



# Kansas 4-H Geology Leader Notebook

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# Water

## Natural Resources — Geology, Level I

What members will learn ...

### About the Project:

- Water is a continuously recyclable source.
- Water is necessary for life.
- Water can be found in three forms: gas, liquid, and solid.

### About Themselves:

- The importance of observation skills
- Why water is important.

### Materials:

- Glue
- Scissors
- Crayons
- Blue Yarn
- Hole Punch
- Flip chart
- Activity Sheet 57 (three pages), *Water Cycle Mobile*
- Activity Sheet 58, *Water Watcher*

### Activity Time Needed: 45-60 minutes

### Activity

All over the world, water is connected in some way. The oceans, rivers, frozen ponds, puddles, water drops on plants, even drinking water from your faucet are all part of the water cycle. Our water supply is used over and over again as it moves through the Earth's atmosphere and circulates between the lands, oceans and sky.

Some of the Earth's water is frozen in polar icecaps and moves slowly through the cycle. However, the total amount of water throughout the world stays the same and the same water is used over and over again.

As users of this vital resource, we are part of the water cycle. When we wash our clothes, take a shower or brush our teeth, the water runs off and ends up in rivers, lakes, gulfs, or oceans. The sun heats the air causing some of the water to evaporate and fill the lower layer of the atmosphere with an invisible water vapor. In the process we call weather, air currents carry the water vapor higher, where clouds are formed. These clouds contain droplets of ice or water. After the clouds are filled with droplets they fall back to Earth in the form of rain, snow, sleet or hail.

### Leader's Notes:

Before discussing the water cycle, have members list on a flip chart as many places as they can where they can find, see or feel some source of water.

Hand out the three pages of Activity Sheet 57, *Water Cycle Mobile*.

Give each member Activity Sheet 58, *Water Watcher*, and take them for a walk. A walk after rain or snow would be one of the best times. Plan ahead of time how to organize your walk. Can several adults go with you?

Rain or snow runs into rivers and streams. Sometimes the water travels into reservoirs and lakes, which supply water treatment plants. These plants treat the water so that chemicals, minerals and bacteria that the water picked up on its journey are removed. Water is then pumped to your home faucet. Then the water cycle begins all over again.

### **Water Cycle Mobile**

We will demonstrate the principles of the water cycle by making a water cycle mobile.

We will weave yarn through the pages to represent the circulation of water. When the yarn is connected, it shows the continuous path of water as it goes through the cycle.

1. Hand out the pages
2. Color (optional) and cut the pages on the solid lines
3. Glue the pages together to make one long sheet
4. Use a paper punch to make a hole at each numbered dot
5. Cut a 50-inch length of blue yarn. Begin at hole #1 and weave the yarn in and out of the holes as numbered.
6. Glue the first and last pages together to make a wheel
7. Tie the ends of the yarn together and cut off excess.

Follow the path of the water cycle.

### **Water Watcher**

Today we are going to be water watchers. We are going to take a walk to see if we see signs of the water cycle. You will each have a checklist and when you see a sign of the water cycle, you can check it off by putting an X or a checkmark in the square box in front of it. What are some things to look for? Look at the checklist before we go out to see what is on it.

### **Dialogue for Critical Thinking:**

#### **Share:**

1. What did you enjoy most about making the water cycle mobile?
2. How many items did you see on your water watcher walk?

#### **Process:**

3. How does water get from the clouds to the river? (*Rain, snow*)
4. How does water get from the river or lake to your faucet? (*Water treatment plant cleans and pumps.*)
5. How does water get from rivers and lakes to the clouds? (*Evaporation*)

#### **Generalize:**

6. Where does the water come from that you drink?
7. Why do you need to drink water?
8. Is it wise to drink any kind of water that we see? Why not?

**Apply:**

9. Why would you want to take care of your water? (*Keep clean, save for later.*)
10. Is there any more water now than when the dinosaurs were around? (*No, it continues to cycle.*)

**Going Further:**

1. Draw pictures of water observed on the walk.
2. Take water watcher checklist home and add to the list.
3. Visit a water treatment facility
4. Visit a bottle water distillery
5. Boil water, observe and collect steam

**References:**

*Water Education for Teachers (WET)*, Kansas State University Extension,  
Copy Cat Magazine

**Author:**

Benetta Foster, Kansas 4-H Geology Curriculum Team

**Reviewed by:**

Will Gilliland, Environmental Scientist, Division of Water Resources,  
Kansas Department of Agriculture

James P. Adams, Associate Professor, 4-H Youth Development, Kansas  
State University

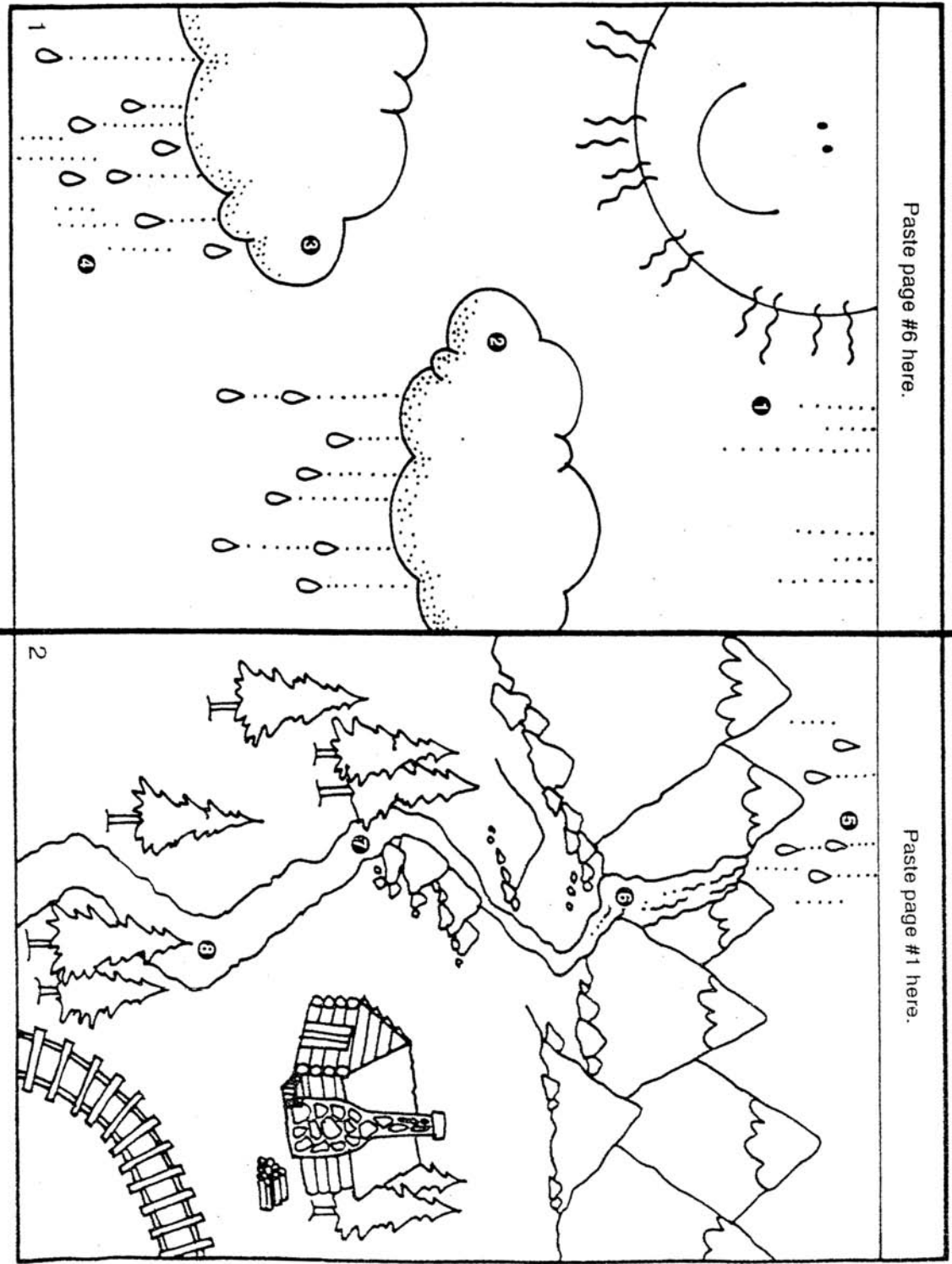
Be prepared to discuss the variations in the supply of drinking water.



