

# Exploring the Native Plant World

A Life Science Curriculum  
Pre-Kindergarten—Kindergarten

*Shapes and Patterns in the Native Plant World*

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# Welcome to the Lady Bird Johnson Wildflower Center

The Lady Bird Johnson Wildflower Center is dedicated to North America's native flora. Our mission to educate people about the environmental necessity, economic value, and natural beauty of native plants guides all that we do.

At the Wildflower Center, we apply nature's principles to designed landscapes. The Wildflower Center nestles gently into 284 acres of Central Texas Hill Country, and the landscape and the buildings reflect our Hill Country home. The Center's focus on native plants, resource conservation, and ecologically sensitive design reflects our deep concern for the environment.

Founded by former First Lady Lady Bird Johnson and the late actress Helen Hayes in 1982, the Lady Bird Johnson Wildflower Center encourages the preservation, conservation, and restoration of native plants in all types of landscape situations. The Center's extensive environmental education program and national Native Plant Information Network combine to extend the Center's mission across North America. Our commitment to education and young people is the foundation for all we do: Education is at the core of our mission, and children are the keys to our future. Together we can work to make a difference.

For more information about the Lady Bird Johnson Wildflower Center, please call (512) 292-4200 or visit our web site at [www.wildflower.org](http://www.wildflower.org).



*Lady Bird Johnson*

# Wildflowercenter

# Exploring the Native Plant World

## A Life Science Curriculum for Pre-Kindergarten through Grade 6

This curriculum is divided into four grade-specific modules: Pre-K/K (Shapes and Patterns); 1-2 (Changes); 3-4 (Survival); 5-6 (Adaptation). The focus is to provide a basis for the study of botany and biological systems and to serve as a foundation for future botanical explorations. Children in pre-kindergarten and kindergarten are introduced to the shapes and patterns found in nature, beginning with the shapes in flowers and continuing through explorations of patterns in time throughout a plant's life. First and second graders find that plants change over time (as does everything on earth) and plants take care of their needs with specialized parts. In the third and fourth grade unit, students learn more about how plants survive and that this survival is carried out through a variety of relationships with other plants and animals and abiotic, or non-living, factors. In the final unit, fifth and sixth graders discover the concepts and mechanisms of natural selection and natural communities, as well as human impact on these communities.

*Exploring the Native Plant World* was designed using the Texas Essential Knowledge and Skills (TEKS) and the National Benchmarks for Science Literacy. A primary goal of this curriculum is to teach botanical principles through all elementary grades in order to build an ecologically literate citizenry. By focusing on native plants, this curriculum also provides an opportunity to learn more about imperiled ecosystems.

*In the end, we will conserve only what we love;  
We will love only what we understand;  
And we will understand only what we are taught.*

—BABA DIOUM, Senegalese conservationist

In today's culture many of us are urban dwellers. Too few children have the opportunity to engage in and observe the natural world. As educators and environmental specialists we can introduce nature to children from all walks of life. Studies show that just as there is a critical time in a child's life when he develops language, there is a time in a child's life when she develops an appreciation of the natural world. Our challenge is to open that window of opportunity and welcome children to a lifetime of exploring and understanding nature's wonders.

*If we sustain plants, they will sustain us.  
It is that simple. And it is that important.*

—RICHARD H. DALEY, former director,  
Arizona-Sonora Desert Museum

## What is a native plant?

A native plant is a plant species that occurs naturally in a particular region, state, ecosystem, and habitat without direct or indirect human actions. Native plants are a part of the natural neighborhood, a component of the local ecosystem, and they function with other organisms within that ecosystem. They are a critical component of nature's web, and they have evolved and adapted to meet climatic and environmental changes over time without intervention or assistance from humans.

Native plants provide food and habitat for animals of all kinds (including humans). They filter the air and reduce soil erosion. Because native plants fill a niche, or specific function, within their ecosystem, they seldom grow beyond the needs and capacities of that ecosystem. The interaction and interdependence of plants and animals within that niche make up our biological community.

## Native plants are in crisis

Farming, ranching, urban development, and chemical application have significantly reduced many of the Earth's native plant communities. Species have become endangered or extinct, natural habitats have degraded, soil erosion has increased, and the genetic diversity so essential for stable, balanced ecosystems has declined. Since the early nineteenth century more than 200 of America's native plant species have been lost, and more than 5,500 species are endangered or threatened. This means that other organisms dependent on those species have lost or might lose an important part of their food chain.

In many places well-meaning landowners have replaced native plants with non-native species in yards or landscapes. Non-native species often require more water, fertilizer, and herbicides than native plant species. Moreover, non-native plants occasionally escape cultivation and become aggressive, invasive weeds, choking out both native and other non-native plants.

## The importance of native plants

There are several important reasons to garden with native plants. They are adapted to the particular combination of soil, temperature, nutrients, and rainfall of their region. Once established they require little, if any, supplemental water, fertilizer, pesticides, or other chemicals. In planned landscapes around schools, homes, commercial developments, or roadsides, native plants require far fewer additional resources.

Besides the practical benefits of using native species, these plants provide habitat for a host of regional animals. Native plants are a welcome mat for the birds, butterflies, and so many other animals that enjoy the habitat. Using native plants in a garden or landscape can provide ecological, economic, and aesthetic benefits—it's a win-win situation for both the gardener and the natural community.

A good way to start protecting and preserving native plants is by learning about your region's native plants. Remember that your region is unlike any other in the world. There are subtle differences everywhere. Visit the Lady Bird Johnson Wildflower Center's Native Plant Information Network (NPIN) for help in learning what native plants belong in your neighborhood. NPIN has regional fact sheets, which include species recommendations, plant and seed sources, and contact information for local native plant organizations. These resources provide tools that can help you teach about your region's native plants and their importance to our future.

# Introduction

## Shapes and Patterns in the Native Plant World

Patterns, as we know them, first existed in nature. They result from the repetition of basic shapes. All natural shapes, both plant and animal, are a result of organisms evolving to meet their own needs: the puzzle pieces of a pine tree's bark or a nautilus' swirled shell allow the organism to grow, and the six-sided chambers of a honeycomb provide bees with a strong storage place. Functional shapes are nature's way of doing more with less.

People have always found patterns fascinating. When we identify a pattern we also find a sense of order and a margin of predictability. Over time we have simply adapted nature's shapes to meet our own needs—after all, nature's patterns make perfect, elegant sense. By looking for the shapes and patterns around us, we are better able to understand the natural world.

This Pre-Kindergarten – Kindergarten unit exposes students to the beauty and abundance of shapes and patterns in nature. Students will begin by finding shapes and patterns in flowers and elsewhere in the natural world. They will discover that there is a pattern to where plants grow and how they combine to form natural neighborhoods. All of these activities are designed to build good observation skills; develop systems to collect, organize, and display data; and furnish a strong basis for future learning. The curriculum introduces the concept of life cycles with the integration of day/night patterns and children's daily routines. The final section shows that seeds, which are part of a plant's life cycle, form patterns in fruits.

Before we can understand anything, we must first see it clearly. So, let us begin!

# Unit Overview

*Shapes and Patterns in the Native Plant World* includes activities needed for writing preparation, fine motor manipulation, and observation skills. The unit incorporates shapes, patterns, and days of the week. Most importantly it encourages and reinforces close observation of the natural world.

**Suggested time:** Three weeks

## Objectives

**Before your field trip, students will learn:**

- Flowers are made from shapes.
- Flowers are made in patterns.

**During your field trip, students will learn:**

- Plants grow in patterns.

**After your field trip, students will learn:**

- Time passes in patterns.
- Fruits grow in patterns.

*Shapes and Patterns in the Native Plant World* addresses the following National Benchmarks for Science Literacy:

## Concepts

- Shapes make patterns.
- Shapes can be used to tell about things.
- Shapes can be found in nature and things people build.
- Patterns can be made with different shapes put together.
- Similar patterns show up in nature.
- Events in nature repeat.
- Things in nature are small and large.
- Some plants look alike and others look different.
- There is variation among individuals in a population.

## Skills

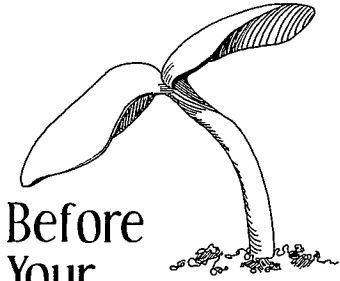
- Describing and comparing things in terms of shape, size, color and number.
- Using numbers to make estimates.

# Lesson 1:

## Flowers are made from shapes

### ACTIVITY 1.1

## Shapes-Go-Round: *Review basic shapes*



### Before Your Field Trip

To prepare for your field trip, your class will:

- review basic shapes
- paint giant shapes
- match flower shapes
- make flowers with cutout shapes
- match flower shapes and patterns
- explore the abundance of patterns in nature
- make repeating patterns of colored shapes
- explore the ways flowers attach to stems.

### Before Activity

Gather materials:

- large drawstring bag
- shapes in wood, plastic, clay, or acrylic: triangles, rectangles, circles, squares, diamonds, ovals, hearts, honeycombs
- music recording and player
- Put all the shapes in the drawstring bag.

### During Activity

- 1) If appropriate, quickly review basic shapes with the class.
- 2) Have students stand or sit in a circle and pass the bag around as the music plays. Stop the music suddenly and ask the student holding the bag to reach in, grasp a shape, and identify the shape by feel. Then have the student take the shape out of the bag, show it to the others, and put it in the middle of the circle. Continue until all shapes have been identified.
- 3) Ask students to look around the room for shapes present in everyday objects, such as chalk erasers, clocks, desks, etc.



## ACTIVITY 1.2

# Shape-A-Flower: *Make flowers with cutout shapes*

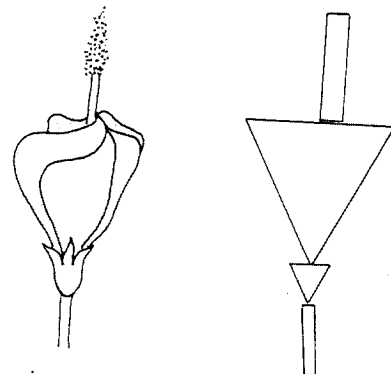
### Before Activity

#### Gather materials:

- *Shape-a-Flower* template, page 22
- overhead projector
- transparency film
- assortment of wildflower photos from magazines or posters
- 4" x 6" index cards (double class set)
- scissors
- glue
- Photocopy a class set of the *Shapes* template onto colored paper. Cut into strips so students can cut out the shapes easily. (Cut the shapes yourself if class time will be limited.)
- Make an overhead transparency of the *Shape-a-Flower* template.
- Cut out wildflower photographs and glue onto one class set of index cards. On each photograph, pick one shape that students have studied and outline it with dark ink.

### During Activity

- 1) Have students cut out the colored shapes.
- 2) Place the *Shape-a-Flower* transparency on the overhead projector and use the cutout shapes to help students recognize the shapes in the flower.
- 3) Give each student two index cards, one with a wildflower picture and the other blank. Have students glue colored shapes onto the blank index cards to replicate their wildflower pictures.



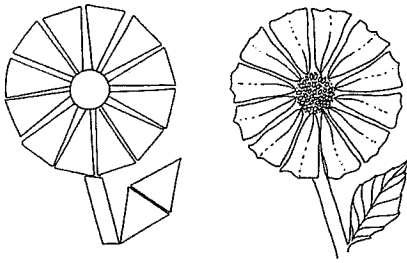
### Teaching Tips

*Whenever possible, focus on native plants in your area. Field guides are available at most libraries or bookstores. They can expose students to the variety of shapes and colors that exist in flowers.*

*Remember—for this age group it is more important to learn good observation skills than to learn the names of individual flowers.*

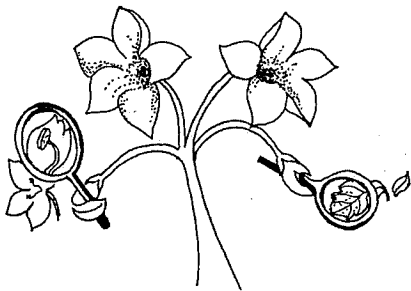
### Activity Extension: Scavenger Hunt

Walk around the school grounds to look for wildflowers. Look in the tended gardens as well as between the cracks in the sidewalk or just beyond the school fence. Help students select a few flowers to bring inside and replicate with paper shapes on black construction paper squares. Make a School Yard Wildflower Quilt by attaching the squares together.



## Teaching Tip

Notice that half of the Wildflower Picture Cards are realistic, but the other half emphasize the flowers' component shapes. Some students may need extra help with this activity.



## Teaching Tip

Notice that the matching flowers are drawn from different views and therefore are not perfect matches. Some students may need extra assistance in this matching activity.

### ACTIVITY 1.3

## Floral Flip N' Match: *Match flower shapes and patterns*

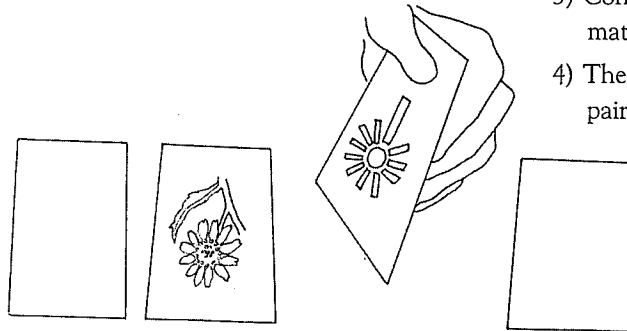
### Before Activity

Gather materials:

- *Floral Flip N' Match Cards* template, page 23
- Photocopy half of a class set of the *Floral Flip N' Match Cards* on white paper, color the cards (if you wish), and cut out along the lines.

