Earth's Magnetic Field

Heat is also being transferred from the solid inner core to the liquid outer core, and this leads to convection of the liquid iron of the outer core. Because iron is a metal and conducts electricity (even when molten), its motion generates a magnetic field.

Earth's magnetic field is defined by the North and South Poles that align generally with the axis of rotation (Figure 9.13). The lines of magnetic force flow into Earth in the northern hemisphere and out of Earth in the southern hemisphere. Because of the shape of the field lines, the magnetic force trends at different angles to the surface in different locations (red arrows of Figure 9.13). At the North and South Poles, the force is vertical. Anywhere on the equator the force is horizontal, and everywhere in between, the magnetic force is at some intermediate angle to the surface. The variations in these orientations provide a critical piece of evidence to the understanding of continental drift as an aspect of plate tectonics.

Earth's magnetic field is generated within the outer core by the convective movement of liquid iron, the magnetic field is not stable over geological time. For reasons that are not completely understood, the magnetic field decays periodically and then becomes re-established. When it does re-establish, it may be oriented the way it was before the decay, or it may be oriented with the reversed polarity. Over the past 250 Ma, there have a few hundred magnetic field reversals, and their timing has been anything but regular. The shortest ones that geologists have been able to define lasted only a few thousand years, and the longest one was more than 30 million years, during the Cretaceous.

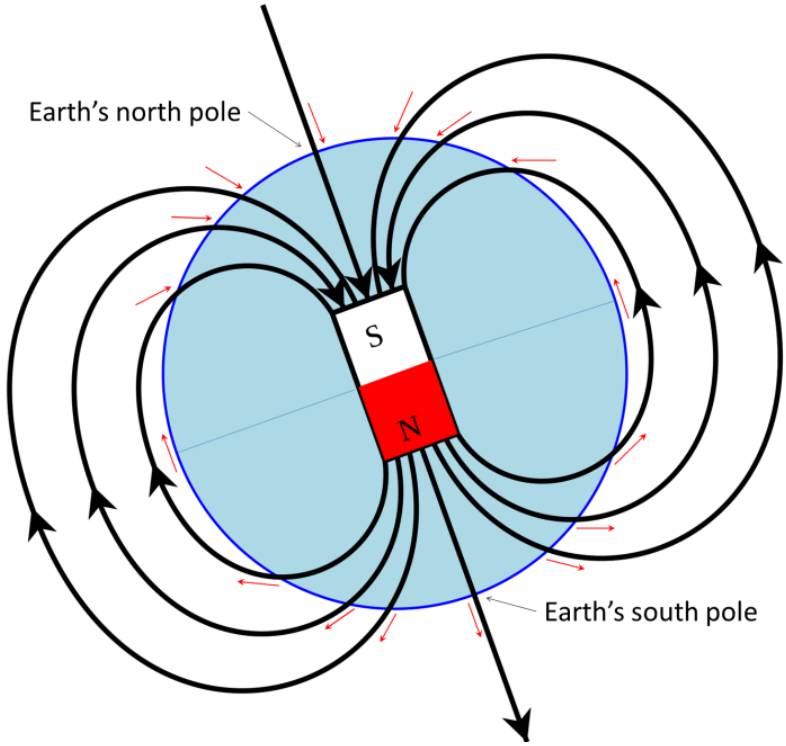

Figure 9.13 Depiction of Earth's magnetic field as a bar magnet coinciding with the core. The south pole of such a magnet points to Earth's North Pole. The red arrows represent the orientation of the magnetic field at various locations on Earth's surface. [SE after: http://upload.wikimedia.org/wikipedia/commons/ 1/17/Earths_Magnetic_Field_ Confusion.svg]

Changes in Earth's magnetic field have been studied using a mathematical model, and reversals have been shown to take place when the model was run to simulate a period of several hundred thousand years. The fact that field reversals took place shows that the model is a reasonably accurate representation of the Earth. According to the lead author of the study, Gary Glatzmaier, of University of California Santa Cruz: "Our solution shows how convection in the fluid outer core is continually trying to reverse the field but that the solid inner core inhibits magnetic reversals because the field in the inner core can only change on the much longer time scale of diffusion. Only once in many attempts is a reversal successful, which is probably the reason why the times between reversals of the Earth's field are long and randomly distributed." A depiction of Earth's magnetic field lines during a stable period and during a reversal.

Text Comprehension:

Answer these questions:

1- *What does the text talk about?*
2- *What does the transferred heat do?*
3- *How is the earth's magnetic surface defined?*
4- *Why are* The lines of magnetic force flow into Earth in the northern hemisphere and out of Earth in the southern hemisphere?
5- *What does the figure 9.13 represent?*

Answer with True or False:

1- At the North and South Poles, the force is horizontal. Anywhere on the equator the force is vertical.
2- the magnetic field is not stable over geological time. For reasons that are completely understood
3- . Over the past 250 Ma, there have a few hundred magnetic field reversals, and their timing has been anything but irregular.
4- The fact that field reversals took place shows that the model is a reasonably accurate representation of the Earth.

Give synonyms of these words:

Field=……., flow=……., force=……., periodically=……., depiction=……., accurate=…….

Translate these words into Arabic:

Heat=……., magnetic field=……., northern hemisphere = ……

Liquid iron=……., diffusion=……..

Check the verbs of the text, tell why are they written in this tense?

Re-order these phrases to have a complete text:

- A compass consists of a small metal needle which is magnetised itself and which is free to turn in any direction.
- Compasses are mainly used in navigation to find direction on the earth.
- A **compass** is an instrument which is used to find the direction of a magnetic field.
- This works because the earth itself has a magnetic field which is similar to that of a bar magnet
- Therefore, when in the presence of a magnetic field, the needle is able to line up in the same direction as the field.
- The compass needle aligns with the earth's magnetic field direction and points north-south. Once you know where north is, you can figure out any other direction.

Grammar:

Asking questions

• The basic rule for asking questions in English is straightforward:

Invert the order of the subject and the first auxiliary verb.

Earth is the densest planet in the Solar System.= **is** earth the densest planet in the solar system?

Earth is a rocky, terrestrial planet.= **is** earth a rocky, terrestrial planet?

• If there is no **auxiliary**, use part of the verb **'to do'**.

Sometimes an earthquake has foreshocks. = **Does** an earthquake have a foreshocks sometimes?

The earthquake grew more intense.= **did** the earthquake grow more intense?

•Note who and what can be the subject:

Who is causing the damage? (who is the subject of the verb).

What can you do to save the people? (what is the subject of the verb) .

What happened? (what is the subject of the verb)

•**Yes/No** questions Subject and verb change their position in statement and question.

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Is our planet safe? (Yes/no is the answer) .

Are you a geologist? (yes/no is the answer) .

- **Questions with question words Question word Verb**

Question words are: what, where, when, who, which, whom, how.

what is geology?

Who discovered earthquake sound DBxi?

When will the turnado happen?