# Water

Activity Sheet 57,  
Water Cycle Mobile

## Natural Resources — Geology, Level I

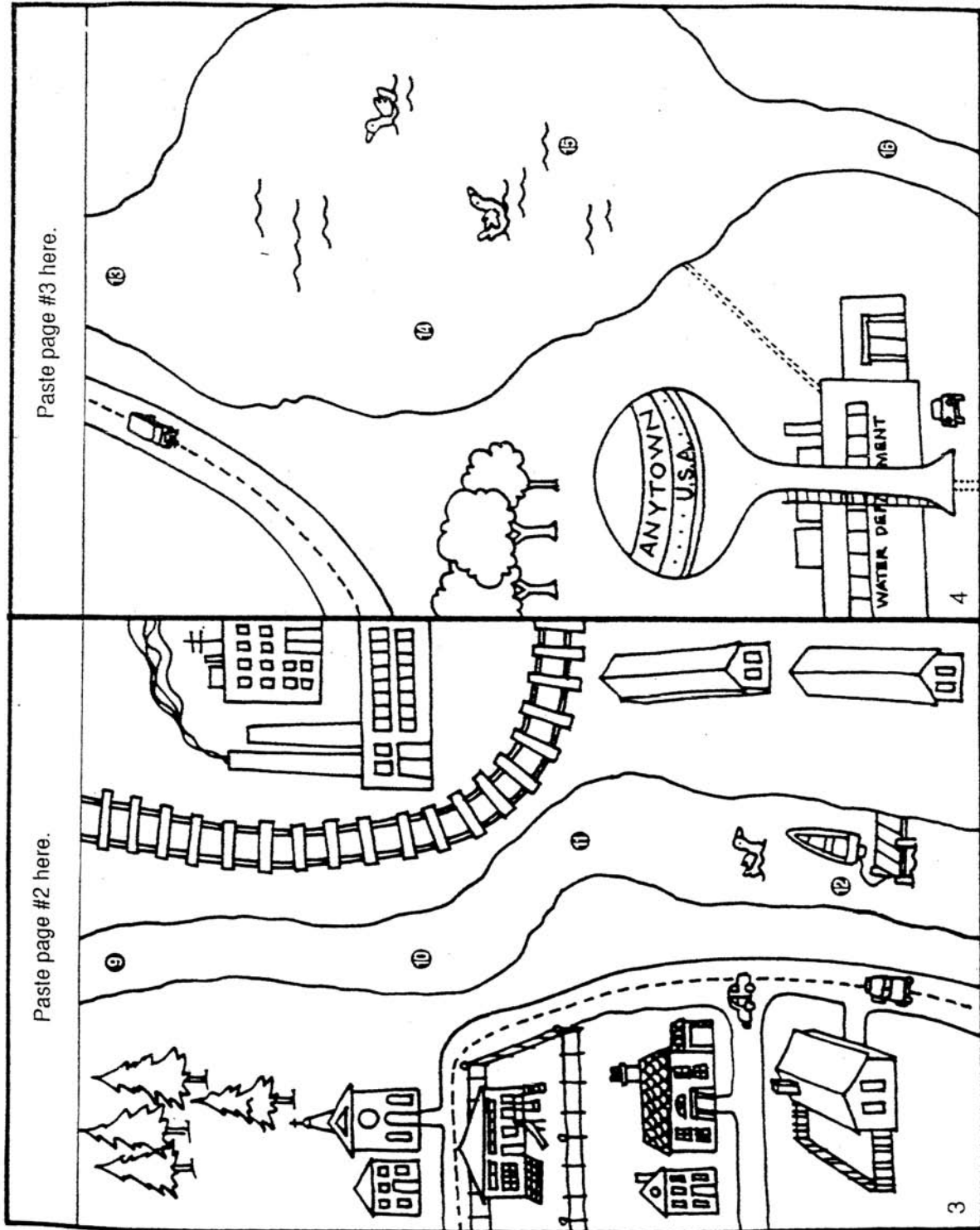




# Water

Activity Sheet 57,  
Water Cycle Mobile

## Natural Resources — Geology, Level I

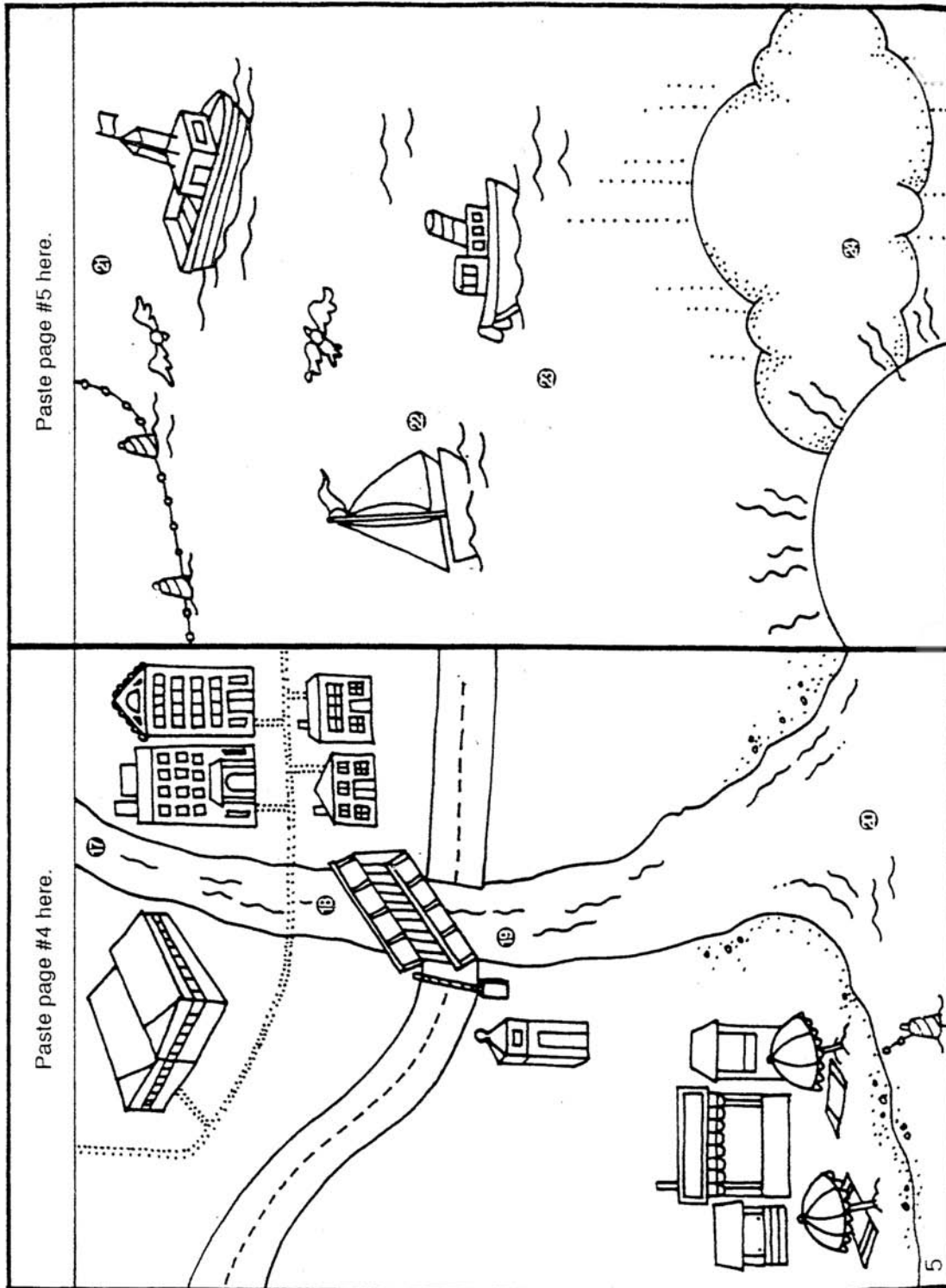




# Water

Activity Sheet 57,  
Water Cycle Mobile

## Natural Resources — Geology, Level I







# Water

Activity Sheet 58,  
Water Watcher

Natural Resources — Geology, Level I

I'm a Water Watcher

This is what I see:

- Water droplets on plants
- Water droplets on windows
- Clothes on a clothesline
- A puddle
- A muddy spot that was once a puddle
- A place that shows soil erosion
- Clouds
- A storm drain
- Water running in the gutter
- A water meter
- A water tower
- A lake
- An icicle
- A snowball
- Fog
- Other \_\_\_\_\_





# Which Way?

## Maps — Geology, Level I

What members will learn ...

### About the Project:

- How to make and use a compass rosette.
- How to find directions on a map.
- Points of geological interest in Kansas.

### About Themselves:

- How to tell and give directions.
- The value of maps.

### Materials:

- Highway type map with a compass rose on it
- Compass
- Activity Sheet 59, *Compass Rosette and Dino Directions*
- Activity Sheet 60, *State Landmarks*
- Pencil
- Scissors
- Blank sheets of paper
- Sidewalk chalk or regular chalk
- Yardstick
- Large open area, preferably on concrete

### Activity Time Needed: 45 minutes

### Activity

Who can tell me what I am holding in my hand? What is it used for? Do you know how it works?" (*A. The moving needle is magnetic and points North and South unless a closer magnet gets in the way.*)

Maps use a paper version of the compass to tell which way is which. Let's look at some maps for the compass rosette.

By using the map people can tell which way they need to go to get somewhere. We are going to fill out this page to learn how it works.

### Leader's Notes:

Ahead of time, draw a large map of the state outdoors on concrete; or indoors, use twine or masking tape to outline the state if you are doing this activity. You may add a few features such as major rivers. The map does not need to be exact. For Kansas, a rectangle almost twice as wide can be used (ex. 10 feet by 19 feet) can be laid out. Then draw a wavy line over the Northeast corner. Keep the directions oriented the way they really are. Draw a simple compass rose nearby. There is an alternative activity that can be used if you prefer.

Show compass.

Allow a little experimentation. Let each member hold and observe the compass. Then tell them they can use it more after the meeting is over.

Show compass rose on the real map.

Hand out Activity Sheet 59, *Compass Rosette and Dino Directions*. Read and do each part with the members, drawing a large compass on a chalkboard or piece of paper if you have a large enough group to warrant it.

If time is short, you could explain this exercise and have them do it at home. Children without a backyard could draw something else, like the room you are meeting in, or any other area they know well.

Distribute Activity Sheet 60, *State Landmarks*.

It will probably be better to work together as one team and find the locations together. If your group is large, you may divide into teams and find the locations. In that case you may want to divide up the sites, or have each group put their initials on their pictures.

Help children who are having trouble by helping them to turn the map the proper direction and coordinate locations.