### During Activity

- 1) Have student pairs mix each set of cards and place them face down in three equal rows.
- 2) Tell student pairs to take turns flipping over two cards at a time to see if they "match." If the cards match, the student removes them and takes another turn. If they do not match, the student flips them back over and loses the next turn.
- 3) Continue until all cards have been matched and removed.
- 4) The student with the most matched pairs wins.



### ACTIVITY 1.4

## Flower Twins: *Match flower shapes*

### Before Activity

Gather materials:

- *Flower Twins* template, page 24
- markers or crayons
- Photocopy a class set of the *Flower Twins* template.

### During Activity

- 1) On the *Flower Twins* handout have students draw lines connecting flowers that are alike.
- 2) Ask students to explain how they knew flowers matched when the pictures looked different.
- 3) Have students color the flower pictures.

# Lesson 2:

## Flowers are made in patterns

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### ACTIVITY 2.1

## Pattern Safari:

*Explore the abundance of patterns in nature*

### Before Activity

Gather materials:

- books about patterns, such as *Let's Look at Patterns* by Nicola Tuxworth, *Look Once, Look Twice* by Janet Marshall, and *Lots and Lots of Zebra Stripes: Patterns in Nature* by Stephen R. Swinburne
- pictures of plants, animals, and objects that show patterns

### During Activity

- 1) Read one or more of the pattern books to the class. As you read, show students the illustrations and have them identify the patterns they see.
- 2) One at a time, show students some pictures of plants, animals, or objects with patterns in them. Ask students to name other plants, animals, or objects that have a pattern.

### Activity Extension: Pattern Buffet

Have students bring natural objects from home that in some way show a pattern. Display the objects on a “pattern” table. Invite other students to explain the patterns they see in the objects. Enjoy nature’s pattern buffet.

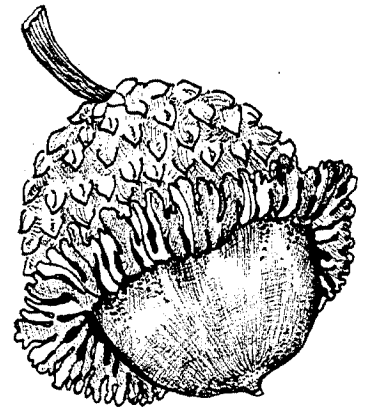
### Activity Enrichment: Patterns in Art and Science

*By Nature's Design* by Pat Murphy with photographs by William Neill.

This book fascinates both children and adults by looking at the art, science, and mathematics found in nature’s designs. Beautiful photographs capture the multitudes of designs and patterns often overlooked in our everyday lives.

*Echoes for the Eye: Poems to Celebrate Patterns in Nature* by Barbara Juster Esbensen.

This book combines poems with illustrations in a delightful exploration of the patterns found in nature.



## ACTIVITY 2.2

# Pattern Power:

## *Make repeating patterns of colored shapes*

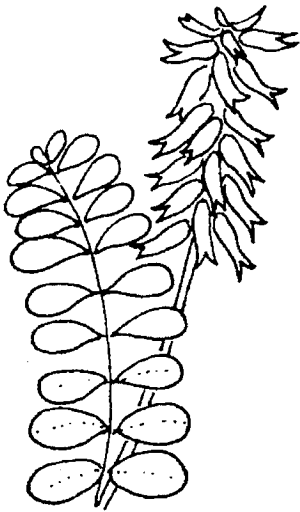
### Before Activity

Gather materials:

- several pictures of quilts
- shape manipulatives, such as plastic parquetry shapes/mosaic tiles, colored foam rhombus shapes, and colored stringing beads

### During Activity

- 1) Show students the pictures of quilts and ask them to find shapes they recognize in each quilt's pattern. How was the pattern built into the quilt? Does it repeat colors? Shapes? Are the shapes the same size? Are there more than two colors in the pattern?
- 2) Use colored tiles or colored beads to create a simple pattern. Start the pattern again and ask students what should come next. If they answer easily and quickly, complicate the pattern by adding more colors and a greater number of steps before repeating the sequence.
- 3) Hand out shape manipulatives and have students make their own patterns. (Some patterns may become three-dimensional, requiring more shapes and space to work in.)
- 4) Challenge students to remember their patterns. Have them close their eyes while you remove one piece. Then have them guess the shape and color of the missing piece.



## Teaching Tip

Learning the names of inflorescences is not age appropriate; however, recognizing the different types of flower bundles helps students learn to see differences in patterns. Students might have fun making up their own names for inflorescence types.

If you use silk flowers, choose them carefully to match the Inflorescence Cards. They may not be botanically correct but can still be effective tools for demonstrating inflorescence.

## ACTIVITY 2.3

# The Essence of Inflorescence:

## *Explore the ways flowers attach to stems*

### Before Activity

Gather materials:

- *Inflorescence Cards* template, pages 25-27
- wildflowers or silk flowers showing different kinds of inflorescence
- construction paper
- puff paint
- circle stickers
- Photocopy, cut out, and laminate three or four sets of *Inflorescence Cards*.
- Highlight the dots on the cards with puff paint to add texture and interest.

### During Activity

- 1) Show students a flower and its corresponding *Inflorescence Card*. Ask them to tell about the pattern they see. Repeat for the remaining inflorescences.
- 2) Give each student an *Inflorescence Card*. Have them count the number of flowers in the flower cluster.
- 3) Have students draw a flower stem (a simple line will do) on a piece of construction paper and then make a picture of the inflorescence pattern by drawing dots or using the circle stickers to represent each flower.

# Activity Extension: Inflorescence Investigation

Take the *Inflorescence Cards* onto the school grounds, into the neighborhood, or into a garden. Have students find flowers that match the patterns on the cards.

## Flower Power: Inflorescences

*Inflorescence* is a term that describes the way flowers are attached to the stem. The word comes from the Latin *infloresco*, or "I begin to bloom." Although an inflorescence can be as simple as one flower at the end of a stem, it also can be as complex as the head of a sunflower, which actually is composed of hundreds of tightly packed individual flowers.

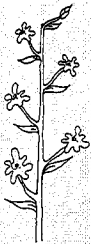
There are many different types of inflorescence, but they all function to accomplish one thing—to make sure flowers get pollinated. Their classification is based on a number of different factors: the order in which the individual flowers bloom, the patterns in which the stems branch, and the presence or absence of flower stems (pedicels).

Here are some different types of inflorescence:

**Solitary:** a single flower at the end of a stem  
*Examples:* pavonia, pink evening primrose, columbine

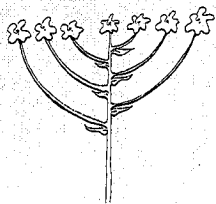
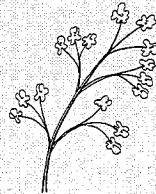


**Spike:** multiple flowers that attach directly to the stem  
*Examples:* Indian paintbrush, obedient plant, flame acanthus



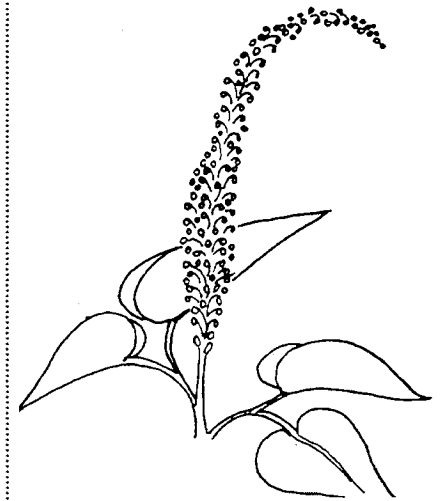
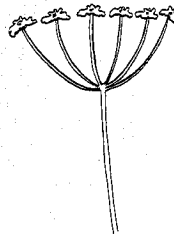
**Raceme:** a spike whose flowers have small stems (pedicels) attached to the main stem  
*Examples:* foxglove, bluebonnet, tropical sage

**Panicle:** a main-branched raceme  
*Examples:* plains lovegrass, Indiangrass, switchgrass



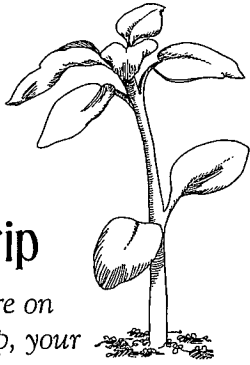
**Corymb:** a raceme with flower stems of varying lengths so the flowers are held at the same level  
*Examples:* goldenrod, boneset, blue mist flower

**Umbel:** multiple flowers attached by flower stems at a single common point, like an umbrella  
*Examples:* beggars ticks, eryngo, Texas parsley



# Lesson 3: Plants grow in patterns

## During Your Field Trip



While you are on your field trip, your class will:

- match shapes in the garden
- plant a garden of make-believe seeds
- observe plants growing in the meadow
- discover that plants belong in their own natural neighborhoods.

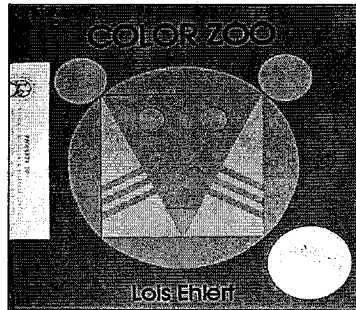
## ACTIVITY 3.1

### Find-a-Shape Scavenger Hunt: *Match shapes in the garden*

#### Before Activity

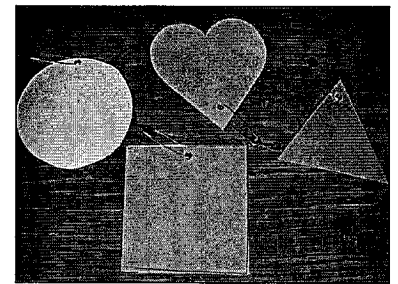
Gather materials:

- \_\_\_ *Color Zoo* by Lois Ehlert
- \_\_\_ pin-on shape for each student



#### During Activity

- 1) Read the book *Color Zoo* aloud. (The book emphasizes the diversity of shapes and colors and explores ways they can be combined to form creatures.)
- 2) Have adult leaders pin a shape onto each student's shirt or dress, in a place easiest for students to see.



- 3) Guide students to a garden area and instruct student pairs to look for leaves and petals that match their pinned-on shapes. Tell students to share their discoveries with their partners.

ACTIVITY 3.2

# Make-believe Gardening: *Plant a garden of make-believe seeds*

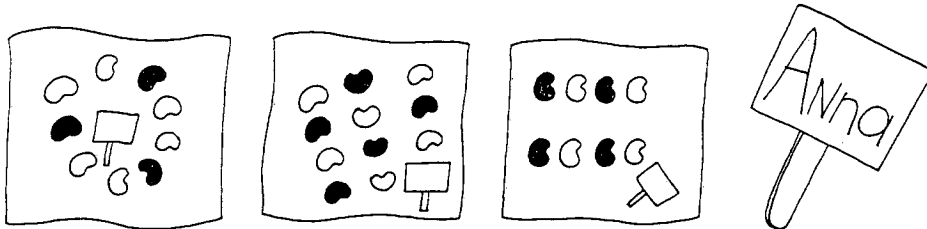
## Before Activity

Gather materials:

- \_\_ butcher paper
- \_\_ colored paper “seeds”
- \_\_ colored marking pens
- \_\_ index cards
- \_\_ craft sticks
- \_\_ glue

## During Activity

- 1) Give each student a piece of butcher paper. Have students “plant” their own “garden” on the butcher paper using paper seeds and glue. Remind students of the patterns they have learned about and encourage them to create a pattern as they plant their gardens.
- 2) Use index cards and craft sticks to mark the students’ garden plots.
- 3) The finished make-believe gardens are yours to keep.



## ACTIVITY 3.3

# What's Short or Tall? Trail Walk: *Observe plants growing in the meadow*

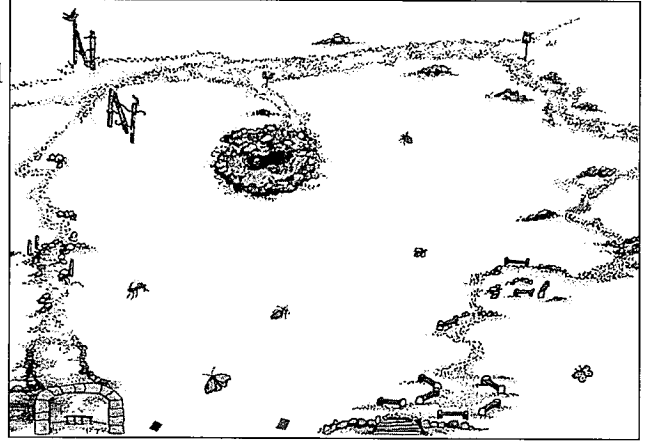
### Before Activity

Gather materials:

- illustrated trail map (white board with trail and buildings marked)
- magnets shaped as trees, grasses, and flowers

### During Activity

- 1) Tell students about places they will see on the trail walk (i.e., woods, meadows, caves). Ask students to pay close attention to these places because later you will need their help to remember.
- 2) At the trailhead, tell students they will use their bodies to help you measure plants along the trail. When you ask them to measure, they must decide if the plants are bigger or smaller than they are.
- 3) Walk along the trail. At significant landmarks, stop and ask students to measure the plants they see. Are the plants bigger or smaller than they are? Remind students to remember where they saw these plants.
- 4) Return to the classroom and have students work with the illustrated trail map. At each landmark painted on the map, ask students to describe the plants there, including whether they are big or small. Invite students to place magnetic trees, grasses, or flowers at the appropriate locations on the map. When the map is complete, there should be an accurate pattern of trees and grasses that grow along the trail.
- 5) Ask students why plants are different sizes. Do they think the short plants are just young? Will they grow taller as they get older? How old is a tree when it stops growing?



