ST[EMpower]

UTES and STEM

VOLUME 11, ISSUE 1, November 2021

Honoring Native American Heritage

THIS ISSUE

Nuu-ciu Strong: A Colorado Fourth Grade Resource Guide Lessons about the Ute People of Colorado (https://ccia.colorado.gov/fourth-grade-ute-resource-guide)

Check it out!

Miqué!

(pronounced "mike")
Ute language for "Hello!"

In this issue, we explore how the Ute people used STEM principles in their daily lives through the centuries!

Tina King-Washington is the Ute Mountain Ute Tribe's Director of K-12 Education and co-author of this issue. Thank you Ms. King-Washington for collaborating! This ST[EMpower] issue was inspired by the curricula Nuu-ciu Strong: A Colorado Fourth Grade Resource Guide Lessons about the Ute People of Colorado. It was written and developed by Ms. King-Washington and her Southern and Northern Ute educator colleagues.

Colorado is the home to the Southern Ute and the Ute Mountain Ute. The Northern Ute, are located in Utah.

The selected Ute words were captured from a phonetic Northern Ute dialect dictionary by Hazel Wardle (1969). Hazel and her husband, Austin, were local ranchers. He was fluent in Ute and believed in connecting with his Ute neighbors.

We participated in CSUnite: No Place for H8 4/2/2018

SCIENCE, TECHNOLOGY, ENGINEERING, AND MATH
COLORADO STATE UNIVERSITY EXTENSION

Sleeping Ute Mountain
Wisuv Káruv (in the Ute language)

Sleeping Ute Mountain is a sacred place for the Ute people. Towaoc, the Ute Mountain Ute Tribal Headquarters, is nestled at the foot of the mountain. Towaoc is located near the big toe (green arrow image above).

Only members of the Ute Tribes are allowed on the mountain. The Ute Mountain Ute hold their annual sacred ritual, the Sun Dance, on Sleeping Ute Mountain in July.

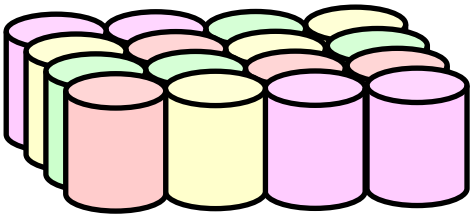
Directions:

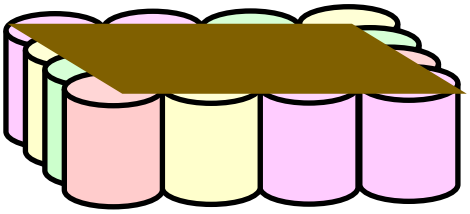
- Print pages 4-11 double-sided, landscape, flip on short edge. Keep the pages in order.
- Fold the eight pages with the title "Legend of the Sleeping Ute" is on the front (pg. 4).
- You have made a little booklet. Read this story to one of your parents.
- After reading the story, look at the Sleeping Ute Mountain picture above. Can you find:
  - the headdress?
  - the face?
  - the arms crossed over the chest?
  - the ribs?
  - the knees?
  - the big toe?
- Sleeping Ute Mountain is primarily **igneous** rock. In this next activity, you will model the rock cycle. There are three types of rocks:
  - **sedimentary** (layered)
  - **metamorphic** (**warped**)
  - **igneous** (melted)
- **Sedimentary** rock is broken down into pieces, and then cemented together. Fossils are found in **sedimentary** rock. Sandstone is a type of **sedimentary** rock.
  - Tear a piece of wax paper about 12" long. Place on the table.
  - Place color mini-marshmallows on the wax paper, 4 rows of four. This represents the bits of rock broken into pieces.
  - With the dinner knife, spread a thin layer of frosting on top of the mini-marshmallows, representing minerals cementing it together.

POWER WORDS

- **igneous**: rock solidified from lava or magma
- **lava**: hot molten or semifluid rock erupted from a volcano or fissure
- **magma**: hot fluid or semifluid material below or within the earth's crust from which lava and other igneous rock is formed on cooling
- **metamorphic**: rock transformed by heat, pressure, or other natural agencies, e.g. in the folding of strata
- **sedimentary**: (of rock) that has formed from sediment deposited by water or air
- **warp**: become bent or twisted out of shape

Towaoc toy—awk





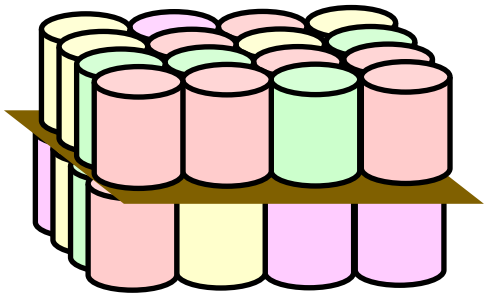
READING MATERIALS

- Print pages 4-11, double-sided, flip on short edge; fold for booklet
- Check your library for the book: Coyote Steals the Blanket: A Ute Tale by Janet Stevens for another wonderful story

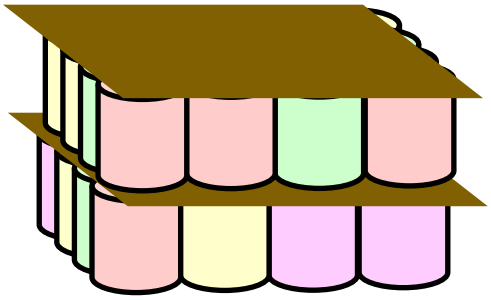
ROCK CYCLE SUPPLIES

- color mini-marshmallows
- frosting (any flavor)
- wax paper
- dinner knife
- small pot
- stove top (and a parent to help you)
- wooden spoon

- Stack another layer of mini-marshmallows on top of the first layer, using the frosting to stick them together. Stack at least 4 rows of 4 mini-marshmallows.



- Spread a thin layer of frosting on top of the mini -marshmallows.



⇒ The marshmallows representing the broken bits of rock can be **sedimentary**, **metamorphic**, or **igneous** rock. The frosting represents the minerals that cement everything together come from above and are carried by water.

- **Metamorphic** rock is formed when it is buried deep in the Earth. It is **warped** by heat (not enough to melt it) and/or pressure. Marble is a type of **metamorphic** rock.
  - Fold the wax paper over your mini-marshmallows and frosting.
  - Stand up and place your hands on top of wax paper and marshmallows.
  - Push down on top of the mini-marshmallow and frosting as hard as you can for 2 minutes without removing your hands.

⇒ The heat from your hands and the pressure of you pushing represent the heat and/or pressure that forms **metamorphic** rock. Examine how the marshmallows and frosting are no longer in orderly rows and columns. They are now **warped** and squished.

- **Igneous** rock is formed when rock deep in the Earth melts and later cools forming this type of rock. Lava is melted rock that comes out of the earth, and magma is melted rock that remains underground. I**gneous** rock builds mountains. Obsidian is a type of **igneous** rock.
  - Scrape the marshmallow and frosting into the pot.
  - Get an adult .
  - Turn the heat on low on the stove, and stir the mixture with the wooden spoon until the marshmallows melt.

⇒ The marshmallows and frosting is now melted into a semi-liquid form. Magma and lava can be thick like Mount St. Helens lava, or thin like the lava of the Hawaiian volcanos.

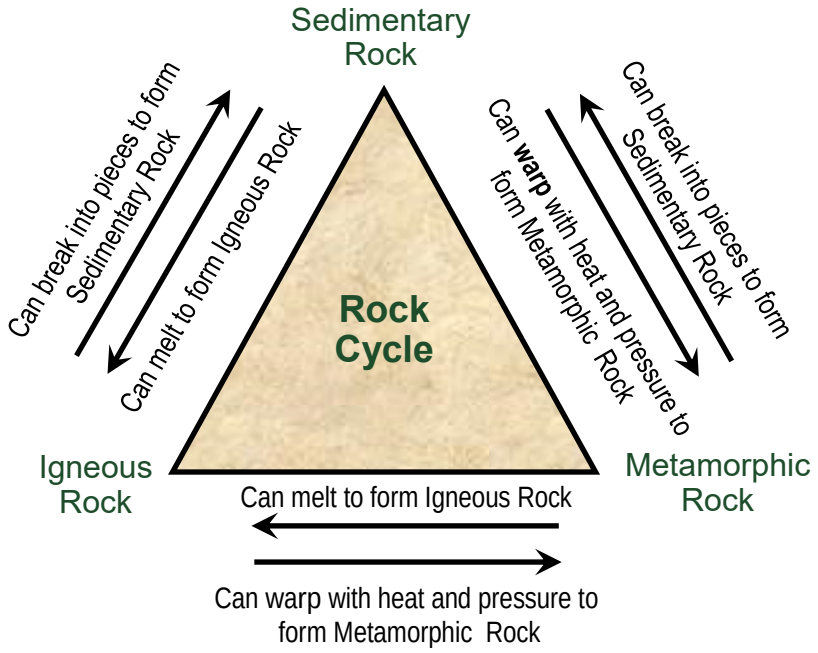
FASCINATING FACTS

- Sedimentary, metamorphic, and igneous rock can change into the other kinds by physical processes: cooling, melting, heat, weathering/ erosion, compacting (squeezing tightly together), cementing, and pressure.

Ute word for story:
p shez i ne up

Ute word for rock:
too pwech

Hmmmmm, I wonder what you can do with your "igneous rock..." Ask your parent first…
YUM!



Legend of the Sleeping Ute

A Ute Mountain Ute Tale

2006
Produced by
Utah State Office of Education
and
San Juan School District Media Center

For more information, visit
www.schools.utah.gov/curr/indianed.
To purchase copies, call
435-678-1229.

Cultural Note

The Ute Mountain Ute people live in southeastern Utah and southwestern Colorado, near the base of *Wisuv Káruv*, or Sleeping Ute Mountain. The Ute Mountain Ute tribal headquarters are located at Towaoc, Colorado. The Ute Mountain Ute Sun Dance is held there every year on Sleeping Ute Mountain.

Vocabulary

emerald

emerge

mantle

roamed

woven

Glossary

tachit - summer

tamin - spring

türmurt - winter

Wisuv Káruv - Sleeping Ute Mountain

yuvant - fall

Reading Suggestions

•Can you name the mountains that surround your home? Learn their names and research to see if there are stories about their names, shapes, etc.

•Plan a family vacation to Towoac, Colorado, where you can see Sleeping Ute Mountain.

•Keep a journal of the seasons. Journals aren't just about lots of writing (although some would be good). Your journal can be like a scrapbook, filled with photos, drawings, and other souveniers. You can write about what you've been doing, or interview other members of your family for interesting stories. You can even write about books or movies you've enjoyed.

Someday, when the Ute people are once again in danger, the Sleeping Warrior will rise to help drive the Evil Ones out of the land.

Legend of the Sleeping Ute

A Ute Mountain Ute Tale

Adapted by
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Originally told by
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of the Ute Mountain Ute Tribe

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Cultural Consultants
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Editing and layout by
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The Native American Indian Literacy Project was made possible by funds from the Utah State Office of Education (USOE). It is a joint effort of the USOE and San Juan School District Media Center. For more information about this project, contact Shirlee Silversmith at (801) 538-7838.

The booklets are available on a CD from the USOE. You may print the booklets off the CD, free of charge, for educational purposes. If you would like to purchase printed copies of the booklets, contact San Juan School District Media Center at (435) 678-1229.

2006
Utah State Office of Education
San Juan School District Media Center

During every season, he lets clouds emerge from his pockets to gather over the highest peak whenever he is happy with his people.

Long, long ago, the Evil Ones roamed the earth creating trouble, so a Great Warrior God came to battle them.

Snow blankets the Sleeping Ute in winter white.

He and the Evil Ones kicked and yanked one another. They punched and wrestled. As they did, their feet pushed up the land into mountains. Valleys formed in their footprints.

2

His fall mantle is woven from red and yellow colors.

7

During summer, the Sleeping Warrior wears an emerald cover.

Even though the Evil Ones injured the Great Warrior, he defeated them. Then he lay down to recover. Blood poured from his wounds and turned into living water for all creatures to drink.

Today, the Great Warrior, still wearing his headdress, sleeps on his back with his arms folded across his chest.

When fog clings to *Wisuv Káruv*, *or* Sleeping Ute Mountain, he is changing his blanket. The pale green one means spring has arrived.

Ute women placed seeds, elk teeth, and eventually glass beads, on thread. They designed very intricate patterns that included repeating triangles and an hourglass design. Beading uses arithmetic, geometry, and Boolean algebra (principles behind computer programming) to form each line for the overall desired shape.

Directions:
Depending on the ages of your participants, the looms will have 3, 4, 5, or 15 bamboo skewers. Direction for older youth start on page 14.

Make your loom
For Younger Participants—directed by an adult:

- For the youngest learners, you will need to build the looms for your participants.
  - Loom 3 x 3—3 skewers with 3 beads on each skewer (use larger beads)
  - Depending on the ages of your participants, you may want to form the 4x4 loom—4 skewers 4 beads on each skewer (use larger beads). You will add one more skewer to the foam when directed.
  - Depending on the ages of your participants, you may want to continue to the 5x5 loom—5 skewers 5 beads on each skewer (use larger beads). You will add one more skewer to the foam when directed.
- Place your ruler on top of your floral foam block. Find the center point. For example, if your block is 8" long, it would be 4" from the left edge.
- At the center point place a bead and push your skewer sharp point into the floral foam about 1" through the hole in the bead. If you use 6" skewers, you will have 5" of the skewer showing.
- To properly space the skewers, leave one bead on the skewer and place another bead next to it leaving a tiny gap

POWER WORDS

- **column**: a group of items shown one under the other down a page
- **row**: a group of items lying side-by-side
- **symmetry**: an object is symmetrical when one half is a mirror image of the other half—the gold dashed line divides the book's left side of the mirror image from the right side

- **template**: a gauge, pattern, or mold used as a guide to the form of a piece being made

The Ute word for bead is:
chee ch

MATERIALS

- pony beads - many colors (older youth)
- larger beads (~1") many colors (Pre-K—2nd)
- floral foam brick around 2.5"x3.5"x8"
- bamboo skewers (3mm x 6")
- ruler
- print selected pages 16-24 (depending on age of youth; can be double-sided)

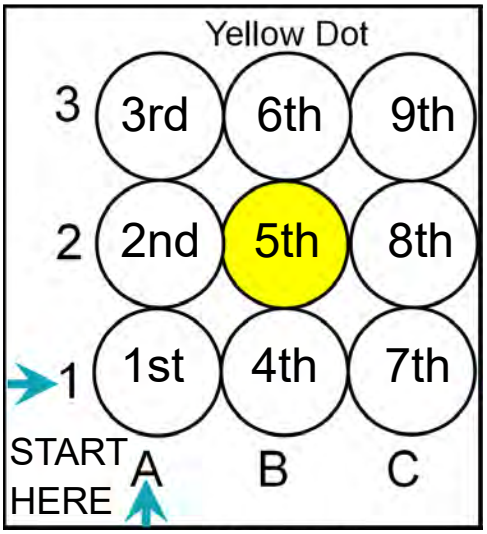
between the beads. Use the ruler to keep beads in a straight line.

- Push the second skewer's sharp end into the foam through the bead's hole.
- Try to insert the skewer at a 90° angle to the foam (straight up and down).
- Continue these steps, alternating sides, until you have completed the loom (3 skewers, 4 skewers, 5 skewers, or 15 skewers). Adjust the skewers to a height of 5".

<u>Make your Patterns</u>

- Pages 16-18 have different patterns for younger children. There are four patterns on page 16 using 3 skewers. Cut out each of these designs and distribute one to each child. Work through the same design with all your children, step by step, emphasizing counting and placement.
- Each circle on the pattern represents a bead.
- Start with row "1" and column "A." Notice that you read the pattern from the bottom to the top in each column.
- Follow the bead pattern on the first skewer, completing the first column (bead 1, A; bead 2, A, then bead 3, A) before moving to the next skewer.
- Example in Yellow Dot:

1st.	1, A—white
2nd.	2, A—white
3rd.	3, A—white
4th.	1, B—white
5th.	2, B—yellow
6th.	3, B—white
7th.	1, C—white
8th.	2, C—white
9th.	3, C—white



POWER WORDS

- **Notice this month we define "**warp**" in two different lessons with two different definitions. It has even more meanings:**

  verb
  - **warp:** become bent or twisted out of shape
  - **warp**: move a ship along by hauling on a rope attached to a stationary object on shore

  noun
  - **warp**: a twist or distortion in the shape or form of something
  - **warp**: (in **weaving**) the threads on a loom over and under which other threads (the weft) are passed to make cloth

Cool!

- Continuing guiding the youth until they are able to work on their own.
- Depending on the participant ages, add one more skewer and distribute the two patterns on page 17. Can your

The Ute words for different colors:

- black: too quer
- blue: sah wah garuth
- brown: oo too quer
- green: pah sah wah garuth
- purple: to quah ut
- red: ah cah garuth
- white: sahger
- yellowish or orange: qwe a ruckarth

participants replicate the bead pattern on that template?

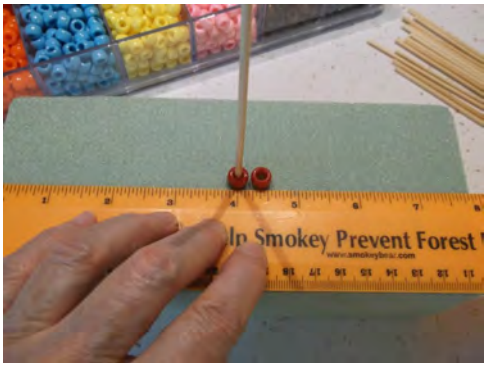
- Depending on the ages of the participants, add one more skewer and distribute the pattern on page 18. Can your participants replicate the bead pattern on that template?
- Depending on the ages of your participants, distribute page 19. Can your participants design their own bead pattern and replicate that pattern?

For Older Participants—
Make your loom

- Start by building your loom 9 x 9 (9 skewers and 9 beads on each skewer). After learning how to build the pattern, you will add 3 skewers to each side of your loom to form a 15 x 13 loom (15 skewers 13 beads on each skewer (image below; use pony beads).

- Place your ruler on top of your floral foam block. Find the center point. For example, if your block is 8" long, it would be 4" from the left edge.
- At the center point, place a pony bead and push your skewer sharp point into the floral foam about 1½" through the bead's hole. If you use 6" skewers, you will have 4½" of the skewer showing.

- To properly space the skewers, leave one bead on the skewer and place another bead next to it leaving a tiny gap between the beads. Use the ruler to keep beads in a straight line.



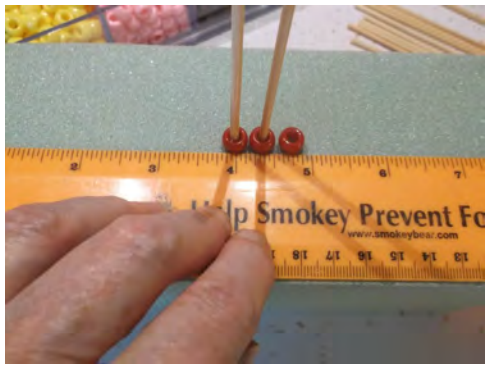
- Push the second skewer's sharp end into the foam through the bead's hole.
- Try to insert the skewer at a 90° angle to the foam (straight up and down).
- Continue these steps, alternating sides, until you have completed the loom. Stop when you have a total of 9 skewers (four on each side of your original center skewer).

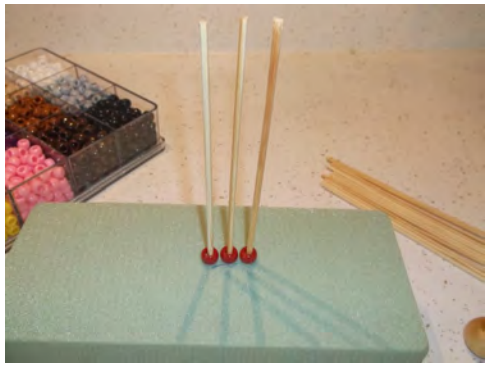
FASCINATING FACTS

- Beadwork is an original Native American art form.
- Archeologists find beads that are thousands of years old.
- The beads were originally made from bone, wood, shells, animal teeth, as well as turquoise. and metal.
- These materials were carefully carved, and each bead a small art piece.
- Christopher Columbus recorded in his log that he gave the Natives of San Salvador Island glass beads on October 12, 1492.
- Beads were used for trade. A tubular shell, the wampum, was an original currency in the Northeast. Beaver pelts tanned and ready for market were traded for European glass beads.