Have members find the locations only on a paper copy of the map. Cut your landmark pieces from the rest of the map and enlarge the map section of the activity sheet. Make enough copies of both parts for everybody. Then work on your paper as the students do

Next, let's turn the paper over and draw a quick map of your backyard. Which way should be up on your map? (*North*) It will be easier to draw it with the directions right, if you turn the paper so that up is the direction North really is. Now draw in a compass rose with North, South, East and West. Now draw your house and a couple of other things that are in your backyard.

The next activity will help you find some interesting things in our state. We will use this little map to find where things are in our state and then find the same locations on this big map of our state that I have drawn here on the floor (or playground) with chalk.

Each picture at the bottom of the page is a special place in Kansas. Have any of you been to any of these places? Where on this small map is our county? Where would that be on the big map? We'll put this picture of a house to show the county where we live. Where would we put the picture of the state capitol? Where is the state capital? Let's put the rest of the pictures on the big map, using the little map to show help us.

#### **Alternate Activity:**

Here is a map of our state. Cut out the landmark pieces and paste them to this map. Where is our state capitol? Paste that picture there. Which way do you live from there? Paste the picture of the house there. Now do the same for the rest of the pictures.

### **Dialogue for Critical Thinking:**

#### **Share:**

1. Which direction is easiest for you to identify? Why?
2. How many of the state landmarks did you know?
3. What is a compass used for?
4. What happens to the compass when you turn different directions?

#### **Process:**

5. What is important to know about using a compass or reading a map?

#### **Generalize:**

6. When would you use the things you learned today?
7. Why is it important to know how to give directions?

#### **Apply:**

8. What is the name of our county? Can you think of any times that what county you are in makes a difference? (Ex-listing your specimens by county)
9. What other times would you think it would be useful to know how to use a compass?

## Going Further:

1. Make a “treasure map” of some convenient place like your backyard and have someone try to find the treasure (some treat). Alternately, the leader could draw the map and hide the treasure, and the 4-Hers could follow the map to find it.
2. At the next field trip, provide a map and encourage members to look at it. Ask questions like, “Which direction will we go when we start the field trip? What county will we be in?”
3. Children may do a purchased puzzle of the state or of the U.S.
4. Do a simple game to “Mother May I.” All start on one side of the room. The leader gives directions such as “take three steps North. Now take one step West.” Gradually advancing the group across the room. Any incorrect responses must take one step back. First, to get across are the winners. If you are fortunate enough to have a tile floor, go three tiles to the North, etc.
5. Encourage the children to study the map on family trips. “Which way is Grandpa’s house from our house?”

## Resources:

Many libraries have books for children on maps, or books that have sections on maps.

State maps available from state highway departments or may be purchased over the counter at gas stations.