# Lesson 4: Time passes in patterns

## ACTIVITY 4.1

### Patterns, Patterns Everywhere:

### *Explore different forms patterns can take*

#### Before Activity

No preparations required.

#### During Activity

- 1) Draw a simple pattern on the board, such as triangle, circle, square, square, circle, triangle. Ask a student to come to the board and draw what comes next. Tell students that this is a *pattern of shapes*.
- 2) Hum or whistle a familiar tune, such as “Twinkle, Twinkle Little Star” or “Old MacDonald Had a Farm.” Stop before the end of the tune and ask students what sound comes next. Tell students that a tune is a *pattern of notes*. This pattern takes place in time. The notes must be in *time order* to make the tune.
- 3) Ask the most outgoing student in the class to come to the front and make a crazy shape with his or her body. Have three more students come forward and each make a different shape. See if the rest of the class can repeat these shapes in order. Tell students that this is a *pattern of shapes in time*.
- 4) Tell students that there are patterns in the lives of plants and people. These are patterns in time.

#### After Your Field Trip



To follow up on your field trip your class will:

- explore different forms patterns can take
- explore the patterns in days and weeks
- discover patterns in the life of a caterpillar
- celebrate the pattern of seasons
- discover the seed patterns in different fruits
- make patterns with pieces of fruit
- use fruits to make stamp patterns
- estimate apple seeds
- make a class book of shapes and patterns in nature.

## ACTIVITY 4.2

# Patterns in Time:

## *Explore the patterns in days and weeks*

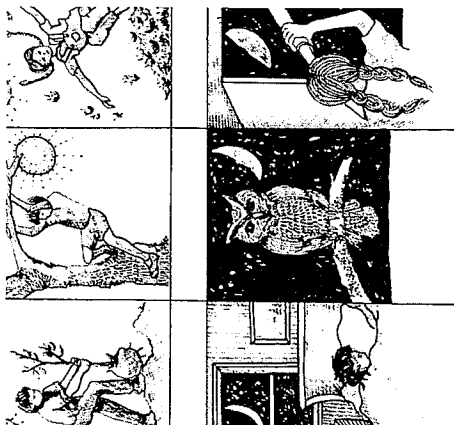
### Before Activity

Gather materials:

- \_\_ *Life Links* templates, pages 28-29
- \_\_ white and black posterboard
- \_\_ tape, glue, or stapler
- \_\_ crayons
- Photocopy a class set of the *Life Links* templates. (Make extra copies of the blank *Life Links* if you want to have students draw their time pattern for more than one day.)
- Mount the white and black posterboard on the bulletin board.

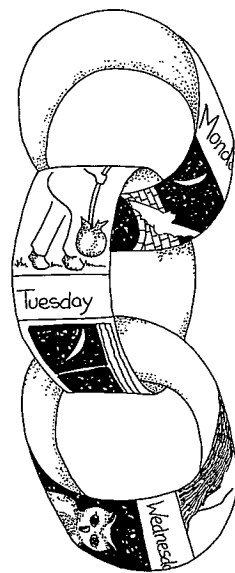
### During Activity

- 1) Ask students what happens when the sun comes up and when it goes down. Explain that day and night make a pattern in time. Every day has a daytime and a nighttime. Was there a daytime on Monday? What about yesterday and tomorrow?
- 3) Have students color their *illustrated Life Links* handout. What clues tell them one picture shows daytime and the other shows nighttime? Have them cut the pictures into eight separate



blocks and put their pictures on the bulletin board—nighttime pictures on the black posterboard and daytime pictures on the white.

- 4) Tell students there is more to each day than light and dark, day and night. In two large squares on the chalkboard, draw a stick figure picture of yourself at school teaching and another of you at home eating. You do these activities almost every day, and they form the time pattern of your week.
- 5) Give each student a copy of the *blank Life Links* handout. Tell them to draw pictures in the blank squares. In one square they should draw a picture of something they do *at school* every day. In the other square they should draw a picture of something they do *after school* every day. This is their time pattern.
- 6) If you wish, have students make additional *Life Links* drawings to show a longer time pattern that includes other regularly occurring events during or after school, perhaps going to the library or the park. Have students label each day, cut the days at the horizontal lines, and fasten the *Links* together (with tape, glue, or staples) to show time passing.



## ACTIVITY 4.3

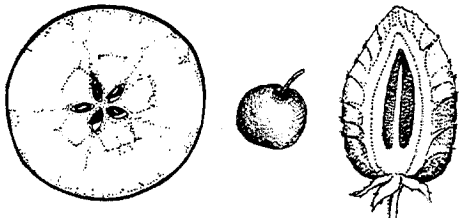
# Time in a Caterpillar's Life:

## *Discover patterns in the life of a caterpillar*

### Before Activity

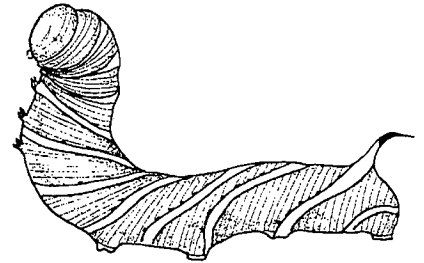
Gather materials:

- \_\_\_ *The Very Hungry Caterpillar* by Eric Carle
- \_\_\_ pictures, stickers, or paper cutouts of fruits and other foods in the story: one apple, two pears, three plums, four strawberries, etc.
- \_\_\_ flipchart paper
- \_\_\_ masking tape or other easy-lift tape
- \_\_\_ monthly calendar
- Draw a weekly calendar on the flipchart paper.
- Use the tape to place a mixture of fruits/food on each day in the weekly calendar.



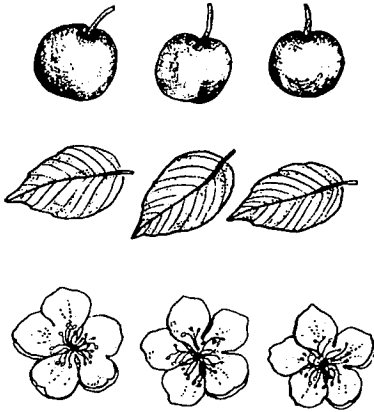
### During Activity

- 1) Read aloud *The Very Hungry Caterpillar*. Point out the pattern of days as the caterpillar grows bigger and then changes into a butterfly.
- 2) Show students the weekly calendar and ask them if it accurately shows what the caterpillar ate on Monday. Follow students' instructions to replace the mixture of items with a picture of one apple. Do the same for Tuesday (two pears), Wednesday (three plums), Thursday (four strawberries), and so on through the end of the week. Ask students to identify the pattern in the caterpillar's diet. Introduce ordinal numbers with what happened on the 1st day (Day 1–Tuesday), 2nd day (Day 2–Wednesday), 3rd day (Day 3–Thursday), and 4th day (Day 4–Friday). Have them use chronological words like “before, after, first, next, and last” to describe what happened in the story.
- 3) Ask students how much time the caterpillar was in the chrysalis. Show students a monthly calendar and have them use it to figure out the amount of time it takes the caterpillar to change into a butterfly.



## ACTIVITY 4.4

# A Round of Seasons: *Celebrate the pattern of seasons*



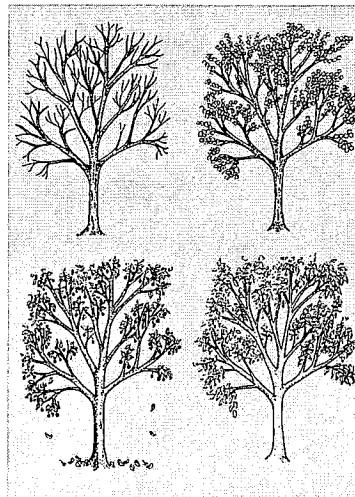
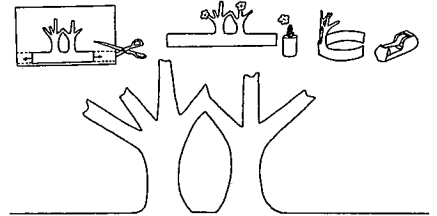
### Before Activity

Gather materials:

- \_\_ *Seasonal Changes* template, page 30
  - \_\_ *Mexican Plum Tree Crown* template, page 31
  - \_\_ *Plums* template, page 32
  - \_\_ *Leaves* template, page 32
  - \_\_ *Flowers* template, page 32
  - \_\_ construction paper: green, yellow, purple, white, and orange
  - \_\_ brown wrapping paper or paper bags
  - \_\_ glue, tape, and/or stapler
  - \_\_ white or silver glitter
  - \_\_ hula hoop
- Photocopy the *Mexican Plum Tree Crown* template to make a crown pattern. Outline the pattern on brown paper and cut out a class set of crowns.
  - Photocopy the *Plums*, *Leaves*, and *Flowers* templates: flowers on white, plums on purple, summer leaves on green, and fall leaves on yellow and orange.

### During Activity

- 1) Ask students to look for differences among the *Seasonal Changes* pictures of the Mexican Plum tree. Discuss what times of year these changes take place.
- 2) Hand out crowns for students to decorate. Give one-fourth of the students flowers, one-fourth plums and green leaves, and one-fourth yellow and orange leaves to attach to their crowns. Give the remaining students glitter to decorate the branches on their crowns. After students have decorated their crowns, adjust each crown to fit and fasten the ends together.

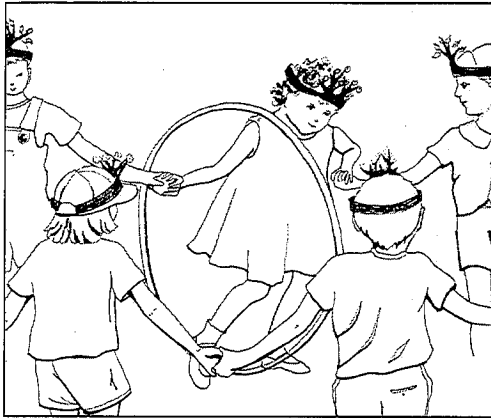


### Mexican Plum, or *Prunus mexicana*

Sometimes called Big-tree Plum, the Mexican Plum tree is a member of the rose family. Mexican Plums grow into small trees that produce lovely white spring blossoms. They produce plums in the summer, but these dry fruits are better suited to songbirds, ring-tailed cats, and foxes than to humans (though they are edible).

For more information about Mexican Plum trees and other Texas native trees, see *Texas Trees* by Paul Cox and Patty Leslie.

3) Have students put on their crowns and join the other students that are their seasons. Form a circle with the seasons arranged in the proper sequence: spring, summer, fall, and winter. Tell students to hold hands. Hold up the Hula Hoop upright so the last “winter” student and the first “spring” student must reach through to hold hands.



- 4) Have students march in a clockwise circle singing “Winter, spring, summer, fall/Plants change through them all!” and passing through the hoop as you hold it. Narrate information about each season as it passes through the hoop. For example, “Cold icy winter, short days, not much growing going on.”
- 5) Stop the march after each student has passed one time through the hoop. Just like the earth’s pattern of going around the sun one time and coming back to the place it started, the round of seasons started and came back to the same place.
- 6) Have students circle through the hoop five or six times (depending upon the average age of your class). Ask students how many winters they have gone through in their lives. How many springs? Summers? Falls? Have them explain the order of the seasons using the words “before,” “after,” and “next.”

## Activity Extension: Adopt-a-Plant

Show students the pictures of the Mexican Plum tree in each of the four seasons. This is the *pattern in time* for this type of tree.

Ask students about the seasonal changes in other trees and plants. Have they seen any of these stages in a tree’s life near the school? Do all trees lose leaves at the same time? Do other plants lose leaves? What time of year do new leaves grow?

Have student groups adopt a tree, shrub, or wildflower to observe and record the plant’s changes over time. Have them draw or photograph the plant periodically to mark the changes—once a *month* for trees but once a *week* for wildflowers (which move quickly through their life cycles).

Put all the pictures and drawings in group notebooks. Each notebook becomes a chronicle of the adopted plant’s growth and changes.

# Lesson 5: Fruits grow in patterns

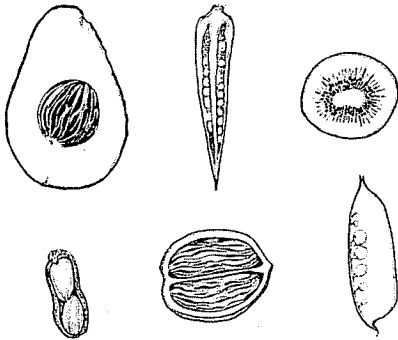
## ACTIVITY 5.1

### Tutti-Frutti: *Discover the seed patterns in different fruits*

#### Before Activity

Gather materials:

- one each of several vegetables: carrots, potatoes, celery
- two each of various fruits: apples, oranges, pears, strawberries, cantaloupe, tomatoes, kiwis, peaches, star fruit, bell peppers
- knife and cutting surface
- large bowl



chambers, then have students count the number of chambers for each fruit.

