Cork on the High Seas

I Wonder Why.....

1. we used a small needle for this compass?
It was light, had magnetic metal in it, and could be easily magnetized.

2. there was a cork in this activity?
It's buoyant, or floats, this takes gravity from the equation.

3. do we know the needle had a magnetic metal in it?
It reacted to the Earth's magnetic field.

4. can't I use aluminum or plastic to replace the needle?
They are not magnetic, can't make a compass from them.

5. a compass doesn't work near a car or other large metal object?
The compass's magnet would react to the car or object.

Think Like a Scientist.....

1. Why is gravity not involved in this simple compass?
The cork is floating, downward pull is equaled by upward push of buoyancy.

2. How do they remove gravity from a hand-held needle compass?
The needle is suspended on a support so it can spin easily and react to the field.

3. Could we have used other metals instead of the steel needle?
Yes, as long as they are light and contain magnetic metals.

4. What field is affecting the magnetic needle floating on the cork?
The Earth's magnetic field.

5. Why does this field affect the needle?
The Earth's field is much greater than this needle's field.

Cork on the High Seas

The Science Connection

Magnetic Compass

The magnetic compass is a device we use to help find our way around, or navigate. The compass is a magnet, just like you found with your *Cork on the High Seas*. This little compass does like every other compass does when it's allowed to move. It responds to the giant, but invisible magnetic field which surrounds us. This is the Earth's magnetic field. A long time ago, people figured out how to use the magnetic field to their advantage.

Before the compass's invention, direction for navigation on land or sea was by the Sun and stars alone. As long as the Sun is out, or the sky is clear at night, people could set a course and generally end up going where they wanted to. But what happens during a cloudy or foggy day? What happens when the night sky is covered by thick clouds? Something which would work at any time was needed.

Magnets were named for the areas where they were found, Magnesia, an area of ancient Greece. At first these naturally magnetized chunks of iron ore were just interesting objects. But when they were suspended from a string, so gravity couldn't affect them, they became very important. The first of these were called lodestones, an old English term which means "leading stones". Since these were a magnet, they acted just like your pin did. It aligns itself with the Earth's magnetic field. It's south pole points to the Earth's north magnetic pole and vice versa. So this simply means the pointer showing magnetic north is actually the south pole of the tiny magnet called the needle.

Cork on the High Seas Teacher's Guide

The Initial View (Introducing the Activity)

It may take a lot of rubbing to convince the straight pin it's a magnet. Be patient with some pins, they just plain don't get it!! Try another. Don't fill the bowl too full of water or the cork will just slide to the edge. Keep metal objects away from the pin or the pin might find the object more attractive than the magnet. *Remind the kids to be careful with the straight pins!* Use a compass to check if the pin is pointing north and south!! Don't let the compass get too close to the pin or the pin and compass can influence each other!

Take a Deeper View! (More Science)

Navigation uses all sorts of science to find where something is or where you're going on the trackless ocean. **Compasses** have been used for a long time to help explorers find their way around. In fact, the first compasses were made from a **Mineral** called **Magnetite**, a magnetic **Ore** of Iron. (an ore is an Earth material which contains a useful substance) The name for this "directionally talented and gifted" rock is **Lodestone**, or "leading stone".

More and Bigger Views! (Additional Classroom Ideas)