The Ute words for numbers:

- 1: soo ece
- 2: wi an ne
- 3: pi ah ne
- 4: wich u anie
- 5: man I ganie
- 6: navine
- 7: nav i cav i nee
- 8: wamf chu anie
- 9: swat ä wamf chu anie
- 10: tompsoo anie

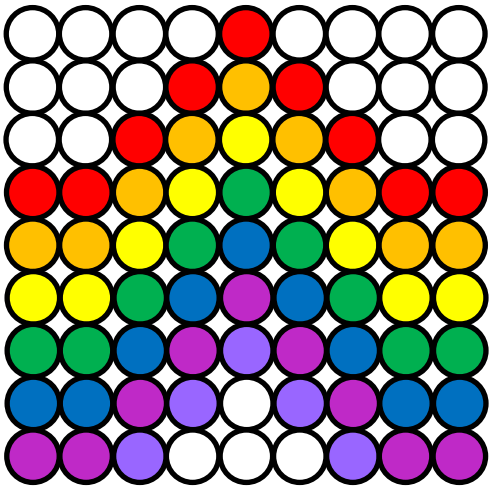




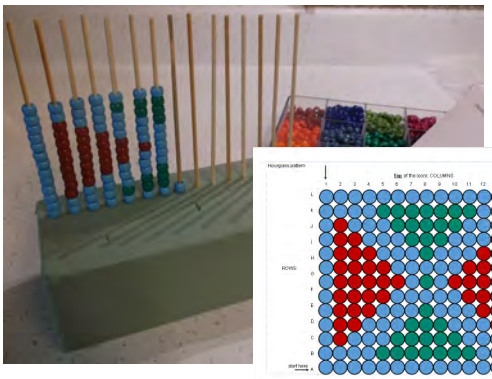
- Continue until you have built your loom pattern with 9 skewers.
- Example: In the rainbow pattern, add 13 light blue beads on the first skewer. Add 2 light blue beads, 9 dark red beads, and 2 light blue beads on the second skewer. Continue reading the pattern until your loom is complete.
- Remove the beads. Try the second and then third pattern.
- Page 24 pattern is for your own design, your own pattern Sketch out a pleasing design, fill in the circle beads, and fill the beads on your loom.

<u>Make your Patterns</u>

- Pages 20-24 have different patterns. Page 20 is the 9x9 pattern to learn how to read the pattern and replicate it on your loom. The other patterns are for the 15x13 loom. When you are ready, add your final 6 skewers and complete those patterns.



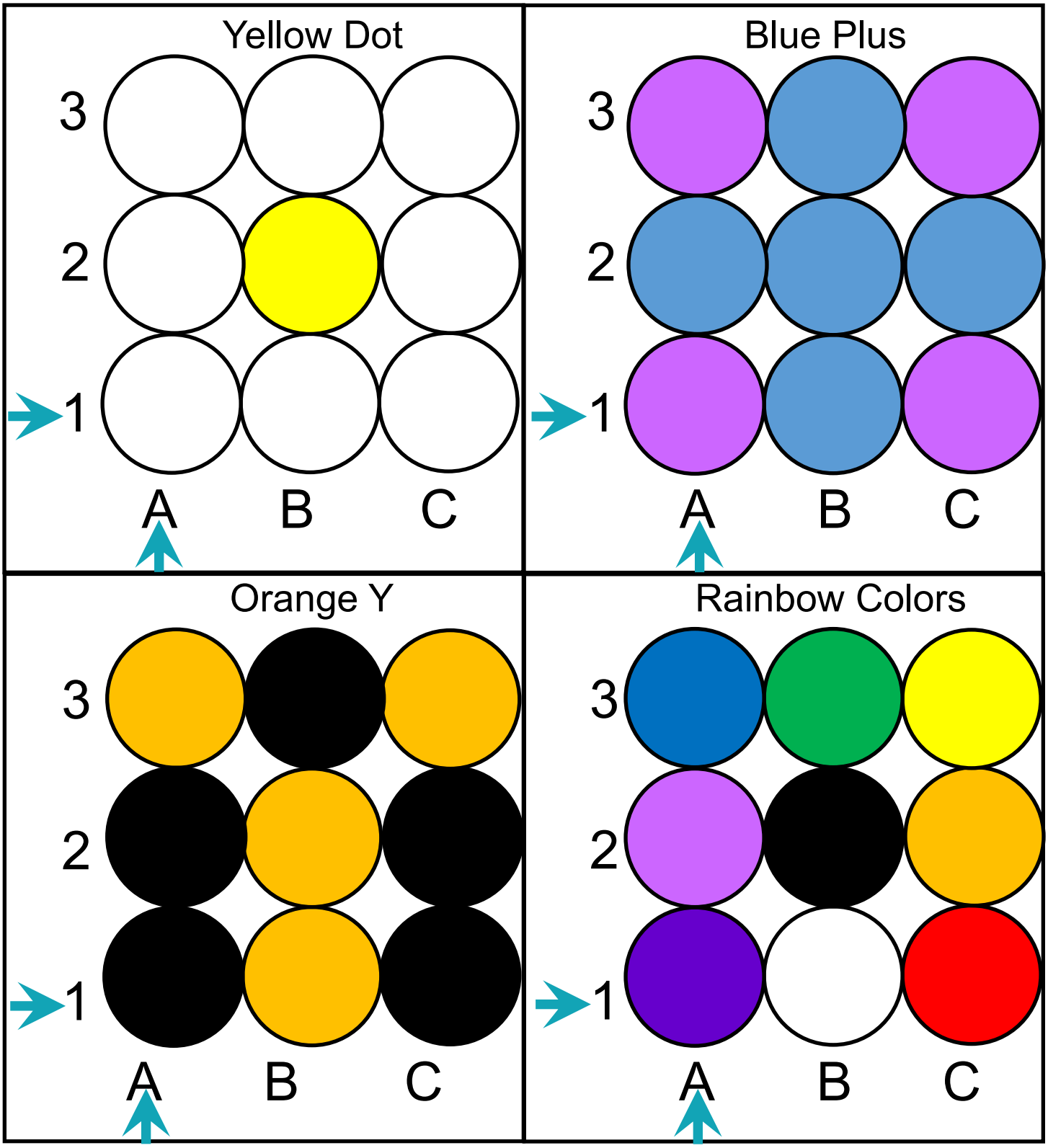
- Start with row "1" and column "A." Notice that you read the pattern from the bottom to the top in each column. Add one light purple, one blue, one green, one yellow, one orange, one red, and three white beads.
- Move to the second column. It is the same pattern as the first column. The third column changes slightly.
- Follow the bead pattern on the first skewer, completing the first column (bead 1A; through bead 1I) before moving to the next skewer adding beads 2A through 2I.
- Example Rainbow: try the 9x9 pattern on page 20. Start in the lower left corner, and work your way up each column before moving to the next column.
- Add the three skewers to each side of your loom, using the ruler as a guide and beads for proper spacing.
- Replicate the designs on pages 21-23. Page 24 is for you to design your own pattern.

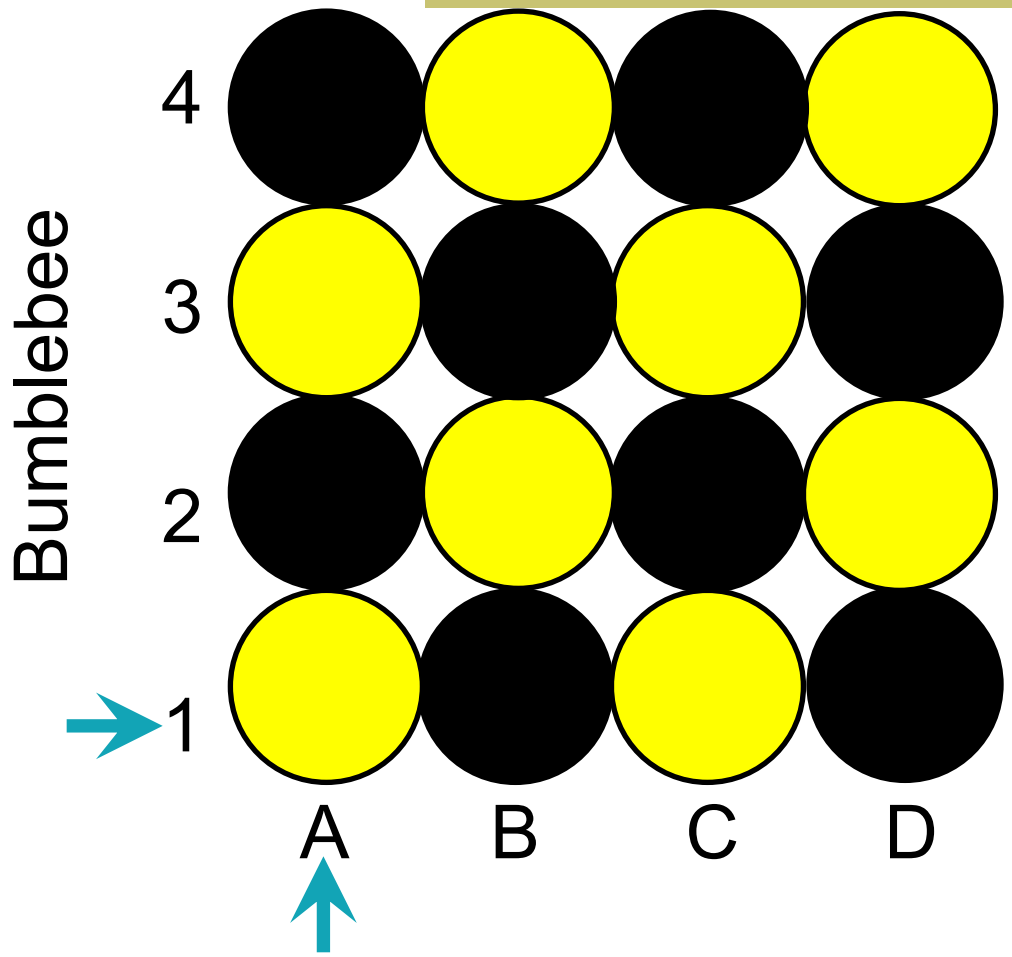


The Ute words for numbers:	
• 11:	*tomp soo anie suke spequat*
• *12:*	*tomp soo anie wike spequat*
• *20:*	*wahm soo anie*
• *30:*	*pamp soo anie*
• *40:*	*wichuke tomp soo anie*
• *50:*	*nah neek tomp soo anie*
• *75:*	*swah soo ece*
• *100:*	*soo coo moo*
• *500:*	*man eek moo*
• 1,000:	soo cus tousand

Print 1 per participant, and cut apart the 4 cards.

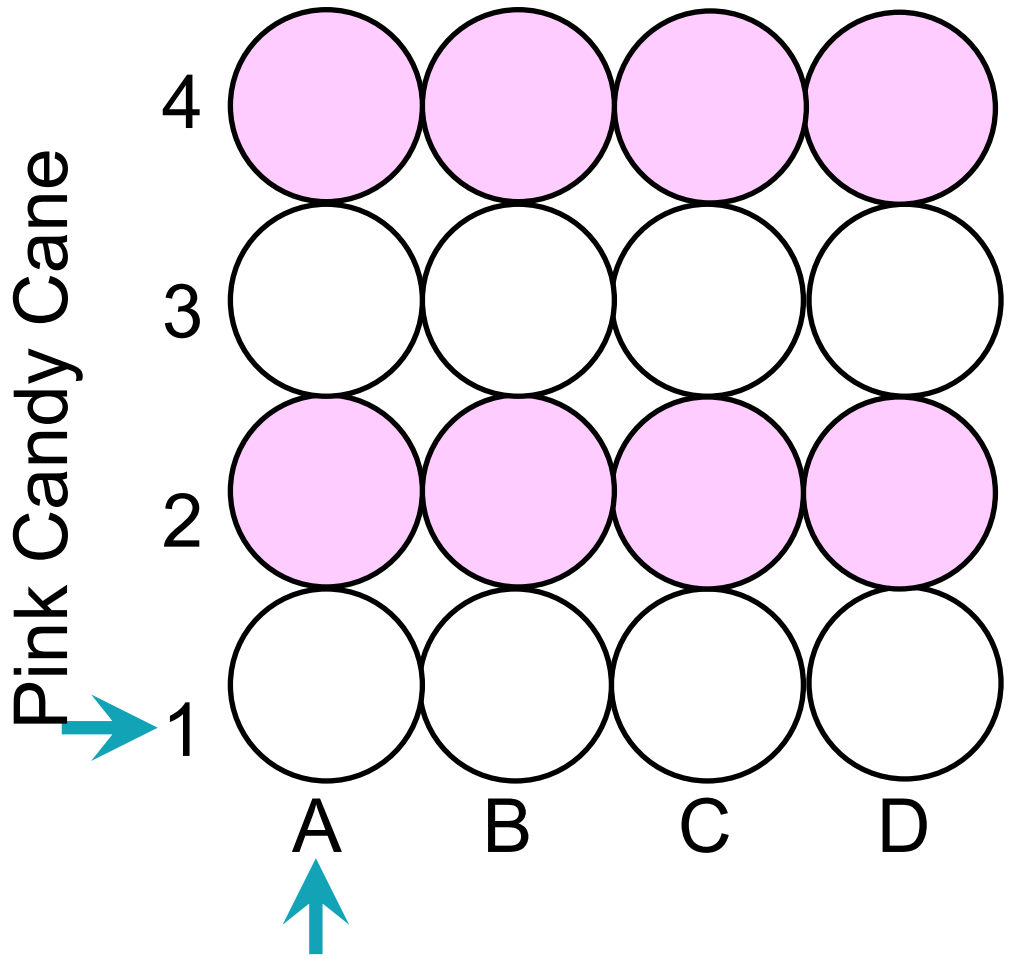
- Example for Yellow Dot:
- Start with the white bead located at 1-A, indicated by the light blue arrows.
- Add the next white bead just above at 2-A.
- Add the next white bead just above at 3-1.
- Move to the next column B, and add the beads B-1 (white bead), B-2 (yellow bead), and B-3 (white bead).
- Repeat these steps for column C.
- Try the other three patterns. Can you match the pattern with your own beads?





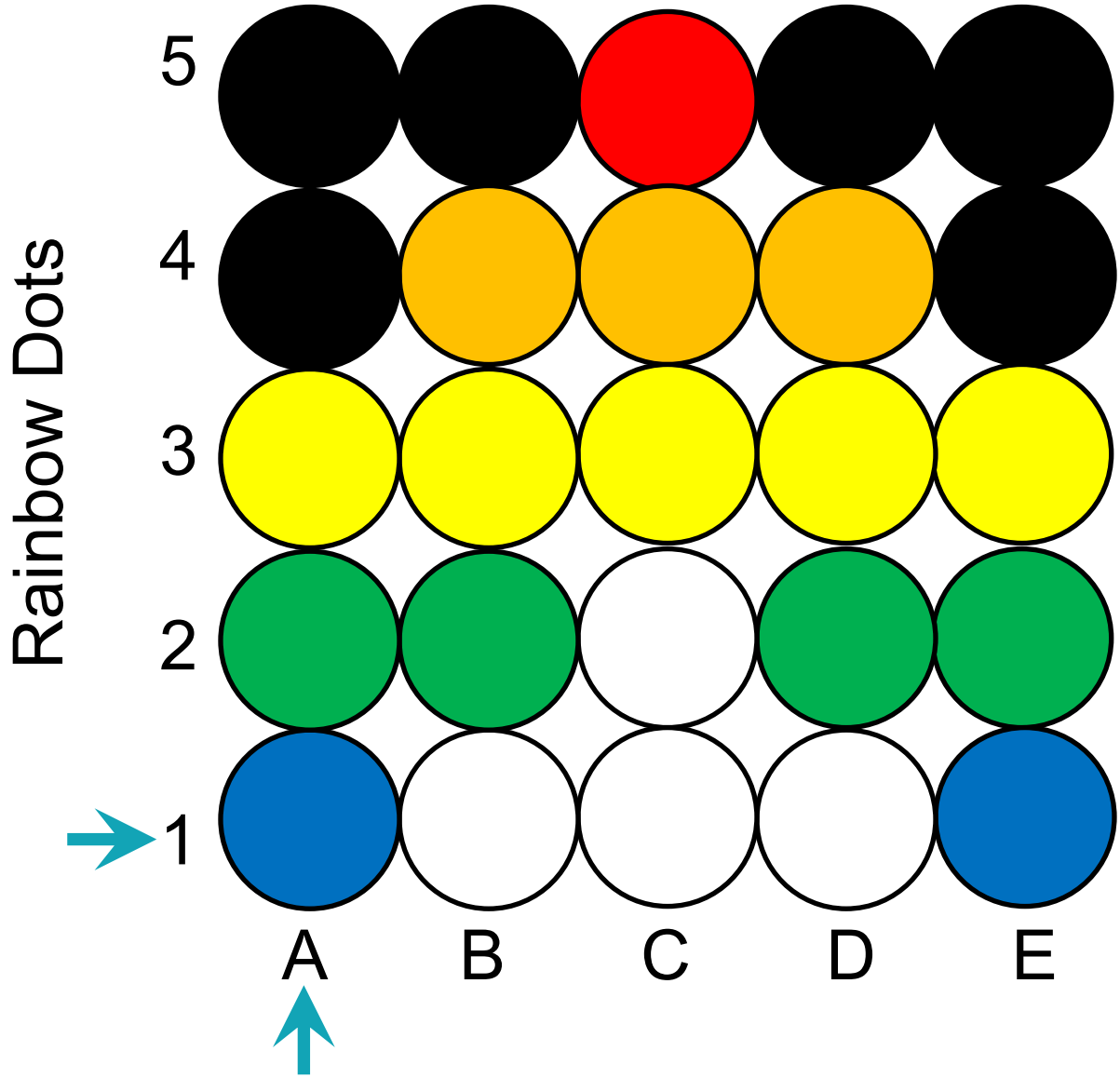
Bumblebee Pattern

- Start with the bead located at 1-A, indicated by the light blue arrows. This will be a yellow bead.
- Add the next bead just above, 2-A. This will be a black bead.
- Continue adding the next bead in column A until you have added 3-A and 4-A beads.
- Move to the next column B, and add the beads B-1, B-2, B-3, and B-4.
- Continue until you have completed the pattern with column C, and finally column D.
- If you would like to keep this pattern, add a drop of white glue to each bead on row 4, the top row.
- Allow to dry.



