



PART 1

Read the text below and answer questions 1–13.

PLATE TECTONICS: THE ENGINE OF EARTH

Plate tectonics is the unifying theory that explains how Earth's rigid outer layer is divided into moving slabs. These slabs—tectonic plates—form the lithosphere, a hard shell made of crust and the uppermost mantle. They move slowly over a deeper, warmer zone known as the asthenosphere, where rock behaves more ductilely over long timescales. The interactions of these plates build mountain ranges, open ocean basins, and generate earthquakes and volcanoes. Although plate tectonics now appears fundamental to Earth science, it was accepted only after several independent lines of evidence were connected and, crucially, after a physical mechanism was identified to explain how large blocks of crust could move.

The first widely discussed proposal that continents had not always been fixed was advanced by the German scientist Alfred Wegener in 1912. Wegener argued that today's continents were once joined in a single supercontinent he called Pangaea, and that they later drifted apart. He pointed to several clues that seemed to converge. The most famous was the “puzzle-piece” resemblance between the coastlines of South America and Africa. On its own, however, this geometric match was not persuasive to many geologists, partly because coastlines can change with erosion and sea-level variation. Wegener's stronger evidence came from geology and fossils: the same distinctive rock sequences and the remains of ancient plants and animals were found on continents now separated by vast oceans, suggesting those lands had once been connected.

Despite its explanatory power, Wegener's theory of continental drift was widely ridiculed by many specialists of his era. The objection was not mainly to his evidence but to his physics: critics demanded a force capable of moving entire continents through solid rock. Wegener suggested possibilities such as the influence of Earth's rotation or tidal forces, but these were far too weak. Without a workable mechanism, continental drift looked to opponents like an elegant story without an engine. For several decades, many researchers preferred alternative explanations, including ideas that continents were fixed while land bridges rose and sank to account for fossil similarities. Drift remained an intriguing minority view, awaiting new observations that could test it more decisively.

Those observations arrived after World War II, when military and scientific investment transformed the study of the oceans. Sonar mapping allowed researchers to “see” the seafloor in detail, revealing an unexpected landscape of long mountain chains, deep trenches, and fracture zones. One of the most important discoveries was the global



system of mid-ocean ridges, including the Mid-Atlantic Ridge, a vast underwater mountain range running roughly down the centre of the Atlantic Ocean. Scientists also noticed that many earthquakes and volcanoes were not randomly scattered but concentrated along these ridges, trenches, and other plate-boundary features. Another striking finding was that the ocean floor is geologically young compared with the oldest continental rocks, implying that oceanic crust is continually created and destroyed rather than preserved indefinitely.

A mechanism that could plausibly drive continental motion emerged in the early 1960s through the work associated with American geologist Harry Hess. Hess proposed seafloor spreading, arguing that new oceanic crust forms at mid-ocean ridges when hot material rises from the mantle, cools, and solidifies. As more magma arrives, the newly formed crust is pushed sideways, so the seafloor slowly moves away from the ridge like a conveyor belt. This spreading implies a complementary process elsewhere: as the oceanic plate moves outward, older crust is carried toward deep-ocean trenches, where it bends downward and sinks back into the mantle. This sinking, called subduction, explains why trenches are often paired with intense seismic zones and volcanic arcs. Together, ridge creation and trench destruction provide the “engine” that continental drift lacked, because continents can be carried passively on plates that are created, transported, and recycled.

The most persuasive confirmation—often described as the “smoking gun”—came from paleomagnetism, the study of magnetic signals locked into rocks. When molten basalt cools on the seafloor, iron-bearing minerals align with Earth’s magnetic field, recording its direction at that time. Because Earth’s magnetic polarity has flipped repeatedly throughout geological history, newly formed crust can preserve a pattern of alternating magnetic orientations. Scientists found symmetrical bands, or “magnetic stripes,” on both sides of mid-ocean ridges: the same sequence of normal and reversed polarity appeared as mirror images, increasing in age away from the ridge. This pattern could be explained simply if new crust formed at the ridge and moved outward in a regular, measurable way. The stripes therefore linked a laboratory-measurable phenomenon (magnetisation) to a large-scale Earth process (seafloor spreading), turning a debated idea into a testable, mapped reality.

