The Bermuda Triangle Effect

Topic

The “Bermuda Triangle effects” can be demonstrated with magnets.

Introduction

The Earth is a huge magnet and, as such, it has a north and a south pole. Invisible magnetic lines of force leave the Earth near the South Pole and enter near the North Pole. For this reason, compass needles always point toward the north. This phenomenon makes it possible for us to use the magnetic field for navigation.

What causes the magnetic field around the Earth? Not all scientists agree, but many support the theory that the thick, dense inner core rotates at a slightly different speed than the other layers. As a result, the molten iron that makes up most of the core acts as a huge electromagnet. Because the Earth is in constant motion, the magnetic field is constantly in a state of flux.

Some places on the Earth experience this flux in the magnetic field more than others. In many of these magnetic-rich regions, the crust is thicker and levels of iron are higher than in other locations. These locations where magnetic fields are strong can sometimes draw compasses away from magnetic north. One area that is famous for its magnetic anomalies is the Bermuda Triangle, a region of the Atlantic Ocean extending from the Florida coast to Bermuda and Puerto Rico (see Figure 1). Ships and planes that travel through this area sometimes report that their compasses malfunction. In this experiment, you will analyze the Bermuda Triangle effect using magnets to create an area where magnetic fields cancel each other.

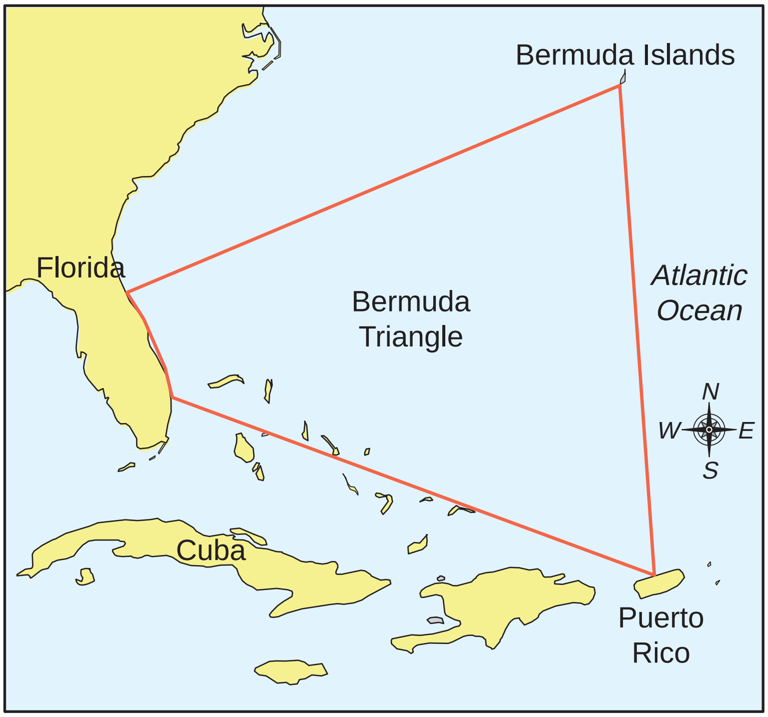
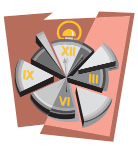
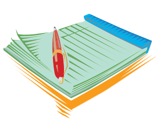


Figure 1



Time Required

60 minutes



Materials

- small compass
- 3 bar magnets
- large piece of butcher paper (about the size of a desktop)
- tape
- 3 colored pencils (red, blue, and green)
- science notebook

Safety Note **Please review and follow the safety guidelines.**

Procedure

1. Tape a large square of butcher paper onto a desktop or the floor.
2. Place the bar magnets in the center of the paper to form a triangle. Space them far enough apart so that there is at least one magnet's distance between each.
3. When the magnets are in position, trace around them and label the north and south poles. Leave the magnets in place on the paper.
4. Place a small compass on the paper so that it comes in contact with one of the magnets.
5. Observe the direction in which the compass needle points. Use the red pencil to place a dot on the paper to show the direction. The dot should be outside the compass case, but in line with the end of the needle. It should also be away from the magnet.
6. Reposition the compass in the direction the needle points and just beyond the dot you just made.
7. Observe the direction in which the needle is pointing. Place a second red dot on the paper outside the compass case to show the direction that the needle points.
8. Continue to reposition the compass and make red dots until you reach another point on the magnet or the edge of the paper.
9. Connect the dots in a smooth curve with a red pencil.
10. Repeat the procedure for other points on the same magnet until you have several lines spread out over the paper.
11. Repeat the entire procedure for the other two magnets. Use blue for one magnet and yellow for the other.
12. When you have finished drawing the field lines, place arrowheads on the lines that show the direction in which the compass needles pointed.
13. On your diagram, find and label areas where field lines from the three magnets are close to each other and moving in the same direction. In these regions, magnetic fields are working together.
14. On your diagram, find and label areas where field lines from the three magnets are close to each other and moving in the opposite directions. In these regions, magnetic fields are canceling each other.

15. Put a compass in a region where magnetic fields are moving in the same direction. Describe the behavior of the compass in one of these areas in your science notebook.
16. Put a compass in a region where magnetic fields are moving in opposite directions. Describe the behavior of the compass in one of these areas in your science notebook.

Analysis

1. How did the compass behave in a region where magnetic fields are moving in the same direction?
2. How did the compass behave in a region where magnetic fields are moving in opposite directions?
3. How do you think stronger magnets would affect the results?
4. Explain why the Bermuda triangle might be a difficult region through which to navigate.

What's Going On?