More detailed maps are available from the Geologic Survey: Kansas Geological Survey, 1930. Constant Avenue, Lawrence, KS, 66047-3726 and at other locations throughout Kansas.

*Roadside Kansas*, by Rex Buchanan, lists many interesting geology locations.

### Author:

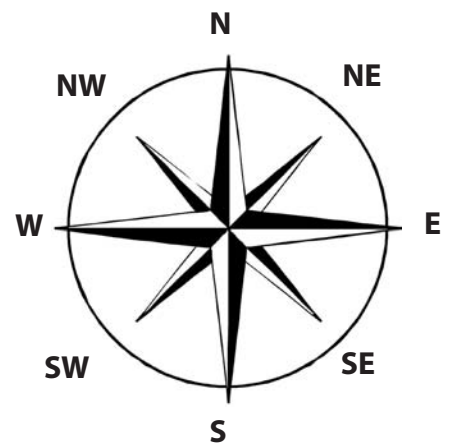
Pat Gilliland, Kansas 4-H Geology Curriculum Team

### Reviewed by:

Will Gilliland, Environmental Scientist, Division of Water Resources, Kansas Department of Agriculture

James P. Adams, Associate Professor, 4-H Youth Development, Kansas State University

Answers to Compass Rosette:



Answers to Dino Directions:

1. N
2. S
3. NW
4. NE
5. SW
6. E



# Which Way?

Activity Sheet 59,  
Compass Rosette  
and Dino Directions

## Maps — Geology, Level I

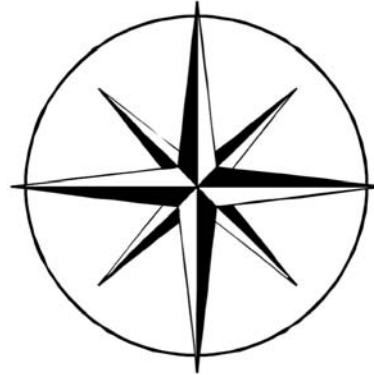
Maps usually have a compass “rosette” on them to show which way is which direction. Put these on the different directions of the compass:

Put an N for North at the top of the compass.  
Up is usually North.

Put an S for South at the bottom of the compass.

Put an E for East on the right side.

Put a W for West on the left side.



Add more directions to the compass, in between the other directions. Between North and East, add Northeast by writing the letters NE. Add these other directions to the compass: Northwest (NW), Southeast (SE) and Southwest (SW).

## Dino Directions

Help find baby Dino find his way. Look at the map below and then tell Dino which way to go. Write in the direction using the letters you used on the compass.

