# GEO.PH15 Plate Tectonics: Structure of the Earth and Types of Plate Margin

Total Marks

AQA 8035 · Calculators not allowed · about 50 minutes

Name: _____ Date: ____ / ____ / _____

**Answer ALL questions. Show all your working.**

**1** Name the three main layers of the Earth and state one physical property of each layer, as used in plate tectonics theory: crust, mantle and core.

**(Total for Question 1 is 3 marks)**

**2** Describe the role of convection currents in the mantle in the movement of tectonic plates, in the context of plate tectonics theory.

**(Total for Question 2 is 2 marks)**

**3** State whether the inner core is solid or liquid, and give one reason why this matters for plate tectonics theory in relation to convection.

**(Total for Question 3 is 1 mark)**

**4** Define the theory of plate tectonics as it is used in GCSE physical geography, naming the main components it explains.

**(Total for Question 4 is 2 marks)**

**5** Give TWO pieces of evidence from geology or geophysics that supported the development of plate tectonics theory.

**(Total for Question 5 is 2 marks)**

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**6** Constructive plate margin labelled cross-section: The diagram shows a mid-ocean ridge where two oceanic plates move apart. Label and explain five features/processes on the cross-section, including: rising magma, new oceanic crust formation, fissure volcanoes, shallow earthquakes and the direction of plate movement.

*Figure (to be drawn):* *Labelled cross-section of a mid-ocean ridge showing two diverging oceanic plates and upwelling magma*

**(Total for Question 6 is 5 marks)**

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**7** Destructive (convergent) plate margin labelled cross-section: The diagram shows an oceanic plate meeting a continental plate. Label and explain five features/processes on the cross-section, including: subduction zone, ocean trench, melting of subducted plate, volcanic arc on the continental plate, and deeper-focus earthquakes.

*Figure (to be drawn):* *Labelled cross-section of an oceanic-continental convergent margin showing subduction*

**(Total for Question 7 is 5 marks)**

**8** Conservative (transform) plate margin labelled cross-section: The diagram shows two plates sliding past each other. Label and explain five features/processes on the cross-section, including: fault line, strike-slip motion, stress accumulation, sudden slip producing earthquakes, and lack of major volcanic activity.

*Figure (to be drawn): Labelled cross-section of a transform fault zone showing two plates sliding horizontally*

**(Total for Question 8 is 5 marks)**

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**9** Figure 1 (descriptive): The map shows dense clusters of earthquakes and volcanoes around the Pacific Ocean rim (the Pacific Ring of Fire), a band of activity across southern Europe into western Asia (the Alpide belt), and a line of activity along the mid-Atlantic ridge. Large areas in the central Pacific Ocean interior and most of continental interiors such as central Australia show very few events.

**(Total for Question 9 is 4 marks)**

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**10** State the type of plate boundary typically found at mid-ocean ridges, as illustrated in mid-ocean ridge settings.

**(Total for Question 10 is 1 mark)**

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**11** State the type of plate margin represented by the San Andreas Fault in California, where two plates slide past one another.

**(Total for Question 11 is 1 mark)**

**12** An illustrative dataset in the prompt states: 'In a ten-year period, 1,200 recorded earthquakes occurred on the Pacific Ring of Fire out of 2,000 recorded globally.' Calculate the percentage of recorded earthquakes that occurred on the Pacific Ring of Fire during that period. Give your answer to one decimal place.

**(Total for Question 12 is 2 marks)**

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**13** Give THREE differences between oceanic crust and continental crust that are relevant to plate margin processes.

**(Total for Question 13 is 3 marks)**

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**14** Use the example of the Nazca Plate subducting beneath the South American Plate to answer this question. Explain how movement at this named convergent (destructive) plate margin can cause either an earthquake or a volcanic eruption. Your answer should explain the processes involved.

Explain how movement at a named plate margin causes an earthquake or volcanic eruption.

**(Total for Question 14 is 6 marks)**

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**15** Explain ONE reason why volcanic activity is uncommon at conservative (transform) plate margins, using the physical processes at that margin type.

