

**Environmental Field Studies
Orienteering
Middle School and High School Level Lesson Plan**



Duration: 2 hours

Objectives:

- **Learn the theory of why Earth has a magnetic field**
- **Identify the importance of the Earth's magnetic field to wildlife**
- **Learn the parts of a magnetic compass and how to use it to find direction**
- **Use the skill to navigate successfully through a compass course**

Conceptual Framework:

- **Opportunities to experience nature through orienteering can contribute to human physical, mental and emotional health.**

Vocabulary:

Inner core, outer core, mantle, crust, convection current, magnetism, magnetic field, base plate, direction of travel, needle, bezel, degree, pace

Description of activity:

Who has ever used a compass?

What did the compass do for you? It can help you find your direction, even when it is overcast or at night.

How did it do that? The magnetized needle in the compass aligns with the Earth's magnetic field.

Why does the magnetized needle inside the compass housing always point in one direction? Because it aligns with the Earth's magnetic field that runs north to south.

Draw a model of the Earth showing the Earth's magnetic field, inner core, outer core, mantle and crust. Use visual aid showing the Earth's interior.

What causes the Earth to have a magnetic field? Scientists believe the convective motion of molten iron within the Earth's outer core causes the magnetic field. Earth's magnetic field can reverse if the motion of the molten iron changes. These reversals have happened in the past and will most likely happen in the future.

How do wild animals take advantage of the Earth's magnetic field? They use it to migrate (birds, sea turtles, marine mammals such as grey whales, and insects)

Is the geographic North Pole in the same location of the magnetic North Pole? No. They are over 1000 miles apart.

We are now going to learn about how to use a map and compass to find your way.

Demonstration of the compass:

The parts of a compass

Base plate – **Why do you think the base plate is clear?** So you can see through it, necessary if you are using it with a map.

What other features are on the base plate?

Direction arrow or direction of travel

Map scales

Compass housing with a moveable bezel on top –

What is inside the housing or capsule? A liquid and a magnetic needle

What is the purpose of the fluid? To stabilize the needle as it moves around.

Notice that the compass housing top, the bezel, is able to move. And the compass housing is marked off in degrees. **How many degrees are there?** 360

What degree is North? 0° and 360°

What degree is East? 90°

What degree is South? 180°

What degree is West? 270°

Have a close look at the magnetic needle inside the liquid-filled capsule.

Which way is the red end of the needle pointing? North

Which way is the black end of the needle pointing? South

Put the lanyard around your neck, stand up so you can turn around as needed, and hold the base plate in your hand so it is horizontal.

Move the bezel so that North or 0° or 360° lines up with the direction of travel arrow.

Now, while holding the compass still, turn your body until the red end of the needle lines up with the red arrow inside the capsule.

You are now facing north.

Now turn the bezel until 180° or south lines up with the direction of travel arrow. Now, while holding the compass still, turn your body until the red end of the needle lines up with the red arrow inside the capsule. You are now facing south.

Let's use the compass with a map.

This is a topographic map of the area where Agua Caliente Park or Felize Paseos Park is located. The map is made by the US Geological Survey and is named the Agua Caliente Hill Quadrangle (Agua Caliente Park) or Cat Mountain Quadrangle (Felize Paseos Park).

Find the outline of the state of Arizona. **What does the dot inside the outline represent?** The approximate location of the area represented on the map.

Who can find the scale of this map? The scale 1:24,000. This means that one inch on the map equals 24,000 inches, or 2000 ft. on the map.

Look at the grid of lines on the map. The lines going side to side are called lines of latitude. The lines going up and down are called lines of longitude. Every point on Earth has a unique coordinate made up of the latitude and longitude. **What is the latitude and longitude of Tucson?** $32^{\circ} 15'$ north latitude and 111° west longitude.

What are all of the squiggly lines on the map? They are called contour lines and connect points that have the same elevation. The contour interval on this map is 40 feet. When you go from one line to the next you have a change of 40 feet (plus or minus) in elevation.

Who can find Agua Caliente Park or Felize Paseos Park on the map? Felize Paseos Park is not labeled on the Cat Mountain map since it is a very new park.

What do the blue features in the park represent? The ponds
What are the small black squares? Buildings on the park grounds

Place one compass on the map so the pivot of the needle is directly over the small black square just to the right of the pond to the right.

Keeping the compass in place, turn the map until the red end of the needle lines up with the red arrow inside the capsule. You have now oriented the map.

Who can Find Agua Caliente Hill on the map?
What is the elevation of Agua Caliente Hill? 5369 feet

If you wanted to walk to Agua Caliente Hill from this point what direction would you walk? About 78°

Use other features for Felize Paseos Park.

Now let's use our skills to complete an orienteering course.

Hand out course directions. Divide the group in to one, two, three, or four groups depending on the size of the group. A class size of 30 would have 7 or 8 students (and at least one adult supervisor) in each group.

Each group has a different starting point. The instructor will take each group to their starting point as described on the course directions. Follow the instructions.

First, line up the direction of travel arrow with the correct bearing. Then turn so the red end of the needle sits inside the red arrow inside the capsule. You are facing the direction that you want to go. Look straight ahead to find a feature in your direction of travel, then pace off the required number of paces. One pace is approximately 3 feet, or one step.

Once you have taken the required number of paces, you will be very near the checkpoint. At the checkpoint, look for a card to find your word clues. Write the word clues in the space provided on your course directions.

Then go to the next step and repeat the process until you have found all 10 checkpoints. When finished, return to the class site/worksheet.

Students go through 10 checkpoints then return to the class meeting site.

Who was able to find all of the word clues? Put all of the words together, starting with checkpoint #1 and going through Checkpoint #10. What is the message?

Discuss what the message means. Students may interpret the message differently.