Measurement With a Pop!

Grade Level or Special Area: 2nd Grade

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Length of Unit: (2 Weeks, 4 Lessons)

I. ABSTRACT

Use Indian corn and popcorn to teach students how to measure! Students will develop an understanding of the many uses of measurement. They will learn about linear measurement using inches and centimeters, use scales to determine weight in ounces, and measure volume in cups. Using prediction, students will record information and present their findings. This unit is to be taught while studying Native Americans in conjunction with the study of Westward Expansion. However, it may also be taught independently.

II. OVERVIEW

A. Concept Objectives

1. Understand measurable attributes of objects and the units, systems, and process of measurement (New Mexico Mathematics Standard 4A: Measurement)
2. Understand appropriate techniques, tools, and formulas to determine measurements (New Mexico Mathematics Standard 4B: Measurement)
3. Understand grammatical and language conventions used to communicate (New Mexico Language Arts Standard II-B)

B. Content from the *Core Knowledge Sequence*

1. Make linear measurements in feet and inches, and in centimeters, p. 57.
2. Know that one foot = 12 inches, p. 57.
3. Know abbreviations: ft., in., p. 57.
4. Measure and draw line segments to ½ inch and in centimeters, p. 57.
5. Estimate linear measurements, then measure to check estimates, p. 57.
6. Compare weights of objects using a balance scale, p.57.
7. Estimate and measure capacity in cups, p.57.
8. Consistently uses correct end punctuation, p. 44.
9. Use capital letters for the first word of a sentence, p. 44.
10. Recognize common abbreviations, p. 44.

C. Skill Objectives

1. Make linear measurements in feet, inches, and centimeters (Hobbs Municipal Schools Scope and Sequence Mathematics 2.12 A.1).
2. Know that one foot = 12 inches (Hobbs Municipal Schools Scope and Sequence Mathematics 2.12 A.2).
3. Know abbreviations ft., in. (Hobbs Municipal Schools Scope and Sequence Mathematics 2.12 A.3).
4. Measure and draw line segments in inches to ½ inch and in centimeters (Hobbs Municipal Schools Scope and Sequence Mathematics 2.12 A.4).
5. Estimate linear measurements, then measure to check estimates (Hobbs Municipal Schools Scope and Sequence Mathematics 2.12 A.5).
6. Compare weights of objects using a balance scale (Hobbs Municipal Schools Scope and Sequence Mathematics 2.12 B.1).

7. Estimate and measure capacity in cups (Hobbs Municipal Schools Scope and Sequence Mathematics 2.12 C.1).
8. Make a simple bar and a picture graph having at least two categories (Hobbs Municipal Schools Scope and Sequence Mathematics 2.13 B).
9. Consistently uses correct punctuation (Hobbs Municipal Schools Scope and Sequence Language Arts 2.2B).
10. Capitalizes the first word of sentences and abbreviations (Hobbs Municipal Schools Scope and Sequence Language Arts 2.2E).

III. BACKGROUND KNOWLEDGE

A. For Teachers
   1. Hirsch Jr., E. D. *What Your Second Grader Needs to Know*. New York, NY: Dell Publishing, 1999, 0-385-31843-X
   2. Ripley, Catherine. *Why Does Popcorn Pop?* Canada: Maple Tree Press, 1997, 189568871X

B. For Students
   1. Students should understand importance of corn to Plains Indians.
   2. Students will understand and be able to identify plant parts.
   3. Students will comprehend nonstandard units of measurement.
   4. Students will understand proper use of capitalization and punctuation.
   5. Students will know how to read and construct simple bar graphs.

IV. RESOURCES

A. Aliki. *Corn is Maize: The Gift of the Indians.* New York: Harper Trophy, 1986, 0064450260.

B. DePaola, Tomie. *The Popcorn Book* .New York*:* Holiday House, 1989, 0823405338.

C. Hirsch Jr., E. D. *What Your Second Grader Needs to Know*. New York, NY: Dell Publishing, 1999, 0-385-31843-X

V. LESSONS

Lesson One: "Measuring Corn" (40 min. session; begin unit on Friday in order to allow corn time to sprout)

A. *Daily Objectives*
   1. Concept Objectives
      a. Understand measurable attributes of objects and the units, systems, and process of measurement (New Mexico Mathematics Standard 4A: Measurement)
      b. Understand appropriate techniques, tools, and formulas to determine measurements (New Mexico Mathematics Standard 4B: Measurement)
   2. Lesson Content
      a. Compare weights of objects using a balance scale
   3. Skill Objective
      a. Compare weights of objects using a balance scale (Hobbs Municipal Schools Scope and Sequence Mathematics 2.12 B.1).
      b. Estimate measurements and develop precision in measuring objects (New Mexico Mathematics Content Standard 4B: Measurement, 2.3).

B. *Materials*

1. Indian Corn—1/2 ear for each group (Dried Indian Corn may be purchased at most grocery stores in the fall.)
2. Balance scale—1 for each group
3. Ounce weights
4. Disposable banana split bowls (available from many ice cream parlors)
5. Math journal for each student (Appendix A: Daily Prediction sheet, Appendix B: Daily Data sheet), Multiple copies will be required for each student. Teacher may pre-assemble math folders. Gather folders with brads, punch holes in appendix pages, and assemble.
6. Chart tablet

C. *Key Vocabulary*

1. Weight, weigh—How heavy an item is
2. Ounce, oz.—A standard unit of measurement. It takes sixteen ounces to make a pound.
3. Scale—An instrument used to determine how heavy an item is
4. Prediction—A logical, reasonable guess

D. *Procedures/Activities*

1. Teacher will introduce unit. You might say, "Today we will begin to learn about measurement by observing and recording the growth of Indian corn."
2. Teacher will introduce vocabulary and write words and definitions on chart tablet where visible to all.
3. Students will be divided into small groups of three or four.
4. Each group will receive half an ear of Indian corn.
5. Groups will be asked to predict weight of corn ear and write prediction on their prediction sheets (Appendix A: Prediction Sheet) in their math journal.
6. Students will weigh their ear of corn using a balance scale, comparing the weight of the corn to ounce weights.
7. Weight of the corn will be recorded in their math journal under Day 1 (Appendix B: Data Sheet).
8. Groups will place the half ear of corn in a banana split bowl; students will measure and add 1 cup of water to each bowl.
9. Corn will be placed in a secure location.
10. Extension activity: Students in need of enrichment may research the metric and English measuring systems and explain them to the class through a poster, PowerPoint, or report.

