L1S1 Model Anser to First Exam

Geology

30-01-2024

(1h30')

1- Define the following terms (2.5 points):

Geology: Geology is the scientific study of the Earth's structure, composition, and history, including the processes that shape its surface and interior (0.5 pt)

Continent

Earth's continents are the large landmasses that make up the planet's solid surface. These continental landmasses are distinct from the Earth's ocean basins and play a significant role in shaping our planet's geography, climate, and ecosystems. Earth's landmasses are concentrated into seven major continents: Africa, Antarctica, Asia, Europe, North America, Australia (Oceania), and South America. These continents are primarily composed of continental crust, which is thicker and less dense than oceanic crust. (0.5 pt)

Lava:

The most visible product of a volcanic eruption is lava, which is molten rock that reaches the Earth's surface. Lava can vary in composition, from basaltic (low in silica) to andesitic or rhyolitic (higher in silica). The type of lava influences its viscosity and behavior, ranging from relatively fluid to highly viscous and explosive.

Comets:

Comets are celestial bodies made up of ice, dust, rock, and organic compounds that orbit the Sun in elongated paths. When a comet gets close to the Sun, the heat causes its ice to vaporize, creating a glowing coma (a cloud of gas and dust) and sometimes a tail that points away from the Sun due to solar wind. (0.5 pt)

Asteroids:

Asteroids are small, rocky objects that orbit the Sun, primarily found in the asteroid belt between Mars and Jupiter. They vary in size from tiny fragments to several hundred kilometers across. Most asteroids are irregularly shaped and composed of rock or metal. They are often remnants from the early solar system formation. (0.5 pt)

2- Explain the hierarchical structure of the universe (5 pts)

he structure of the universe is still not fully understood. Astronomers are constantly studying the universe in an effort to learn more about its structure and evolution. Here are some of the different structures in the universe:

Galaxies: are the largest gravitationally bound structures in the universe. They contain billions of stars, as well as gas, dust, and dark matter. (1 pt)

Clusters of galaxies: are groups of galaxies that are held together by gravity. They can contain hundreds or even thousands of galaxies. (1 pt)

Superclusters: are even larger structures that contain clusters of galaxies. They can be millions of light-years across. (1 pt)

Voids: are vast regions of space that are relatively empty of galaxies. They can be hundreds of millions of light-years across. (1 pt)

The cosmic web: is the network of filaments and voids that makes up the large-scale structure of the universe. (1 pt)

3- Explain and diagram the internal structure of the Earth's globe (5 pts)

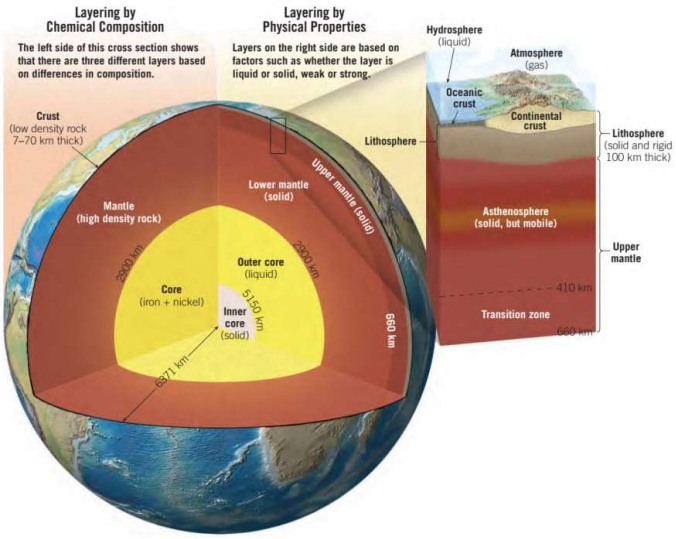
Crust: The outermost layer, composed of solid rock, ranging from about 5 to 70 kilometers thick beneath the continents and around 5 to 10 kilometers thick beneath the ocean floor. (0.5 pt)

Mantle: Beneath the crust lies the mantle, a thick layer of solid rock that extends to about 2,900 kilometers below the Earth's surface. It's divided into **the upper mantle**, which is partially molten and flows slowly over time (0.5 pt), and **the lower mantle**, which is solid (0.5 pt).