1. History Time!! Find out what ancient sea-going people used Lodestones to help find their way around. Find out how these people used the stones for navigation.
2. What were some other navigational aids used by these ancient sailors?
3. How is the **GPS** (**Global Positioning System**) used for navigation, rescue, and surveying? Get on the Internet to find out more about GPS.
4. If a hunter, rock climber or hiker has a GPS unit, have them bring it to class and demonstrate its uses. (Many wilderness areas require the use of a GPS device to reduce the number of people who have to be rescued when they get lost!)
5. Certain areas on Earth are not very friendly to the use of compasses. Find out more about these **Magnetic Anomalies**, where they are, and how they affect compasses.
6. Bring a magnet close to the bowl and notice how it affects your cork "compass".
7. The **Magnetic North Pole** is not the same as the **Geographic North Pole** of Santa Claus and geography fame. Get out some maps and find these two locations. Do the same thing for the south end of the Earth!!!
8. Look at the inside structure of the Earth to find out what makes our planet a giant magnet! What elements are involved, how deep are these layers, and how hot are they?
9. Find someone who has the hobby of **Orienteering** (map reading, etc.). They are experts in the use of compasses. Have them come to class to show their hobby off, their compass skills, map reading skills, and many other abilities!
10. Research what other math and science is involved in navigation.
11. Learn more about the **Longitude** and **Latitude** lines used on maps to help with navigation and location. Locate the **Equator**, **Prime Meridian**, and the **International Date Line.** Find the **Tropic of Capricorn** and the **Tropic of Cancer** as well!
12. Find out the exact longitude and latitude of your home, school, or other location. GPS units will help greatly in this, though maps skills can help as well!
13. What other metals are magnetic? How are magnets and electromagnets made?
14. Research other uses for magnets. Report on what you've learned to class.

Answers

1. (once you know which way is north, you can find the other directions)

Cork on the High Seas

Safety Alert:

Sharp pins, Slippage

Getting Ready

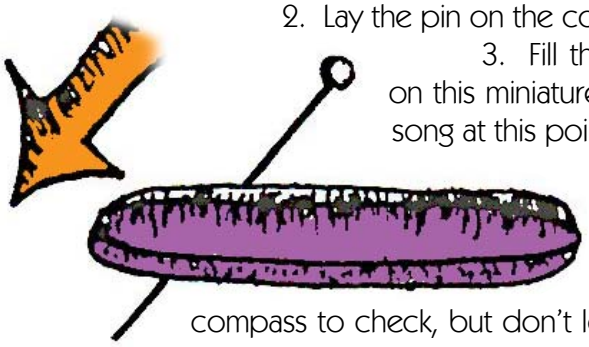
A compass is needed on the ocean. Let's make a compass, a *Cork on the High Seas*!

Stuff to Make it Happen (Materials) *(The floor could get slippery, be careful!)*

magnet	straight pin	small cork	compass
bowl*	water*	adhesive tape*	

Making it Happen *(Sharp kids and sharp pins mean you must be careful with them!)*

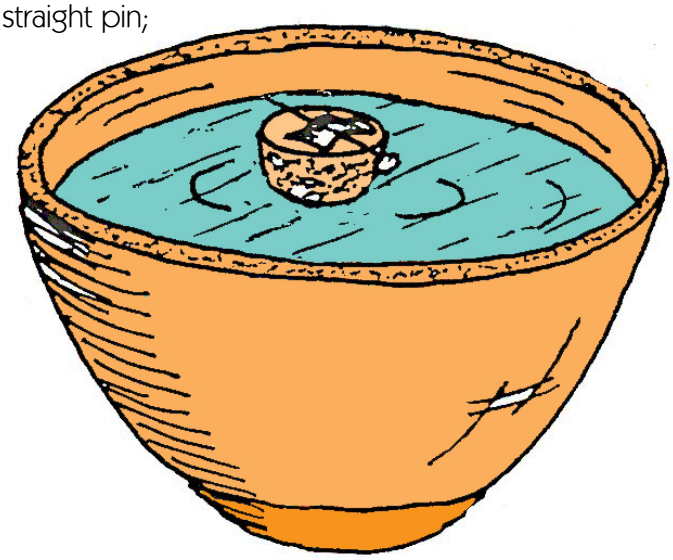
1. You must make the straight pin think it's a magnet. Rub the pin about 30 times against the magnet. *Always remember to rub the pin in the same direction*!



2. Lay the pin on the cork's top and tape it down.
3. Fill the bowl with water and let your cork "set sail" on this miniature "ocean". (Sing an appropriate ocean or Navy song at this point to make the cork feel more at home!)
4. Stop singing. Let the cork quit jiggling around. (Maybe the singing bothered it?)
5. The pin and its cork "life preserver" should point north and south! (Use the real compass to check, but don't let it get too close to yours!) If the pin doesn't line up north and south try rubbing it against the magnet for a longer time. (Remember, in the *same* direction as before!) Tape the pin back on. *The cork must float freely inside the bowl, not against it*.
6. If the pin points north and south, you're a success! Start the singing again!!