E. *Assessment/Evaluation*

1. Teacher observation of student participation in group work.
2. Teacher will collect journals and assess work completion and how reasonable predictions are.

Lesson Two: Growth (30-40 minutes, 10 minutes/day for following 10 days)

A. *Daily Objectives*

1. Concept Objective(s)
   a. Understand measurable attributes of objects and the units, systems, and process of measurement (New Mexico Mathematics Standard 4A: Measurement).

b. Understand appropriate techniques, tools, and formulas to determine measurements (New Mexico Mathematics Standard 4B: Measurement)

2. Lesson Content
   a. Make linear measurements in feet, inches, and centimeters.
   b. Know that one foot = 12 inches
   c. Know abbreviations ft., in.
   d. Measure and draw line segments in inches to ½ inch and in centimeters
   e. Estimate linear measurements, then measure to check estimates.
   f. Make a simple bar and a picture graph having at least two categories
3. Skill Objective(s)
   a. Make linear measurements in feet, inches, and centimeters (Hobbs Municipal Schools Scope and Sequence Mathematics 2.12 A.1).
   b. Know that one foot = 12 inches (Hobbs Municipal Schools Scope and Sequence Mathematics 2.12 A.2).
   c. Know abbreviations ft., in. (Hobbs Municipal Schools Scope and Sequence Mathematics 2.12 A.3).
   d. Measure and draw line segments in inches to ½ inch and in centimeters
      (Hobbs Municipal Schools Scope and Sequence Mathematics 2.12 A.4).
   e. Estimate linear measurements, then measure to check estimates (Hobbs Municipal Schools Scope and Sequence Mathematics 2.12 A.5).
   f. Make a simple bar and a picture graph having at least two categories (Hobbs Municipal Schools Scope and Sequence Mathematics 2.13 B).

B. *Materials*
1. Student Journals (Add Appendix C: Growth Graph)
2. Rulers with inch and centimeter markings
3. Sprouting corn ears in bowls
4. *Corn is Maize* by Aliki
5. Chart tablet

C. *Key Vocabulary*
1. Kernel—the seed of the corn plant
2. Seed Coat—protective covering around the baby plant
3. Standard measurement of length—inches and centimeters
4. Stem—part of the plant that grows above ground and supports the plant
5. Roots—part of the plant that grows down from the seed and supplies water and minerals to the plant.
6. Inch—a standard unit of measurement about the same length as the distance between the first bend (joint) and the tip of the thumb.
7. Centimeter—a standard unit of measurement about the same size as a Cheerio.

D. *Procedures/Activities*

1. Describe to students that they will be predicting, measuring, and graphing the growth of the Indian corn.
2. Teacher will introduce vocabulary and write words and definitions on chart tablet where visible to all.
3. Read and discuss *Corn is Maize* by Aliki.
4. Students will predict the length of stem and root by observation and will write prediction on Appendix A: Prediction Sheet.
5. Groups will choose tallest corn sprout and measure length of stem and root. Students should measure by centimeters and to the nearest ½ inch.
6. Students will record information in their journal on Appendix B: Data Sheet under Day 2.
7. Students will show growth of corn sprout on a bar graph (Appendix C: Growth Graph) by coloring in bar up to appropriate level. If growth has not begun, students will record, "No growth."
8. For each of the following 10 days, groups will take ten minutes to predict, measure, record, and graph growth of corn sprout and root. Every other day, students must change the water in their bowls in order to avoid stagnation and appearance of gnats.
9. Extension activity: Students in need of enrichment may research another grass: bamboo. They may prepare a chart detailing the similarities and differences between corn and bamboo.

E. *Assessment/Evaluation*

1. Teacher observation of student participation in class discussion.
2. Teacher will collect journals and evaluate how reasonable predictions are, how accurate measurements are, and whether bar graphs are completed correctly.

Lesson Three: "How Our Corn Has Changed" (40 minutes)

A. *Daily Objectives*

1. Concept Objective(s)
   a. Understand measurable attributes of objects and the units, systems, and process of measurement (New Mexico Mathematics Standard 4A: Measurement)
   b. Understand appropriate techniques, tools, and formulas to determine measurements (New Mexico Mathematics Standard 4B: Measurement)
   c. Understand grammatical and language conventions used to communicate (New Mexico Language Arts Standard II-B)
2. Lesson Content
   a. Make linear measurements in feet, inches, and centimeters
   b. Know abbreviations ft., in.
   c. Estimate linear measurements, then measure to check estimates
   d. Compare weights of objects using a balance scale
   e. Consistently uses correct end punctuation
   f. Use capital letters for the first word of a sentence
   g. Recognize common abbreviations
3. Skill Objective(s)

a. Make linear measurements in feet, inches, and centimeters (Hobbs Municipal Schools Scope and Sequence Mathematics 2.12 A.1).
b. Know abbreviations ft., in. (Hobbs Municipal Schools Scope and Sequence Mathematics 2.12 A.3).
c. Estimate linear measurements, then measure to check estimates (Hobbs Municipal Schools Scope and Sequence Mathematics 2.12 A.5).
d. Compare weights of objects using a balance scale (Hobbs Municipal Schools Scope and Sequence Mathematics 2.12 B.1).
e. Make a simple bar and a picture graph having at least two categories (Hobbs Municipal Schools Scope and Sequence Mathematics 2.13 B).
f. Consistently uses correct punctuation (Hobbs Municipal Schools Scope and Sequence Language Arts 2.2B).
g. Capitalizes the first word of sentences and abbreviations (Hobbs Municipal Schools Scope and Sequence Language Arts 2.2E).

