Young children are naturally curious and want to observe, explore, and compare a variety of objects and events in their daily lives. During this series of learning experiences, students observe and explore the properties of matter using their own senses as tools. Students also explore other properties of objects and matter, including pitch of sound, color, geometric shape, smell, and texture as they make concrete comparative measurements in length, mass, capacity, and temperature of objects.

Kindergarten children will also enjoy the heartwarming story of how a girl named Emily Elizabeth became the owner of a very large red dog named Clifford. Students will observe the changes in Clifford and his belongings as he grows by making comparisons of length, mass, and capacity.
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Interdisciplinary Connections

See pages 43-48 for complete wording of the Texas Essential Knowledge & Skills for each content area TEKS addressed in this learning experience.
### Overview of Learning Experiences

| TEKS | 
| --- | --- |
| **K.4** | The student uses age-appropriate tools and models to verify that organisms and objects and parts of organisms and objects can be observed, described, and measured. The student is expected to: (A) identify and use senses as tools of observation; and (B) make observations using tools including hand lenses, balances, cups, bowls, and computers. |
| **K.5** | The student knows that objects and events have properties and patterns. The student is expected to: (A) describe properties of objects and characteristics of organisms (B) observe and identify patterns and predict what happens next; and (C) recognize and copy patterns. |
| **K.7** | The student knows that many types of change occur. The student is expected to: (A) observe, describe, and record changes in size, mass, color, position, quantity, time, temperature, sound, and movement; (B) identify that heat causes change, such as ice melting or the Sun warming the air, and compare objects according to temperature. |

*To read complete TEKS student expectations for K.5 and K.7, see page 43-48.*

| Engage | ♦ Students observe "Candy Connection" and list five senses, using sense cards. ♦ Students read *My Five Senses*, and discuss how senses help us observe and compare. ♦ Students predict the objects in the closed Secret Shoebox. ♦ Students read and agree to follow Safety Sense contract. |
| Explore | ♦ Students compare length of pipe cleaners, and sequence them. ♦ Students use senses to hear high and low tones of a xylophone. ♦ Students compare temperatures of objects. ♦ Students compare mass of objects by hefting and using a homemade balance. ♦ Students compare the masses of round objects, using a flat arm balance. |
| Explain | ♦ Students explain their experiences of using their senses to compare materials according to length, mass, capacity, and temperature. |
| Elaborate | ♦ Read *Clifford, the Small Red Puppy*, and discuss how he changed as he grew. ♦ Students compare the size of Clifford as a small puppy and a BIG dog in height and mass, using Clifford-like stuffed toys and accessories to make comparisons. ♦ Students read *Goldilocks and the Three Bears*, and dramatize it. ♦ Students participate in "Small/Tall Races" in P.E. |
| Evaluate | **SUMMATIVE ASSESSMENT** ♦ Students demonstrate understanding of comparison of length, mass, capacity, and temperature. |
Engage

A. The Candy Connection

1. Prepare a chart with 5 unlabeled columns.
2. Ask the students to close their eyes, without peeking, as you place a foil wrapped object on their desks. Do not mention that the object is a Gummy Life Saver.
3. Assure students that the object in front of them is safe to touch, and remind them that they still need to keep their eyes closed. Ask them to feel the object with their hands, and think of describing words to tell how it feels.
4. List student responses about how the object feels in the first column, without saying why.
5. Ask students to take the outside cover off the object, and ask if they notice or observe anything else about the object that they could tell about using describing words. Write any response about sound, such as the wrapper is crackly-sounding, in the second column.
6. Allow students to open their eyes. Ask them to open the inside wrapper, look carefully at the object, and think of describing words to tell what they observe. Write their responses about how the object looks in the third column.
7. Ask students if they notice or observe anything else about the object that they could describe. Gummy Life Savers smell very fruity when opened, so students will probably want to describe the odor. Discuss the importance of safety when smelling any substance, and that they should always wait for the teacher's instructions before smelling.

MATERIALS (details p. 38)

Candy Connection
For the class:
- chart paper
- markers
For each student:
- foil wrapped Gummy Life Savers (individual size)

My Five Senses
For the class:
- My Five Senses book
- chart for listing use of senses
For each group:
- sense icon cards
- crayons

Candy Connection Chart

<p>| | |</p>
<table>
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<tr>
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Emphasize safety concerns: Never smell or taste anything in science class without the teacher's permission.

- Students should wait for instructions from the teacher before smelling or tasting a substance or an object.
- Demonstrate how to smell an object safely by holding it away from you as you waft your hand toward your face.

8. List any words about the odor of the candy in the fourth column of the chart.

9. Ask if there are other ways they could observe the candy. Students will readily note that they should put the candy in their mouths to observe its taste. Emphasize that students should never taste or smell a substance without the teacher's permission and instructions. Give permission and instructions for students to carefully place the candy on their tongue. List any describing words about the taste of the candy in the fifth column of the chart.

10. Draw student’s attention to the chart. How are the describing words in the first column similar? Lead students to observe that all of the words are similar because they describe how the candy felt while it was in the wrapper. Ask what part of the body was used to feel the candy? After they agree that hands were used to feel the candy, hold up the Sense of Touch card, and ask where it should be placed on the chart. Emphasize that the skin, or covering of the hands and body help us to feel, so we are using the hand as a symbol for the sense of touch.

*K through Grade 2:*

People use their senses to find out about their surroundings and themselves. Different senses give different information. Sometimes a person can get different information about the same thing by moving closer to it or further away from it.

*Benchmarks for Science Literacy, p. 146*
11. Ask students to look at the describing words in the second column of the chart. Lead students to observe that they all have to do with hearing the candy wrapper. What part of the body helps us to hear? When all agree that our ears help us to hear, hold up the Sense of Hearing card, and ask where it should be placed on the chart. Place it at the top of the column that describes hearing the candy wrapper.