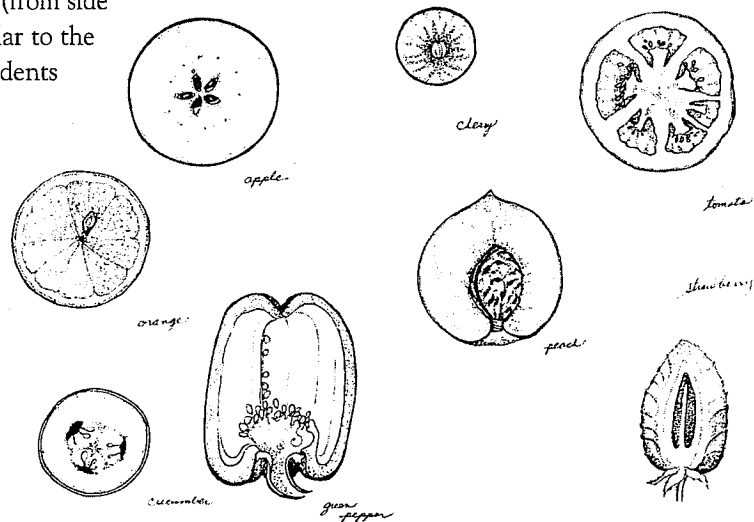
- 4) Cut the remaining whole fruits in half and have students compare the seed chambers of each pair of fruit. Do both have the same number of chambers and seeds? Use “more than” and “less than” to describe the differences in seed chambers.

Fruit	Seed Chambers
Peaches	1
Cantaloupes	3
Bell peppers	2-4
Tomatoes	2-8
Apples	5
Oranges	8-16
Kiwis	More than 30

#### During Activity

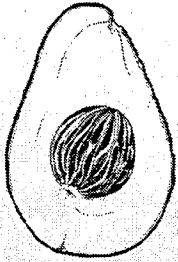
- 1) Cut the vegetables in half and ask students to look for seeds. Explain that only fruits have seeds.
- 2) Show students a tomato and a bell pepper. Point out that they are fruits (even though we think of them as vegetables) because they have seeds. Cut one of each in half (from side to side, perpendicular to the stem) and show students the seeds.
- 3) Cut one each of the remaining fruits in half (from side to side). Display all the fruit halves and have students look for patterns in the ways the seeds are arranged. Point out that the seeds are divided among

- 5) Discard the vegetables and refrigerate the halved fruits to use later in Activity 5.2 and Activity 5.3.



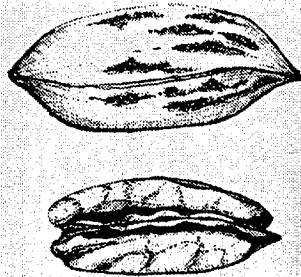
## Fruit Facts

Many of the foods we typically think of as vegetables are really *fruits*, including corn, green beans, cucumbers, okra, squash, and tomatoes. A simple rule of thumb to distinguish between fruits and vegetables is this: *Fruits have seeds inside them; vegetables do not.*



Botanists define a fruit as a *ripened or mature ovary (pistil)*. Fruits are one way plants protect and scatter their seeds. However, many plants produce **seedless fruits**. These plants produce fruit without fertilization through a process called *parthenocarpy*. Bananas, seedless grapes, and naval oranges are just a few parthenocarpic fruits. This process is not unusual in nature, and many of the seedless fruits we enjoy have been especially selected from naturally occurring seedless or small-seed varieties.

Nuts are dry, simple fruits that do not split open when they mature. They contain a single seed and have hard outer shells. Nuts develop from a single ovary, which contains many ovules. Only one of the ovules develops into a seed while all the others abort. Walnuts, acorns, and pecans are examples of nuts.

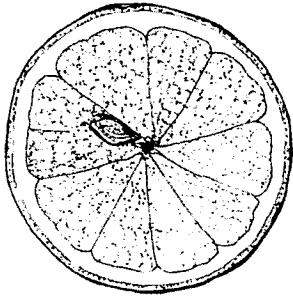


## And Those Other Plants We Eat . . .

*Webster's New Collegiate Dictionary* defines a vegetable as "an herbaceous plant grown for an edible part." The plant parts we consider vegetables include stems, roots, and leaves. For example, potatoes are really modified stems called tubers, and carrots are roots.

## ACTIVITY 5.2

# Pattern Kabobs: *Make patterns with pieces of fruit*



### Before Activity

Gather materials:

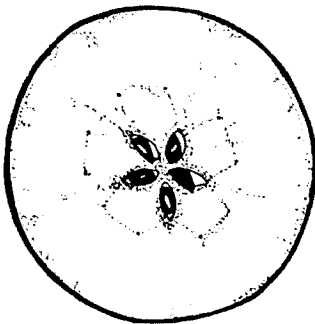
- \_\_\_ one-half of fruit from Activity 5.1
- \_\_\_ coffee stir sticks or straws
- \_\_\_ knife and cutting surface
- Cut fruit halves into small pieces.

### During Activity

- 1) Have students skewer fruit pieces in a pattern on stir sticks or straws. Encourage them to experiment with different kinds of patterns. For example,

they could base their patterns on color, type of fruit, shape of fruit, even the number of seed chambers.

- 2) Ask students to tell the class about their fruit patterns and use language ordering like “before and after,” and “first, second, third.” You also may want to have students form groups according to the kind of pattern they created (color, type of fruit, etc.) and discuss how each group’s fruit kabobs are alike and how they are different.



## ACTIVITY 5.3

# Prints Charming: *Use fruits to make stamp patterns*

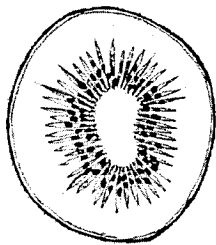
### Before Activity

Gather materials:

- \_\_\_ one-half of fruit from Activity 5.1
- \_\_\_ plain or colored paper (optional: muslin bandannas)
- \_\_\_ tempera paints
- \_\_\_ pie pans or other shallow containers
- Prepare tempera paints in shallow containers.

### During Activity

- 1) Distribute a variety of fruit halves and paint containers among student work areas.
- 2) Have students dip the fruit in paint and press like a stamp onto the paper. Encourage them to experiment with paint colors and fruit shapes to create interesting patterns. Ask them to identify the fruit shapes.



## ACTIVITY 5.4

# A Seedy Experiment: *Estimate numbers of apple seeds*

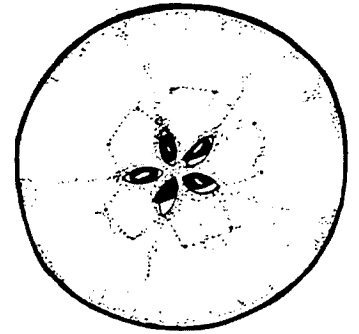
## Before Activity

### Gather materials:

- \_\_\_ *Apple Seed Graph* template, page 33
- \_\_\_ five to seven each of five varieties of apples, such as Macintosh, Gala, Delicious, Granny Smith, and Fuji
- \_\_\_ knife and cutting surface
- \_\_\_ glue or tape
- Photocopy one copy of the *Apple Seed Graph* template and write the apple varieties in the appropriate boxes. Use this master copy to make an additional 10 to 14 copies for the class.

## During Activity

- 1) Point out to students that there are many different kinds of apples. Do all apples have the same number of seeds? Ask students if they can think of a way to find an answer to that question. Encourage discussion.
- 2) Divide the class into five to seven groups and provide each with five different apples and one copy of the *Apple Seed Graph*. (Save the extra *Apple Seed Graph* handouts in case students need fresh copies.)
- 3) Before cutting the apples, ask students to guess the number of seeds in each type. Record their guesses on the board.
- 4) Cut each group's apples in half (from side to side, perpendicular to the stem). Ask the groups to estimate the number of seeds in each type of apple. Help them record each estimate on their *Apple Seed Graphs*.
- 5) Have students remove the seeds from one apple and glue or tape them in the appropriate column on the *Apple Seed Graph*. Then have students repeat with the remaining apples one by one.
- 6) After all seeds are on their graphs, have the groups count each column and record the number in the appropriate box. Have each group present their findings to the class. Do all types of apples have the same number of seeds?
- 7) Have students discuss their findings. Which apple has the most seeds? The least? Do bigger apples have more seeds than smaller ones? Why do different apples have different numbers of seeds?
- 8) Eat the apples!



# Unit Review: Nature is full of shapes and patterns

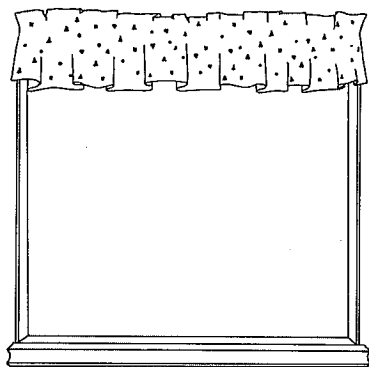
## ACTIVITY 6.1

### Shape Celebration! *Make a class book of shapes and patterns in nature*

#### Before Activity

Gather materials:

- *Celebrating Shapes in Nature Book*
- Cover template, page 34
- class set of frames (3x5", 4x6", or 5x7") made from cardboard, tagboard, or popsicle sticks/straws fastened together
- paper
- colored pencils, crayons, or markers
- clipboards or drawing boards
- Make one copy of the *Celebrating Shapes in Nature* template on cardstock paper for the book cover.
- If necessary, prepare frames for students.



#### During Activity

- 1) For the unit review, invite students to join you in building a book about what they have learned.
- 2) Give students their frames. Explain that sometimes artists use frames to make sure they see everything that belongs in the picture. (Make a frame with your fingers to illustrate.) Explain that the frames will help the students focus on what they are drawing. They may hold the frames up to look through, or they may set the frames down around the plants they want to draw.
- 3) Give students paper, something to draw with, and clipboards or drawing boards to provide a drawing surface. Take students to visit the most diverse plant location on the school grounds or (if the weather is inclement) have them look out the classroom window. Tell students to use their frames to find something to draw for their class book. They may choose to draw both natural and man-made objects, but emphasize objects from nature. Remind students to pay attention to shapes and patterns.
- 4) When students have finished their drawings, have them think of captions. Write the caption on each picture. For example, the caption for a picture of sunflowers on a sunny day could be "When I look outside I see circles in the sun and the sunflowers."
- 5) Create a colorful *Celebrating Shapes in Nature* book cover using the template in the appendix. Add some thick paper or cardboard for the cover and last page to protect the paper inside. When all the pictures are complete, add the cover, bind the collection together, and display your class book.

# Appendix 1: Book List

## Shapes and Patterns

- Ball, Phillip. 1998. *The Self-Made Tapestry: Pattern Formation in Nature*. Oxford University.
- Cook, Theodore Andrea. 1979. *The Curves of Life: Being an Account of Spiral Formations and Their Application to Growth in Nature, to Science, and to Art: With Special Reference*. Dover Publications.
- Esbensen, Barbara Juster. 1996. *Echoes for the Eye: Poems to Celebrate Patterns in Nature*. Harper Collins.
- Marshall, Janet. 1995. *Look Once, Look Twice*. New York: Houghton Mifflin (Ticknor & Fields Books for Young Readers).
- McMillan, Bruce. 1986. *Counting Wildflowers*. New York: William Morrow & Co. (Mulberry Books).
- Murphy, Pat, and William Neill. 1993. *By Nature's Design*. (An Exploration Book) Chronicle Books.
- Swineburne, Stephen R. 1998. *Lots and Lots of Zebra Stripes: Patterns in Nature*. Boyd Mills.
- Tuxworth, Nicola. 1997. *Let's Look at Patterns*. Lorenz Books.

## Patterns in Time

- Jonas, Ann. 1983. *Round Trip*. Greenwillow Books.
- Rylant, Cynthia. 1986. *Night in the Country*. Aladdin Paperbacks.
- Zolotow, Charlotte. 1995. *When the Wind Stops*. Harper Collins Publishers.