**(Total for Question 15 is 3 marks)**

# Mark scheme · GEO.PH15 Plate Tectonics: Structure of the Earth and Types of Plate Margin

## Question 1

- **B1** crust named with a correct property, e.g. thin, rigid outer layer or composed of continental or oceanic rock, oe
- **B1** mantle named with a correct property, e.g. thick layer of semi-molten rock that convects, oe
- **B1** core named with a correct property, e.g. very hot, dense inner region divided into solid inner core and liquid outer core, oe
- **Answer: Crust: thin, rigid outer layer (continental or oceanic rock). Mantle: thick layer of hot, partly solid/partly plastic rock that convects. Core: very hot, dense centre (solid inner core and liquid outer core).**

## Question 2

- **B1** mantle convection explained: heating near the core causes rock to become less dense and rise, then cool and sink, oe
- **B1** these circulating flows drag or push the base of tectonic plates, causing them to move relative to each other, oe
- **Answer: Heat from the core heats mantle rock, which becomes less dense and rises, then cools and sinks, producing convection cells; these circulating flows transfer force to the base of tectonic plates and cause plates to move.**

## Question 3

- **B1** inner core is solid
- **Answer: The inner core is solid.**

## Question 4

- **B1** plate tectonics is the theory that the Earth's lithosphere is divided into plates that move relative to each other, oe
- **B1** it explains features and processes such as earthquakes, volcanoes and mountain building at plate margins, oe
- **Answer: Plate tectonics is the theory that the Earth's rigid lithosphere is broken into plates that move over the semi-molten mantle; it explains earthquakes, volcanoes and mountain building at plate margins.**

## Question 5

- **B1** matching coastlines and rock sequences on different continents, e.g. fit of South America and Africa, oe
- **B1** distribution of earthquakes and volcanoes along plate boundaries, or evidence from magnetic stripes on the ocean floor, oe
- **Answer: Matching coastlines and rock sequences on different continents; distribution of earthquakes and volcanoes along plate boundaries or magnetic stripes on the ocean floor.**

## Question 6

- **B1** rising magma at the ridge labelled and explained as material from the mantle filling the gap, forming new crust
- **B1** new oceanic crust formation labelled and explained as magma cooling to form basaltic crust at the ridge
- **B1** fissure volcanoes or shallow volcanic activity labelled and explained as eruptions along the ridge where plates separate
- **B1** shallow, low-magnitude earthquakes labelled and explained as caused by tensional forces and fracturing of the crust during separation
- **B1** direction of plate movement labelled (plates moving apart) and explained as driven by mantle upwelling and slab push/pull, oe
- **Answer: Labelled features: rising magma at ridge (mantle upwelling filling gap), formation of new oceanic crust as magma cools, fissure volcanoes/volcanic activity along the ridge, shallow earthquakes from tensional fracturing, and arrows showing plates moving apart driven by mantle convection.**

### Question 7

- **B1** subduction zone labelled and explained as the denser oceanic plate sinking beneath the continental plate
- **B1** ocean trench labelled and explained as the deep sea floor feature at the point of subduction
- **B1** melting of the subducted plate labelled and explained as heat and pressure causing partial melting and magma formation
- **B1** volcanic arc on the continental plate labelled and explained as magma rising to form volcanoes inland of the trench
- **B1** deeper-focus earthquakes labelled and explained as fracturing of the subducting slab at depth, producing deeper earthquakes than at divergent margins
- **Answer: Labelled features: subduction of oceanic plate beneath continental plate, ocean trench at the subduction zone, melting of the subducted plate to form magma, volcanic arc on the continental plate from rising magma, and deeper-focus earthquakes within the subducting slab.**

### Question 8

- **B1** fault line labelled and explained as the plane along which the two plates slide past each other
- **B1** strike-slip or lateral motion labelled and explained as horizontal movement of plates in opposite directions
- **B1** stress accumulation labelled and explained as friction preventing smooth movement until stress builds up
- **B1** sudden slip producing earthquakes labelled and explained as release of stored elastic energy when friction is overcome
- **B1** lack of major volcanic activity labelled and explained because there is no creation or destruction of crust to generate magma, oe
- **Answer: Labelled features: fault line, strike-slip lateral motion, build-up of stress due to friction, sudden slip causing earthquakes, and little or no volcanism because crust is neither created nor subducted.**