12. Ask students to look at the describing words in the third column of the chart, and lead students to observe that they are all similar because they describe how the candy looks. What part of our body helps us to see? When all agree that our eyes help us to see, hold up the Sense of Sight card, and place it at the top of the column of words that describe how the candy looks.

13. Ask students to look at the describing words in the fourth column of the chart, and lead students to observe that they are all similar because they describe how the candy smells. What part of our body helps us to smell? When all agree that our nose help us to smell, hold up the Sense of Smell card, and place it at the top of the column of words that describe how the candy smells.

14. Ask students to look at the describing words in the last column of the chart, and lead students to observe that they are all similar because they describe how the candy tastes. What part of our body helps us to taste? When all agree that our tongue helps us to taste, hold up the Sense of Taste card, and place it at the top of the column of words that describe how the candy tastes.

15. Ask students to use their fingers to count the senses we used to find out about Gummy Life Savers as you point to the overhead transparency of a hand with a sense at the end of each fingertip.
16. Discuss that when we use our senses as tools to find out about objects, we can use describing words to tell about their properties. Review the properties of the Gummy Life Savers® that were observed by students using their five senses, using the following questioning strategies:

- What colors of candy did you observe? (red, green, yellow, orange, purple)
- What sense did you use to observe the property of color? (sense of sight)
- What shape were the candies? (round, with a round hole in the middle)
- What sense/senses did you use to observe the property of shape? (sense of sight and touch)
- What other properties did you discover about the candy by using your sense of touch? (soft, bendable, squeezable, and smooth.)
- What properties of the candy did you discover by using your sense of smell? (They smell fruity.)
- What other properties of Gummy Life Savers did you discover? (They taste sweet and fruity!)
- Can we use our senses to observe other objects? Let’s find out in a book called My Five Senses by Aliki.

B. My Five Senses

1. Hand out plastic bags containing sense cards for each pair of students. Ask students to be active participants in the story by holding up a sense card when it is mentioned in the book.
2. Read the book on senses, pausing at each page to give students a chance to hold up their sense cards.
3. After reading the book aloud and sharing the illustrations, ask students to record picture responses on the My Five Senses Data sheet by drawing or pasting pictures of the objects observed by each sense in the story.

4. The completed My Five Senses Data sheet can be pasted on a page of each student’s journal.

- How many senses were described in the story? (Five, which can be reinforced by pointing to the sense symbols to the top of each finger as students name them.)
- What did the child observe using the sense of sight? (sun, frog, baby sister)
- What did the child observe using the sense of hearing? (drum, fire engine, bird)
- What did the child observe using the sense of smell? (flowers, soap, pine tree, fresh cookies)
- What did the child observe using the sense of taste? (ice cream, spaghetti, salad, milk)
- What did the child observe using the sense of touch? (rabbit, kitten, balloon, water)
- Did the child ever use more than one sense at a time? (playing with his puppy and playing ball)
- Why are senses so important to us? (They help us to be aware of what is going on around us.)
- Why is it important to follow safety rules? (Our senses are very important tools that help us find out about our world. We can protect our senses by following safety rules at school and at home.)
C. Safety Sense Contract

1. Read the safety contract to students, pointing to an overhead copy while reading. Make sure that students understand each part.

2. Ask students to write their name on the line marked Student signature, after discussing that this means that they promise to follow all of the safety rules.

3. Ask students to take the safety contract home so their parents can read and sign it.

4. The contract can be cut out and pasted into each child’s science journal as a handy reference and review of safety expectations.

D. My Science Journal of Senses

1. Provide each student with stapled primary journal pages to make a science journal of their discoveries about senses and other tools of observation.

2. Each page of the journal should have a large section for drawing pictures, and several widely spaced lines to paste or record comparison word cards.

3. Each student can demonstrate understanding of senses and other tools by creating a decorative cover for their journal.
Safety Sense Contract

I am learning how to use my senses and tools to observe in science class. I know that I can learn science best if I follow these safety rules:

a. I will listen carefully to the teacher’s directions, and make sure I know what to do before I begin an activity.

b. I will wait for permission to touch or use science materials or tools.
c. I will handle science materials and tools carefully, and put them away when I am finished using them.

d. I will protect my eyes by using safety goggles.

e. I will smell objects safely by holding them away from my face and wafting the smell toward me.

f. I will use my sense of taste only when given instructions and permission by the teacher.

I promise to follow these safety rules to protect myself and others.

Student signature ______________________________________

Parent signature ______________________________________
# Sense Cards

<table>
<thead>
<tr>
<th>Sense of Sight</th>
<th>Sense of Hearing</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Eye" /></td>
<td><img src="image" alt="Ear" /></td>
</tr>
<tr>
<td>Eye</td>
<td>Ear</td>
</tr>
<tr>
<td>Sense of Smell</td>
<td>Sense of Touch</td>
</tr>
<tr>
<td><img src="image" alt="Nose" /></td>
<td><img src="image" alt="Hand" /></td>
</tr>
<tr>
<td>Nose</td>
<td>Hand</td>
</tr>
</tbody>
</table>
Sense of Taste

Tongue
My Five Senses

Listen to the story called *My Five Senses*. Draw a picture in each box to show one object that each sense helped the child to observe.
E. Secret Shoebox

1. Prepare a small shoebox for each group by putting one of the matching objects inside the closed box. Place four objects on a tray: one object that matches the object in the box, and three other objects that do not match the object in the box.

2. Place an object in a large shoebox covered with wrapping paper to use as a demonstration with the whole class.

3. Hold up the large covered box, and ask students to predict what might be in the box without holding or shaking the box. After several predictions, ask why it is so hard to tell what is in the box? Could they make better predictions if they could use some of their senses to find out more about the object? What could they do to the box to find out something about what is inside? They may suggest holding the box to see if it is heavy or light, or shaking it to get some clues.