B. *Materials*
1. Corn in bowls
2. Math Journals
3. Copy of Appendix D for each student
4. Balance scales and ounce weights
5. Rulers

C. *Key Vocabulary*
Review previously introduced vocabulary.

D. *Procedures/Activities*
1. Groups will drain water from sprouted corn.
2. Students will predict whether corn weighs more or less than at beginning of unit. How much will it weigh? Record estimate on Appendix A: Prediction Sheet.
3. Students will weigh corn ear with balance scale using ounce weights.
4. Students will record finished weight of corn ear in journals on Appendix B: Data sheet.
5. Students will record final length on Appendix C: Growth Graph.
6. Ask students to compare beginning weight of corn ears with final weight and explain in a paragraph.
7. Distribute Paragraph Rubric (Appendix D: Rubric) to class and discuss criteria. Teacher should emphasize criteria: content, format, and organization.
8. Students will formulate a theory for weight change and write a paragraph explaining it on a lined sheet in their journals.

E. *Assessment/Evaluation*
1. Teacher observation of student participation in group activity.
2. Teacher will use Appendix D: Paragraph Rubric to assess paragraph.

Lesson Four: Popping Corn (45 minutes)

A. *Daily Objectives*
1. Concept Objective(s)

a. Understand measurable attributes of objects and the units, systems, and process of measurement (New Mexico Mathematics Standard 4A: Measurement)
b. Understand appropriate techniques, tools, and formulas to determine measurements (New Mexico Mathematics Standard 4B: Measurement)
c. Understand grammatical and language conventions used to communicate (New Mexico Language Arts Standard II-B)

2. Lesson Content
   a. Make linear measurements in feet, inches, and centimeters
   b. Know that one foot = 12 inches
   c. Know abbreviations ft., in.
   d. Measure and draw line segments in inches to ½ inch and in centimeters
   e. Estimate linear measurements, then measure to check estimates
   f. Estimate and measure capacity in cups
   g. Consistently uses correct end punctuation
   h. Use capital letters for the first word of a sentence
   i. Recognize common abbreviations
3. Skill Objectives
   a. Make linear measurements in feet, inches, and centimeters (Hobbs Municipal Schools Scope and Sequence Mathematics 2.12 A.1).
   b. Know that one foot = 12 inches (Hobbs Municipal Schools Scope and Sequence Mathematics 2.12 A.2).
   c. Know abbreviations ft., in. (Hobbs Municipal Schools Scope and Sequence Mathematics 2.12 A.3).
   d. Measure and draw line segments in inches to ½ inch and in centimeters (Hobbs Municipal Schools Scope and Sequence Mathematics 2.12 A.4).
   e. Estimate linear measurements, then measure to check estimates (Hobbs Municipal Schools Scope and Sequence Mathematics 2.12 A.5).
   f. Estimate and measure capacity in cups (Hobbs Municipal Schools Scope and Sequence Mathematics 2.12 C.1).
   g. Consistently uses correct punctuation (Hobbs Municipal Schools Scope and Sequence Language Arts 2.2B).
   h. Capitalizes the first word of sentences and abbreviations (Hobbs Municipal Schools Scope and Sequence Language Arts 2.2E).

B. *Materials*
1. Unpopped popcorn
2. Clear Measuring Cups
3. Chart tablet and marker
4. Hot air popcorn popper
5. Old flat bed sheet and 2 large bowls for popcorn
6. Pencils
7. Rulers with inch and centimeter markings
8. Math journals

9. *The Popcorn Book* by Tomie DePaola
10. Appendix D, one copy per student

C. *Key Vocabulary*

1. Popcorn—dried corn that, when exposed to heat, transforms into a tasty snack.
2. Volume—amount of a substance, how much space it takes up
3. Distance—how far something travels

D. *Procedures/Activities*

1. Teacher will introduce the lesson by reading *The Popcorn Book* by Tomie DePaola.
2. Teacher will measure and show ¼ cup of unpopped popcorn to students sitting on the floor in a circle.
3. Students will predict the increase in the volume of popcorn when popped. Teacher will write students' predictions on chart paper. Teacher will introduce abbreviation for cup as predictions are written.
4. Students will also predict how far the popcorn will travel when leaving the hot air popper. Teacher will write these predictions on chart paper, introducing abbreviations for inches, feet, and centimeters.
5. Students will mark where hot air popper will be placed using a pencil to make an "x" on the bed sheet.
6. Placing hot air popper in center of flat sheet with students in a circle around it, teacher will begin popping corn.
7. When popping is completed, students will judge which kernels of popcorn traveled the greatest distance. Use pencil to mark the locations of 2 or 3 most distant kernels.
8. Gather edges of sheet and pour popcorn into a large bowl.
9. Students will use a pencil to draw lines between the locations of the hot air popper and the farthest kernel locations. They will use rulers and a pencil to measure the lines, marking it off in feet. They will compare their predictions with the actual distances traveled.
10. Students should use the clear measuring cup to measure popcorn and place into the second bowl.
11. Compare original amount of unpopped popcorn with final volume of corn when popped.
12. Teacher may say, "How does your prediction compare with the final volume of the popped corn?"
13. Teacher may say, "What conclusions can you make about popping popcorn? Why?"
14. Students will write a paragraph in their math journals about volume and distance as it relates to this experiment.
15. Distribute Paragraph Rubrics (Appendix D: Paragraph Rubric) to class and discuss criteria.
16. Extension activity: Students needing enrichment may have researched the subject by reading books such as *Why Does Popcorn Pop?* By Catherine Ripley and may report their findings to the class.

E. *Assessment/Evaluation*

1. Teacher observation of listening skills and accuracy of predictions.
2. Teacher will read paragraphs, assessing for understanding of measurement of volume and distance, using Appendix D: Paragraph Rubric.

VI. CULMINATING ACTIVITIES

A. The teacher will introduce the concept of mosaics as works of art made of small pieces of colored material. Note that Native Americans use the technique in jewelry and pottery. The teacher will duplicate designs from Appendix E: Native American Symbols onto 9" x 12" construction paper. Students will use colored rice and unpopped kernels of popcorn to fill in spaces in symbols. In order to color the rice, use self-sealing plastic bags and tempera paint. Half-fill the bags with rice and add ½ cup of dry tempera, adding more to increase intensity of color if desired. Seal and shake or allow the students to shake. Have students choose the Native American symbol they want to use. The students should use black crayons to darken the outlines of the symbols and to separate the sections. The teacher should pour colored rice into bowls, provide a bowl of popcorn kernels, and place on student desks or tables. Students glue popcorn kernels and rice onto Native American symbols, filling each section with a different color.