1. Which way is the pretty diamond? \_\_\_\_\_

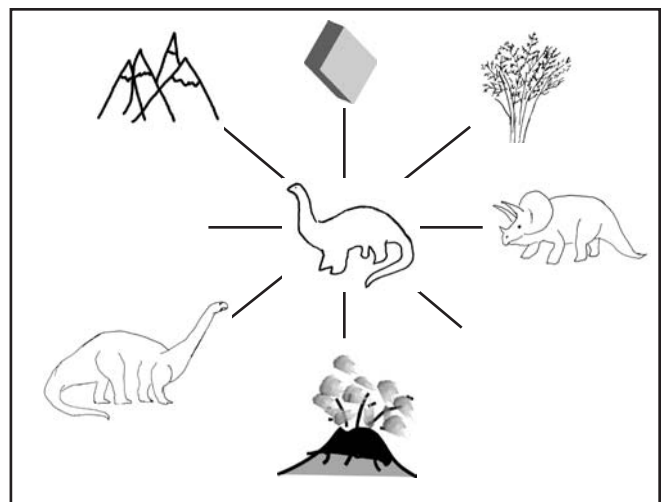
2. Which way is the volcano? \_\_\_\_\_

3. Which way are the mountains? \_\_\_\_\_

4. Which way would Dino go to find some plants to eat?  
\_\_\_\_\_

5. Which way would Dino go to find his mother?  
\_\_\_\_\_

6. Which way should Dino not go because it has a scary Triceratops? \_\_\_\_\_

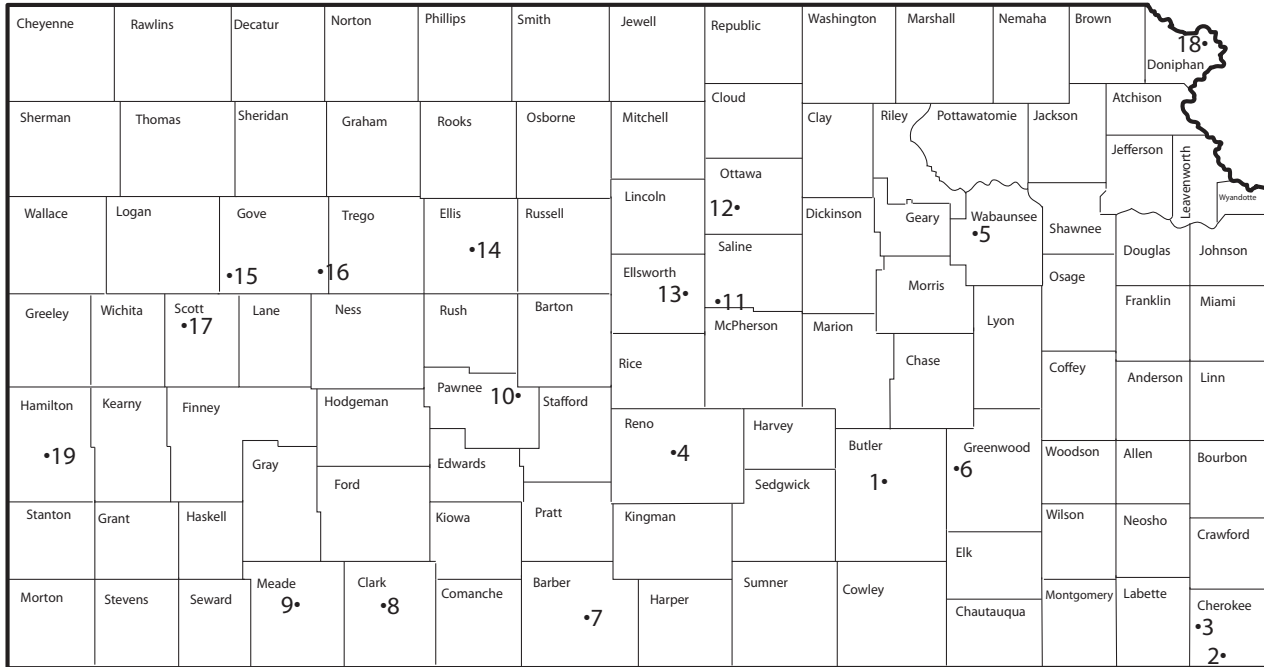




# Which Way?

Activity Sheet 60,  
State Landmarks

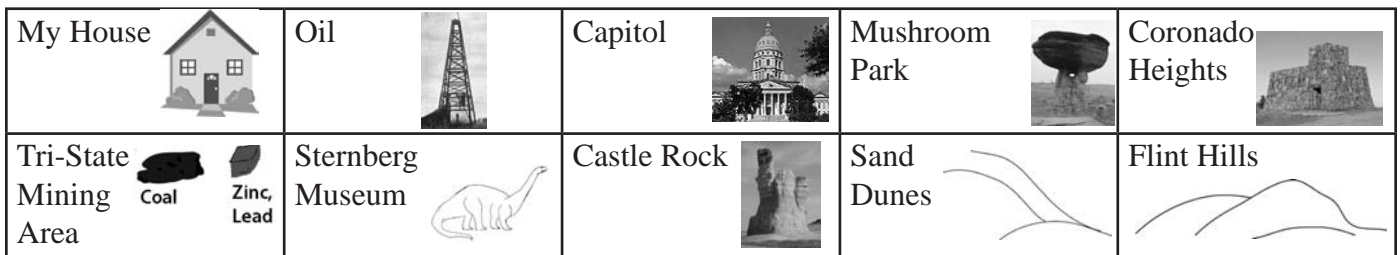
## Maps — Geology, Level I



Map adapted from Kansas Geological Survey

- |   |                                     |   |
|---|-------------------------------------|---|
| 1. El Dorado Oil Museum                       | 8. Big Basin                        | 15. Monument Rocks  |
| 2. Zinc mines and chat piles                  | 9. Meade salt sink and Seybert sink | 16. Castle Rock   |
| 3. Coal strip mined by giant shovel           | 10. Pawnee Rock                     | 17. Scott County State Lake and Park                            |
| 4. Salt mines                                 | 11. Coronado Heights                | 18. Loess Bluffs along the Missouri Rivers "Little Switzerland" |
| 5. Skyline scenic drive (Flint Hills)         | 12. Rock City                       | 19. Sand dune area, south of Syracuse                           |
| 6. Flint Hills drive (unmarked)               | 13. Mushroom Rock                   |   |
| 7. Medicine Lodge, heart of Red Hills Country | 14. Sternberg Museum at Hays        |   |

Cut out these items and add them to your map.



### Map of Backyard

Now that you know directions, please draw a map of your backyard on the back of this sheet. Start by turning the paper so that up is North. Then put in your house and at least 2 other things.







# Rocks You Eat and Use

## Natural Resources — Geology, Level II

What will members learn ...

### About the Project:

- Geologic products affect every part of our lives.
- Geologic products have some very unexpected uses.

### About Themselves:

- Their relationships to geological products.
- How to categorize items.

### Materials:

- Products brought to you by members (see Advance Preparation note)
- A few unusual products of your own, including some food products
- Member Handout 35, *Geological Products in Your Home* for each person
- Small prizes (1-3) for most unusual product
- Poster “Your House Came out of a Mine” (optional, see reference)

### Activity Time Needed: 10-15 minutes

### Activity

Let's look at things you brought from home that are geology related. What a variety! Let's group them into categories. What would be some good ones? (*A. Foods, metals, electronics, building materials, etc.*) Are you surprised that we even eat rocks? The most common one is probably salt, but they are also in many other things, like calcium for strong bones. Some drinks used to have a small amount of clay, kaolin, in them to make them look cloudy. Now they often have a calcium product. What are some others? Let's look at the labels and see what is in them

It's probably not so surprising that we use geology products for building, from the cement for the basement to the bricks for the chimney. Even petroleum products are considered geologic materials. Are you surprised that electronics are geology related? Even the silicone for computer chips is a geology product. Here is a page listing some geology products. Which product do you think is unusual? Why? All your products were interesting and helped us learn about geology. Let's take a vote to see which is the most unusual product that one of you brought.

### Advance Preparation:

When you notify your members of the meeting, ask each of them to bring one to four geology related products from home (number depending on the size of your group). Tell them they will receive a small prize if they bring the most unusual one.

### Leader's Notes:

Designate a table for them.

Use categories that make sense with what products you have.

Hold up a bottle or can and show the label.

Provide Member Handout 35, *Geological Products in Your Home*.

You could choose the winner yourself instead but this makes them think about them more.

## Dialogue for Critical Thinking:

### Share:

1. What products surprised you the most?
2. What new uses of geology products did you learn tonight?

### Process:

3. What kind of products were alike, and in what way? (Use? Appearance?)
4. Did you think mostly of metals when we first mentioned this lesson?

### Generalize:

5. What did you learn about grouping items into categories? (*A. Decided whether to use similar characteristics, uses etc. Items do not always fit neatly into one category or may fit in more than one etc.*)
6. How important is geology in your life?

### Apply:

7. What unusual items do you have in your home?
8. What would you say to someone who told you that geology wasn't important?

### Going Further:

1. Compare orange drink with a geological product in it to make it look thicker, with a clear one. (Tang to orange Kool-Aid would be one example.) Read the label to find out what is in each.
2. Make a poster or display of geology products and exhibit it.
3. Investigate what geology products are produced in your state. Make a display or presentation.

### References:

*Your Home Comes Out of Mine* (free flyer), one page summary poster from the SME Foundation for Public Information and Education, Inc., 8307 Shaffer PKWY. Littleton CO 80127 Phone (303) 973-9550.

### Author:

Pat Gilliland, Kansas 4-H Geology Curriculum Team

### Reviewed by:

Will Gilliland, Environmental Scientist, Division of Water Resources, Kansas Department of Agriculture

James P. Adams, Associate Professor, 4-H Youth Development, Kansas State University



# Rocks You Eat and Use

Member Handout 35,  
Geological Products  
In Your Home

## Natural Resources — Geology, Level II

### Building:

Many parts made of wood, a plant material rather than geologic, but a lot of components are made of geologic products.

**Foundations, slab:** concrete (composed of cement, sand and gravel)

### Walls:

Concrete — as in concrete block houses

Building stone — limestone, or others

Metal in nails, bolts, plates, wire — Could be iron, copper, or aluminum

Plaster board and plaster — made of gypsum

Paint — assorted metals, petroleum products, limestone and dolomite

**Roof:** if not wood, it could be slate, metals such as iron or copper, petroleum products, mineral or rock fragments

### Fixtures/ Furniture:

Iron, copper, tin, zinc, glass  
petroleum products

### Heating and Cooling:

Oil, gas, coal

Electricity carried on metal wires

### Clothing and Care Products:

Some made of plant and animal fibers.

Others made of these:

Petroleum products (polyester), metals

Detergents, additives and fillers (borax, phosphates, etc.)

### Health Care Products:

Medicines — Antacids, laxatives

Fillers in medicines — clays, calcite, etc.

Abrasives, such as found in toothpaste — limestone, dolomite, salt

### Food Products and Supplements:

Minerals needed for life — iron, calcium, etc. Salt

Limestone and dolomite fillers (to make products look cloudy or be thicker)

Clays and minerals

Cooking and eating utensils

### Entertainment:

Wires, metal parts on TVs etc.

Silicon chips, without which computers would be very primitive.





# Cross Sections

## Maps — Geology, Level II

*What members will learn ...*

### About the Project:

- How a geologist can tell what is under the surface of the earth.
- How core drilling works.
- How to read and use the cross section maps.

### About Themselves:

- How to analyze information to make logical deductions.

### Materials:

- Cross section maps
- Kansas map showing I-70 cross section (Available from the Kansas Geological Survey.)
- Peanut butter
- Dark jelly (like grape)
- White bread and whole wheat bread
- Sharp knife, and table knives (could be plastic)
- Plastic straws, large if possible, for each member
- Small sharp scissors (optional)
- Napkins or paper plates
- Actual core samples (Possibly from Kansas Gas Service (KGS) Well Log Library in Wichita.)