4. Ask each group’s Materials Manager to pick up a Secret Shoebox and a tray of four items. Explain that the shoebox only contains one item, and the item is identical to one of the items on the tray. Their job is to make careful observations of the box and its contents by shaking it or hefting it to compare its mass to the items on the tray.

5. Ask students to predict which item on the tray matches the object in the box, without putting their hands in or opening the box. The item chosen as matching should be placed outside the tray as a sign that the group has made a prediction.

6. After each group has predicted a matching object, allow members of the groups to take turns putting their hand inside the fabric-covered flap to gather more information about the object inside.

7. After everyone has had a turn putting their hand in the box, allow students to refine their prediction of

MATERIALS

- Secret Shoebox
  - For the class:
    - a large shoebox containing a stuffed animal, and covered in wrapping paper.
  - For each group:
    - tray
    - wooden blocks (2 each of rectangles, spheres, cubes, triangles, cones, cylinders)
    - round objects of different sizes (2 each of rubber balls, Styrofoam balls, large marbles)
    - a shoebox for each group with a hole at one end covered with a flap of fabric

Prediction is the use of knowledge to identify and explain observations, or changes, in advance.

National Science Education Standards, p. 116
the matching object on the tray before finally opening the top of the shoebox to see the object.

- Have there been any other occasions when you have tried to predict what was in a covered box? *(I try to find out what my Christmas presents contain by shaking them and listening.)*
- Why was it hard to predict what was inside the large, wrapped box that I held up? *(We couldn’t use our senses to find out about the object.)*
- What are some other ways we observed the object in the closed box? *(We listened to it rattling in the box by using our sense of hearing.)*
- Which senses did you use to make your first prediction about the object in the small shoebox? *(We used our sense of hearing and sense of touch to see how heavy it is.)*
- Which sense helped you discover more about the properties of the object in the box? *(When we were allowed to put our hands into the box, we could actually feel the shape of the object.)*
- What can we discover about the properties of an object by feeling it, or using our sense of touch? *(We can feel if it is a circle, square or triangle, if it has a smooth or rough texture, made of a hard or soft material, or if it is heavy or light.)*
- What sense were you unable to use until the box was opened? *(Our sense of sight.)*
- What properties of the object did you observe when the box was opened? *(We could see its color and shape with our sense of sight.)*
- What did we use to find out what was in the shoebox? *(We used our senses to find out the properties of the object.)*
- Since we use our senses to make discoveries about the properties of objects in science, could we call our senses important science tools?
EXPLORE

* Please note that an Explain section follows each Explore station.

Station 1: Comparing Length
1. Prepare plastic bags with five colors of pipe cleaners, cut in the lengths shown below:
   - Shortest - Red
   - Short - Orange
   - Medium - Yellow
   - Long - Green
   - Longer - Blue
   - Longest - Purple

2. Use a transparency of the Longer or Shorter data sheet on the overhead to provide an example of how to complete the data sheet. Discuss the words shorter and longer. Ask students to put the pipe cleaners in order from shortest to longest, and then color a line on the data sheet for each pipe cleaner to record the order of the pipe cleaner colors from shortest to longest.
**EXPLAIN**

1. Ask students to hold up their pipe cleaners to show the order from shortest to longest. Place a set of pipe cleaners on the Longer or Shorter transparency on the overhead. Draw the student's attention to the long line that goes across the bottom of the page. This is a starting line used to line up objects when comparing their length, just as runners in a race have to start at the *starting line*. To have a fair race, the runners all have to start running from the same place, called the *starting line*. To make a fair measurement, all of the objects also have to line up at the starting line.

2. To demonstrate the importance of the *starting line*, place a short pencil and a long pencil in your closed hand so that they appear to be the same length, judging by the portion of the pencil that can be seen. Ask students to compare the length of the pencils, and most would say they are the same.

3. Open your hand, and reveal that the pencils are not the same length. What made them look like they were the same length? *(They did not have a fair start, because one was "ahead" of the other one.)*

4. Which one is shortest? Point out the word shorter on the mat, and place the pencil at the starting line near the word shortest. Which one is longest? Point out the word longest on the mat, and place the longest pencil at the starting line near the word longest.

5. Encourage students to use comparison vocabulary by saying "This pipe cleaner is longest, so it belongs on this side of the mat." or "This pipe cleaner is shortest, so it goes on this side of the mat."

6. Ask students to name the colors of the pipe cleaners in order from shortest to longest. Does everyone have the same *pattern* of colors? *(Red, orange, yellow, green, blue,*
7. Ask students if they have ever seen this **pattern** of colors before, and where they saw it. Students who have experienced Light and Optical Systems will be able to recognize that the color order of the pipe cleaners is the same as the pattern of colors that appears in a rainbow. Show a picture of a rainbow, and discuss the repeating **pattern** of rainbow colors on the mats around the room.

8. Ask students to put all of the pipe cleaners back in the plastic bag, except for the green one.

9. Hand out three pieces of clay for each student. Then, ask them to make one clay snake that is the **same** length as the green pipe cleaner, one that is **shorter** than the green pipe cleaner, and one that is **longer** than the green pipe cleaner.