B. Teacher brings popped popcorn, approximately 2 cups for each child. Provide food server's gloves for each child. Butter the gloves while on students' hands to prevent sticking. Place a square of waxed paper on each student's desk. Place 1 ½ --2 cups of popcorn on the waxed paper and pour about 1/3 cup of corn syrup onto popcorn. More may be added if popcorn is dry. Two or three drops of orange food coloring may be added to each child's popcorn. Students form the popcorn into balls. Gather edges of waxed paper and tie shut with twist tie. Let sit for an hour or more. Eat and enjoy.

VII. HANDOUTS/WORKSHEETS

A. Appendix A: Prediction Sheet
B. Appendix B: Data Sheet
C. Appendix C: Growth Graphs (4 pages)
D. Appendix D. Paragraph Rubric
E. Appendix E: Native American Symbols (3 pages)

VIII. BIBLIOGRAPHY

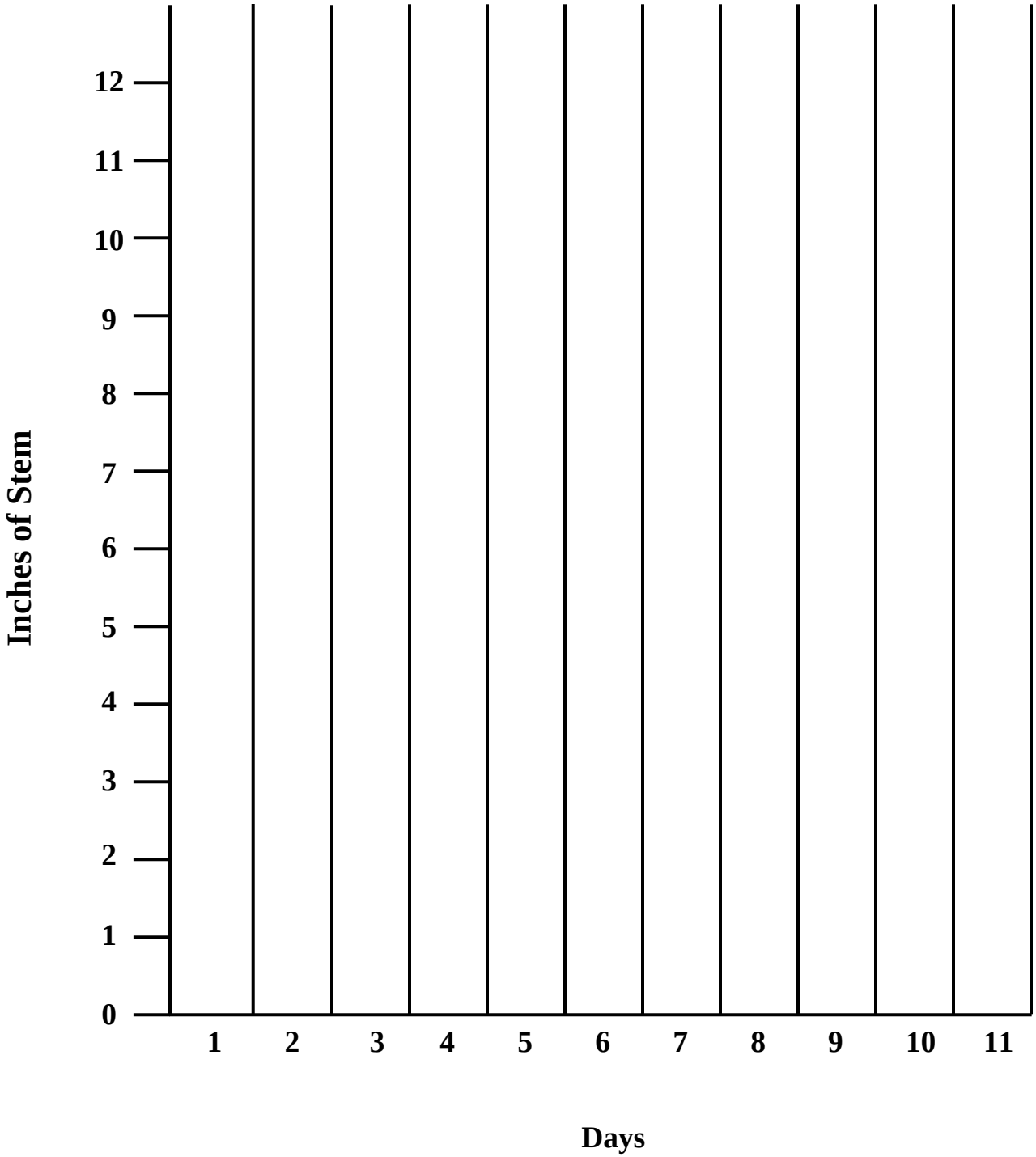
A. Aliki. *Corn is Maize: The Gift of the Indians.* New York: Harper Trophy, 1986, 0064450260.
B. DePaola, Tomie. *The Popcorn Book .New York:* Holiday House, 1989, 0823405338.
C. Hirsch Jr., E. D. *What Your Second Grader Needs to Know.* New York, NY: Dell Publishing, 1999, 0-385-31843-X
D. Landau, Elaine. *Popcorn!* Massachusetts: Trade Cloth, Charlesbridge Publishing, 2003, 1570914427.
E. Moran, Alex. *Popcorn.* California: Greenlight Readers, Inc. 2003, 0152048618.
F. Ripley, Catherine. *Why Does Popcorn Pop?* Canada: Maple Tree Press, 1997, 189568871X
G. www.education-world.com/a_lesson/03/1p324-02.shtml
H. http://projects.edteach.Sandi.net/velem/poppingovercorn/
I. http://dmoz.org/Kids_andTeens/School_Time/Science/Measurement/