### Activity Time Needed: 30 minutes

### Activity

Did you ever wonder how a geologist can tell what is underneath the surface of the earth? One way they find out is by drilling holes into the earth.

By seeing what comes out of the hole, an experienced geologist can map underground layers far below the surface of the earth.

Sometimes they use a drill that brings up the layers whole in a round core. This is called a core drill. Auger or rotary drill, on the other hand, grind the rocks and dirt up as they drill, and then bring pieces to the surface. They sometimes also use sophisticated instruments to “see” below the surface.

### Cross Section:

Here is a map of Kansas showing where different layers show at the surface. The cross section at the bottom shows what it is like underneath the surface at I-70 highway. I will use this peanut butter sandwich to show how that

### Leader’s Notes:

#### Preparation:

Make two peanut butter sandwiches ahead of time. One should be many layers thick, and one should have grape jelly spread on only one quarter of the sandwich, with no jelly showing on the outside edge.

Use the taller peanut butter sandwich you made to show this.

Bend the sandwich slightly to show a hill for buckling.

Cut off a piece at least three layers thick at one side and one layer thick on the other.

Make a perpendicular cut to cut the sandwich in half.

If you can, make enough sandwiches so that every two or three members have one to experiment with.

If you don't have scissors, try gently blowing the core out.

Show core sample and pass it around, if you have one.

If you don't have enough for each member to make a sandwich, then have them do it in pairs. If their hands are clean, they may eat the sandwich afterwards.

works. See how it is several layers tall. The layers were originally laid down flat, although they may not have been quite as flat as these are. Then, our earth became more active geologically. Parts were buckled and erosion washed away a lot of Kansas.

I am making a slanting cut to show how more is gone in the Eastern part of Kansas than in Western. What layers are showing at the surface now? (*A. Now different, lower ones show at the surface.*) We can't be sure that the layers that are not there (cut off) were actually like the ones that are left, as that part is gone. Now I am going to cut the sandwich in half. This would be like the cross section.

See how all the layers show now and you can tell how deep they are. Look at your maps. The cross section they show was not really ever cut there. It is just to show what it would show if you could. See the letter 'A' and the line on the top map? That is about where Interstate Highway 70 is? That is where they did the cross section and it shows what is under Interstate 70. Have you driven on that highway? Do you remember that Western Kansas looks different than Eastern? At least part of the reason is that different rock layers are showing at each area. Look at the map and find your county. Now look straight down to the cross section. What rock layers are under your county and in what order?

### **Core Sample:**

Can you think of a place where you have seen a cross section? (*Road cuts, Dam spillways.*) Most of the time geologists can't cut away the dirt to see what they want to know, so they make drill holes to find out. Here is another peanut butter sandwich. I have put grape jelly on one quarter. Can you tell which it is? Each of you take a guess which quarter of the sandwich has the grape jelly. Use a straw and take a pretend core sample on a part of the sandwich. Push the straw straight down with a slight twist. Cut down the side of the straw until you can see the whole plug. Do you see any grape jelly? Keep trying until you find the jelly in the sandwich.

A real core sample is usually several inches in diameter. Sometimes they are put in long trays to keep them in order so they can be examined later. Now, you are going to make a sandwich with grape jelly on one quarter. When you have made your sandwich, find someone who hasn't watched you make it, and core sample it to find the grape jelly.

## **Dialogue for Critical Thinking:**

### **Share:**

1. How does a cross section of a sandwich help you understand the earth?
2. How does a core sample substitute for a cross section?

### **Process:**

3. Where can you find good cross sections of earth layers?
4. How do geologists use core samples? Why?

**Generalize:**

5. Where else might cross sections be used?

**Apply:**

6. Why do people need to know what is below the earth's surface?  
(Consider buildings, highways, natural resources and earthquakes)
7. When might a core sample be misleading?

**Going Further:**

1. See if you can get some actual core sections to study. Observe them closely. Can you tell the different kinds of rocks? How does it compare to a profile (cross section) of the area? Can you see any interesting features, like fossils, in it?
2. Map a road cut. Measure each feature carefully so you will have an accurate map. (See Mapping, levels 3 and 4)
3. Find out some of the other methods geologists use in addition to core holes. Compare.
4. Observe a water or oil well being drilled. The materials coming out are ground up. Can you still tell what is under the surface? How?
5. Take your I-70 cross section map with you on a trip. Can you identify any of the layers?
6. Make a chart or prepare a talk on the advantages and disadvantages of a cross section or core sample.

**References:**

VanCleave, Janice, *Earth Science for Every Kid*, 1991, John Wiley & Sons, Inc.

**Author:**

Pat Gilliland, Kansas 4-H Geology Curriculum Team

**Reviewed by:**

Rex Buchanan, Geologist, Kansas Geological Survey.

James P. Adams, Associate Professor, 4-H Youth Development, Kansas State University







# Top It Off

## Maps — Geology, Level III

*What members will learn ...*

### About the Project:

- How to read a topographic map.
- Elevation lines are:
  - Equal distance apart in elevation.
  - The same distance above the ocean anywhere on the line.
  - Closest together where land is steepest.
  - Form a V pointing up river.
  - Form circles for mountains or hills.
  - Changes in direction are indicated by hash marks.

### About Themselves:

- How models and observation help learning.

### Materials:

- Large amount of modeling clay or play dough
- Clear shoe box style storage box with clear lids or plexi glass to lay over top of it
- Clear acrylic sheets like overhead transparencies or report covers cut to size of shoe box
- Grease pencil or permanent marker that will draw on sheets
- Large tray or cookie sheet to catch drips, and a towel
- Water — at least two gallons — and pitchers
- Food color
- Pencils
- Masking tape, ruler, nail
- Topographic map of your area, and other topographic and relief maps as available
- Activity Sheet 61, *Topographic Maps*

### Activity Time Needed: 45 minutes or more

### Activity

A special kind of map is used in geology to show elevations, which is the height above sea level. Do you know what it is called? A. Topo, or topographic map. Here is one for our area. See all the little lines? Each line shows a certain elevation, and everywhere on that line is the same elevation.

### Leader's Notes:

Let them look at the map for a while and give examples of elevation.

If only two groups, have one group do a young (V-shaped) river valley and the other do a typical cone-shaped mountain that can later be modified into a volcano. More groups (reuse play dough?) can do a mesa or cliff, a plain (gradually sloping) or a volcano.

Monitor each group as they work.

Repeat or modify for volcano. Use a pencil to punch a hole through to crater so water can get inside.

Add some hash marks.

Repeat with other features, which should show:

Plain: gradual lines far apart.

Mesa or cliff: closely spaced lines where it is steep.

Point out symbols, compass rose, scale, etc.

Repeat with several locations. Have them find a mountain or hill, and a river or stream.

Do Activity Sheet 61, *Topographic Maps*, following the directions and reinforcing concepts.

**Answers:**

1. River-C, Mountain-A, Plain-D, Volcano-B
2. North
3. A
4. Up

You can tell a lot about the shape of the land by looking at a topographic map. We are going to do an experiment to show how topographic maps work. I am going to divide you up in groups and I want you to make a small model of your assigned land form feature that will fit into a shoe box. When we are done, we will pour water on the models to different depths to show how different landforms make different patterns on the topographic maps.

