.

   Discuss two forms of plant *propagation*: tubers and cuttings. Propagation is the ability of a plant to form new plants from parts of the existing plant. Have a student research plant propagation and place the report in your science center along with the potato plant and sponge garden.