The Earth acts as a single, gigantic bar magnet. The north-seeking tip of a compass points to the North Pole of the Earth or the south pole of a bar magnet. This tells you that the region we call the North Pole is actually the south pole of the Earth's magnetic field. Generally, compasses clearly indicate the location of the Earth's poles. However, in some areas, the Earth's geology causes local disruptions in the magnetic field. When this occurs, compasses do not work as intended. Disruptions in the magnetic field can be visualized by placing magnets close together and drawing lines to show their invisible fields. When magnets are in close proximity to each to each, their fields interfere and cause the Bermuda Triangle effect.

Want to Know More?

See Our Findings.

OUR FINDINGS

THE BERMUDA TRIANGLE EFFECT

Suggestion for class discussion: Ask students if they have heard of the Bermuda Triangle. Ask them to suggest some reasons for the loss of many ships and planes in the region.

Analysis

1. The compass points toward a region between the north ends of two magnets.
2. Answers will vary. The compass may spin and does not point toward north on any magnet.
3. Answers will vary. Stronger magnets produce more pronounced magnetic fields lines, but the results would be similar.
4. Answers will vary. Students answers might explain that compass readings in this area might be unreliable, causing an ocean liner to veer off course.

SAFETY PRECAUTIONS

Review Before Starting Any Experment

Each experiment includes special safety precautions that are relevant to that particular project. These do not include all the basic safety precautions that are necessary whenever you are working on a scientific experiment. For this reason, it is absolutely necessary that you read and remain mindful of the General Safety Precautions that follow this note. Experimental science can be dangerous, and good laboratory procedure always includes following basic safety rules. Things can happen very quickly while you are performing an experiment. Materials can spill, break, or even catch fire. There will be no time after the fact to protect yourself. Always prepare for unexpected dangers by following the basic safety guidelines during the entire experiment, whether or not something seems dangerous to you at a given moment.

We have been quite sparing in prescribing safety precautions for the individual experiments. For one reason, we want you to take very seriously every safety precaution that is printed in this book. If you see it written here, you can be sure that it is here because it is absolutely critical.

Read the safety precautions here and at the beginning of each experiment before performing each lab activity. It is difficult to remember a long set of general rules. By rereading these general precautions every time you set up an experiment, you will be reminding yourself that lab safety is critically important. In addition, use your good judgment and pay close attention when performing potentially dangerous procedures. Just because the book does not say “Be careful with hot liquids” or “Don’t cut yourself with a knife” does not mean that you can be careless when boiling water or using knives. Notes in the text are special precautions to which you must pay special attention.

GENERAL SAFETY PRECAUTIONS

Accidents caused by carelessness, haste, insufficient knowledge, or taking an unnecessary risk can be avoided by practicing safety procedures and being alert while conducting experiments. Be sure to check the individual experiments in this book for additional safety regulations and adult supervision requirements. Anytime you are working with an electrical current, it becomes possible to shock yourself on exposed wires. If you will be working in a lab, do not work alone. When you are working off-site, keep in groups with a minimum of three students per group, and follow school rules and state legal requirements for the number of supervisors required. Ask an adult supervisor with basic training in first aid to carry a small first-aid kit. Make sure everyone knows where this person will be during the experiment.

PREPARING

- Clear all surfaces before beginning experiments.
- Read the instructions before you start.
- Know the hazards of the experiments and anticipate dangers.

PROTECTING YOURSELF

- Follow the directions step by step.
- Do only one experiment at a time.
- Locate exits, fire blanket and extinguisher, master gas and electricity shut-offs, eyewash, and first-aid kit.
- Make sure there is adequate ventilation.
- Do not horseplay.
- Keep floor and workspace neat, clean, and dry.
- Clean up spills immediately.
- If glassware breaks, do not clean it up by yourself; ask for teacher assistance.
- Tie back long hair.
- Never eat, drink, or smoke in the laboratory or workspace.
- Do not eat or drink any substances tested unless expressly permitted to do so by a knowledgeable adult.

USING EQUIPMENT WITH CARE

- Set up apparatus far from the edge of the desk.
- Use knives or other sharp, pointed instruments with care.
- Pull plugs, not cards, when removing electrical plugs.
- Clean glassware before and after use.
- Check glassware for scratches, cracks, and sharp edges.
- Let your teacher know about broken glassware immediately.
- Do no use reflected sunlight to illuminate your microscope.
- Do not touch metal conductors.
- Use alcohol-filled thermometers, not mercury-filled thermometers.

USING CHEMICALS

- Never taste or inhale chemicals
- Label all bottles and apparatus containing chemicals
- Read labels carefully.
- Avoid chemical contact with skin and eyes (wear safety glasses, lab apron, and gloves).
- Do not touch chemical solutions.
- Wash hands before and after using solutions.
- Wipe up spills thoroughly.

HEATING SUBSTANCES

- Wear safety glasses, apron, and gloves when boiling water.
- Keep your face away from test tubes and beakers.
- Use test tubes, beakers, and other glassware made of Pyrex™ glass.
- Never leave apparatus unattended.
- Use safety tongs and heat-resistant gloves.
- If your laboratory does not have heat-proof workbenches, put your Bunsen burner on a heat-proof mat before lighting it.
- Take care when lighting your Bunsen burner; light it with the airhole closed, and use a Bunsen burner lighter rather than wooden matches.
- Turn off hot plates, Bunsen burners, and gas when you are done.
- Keep flammable substances away from flames and other sources of heat.
- Have a fire extinguisher on hand.

FINISHING UP

- Thoroughly clean your work area and any glassware used.
- Wash your hands.
- Be careful not to return chemicals or contaminated reagents to the wrong containers.
- Do not dispose of materials in the sink unless instructed to do so.
- Clean up all residues and put in proper containers for disposal.
- Dispose of all chemicals according to all local, state, and federal laws.

BE SAFETY CONSCIOUS AT ALL TIMES!