### Question 9

- **B1** identifies Pacific Ring of Fire as a major concentration zone, oe
- **B1** identifies another concentration such as the Alpide belt (southern Europe to western Asia) or the mid-Atlantic ridge, oe
- **B1** notes that events are concentrated along plate boundaries rather than interior regions, oe
- **B1** states an area with few tectonic events, e.g. central Pacific, central Australia, oe
- **Answer: Earthquakes and volcanoes are concentrated along plate boundaries, especially the Pacific Ring of Fire around the Pacific Ocean, and the Alpide belt from southern Europe into western Asia or along the mid-Atlantic ridge; continental interiors such as central Australia and large parts of the central Pacific have few events.**

### Question 10

- **B1** constructive (divergent) plate boundary
- **Answer: Constructive (divergent) plate boundary.**

### Question 11

- **B1** conservative (transform) plate margin
- **Answer: Conservative (transform) plate margin.**

### Question 12

- **M1** 1200 / 2000 seen or implied, oe
- **A1** 60.0% cao
- **Answer: 60.0%.**

### Question 13

- **B1** oceanic crust is generally thinner than continental crust, oe
- **B1** oceanic crust is denser and composed mainly of basalt, continental crust is less dense and composed mainly of granitic rocks, oe
- **B1** oceanic crust is younger on average and is recycled at subduction zones, while continental crust is older and is not easily subducted, oe
- **Answer: Oceanic crust is thinner than continental crust; oceanic crust is denser and basaltic while continental crust is less dense and more granitic; oceanic crust is generally younger and is recycled at subduction zones, whereas continental crust is older and resists subduction.**

## Question 14

- **Level 3** (5-6): A detailed, well developed explanation that names the Nazca and South American plate margin, describes subduction of the denser oceanic Nazca Plate beneath the continental South American Plate, explains how friction and bending of the subducting slab generate earthquakes at varying depths, and explains how heat and pressure cause partial melting of the subducted plate to form magma which rises to produce volcanic eruptions on the continental plate, with clear causal links.
- **Level 2** (3-4): A clear explanation that mentions subduction at the named margin and gives either a credible account of earthquake generation or of magma formation and volcanism, with some development of the processes.
- **Level 1** (1-2): A simple or partial statement about the named margin, such as 'the oceanic plate sinks and causes earthquakes' or 'magma forms and causes volcanoes', with limited explanation of how or why.
- **Level 0** (0): No relevant content.
- **Indicative content:**
  - The margin named: Nazca Plate subducting beneath the South American Plate, a convergent oceanic-continental margin.
  - Subduction process: the denser Nazca oceanic plate sinks beneath the lighter continental plate at the subduction zone.
  - Earthquake generation: friction and mechanical interaction between the plates cause stress to build up; sudden release of this stress produces earthquakes; earthquakes can occur shallow near the trench and deeper within the sinking slab.
  - Magma formation and volcanism: increasing heat and pressure on the subducted slab and mantle wedge cause partial melting of the slab and surrounding mantle, forming magma.
  - Magma ascent: magma is less dense so it rises through cracks in the continental crust and can erupt to form a volcanic arc on the continental plate.
  - Causal chain: link subduction to both earthquake mechanisms and to melting and magma rise, explaining the processes rather than just naming outcomes.

## Question 15

- **B1** states that transform margins involve plates sliding past each other rather than creating or destroying crust, oe
- **B1** explains that without subduction there is no significant melting of plate material to form magma, oe
- **B1** links to consequence that therefore major volcanic arcs do not form at transform margins, oe
- **Answer: Transform margins involve plates sliding past each other, not creating or destroying crust; because there is no subduction or significant addition of heat and pressure to produce large volumes of magma, major volcanic arcs do not form at transform boundaries.**