Outer Core: Below the mantle is the outer core, a layer of molten iron and nickel. It extends from about 2,900 to 5,150 kilometers below the surface. The movement of this molten material generates the Earth's magnetic field. (0.5 pt)

Inner Core: At the center of the Earth lies the inner core, a solid sphere composed mainly of iron and nickel. It has a radius of about 1,220 kilometers and is under immense pressure, which keeps it solid despite the high temperatures. (0.5 pt)

This layered structure is known as the Earth's "**lithosphere-asthenosphere** " model and plays a crucial role in various geological processes, including plate tectonics, volcanic activity, and the generation of the Earth's magnetic field. (0.5 pt)



(2.5 pts)

4- What are the main differences between continental and oceanic crusts?(2.5 pts)

he oceanic and continental plates differ in several key ways:

▪ **Composition: (0.5 pt)**

– Continental Plates: Continental plates are primarily composed of less dense, granitic rock. This type of rock is lighter and less dense than the rock making up oceanic plates.44 Chapter 8. Continental drift and plate tectonics

– Oceanic Plates: Oceanic plates are primarily composed of denser, basaltic rock. Basalt is heavier and more dense than the continental crust.

▪ **Thickness: (0.5 pt)**

– Continental Plates: Continental plates are thicker and can extend up to 70 kilometers

(43 miles) in depth. They are generally much thicker than oceanic plates.
– Oceanic Plates: Oceanic plates are thinner, typically ranging from 5 to 10 kilometers (3 to 6 miles) in thickness. They are significantly thinner compared to continental plates.

▪ **Density: (0.5 pt)**

– Continental Plates: Continental plates are less dense due to their granitic composition, which makes them "float" higher on the denser mantle.
– Oceanic Plates: Oceanic plates are denser because of their basaltic composition, causing them to "sink" lower into the underlying mantle.

▪ **Age: (0.5 pt)**

– Continental Plates: Continental plates are typically older than oceanic plates. Some continental crust dates back billions of years.
– Oceanic Plates: Oceanic plates are relatively young compared to continental plates, with most of them being less than 200 million years old.

▪ **Location: (0.5 pt)**

– Continental Plates: Continental plates are found beneath the Earth's continents and make up the continental crust.
– Oceanic Plates: Oceanic plates are located beneath the Earth's oceans, forming the oceanic crust.

5- Explain the two theories: continental drift and plate tectonics (5 points)

Continental Drift: (2.5 pts)

Proposed by Alfred Wegener in the early 20th century, the theory of continental drift suggests that the continents were once part of a single supercontinent called Pangaea, which began breaking apart around 200 million years ago (0.5 pt).
According to this theory, the continents slowly drifted apart to their current positions due to the movement of the Earth's lithospheric plates. Wegener suggested that the continents "plowed" through the oceanic crust, driven by forces that he couldn't fully explain at the time. (0.5 pt).
Evidence supporting continental drift includes the matching coastlines of continents like South America and Africa, similar geological formations and rock types across continents, and the distribution of fossils of ancient plants and animals that are found on multiple continents. (1.5 pts)

Plate Tectonics: (2.5 pts)

Building upon Wegener's theory, the modern understanding of plate tectonics explains the movement of the Earth's lithospheric plates, which float on the semi-fluid asthenosphere beneath them. (0.5 pt)
The Earth's lithosphere is divided into several large and small plates that interact with one another at plate boundaries. These interactions result in various geological phenomena such as earthquakes, volcanic eruptions, and the formation of mountain ranges. (0.5 pts)
There are three main types of plate boundaries:
Divergent Boundaries: Where plates move apart from each other, leading to the formation of new oceanic crust. This occurs at mid-ocean ridges.

Convergent Boundaries: Where plates move towards each other, resulting in subduction (one plate sinking beneath another) or collision. This can lead to the formation of deep ocean trenches, volcanic arcs, and mountain ranges.
Transform Boundaries: Where plates slide past each other horizontally, causing earthquakes. An example of this is the San Andreas Fault in California. (1.5 pts)