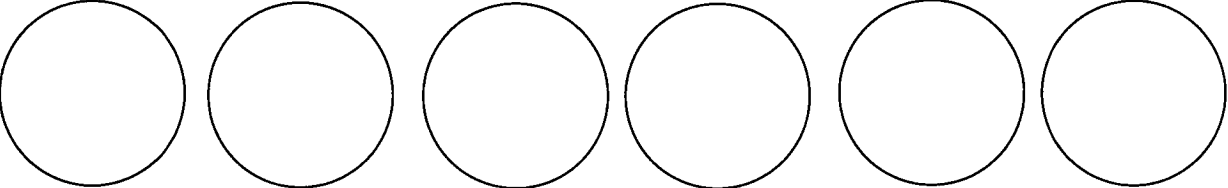
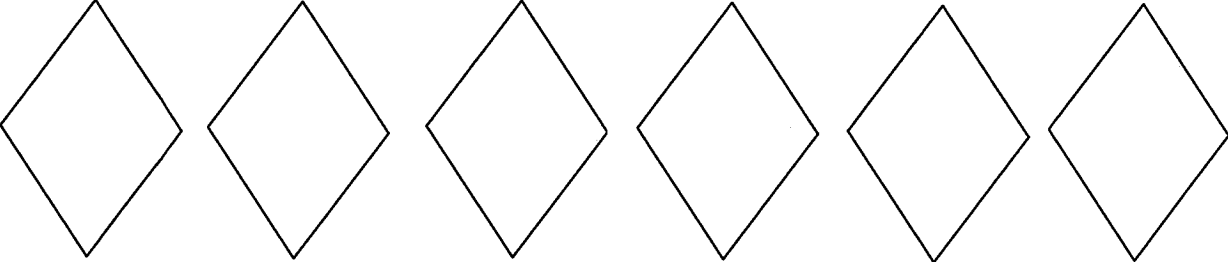
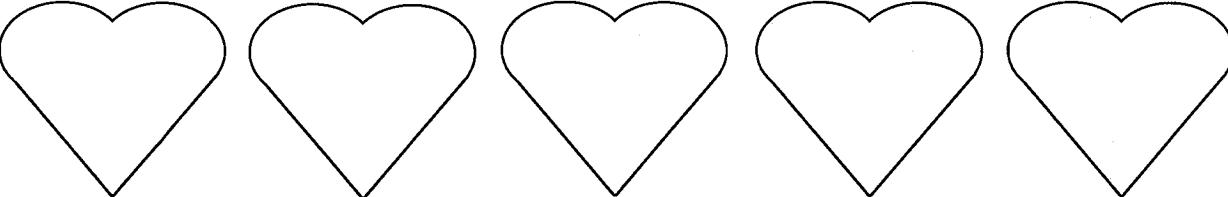
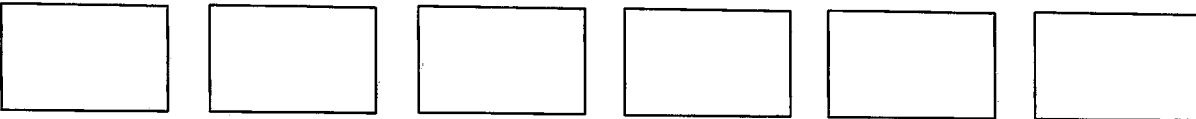
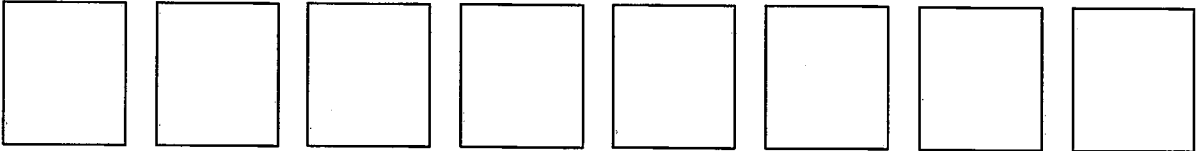
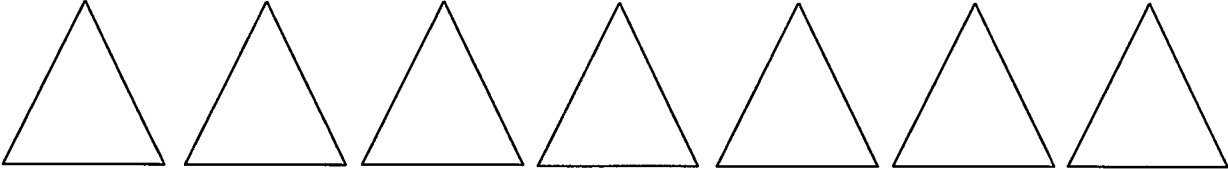
## Patterns in the Lives of Plants and Animals

- Carle, Eric. 1969. *The Very Hungry Caterpillar*. New York: The Putnam & Grosset Group (Philomel Books).
- Ehlert, Lois. 1991. *Red Leaf, Yellow Leaf*. Harcourt Brace and Company.
- Gibbons, Gail. 1984. *The Seasons of Arnold's Apple Tree*. Harcourt Brace and Company.
- Watts, Barrie. 1986. *Apple Tree*. Englewood Cliffs, NJ: Silver Burdett Press.

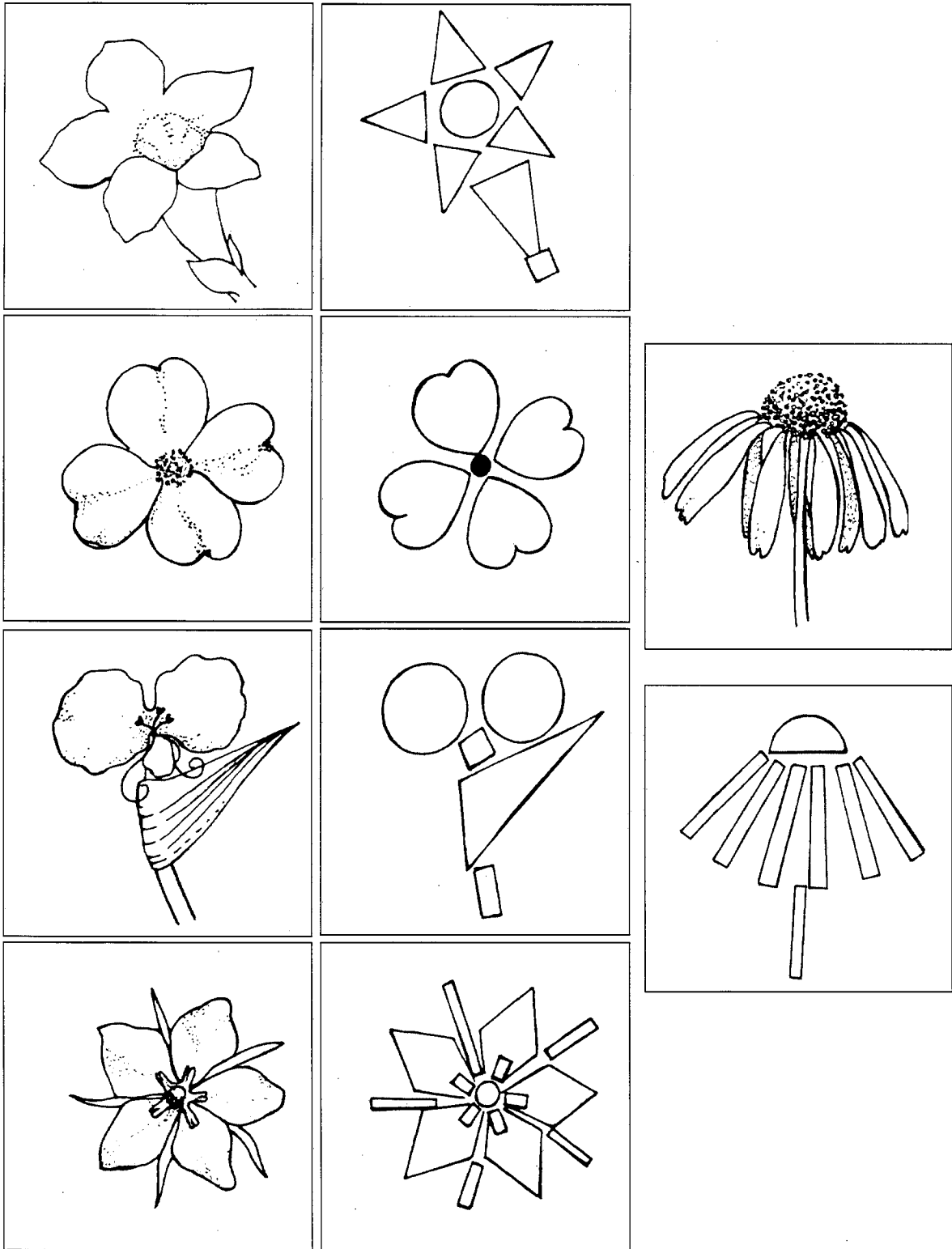
## Additional Resources

- Ehlert, Lois. 1988. *Planting a Rainbow*. Harcourt Brace and Company.
- Kellogg, Stephen. 1988. *Johnny Appleseed*. Morrow Junior Books.
- Leslie, Patty, and Paul Cox. 1988. *Texas Trees: A Friendly Guide*. Corona Publishing.