10. Ask each student to check and verify with their partner about the length and placement of the snakes on the mat.

- Why was it hard to tell which pencil was longer? *(The starting line of the pencils was hidden in your hand.)*
- Why is it important to line up objects at the same starting line when comparing length? *(So the objects start at the same starting point, like runners in a race.)*
- What was the **pattern** of colors in the pipe cleaners? *(The rainbow color pattern of red, orange, yellow, green, blue, violet.)*
- Can you think of other examples of **patterns** of letters, numbers, or objects? *(123, 123, 123) (abc, abc, abc) (boy, girl, boy, girl, boy, girl)*
Longer or Shorter Data Sheet

1. Put the pipe cleaners in order from shortest to longest.
2. Draw a colored line as long as each pipe cleaner to show the order.
EXPLORE
Station 2: Comparing Mass

1. Gather students into a circle in front of a demonstration table that holds a collection of items that are either heavy or light.
2. Hold up a wide plastic ruler, and ask students to predict if it can be balanced on one finger. Ask for several volunteers to try to balance the ruler on one finger. How do we know if the ruler is balanced?
3. Ask another student to hold up two things with very different masses, such as a book and a cotton ball. Ask the students which object is lighter? Which is heavier? Encourage the student to model the answer with his/her arms, saying, "The cotton ball is lighter than the book," or "The book is heavier than the cotton ball," while holding the hand and arm with the cotton ball much higher than the hand and arm with the book. Introduce that being heavy or light is another example of a property of an object.
4. At the mass station, ask students to continue to compare sets of objects by hefting them, with the book and the cotton ball as the first set of objects. Ask students to record a picture of each item in the appropriate column of the t-chart.
5. Some items are so close in mass that it is hard to compare them by hefting. Ask groups to use the flat beam balance to help them compare objects.
EXPLAIN

6. Discuss ways to make a more accurate comparison of the objects. Students may say it is hard to compare two small, light objects.

7. Show students a balance made out of a hanger, string, and two baskets. Ask how the balance is like the ruler. Put a heavy item, like a shell, in one basket. What happens to the hanger? What does that mean?

8. Ask students how they could change the parts of the homemade balance to compare heavy or light objects. Can they think of other materials or parts that will work together make a balance? Explain that when parts work together they are called a system.

- How do the pan of an empty hanger balance look? *(The sides look even and straight.)*
- What does it mean if one pan is lower than the other? *(That side has a heavier object on it than the other side.)*
- What does it mean if one pan is higher than the other? *(That side has a lighter object on it than the other side.)*
- Is the hanger balance a system? *(It is a system because it has parts that work together.)*
- Can you think of other materials to use to make a balance? *(Put a ruler on a pencil and balance it, so it works like a see-saw or flat beam balance.)*
- Let's practice using the flat beam balance to compare round objects.

K through Grade 2:

Students in the elementary grades acquire the experiences that they will use in the middle grades and beyond to develop an understanding of systems. Students should practice identifying the parts of things and how one part connects to and affects another. Students should predict the effects of removing or changing parts.

*Benchmarks for Science Literacy, p. 264*
Comparing Mass

1. Show students the two new blocks of clay, and ask if they think there is the same amount of clay in each one of the wrappers.
2. Remove wrappers from the clay, and roll one piece into a ball. Roll the other piece into a clay snake. Ask again if there is the same amount of clay in the two pieces of clay. How could we find out? Students may suggest using a dowel rod balance to compare the pieces of clay.
3. Review that a balance is a tool make a more accurate comparison of the heaviness or lightness of objects. There are many types of balances. Show students the large primary flat beam balance, and ask if it reminds them of a playground toy. Most would say it looks like a seesaw, even though they currently are seldom seen on school playgrounds. How does a seesaw work? Show a picture of a seesaw, and point out the parts that work together. Compare it to the primary balance.
4. Draw attention to the position of the “arms” of the balance. Ask students use their own arms to model what might happen to the arms of the balance when you place a yo-yo on one pan.
5. Ask students to look the round objects in the plastic bag, and put them in order from smallest to largest. Show this on the data sheet by cutting out the pictures of the round objects, and gluing them on the data sheet.
6. In the last set of boxes, students will use the balance to sequence the round objects from lightest to heaviest, and paste the pictures of the objects in the boxes from lightest to heaviest.
7. Is the largest object always the heaviest?

"Education for science literacy implies that students be helped to develop the habit of using tools, along with scientific and mathematical ideas and computation skills, to solve practical problems and to increase their understanding, throughout life, of how the world works."

Benchmarks For Scientific Literacy, p. 292
Size and Weight
Data Sheet

1. Cut out the pictures that match up with the round objects in the plastic bag, and sequence them in the boxes from smallest to largest.

Smallest          Largest

2. Use the flat beam balance to help you put the round objects in order from lightest to heaviest.

Lightest          Heaviest
EXPLORE
Station 3: Comparing Temperature

1. Ask students from each group to place their right hand on a warm baggie of water. Ask students to find things in the room that are warmer than the baggie felt, and cooler than the baggie felt.

2. Make a class list of objects that are warmer or cooler than the baggie.
   - What items were warmer than the baggie?
   - What items were colder than the baggie?
   - Would an object like a window be different in summer or winter? (The windows would hot in the summer if sun is shining on them, but cold in winter)
   - What are clues that an object is too hot to touch? (Steam comes off them, they feel warm when your hand gets close, and they glow.)

3. Ask students to sequence the It’s Hot or Not Cards, from coldest to hottest.

4. Allow students to cut out pictures from magazines to make new sets of cold, warm and hot pictures to play the game with partners.

Questioning Strategies

MATERIALS (details p. 40)

For the class:
- freezer baggies
- warm water
- cold water

For each group:
- set of It’s Hot or Not cards in a plastic bag
It’s Hot Or Not

Cut out the pictures, and place them in order from coldest to hottest.