Use a separate sheet of clear plastic for each landform. Start with the mountain. Tape first clear sheet to top of box.

Place the landform model in shoebox. Readjust as needed to fit. Be prepared for a little messiness and spilled water. Use grease pencil and ruler to mark 1-inch levels on side of shoebox, starting from bottom.

Pour water in until it reaches first mark (or about a half inch if models are small). Looking straight down, draw a line where the model meets the water. Repeat for each inch. The lines should eventually become somewhat circular and closer together as you move up the mountain to steeper slopes. When done ask:

What shapes approximately do the lines form? (*A. A circle*)

Where were the lines closer together? (*A. Where steepest*)

How can you tell if the lines are going up or down in the center? Can't? Mappers use hash marks, or short lines, to tell if it changes direction.

Do the river the same way.

What shape does this form? (*A. V's*)

Which way do the V's point? (*A. Up river in the direction the river is getting higher. Not all V's show where the water would run together on its way to form a river or stream.*)

Here is a real topographic map. How does it look different? (*A. Much more on it.*)

Colors: typically, each fifth topographic line is darker or a different color to make it easier to follow and figure out elevation.

Find \_\_\_\_\_ (pick a feature on the map, like where you are meeting or a landform)

What elevation is it?

If you climb this mountain, or go to this lake, from \_\_\_\_\_, what would be the easiest way to go? The most challenging?

Now we will do simplified worksheet of land forms.

OPTIONAL or substitute if not doing models:

Trace different contours off of a simple topographic map or from the activity sheet, showing one or two features. Cut each contour out of cardboard, or foam board, painting each layer a different color if desired. Use only every fifth line if area is large. Stack them up in proper order and glue to resemble the area. Study and analyze it as you did the other models.

## Dialogue for Critical Thinking:

### Share:

1. Was it easy or hard for you to identify features on the topo maps?
2. How did the models help you learn the map features?

### Process:

3. When are the contour lines closest together? (*A. Where land is steep*)
4. What is the basic reason for topo maps? (*A. To show elevations of different areas, which can tell you what landforms are at a location.*)

### Generalize:

5. How could you use a model in other areas of your life?

### Apply:

6. How would you use topographic maps to find a good place for a field trip?
7. Where on a topographic map would it indicate a pretty view?
8. How would a topographical map help you build a highway? (*Consider cost, view, safety, distance, etc.*)

### Going Further:

1. Study a variety of topographic maps. Try to get ones showing different features, such as karst topography or sinkholes.
2. Collect relief model maps and study them. They are often available at National Parks and those have interesting features. Compare them to each other and to topographic maps. What is the highest elevation on each? What would you consider the outstanding feature on each?
3. If you can get some stereoscopes and stereo photos of different types of landforms, these can be a good way for members to comprehend topographic maps.

### References:

These books have good analysis of topographic maps whether or not you use a stereoscope (3-D viewer) with them.

*Stereogram Book of Contours* by Horace MacMahan, Jr.; Hubbard Scientific Company, 2855 Shermer Road, Northbrook, Illinois 60062. (Good book with basics of elevations and generalized topo maps of landforms)

*Stereo Atlas* sponsored by the Am. Geological Institute; also printed by Hubbard. (Has aerial views, stereo aerial views and a topographic map section of 50 interesting geological features)

### Author:

Pat Gilliland, Kansas 4-H Geology Curriculum Team

### Reviewed by:

Rex Buchanan, Geologist, Kansas Geological Survey.

James P. Adams, Associate Professor, 4-H Youth Development, Kansas State University



# Top It Off

Activity Sheet 61,  
Topographic Maps

## Maps — Geology, Level III

Use the map below to answer these questions:

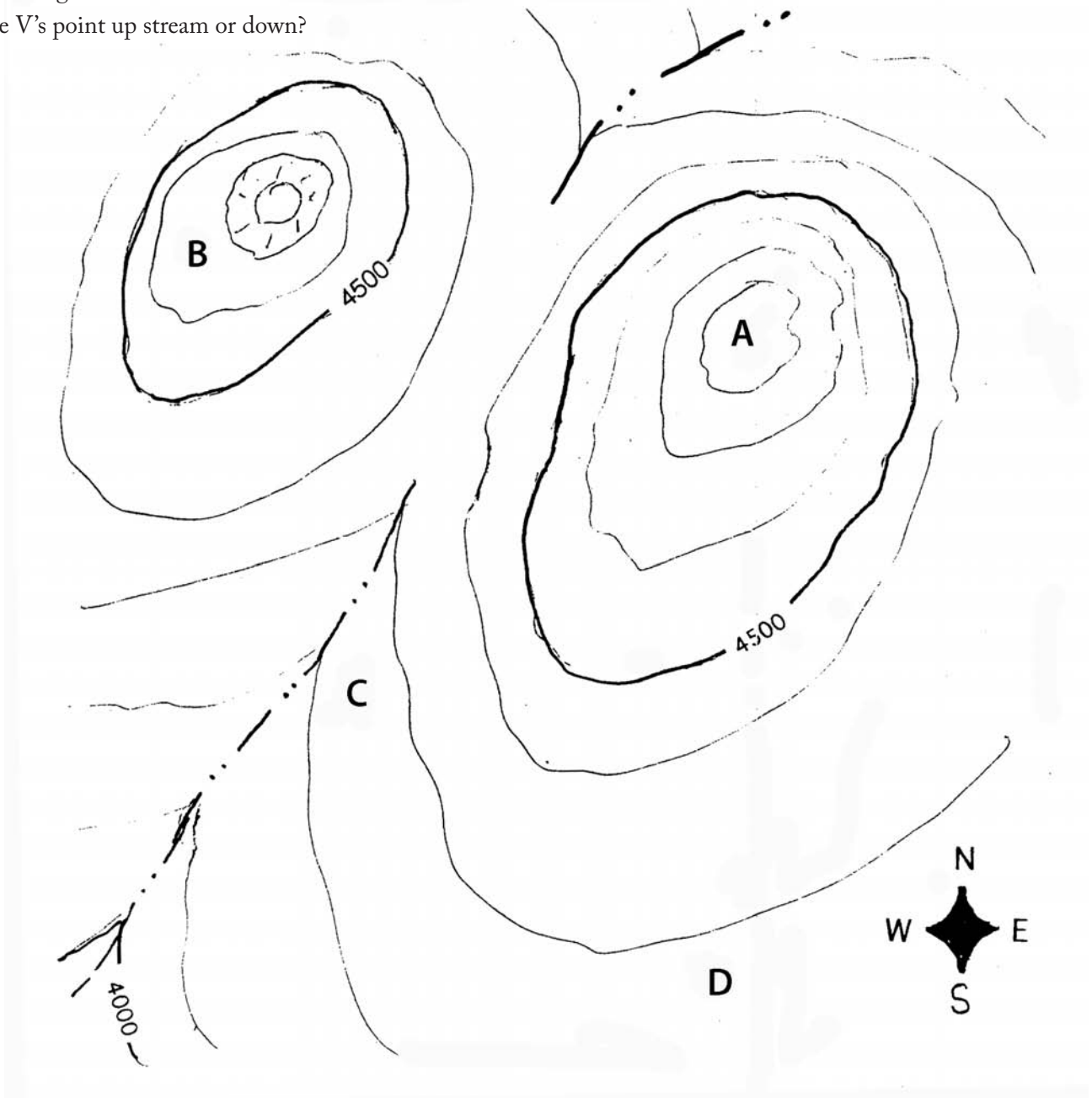
1. What letter is on each of these land forms:

