S.5 PHYSICAL GEOGRAPHY

SAMPLE ITEMS: THE STRUCTURE OF THE EARTH AND ORIGIN OF CONTINENTS AND OCEAN BASINS.

N.B. Use appropriate diagrams where necessary.

Item 1

Earth is the third planet from the Sun and the only known planet that can sustain life. Unlike other planets in our solar system, Earth has the right conditions to support a vast diversity of organisms. However, while studying about the Earth, you also begin to explore its interior structure. You learn that beneath its surface, Earth is composed of different layers, each with distinct properties. These layers play a crucial role in shaping the planet's geology, from volcanic eruptions to earthquakes.

Task

(a) What are some of the key factors that make Earth unique and suitable for life compared to other planets? (05 scores)
(b) Describe the major layers of the Earth, from the outermost to the innermost, and explain the unique characteristics of each layer. (10 scores)

Item 2

During a school field trip to a science museum, students visit an exhibit about the Earth's internal structure. They learn that the mantle, which lies between the crust and the core, plays a major role in transferring heat from the interior to the surface of the Earth. The exhibit explains that this heat comes from two main sources: the decay of radioactive elements and residual heat from the planet's formation.

Task.

Based on what you have learned, explain how heat is generated in the Earth's mantle and describe how this heat contributes to geological processes such as plate tectonics and volcanic activity.

Item 3

In the year 1912, a German scientist named Alfred presented his ground-breaking theory on how continents moved across the Earth's surface. He gathered evidence from different continents, showing that similar fossils, rock formations, and ancient climatic conditions existed in far-apart regions.

Imagine you are a researcher in the early 20th century, attending one of Wegener's lectures. He explains that South America and Africa seem to fit together like puzzle pieces, and he shows fossil evidence of Mesosaurus, a freshwater reptile found in both continents but nowhere else. He also points out that coal deposits found in Antarctica suggest that the continent once had a warm, tropical climate. However, many scientists in the room are puzzled because they believe the Earth's crust is static and unmoving. After the lecture, you are asked to write a detailed scientific response.

Task

(a) Explain whether you agree or disagree with Wegener's theory and justify your position.
(b) Use at least four evidences that support or contradict his ideas.

Item 4

During a geography field study, a team of scientists observes two distinct geological regions. In Region A, they find a deep oceanic trench near a volcanic mountain range along the coast, while in Region B, there's a wide rift valley with frequent shallow earthquakes and evidence of new crust forming. The scientists suspect that these features are directly related to plate tectonic activity explained by the continental drift theory.

Task.

Using your understanding of continental drift theory and plate tectonics, explain the type of plate boundary activity occurring in both Region A and Region B.

Item 5

In a high school geography class, students have been studying various theories that explain the structure and movement of the Earth's surface. During a group discussion, the teacher introduces the theory of continental drift proposed by Alfred Wegener in the early 20th century. Wegener suggested that continents were once joined together in a supercontinent called Pangaea and have since drifted apart to their current positions. However, the students are puzzled because Wegener's theory lacked a convincing explanation of how the continents moved.

Later in the term, the class learns about the more recent Plate Tectonics Theory, which provides a scientific framework for understanding continental movement. The teacher explains that the Earth's lithosphere is broken into large tectonic plates that float on the semi-molten asthenosphere beneath. The movement of these plates, driven by processes such as mantle convection, slab pull, and ridge push, helps explain not only continental drift but also the formation of mountains, earthquakes, and volcanoes.

Task.

(a) Using the theory of plate tectonics, explain how it justifies and builds upon Wegener's earlier theory of continental drift.
(b) Describe the mechanisms that drive plate movement and provide at least two pieces of evidence from plate tectonics that support the idea that continents have moved over geological time.

Item 6

In a recent oceanographic expedition, a team of geologists and marine scientists embarked on a month-long research mission aboard a vessel traveling along the Mid-Atlantic Ridge. Their goal was to study the ocean floor, collect rock samples, and Analyze magnetic patterns on either side of the ridge. As the expedition progressed, they noticed a symmetrical pattern of magnetic striping on both sides of the ridge. Radiometric dating of rock samples showed that the rocks closer to the ridge were younger, while those farther away were progressively older.

In addition, underwater sonar mapping revealed a continuous mountain range along the ridge, with volcanic activity concentrated at its centre. The scientists also noted that similar rock types and fossilized marine organisms were found on both the eastern edge of South America and the western edge of Africa.

After weeks of analysis, the team proposed that these findings strongly supported the theory of seafloor spreading. They presented their data to a panel of geologists who challenged them to connect their observations to the larger theory of continental drift.

Task.

Using the information from the scenario, explain how the evidence gathered by the scientists supports the theory of seafloor spreading and how this theory contributes to the broader understanding of continental drift.

Item 7

Imagine you are a geologist who has been invited to present your findings at an international scientific conference about the history of Earth's continents. Your task is to explain how different types of evidence support the theory of continental drift, first proposed by Alfred Wegener.

As part of your research, you've travelled to multiple continents including South America, Africa, Antarctica, and Australia. During your expeditions, you have gathered various forms of data such as fossil records, rock formations, glacial markings, and satellite images showing plate movements.

In South America and Africa, you observed that the coastlines appear to fit together like puzzle pieces. You also found identical fossil remains, a freshwater reptile, in rock layers of both continents. In Antarctica, despite its current icy climate, you discovered evidence of ancient tropical plants in the form of fossilized leaves. In Australia and India, you encountered similar patterns in rock strata and mountain chains that seemed to have once been part of a larger, connected landmass.

Task.

Using the scenario above, describe at least four different pieces of evidence that support the theory of continental drift. For each piece of evidence, explain how it supports the idea that continents were once joined together and have since drifted apart.

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