Magnetism – Poles

*Geographic* N

*Geographic* S

N

S

How are Magnetic Poles Labeled?

# **Introduction**

# **Purpose**: To investigate how magnetic poles are labeled.

**Discussion**

*Opposite poles attract*

*Like Poles repel*

In previous activities, you discovered that the two ends of a magnetic object reacted differently to the ends of other magnetic objects. It may be useful to have a convention for keeping track of the two ends of a magnetic object. Can you develop one?

Cow Magnet

Cut Nail

N

“Rub the nail in a “loop”

N end

S

# **Materials**: 3 Cut Nails Cow Magnet masking tape

# Pie Tin Plastic Lid

**Procedures**:

1. Unrub/demagnetize your cut nails before beginning this activity. [*The cow magnet should be strong enough to magnetize the nails without “demagnetizing” two of them.*]
2. Your first task is to figure out how to rub one of the nails with a magnet in such a way, that when floated and left to settle, its “point” end will point north being attracted to geographic north, meaning it is the south pole of the nail magnet. We will call this nail a **“Point North**” nail it points towards the north pole of the earth.
3. For the same rubbed nail, the “head” end will represent the north end of the nail magnet being attracted to geographic south of the earth. We can also call this nail a **“Head North**” nail it represents the north end of the nail magnet.
4. When you are finished determining the poles of the nail, place a piece of masking tape on the geographic **north** of the nail. You may want to label the magnet poles as well (remember opposite poles attract). Magnetize and label a second nail in the same way. Leave the third nail unrubbed and far away from the two rubbed nails.
5. Describe how you accomplished this task well enough so that someone else reading your description could repeat your method. You need to be specific regarding how to orient and to hold the magnet, and how to rub the nail for each of the two cases.
6. Make a drawing that illustrates the process you used to create poles on your nails from the magnet. (Use the drawing below as a start.)

* Label: a) the North end of the nails b) the poles of the magnets c) direction of rubbing

1. Could you have accomplished your tasks in a different way? Check with other students to see if they all accomplished the labeling of poles another way. Describe that other way.
2. You will set up the apparatus of the pie tin and plastic lid to float the “point north” nail. First, **PREDICT** what would happen if you bring each end of the “head north” nail near each end of the “point north” nail. Complete the prediction table below. Place an (**A**) in the box if you think the stirrer will be attracted towards the object; place an (**R**) in the box if you think the stirrer will be repelled away from the object; and place an (**O**) in the box if you think there will be NO noticeable response between the object and the stirrer.

|  |  |  |
| --- | --- | --- |
| **PREDICTION TABLE** | Second Rubbed Nail (floating) | |
| Head end | Point end |
| Point of “Head North” nail brought near |  |  |
| Head of “Head North” nail brought near |  |  |

Give some reasons for your predictions BEFORE you actually test them:

1. **TEST** your predictions by doing the actual experiment. Complete the table below.

|  |  |  |
| --- | --- | --- |
| **OBSERVATION TABLE** | Second Rubbed Nail (floating) | |
| Head end | Point end |
| Point of “Head North” nail brought near |  |  |
| Head of “Head North” nail brought near |  |  |

1. Keep the “point north” nail floating … **PREDICT** what would happen if you brought an unrubbed nail near each end of the “point north” nail. Complete the prediction table below.

|  |  |  |
| --- | --- | --- |
| **PREDICTION TABLE** | Rubbed Nail (floating) | |
| Head end | Point end |
| Point of unrubbed nail brought near |  |  |
| Head of unrubbed nail brought near |  |  |

Give some reasons for your predictions BEFORE you actually test them:

1. **TEST** your predictions by doing the actual experiment. Complete the table below.

|  |  |  |
| --- | --- | --- |
| **OBSERVATION TABLE** | Rubbed Nail (floating) | |
| Head end | Point end |
| Point of unrubbed nail brought near |  |  |
| Head of unrubbed nail brought near |  |  |

Magnetism Lab 3

FOLLOW UP ACTIVITY

How are Magnetic Poles Labeled?

* Add the follow up activity to your lab report.
* The EXPERIMENT CHART below shows four different substances and their response to a magnet and an electrified object held near them. Below the chart is a list of the four substances.
* Complete the ASSIGNMENT CHART in your lab report based on your experimentation over the past week. You will assign each of the unknown substances listed in the EXPERIMENT CHART to the actual substance. Give supporting evidence for each substance you chose.

|  |  |  |
| --- | --- | --- |
| EXPERIMENT CHART | Magnet brought near  unknown substance | Electrified Object brought near unknown substance |
| Unknown #1 | No response | Attracted |
| Unknown #2 | No response | Attracted |
| Unknown #3 | Attracted | Attracted |
| Unknown #4 | Attracted or Repelled | Attracted |

#### Unknown substances

Unmagnetized Paper Clip

Magnetized Paper Clip

Aluminum Foil

Unrubbed Coffee Stirrer

|  |  |  |
| --- | --- | --- |
| Unknown Substance | **Actual Substance** | **Supporting Evidence** |
| Unknown #1 |  |  |
| Unknown #2 |  |  |
| Unknown #3 |  |  |
| Unknown #4 |  |  |