1. wooden block
2. ice
3. child’s hand
4. boiling soup
E LABORATE

A. Clifford, The Small Red Puppy

1. Tell students you are going to share a book with them about a very special pet called Clifford, the Small Red Puppy by Norman Bridwell. Ask students to listen carefully and be ready to talk about any changes they observe in Clifford. After reading the book aloud and sharing the illustrations, ask students the following types of questions:

- Who is telling the story in the book? (A girl named Emily Elizabeth is telling her friend Martha the story of how she got her dog, Clifford.)
- Where did Emily get her dog? (A neighbor’s dog had puppies, and her parents let her choose one.)
- Can you describe her puppy? (He was red, and much smaller than the other puppies. He was so small that Emily had to feed him with a baby bottle, and the smallest dog collar was too big for him. He was so small that he always got lost, even in their small apartment. Emily was worried that he was too small, so she let him sleep on her pillow, and told him that she wished he could grow to be a big dog.)
- How did Clifford change after Emily’s wish? (Clifford began to grow. He got too big for their small apartment, so he had to go and live with Emily’s uncle in the country.)
- Did Emily and Clifford get to see each other again? (Emily’s father got a new job with her uncle, and Emily moved to a house in the country where she could have Clifford.)
- Did Clifford keep growing? (He stopped growing when Emily told him he was just the right size.)
- Is this story realistic or make-believe? (make-believe)
- Let’s compare Clifford and some items that he used to find out how he changes as he grew.
Comparing the Mass of Clifford’s Friends

1. Show students the large and small stuffed Clifford dogs. Ask students which one is like Clifford the puppy? Ask students which one is like Clifford as a grown dog?

2. Ask a student volunteer to hold a large and small Clifford stuffed toy, one in each hand, with arms extended. Which one is the heaviest? Most students will guess that the large one is the heaviest. Ask the student to exaggerate how heavy the large one is by letting it “weigh down” that arm. Do we need to use a balance to compare which of the Clifford dogs is heaviest?

3. What if we want to compare two items that are very similar, such as Clifford’s little stuffed dog friends? What could we use to compare them? (Students will suggest making a homemade balance, or using a flat beam balance.)

4. Explain that there are many types of balances, such as the rocker arm balance on the demonstration table. Ask where the “arms” of the balance might be located.

Ask a student volunteer to place one of Clifford’s stuffed dog friends in one pan of the balance. What happens to the pan after the object is placed on it? How could we compare the two stuffed dogs? Follow student suggestions about placing the other dog in the other pan of the balance.

- What are the pans used for? *(to hold objects)*
- Which balance does the rocker arm balance remind you of? *(the hanger and the dowel rod balance)*
- What are the parts of the rocker arm balance system? *(arms, pans, support stand, pointer)*
- Which of the stuffed dog friends is the heaviest, or has the most mass?
Length of Clifford’s Collar

1. Ask students to look at the size-sorting mat on the overhead. Review that the starting line is used when comparing length of objects, just as runners in a race have to start at the starting line.

2. Push a pencil through the dog collar rings, and use it to hold up the dog collars. Which collar is shortest? Which collar is longest? Where is the starting line?

3. Ask students which collar size might fit the Clifford the puppy? Ask students which collar size might fit the Clifford when he was grown? How could we test it? (Most students would suggest trying the collars on Clifford.)

4. What if Emily Elizabeth needed to buy Clifford a collar, but couldn’t bring him with her because he was too small, or too big? How could she remember the size of Clifford’s neck when she went to the pet store? Lead students to the idea of stretching a piece of red yarn around each of the Clifford dog’s necks to find out the length of each collar.

5. Then, ask them to choose the yarn “collar” that would fit Clifford the puppy, and place it on the mat on the starting line. They should also choose a yarn “collar” that would fit big Clifford, and place it on the mat at the starting line. Using the third piece of yarn, they will make a “collar” that is a size that would fit Martha’s dog and place it on the mat, which is the longest? Which is the shortest? Are they in order by size?

**Questioning Strategies**

- Why is it important to use the same starting line when comparing length? (So it will be the same starting point, like runners in a race.)
- How did you describe small Clifford’s collar length? (shortest)
- How did you describe large Clifford’s collar length? (longest)
Capacity of Clifford’s Dish

1. Hold up the small and large dog food dishes. Ask them which one holds enough food for Clifford the puppy, or Clifford the adult dog. How much material an object can hold is called capacity, which is a property of an object. Ask which food dish holds more, and put the holds more sign in front of it. Ask which one holds less, and put the holds less sign in front of it.

2. Point to the variety of containers on the table, and ask students to observe their properties, such as shape and color. Some have tall, thin shapes, while others are short and wide. Some have curved sides, while others have straight sides. Note the stickers on the containers, which are circles, squares and triangles of different colors. Discuss the shape of each sticker, so students will notice that the circle stickers have curved sides, while the square and triangle have straight sides. Review each sticker color to reinforce color and shape as properties.

3. Ask which of the containers might hold the same amount as the large food dish? Discuss that predicting how much a container can hold is also called estimating. How could we check our prediction or estimate? Students will suggest that we could pour the rice in each container in the large food dish to check our estimate.

4. Show a tall, thin container of rice that is filled past the top of the container, and ask if it is full. Ask how we could make sure it had rice just to the top of the container, rather than being too full? Lead students to suggest leveling the rice off with a craft stick so it will be filled just to the top of the container. Discuss that filling the containers to the top and leveling it off is important to make sure it is a fair comparison.

K through Grade 2:

Students should know that shapes such as circles, squares, and triangles can be used to describe many things that can be seen.

Benchmarks for Science Literacy, p. 223
5. Ask students to estimate if the large rice container might hold the more, less, or the same amount of rice as the large dog dish. Place the dish over a large tub to model how to pour materials so that spills will be caught in the tub.

6. Model pouring the rice from the large rice container, which has an orange dot on it, into the dog dish. As the rice overflows over the edge of the dog dish, ask students where we should put the orange dot on the Holds More, Less, or the Same chart. They will agree that it should be placed under the Holds More column because it overflowed over the edge of the dog dish. Model examples of Holds Less and Holds the Same to give students practice with comparing capacity.

7. Ask students to color in the shape and color of the sticker on each container on the Which Holds More? data sheet after the class tests each container and places the sticker in the correct column of the chart.
Which Holds More?

Put the stickers from the containers in the correct circle.