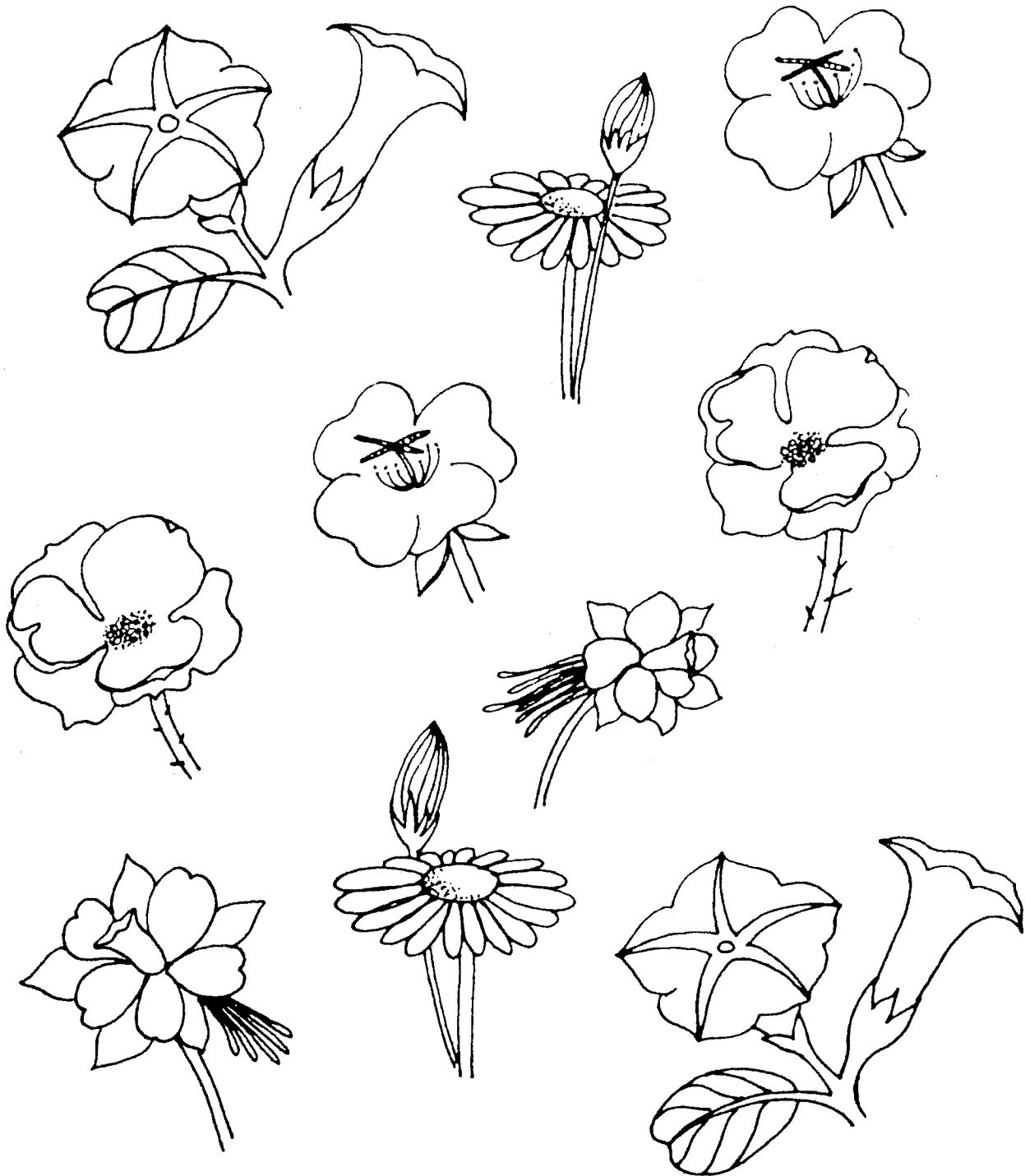
# Appendix 2: 1.2 Shape-a-Flower



### 1.3 Floral Flip n' Match Cards

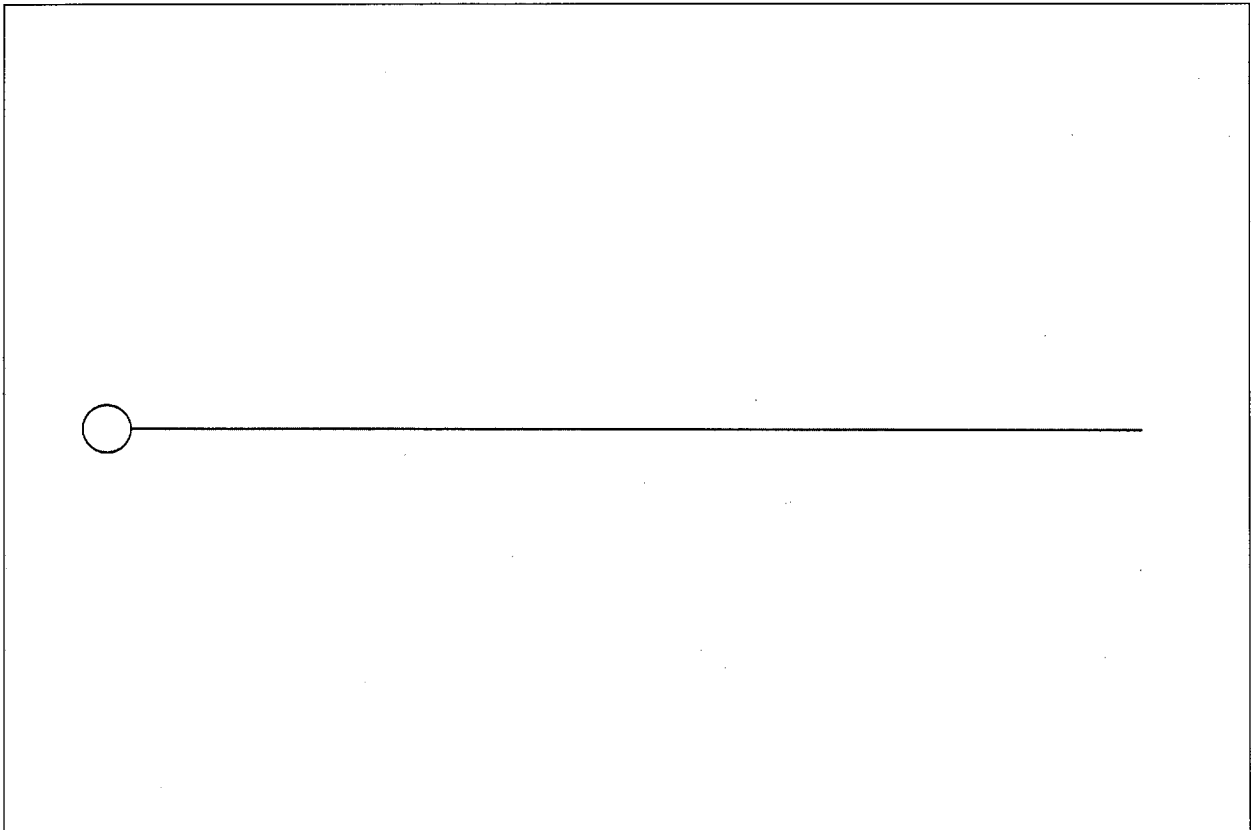


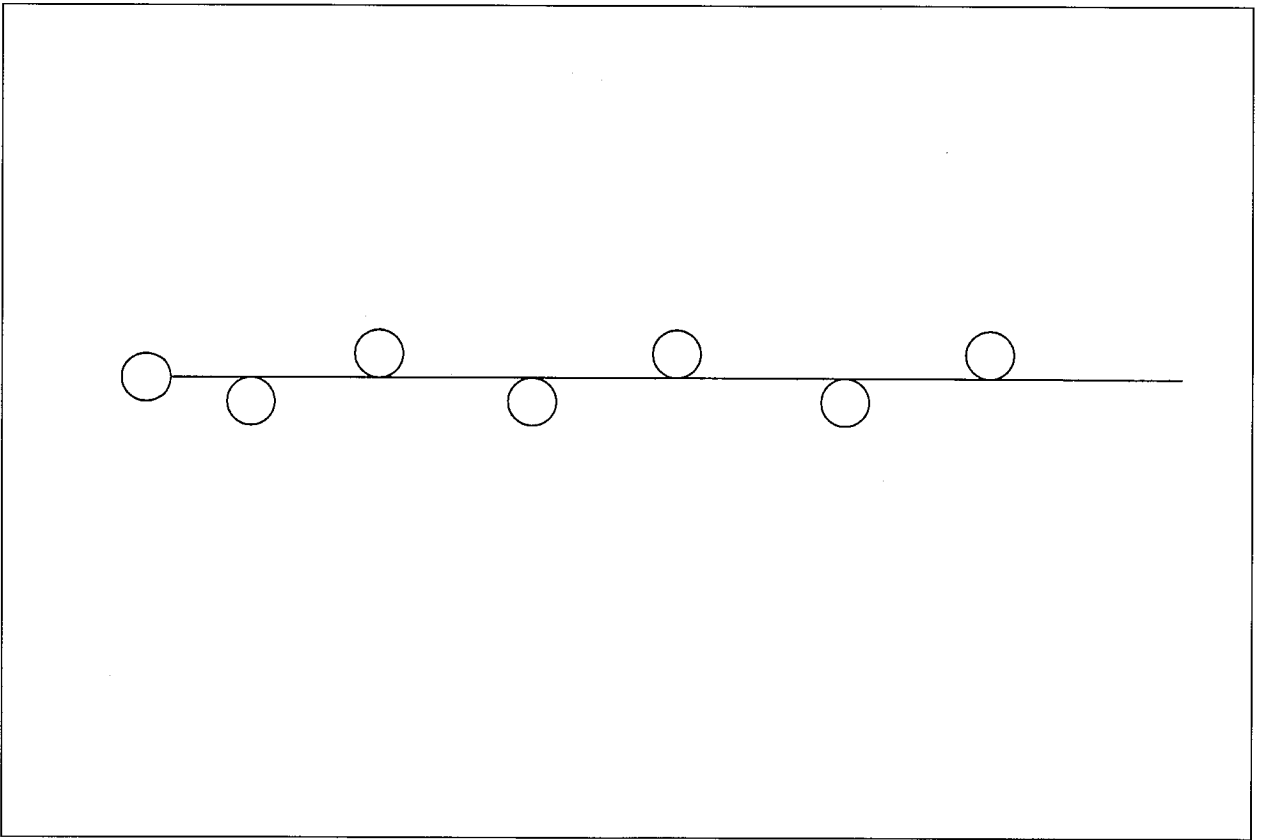
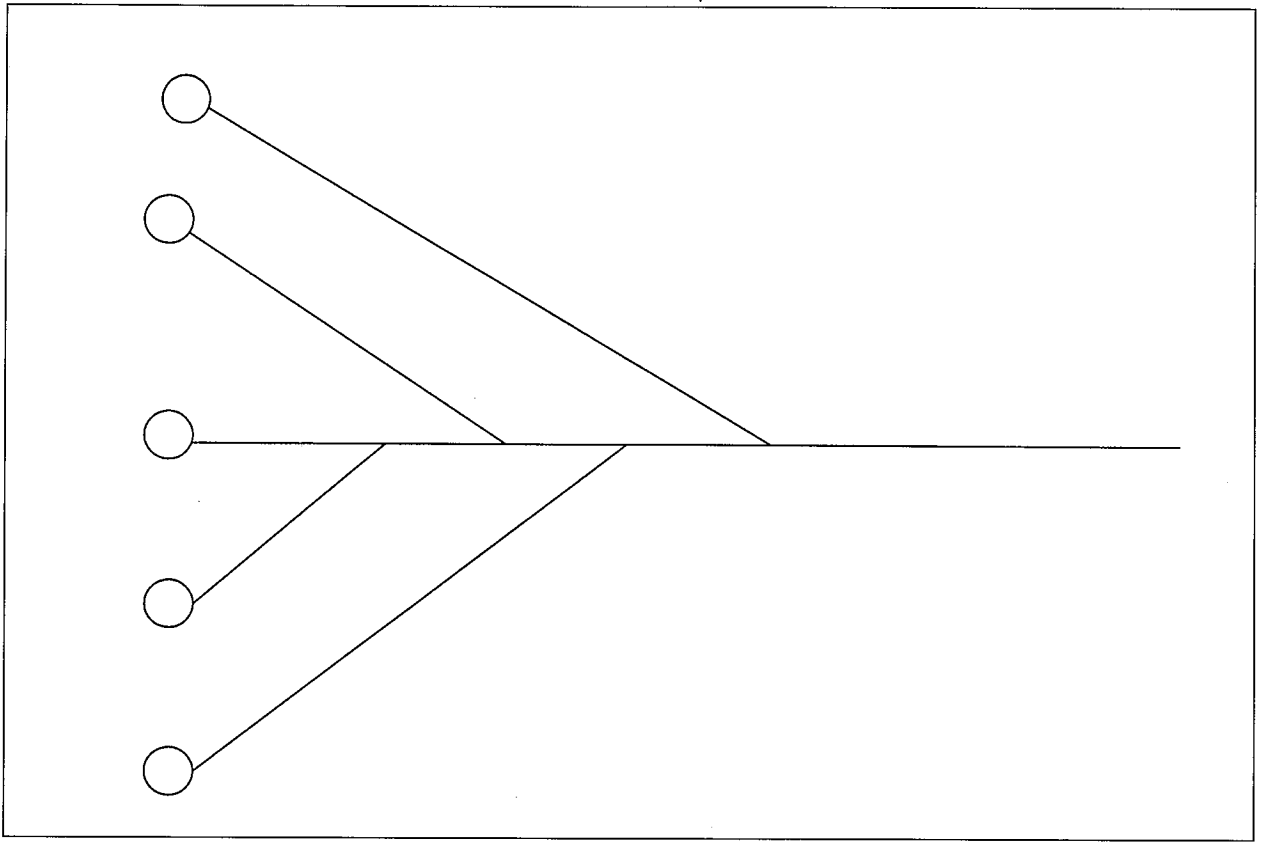
1.4 Flower Twins. Draw a line to connect the flowers that look alike.

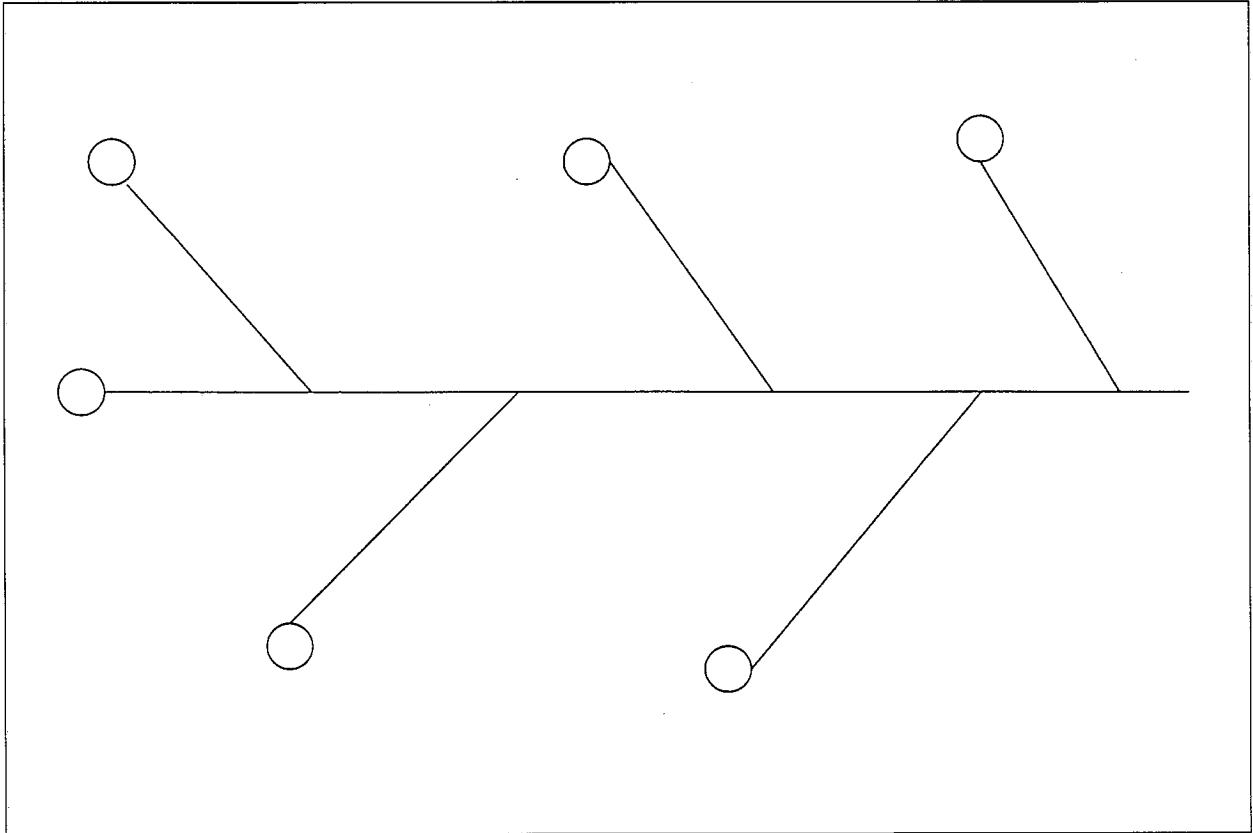
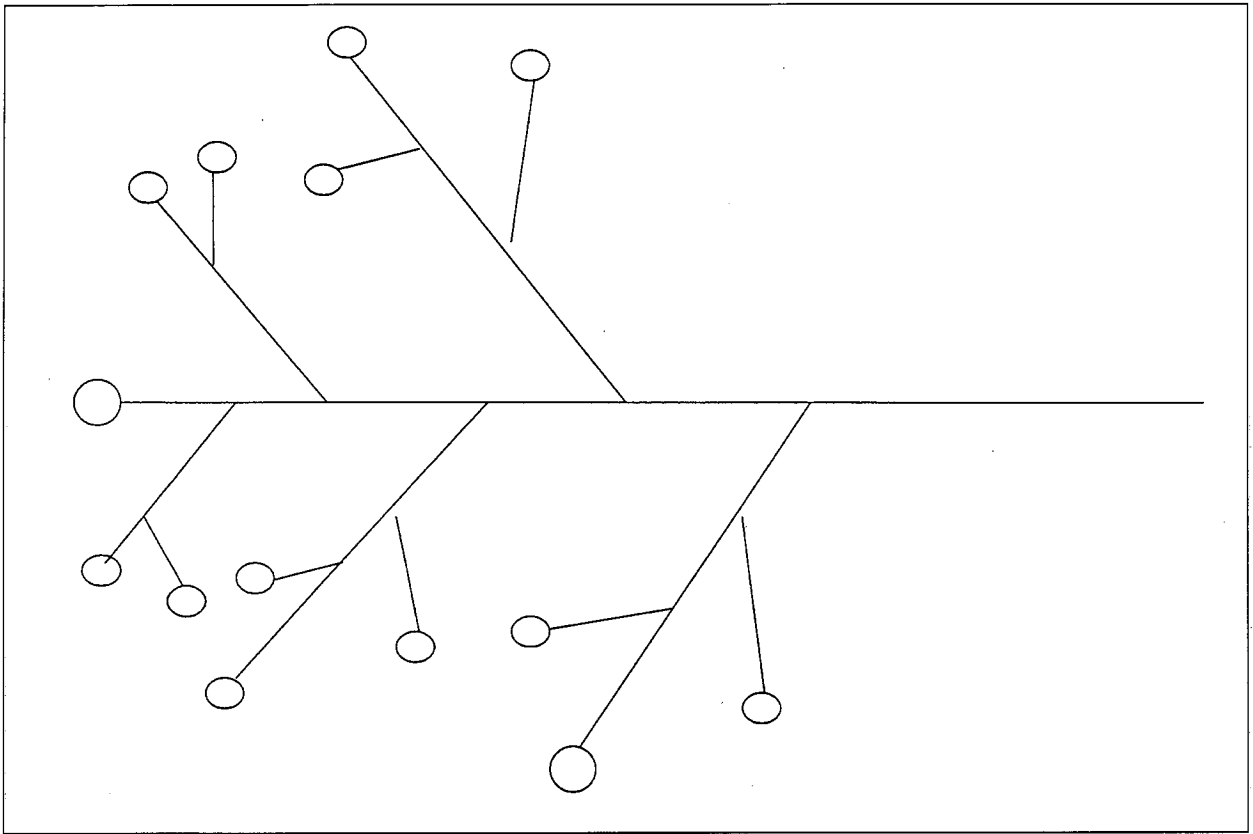


**2.3 The Essence of Inflorescence Pattern Cards.** Paste a copy onto index cards.

Fill each circle with a drop of squeezable "puff" paint to make inflorescences, then laminate.

