Earth's Magnetic Field CER

Question: What do you think causes the Earth's magnetic field?

Develop a claim to answer this question. You can use these sentence frames below to help you construct your claim. Write your claim as a paragraph, supported with evidence and reasoning to explain the evidence.

Sentence Frames:

The source of Earth's magnetic field is _____, because _____.

Earth's magnetic field is formed by / a result of _____. My evidence is _____. And another piece of evidence includes _____.

Read through each of the 5 cards and analyze if each of the cards contains evidence that can support your claim. Write your analysis of each card.

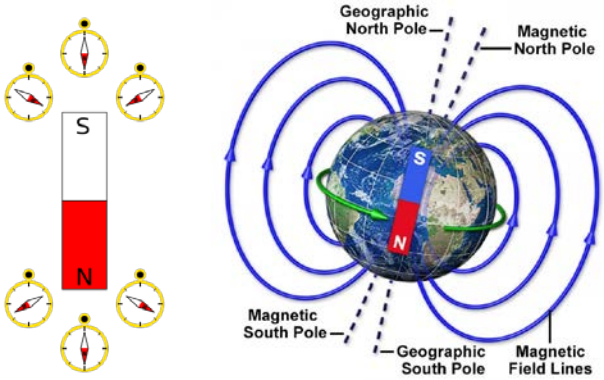
Card 1: Earth's internal structure

The Earth has a solid crust and mantle, a liquid outer core, and a solid inner core. The temperature of the core is >3,000°C, but the pressure on the inner core (3.6 million times the pressure on Earth's surface) squeezes it into a solid. Turbulent convection occurs in the liquid outer core. Image MM used by permission

Card 2: Composition of the Earth

Earth's crust and mantle are rocky, and the core is mostly iron. The iron and nickel (4%) in the core are both metals, and exist as charged ions and free electrons at core temperatures (iron melts at around 1,500°C). The outer core material is likely molten metal and flows around inside the Earth as it spins. Image CC0 MarPockStudios - Pixabay

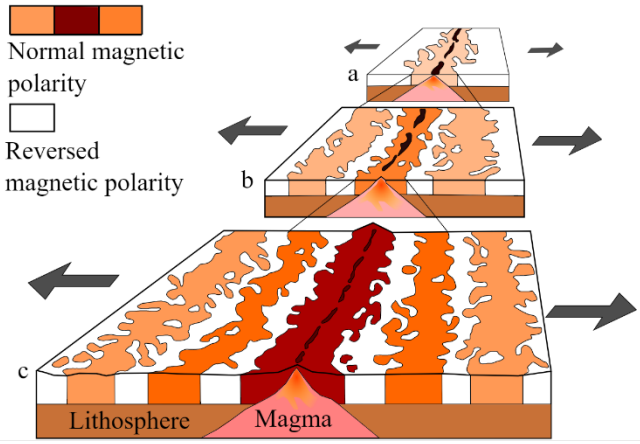
Card 3: Compass readings on Earth



Left: Compass alignment with a bar magnet field (magnetic north poles are shown in red). A compass needle's north pole points toward the Earth's magnetic south pole). The geographic pole is a fixed spot but the magnetic poles are dynamic and moving spots. A compass points to the magnetic poles only.

Left image CC BY-SA TStein – Wikimedia
Right image Naionalmaglab.org

Card 4: Magnetic field reversals



New crust forms at a mid-ocean ridge, and then spreads apart as more crust forms. Iron in the magma aligns with the Earth's magnetic field and is set as a permanent magnet as the rock cools and solidifies. The ocean floor crust is magnetized in alternating directions, showing that the magnetic poles have reversed several times over 0.1- to 1- million-year timescales. Image Public Domain by Chmee2 - Wikimedia

Card 5: Auroras form at magnetic poles

Auroras occur when charged particles from the sun travel down along the magnetic field lines and hit Earth's atmosphere near the poles. As particles come down through the atmosphere, they glow. Particle size and incoming speed can vary, as can the exact location of the field lines, so auroras move and change color. Image Public Domain NASA – Wikimedia

Analysis

On the next page answer the questions and then use that information to construct your claim, evidence and reasoning paragraph.