- More
- Same
- Less
Properties Matter                      Teaching Guide                      Grade K

B. Small/Tall Race

1. Have students stand at the starting line marked with tape, and ask them to model how they could make their bodies as small as possible. (Demonstrate how to crouch down to get “smaller”, if needed.)
2. Students race by walking as fast as they can while staying “small” all the way to the end line.
3. Ask them to model how to make their bodies as tall as possible. Point out students who are stretching very tall.
4. Students race by walking as fast as they can while staying “tall” all the way to the end.

C. A House for the Three Bears

1. Read Goldilocks and the Three Bears, and ask students what is different about the furniture for the Daddy bear, Mama bear, and Baby bear.
2. Generate a list of furniture that is mentioned in the story on chart paper.
3. Using the materials provided, students make a “house” for the bears out a shoebox.
4. Students also design furniture in small medium, and large sizes for each one of the bears, using clay or other materials.
5. Act out the story of Goldilocks and the Three Bears, giving Papa Bear a low sounding voice, Mama Bear a medium sounding voice, and Baby Bear a high sounding voice.

MATERIALS (details p. 31)

Small/Tall Races
For each group:
☐ masking tape lines

A House for the Three Bears
For the class:
☐ Goldilocks and the Three Bears book

For each group:
☐ clay
☐ shoeboxes
☐ construction paper
☐ scissors
☐ glue sticks
☐ crayons
**EVALUATE**

1. Have students complete the summative assessment sheet. In most cases, the teacher will need to read and explain the instructions and format as students mark and draw answers. In other cases, the teacher may need to read the questions and record the student’s oral responses. To assist the kindergarten students' orientation on the sheet, small icons have been added to some lines. For example, prior to reading the instructions for the first item, the teacher can direct the students' attention to the box with the flower beside it. It is often helpful to have the student place the index finger of the hand they do not write with on top of the icon (left or right depending upon their handedness). After allowing ample time for students to mark their answer, the teacher can then direct attention to the box with the bunny beside it, and so on.
Properties Matter
Assessment

Color the circle red, the square green, and the triangle yellow.

- Circle the picture of the heavier pet.

- Circle the picture of the lighter pet.

Put an X on the shape with curved sides.

- Circle the picture of the heavier pet.

- Circle the picture of the lighter pet.
Which sense helps us to compare hot or cold bath water? Circle your answer.

Which sense helps us to compare the length of yarn? Circle your answer.

Which sense helps us to compare sounds? Circle your answer.

Which sense helps us to compare odors? Circle your answer.

Which sense helps us to find out if a dessert is sweet? Circle your answer.
Assessment

Circle the picture that shows how to compare length of crayons.

Circle the picture that shows how to compare which holds more.

Draw the part of the balance system that is missing in the box.

Draw a picture of a balance that compares two toys that weigh the same amount.
# Properties Matter

## Scoring Rubric

<table>
<thead>
<tr>
<th>TASK</th>
<th>CRITERIA</th>
<th>BEGINNING LEARNER</th>
<th>MEETING EXPECTATIONS</th>
<th>EXCEEDING EXPECTATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEKS K.4</td>
<td>Identifies properties of color and shape</td>
<td>Identifies less than 2 shapes and colors</td>
<td>Identifies all 3 shapes and colors</td>
<td>Identifies all 3 shapes and colors plus recognizes shape with curved sides</td>
</tr>
<tr>
<td>TEKS K.5</td>
<td>Identifies senses used to observe</td>
<td>Identifies less than 3 senses</td>
<td>Identifies 3 or more senses</td>
<td>Identifies all 5 senses</td>
</tr>
<tr>
<td>TEKS K.6</td>
<td>Identifies procedures for comparing length, mass, capacity, and temperature</td>
<td>Identifies less than 2 procedures</td>
<td>Identifies 3 procedures</td>
<td>Identifies procedures for comparing length, mass, capacity, and temperature</td>
</tr>
<tr>
<td>Analyze parts of a system</td>
<td>Identifies how the parts of the balance system work</td>
<td>Does not draw balance correctly</td>
<td>Draws balance correctly</td>
<td>Draws balance correctly, and shows toys on level arms</td>
</tr>
<tr>
<td></td>
<td>Identifies balance parts working together as system (Baskets, arms, and string)</td>
<td>Does not draw balance correctly AND does not draw missing part</td>
<td>Draws balance correctly OR draws missing part</td>
<td>Draws balance correctly AND draws missing part</td>
</tr>
</tbody>
</table>
Materials Detail Sheet

ENGAGE

Candy Connection
For the class:
☐ chart paper
☐ markers
For each student:
☐ foil wrapped Gummy Life Savers (individual size)

My Five Senses
For the class:
*Currently available at most bookstores for $4.95*
☐ chart for listing use of senses
For each group:
☐ sense icon cards (Prepare a laminated set for each pair of students from Sense Card Masters)
☐ crayons

Secret Shoebox
For the class:
☐ a large shoebox covered
in wrapping paper, containing a stuffed animal

For each group:
☐ tray for comparison objects
☐ wooden blocks (2 each of rectangles, spheres, cubes, cylinders)
☐ round objects of different sizes (2 each of rubber balls, Styrofoam balls, large marbles)
☐ pens, pencils, pennies (2 of each)
☐ a shoebox for each group with an opening at one end covered with a flap of fabric
EXPLORE

Comparing Length
For the class:
☐ Longer or Shorter? Data Sheet transparency
☐ overhead projector

For each group:
☐ plastic bag of rainbow pipe cleaners (Cut in: Shortest - Red, Short - Orange, Medium
- Yellow, Long - Green, Longer - Blue, Longest - Purple)

For each student:
☐ Longer or Shorter? Data Sheet

Capacity Xylophone
For the class:
☐ one large glass of water
☐ pencil or plastic spoon
☐ toy xylophone