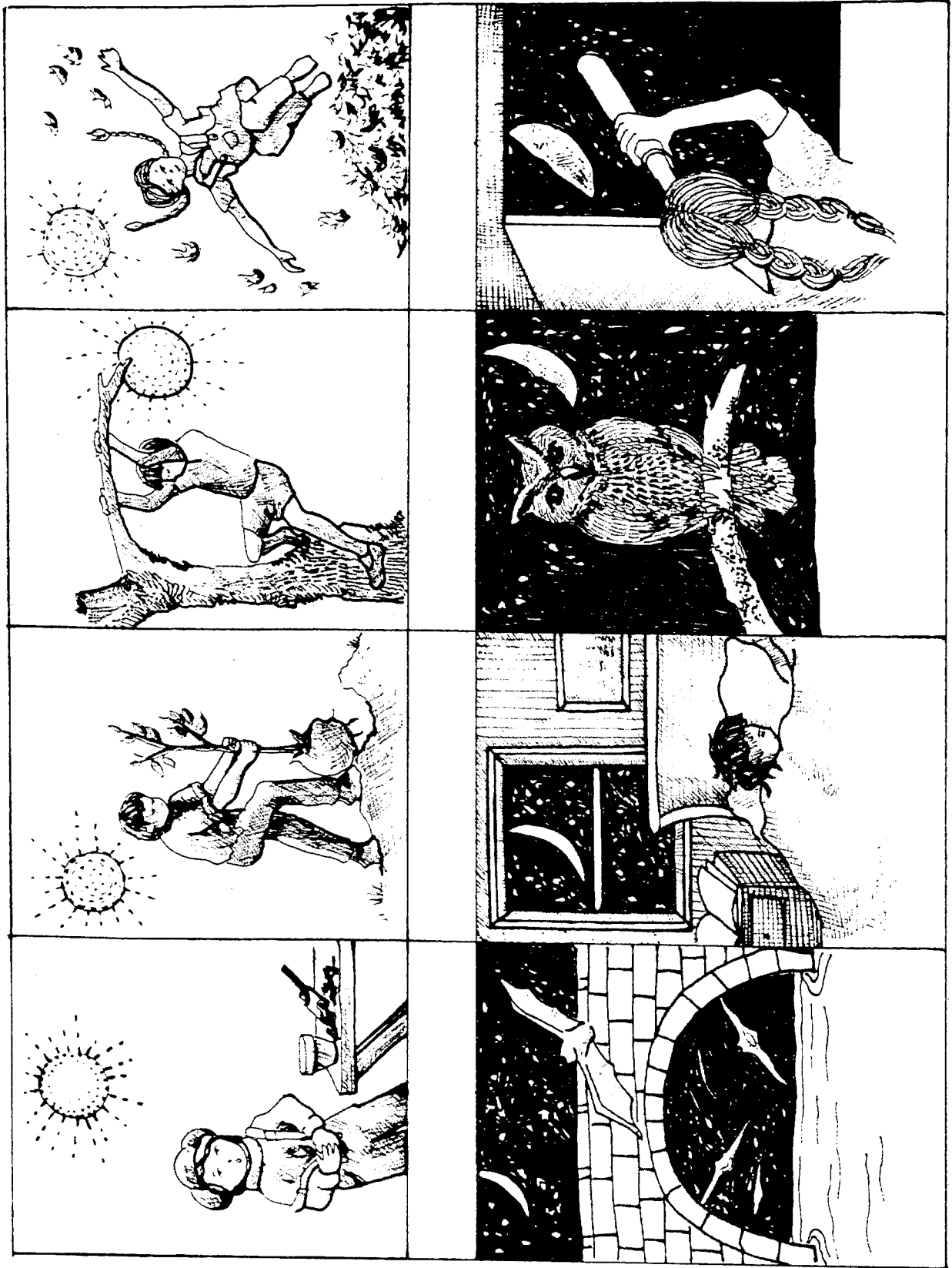




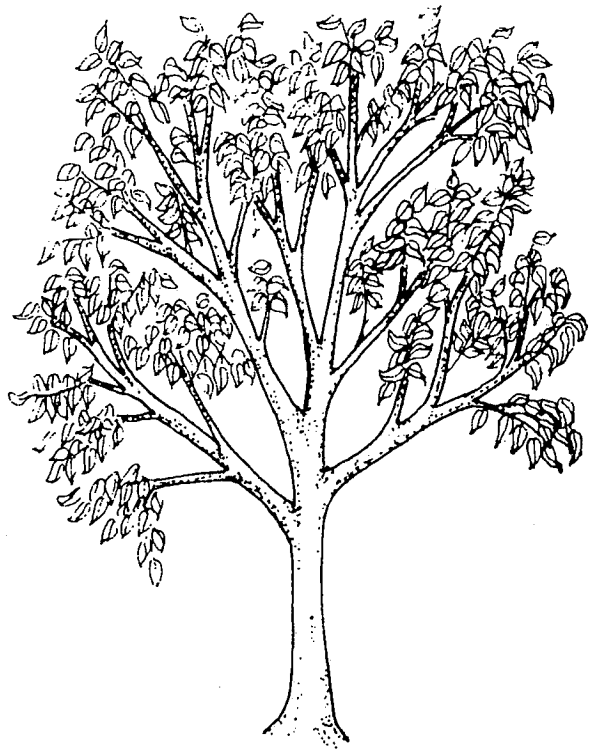
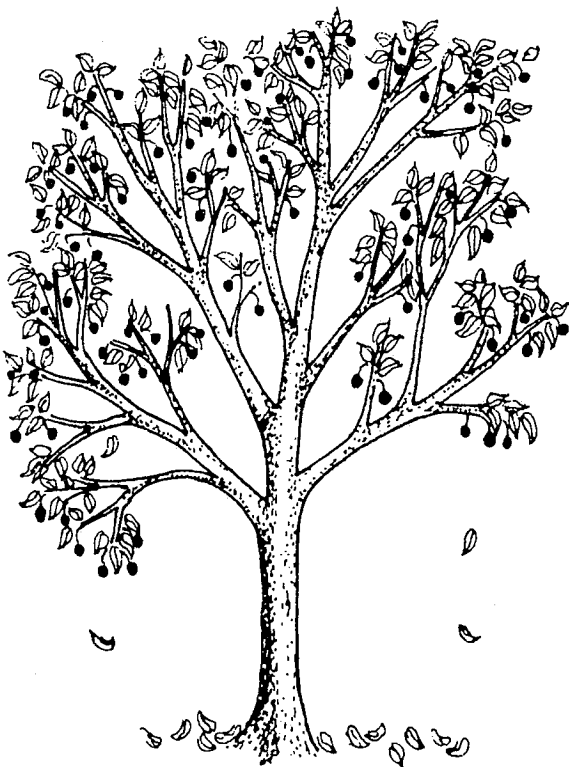
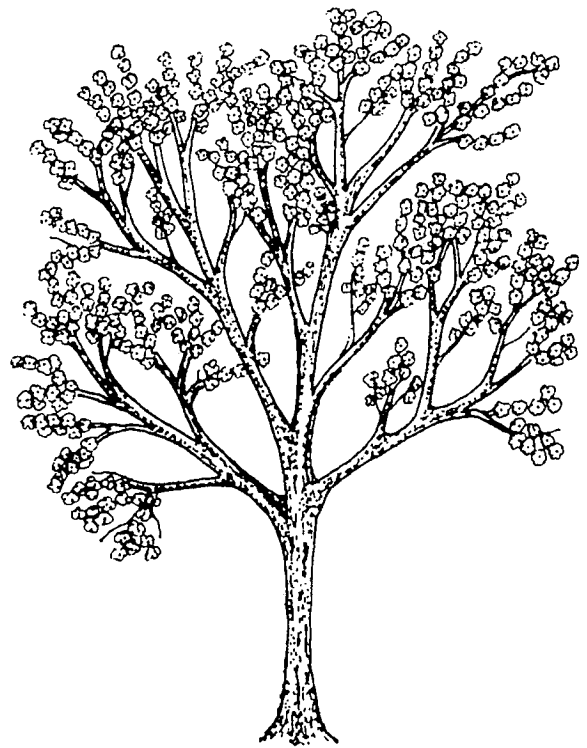
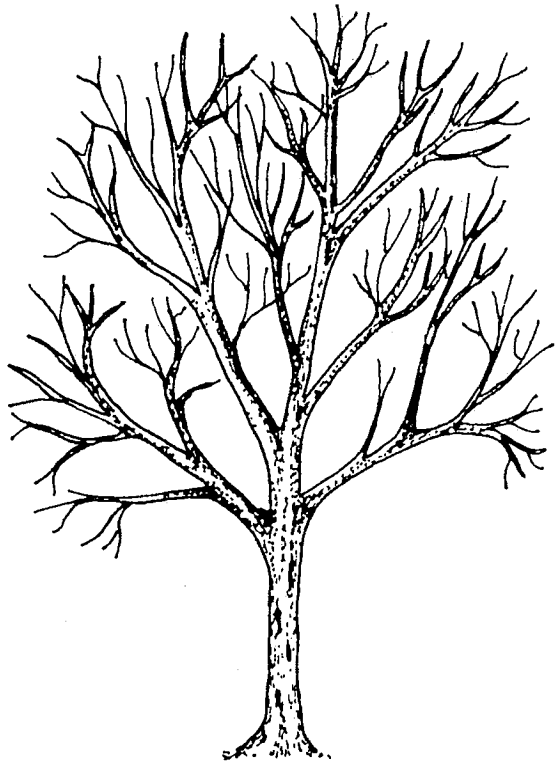