Measurement With a Pop!
Appendix A: Prediction Sheet

Day	Date	Student's Daily Prediction

Measurement With a Pop!
Appendix B: Student Data Sheet

Day	Date	Student's Data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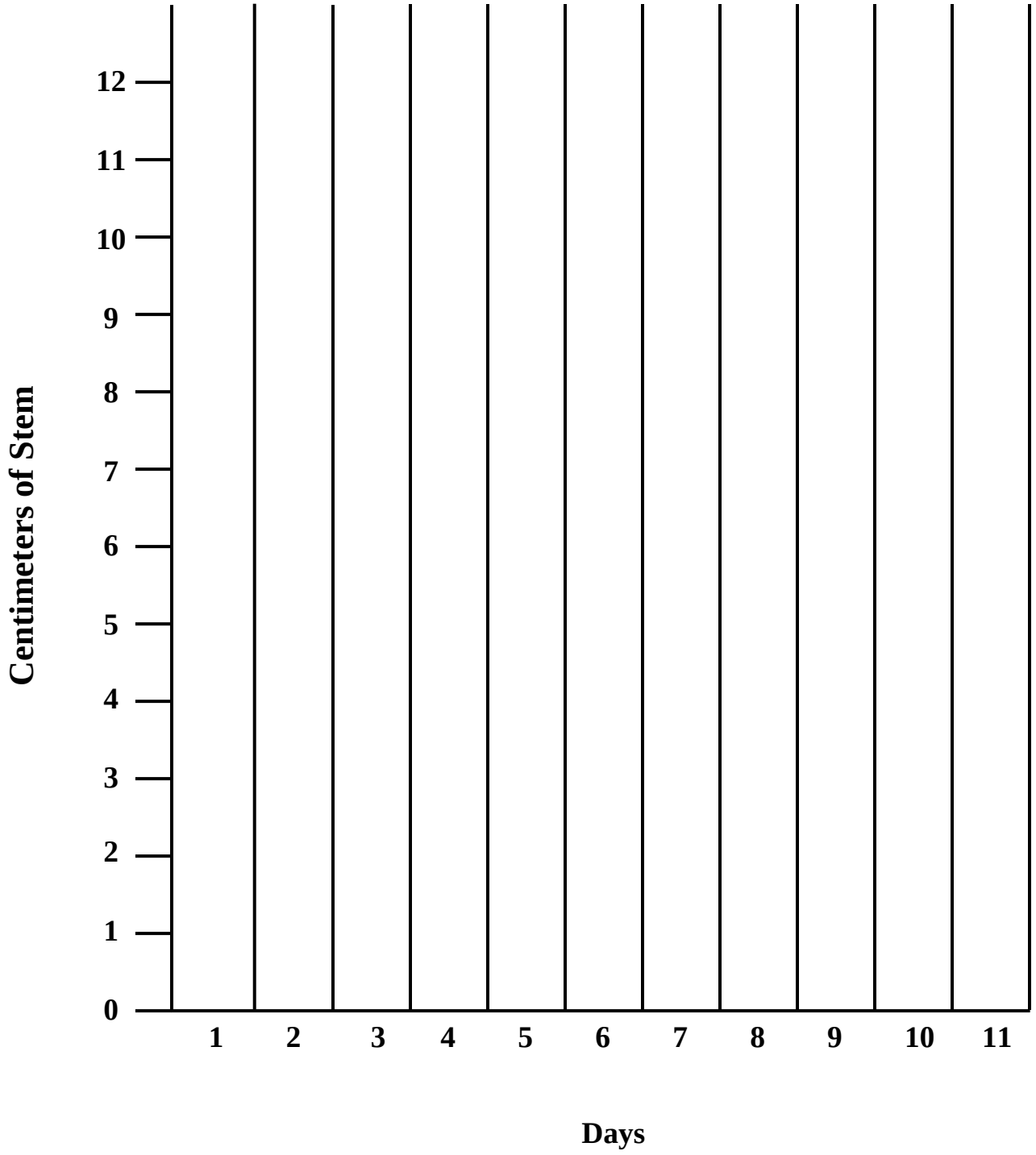
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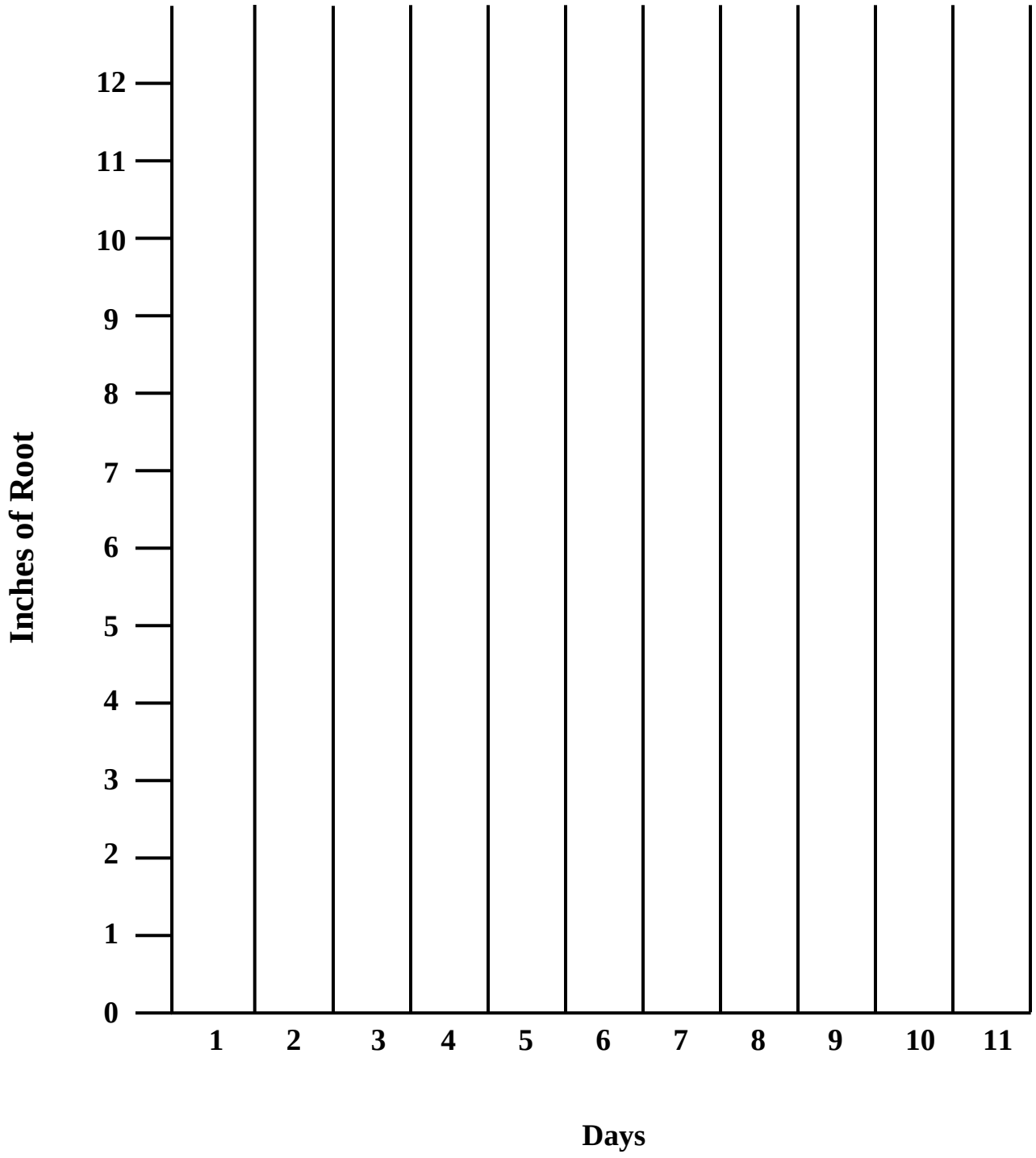
Inches of Root
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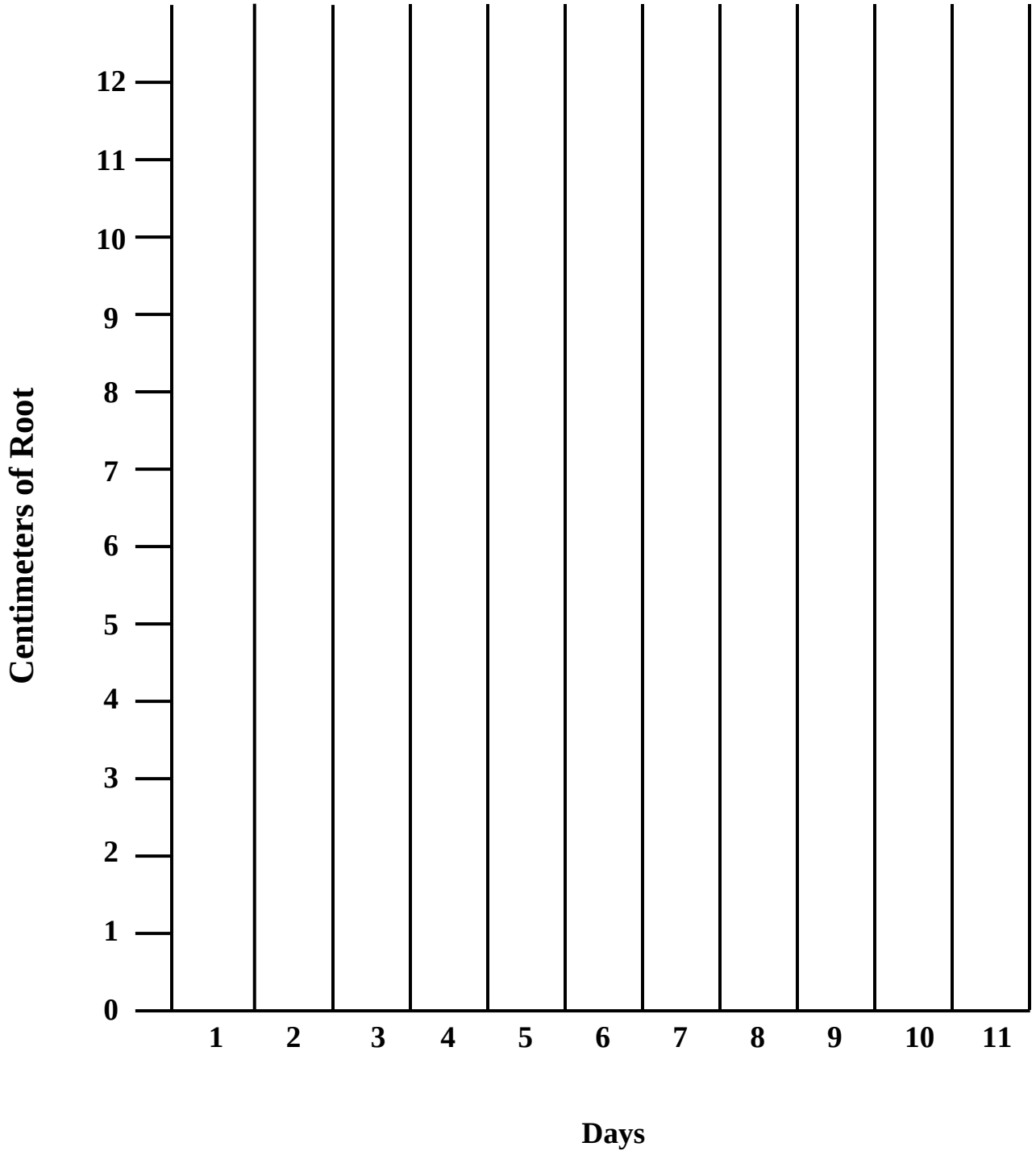
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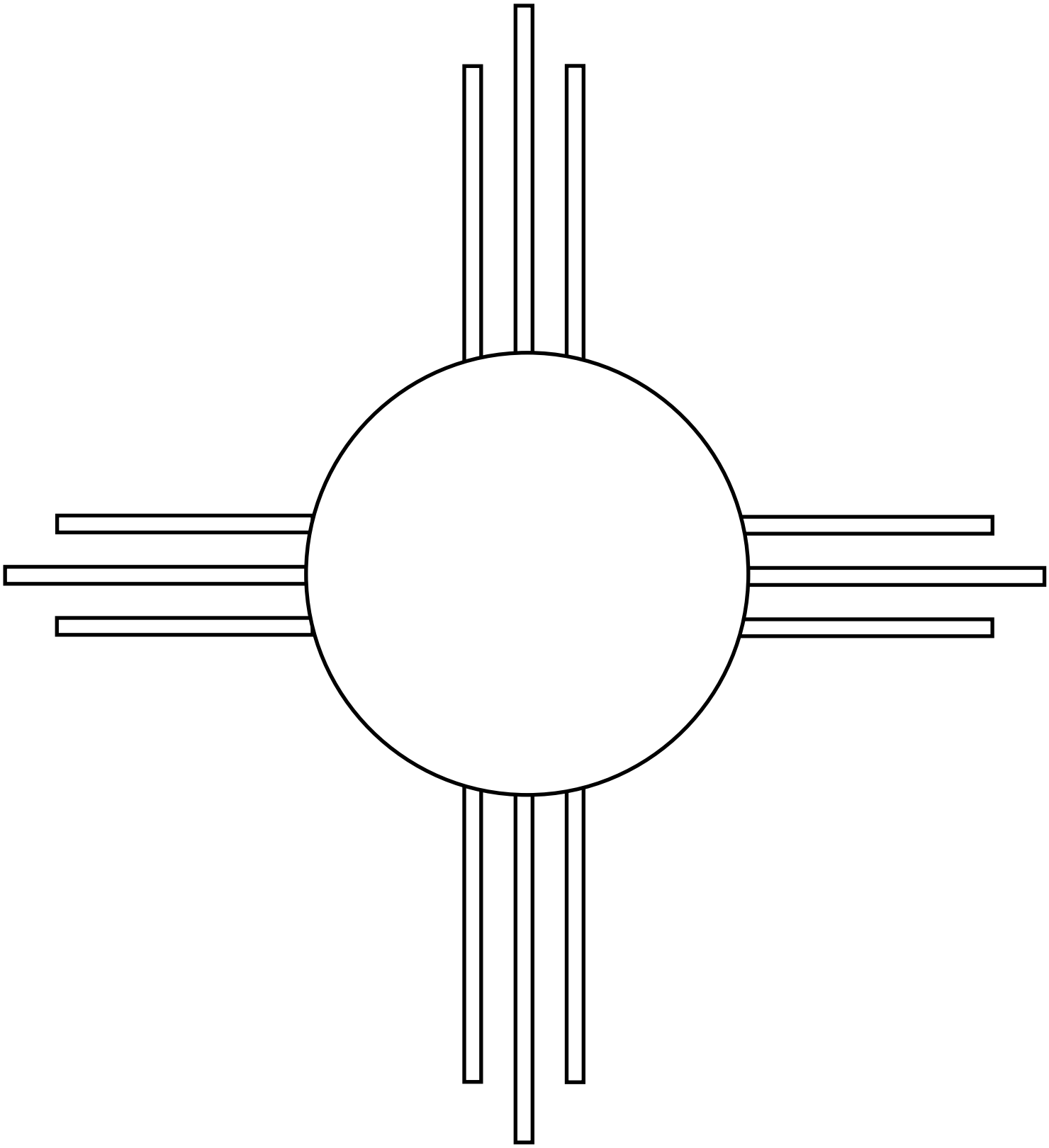