For each group:
☐ 3 small jars or glasses (fill one with \( \frac{1}{2} \) cup of water and add 4 drops of red food
coloring, one with one cup of water with 4 drops of green food coloring, and one with 1 \( \frac{1}{2} \)
cup of water with 4 drops of blue food coloring)
☐ pencil or plastic spoon
☐ water
☐ food coloring
☐ measuring cup
☐ Capacity Xylophone station card

For each student:
☐ science journal
☐ paper models of jars
Comparing mass
For the class:
- large homemade dowel balance (3 pieces of string, dowel rod, binder clips)
- homemade hanger balance
- large flat beam balance
- new blocks of clay
- yo-yo
- picture of a seesaw

For each group:
- items of varying mass (plastic animals, pencil, small book, pennies, washers, shells, cotton balls)
- homemade hanger balance (Use a hanger with skirt clips, and suspend by a string attached to the curved part of hanger.)
- homemade ruler balance (Made with 3 pieces of string, ruler with three holes, and binder clips. Suspend the ruler from a string attached to the middle hole of the ruler, and attach the binder clips by strings that go through the holes at each end of the ruler)
- heavier, lighter signs
- flat beam balance
- plastic bag of round objects (marbles, wooden balls, styrofoam balls, steel ball)

For each student:
- heavier or lighter chart in student journal
- crayons
- Size and Weight Data Sheet
- Extra sheet of round objects pictures from Size and Weight Data Sheet
- scissors
- glue stick

Comparing Temperature
For the class:
- freezer baggies
- warm water
- cold water
- Warmer/Cooler chart

For each group:
- set of It’s Hot or Not cards in a plastic bag
ELABORATE

For the class:
  - Currently available at most area bookstores for $3.50
- large Clifford stuffed dog, sold at local discount stores
- small Clifford stuffed dog, sold at local discount stores
- large red dog dish with a Clifford label (made with label maker)
- small Clifford dog dish
- small baby bottle
- medium dog collar
- large dog collar
- small Clifford stuffed dog friends
- large, medium, and small containers of different shapes, with stickers of different colors and shapes

For each group of students:
- rocker arm balance
- longest, shortest mat
- red yarn
- paper “collar” models (Student Page P)

For each student:
- Longest, shortest mat
- Which Holds More? Data sheet

EVALUATE

For the class:
- transparencies of Properties Matter Student Assessment Sheets

For each student:
- Properties Matter Student Assessment Sheets
- Properties Matter Rubric
- crayons
Background Information for Teachers

Young children naturally begin to compare and quantify the objects and events in their lives from an early age. They want to know how much candy they are allowed to eat, how late they can stay up, and how much farther they will have to ride in the car on a trip. Fostering a young child’s ability to observe the world in a quantitative manner provides them with a solid foundation for understanding many science and math concepts. Children can develop an understanding of measurement procedures most effectively in a sequential set of experiences that begins with concrete comparative measurements, progresses to nonstandard units of measure, and culminates in the proficient use of the units and tools of standard metric measurement.

Children should have many comparative experiences before they are expected to learn nonstandard or standard units of measure. In the earliest stages of measurement concept development, children learn to make direct comparisons between the properties of objects, people, or events. For example, two children can quickly compare the amount of candy given to each of them in a birthday party candy bag! Other direct comparisons children might make about the properties or attributes of objects, events, and people in their lives could include: “Daddy is taller than I am,” or “I get to stay up later than the baby because I am older.” Activities that build upon this natural inclination to compare and order objects based on their properties will help children develop a concrete understanding of measurement procedures, and foster cognitive skills in conservation, ordering, and estimation that are essential to success in reading and mathematics.

The first step in comparing or measuring is to determine what property or attribute of an object to measure. Properties such as length, width, height, mass, temperature, or capacity of objects can be measured. Students should experience many properties of objects by using their senses as important science tools. They should have many opportunities to see, smell, touch, hear, and taste as they learn to observe matter and describe its properties.
Science TEKS

K.1 The student participates in classroom and field investigations following home and school safety procedures. The student is expected to:
   (A) demonstrate safe practices during classroom and field investigations.

K.2 The student develops abilities necessary to do scientific inquiry in the field and the classroom. The student is expected to:
   (A) ask questions about organisms, objects, and events;
   (B) plan and conduct simple descriptive investigations;
   (C) gather information using simple equipment and tools to extend the senses;
   (D) construct reasonable explanations using information;
   (E) communicate findings about simple investigations.

K.3 The student knows that information and critical thinking are used in making decisions. The student is expected to:
   (A) make decisions using information;
   (B) discuss and justify the merits of decisions;
   (C) explain a problem in his/her own words and propose a solution.

K.4 The student uses age-appropriate tools and models to verify that organisms and objects and parts of organisms and objects can be observed, described, and measured. The student is expected to:
   (A) identify and use senses as tools of observation; and
   (B) make observations using tools including hand lenses, balances, cups, bowls, and computers.

K.5 The student knows that organisms, objects, and events have properties and patterns. The student is expected to:
   (A) describe properties of objects and characteristics of organisms;
   (B) observe and identify patterns including seasons, growth, and day and night and predict what happens next;
   (C) recognize and copy patterns seen in charts and graphs.
K.7 The student knows that many types of change occur. The student is expected to:
   (A) observe, describe, and record changes in size, mass, color, position, quantity, 
   time, temperature, sound, and movement;
   (B) identify that heat causes change, such as ice melting or the Sun warming the air, 
   and compare objects according to temperature.

**Language Arts TEKS**

**K(1) Listening/speaking/purposes.** The student listens attentively and engages actively in 
a variety of oral language experiences. The student is expected to:
   (A) determine the purposes for listening such as to get information, to solve 
   problems, and to enjoy and appreciate;
   (B) respond appropriately and courteously to directions and questions;
   (C) participate in rhymes, songs, conversations, and discussions;
   (D) listen critically to interpret and evaluate;
   (E) listen responsively to stories and other texts read aloud, including selections 
   from classic and contemporary works.