Once seafloor spreading was accepted, the broader framework of plate tectonics followed. Researchers classified plate boundaries into distinct types with characteristic outcomes. At divergent boundaries, plates move apart and create new crust, forming mid-ocean ridges and, on continents, rift valleys. At convergent boundaries, plates move together: if oceanic lithosphere meets continental lithosphere, subduction tends to occur, producing trenches and volcanic chains; if two continents collide, neither easily sinks, so



the crust crumples and thickens into mountain ranges. At transform boundaries, plates slide laterally past one another, generating shallow but sometimes destructive earthquakes. These boundary types explain why many hazards occur in narrow belts, such as along the Pacific “Ring of Fire,” rather than being evenly distributed across the globe.

What drives the plates remains an area of refinement, though the central idea is that Earth’s internal heat powers motion. Heat escaping from the mantle produces slow convection, but many geophysicists emphasise forces linked to plate geometry and density. One major driver is slab pull: as a cold, dense oceanic plate sinks at a subduction zone, it can tug the rest of the plate behind it. Another contributor is ridge push, a gravitational sliding away from the elevated ridge crest as new, hot crust cools and thickens. While details of the force balance are complex, the plate-tectonic framework has proved remarkably successful. It not only explains earthquakes, volcanoes, and mountain building, but also helps scientists understand long-term climate shifts, ocean circulation, and the distribution of mineral and energy resources, showing Earth as a dynamic system rather than a static planet.

Questions 1–5

Select the correct answer.

1 What is the main purpose of the passage?

- A** To compare competing explanations for why similar fossils occur on different continents.
- B** To trace how evidence and a workable mechanism led to the acceptance of plate tectonics.
- C** To describe modern methods for predicting hazards at different kinds of plate boundary.
- D** To determine which of the proposed forces is primarily responsible for plate movement.

2 Why did many scientists doubt Wegener’s idea when it was first proposed?

- A** He could not identify a force powerful enough to move continents through solid rock.
- B** He could not explain why related fossils and rock sequences occurred on separate continents.
- C** He argued that temporary land bridges provided stronger evidence than continental movement.
- D** He relied on magnetic patterns from the seafloor that other scientists could not reproduce.

3 Which post-war development most directly advanced understanding of the seafloor?

- A** The systematic use of fossils to reconstruct the shape of Pangaea.
- B** New calculations of the tidal forces that Wegener believed moved continents.



- C** The use of sonar to reveal features such as ridges, trenches and fracture zones.
- D** Laboratory measurements showing how rapidly mantle convection transports tectonic plates.

4 According to the passage, what did the youth of the ocean floor imply?

- A** Oceanic crust had formed before the oldest rocks found on the continents.
- B** Deep-ocean trenches prevented older sections of seafloor from being destroyed.
- C** Ocean basins remained fixed while continents travelled independently across them.
- D** Oceanic crust is continually created and destroyed rather than preserved indefinitely.

5 What did paleomagnetic “stripes” provide for seafloor spreading?

- A** Confirmation that continents move through an otherwise stationary ocean floor.
- B** Evidence that crust formed at ridges and moved outward in a regular, symmetrical pattern.
- C** Proof that matching rock sequences developed independently on opposite sides of each ridge.
- D** Evidence that changes in magnetic polarity supply the force that drives plate movement.

Questions 6–9

Complete the summary below. Choose **NO MORE THAN TWO WORDS** from the text for each answer.

The mechanism and evidence for seafloor spreading

New seafloor develops as rising material solidifies along mid-ocean **6** As spreading continues, older oceanic crust is carried into deep-ocean **7** and recycled into the mantle. Mirror-image magnetic patterns provided powerful confirmation through the field known as **8** One important driving force is **9**, in which a descending dense plate pulls the remainder of the plate behind it.

Questions 10–13

Choose **TRUE** if the statement agrees with the information given in the text, choose **FALSE** if the statement contradicts the information, or choose **NOT GIVEN** if there is no information on this.

10 The passage suggests that Wegener’s proposal was widely accepted immediately in 1912.

11 The passage states that sonar mapping after World War II revealed major seafloor features.



12 The passage claims that transform boundaries create new oceanic crust.

13 The passage provides precise global measurements for the speed of every tectonic plate.

Answer Key

1. B
2. A
3. C
4. D
5. B
6. ridges
7. trenches
8. paleomagnetism
9. slab pull
10. FALSE
11. TRUE
12. FALSE
13. NOT GIVEN