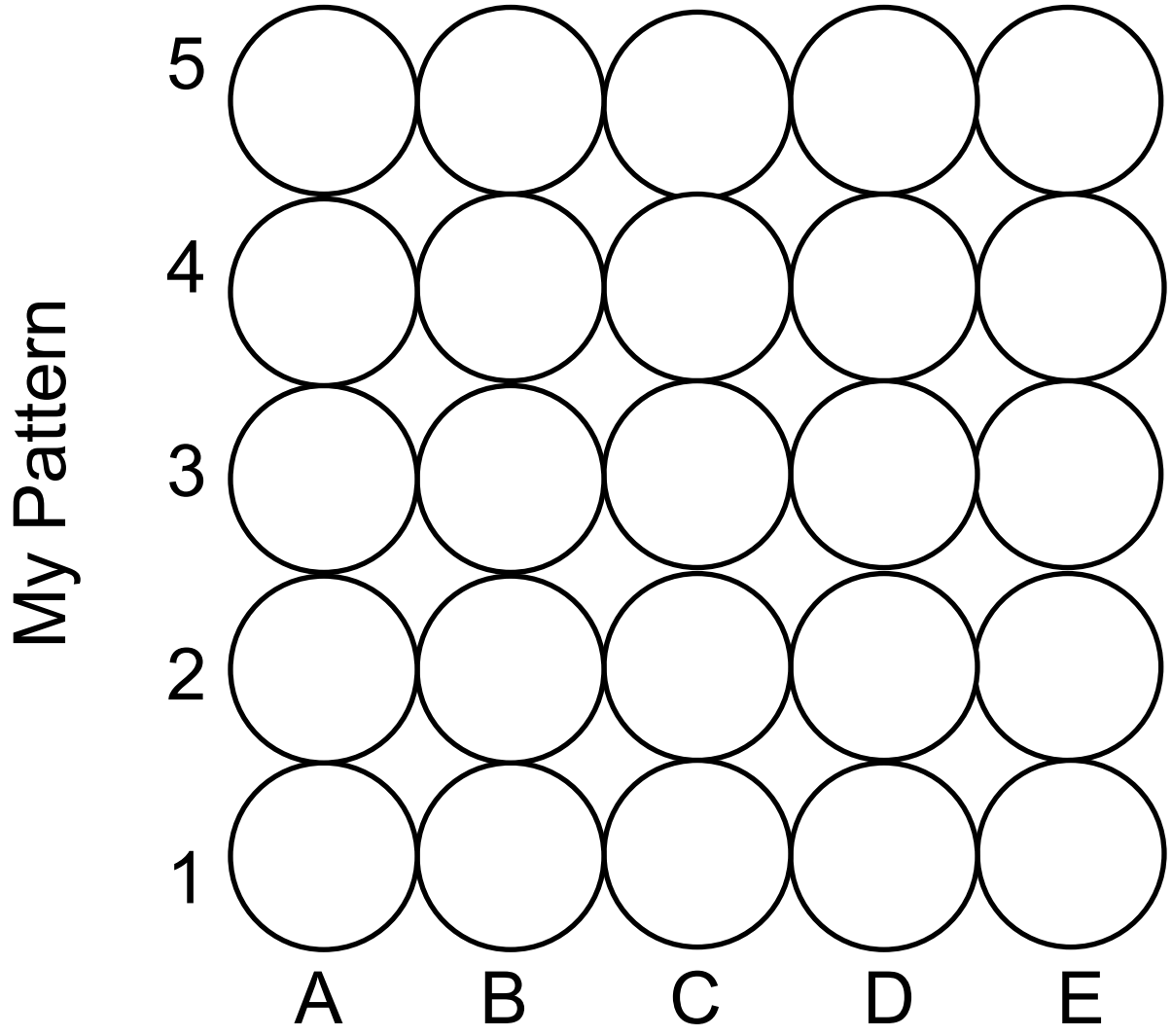
Pink Candy Cane Pattern

- Can you follow the pattern to recreate this new Pink Candy Cane pattern?
- Hint—start at the light blue arrows.



Rainbow Dots Pattern

- Start with the bead located at 1-A, indicated by the light blue arrows. This will be a blue bead.
- Add the next bead just above, 2-A. This will be a black bead.
- Continue adding the next bead in column A until you have added 3-A (black bead), 4-A (black bead) and 5-A (red bead).
- Move to the next column B, and add the beads B-1, B-2, B-3, and B-4.
- Continue until you have completed the pattern with column C, and finally column D.
- If you would like to keep this pattern, add a drop of white glue to each bead on row 4, the top row.
- Allow to dry.



Design your own!

Design your own:

- Sketch some patterns until you have a design that you like.
- Each circle above represents one bead in your design. You many need to alter your design to fit in the 25 beads in this loom. of 5 rows (1-5) by 5 columns (A-E).
- Start with 1-A, and begin to transfer the pattern to the bead loom.
- Work your way from column A, filling in each rom 1-5.
- Repeat for Column B, filing in each row 1-5.
- Repeat for Column C, D, and E, until you have completed your design on your bead loom.
- If you would like to keep this pattern, add a drop of white glue to each bead on row 4, the top row.
- Allow to dry.

Rainbow pattern

Top of the loom: COLUMNS

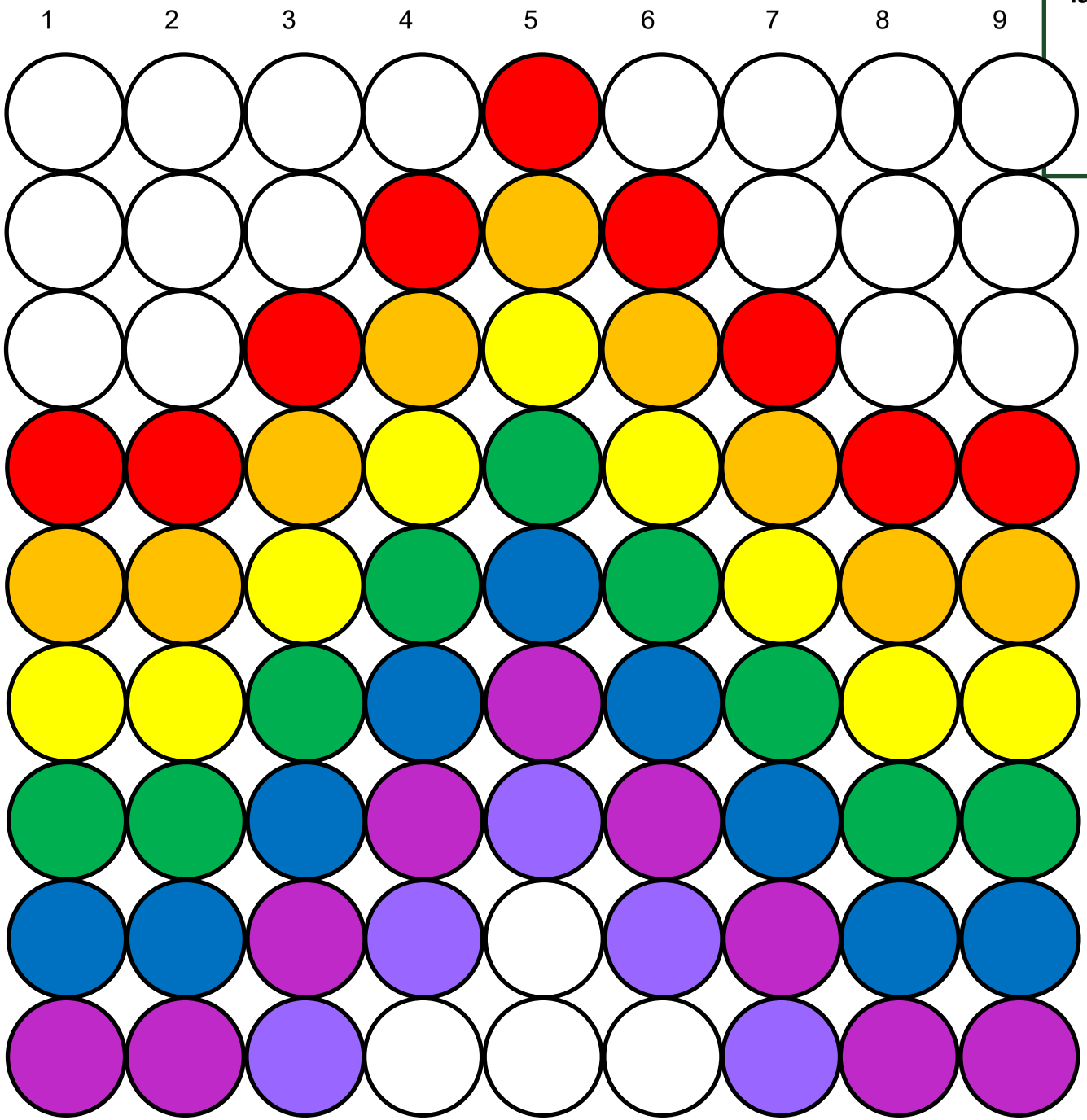
Turn page to landscape.

This side

Complete Column 1 before starting Column 2.

ROWS

Start at the bottom and work up before moving to the next column.



Hourglass pattern

Turn page to landscape.

This side up.

Top

Complete column 1 before starting Column 2.

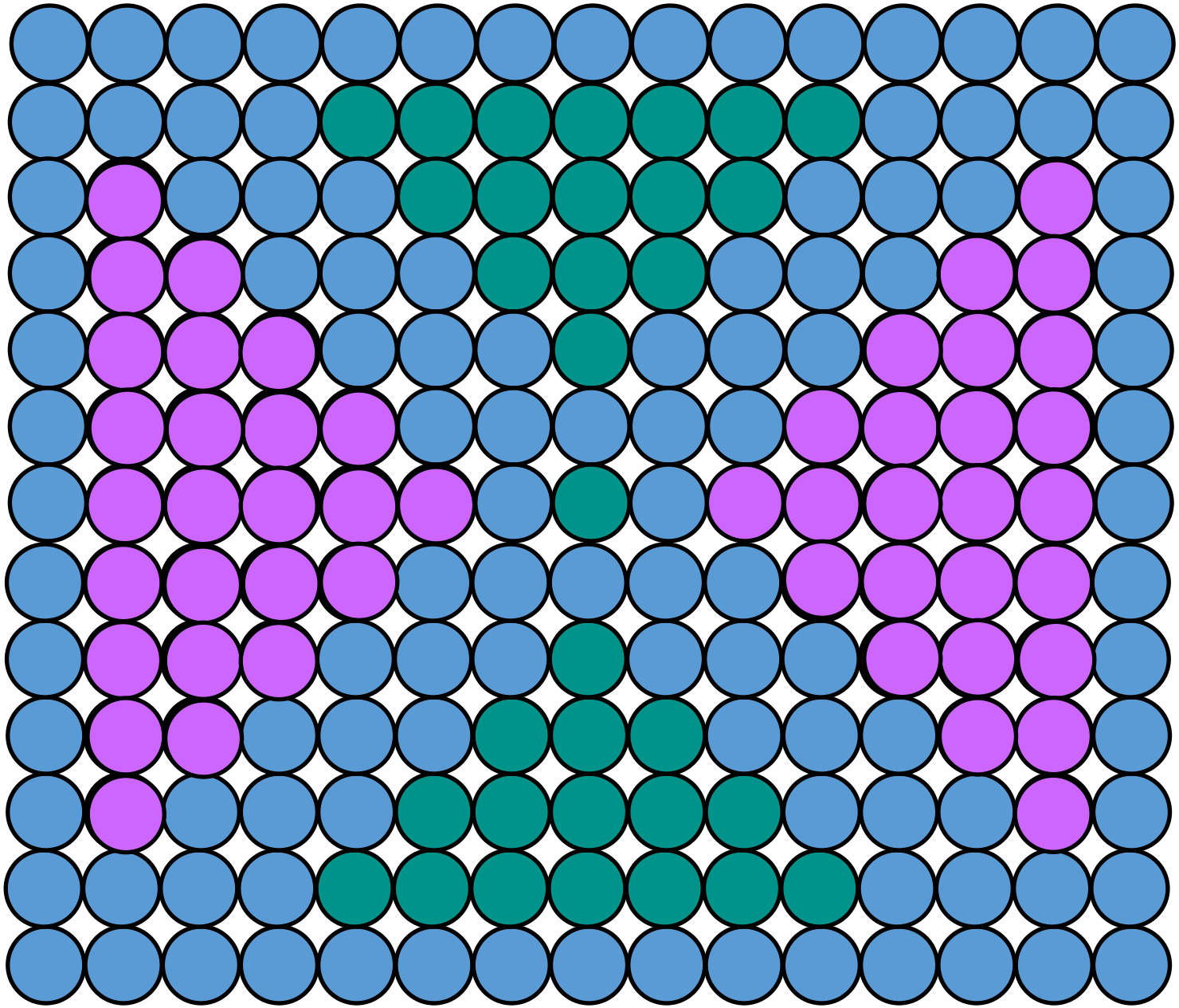
of the loom: COLUMNS

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

ROWS

L k J I H G F E D C B A

Start at the bottom and work up before moving to the next column.



Hourglass pattern

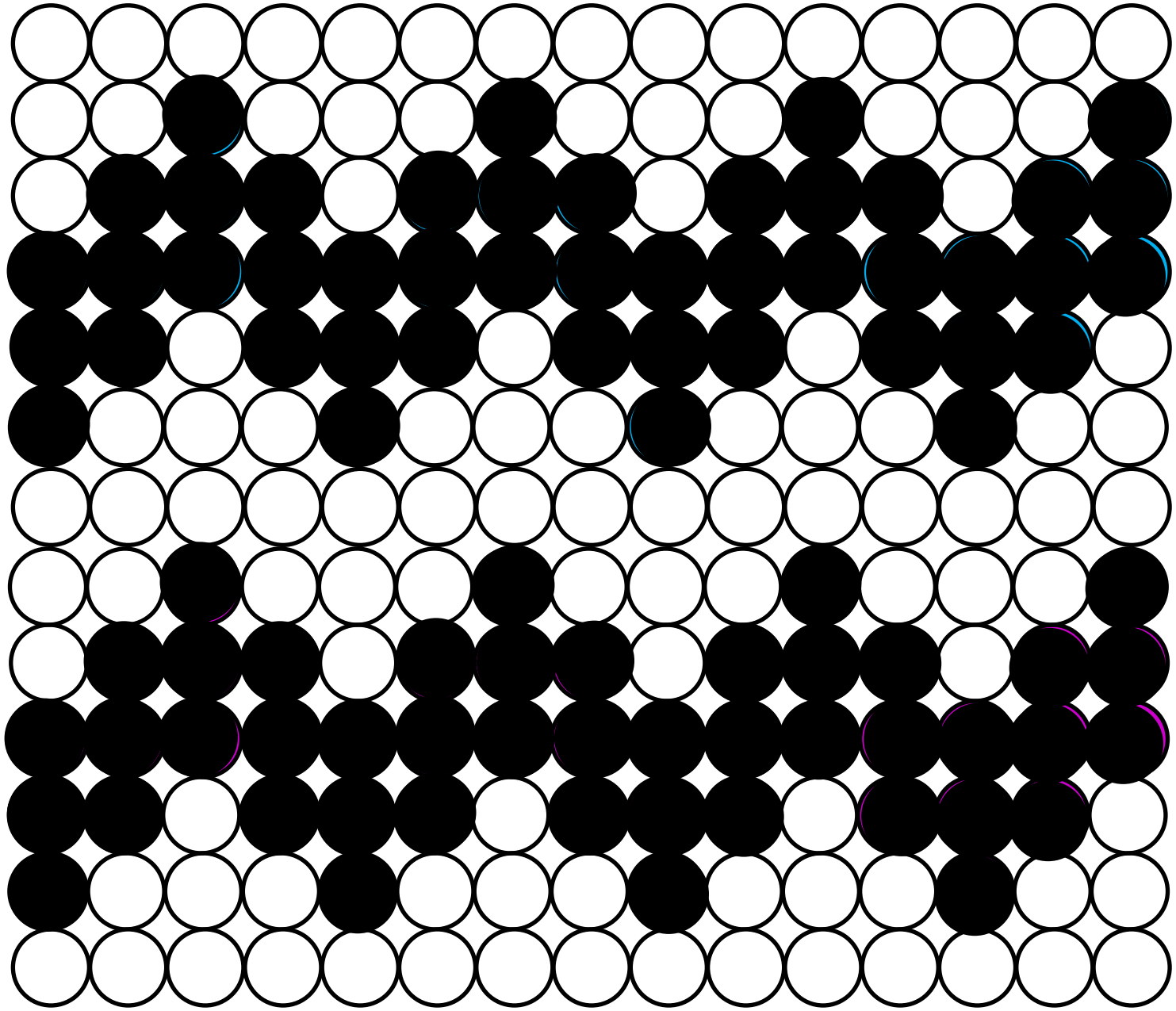
Turn page to landscape.

This side up.

Top of the loom: COLUMNS

ROWS

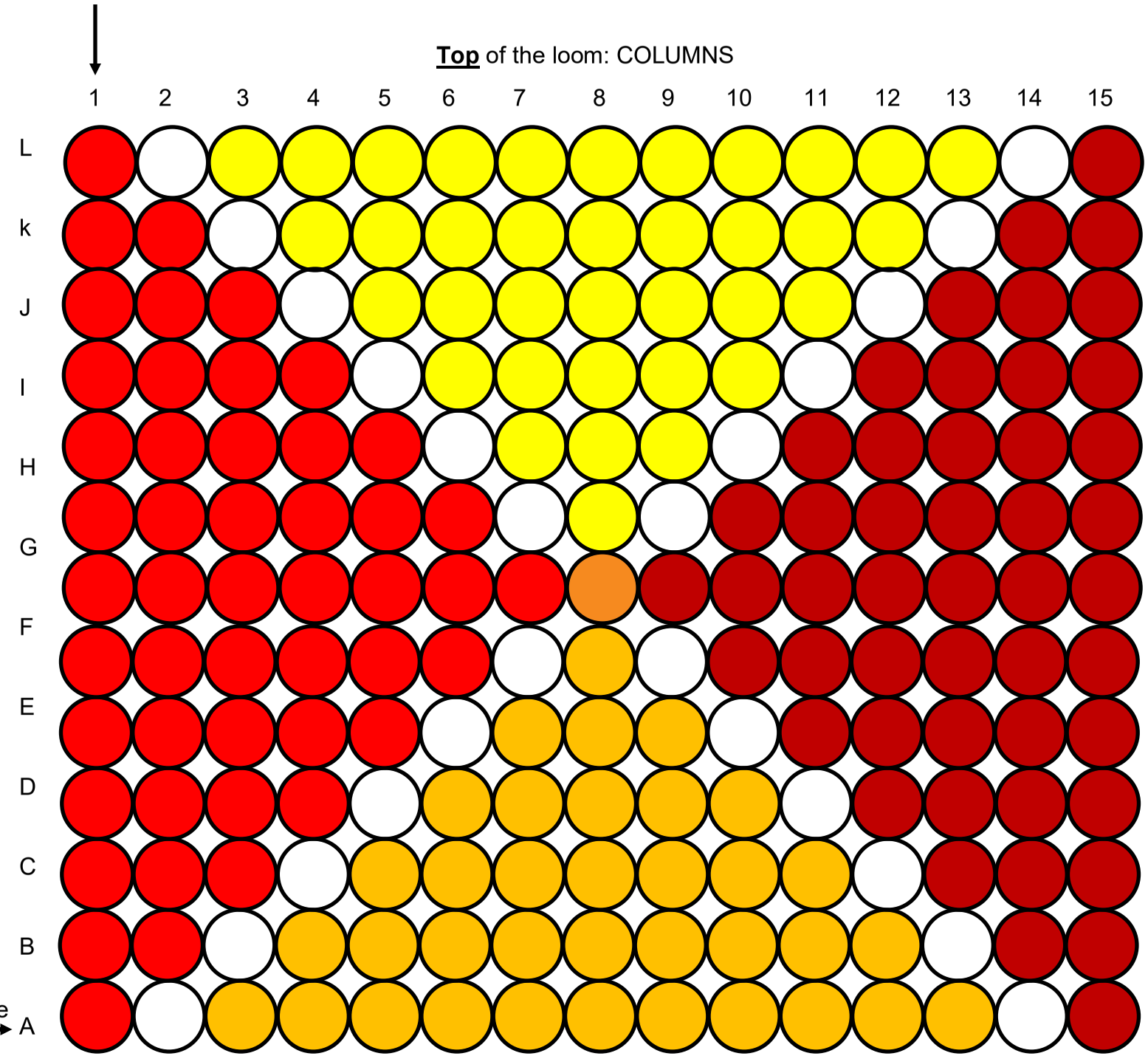
start here



Hourglass pattern

Turn page to landscape.

This side up.



Design your own pattern

Turn page to landscape.

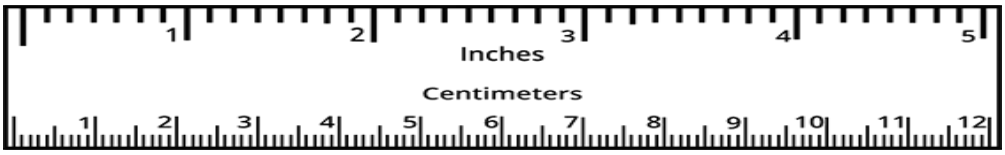
This side up.

Top of the loom: COLUMNS

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

ROWS

L
k
J
I
H
G
F
E
D
C
B
start here A



The Utes wove baskets for different purposes. Loose **weave** baskets were good for separating nuts from pinecones and other larger objects. A tight **weave** was good for gathering berries. The tightest **weave** was coated with pine sap to seal it. This basket was used to carry water.

The Utes used thin willow branches. They stripped the bark off the willow and split the reeds with their teeth. They wove them into a basket.