1. Is the information on Cards 1–5 consistent with your claim? Why or why not?
    a. Card 1:

    b. Card 2:

    c. Card 3:

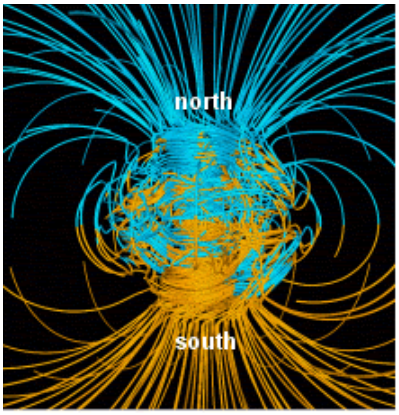
    d. Card 4:

    e. Card 5:

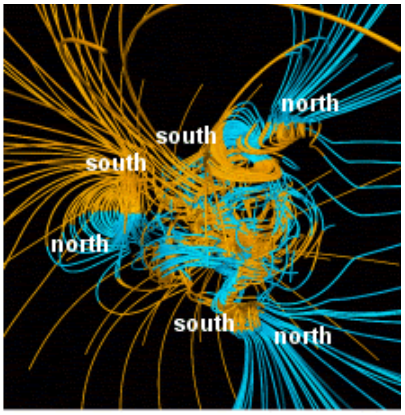
2. What other data would you want to collect and/or analyze in order to better understand Earth's magnetic field?

3. What layer in the Earth do you think is the source of the magnetic field? What is the evidence for this?

4. A geomagnetic **reversal** is a change in a planet's **magnetic field** such that the positions of **magnetic** north and **magnetic** south are interchanged (not to be confused with geographic north and geographic south). **Reversal** occurrences are statistically random. There have been 183 **reversals** over the last 83 million years. Make a prediction of ways that a magnetic reversal could affect our daily lives.



between reversals



during a reversal

5. These images show a computer model of the Earth's magnetic field lines during reversed polarity (left) and when a reversal is happening (right). The tangled ball of lines is inside the Earth's outer core. What do you think might cause a magnetic field reversal to happen?

6. This in an open question that scientists are working on today! How would you investigate this further to help answer the question with some supporting evidence?

7. Now write your claim to the original question. What do you think causes the Earth's magnetic field? Support your claim with evidence and reasoning. This should be a paragraph.

Congratulations! You made it to the last week of school.

This is not exactly what I had in mind for the last week of school. I had hoped we could do our rocket launches, after we beat the 3rd graders with the paper rockets. I have been launching rockets with the 8th graders for almost 17 years, this year being the exception. I am excited for you all to begin high school and begin the next phase of your learning, and at the same time sad that my last year at Freiler has not ended with rocket launches. Soooooo, here's my idea.

Build a rocket anyways, if you want. Check out these websites.

http://www.rocklin.k12.ca.us/staff/pmorrison/ConPhys/Rockets/Mr_%20Hayhurst's%20Quick%20and%20Easy%20Bottle%20Rocket.htm (my favorite website for getting tips)

http://tclauset.org/21_BtlRockets/BTL.html (my second favorite website for tips, check out the photo gallery)

https://www.teachengineering.org/activities/view/ucd_bottlerockets_activity1 (has a good video to see what launching can be like)

https://www.nasa.gov/pdf/153406main_Rockets_Water_Rocket_Construction.pdf (some technical explanations)

There are a couple of rules you have to follow when building a rocket.

- Use a 2 liter soda bottle as the base
- Do not put holes in it, not for any reason, it will not pressurize
- Wings must be attached to the base bottle

Go ahead and build a rocket…..if you can…..if you want to……and maybe, maybe, during the summer or in August or September, when it seems safe to do so and is ok to do so……I can be at the park next to Freiler and we can launch your rocket. I can't make promises not knowing the future, but I can say if there is a will I will find a way for you to safely launch your rocket.

I have your parents email and we'll have Edmodo. If I can find a safe way to do it I will send you information on the when and where. I wish you the best in your future endeavors. You have been a wonderful group of students to work with. I look forward to hearing about where your future choices take you. Keep shining stars!!!