River: \_\_\_\_\_ Mountain: \_\_\_\_\_ Plain: \_\_\_\_\_ Volcano: \_\_\_\_\_

2. Which side of the mountain (A) is steepest

3. Which is higher: Mountain A or Volcano B?

4. Do the V's point up stream or down?





# Section, Township and Range

## Maps — Geology, Level III

*What members will learn ...*

### About the Project:

- What a plat map is.
- How to read section, township and range from a plat map
- How to locate a land owner

### About Themselves:

- You should respect other people's rights and get permission before going on private property

### Materials:

- Member Handout 36, *Plat Maps*
- Activity Sheet 62, *Using Sections*
- Real plat maps, preferably of your area, available at your county offices
- Larger map or globe showing longitude and latitude
- State map showing township and range
- Pencils
- Field trip logs (optional)

### Activity Time Needed: 30 minutes

### Activity

To collect specimens you will need to get permission from landowners of private property. To do this, you need to use a type of map that has a smaller scale than most of the ones you have been using. These are plat maps, which show property owners and local features. Plat maps help you find the legal description, which you can use to confirm that the present owner is still the one listed on the map. Then you can contact the owner and ask permission to collect. Sometimes, good collecting locations are described by this method. You can get these maps from the county offices, and they look like this.

The land description system uses section, township and range to tell the location. When you know these things, you can locate to the nearest square mile where the land is in the state. Many places in Kansas have roads on all four sides of the square mile. Sometimes collecting spots are described even more closely, by telling which quarter of the section to use. By using this neat, orderly system, anyone can figure out a location. Here is a handout and an activity sheet on the section numbering system. It is not hard to learn. Let's do it now.

### Leader's Notes:

Hold up a plat map.

Provide Member Handout 36, *Plat Maps*, and Activity Sheet 62, *Using Sections*, plus pencils.

Outline areas with finger as you discuss each.

O.K., now we are going to look at a map of the world and work our way down to a map of our own area. First, let's look at this larger map (or globe). What longitude and latitude are we?

Next is the state map. Locate the latitude and longitude lines. These are the basis for the numbering used in determining the sections. Now here is a map of just our area. What section of the larger map does it show?

Can you find your own house on it? Now figure out the section, township and range for it.

### **Dialogue for Critical Thinking:**

#### **Share:**

1. Have you ever heard of section, township or range? When?
2. How difficult was it to find a specific feature and list the legal description?

#### **Process:**

3. What is the advantage of listing the section, township, and range of your stops on a field trip?

#### **Generalize:**

4. Why is it important to get permission before you do collecting, or even just walk, on someone's property?

#### **Apply:**

5. What are some non-geology uses for plat maps? (*A. Any time you need the legal description. You could use this in connection with buying some property, locating property to be re-zoned, etc.*)

#### **Going Further:**

1. Use your field trip logs to locate section, township and range of the collecting stops. If they are already given, look up the locations on the map. If not, try to locate the stop on the map and add them to the log.
2. Add section, township and ranges to each stop on the list of your specimens.
3. For the next field trip, actually look up the section, township and range before the trip, and add them to the log. Look up any landowners and contact them for permission.
4. Read about a zoning change in the newspaper; then try to locate that area on a map.

#### **Author:**

Pat Gilliland and Alan De Good, members, Kansas 4-H Geology Curriculum Team

#### **Reviewed by:**

Rex Buchanan, Geologist, Kansas Geological Survey.

James P. Adams, Associate Professor, 4-H Youth Development, Kansas State University



# Section, Township and Range

**Member Handout 36,  
Plat Maps**

## Maps — Geology, Level III

**Plat maps** are usually available at you local abstractor's office. They are called plat maps because they show the names of the owner on each tract of land within the boundaries of the map. Plat maps have smaller scales than most general highway maps and usually represent geographical areas the size of a county or less.

Plat maps show such features as roads, railroads, houses, schools, churches, etc. They have other details of specific use to rock collectors. For example, the top of the map always represents north. Also, they describe each plot of land according to the legal government land division.

Government townships and sections are the basic units of land division. The townships are designated by positions relative to north-south lines of longitude called base lines. On the map, note the area, including Kansas, governed by the sixth principal meridian and east-west latitude



Map showing areas governed by the sixth principal meridian and its base line.

lines called base lines.

The word "range" is used to designate the location of the townships either east or west of the principal meridian, and "township" is used to designate location of township north or south of the base line. Each standard township is 6 miles or 36 square miles in size. Each section is 1 mile square or 640 acres.

Each standard township contains 36 sections. Numbering of the sections within a township starts in the upper right hand corner of the township and goes back and forth across the township with section 36 in the lower right hand corner.

The sketch shows how townships are designated and how sections are numbered within the townships. When you look at your plat map, you will find that townships are coded along the east and west margins of the map; ranges, along the north and south margins; and sections numbered, as indicated, within each township.

If you see the abbreviation "sec.1, T. 1S..R. 2E.," you know this is the northeast section in the first township south of the base line and the second range east of the sixth principal meridian. Note that all townships are south in Kansas because the base line is the north boundary of the state.

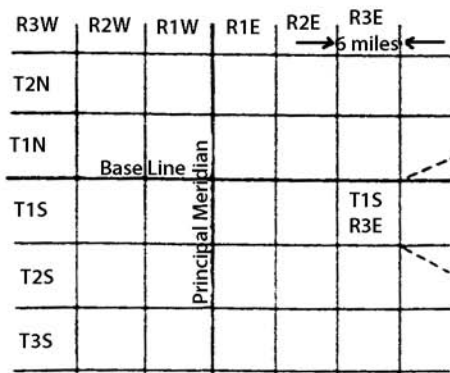
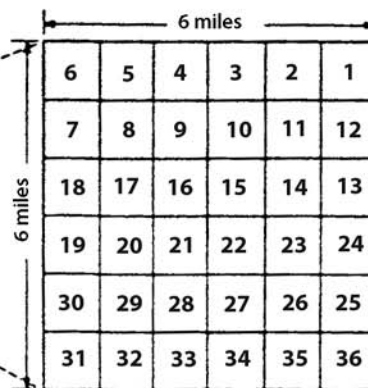


Diagram showing designation of townships and ranges



Sectionalized Township

A sketch showing how townships and ranges are numbered from principal meridians and base lines, and the numbering of sections within a township.



# Section, Township and Range

Activity Sheet 62,  
Using Sections

Maps — Geology, Level III

**Locating objects on a map by section:**

**Step 1:** Put North, South, East and West on your township plat map.

**Step 2:** Number the sections on your township plat map.

**Question 1:** What section is the following letter found in? A \_\_\_\_, B \_\_\_\_, C \_\_\_\_, D \_\_\_\_, E \_\_\_\_, F \_\_\_\_?

**Question 2:** Starting in the southwest corner of section 1, go 2½ miles south and 1½ miles west. What section are you now?

**Question 3:** How many miles is it around the township plat? A. 20 miles, B. 24 miles, C. 36 miles

**Question 4:** How many miles is it around a section? A. 1 mile B. 2 miles C. 4 miles