Directions:
For Younger Participants—directed by an adult:

- For the youngest learners, you will prepare the cup for weaving. Depending on the ages of your participants, you will cut the length of the cup 3 or 5 strips.
- With the cloth tape, measure the rim of the cup. It may be easier to tape the cloth tape to hold it in place.

- Always use an odd number of cuts. Divide that number by 3 or 5.
- With the permanent marker, tick to rim of the cup at those measurements. For example, your cup circumference measurement is 12”, divided by 3 = 4”. Place a tick mark every 4 inches. If you want a tighter weave, 12” divided by 5 = 2.4 inches (around 2 $^{3}/_{8}$”). Remove the tape measurer.

- With sharp scissors, cut through the rim to the bottom of the cup. Do not cut through the cup’s bottom.

- Directions continue on page 26—For All Participants).

For Older Participants—

- With the cloth tape, measure the rim of the cup. It may be easier to tape the cloth tape to hold it in place.
- Record that measurement on your datasheet (page 29) in both inches and centimeters. (1” = 2.5cm). The worksheet

POWER WORDS

- **adhere**: to **stick** tight, cling
- **alternate**: arranged one above, beside, or next to another
- **arid**: dry, with little rainfall annually
- **circumference**: the line that goes around a circle
- **secure**: to make fast
- **warp**: (in **weaving**) the threads on a loom over and under which other threads (the weft) are passed to make cloth
- **weave**: to make by passing threads or strips over and under each other

The Ute word for basket is
seer a wots

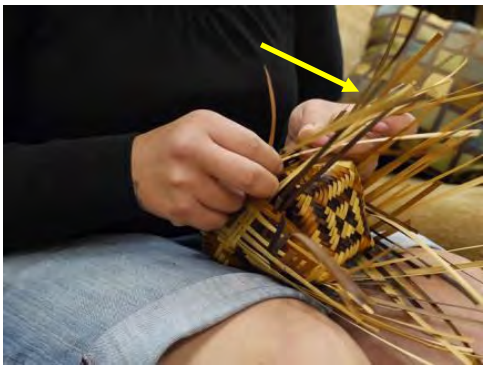
continued on page 26

MATERIALS

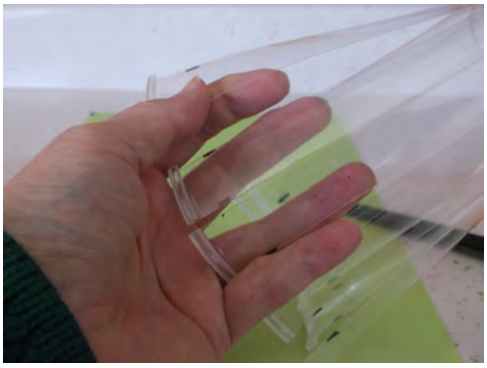
- paper or plastic cups (paper works better)
- yarn, pretty colors
- tape
- Print page 29 for older participants
- pencil
- permanent marker
- sharp scissors
- cloth tape measure
- hot glue gun works best, but you can use white school glue with parent to help you

will help you determine how many cuts you need to make. The cup in these images used 11 cuts.

- The cup represents the **warp** in **weaving**. In the image below from the Smithsonian website, a Cherokee woman is **weaving** a basket. The arrow points to the **warp**. The **weft** is making the pattern, woven into the **warp**.



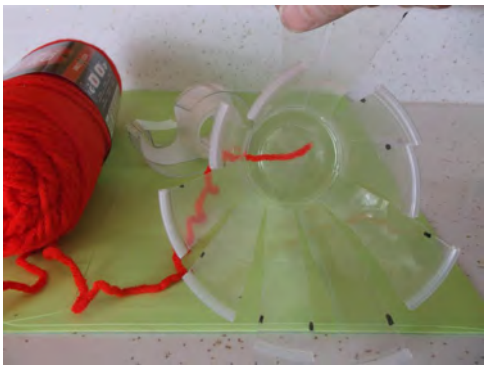
- Your cup needs to be cut into an odd number of strips for the **warp** (5, 7, 9, 11, 13, 15). Can you think of a reason why an even number will not work? Page 29 is a worksheet to calculate the **warp**. You can round.
- In example 1 on page 29 the **circumference** is 11". The measurement is divided by the number of **warp** strips, in this case 11. Mark the **circumference** at 1" intervals around the cup rim.
- Using your calculated measurement intervals, place a mark on the cup with the permanent marker. Continue measuring and marking the entire **circumference**.
- Remove the cloth tape measure from the cup.
- At the mark, cut your cup



from the top to the bottom, but do not cut through the cup's bottom.

For ALL Participants

- Tape the end of your yarn to the inside bottom of your cup. Thread it through the **warp**. The **weft** (yarn) will make your basket design.
- **Alternate** your yarn from in front of one **warp** strip to the back of the next strip.



POWER WORDS
continued from page 25

- **weft**: (in **weaving**) the crosswise threads on a loom over and under which other threads (the warp) are passed to make cloth

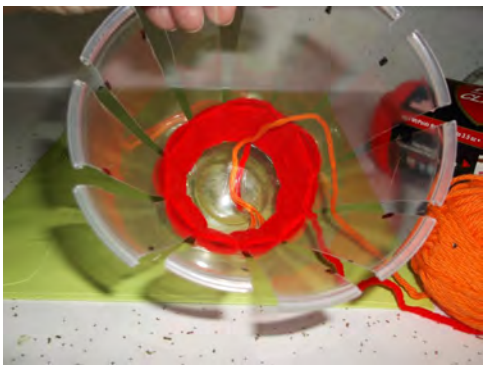
The Ute word for water jug basket is
soo check

Cogitation Expedition
hint: Albert Einstein

FASCINATING FACTS

- The oldest Native American baskets were found in the American Southwest. The **arid** climate of the Southwest helped preserve these baskets believed to be around 8,000 years old. Baskets were an important part of Native American life. Each basket was created for a specific purpose.

- As you work, push the yarn down snug on the row below.
- When you are ready to change colors, tape the new color yarn (orange in the images) to the bottom of the cup. Bring the first color (red in the images) inside the cup, tape to the bottom of the cup, and snip the yarn.



- Replace the old color (red) for the new color (orange) and continue weaving, and pushing down the yarn on the lower rows.

- Continue weaving. If you want to change colors again, repeat the directions above.

- Challenge: can you alter the design to a wave? How would you need to weave your colors to achieve this design?

- When you reach the top of your cup, tape the end of the yarn to the bottom of the cup and cut the thread .

Finish your cup basket

- You can still see the plastic rim on the cup. To finish your basket make a braid of your yarn for the top and bottom. You can select any colors for your braid. It can be the same colors of your cup basket, or you can select something different.
- Tape your cloth tape measure to the table or countertop from 0 to 40”.

The Ute word for a Cambrian trilobite “little water bug living in a house of stone” is

Timpe-Konitza-Pachuee

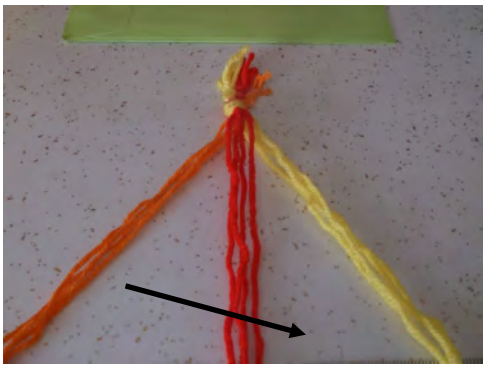
Image from Western Trilobite Association of *Leiostegium manitouensis*
http://www.westerntrilobites.com/Species/L.manitouensis.htm

FASCINATING FACTS

- The Ute Tribes are now located in SW Colorado and Utah. They roamed throughout the Western Rocky Mountains, venturing onto the Eastern Plains. They found Cambrian trilobites and carried them as protective charms, “Timpe-Konitza-Pachuee.” or “little water bug living in a house of stone.”

- Measure and cut 12 strands of yarn 40”. What colors do you want the top and bottom of your basket? The colors you pick are up to you.

- When you have 12 strands, divide them into 3 groups of 4 strands each.
- Tie strands together close to one end. Keep strands in 3 groups of 4 and braid together, tying a knot to **secure** end.

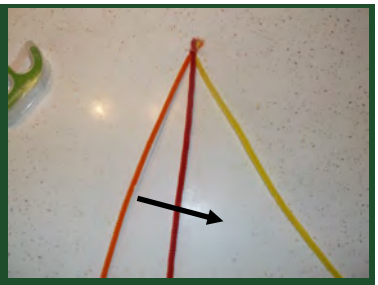


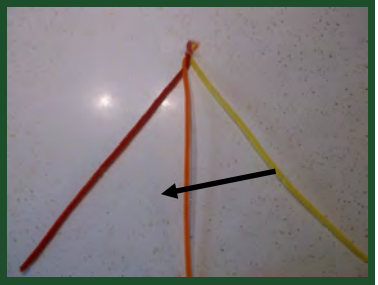
- Tape the knotted end of the strands to the counter, and braid the three strands.

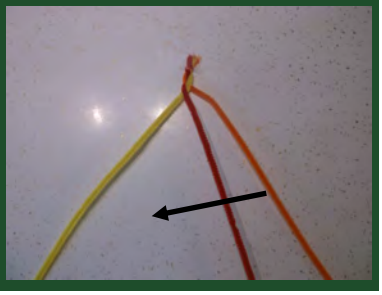
- Use the hot glue gun to **adhere** the braid around top edge of cup. Secure the ends together with glue.
- Repeat the directions to make a shorter braid 30”.
- Glue this braid to the bottom of the cup.
- You can use your new cup basket to hold pencils and pens, or other small object. It is not water proof. If you want to use it for a flower vase, cut the rim off another cup the same size, and insert it into your basket.

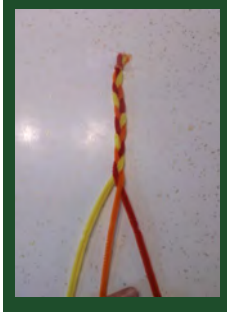
HOW TO BRAID

- Twist one end of the three pipe cleaners together. Tape the top to the counter.
- Notice that the order is orange on the left, red in the middle, and yellow on the right.
- Place the left orange stand over the red strand. The orange would now be in the middle and the red would be on the left of the three strands.
- Place the yellow strand over the orange strand. The yellow strand is now in the middle, and the orange strand is on the right.
- Place the red strand over the yellow strand. It is now the middle, yellow on the left and orange on the right.
- Continue until you reach the bottom of the strands.









Cup Weaving #1

Measure the rim of the cup. Write down that number in both centimeters and inches:

Centimeters: _____

Inches: _____

For a tight **weave**, select a higher odd number, like 11, 13, or 15.

_____

For a looser **weave**, select a lower odd number, like 5, 7, or 9.

_____

To figure out how to make your warp evenly spaced around the cup, divide the number you picked (# warp) into the measurement, first in centimeters, and then in inches:

Example 1:

1 in

11 (# warp) | 11 in (measurement)

-11

0

Centimeters:

Inches:

Cup Weaving #2

Measure the rim of the cup. Write down that number in both centimeters and inches:

Centimeters: _____

Inches: _____

For a tight **weave**, select a higher odd number, like 11, 13, or 15.

_____

For a looser **weave**, select a lower odd number, like 5, 7, or 9.

_____

To figure out how to make your warp evenly spaced around the cup, divide the number you picked (# warp) into the measurement, first in centimeters, and then in inches:

Example 2:

4 cm

7 (# warp) | 28 cm (measurement)

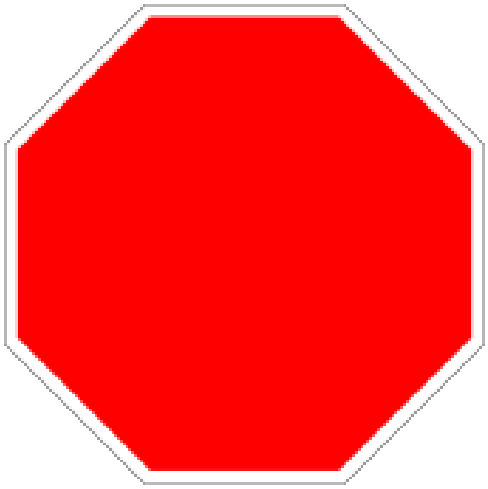
-28

0

Centimeters:

Inches:

We use symbolism in our daily lives. For example, you know what this symbol means.

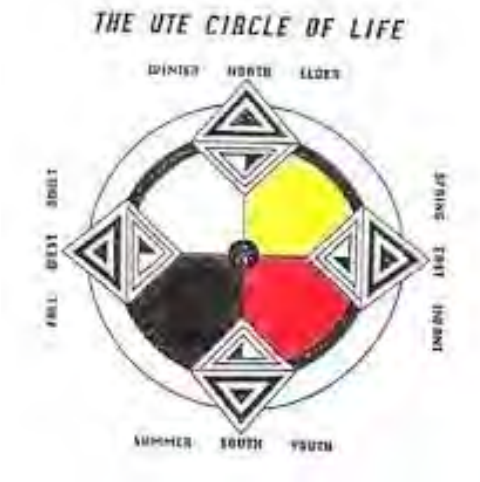


Symbols are a mark, sign, or word that **indicates** or **represents** an idea, object, or relationship. Many symbols are specific to a culture. The sun has many different symbols and meanings among the different Native people.

People from European ancestors often mistake that any Native American symbol is common to all Native American people. There are 574 federally recognized Native American Indian and Alaska Native tribes and villages. Of the more than 300 languages spoken when Europeans first arrived on the New World, there are about 150 languages still spoken.

Directions:

- Page 31displays the three **Great Seals** for the three Ute tribes: Northern Ute, Southern Ute, and the Ute Mountain Ute. Examine the three seals, and list the all the different symbols you can identify.
- Read about the Northern Utes:
  - http://www.utetribe.com/
  - https://indian.utah.gov/ute-indian-tribe-of-the-uintah-ouray-reservation/
- Read about the Southern Utes:
  - https://www.southernute-nsn.gov/
  - https://www.colorado.gov/pacific/ccia/southern-ute-indian-tribe
- Read about the Ute Mountain Utes:
  - http://www.utemountainutetribe.com/
  - https://www.colorado.gov/pacific/ccia/ute-mountain-ute-tribe
- Can you figure out what each symbol means? List them.



POWER WORDS

- **Great Seal**: a seal used for the authentication of state documents of the highest importance
- **indicate**: point out, show
- **represent**: (of a sign or symbol) have a particular signification, stand for

- To the left is the Ute Circle of Life. Examine it closely. Explain:
- Colors—
  - White
  - Yellow
  - Red
  - Black
- Compass points—
  - North / Winter / Elder
  - East / Spring / Infant
  - South / Summer / Youth
  - West / Fall / Adult

MATERIALS

- paper
- color pencils or markers
- computer with internet
- print pages 31 and 35-39
- string
- 2 push pins
- eraser
- straight edge ruler

The **Great Seals** of the three Ute Tribes: Identify each image in the seal and what you think it means. (Example: Southern Ute's sun represents, "The spirit that watches over our people."

Northern Ute—located in the northern Utah

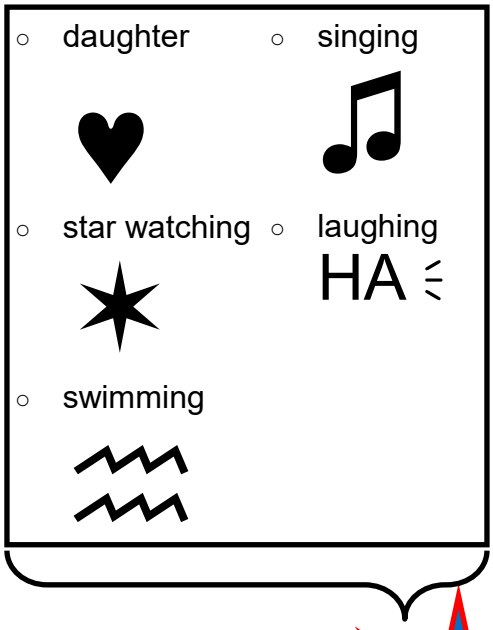
Southern Ute—located in the southern Colorado (explanation https://www.southernute-nsn.gov/government/tribal-seal/)

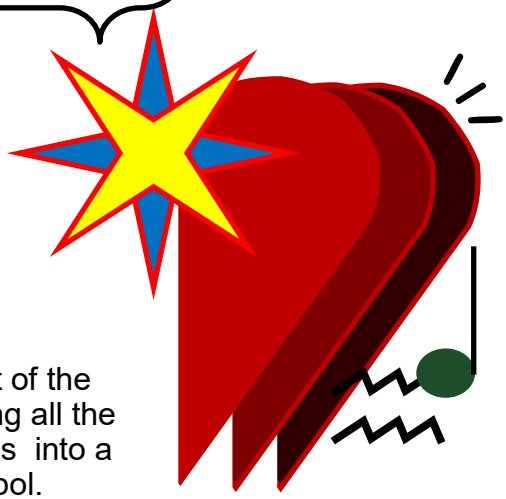
Ute Mountain Ute—located in Four Corners southwest Colorado, New Mexico, and Utah

Ute art is beautiful. There are images of two different pottery pieces created by Ute Mountain Ute artists on page 35. The designs on the pottery are a wonderful combination of arcs and straight lines. In this activity, you will explore you, your interests and dreams. You will then incorporate those into you very own Great Seal!

Directions:

- Complete the worksheet on pages 36-37. This will **prompt** you as you design your personal symbol.
- Examine your words. Put them into different categories:
  - Words that describe who you are (**e.g.** son/ daughter; brother/sister; short/tall, etc.)
  - Words that describe things that are joyful (**e.g.** church, hiking, star watching)
  - Words that describe your interests (**e.g.** astronomy, swimming, animals)
  - Words that describe your skills (**e.g.** math, singer, writing)
  - Words that express your dreams (**e.g.** your future career and hopes)
- From this list, select one word from each of your categories.
- On a piece of paper (or if you want to make your symbols graphic, you can use the graph paper on pages 38-39) sketch some ideas to represent the words. See the example on the right. You may have several ideas for a single word. For example, "daughter" could be a heart and stick figures to represent your family). Do not limit yourself. This is the creative phase of the activity.
- Examine the different images. **Stylize** them, combining them until you are pleased with your results.
- You can use them individually or merge them into one image. Use different ideas of circles, arcs, and straight lines until you find a design that is pleasing to you. Does it represents you? Below is an example of a final symbol, combining each individual symbol of your words into something that now represents you!





The final result of the example, merging all the individual images into a single symbol.

POWER WORDS

- **prompt**: (of an event or fact) cause or bring about (an action or feeling)
- **stylize**: give (something) a distinctive design or appearance
- **taut**: stretched or pulled tight; not slack

- The last activity is to develop your very own Great Seal!
- Notice that the three Great Seals of the Ute People are all circles.

Draw a perfect circle:

- The circle **radius** should be 2,5 to 3 inches, and the diameter 5 to 6 inches. How big will the circumference be?

