Name _____ Date _____

Build a Magnetometer

Recorder: Read aloud the directions below as the others in your group perform their roles.

1. Make sure the glass jar is clean, dry, and free of labels.

2. Use scissors to put a small hole into the center of the jar top. It should be just large enough to allow you to pass string through.

3. Fill ¼ of the bottom of the jar with sand to keep it from tipping over.

4. Measure and cut the index card so that it will fit inside the jar without touching the sides. Measure the diameter of the jar and subtract 4 centimeters to make sure the card will not touch the sides.

5. Place a ruler from the top right corner of the card to the bottom left corner so that the edge of the ruler is lined up with both corners. Draw a line along the edge of the ruler. Place the ruler from the top left corner to the bottom right corner. Draw a line along the edge of the ruler. The location of the center of the card is where the lines intersect. Glue the small craft mirror at the center of the card.

6. Find the midpoint of the top of the index card by measuring the top edge of the card and dividing the measurement in half. Mark it with a pencil. Glue the small bar magnet to the card so that the center of the length of the magnet is at the center mark on the card. The bar magnet should line up with the top of the card and should not be touching the mirror. The placement of the magnet on the card is very important and should be level with the card top.

7. Measure and cut a 2.5 centimeter section of a plastic straw and glue the straw to the top of the card and magnet. The top of the card and the magnet should be lined up evenly so that the straw sits on top of the card and magnet. The straw should prevent you from seeing the card or the magnet in its location. The straw is your guide for the string to keep your magnet and mirror in a level position.

8. Run the thread through the straw and tie into a triangle with 5 centimeter sides. Run the other end of the thread through the top of the bottle and then the lid of the jar. Make sure the magnet/card apparatus hangs freely and below the cut on the bottle. Tape the thread to the lid.

Build a Magnetometer, continued

❾ Place the bottle on a flat surface and point the laser pointer so that a reflected spot shows on a nearby wall about 2 meters (6 feet) away. Tape a piece of white paper on the wall. Use a pencil to mark the point where the light is reflected. This point will be your reference point.

❿ Check your magnetometer to gather data. Measure the changes from the reference spot position to the current position of the reflected light. Record this measurement on your data sheet. This is the Measured Change in Reflection (due to the reflection of the light). When magnetic storms occur, you will see the reflection point change by several degrees within a few hours, and then return to its normal orientation pointing toward the magnetic north pole. Your magnetometer is sensitive to changes in the magnetic field and the reflected spot will show the changes by slight changes in position. Those changes can be measured using a ruler. Measure the change in reflection in centimeters. Convert the measurement to Degrees of Deflection by multiplying the change in reflection by 0.25 degrees.

Modifications

- If you choose to use a 2-liter plastic soda bottle instead of a glass jar: In ❶, you will need to carefully cut around the bottle about ⅓ of the way down from the neck of the bottle. This will allow you access to assemble the magnetometer inside of the bottle. Before ❾, use the clear tape and tape the top and bottom of the bottle back together.

- If you do not have a laser pointer, you can use a gooseneck lamp for ❾ instead. Make sure to use a clear light bulb.