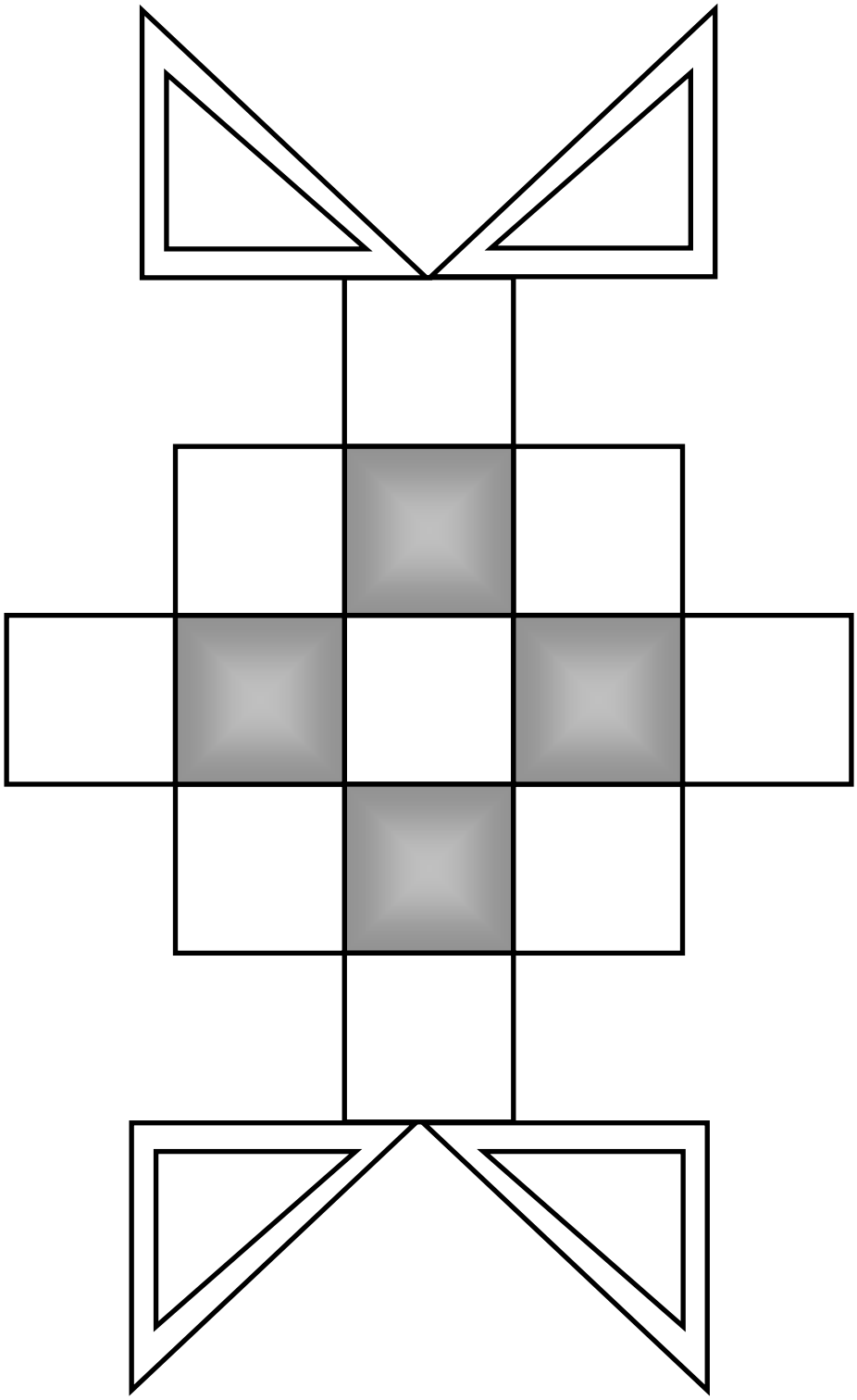
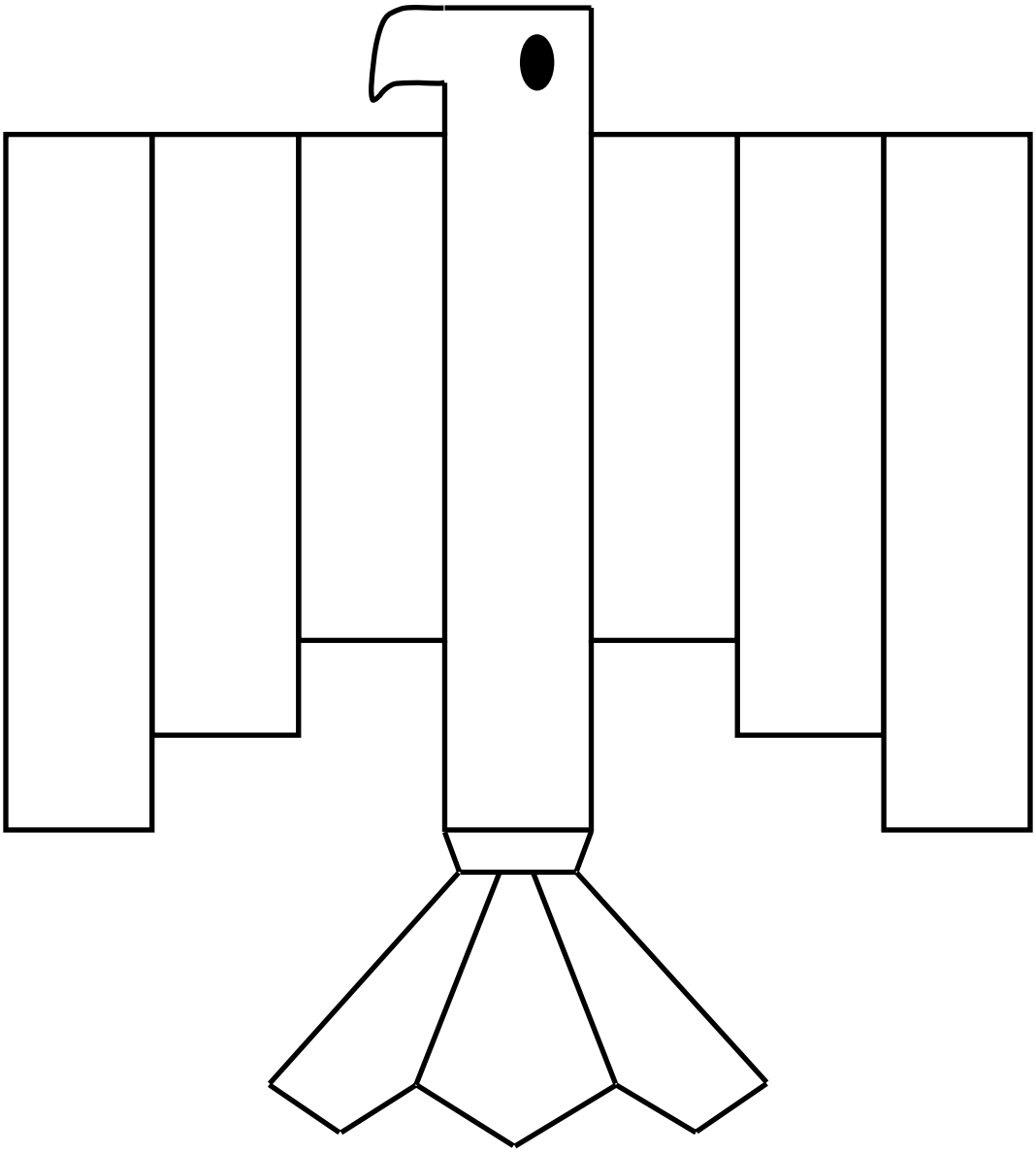
Indian Corn Growth and Measurement
Appendix D: Paragraph Rubric

Student's Name: _____ Date: _____

Objectives	Low Performance	Below Average Performance	Average Performance	Above Average Performance	Earned Points
Core Knowledge Content-Mathematics-Measurement of Weight	**1 point** Student does not have a grasp of information concerning measurement of weight.	**2 points** Student is unable to formulate a clear theory about weight measurement.	**3 points** Student demonstrates understanding of weight measurement by formulating a clear theory.	**4 points** Student demonstrate understanding of weight measurement by formulating a clear theory and elaborating.	
Organization	**1 point** Reader cannot understand theory because little information is given.	**2 points** Reader has difficulty following theory presentation because of lack of sequence of information.	**3 points** Student presents information in logical sequence that reader can follow.	**4 points** Student presents information in logical and interesting sequence that reader can follow.	
Format-Proper Use of Capitalization and Punctuation	**1 point** More than 8 errors in capitalization and punctuation.	**2 points** Five to eight errors in capitalization and punctuation.	**3 points** Fewer than 5 errors in capitalization and punctuation.	**4 points** No more than 2 errors in capitalization and punctuation.	
				Score:	

Comments:

Appendix E: Native American Symbols (Page 1 of 3)