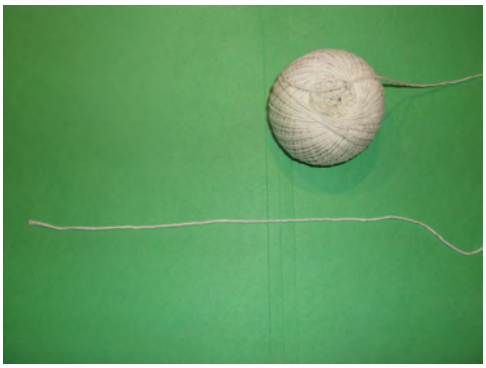
$$C = 2\pi r$$

  - C = circumference
  - 2 - multiply by 2
  - **π** (pi) = 3.14
  - r (**radius**) = 1/2 diameter

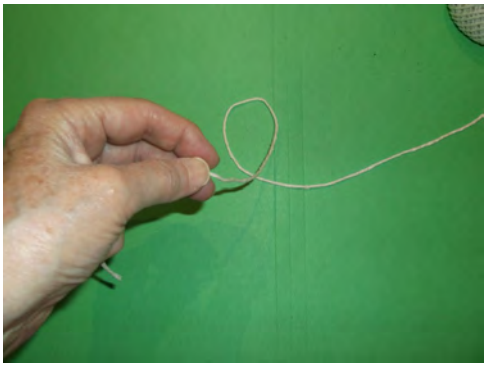
$$C = 2 \times 3.14 \times 3$$

answer on page 67

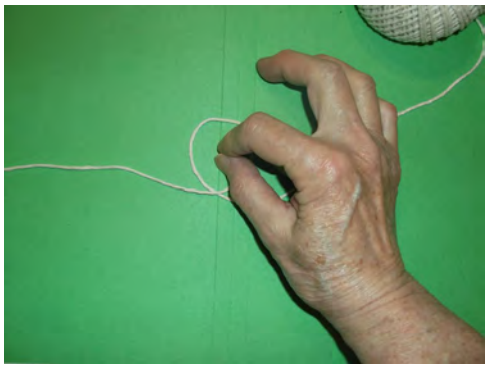
- Slip knots are probably the easiest knot to tie for this activity. If you pull on one end of the string, it will close the loop. The other string is stationary. You can pull on the loop to make it bigger. If you pull on the moving string, tightening the loop, it will pull through the loop and become a single piece of string again. Here are the simple steps to tie a simple slip knot:
  - Lay down 12" of your string with the tail end on the left, and the ball of string on the right.



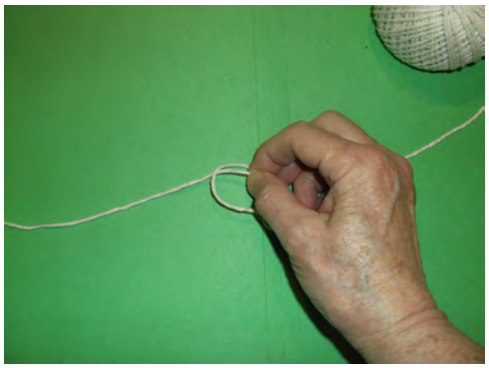
  - Make a loop by grabbing the tail end of the string and looping over the top of the ball end of the string.



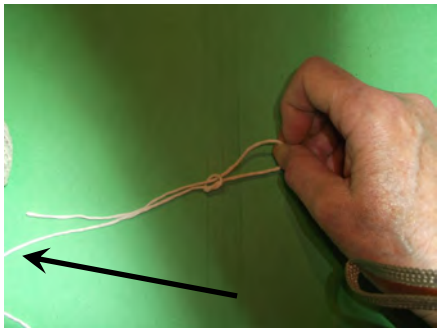
  - Make "pinch" fingers with your right hand index and middle fingers. Place in the center of your loop.



  - Lift the loop so you can grab the tail end string through the loop.



  - Keep holding the string with your right hand. With your left hand, pull the ball end of the string until the loop knot tightens.



Pull the ball end while pinching the string with your right hand.

POWER WORDS

- **circumference**: the distance that goes around a circle
- **diameter**: a straight line passing from side to side through the center of a circle or sphere
- **pi (π):** a ratio of the distance around a circle (**circumference**) to the circle's **diameter: it is** always the same number 3.1416...
- **radius**: straight line from the center to the circumference of a circle or sphere

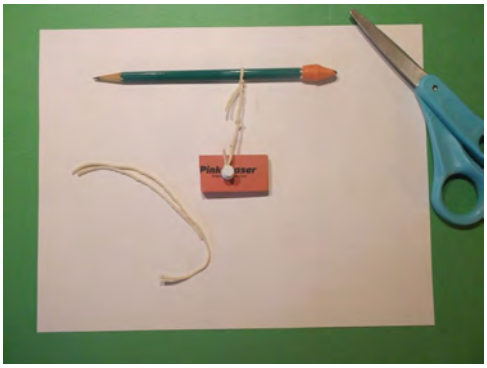
FASCINATING FACT

- Ropes and cords were the ancient fasteners.
- Different knots were used for different purposes. A shoelace knot is secure, but can be easily released. A clinch knot will hold a hook on your fishing line without slipping.

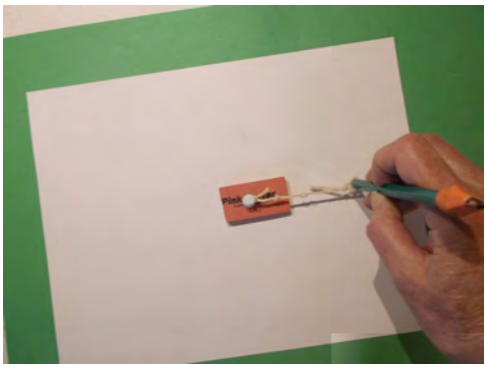
- Make your first slip knot. You need two, one on each end, and the string between to be between 2.5 to 3”. Cut your string about 8” (so you have enough to easily make your second slip knot). You want adjust the length in the next step.

- To adjust your string length between the two slip knots, tie a know, remeasure, and continue tying single knots until your string is between 2.5 and 3 inches. The image below needed two knots (arrows) to shorten the string length to fall within the correct measurement range.

- Snit the long ends, leaving about 1/2 inch of string. They will get in the way while you draw your circle.



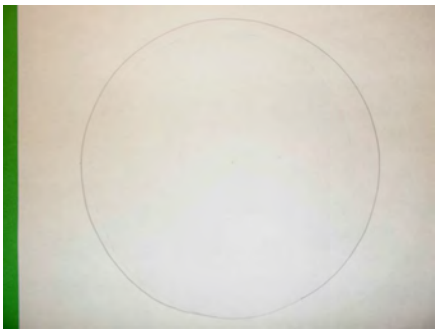
- Push a push pin into the center of a rectangular eraser. Loop one slip knot over the push pin and pull tight.
- Loop the other end over your pencil and pull tight.
- Your pencil slip knot needs to be level to the slip knot on the push pin. To keep in place, hold your pencil and slip knot. You can also tape it to the pencil.



- Hold your pencil **vertical** (straight up and down—90°) to the paper.
- With your other hand, press down on the push pen to keep the eraser from slipping.
- Pull the pencil until the string is taut. Press down on the pencil and carefully pull the pencil around in a circle. You may need to practice a couple of times until you achieve a good circle.
- Erase any pencil slips.

FASCINATING FACT

- Geometry is a branch of mathematics that studies points, lines, surfaces, solids (3-D shapes). This includes circle, ellipse, and oval shapes.
- “Geo” means Earth and “metry” means measure.
- Principles of geometry date back 3,000BC (over 5 thousand years ago). The people from ancient Babylonia discovered it was practical to use in construction, astronomy, surveying, and various crafts.
- Ancient Egyptians used geometric equations to calculate area of circles and other shapes.



The two cups pictured here were created by Ute Mountain Ute artists. The top 3 pictures is a cup that includes the symbol for coyote.

The cup below is a pleasing design.

Design your own Great Seal Worksheet:

Determine your symbols (you may answer or skip any of the below) - What is (are) your:

- How do you describe yourself (happy, thoughtful, etc. MUST BE POSITIVE): _____

  _____

- What brings you joy? _____
- What is your biggest accomplishment? _____
- What career do you want when you are an adult? _____
- Favorite family tradition: _____
- Favorite color: _____
- Favorite song, book, movie, TV show, and game?: _____

  _____

- Favorite hobby: _____
- Favorite thing to do after school: _____
- Favorite subject in school: _____
- Favorite food: _____
- Favorite holiday:_____
- Look at your list above. How well does this describe you and your interests? Is anything missing?

  _____

Some of the questions above will better describe your interests. For example, you most like talking with your friends after school, reading, and basketball, they would better describe you. List them:

- _____

  _____

  _____

  _____

  _____

  _____

Design your own Great Seal Worksheet—Continued:

- Descriptor words (transfer the words from your worksheet into this table):

Who You Are	Make You Joyful	Interests	Skills	Dreams

- Select one word out of each column. If you look at the words in the column, you may have a single word that best describes all of them. For example, if you list music, singer, guitar, and piano, you can substitute “music” or “musician.”
- Develop a stylized symbol for each of the words you selected. Use the graph paper or plain paper as you develop your images. You will have 5 symbols. (See page 32 as an example.)
- Draw two circles, one on a piece of graph paper, and the other on a blank piece of paper. See the directions on page 33-34). The graph paper is for you to design your Great Seal. The blank piece of paper is your final design.
- Around the edge of your circle, write “The Great Seal of (your full name)”
- In the center, draw your symbol. The image on the right is based on the example used in the directions on page 32.
- Identify each picture, and list what it means.
- Did your Great Seal capture you? If not, what is missing? You need to repeat these steps until your Great Seal really captures who you are!

Pottery is made from **clay**. Native American peoples collected the **clay** from hillsides or nearby streams. The process was difficult. The **clay** was mined and then **purified**.

The mud **clay** had to be mixed with **sand**, plant fiber, and some ancient potters even used ground mussel shells. Without adding these materials, the pottery was much more likely to crack when it was fired.

When the pot was finished, the potter left the pot in the sun to dry. After the pot was dry, it was painted with **pigments** made from residues of boiled plants or finely ground metallic rocks. Brushes were cut and shaped from the chewed ends of twigs or yucca fronds.

The pots hardened in an outdoor bonfire reaching temperatures of 1,300°F. Firing the pottery in a fire made sure all the water was removed and the clay had turned to pottery.

We are going to explore Ute pottery with two activities:

1. Make a pinch pot from air-dry clay
2. Separate **soil** by size of the **particles**:
   - **sand** (largest)
   - **silt** (in between)
   - **clay** (smallest)

Directions—Activity 1

- Cut your cardboard into smaller piece. In the image above center, the cardboard is 6” width x 12” length. The cardboard will allow you to move your pinch pot. Be careful that the pot doesn’t tip over while moving it.

- Use the wax paper as your surface while working with your clay. Tear a piece of wax paper larger than the cardboard. Place over the cardboard. Wrap the sides of the wax paper under the cardboard, smooth, and secure with tape.

- Take a nice size piece of clay. Roll it into a ball. It will fit comfortably in your cupped hand.

- Stick your thumb into the center of the ball.

POWER WORDS

- **clay**: sediment particles smaller than silt
- **contaminant**: make something impure; e.g. twigs or leaves
- **dirt**: loose soil or earth; the ground
- **etch**: carve a drawing on an object with a sharp tool
- **murky**: (of liquid) dark and dirty; not clear
- **organic**: from living matter
- **particle**: a minute (tiny) portion of matter
- **percentages:** a part of a whole expressed in hundredths; soil is 100%: the amounts of sand, silt and clay will add up to 100%

continued on page 41

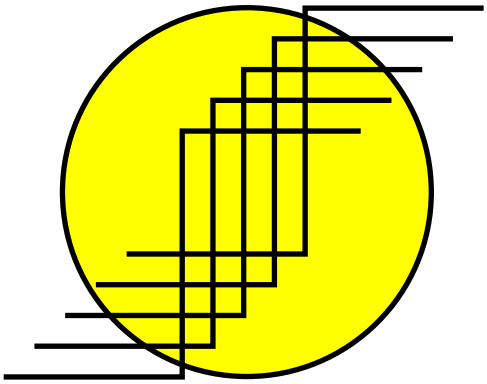
- Carefully open the hole with your fingers, widening it into a bowl shape. Use a pinching motion to make the sides thinner and taller as you work.

MATERIALS - Pots

- air dry clay
- acrylic (shinier) or tempera (dull/earthy) paints
- paint brushes
- wax paper
- corrugated cardboard cut to a smaller size
- tape
- sharp scissors or box cutter
- sharp pencil
- plastic knife
- paper
- color pencils
- clear nail polish

- When you are pleased with your bowl shape, you can use a sharpened pencil or plastic knife to **etch** designs into the soft clay. You don't need to do that, but it will add extra interest to your pot.

- Allow your pinch pot to completely dry. It will take several days up to a week.
- What designs would you like to paint on your pot? Use the ideas developed during the Symbols activity to help you with the design. Use angles, lines, arcs, and circles.



- Allow the paint on your pot to dry before the next step.
- Grab an adult.
- Move your pot outside. To seal your pot, paint a thin coat of the clear nail polish on all surfaces. You need to do this in stages. Paint the inside bowl and the side. Allow to dry completely. Turn over the pot and paint the bottom with the clear nail polish. Allow to dry.
- You can use a spray acrylic instead of clear nail polish.

Directions—Activity 2

- Did you know that soil contains **organic** matter, **sand**, **silt**, and **clay**? In this activity, you will separate these four particles. If you were a potter, you would use the clay layer, and maybe a bit of the sand.
- First, make your best guess:
  - **clay** - the smallest particles. If they are the smallest, do you think that they will be the heaviest, lightest, or in between?
  - **organic** matter - includes plant matter, and will be the largest bits in your bottle. Wood floats. What will happen with most of the organic matter in the experiment?
  - **sand** - the largest particles in soil. If they are the largest, do you think they will be the heaviest, lightest, or in between?
  - **silt** - is between sand and clay in particle size. Do you think that these particles will be heaviest, lightest, or in between?
- Put this information together. The largest, heaviest particles will sink first. The lightest, smallest particles will sink last. The organic matter will mostly float.

POWER WORDS
continued from page 40

- **pigment**: natural coloring matter
- **purify**: remove **contaminants** from
- **sand**: sediment particles larger than silt
- **sediment**: particle matter carried by water or wind and deposited on the surface of the land or the bottom of a body of water
- **silt**: sediment particles between clay and sand in size
- **soil**: the upper layer of earth consisting of a mixture of **organic** remains, **clay**, **sand**, **silt**, and rock **particles**

continued on page 42

What order will the soil settle?

- **Organic** matter
- hazy water
- lightest
- in between
- heaviest

MATERIALS - Activity 1
Clay in Soil

- water bottle with cap
- plastic baggie
- hand **trowel** or small shovel
- newspaper
- hammer
- funnel
- water
  water softener, like Calgon Bath Beads (optional, but works better if you use this)
- plastic spoon
- sharpie
- clock with second hand

- Go outside with your **trowel** and a baggie. Find an area that has bare dirt.
- Scrape the top of that layer. With the trowel, collect about half a cup of dirt. Scoop it into the plastic baggie.

- If your dirt is wet, it is easier if you dry it out. Spread out your newspaper and pour your dirt on top. Allow it to dry before starting the next step.
- Go through your dirt and remove any leaves, twigs, or other plant or animal matter from your dirt. Try to remove all the bits of **organic** matter.

- With the hammer, gently break clumps until your dirt is like powder.

- Ask a parent to hold your water bottle on top of the newspaper. Remove the cap and place the funnel into the mouth of the bottle.
- Carefully pour your dirt into the funnel. You may need to tap the funnel so the dirt falls into your bottle.

- Add water until your water bottle is about 3/4 full.
- Add one plastic spoonful of the water softener into your bottle, using the funnel.

- Remove the funnel. Tightly screw on your cap.
- Shake your bottle for 15 minutes!
- Shake…
- Shake…Shake…Shake…

POWER WORDS
continued from page 41

- **trowel**: a small handheld tool with a curved scoop for lifting plants or earth

The Ute word for cooking pot is
sah at nup

SHAKE

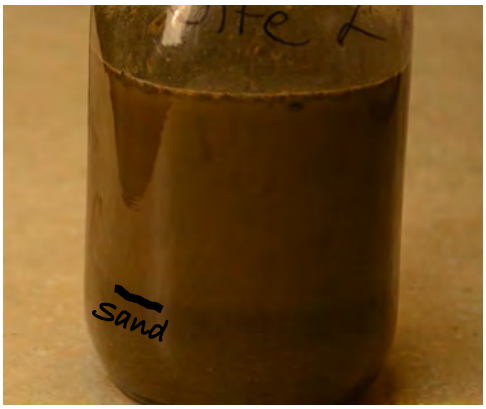
FASCINATING FACTS

- **Clay** is a naturally occurring material made from fine-grained minerals. Clay absorbs water slowly. Once it has absorbed the water, it can hold a lot of water. Clay can be hardened when dried and/or fired.

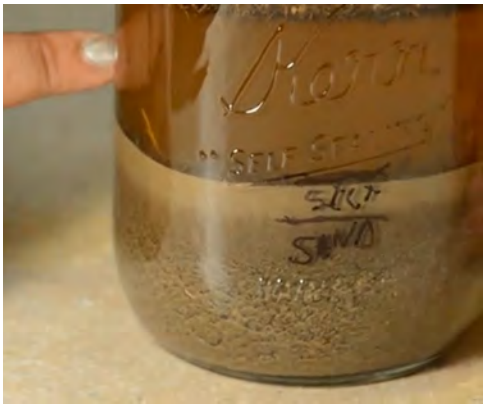
POWER WORDS

- **absorb**: to take in or swallow up

- Set your bottle down, and time 10 minutes. This will give the heaviest particles, the sand, time to settle on the bottom. Mark that level with your sharpie.

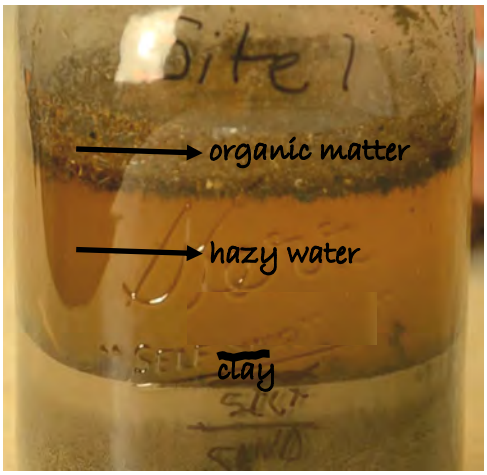


- Set your timer for 2 hours. At the end of 2 hours, mark the in-between layer, the silt.



Draw a line and label "Silt."

- Clay is the smallest and lightest, so it takes the longest to settle in your bottle. Check your bottle after 3 days. If the water is still **murky**, wait another 3 days. Continue until the water in the top of your bottle clears, up to a month!
- Mark "clay" with your sharpie on the top layer of soil. The next area is the water (note that it is still hazy, but you can see through it. That means there is still some clay particles in the water. You can actually wait until that layer is clear. The top layer is organic matter (like decaying leaves and grass).



- Soil samples from different areas will have different amounts of sand, silt, and clay. Ancient potters would find soils that had high clay **percentages**.

What order will the soil settle?

- **Organic** matter
- hazy water (suspended clay)
- lightest (clay)
- in between (silt)
- heaviest (sand)

FASCINATING FACTS

- There is evidence that pottery making may have been discovered by early Native Americans lining their cooking baskets with mud. The mud would make the container better while cooking. They would put the baskets in the fire. The fire burned away the basket, leaving the hardened clay.

The Ute word for dig is
poo coo ri
or
oo rah

The Ute word for earth is
t wip

Think about this!

- How do you think ancient potters separated the sand and silt from the clay?
- As the clay dries it shrinks. If potters used only clay, the pot would break or crack as it shrank. They would add sand, or even ground shells. Why?

WATCH IT!

- CSU Montrose Extension County Office developed a video on soil particle size. You can watch the entire process on this fun video featuring 4-H Teen Leaders Sadie Shea and Aubrey Casey. https://tra.extension.colostate.edu/stem-k12/about-stem-k12/

Clocks and clockmaking are traditional European crafts. The first mechanical clocks were built in the 14th Century (1500s).

All cultures have discovered different ways to tell time. We made a clock based on the stars in 63.Hogwarts ST[EMpower] issue, (page 7; https://tra.extension.colostate.edu/stem-k12/stem-resources/). The Big Dipper in the constellation Big Bear (*Ursa Major*), Little Dipper in the Constellation Little Bear (*Ursa Minor*), and the constellation *Cassiopeia* are in different places in the sky. The project provides their location at 8:00 PM. This can also be used as a clock throughout the night.

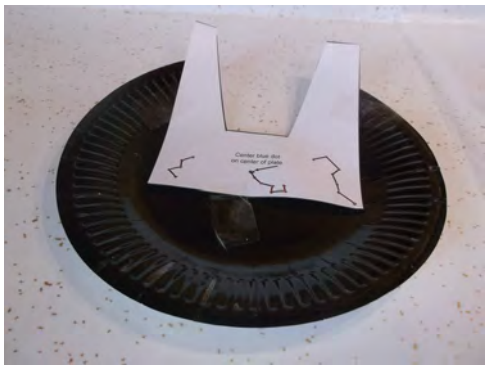
These constellations can be used to determine the time during the night. Every night, these three constellations **circumnavigate** around Polaris, the north star. We can determine the time based on their orientation in the sky.