Understanding the Science

Magnetism is a special **Property** of only a few materials. Iron and steel are examples of **Metals** which can be pulled or attracted by a **Magnet**. (they're called **Ferromagnetic**) When you rubbed the straight pin with the magnet you made the pin's iron **Atoms** line up in a special way. *Instant magnet*!. (You could say the pin "borrows" or "copies" the magnetism.) The needle in a real compass is also a magnet. It lines itself up with the Earth's **Magnetic Field**! (A magnetic field grows no crops. It is an area where a magnet can **Pull** or **Push** on a piece of magnetic material or another magnet.) The Earth's magnetic field makes a compass line up with it. It also does this to your "magnet" straight pin; it's a *Cork on the High Seas*!



Let's Check the View! (Questions and Assessments)

1. How do you use the fact a compass points north to help you find your way?

Cork on the High Seas

Safety Alert:

Sharp pins, Slippage

Getting Ready

Stanley the Hammer knows a compass is needed on the ocean. Let's make a compass, a *Cork on the High Seas*!

Stuff to Make it Happen (Materials)

(The floor could get slippery, be careful!)

magnet	straight pin	small cork	compass
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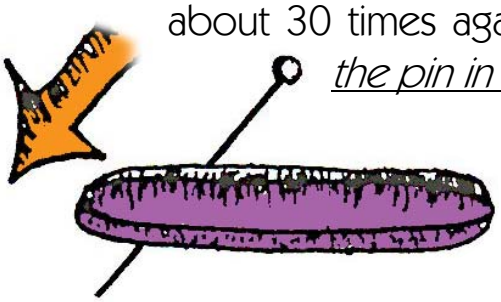

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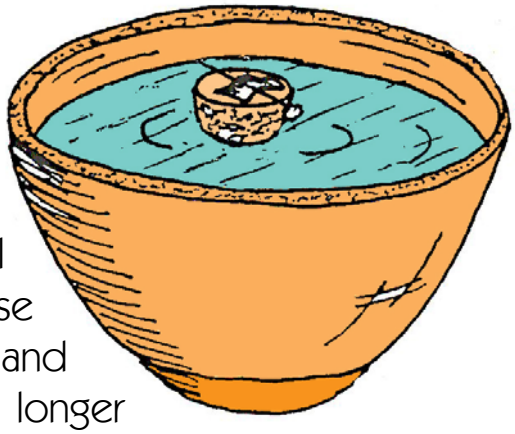

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6. If the pin points north and south, you're a success!

Cork on the High Seas

Stanley the Hammer thought that was amazing! Now he wants to understand the science of why that worked.

Understanding the Science

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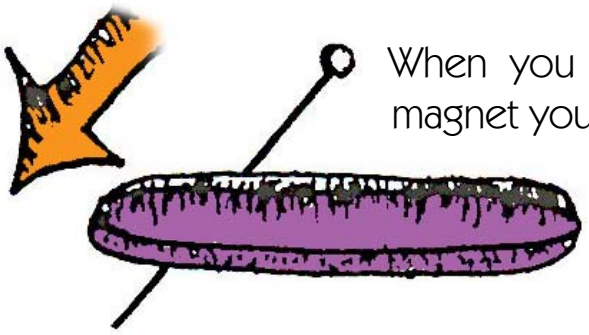

