

Θέμα 5^ο

Flight Instruments II: Compass

Pre-reading Activity

Decide whether the following statements are **true** (T) or **false** (F).

1. The magnetic field of the Earth protects the planet from space radiation.
.....
2. The magnetic field of the Earth is generated by electrical currents from space.
.....
3. The Earth's magnetic field reverses itself every other year.
4. The magnetosphere is a huge sphere deep inside the core of the Earth.
.....

Reading 1 (ΜΕΤΑΦΡΑΣΗ)

Read the text below and check your answers.

Earth's Magnetic Field

We can't see it, but there's a gigantic magnetic field surrounding the Earth, acting like a force field, protecting the planet - and all the life - from space **radiation**.

More specifically, the Earth is like a great big magnet. The north pole of the magnet is near the top of the planet, near the geographic north pole, and the south pole is near the geographic south pole. Magnetic field lines extend from these poles for tens of thousands of kilometers into space; this is the Earth's **magnetosphere**.

“The Earth is like a great big magnet. The north pole of the magnet is near the top of the planet, near the geographic north pole, and the south pole is near the geographic south pole.”

The **geographic poles** and the **magnetic poles** are far enough apart that scientists distinguish them differently. If you could draw a line

between the magnetic north and south poles, you would get a magnetic axis that's **tilted** about 11.5 degrees away from the Earth's axis of rotation. And these magnetic poles are known to move around

the surface, wandering as much as 15 km every year.

Scientists think that the Earth's magnetic field is generated by electrical

currents flowing in the liquid outer core deep inside the Earth. Although it's liquid metal, it moves around through a process called **convection**. And the movements of metal in the core set up the currents and magnetic field.

As mentioned before, the magnetic field of the Earth protects the planet from space radiation. The biggest **culprit** is the Sun's solar wind, consisting of highly charged particles blasted out from the Sun like a steady wind. The Earth's magnetosphere channels the solar wind around the

planet, so that it doesn't impact us. Without the magnetic field, the solar wind would strip away our atmosphere - this is what probably happened to Mars.

The Earth's magnetic field reverses itself every 250,000 years or so. The north magnetic pole becomes the south pole, and vice versa.

Scientists have no clear theory about why the reversals happen. One interesting note is that we're long overdue for a reversal. The last one happened about 780,000 years ago.

Reading Activity – Comprehension Questions

Read the text again and answer the following questions.

1. Does the magnetic axis coincide with the Earth's axis of rotation?
2. What is the Earth's magnetosphere?
3. What does the magnetosphere do?
4. According to Reading 1, how often does approximately the Earth's magnetic field reverse itself?

Word Study

Read the text again and choose the words in bold that mean the following.

1. refers to the emission and propagation of energy in the form of rays or waves.
2. The is a region of the Earth's extreme upper atmosphere that is dominated by the magnetic field and acts as a type of radiation shield.
3. To is to incline or cause to incline at an angle.
4. The transfer of heat through a fluid (liquid or gas) caused by molecular motion is called
5. A refers to a person or thing responsible for something wrong, unpleasant, etc.

Vocabulary Review 1 – Magnetism

Fill in the gaps of the following text using the words from the list below.

compass	needle	deviated	Earth
poles	geographic	attract	pointed

The ancient Greeks, originally those near the city of Magnesia, and also the early Chinese knew about strange and rare stones (possibly chunks of iron ore struck by lightning) with the power to **1.** iron. A steel needle stroked with such a "lodestone" became "magnetic" as well, and around 1000 the Chinese found that such a **2.**, when freely suspended, **3.** north-south. The magnetic **4.** soon spread to Europe. Columbus used it when he crossed the Atlantic ocean, noting not only that the needle **5.** slightly from exact north (as indicated by the stars) but also that the deviation changed during the voyage. Around 1600 William Gilbert, physician to Queen Elizabeth I of England, proposed an explanation: the **6.** itself was a giant magnet, with its magnetic **7.** some distance away from its **8.** ones (i.e. near the points defining the axis around which the Earth turns).

Vocabulary Review 2 – The Magnetosphere

Skim the passage quickly and select the appropriate word for each blank from the choices provided.

On Earth one needs a sensitive needle to ...(1)... magnetic forces, whereas out in space they are usually extremely weaker. But beyond the dense atmosphere, such forces have a more important role, and a region exists ...(2)... the Earth where they dominate the environment, a region known as the Earth's ...(3)... That region contains a mix of electrically charged particles, and electric and magnetic phenomena rather than ...(4)... determine its structure.