Modern people do not know the night sky like our ancestors did. Knowing the season and sky watching, the Ute ancestors would have a good idea of the time from sunset and the time to sunrise by reading the stars.

Directions for Star Clock:

- The Star Clock has three parts to complete:
  - night sky plate
  - the hour plate
  - put it together
- The first part is the night sky plate (the dark plate). Print the star pattern on page 48. The blue dot is placed in the center of your black plate.
- Lightly tape the star pattern on your black plate (face up) checking that the blue dot is in the center.
- Place the plate on your corrugated cardboard.
- With your nail, poke a hole through the paper and the plate on the red and each of the blue dots.

- Cut out the **trapezoid** window from the edge of your plate.



- Connect the dots with the white crayon to form the Big Dipper, the Little Dipper, and *Cassiopeia* on the dark plate.
- The second part is to make your Star Clock on the white, hour plate.
- Cut out the circle on page 48. With your glue stick, attach the time to the plate.
- Poke a hole in the center dot with your nail and push all the way through.

POWER WORDS

- **asterism**: a prominent pattern or group of stars, typically having a popular name
- **cardinal**: directions of north, east, south, and west; on a **compass rose**, there will be four points indicating north, south, east, and west.
- **circumnavigate**: travel all the way around
- **compass rose**: a circle showing the principal directions printed on a map or chart
- **diameter**: a straight line passing from side to side through the center of a body or figure, especially a circle or sphere

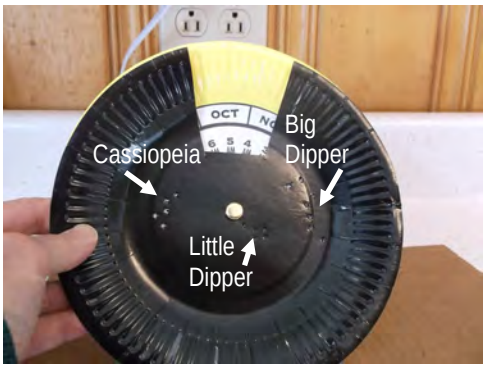
continued on page 45

MATERIALS - Star Clock

- print page 48 and 49 single sided
- 1 dark dessert paper plate
- 1 white dessert paper plate
- glue stick
- scissors
- pencil
- corrugated cardboard
- nail
- markers or color pencils
- brass brad paper fastener
- tape
- white crayon

- The third part: put it together.
- Place the dark plate over the light plate.

- Insert the brass brad paper fastener in the center hole through both the dark and then the light plates.
- How to use at night:



  - Face the North.
  - Locate the Big Dipper. Use the pointer stars to find Polaris, the North Star. If you do not know how to do this, see page 47.
  - Rotate the time clock on the light plate until the correct month shows in the **trapezoid** window.
  - Keep the light plate with the correct month on top.
  - Turn the dark plate until the images of the Big Dipper, Little Dipper, and Cassiopeia match the location of the **asterisms** and the constellation.
  - Read the time in the **trapezoid** window.

During the day, the Utes would use a stick's shadow to tell the time. This next activity demonstrates how, with a stick, a clear sky, and no overhead obstructions, you can tell the time too.

Directions for Shadow Clock:

- Pick a day when you can go outside every hour to record the shadow.
- Locate a place outside with bare ground. There must be no overhead obstructions (like a tree branch or power line).
- Rake and smooth the ground.
- Draw a circle with the trowel or shovel with about a 5 foot **diameter**.
- Insert the stick into the ground **vertically** in the center of your circle. You may need to dig a small hole with the trowel to make sure your stick is deep enough in the ground to remain stable.
- Trace the shadow line and note the time.
- What is the time? Note that the data sheet (page 49) starts at 6:00 AM and ends at 8:00 PM. If you do this activity during the summer, you may get readings for all those times. If you are doing this activity in November, then your first reading will be either 8:00 or 9:00 AM. Start on the row that is your correct starting time.
- What is the compass orientation for your shadow line? Record that on your Datasheet (page 49).

How to read a compass:

- The red needle will always point to the

POWER WORDS
continued from page 44

- **ordinal**: the direction found at the point equally between each cardinal direction; on a **compass rose**, a **compass rose** with both ordinal and cardinal directions will have eight points: N, NE, E, SE, S, SW, W, and NW
- **parallel**: (of lines, planes, surfaces, or objects) side by side and having the same distance continuously between them
- **quadrilateral**: a four-sided figure

The Ute word for star is
poo cheeve

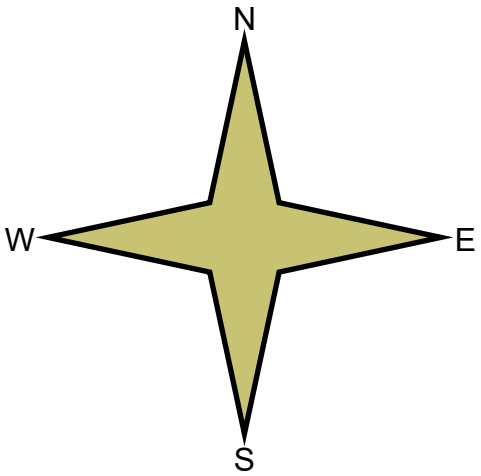
continued on page 46

MATERIALS - Shadow Clock

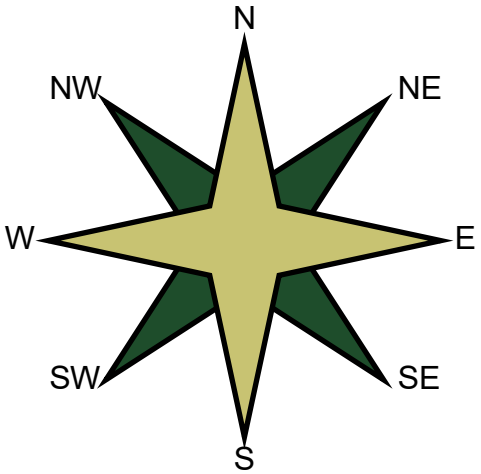
- rake
- straight stick (longer is better)
- trowel or small shovel
- print page 49
- magnetic compass
- tape measure
- clock with timer (e.g. cell phone)
- camera (e.g. cell phone)

magnetic north (close to but not directly at the North Pole, true north).

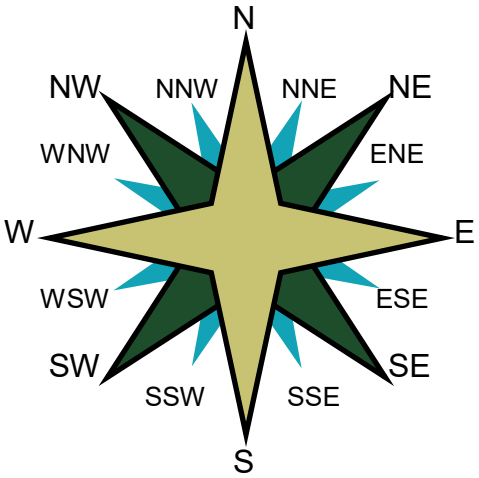
- All compasses will include a **compass rose** below the red arrow with at least the **cardinal** points.
- **Cardinal** points (gold) are North (N), East (E), South (S), and West (W).



- The **ordinal** points (green) are between the cardinal points, NW, NE, SW, SE.



- **Secondary intercardinal** (light blue) points are between the cardinal and ordinal points; NNW, NNE, ENE, ESE, SSE, SSW, WSW, and WNW (image located at the top, center column).



- Your compass may have all 16 points, or only 4.
- Stand out of the line shadow.
- Hold your compass directly over the stick level and flat in your hand.
- Turn the compass until the red needle points to the compass North.
- Estimate the direction of the shadow. Record in in your datasheet in the 2nd column.
- Measure from the stick to the end of the shadow and record that measurement in the datasheets 3rd column.

POWER WORDS
continued from page 45

- **secondary intercardinal**: directions midway between each **cardinal** and **ordinal** direction; NNE, ENE, ESE, SSE, SSW, WSW, NWN, and NNW
- **trapezoid**: a **quadrilateral** with only one pair of **parallel** sides
- **vertically**: at right angles to a horizontal plane; aligned in such a way that the top is directly above the bottom

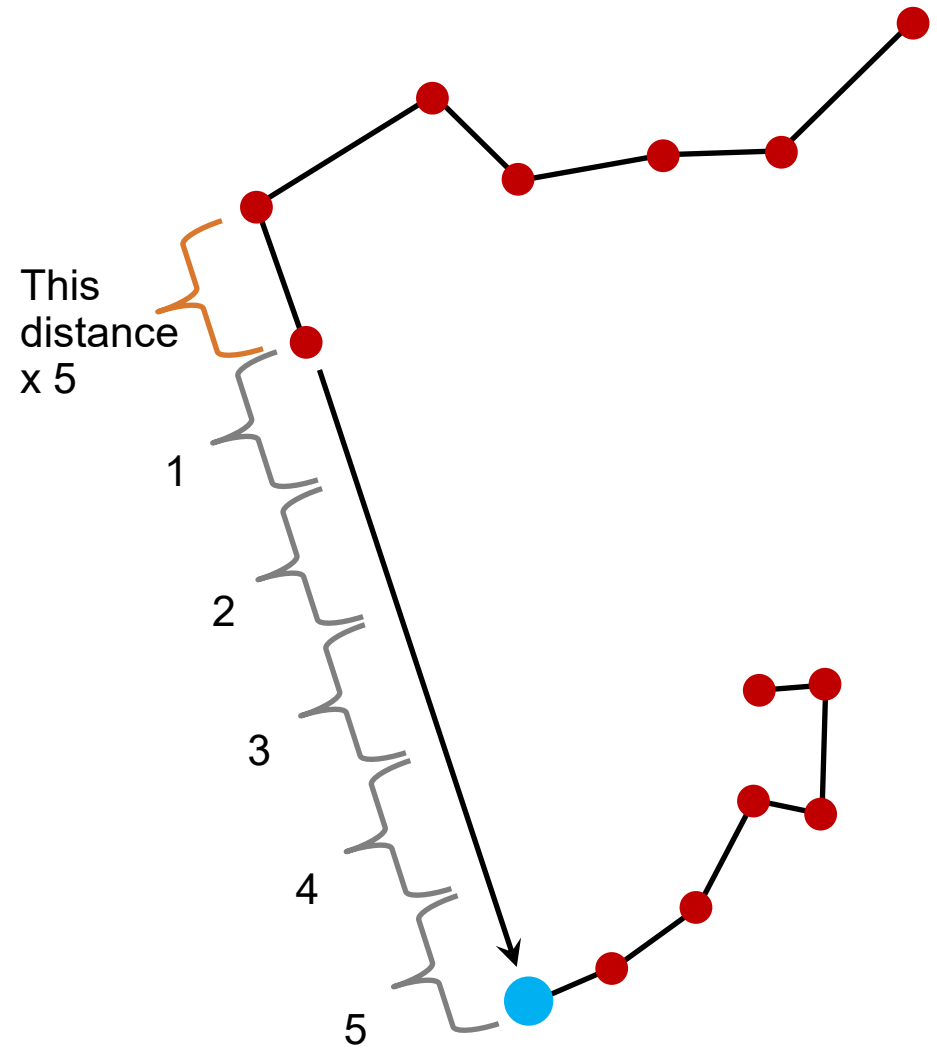
- The image on the left was taken at 11:00 AM on 10/21/20. The compass direction is NW. The shadow length is 22”. The stick is 15” tall from ground to top.
- Repeat these steps every hour throughout the day. If you have a camera, take an image each hour.
- Examine your datasheet against the picture. Do you see a pattern?
- On another day, use your stick to estimate the time based on the shadow direction and length.

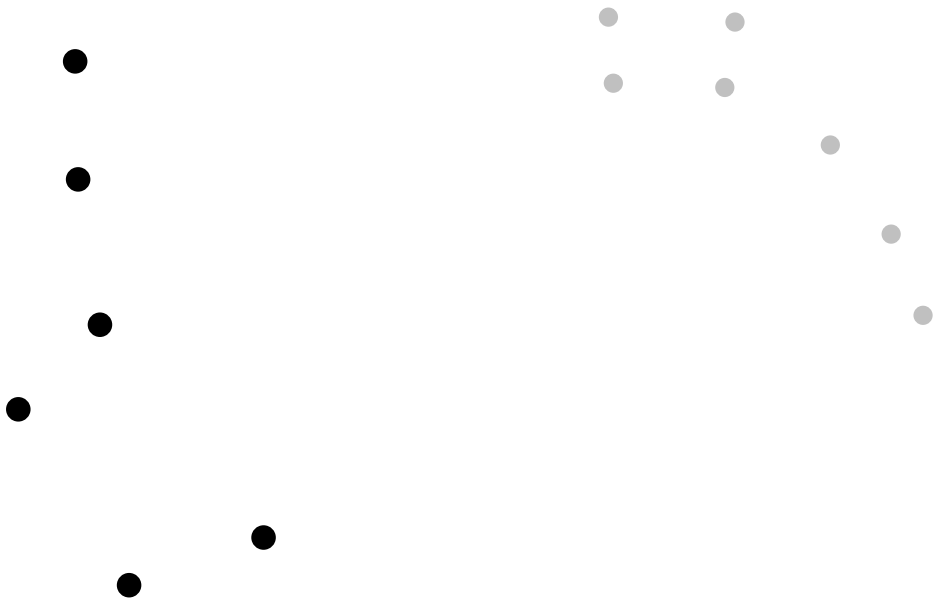
FASCINATING FACT

- The compass was invented in China during the Han Dynasty (20 BC to 20 AD).
- Dr. Albert Einstein's interest in physics was sparked by a compass. He was five years old and sick. His father brought him a magnetic compass. He was fascinated that the needle always pointed north, even if he shook it. That curiosity led him to his interest in physics.

How to find Polaris, the North Star, in the night sky. The Little Dipper is quite faint and hard to find. The Big Dipper has many bright stars.

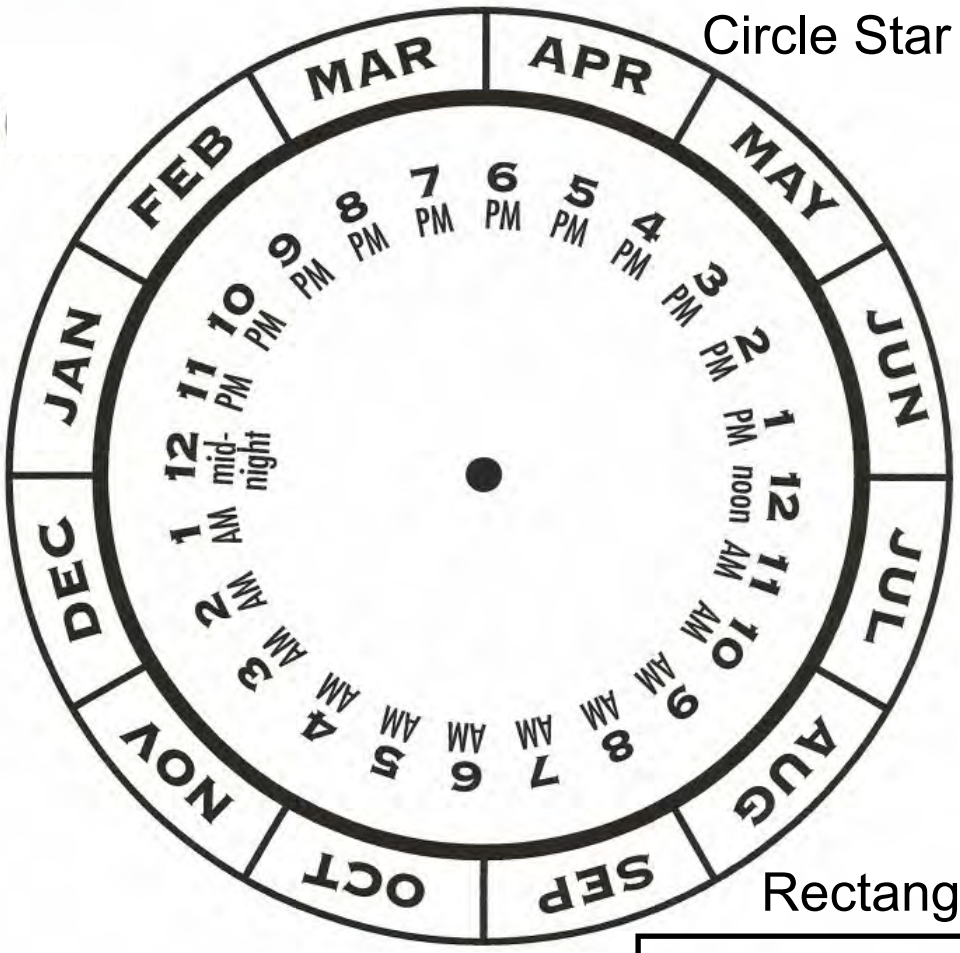
- Locate the Big Dipper.
- Use the distance between the two stars indicated by the orange bracket.
- Follow the direction they point.
- Use that distance five times to find Polaris, the North Star. Polaris is indicated by the blue dot.
- Polaris is very feint, but it is almost directly over the North Pole of Earth. We can use this faint star to tell us the direction of true north all night long.
- Now you try to find the North Star!





Answer on page 48.

Circle Star Clock



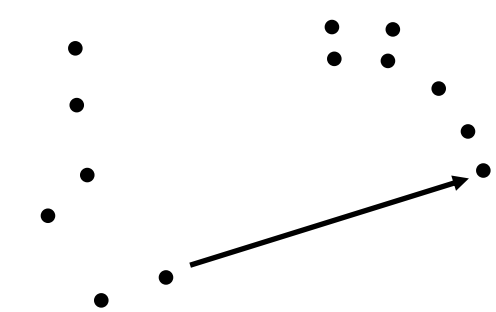
- *How to read the time*:
- Face the North.
- Locate the Big Dipper. Use the pointer stars to find Polaris, the North Star (see page 47 for directions on how to do this step).

Continued below left

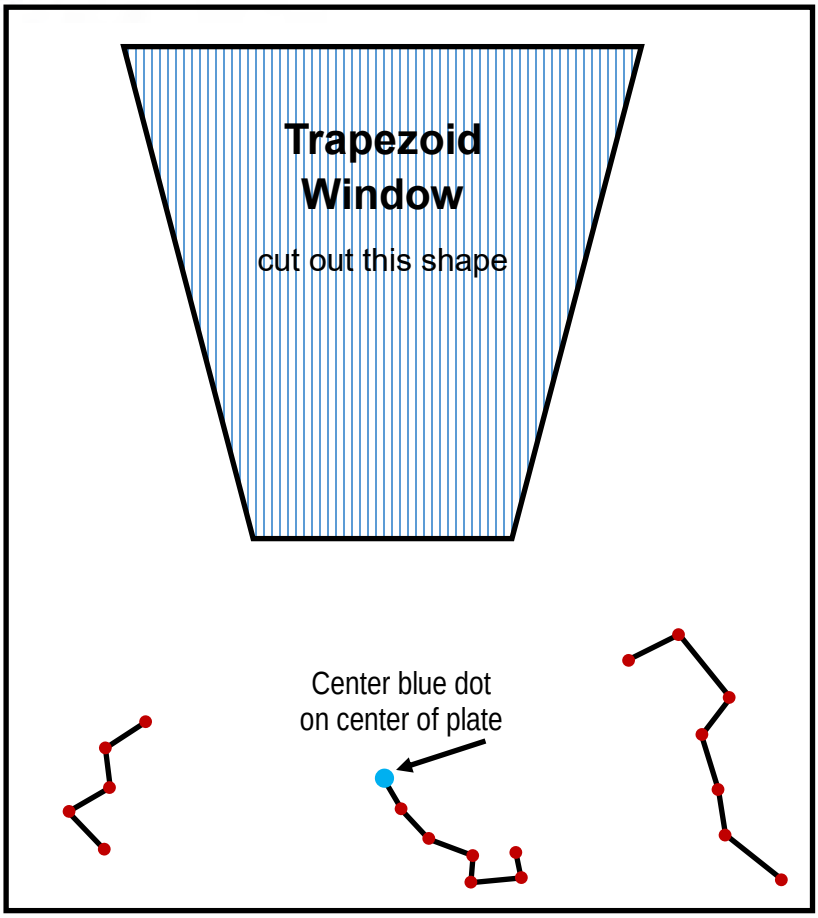
Continued from above right.