## 4.2 Patterns in Time–Life Links

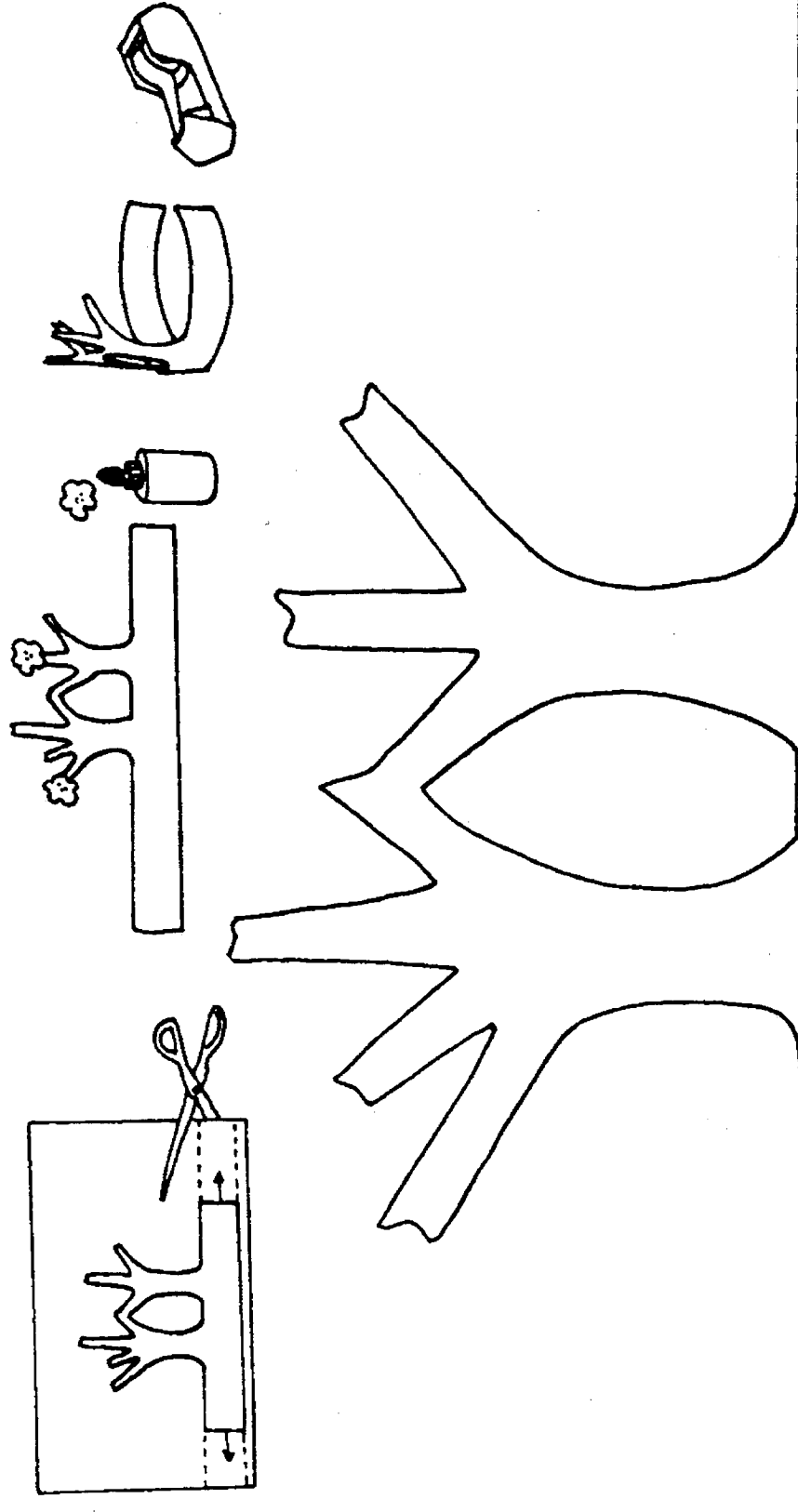

## 4.2 Patterns in Time-Life Links



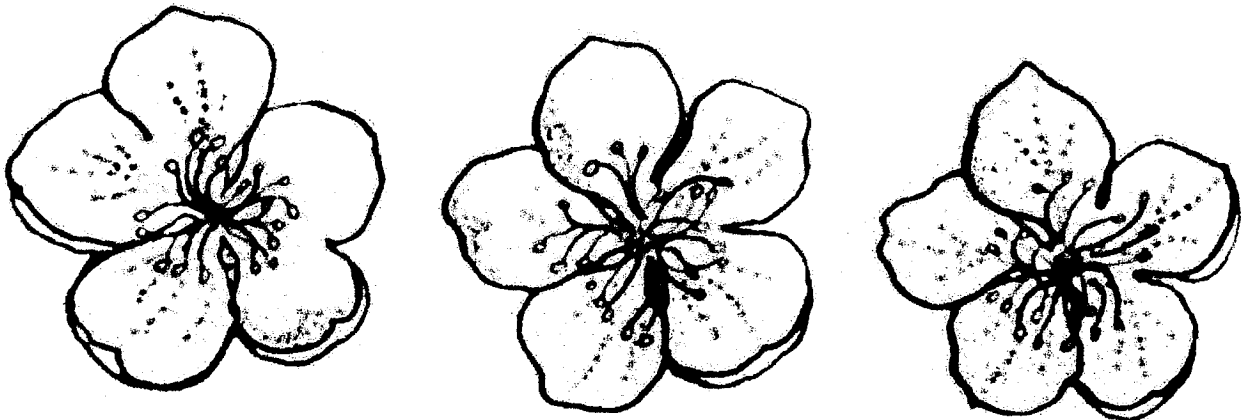
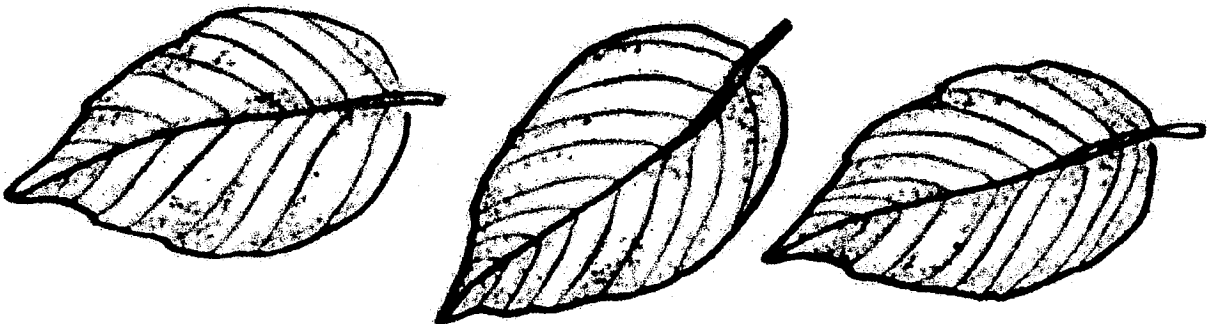
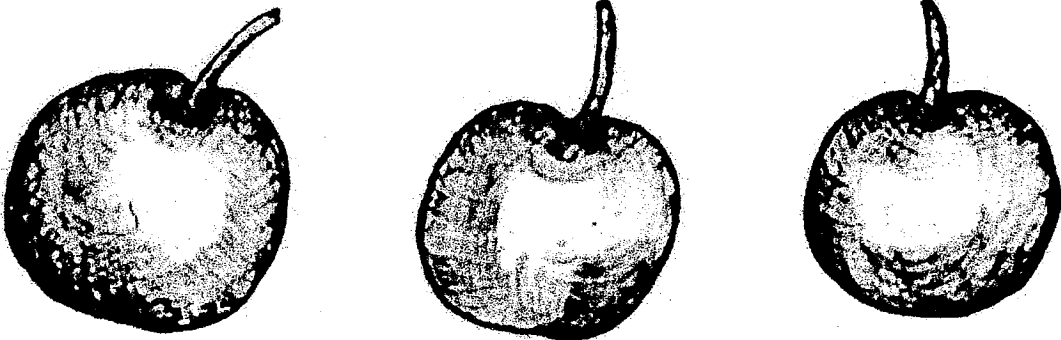
## 4.4 A Round of Seasons—Seasonal Changes



# 4.4 A Round of Seasons—Mexican Plum Tree Crown

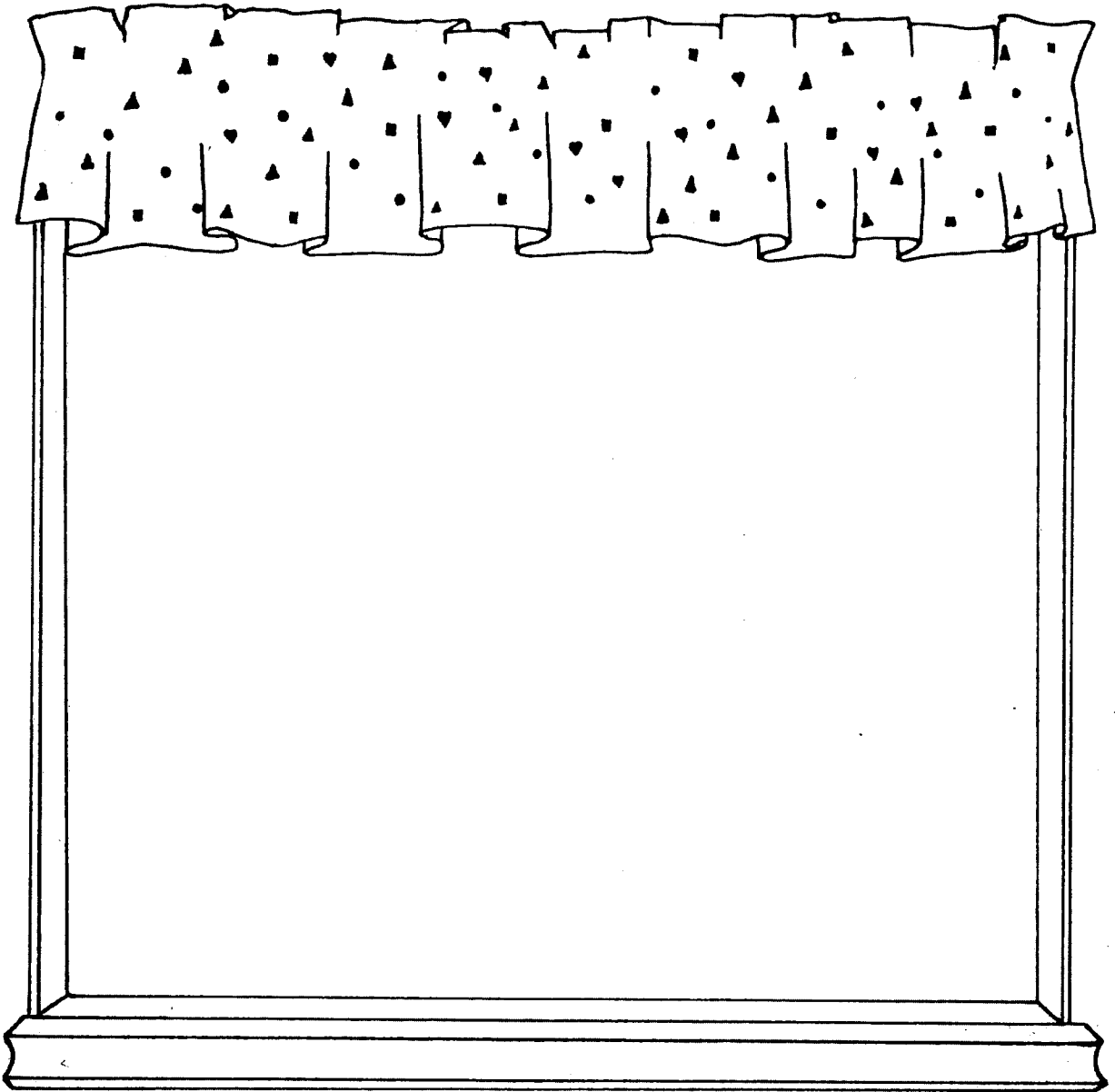


4.4. A Round of Seasons—Plums, Leaves, and Flowers





## 6.1 Shape Celebration—Book Cover



# Appendix 3: Texas Essential Knowledge and Skills

## Lesson 1 Flowers are made from shapes

Activity 1.1 Shapes-Go-Round: *Review basic shapes.*

TEKS: Math K(9B,C); Art K(1B)

Activity 1.2 Shape-a-Flower: *Make flowers with cutout shapes.*

TEKS: Math K(9A-C); Art K(1B); K(2A-C)

Activity 1.3 Floral Flip N' Match: *Match flower shapes and patterns.*

TEKS: Math K(8A-C); K(9A-C)

Activity 1.4 Flower Twins: *Match flower shapes.*

TEKS: Science K(3A); Math K(5); K(8A-C); English, Language Arts, & Reading K(1B,C); Art K(2A,C)

## Lesson 2 Flowers are made in patterns

Activity 2.1 Pattern Safari: *Explore the abundance of patterns in nature.*

TEKS: Math K(9A,B); English, Language Arts, & Reading K(1A-C,E); Art K(1B)

Activity 2.2 Pattern Power: *Make repeating patterns of colored shapes.*

TEKS: Science K(3A), K(4A); Math K(1A), K(2A), K(5), K(6A); English, Language Arts, & Reading K(1B,C); Art K(1B)

Activity 2.3 The Essence of Inflorescence: *Explore the ways flowers attach to stems.*

TEKS: Science K(5B,C); Math K(1B,C), K(4), K(5), K(7A), K(9A,B); Art K(1B)

## Lesson 3 Plants grow in patterns

Activity 3.1 Find-a-Shape Scavenger Hunt: *Match shapes in the garden.*

TEKS: Science K(2C), K(2E), K(1A), K(4A); Math K(9A-C), K(8A); English, Language Arts, & Reading K(1D); Art K(1A,B)

Activity 3.2 Make-believe Gardening: *Plant a garden of make-believe seeds.*

TEKS: Science K(5); Math K(5); Art K(2A-C)

Activity 3.3 What's Short or Tall? Trail Walk: *Observe plants growing in the meadow.*

TEKS: Science K(1A), K(2B,E), K(3A), K(4A); Math K(14A), K(1A,B), K(7A,B), K(8A,B), K(10A,B); Art K(1A,B); Social Studies K(5A,B)

## Lesson 4 Time passes in patterns

Activity 4.1 Patterns, Patterns Everywhere: *Explore different forms patterns can take.*

TEKS: Science K(5B); Math K(5), K(6A), K(9B); English, Language Arts, & Reading K(1B,C)

Activity 4.2 Patterns in Time: *Explore the patterns in days and weeks.*

TEKS: Science K(5B,C), K(7A); Math K(5), K(6A); English, Language Arts, & Reading K(1B,C)

Activity 4.3 Time in a Caterpillar's Life: *Discover patterns in the life of a caterpillar.*

TEKS: Science K(5B), K(7A,D); Math K(2A,B), K(5), K(6A), K(11C, D); English, Language Arts, & Reading K(1A-E); Social Studies K(3A,B)

Activity 4.4 A Round of Seasons: *Celebrate the pattern of seasons.*

TEKS: Science K(5B), K(7A, B); Math K(5), K(11 A-C); English, Language Arts, & Reading K(1B-D, F); Social Studies K(3B)

Extension Activity: *Adopt-a-Plant*

TEKS: Science K(1A), K(2B-E), K(4A,B); K(7A-D); Art K(2A-C); Social Studies K15(A-D)

## Lesson 5 Fruits grow in patterns

Activity 5.1 Tutti-Frutti: *Discover the seed patterns in different fruits.*

TEKS: Science K(1A), K(2B, C), K(3A), K(5A,B); Math K(5), K(1A-C); Art K(1A, B)

- Activity 5.2 Pattern-Kabobs: *Make patterns with pieces of fruit.*  
TEKS: Science K(5A, B); Math K(2A, B), K(5); Art K(1A, B)
- Activity 5.3 Prints Charming: *Use fruits to make stamp patterns.*  
TEKS: Math K(5), K(9B); Art K(1B), K(2A-C)
- Activity 5.4 A Seedy Experiment: *Estimate number of apple seeds.*  
TEKS: Science K(1A), K(2AB-E), K(4A, B), K(5C); Math K(1A-C), K(4), K(8A-C), K(12A,B), K(14A); English, Language Arts, & Reading K(1B-D)

**Unit Review: Nature is full of shapes and patterns**

- Activity 6.1 Shape Celebration! *Make a class book of shapes and patterns in nature.*  
TEKS: Science K(1A); Math K(5), K(9A, B); English, Language Arts, & Reading K(4B); Art K(1A, B), K(2A-C), K(3A); Social Studies K(16A, B)