**K(3) Listening/speaking/audiences/oral grammar.** The student speaks appropriately to 
different audiences for different purposes and occasions. The student is expected to:
   (C) ask and answer relevant questions and make contributions in small and large 
   group discussions.

**K(4) Listening/speaking/communication.** The student communicates clearly by putting 
thoughts and feelings into spoken words. The student is expected to:
   (A) learn the vocabulary of school such as numbers, shapes, colors, directions, and 
categories;
   (B) uses vocabulary to describe clearly ideas, feelings, and experiences;
   (C) clarify and support spoken messages using appropriate props such as objects, 
pictures, or charts;
   (D) retell a spoken message by summarizing or clarifying.

**K(8) Reading/vocabulary development.** The student develops an extensive vocabulary. The 
student is expected to:
   (A) discuss meanings of words and develop vocabulary through meaningful/concrete 
   experiences;
(B) develop vocabulary by listening to and discussing both familiar and conceptually challenging selections read aloud.

K(9) Reading/comprehension. The student uses a variety of strategies to comprehend selections read aloud. The student is expected to:

(A) use prior knowledge to anticipate meaning and make sense of texts;
(B) establish purposes for reading or listening such as to be informed, to follow directions, and to be entertained.

K(10) Reading/literary/response. The student responds to various texts. The student is expected to:

(A) listen to stories being read aloud;
(B) participate actively (react, speculate, join in, read along) when predictable and patterned selections are read aloud;
(C) respond through talk, movement, music, art, drama, and writing to a variety of stories and poems in ways that reflect understanding and interpretation;
(D) describe how illustrations contribute to the text;

K(12) Reading/inquiry/research. The student generates questions and conducts research about topics introduced through selections read aloud and from a variety of other sources. The student is expected to:

(A) identify relevant questions for inquiry such as "Why did knights wear armor?"
(B) use pictures, print, and people to gather information and answer questions;
(C) draw conclusions from information gathered.

K(16) Writing/inquiry/research. The student uses writing as a tool for learning and research.

(B) record or dictate his/her own knowledge of a topic in various ways such as by drawing pictures, making lists, and showing connections among ideas.

Mathematics TEKS

K(2) Number, operation, and quantitative reasoning. The student describes order of events or objects.

(B) name the ordinal positions in a sequence such as first, second, third, etc.;
**K(5)** Patterns, relationships, and algebraic thinking.  The student identifies, extends, and creates patterns. The student is expected to identify, extend, and create patterns of sounds, physical movement, and concrete objects.

**K(7)** Geometry and spatial reasoning: The student describes the relative positions of objects. The student is expected to:

- (A) describe one object in relation to another using informal language such as over, under, above, or below;
- (B) place an object in a specified position.

**K(8)** Geometry and spatial reasoning. The student uses attributes to determine how objects are alike and different. The student is expected to:

- (A) describe and identify an object by its attributes using informal language;
- (B) compare two objects based on their attributes.

**K(9)** Geometry and spatial reasoning. The student recognizes characteristics of shapes and solids. The student is expected to:

- (C) describe, identify, and compare circles, triangles, and rectangles including squares.

**K(10)** Measurement. The student uses attributes such as length, weight, or capacity to compare and order objects. The student is expected to:

- (A) compare and order two or three concrete objects according to length (shorter or longer), capacity (holds more or holds less), or weight (lighter or heavier);
- (B) find concrete objects that are about the same as, less than, or greater than a given object according to length, capacity, or weight.

**K(11)** Measurement. The student uses time and temperature to compare and order events, situations, and/or objects. The student is expected to:

- (A) compare situations or objects according to temperature such as hotter or colder.

**K(13)** Underlying processes and mathematical tools. The student applies Kindergarten mathematics to solve problems connected to everyday experiences and activities in and outside of school. The student is expected to:

- (C) select or develop an appropriate problem-solving strategy including drawing a picture, looking for a pattern, systematic guessing and checking, or acting it out in order to solve a problem.
Social Studies TEKS

K. 4 Geography. The student understands the concept of location. The student is expected to:
   (A) use terms, including over, under, near, far, left, and right, to describe relative location.

K. 8 Government. The student understands the purpose of rules. The student is expected to:
   (A) identify purposes for having rules;
   (B) identify rules that provide order, security, and safety in the home and school.

K. 16 Social studies skills. The student communicates in oral and visual forms. The student is expected to:
   (A) express ideas orally based on knowledge and experiences;
   (B) create and interpret visuals including pictures and maps.

Music TEKS

K(3) Historical/cultural heritage. The student relates music to history, to society, and to culture. The student is expected to:
   (C) identify simple relationships between music and other subjects.

K(4) Response/evaluation. The student responds to and evaluates music and musical performance. The student is expected to:
   (B) identify higher/lower, louder/softer, and same/different in musical performances.

Physical Education TEKS

K. 1 The student demonstrates competency in fundamental movement patterns and proficiency in a few specialized movement forms. The student is expected to:
   (C) demonstrate non-locomotor (axial) movements such as bend and stretch;
   (F) demonstrate a variety of relationships such as under, over, behind, next to, through, right, left, up, down, forward, backward, in front of.
Art TEKS

K(1) Perception. The student develops and organizes ideas from the environment. The student is expected to:
   (A) glean information from the environment, using the five senses;
   (B) identify colors, textures, forms, and subjects in the environment.

K(2) Creative expression/performance. The student expresses ideas through original artworks, using a variety of media with appropriate skill. The student is expected to:
   (A) create artworks using a variety of colors, forms, and lines.
Reading Connections

The following books are recommended as literary resources for teachers to share with kindergarten students. Teachers are cautioned, however, to remember that “reading about science” is not “doing science.” These books can enhance students’ study of rainbows but cannot replace the learning that occurs by active engagement in the learning experiences.


References


Berk, Laura E. Child Development. Allyn and Bacon, Boston, Massachusetts, 1997.