- Rotate the time clock on the light plate so the correct month is displayed at the top of the clock.
- Keep the light plate in the same position, with the correct month at the top.
- Turn the dark plate until the images of the Bid Dipper, Little Dipper, and Cassiopeia match the location of those asterisms and the constellation.
- Read the time.

Answer from page 47.



Rectangle Star Template



Time	Shadow Direction	Shadow Length
6:00 AM		
7:00 AM		
8:00 AM		
9:00 AM		
10:00 AM		
11:00 AM		
12:00 PM		
1:00 PM		
2:00 PM		
3:00 PM		
4:00 PM		
5:00 PM		
6:00 PM		
7:00 PM		
8:00 PM		
	Length of stick from ground to tip	

The Ute people were **nomadic**, traveling vast distances. Their homes were **temporary** structures (like tents we use when we camp) called wickiups (WICK-ee-ups).

How wickiups were built:

1. cut about thirty **sapling** willow trees
2. strip off the small branches
3. stick the **sapling** poles into small holes in the ground in an oval
4. bend over the poles in pairs (across the circle from each other) and tie the tops together with thin strips of bark or leather
5. when all the poles are tied together, attach branches **horizontally** all the way around
6. cover the whole frame with small branches cut from the willow saplings, cotton blankets, leather skins, big leaves, long grass, or anything else available
7. if cold, the Utes built a fire inside the wickiup by laying a circle of stones on the ground (sometimes placed a large flat stone in front like a hearth)
8. they also brought piles of juniper tree bark inside the wickiup to use as beds

Image used with permission from the Denver Public Library, Western History Collection, X-30401

Even though these were temporary structures, some of them are still standing today. The Durango Herald wrote an article about historians documenting these shelters in Colorado. You can read the article here: https://durangoherald.com/articles/267717

Now, you get to build your own model wickiup!

Directions:

- The Utes would find different plants for their wickiups as they travelled. They would range from panhandle of Oklahoma to the eastern edge of Nevada. Vegetation varies from place to place. Look outside in an **undeveloped** area. The native vegetation you see would be the materials that the Utes used if they spent the night where you live now.
- In your model, some of the materials you use will represent the natural materials the Utes used:
  - willow **saplings -** bamboo skewers
  - thin strips of bark or leather to lash the saplings together and thin branches attached horizontally around the wickiups - brown yarn
  - ground - corrugated cardboard

POWER WORDS

- **circumference** (C): the enclosing boundary of a curved geometric figure, especially a circle
- **diameter**: a straight line passing from side to side through the center of a body or figure, especially a circle or sphere
- **ellipse**: a regular oval shape
- **even number**: any whole number that can be divided by two with no remainder
- **horizontal**: parallel to the plane of the horizon; at right angles to the vertical

continued on page 51

MATERIALS

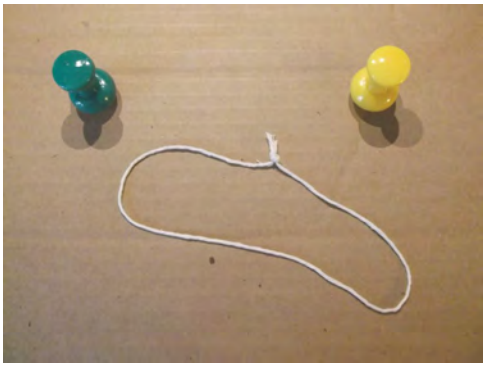
- corrugated cardboard ~12” x 12”
- 2 push pins
- string
- pencil
- thin 8” to12” bamboo skewers
- glue
- brown yarn (optional use both thin and bulky weight yarn)
- scissors
- outside plants
- optional: double sided tape
- optional: large can

- Look at the image of the wickiup on page 50. There is a space for the door.
- You need an even number of bamboo skewers. You will probably use about 20 of them, depending on the size of your model.
- The base of the **wickiup**is **oval** / **ellipse**.

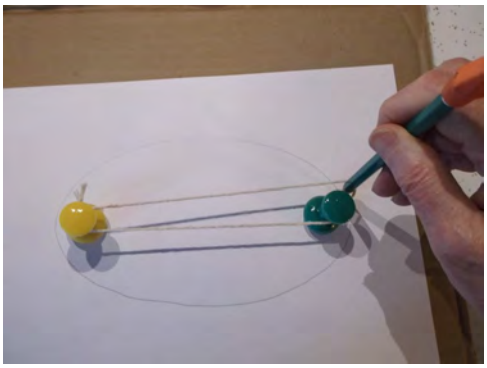
Draw a perfect ellipse

- You need 2 push pins, cotton twine, pencil, scissors, paper, and a piece of cardboard. You may need to stack two or three pieces of cardboard, depending on how big your push pins are.

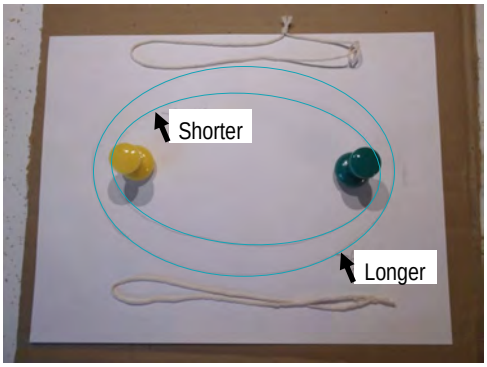
- You have two variables to making your **ellipse**:
  - length of the string
  - distance of the push pins
- Cut a piece of twine 15" long, and a second piece of twine 17" long.
- Tie each string to make a loop.



- Place a piece of paper on the card board and poke the push pins 5¾" apart.
- Place the smaller loop over the two push pens. Insert the pencil in the twine loop and gently pull taut. You may need to support the opposite push pin with your other hand.



- Hold the pencil vertically, and draw the **ellipse**. The string will guide you.
- Label the **ellipse**, "Pins further, shorter string."
- Repeat with the larger string.
- Label that **ellipse**, "Pins further, longer string."
- Notice that the longer string makes a larger **ellipse**, and both have fairly squished circle shapes.



- How will the **ellipse**s change if you poke the two push pins closer together?
- Move your push puns closer in to 4½" apart on top of your paper.
- Repeat drawing the **ellipse** with the shorter string.

POWER WORDS
continued from page 50

- **nomadic**: living the life of a nomad, someone who travels from place to place; wandering
- **oval**: having a rounded and slightly elongated outline or shape like that of an egg
- **pi** (**π**): ratio of a circumference of a circle to its diameter (example 8 divided into 25.13 = 3.14 (rounded)
- **radius**: a straight line from the center to the circumference of a circle or sphere
- **sapling**: a young tree, especially one with a slender trunk

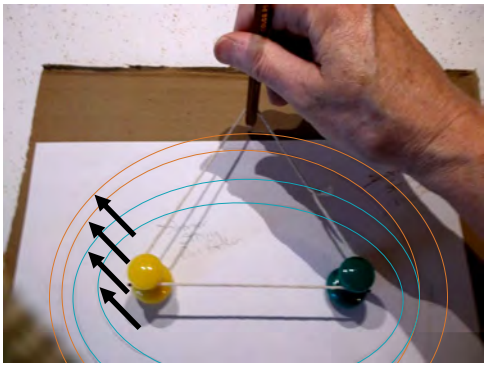
continued on page 52

FASCINATING FACT

- The Ute Mountain Utes had to bring water into their reservation in a water truck several times a day until1994! The Dolores Water Project finally brought water. Ute Mountain Utes have only had water in their homes since then.

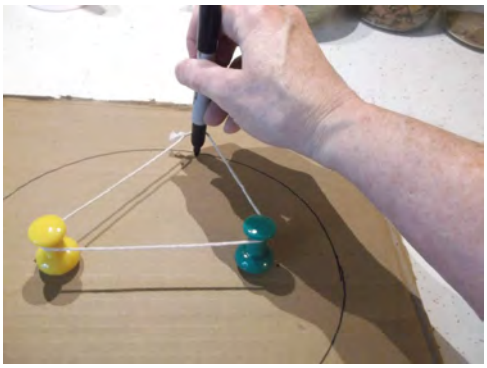
The Ute word for "my house" is
cahn neva

- Label that **ellipse** as “Closer pins, shorter string.”
- Repeat drawing the **ellipse** with the longer string.
- Label that **ellipse** as “Closer pins, longer string.”
- Can you describe how these variables change”?
  - The further the pins, the more squished the circle (blue circles in the image below). The further the pins, the closer the shape comes to making a circle (orange circles in the image below.
  - The longer the string, the larger the circle.
  - Even the shorter circle is larger when the pins are closer together than the longer string when the pins are further apart.
  - None of them overlap (but two touch).



The Base of Your Model

- Your base will determine the size of your **wikiup** model.
- Examine your 4 **ellipses**.



Use the larges ellipse that fits the piece of carboard you have cut for the base.

- You can either estimate 1” or use a ruler for spacing as shown in the image below. Keep the ruler on the outside of the **circumference** (it is easier) and slowly pivot the ruler along the pencil line **circumference** to the next inch. The model images in this lesson uses 24 skewers. The door opening is ~3.5 inches. If you end up with an odd number of skewers, remove one by the door.

- Add one drop of white school glue to each hole.

POWER WORDS
continued from page 51

- **temporary**: lasting for only a limited period of time; not permanent
- **undeveloped**: land not converted to a new purpose
- **vertical**: right angle to a horizontal plane; aligned so the top is directly above the bottom
- **wikiup**: a hut consisting of an oval frame covered with brushwood or grass, formerly used by nomadic peoples in southwestern US

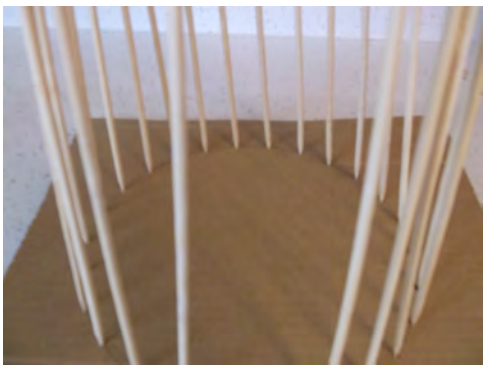
- Place one skewer in each hole. If the cardboard you use does not allow the skewers to remain upright, you can use a large can (pictured is a 3 lb 3 oz coffee can). Hint: It was easier to use double sided tape along the rim of the coffee can to lightly adhere the skewer to the can.

FASCINATING FACT—HORSES

- The Utes call themselves the people of the horse. They were famous for processing hides. They met and traded with Spanish and mountain men. They acquired horses around this time.

The Ute word for horse is
cah vah

- Allow the glue to dry completely before carefully removing the large can.



- With the yarn (thin weight if you are using two different weights of yarn), pull together two bamboo skewers (starting with one by the door and tie to the opposite bamboo skewer. Count the skewers to make sure you select the opposite one.

- Tie at the top with a piece of string.
- Continue tying them together until you have tied all of them to another bamboo skewer on the opposite side.

- You may need to tie all the skewers together at the top.
- How stable is your wickiup? Apply some pressure to the tops and sides to check this out.
- Use the yarn (bulky yarn if you are using two different weights of yarn) to represent the **horizontal** branches. Start at the bottom of your wickiup. Tie one end of the yarn to the first bamboo skewer at the opening, and wrap the string around the outside of the bamboo skewers until you reach the

FASCINATING FACTS SCHOOLS

- Indian boarding schools were founded to eliminate traditional American Indian ways of life and replace them with mainstream American culture. The first boarding schools were set up either by the government or Christian missionaries.
- At boarding schools, Indian children were separated from their families and cultural ways for long periods, sometimes four or more years.
- The children were forced to cut their hair and give up their traditional clothing.
- They had to give up their meaningful Native names and take English ones.
- They were not only taught to speak English, but were punished for speaking their own languages.
- Some teachers ridiculed and made fun of the students' traditions.
- Lessons humiliated the students and taught them to be ashamed of being American Indian.

FASCINATING FACTS—continued

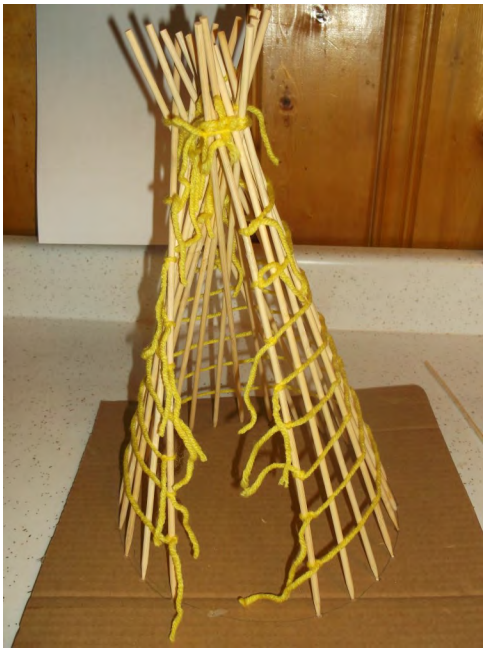
- Their own traditional religious practices were forcibly replaced with Christianity. They were taught that their cultures were inferior.

The Ute word for children is

to wutch u oo

last bamboo at the opening on the other side. Tie off. If the yarn slips as you wrap around, add a bit of glue to hold into place.

- Repeat about 1" above the first **horizontal** yarn.
- Continue about 1" above the last **horizontal** yarn until you reach the top of your wickiup. You will have added about 10 rows of the yarn.



- Go outside and collect vegetation to add to the outside of your wickiup. Try to use native vegetation rather than ornamental plants in your yard.
- Hint: use leaves that have not been damaged by frost. It may take a bit to find them this time of year. Can you locate some pine or fir trees? How about some vegetation that has been protected from frosts or snow.

- Add leaves and twigs until your wickiup is completely enclosed. Weave them in and out of the yarn to secure into place.

- If it were cold out, the Ute would add a circle of stones to contain the fire. Find small stones for your fire circle. Glue the stones down on your corrugated cardboard.
- Add the beds of bark, leather and fur. What can you use to represent those?
- Do you think you could make a life-size wickiup? Next summer, try it out!

FASCINATING FACT HORSES

- The Utes were one of the first, perhaps the first, Native people to use horses. This had a profound impact on their culture and lifestyle.
- Horses allowed the Utes to expand their hunting grounds.
- After acquiring horses, the Utes became adept horsemen and warriors, raiding other tribes.
- The Utes were the last of the Western Tribes to be forced onto a reservation.

FASCINATING FACT SCHOOLS

- The boarding schools had a negative effect on the self-esteem of Indian students and on the well being of Native languages and cultures.

The Ute word for bear is

que auget

- Finish your model of the wickiup with fire ring inside, and logs for the fire.
- Place fabric "skins and furs" for the sleeping area.
- Cover the cardboard with a think layer of glue and add some soil. Allow to dry.

Solution: Cogitation Expedition:

"Old man's advice to youth: 'Never lose a holy curiosity.'" Life Magazine article about Albert Einstein.

> The important thing is not to stop questioning. Curiosity has its own reason for existence. One cannot help but be in awe when he contemplates the mysteries of eternity, of life, of the marvelous structure of reality. It is enough if one tries merely to comprehend a little of this mystery each day.

Build Your Own Stereoscope!

The Denver Library gave permission to use the image on page 50. It is actually two pictures to view in a stereoscope.

A stereoscope is an instrument that views a two dimensional image and make it look three dimensional. You can make your own stereoscope to look at this historical image in **3D**! The directions are for a simple, inexpensive stereoscope with materials you can find at a grocery store or at home.

There are also directions to take your own stereoscope images.

Directions:

- The two toilet paper tubes need to have a flat edge, like the capital letter "D." Push down and pinch the TP tube and form a crease.

- Measure about one inch along the TP tube edge (see arrow on image to the right), and form a second crease, pinching the TP tube at the 1" on the ruler. This will form a flat side (like the capital letter "D").

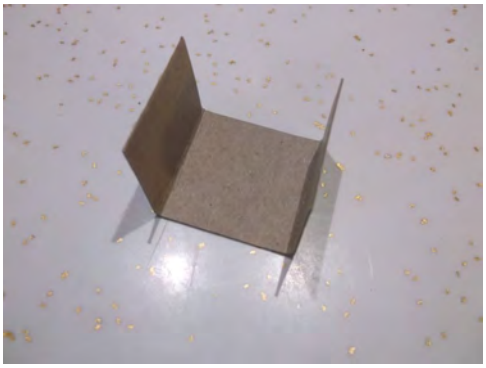
MATERIALS

- 2 toilet paper tubes
- piece of cardboard about 3" x 1"
- 1 pair of reading glasses
- 2 rubber bands (large and thin, easy to stretch)
- scissors
- tape
- ruler
- print page 58
- camera
- Optional: art supplies to decorate your stereoscope

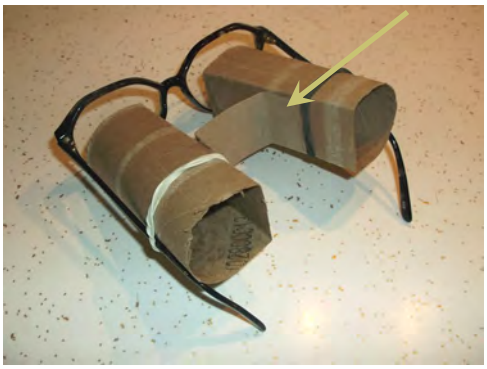
- Repeat with the other TP tube.

- Measure and cut a piece of cardboard 1” x 3”.

- The center measurement needs to be between 1-2 inches. After you have built your stereoscope, you may want to make another with a distance that works better for your reading glasses.



- This piece fits between the two TP tubes. The center piece blocks the view between your two eyes. Each side is taped to the flat side of the TP tubes. The completed stereoscope shows how the center piece needs to be attached to the TP tubes (see arrow below).



- Tape the center piece to the TP tube on both sides to secure (arrows point to the tape).

- Repeat with the other TP tube on the other side of the center piece. When you attach the second TP tube, be sure that the 2 TP tubes are aligned (image on the right).

FASCINATING FACT

- We see three dimensionally because our eyes are separated about 2” apart. Each eye sees the same object, but at a slightly different angle.
- Owls ears are at different levels on their heads. This helps them to hear three dimensionally!

- The center piece will hold the two TP tubes

CHECK IT OUT!

- You need 2 pencils.
- Hold one pencil in your left and the other pencil in your right hand. The erasers need to be pointing towards each other
- Hold the pencils at arms length and about 2 feet apart.
- Close one eye.
- Touch the two erasers only using one eye (the other eyelid is closed).

between 1” and 2” inches apart. You may need to adjust the distance depending on the size of your reading glasses.

- Attach the TP tubes to your glasses frame with rubber bands. The rubber bands need to secure the TP tubes but not crush them.

- Print the Wickiup stereoscope images on page 58.

- Place the images on a table with good light. Stand above the images and look through your stereoscope at the wickiup images. Shut your left eye and line the straight edge of the TP tube along the center line of the double image. Shut your right eye, and line the straight edge of the TP tube along the center line of the double image.
- Open both eyes. You may need to relax your gaze to bring these two images together. Once you do, the image will be 3 dimensional!

Make Your Own Stereoscope Images!

- You need a camera, ruler, and an object.
- The pupils of your eyes are about 2” apart.
- Place your camera just behind a ruler towards your object (a dinosaur salt shaker in the images).
- Focus your camera. and snap the image.

- Move the camera 2” to the right. Focus the camera and snap the image.

- Download the images and set them side by side. Be sure to place the image snapped on the left on the left of the image snapped on the right.
- Print and check out your 3 dimensional object!

Make a Beautiful Stereoscope!

The directions in this activity were design to be as simple as possible. During the 1800s, stereoscopes were beautifully designed. The following websites have other designs of stereoscopes. Check them out!

