

Chapter-4

Distribution of Oceans and Continents

1. Multiple choice question

(i) Who amongst the following was the first to consider the possibility of Europe, Africa and America having been located side by side.

- (a) Alfred Wegener**
- (b) Antonio Pellegrini**
- (c) Abraham Ortelius**
- (d) Edmond Hess**

Answer:

- (c) Abraham Ortelius**

(ii) Polar fleeing force relates to:

- (a) Revolution of the Earth**
- (b) Gravitation**
- (c) Rotation of the earth**
- (d) Tides**

Answer:

- (c) Rotation of the earth**

(iii) Which one of the following is not a minor plate?

- (a) Nazca**
- (b) Arabia**
- (c) Philippines**
- (d) Antarctica**

Answer:

- (d) Antarctica**

(iv) Which one of the following facts was not considered by those while discussing the concept of sea floor spreading?

- (a) Volcanic activity along the mid-oceanic ridges.**
- (b) Stripes of normal and reverse magnetic field observed in rocks of ocean floor.**
- (c) Distribution of fossils in different continents.**
- (d) Age of rocks from the ocean floor.**

Answer:

- (c) Distribution of fossils in different continents.**

(v) Which one of the following is the type of plate boundary of the Indian plate along the Himalayan mountains?

- (a) Ocean-continent convergence**
- (b) Divergent boundary**
- (c) Transform boundary**
- (d) Continent-continent convergence**

Answer:

- (d) Continent-continent convergence**

2. Answer the following questions in about 30 words

(i) What were the forces suggested by Wegener for the movement of the continents?

Answer:

Wegener suggested that two forces were responsible for continental drift. These are Polar fleeing force and Tidal force. The Polar fleeing force is related to the rotation of the earth. The Tidal force is due to the attraction of the moon and the sun, which causes tides in the oceans.

(ii) How are the convectional currents in the mantle initiated and maintained?

Answer:

Arthur Holmes in 1930s discussed the possibility of convection currents operating in the mantle portion. These currents are generated due to radioactive elements causing thermal differences in the mantle portion. According to Holmes, there exists a system of such currents in the entire mantle portion. This was an attempt to

provide an explanation to the issue of force, on the basis of which contemporary scientists discarded the continental drift theory.

(iii) What is the major difference between the transform boundary and the convergent or divergent boundaries of plates?

Answer:

The transform boundary is formed when two adjacent plates slip horizontally past one another. Convergent boundary is formed when two plates come closer while divergent boundary is formed when two plates move away from each other.

(iv) What was the location of the Indian landmass during the formation of the Deccan Traps?

Answer:

About 140 million years before the present, the subcontinent was located as south as 50°S latitude. During the movement of the Indian plate towards the Asiatic plate, a major event that occurred was the outpouring of lava and formation of the Deccan Traps. This started somewhere around 60 million years ago and continued for a long period of time. Note that the subcontinent was still close to the equator. From 40 million years ago and thereafter, the event of formation of the Himalayas took place. Scientists believe that the process is still continuing and the height of the Himalayas is rising even to this date.

3. Answer the following questions in about 150 words

(i) What are the evidences in support of the continental drift theory?

Answer:

A variety of evidence was offered in support of the continental drift. Some of these are given below:

1. The Matching of Continents (Jig-Saw-Fit): The shorelines of Africa and South America facing each other have a remarkable and unmistakable match.

2. Rocks of Same Age Across the Oceans: The belt of ancient rocks of 2,000 million years from Brazil coast matches with those from western Africa. The earliest marine deposits along the coastline of South America and Africa are of the Jurassic age. This suggests that the ocean did not exist prior to that time.

3. Tillite: It is the sedimentary rock formed out of deposits of glaciers. The Gondwana system of sediments from India is known to have its counter parts in six different landmasses of the Southern Hemisphere. At the base the system has thick tillite indicating extensive and prolonged glaciation. Counter parts of this succession are found in Africa, Falkland Island, Madagascar, Antarctica and Australia besides India. Overall resemblance of the Gondwana type sediments clearly demonstrates

that these landmasses had remarkably similar histories. The 45 glacial tillite provides unambiguous evidence of palaeoclimates and also of drifting of continents.

4. Placer Deposits: The occurrence of rich placer deposits of gold in the Ghana coast and the absolute absence of source rock in the region is an amazing fact. The gold bearing veins are in Brazil and it is obvious that the gold deposits of the Ghana are derived from the Brazil plateau when the two continents lay side by side.

5. Distribution of Fossils: The observations that Lemurs occur in India, Madagascar and Africa led some to consider a contiguous landmass "Lemuria" linking these three landmasses. Mesosaurus was a small reptile adapted to shallow brackish water. The skeletons of these are found only in two localities : the Southern Cape province of South Africa and Traver formations of Brazil. The two localities presently are 4,800 km apart with an ocean in between them.

(ii) Bring about the basic difference between the Drift theory and Plate tectonics.

Answer:

Drift Theory: German meteorologist Alfred Wegener suggested the first comprehensive theory of continental drift in 1912. According to Wegener, all the continents formed a single continental mass and mega ocean named Tethys surrounded the same. He argued that around 200 million years ago, the super continent, Pangaea, began to split into two large continental masses as Laurasia and Gondwanaland. Subsequently, Laurasia and Gondwanaland continued to break into various smaller continents that exist today. The continents assumed a shape somewhat similar to the present shape in the Pleistocene Age about 50-60 million years ago.

Plate Tectonics: In the 20th century, McKenzie, Parker, and Morgan, independently collected the available ideas and came out with a concept termed Plate Tectonics. A tectonic plate is a massive, irregularly shaped slab of solid rock, generally composed of both continental and oceanic lithosphere. Plates move horizontally over the earth's asthenosphere as rigid units. The theory of plate tectonics proposes that the earth's lithosphere is divided into major and minor plates. Young Fold Mountain ridges, trenches, and/or faults surround these major plates. Due to movements of the currents, the rigid plates of the lithosphere, which 'float' on asthenosphere, are in constant motion.

(iii) What were the major post-drift discoveries that rejuvenated the interest of scientists in the study of distribution of oceans and continents?

Answer:

A number of discoveries during the post-war period added new information to geological literature. Particularly, the information collected from the ocean floor

mapping provided new dimensions for the study of distribution of oceans and continents.

1. These currents are generated due to radioactive elements causing thermal differences in the mantle portion. Holmes argued that there exists a system of such currents in the entire mantle portion. This was an attempt to provide an explanation to the issue of force, on the basis of which contemporary scientists discarded the continental drift theory.
2. Detailed research of the ocean configuration revealed that the ocean floor is not just a vast plain but it is full of relief.
3. Expeditions to map the oceanic floor in the post-war period provided a detailed picture of the ocean relief and indicated the existence of submerged mountain ranges as well as deep trenches, mostly located closer to the continent margins.
4. The mid-oceanic ridges were found to be most active in terms of volcanic eruptions. The dating of the rocks from the oceanic crust revealed the fact that they are much younger than the continental areas.
5. Rocks on either side of the crest of oceanic ridges and having equi-distant locations from the crest were found to have remarkable similarities both in terms of their constituents and their age.