ANSWERS

1. You will set up the apparatus of the pie tin and plastic lid to float the “point north” nail. First, **PREDICT** what would happen if you bring each end of the “head north” nail near each end of the “point north” nail. Copy and complete the prediction table below. Place an (**A**) in the box if you think the stirrer will be attracted towards the object; place an (**R**) in the box if you think the stirrer will be repelled away from the object; and place an (**O**) in the box if you think there will be NO noticeable response between the object and the stirrer.

|  |  |  |
| --- | --- | --- |
| **PREDICTION TABLE** | Second Rubbed Nail (floating) | |
| Head end [**N]** | Point end [**S]** |
| **Point** of “Head North” nail brought near [**S]** | Predictions | |
| **Head** of “**Head North**” nail brought near [N] |

* “***Point NORTH” means that the point end of the nail is the “S” pole of the nail, pointing GEOGRAPHIC North; while the Head end is the “N” pole of the nail, facing Geographic S.***
* “***Head NORTH” means that the Head end of the nail is the “N” pole of the nail, facing GEOGRAPHIC South; while the Point end is the “S” pole of the nail, facing Geographic N.***

1. **TEST** your predictions by doing the actual experiment. Copy and complete the table below.

|  |  |  |
| --- | --- | --- |
| **OBSERVATION TABLE** | Second Rubbed Nail (floating) | |
| Head end [**N**] | Point end [**S**] |
| **Point** of “Head North” nail brought near [**S]** | **A** | **R** |
| **Head** of “**Head north**” nail brought near [**N]** | **R** | **A** |

* ***Opposite Poles ATTRACT***
* ***Like Poles REPEL***

1. Keep the “point north” nail floating … **PREDICT** what would happen if you brought an unrubbed nail near each end of the “point north” nail. Copy and complete the prediction table below.

|  |  |  |
| --- | --- | --- |
| **PREDICTION TABLE** | Rubbed Nail (floating) | |
| Head end | Point end |
| Point of unrubbed nail brought near | Predictions | |
| Head of unrubbed nail brought near |

* “***Point NORTH” means that the point end of the nail is the “S” pole of the nail, pointing GEOGRAPHIC North [magnetic north of the earth]; while the Head end is the “N” pole of the nail, facing Geographic S [magnetic south of the earth]***
* “***Head NORTH” means that the Head end of the nail is the “N” pole of the nail, facing GEOGRAPHIC South [magnetic south of the earth]; while the Point end is the “S” pole of the nail, pointing Geographic N [magnetic North of the earth]***

1. **TEST** your predictions by doing the actual experiment. Copy and complete the table below.

|  |  |  |
| --- | --- | --- |
| **OBSERVATION TABLE** | Rubbed Nail (floating) | |
| Head end | Point end |
| Point of unrubbed nail brought near | **A** | **A** |
| Head of unrubbed nail brought near | **A** | **A** |

* ***The unrubbed/demagnetized nail attracts either pole of a magnet***

Magnetism Lab 3 FOLLOW UP ACTIVITY

How are Magnetic Poles Labeled?

* Add the follow up activity to your lab report.
* The EXPERIMENT CHART below shows four different substances and their response to a magnet and an electrified object held near them. Below the chart is a list of the four substances.
* Complete the ASSIGNMENT CHART in your lab report based on your experimentation over the past week. You will assign each of the unknown substances listed in the EXPERIMENT CHART to the actual substance. Give supporting evidence for each substance you chose.

|  |  |  |
| --- | --- | --- |
| EXPERIMENT CHART | Magnet brought near  unknown substance | Electrified Object brought near unknown substance |
| Unknown #1 | No response | Attracted |
| Unknown #2 | No response | Attracted |
| Unknown #3 | Attracted | Attracted |
| Unknown #4 | Attracted or Repelled | Attracted |

|  |  |  |
| --- | --- | --- |
| Unknown Substance | **Actual Substance** | **Supporting Evidence** |
| Unknown #1 | Unrubbed Coffee Stirrer | **The magnet had no effect (substance must be non-metallic) and the electrified object attracts all uncharged objects.**  [*Static Electricity Lab 1*] |
| Unknown #2 | Aluminum Foil | **The magnet had no effect (NOT ALL METALS RESPOND TO MAGNETS) and the electrified object attracts all uncharged objects.**  [*Static Electricity Lab 1 & Induction*] |
| Unknown #3 | Unmagnetized Paper Clip | **The magnet attracted (metallic) and the electrified object attracts all uncharged objects.**  [*Static Electricity Lab 1*] |
| Unknown #4 | Magnetized Paper Clip | **The magnet attracted or repelled (metallic and magnetized) and the electrified object attracts all uncharged objects.** [*Magnetism Lab 3*] |

* *One needs more tests to distinguish the Unrubbed Coffee Stirrer and the Aluminum Foil*