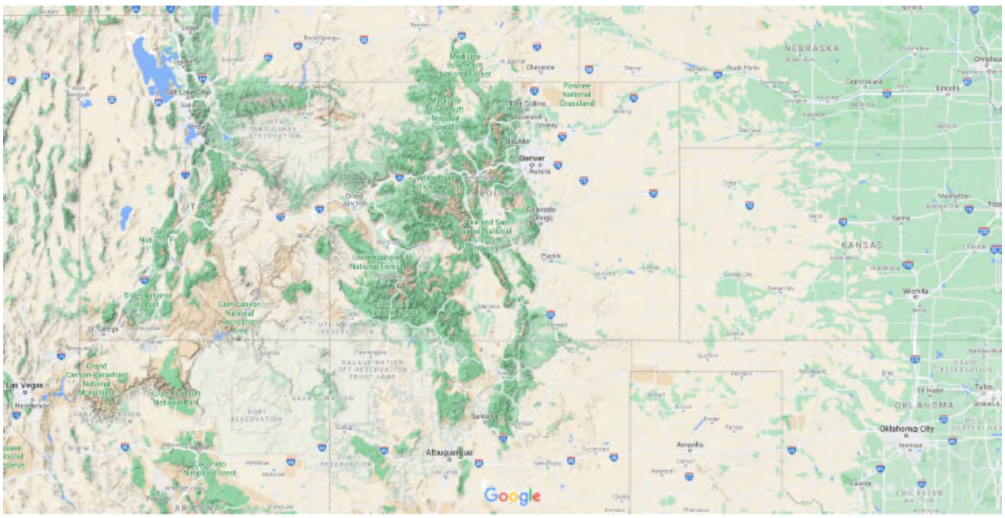
- Beautiful paper stereoscope — https://www.youtube.com/watch?v=Br4butlws7E&ab_channel=NicholaBattilana
- Complex—Smithsonian Museum Lemelson Center for the Study of Invention and Innovation: https://invention.si.edu/diy-victorian-virtual-reality

FASCINATING FACT

- Stereoscopes were patented by Sir Charles Wheatstone in 1838.
- They were popular up until the early 1900s.
- The two photos on the stereo card appear as one 3D image.
- The lenses make the images appear larger and further away, enhancing the 3 dimensionality.

Directions:

- Place this paper on a well lit table. Stand over the image.
- Hold your stereoscope over your eyes and look down (about 12 to 18” away). Relax your gaze and see the 3 dimensional wickiup!
- Try out the different sized images. Which works best for you?



Most people who belonged to the Ute Tribes now live in Utah, New Mexico, and Colorado. Their traditional lands spanned Wyoming, Nevada Utah, Arizona, New Mexico, Kansas Oklahoma, Texas, and Colorado. They lived in seven **nomadic bands** that now form the three Tribes: Northern Ute in Utah, Southern Ute in Archuleta, La Plata, and Montezuma Counties, and the Ute Mountain Ute in Montezuma County, Arizona, and Utah.

Maps contain data that can be used to extrapolate information. As a paleontologist, I use maps developed by Dr. Scotese. He has spent his career examining peer reviewed paleontology and geologic literature to piece together hypotheses as to the relationship of landmasses to each other, latitude location, and climate for different **periods** through time. http://scotese.com/earth.htm. Check them out! They are very cool.

Geographic information systems GIS): an integrated collection of computer software and data used to view and manage information about geographic places, analyze spatial relationships and model spatial processes: GIS provides a framework for gathering and organizing spatial data and related information so that it can be displayed and analyzed. Computer maps contain data utilizing layers. Each layer contains a different type of data. In this activity, you do not need to purchase an expensive computer program and learn how to use it. You will, however, learn how these mapping programs work in a low-tech simulation activity.

In this activity, you will:

- research information on the internet about the original seven Ute bands
- add a layer for the territory they occupied prior to Europeans

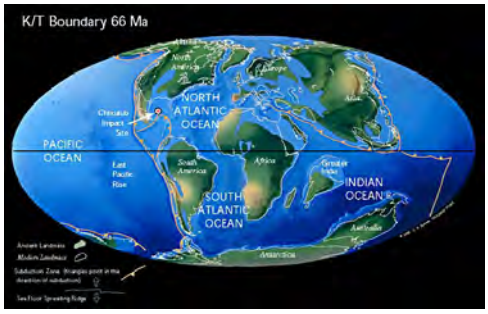


Plate tectonic maps and Continental drift animations by C. R. Scotese, PALEOMAP Project (www.scotese.com)

POWER WORDS

- **analyze**: examine to explain and interpret
- **base map: a** map showing background reference information, such as roads, political boundaries or landforms onto which specific information is added
- **cartography**: the production of maps, including projections, design, compilation, drafting, reproduction
- **coordinates:** value set that defines the location of a point or line in space relative to other points: Cartesian coordinate systems use x and y values (z in 3D systems) in geographic coordinate systems that use latitude and longitude points

continued on page 60

MATERIALS

- print page 63
- 4 binder clips
- 5 transparencies (clear covers on report folders or 3 page protectors with the sleeve cut apart for a total of 6 transparencies)
- scissors
- permanent markers in multiple colors
- black permanent marker
- computer with internet
- scratch paper (for notes)
- pencil

wanting to live and prospect here
- add a layer of the territory in 1868
- add a layer of the territory they occupied in 1873
- location of the Northern Ute, Southern Ute, and Ute Mountain Ute reservations
- which bands formed the three tribes
- analyze this information to draw conclusions about the history of the Ute people
- confirm your analyses

Directions:
Cartography
- **Geographic information systems (GIS)** is an integrated collection of computer software and data used to view and manage information about geographic places. You can analyze spatial relationships and model spatial processes. GIS provides a framework for gathering and organizing spatial data and related information so that it can be displayed and analyzed.
- Modern maps are built in layers to store **spatial data**. This becomes a very powerful tool in analyzing issues or solving problems.
- The copy of a Google map printed on page 63 is the base map. Place five transparencies on top, and

hold in place with one binder clip. This will keep each layer from slipping. Do not move or shift the transparencies while working. You can flip them back and forth to verify your information displays easily.
- As you do this step, add the label to the next layer so it does not overlap the layer below. Start with the lowest layer, just above the **base map**. Label each layer as follows (from closest to the **base map** as the first layer, and the top layer as the fifth layer:
  - 1st layer (closest to **base map)**—Original Ute Domain
  - 2nd layer—Bands of Utes
  - 3rd layer—1868
  - 4th layer—1873
  - 5th layer (top layer)—2020
- Research for your maps. Try different searches to locate the information of the Ute Territory and Hunting Grounds before Europeans arrived. Remember to check your sources. You can rely on accredited universities, the three Tribes information, and government documents. If you use Wikipedia, check their citations at

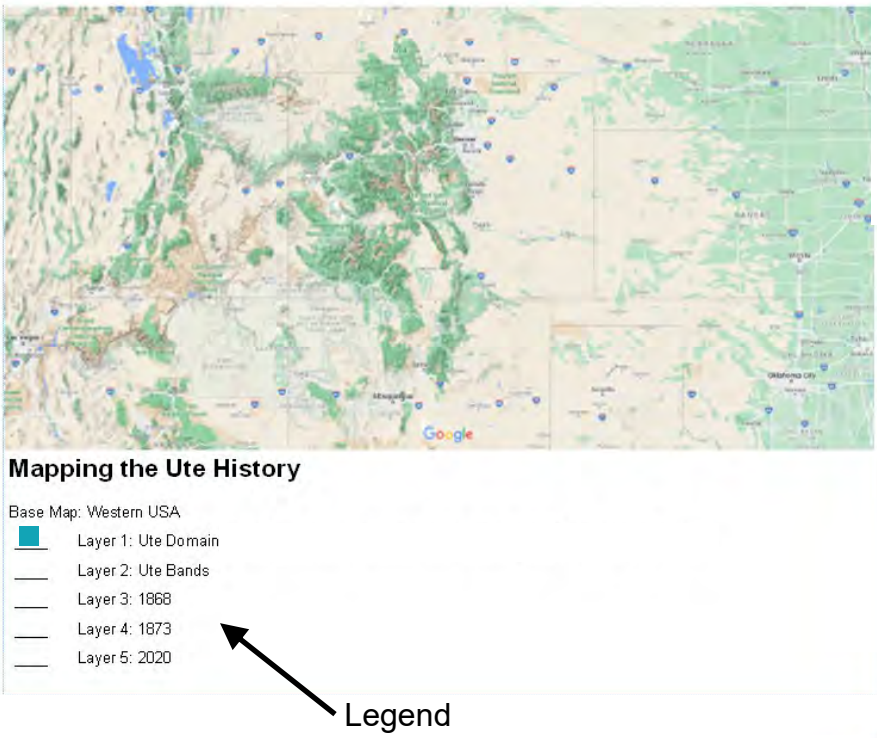
POWER WORDS
continued from page 59

- **data**: factual information, especially information organized for analysis or used to reason or make decisions
- **feature**: representation of a real-world object
- **geographic information systems GIS):** an integrated collection of computer software and data used to view and manage information about geographic places, analyze spatial relationships and model spatial processes; a framework for gathering and organizing spatial data for analysis

continued on page 61

FASCINATING FACTS
- The earliest known maps are of the heavens, not Earth. Dots dating to 16,500 BC found on the walls of the Lascaux caves map out part of the night sky.

The Ute word for man is: **tah watch**
The Ute word for woman is: **mah mutch**



the end of the article to verify the source. The bottom green box on page 62 has several suggestions for searching to locate this information.

- The base map includes a legend. As you work through each layer, denote the color or colors you use on that layer in the legend. There is a line in front of the layer title to color with one example above.
- On your map's first layer (Original Ute Domain), outline the Territory and outline the Hunting Grounds. Can you differentiate between the Territory from the Hunting Grounds? Do you want to use two different color markers, or the same color marker but different shading/hatch marks? This first layer will include nine states: the primary territory includes 4 states, and the hunting grounds include parts of another 5 states. Add the color(s) on Layer 1 to your map's legend.
- On the second layer, research the different bands of Utes and their distribution. Use a separate color to denote the areas they lived. Add the color(s) on your map's legend.
- Research your third layer. What changes happened to the Ute Territory as recorded in 1868. Outline this territory in a different color marker. Add the color(s) on your map's legend.
- Research your fourth layer. What changes happened to the Ute Territory in 1873? Use a different color maker to outline this territory. Add the color(s) on your map's legend.
- Research the location of the Ute reservations. The Northern Ute can be found as the Uintah and Ouray Reservation. The Ute Mountain Ute and

POWER WORDS
continued from page 60

- **line feature**: a map feature that has length but not area at a given scale, such as a river on a world map or a street on a city map
- **period:** a major division of geological time
- **point feature**: map feature with neither width nor length at a given scale, e.g. a city on a world map
- **polygon feature**: a map feature that has both length and area at a given scale, such as country on a world map or a football field on a city map

continued on page 62

FASCINATING FACTS

- The Ute people called themselves Nuu-ciu. This means "the people." The term "Ute" was probably from "Yuta" by the exploring Spaniards. They learned this from other Native American people who called the Ute "Yoo'tawtch" or "Guaputa". "Guaputa" is the Jemez Pueblo Indian word for "people who live in stick houses."

Southern Ute reservations can be found under their tribal names. Use a different color marker to outline the current reservation lands. Add the color(s) on your map's legend.

- What are the names of the original bands? Which bands formed the Northern Ute? Which bands for the Southern Ute? Which bands formed the Ute Mountain Ute? How can you show where they lived to their current reservations.
- Examine your map and each layer. Make any final adjustments to your layers. Be sure that each layer is labeled.

Analysis:

- Modern mapping terminology uses words to describe attributes of different features. Common terms include **point feature**, **line feature**, and **polygon feature**. A **point feature** is something represented by a single point, for example a house, trash or trash receptacle. A **line feature** represents things like roads or rivers. A **polygon feature** represents things like fields, lakes, or buildings.
- Look carefully at the map and the layers. You may need to shift the layers a bit to have them align properly.
- **Analyze** your **data**: Look carefully at your map. What observations can you make? Write those down on the back of your map. Start with basic impressions.
- Start to look carefully at each layer compared to the layer below. Do you see any **trends** in these data?
- Examine each of your basic impressions. List a series of questions for each observation. For example, comparing the Layers 1868 and 1873. What questions do you have about the differences?
- Why were the different bands moved to a specific reservation. Can you determine reasons for this?
- How could the Ute Hunting Grounds span such a large area? How did they utilize this area?
- How can you answer these questions? While you were researching your maps, you probably found sites that also explain the reasons for the differences.
- After you have answers to your questions, review your map again. Share this information with family members and friends. Can you explain these changes?
- Read about the history of the Utes. The Southern Ute website has some great information. Does this support your conclusions from your map?

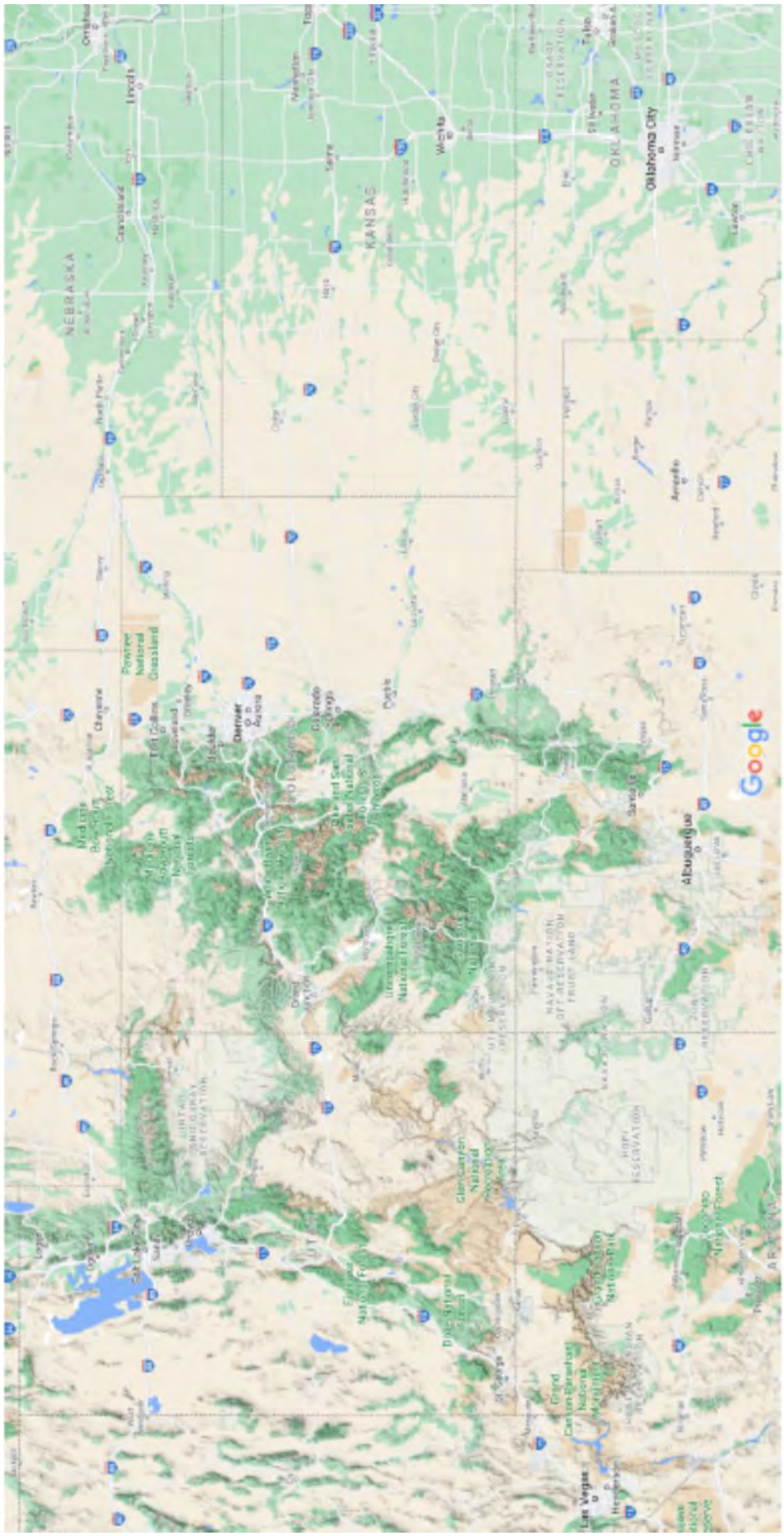
POWER WORDS
continued from page 61

- **spatial data:** related to or existing in space*; in GIS, related to a location on earth
- **trend**: the general course or prevailing tendency, inclination, bent, or predisposition to something

The Ute word for children is
to wutch u oo

WEBSITES?
Are you struggling to find some websites? Here are a couple places to get you started:

- https://www.nps.gov/parkhistory/online_books/blm/co/10/chap5.htm
- https://www.southernute-nsn.gov/history/



Mapping the Ute History

Base Map: Western USA

- ___ Layer 1: Original Ute Domain
- ___ Layer 2: Ute Bands
- ___ Layer 3: 1868
- ___ Layer 4: 1873
- ___ Layer 5: 2020

Hint on page 26.

Ready for some puzzling fun? Cryptograms are substitution puzzles. This cryptogram is a famous quote. Each letter has been substituted for another letter. Print this page and solve this quote.

Hints:

- the most common letter in the English language is “e”
- a single letter is probably the letter “a” or “I”
- the most common three letter word is “the”

Solution hidden in this issue.

"Bec Vtm’q Tchzok db Pbfdl: 'Mkhks Ebqk t Lbep Ofszbqzdp.'" ***EZWK Vtutgzmk tsdzoek tnbfd Tenksd Kzmqdkzm***

Dlk zvybsdtmd dlzmu zq mbd db qdby rfkqdzbmzmu. Ofszbqzdp ltq zdq bim sktqbm wbs kjzqdkmok. Bmk otmmbd lkey nfd nk zm tik ilkm lk obmdkvyetdkq dlk vpqdkszkq bw kdksmzdp, bw ezwk, bw dlk vtshkebfq qdsfodfsk bw sktezdp. Zd zq kmbful zw bmk dszkq vkskep db obvysklkmc t ezddek bw dlzq vpqdksp ktol ctp.

Ute to English

Ute	English
ah cah garuth	red
chee ch	bead
miqué	hello
oo too quer	brown
p shez i ne up	story
pah sah wah garuth	green
qwe a ruckarth	yellow or orange
sah at nup	cooking pot
sah wah garuth	blue
sahger	white
seer a wots	basket
soo check	water jug basket
timpe konitza pachuee	little water bug living in a house of stone
to quah ut	purple
too pwech	rock
too quer	black

English to Ute

English	Ute
basket	seer a wots
bead	chee ch
black	too quer
blue	sah wah garuth
brown	oo too quer
Cambrian trilobite "little water bug"	timpe-konitza-pachuee
cooking pot	sah at nup
green	pah sah wah garuth
hello	miqué
purple	to quah ut
red	ah cah garuth
rock	too pwech
story	p shez i ne up
water jug basket	soo check
white	sahger
yellow or orange	que a ruckarth

Ute to English

Ute	English
man eek moo	1
man l ganie	500
nah neek tomp soo anie	5
nav i cav i nee	50
navine	7
pamp soo anie	6
pi ah ne	30
soo coo moo	3
soo cus tousand	100
soo ece	1000
swah soo ece	75
swat ä wamf chu anie	9
tomp soo anie suke spequat	11
tomp soo anie wike spequat	12
tompsoo anie	10
wahm soo anie	20
wamf chu anie	8
wi an ne	2
wich u anie	4
wichuke tomp soo anie	40

English to Ute

English	Ute
1	soo ece
2	wi an ne
3	pi ah ne
4	wich u anie
5	man l ganie
6	navine
7	nav i cav i nee
8	wamf chu anie
9	swat ä wamf chu anie
10	tompsoo anie
11	*tomp soo anie suke spequat*
12	*tomp soo anie wike spequat*
20	*wahm soo anie*
30	*pamp soo anie*
40	*wichuke tomp soo anie*
50	*nah neek tomp soo anie*
75	*swah soo ece*
100	*soo coo moo*
500	*man eek moo*
1000	soo cus tousand

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Answer from page 33:
C =2 **π r**
C = 2 x 3.1416 x 3”
C = 18.8496” or rounded to 18 $^{7}/_{8}$ inches

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