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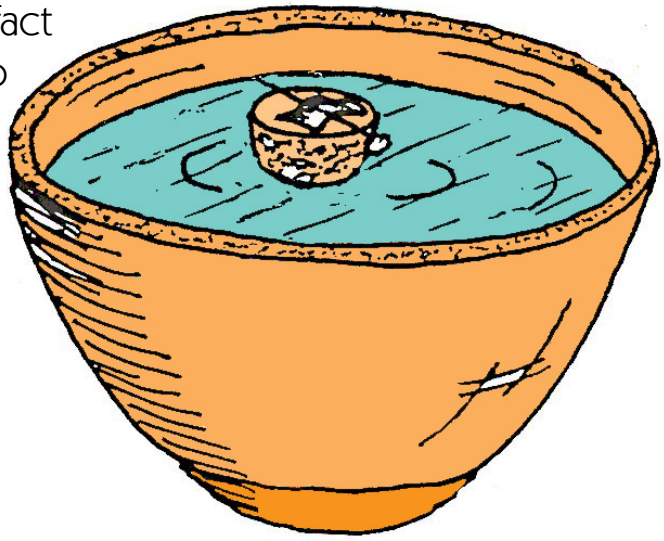


Cork on the High Seas

Name

Student Assessment

Let's Think About It!

1. Which of these are metals which are attracted to a magnet? *Stanley* wants to know too, so circle the right answer for him.

   isomagnetic **paramagnetic** **ferromagnetic**

2. Two similar magnetic poles __. Circle the right answer for *Stanley*, would you please?

   attract **repel** **do nothing** **cause attraction**

3. Attraction of a magnet for another magnet or some metals is a __. Circle the answer for *Stanley*.

   pull **push** **repulsion** **a repelling force**

4. When did the compass attract the needle? Circle the answer for *Stanley*.

   when opposite magnetic poles pulled
   when similar magnetic poles repelled
   when the compass was far away from the needle

5. When did the compass repel the needle? Circle the answer for *Stanley*.

   when opposite magnetic poles pulled
   when similar magnetic poles repelled
   when the compass was far away from the needle

Name _____

"Stanley" the Force **says it's time to learn more about this activity! Follow your teacher's directions!**

Cork on the High Seas

Student Assessment

Let's Think About It!

1. **T** or **F** Not all materials are magnetic.

2-3. What does it mean if something is ferromagnetic?

4-5. Name two magnetic metals.

A) B)

6-7. What did you do to the pin in the activity to make it into a magnet?

8-9. What two kinds of forces can a magnet put on another magnet or a magnetic metal?

A) B)

10. The Earth's magnetic _____ affects a compass.

Optional; Read and write about GPS navigation.

Cork on the High Seas

Student Assessment

Let's Think About It!

***Transitional* Student Assessment Answers**

Cork on the High Seas

1. ferromagnetic
2. repel
3. pull
4. when opposite magnetic poles pulled
5. when similar magnetic poles repelled

"Stanley" the Force **says it's time to learn more about this activity! Follow your teacher's directions!**

Cork on the High Seas

Student Assessment

Student Assessment Answers

Cork on the High Seas

1. T

2-3. it is attracted to a magnet or can be made into a magnet, etc.

4-5. steel, iron, etc.

6-7. rub it against a real magnet, always in the same direction

8-9. push, pull

10. field

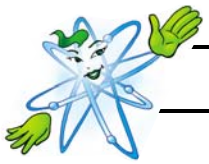
Optional; student research

Student: _____ Date: _____

Cork on the High Seas

Think It Through Questions

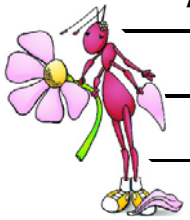
1. **Describe what the first magnetic compasses were like.**



2. **Why are compasses so important to navigation?**

3. **Tell how GPS technology helps us to navigate.**

4. **Why could compasses be giving you false readings?**

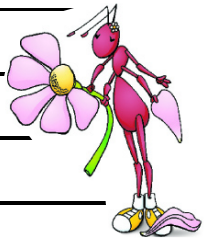


Student: _____ Date: _____

Cork on the High Seas

Observations, drawings and things I did

My Discoveries —- What did I find?



Internet ideas and places

SeeLA Science

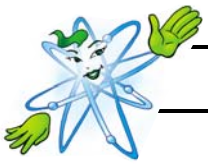
The Learning Zone

Student: _____ Date: _____

Cork on the High Seas

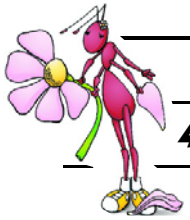
Think It Through Questions — How have my thoughts changed?

1.



2.

3.



4.

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