Only a few of the phenomena observed on the ground come ...(5)... the magnetosphere: fluctuations of the magnetic field known as magnetic ...(6)... and substorms, and the polar aurora or "northern lights," appearing in the night skies of places like Alaska and Norway. ...(7)... in space, however, sense much more: radiation belts, magnetic structures, fast streaming ...(8)... and processes which energize them.

1. a. repel b. detect
c. attract
2. a. around b. in
c. below
3. a. magnetosphere b. mesosphere
c. stratosphere
4. a. density b. weight
c. gravity
5. a. into b. upon
c. from
6. a. squalls b. storms
c. blizzards
7. a. Probes b. Satellites
c. Asteroids
8. a. particles b. nuclei
c. neutrons

Pre-reading Activity

Match the terms on the left with their definitions on the right.

1. magnetic variation	a. The direction along the Earth's surface towards the geographic north pole.
2. magnetic north	b. Numbers or amounts shown on a piece of measuring equipment.
3. readings	c. The angle (at a particular location) between magnetic north and true north.
4. true north	d. The direction indicated by the north-seeking pole of a freely suspended magnetic needle, influenced only by the Earth's magnetic field.

1.	2.	3.	4.
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Reading 2 (ΜΕΤΑΦΡΑΣΗ)

Read the text below and check your answers.

Magnetic Compass

A **free-spinning magnetized needle** points toward magnetic north on a **compass dial** (a small pocket compass with a sundial). Magnetic north is located in a different place than the geographic North Pole, or **true north**. The location of magnetic north is determined by the orientation of the Earth's magnetic field. On the other hand, the location of the North Pole (true north) is determined by the axis of the Earth's daily rotation. On maps and navigational charts, true north is offset from magnetic north. To find true north, a correction called the magnetic **variation** or declination must be made on all **compass readings**.

“The magnetic poles are located at considerable distance from the geographic poles, which are the ends of the axis that the Earth revolves around.”

More specifically, the magnetic poles are located at considerable distance from the geographic poles, which are the ends of the axis that the Earth revolves around. The **north magnetic pole** is situated in the vicinity of Ellef Ringnes Island in northern Canada, about 1300 km from the North Pole.

The south magnetic pole is located just off of the coast of Wilkes Land, Antarctica. It is 2550 km from the geographic South Pole.

The Earth's magnetic field is not perfectly symmetrical, but is wavy and somewhat irregular. Because of this irregularity, a compass some distance away from a magnetic pole may not point directly toward the magnetic pole; rather, the compass follows the direction of the Earth's magnetic field

at that location. The path created by following the compass in the direction of the poles may be wavy, but it will end at a magnetic pole. Most maps indicate the directions of both true north, meaning the direction of the geographic north pole, and magnetic north, the direction in which a compass points. The difference in angle between the direction of true north and magnetic north at any given point on a map is known as the variation (See Section Two). Knowledge of magnetic variation is critically important when navigating with a compass and a map.



Reading Activity 1 – Comprehension Questions

Read the text again and answer the following questions.

1. Where does the magnetized needle of the compass point?
2. Where is the south magnetic pole situated?
3. Where is the north magnetic pole located?
4. What is magnetic variation?

Reading Activity 2

*Decide whether the following statements are **true** (T) or **false** (F).*

1. True north and magnetic north coincide.
2. The location of the geographic North Pole is determined by the axis of the Earth's daily rotation.
3. The Earth's magnetic field is flat and absolutely symmetrical.
4. The geographic North Pole is also called true north.

Vocabulary Review – Various Types of Compasses

Fill in the gaps of the following text using the words from the list below.

masses	accurate	detects	unaffected	magnetic
variations	power	true	field	—

In the magnetic compass, directions are obtained by means of one or more magnetic needles pointing in the general direction of the **1.** North Pole under the influence of the magnetic **2.** of the earth. A variation compass is a specific instrument of a delicate type of construction. It is used by observing **3.** of the needle. A recent development is the electronic compass, which **4.** the magnetic directions without requiring moving parts. This device frequently appears as an optional subsystem built into Global Positioning Satellite Receivers (GPSRs). There are other, more **5.**, devices for determining north (known in such cases as **6.** north, as opposed to magnetic north), which do not depend on the Earth's magnetic field for operation. A gyrocompass developed at the beginning of the 20th century or astrocompass can be used to find true north, while being **7.** by stray magnetic fields, nearby electrical **8.** circuits or nearby large **9.** of ferrous metals.