

Natural Hazards, 3rd Canadian Edition (Keller et al.)

Chapter 2 Internal Structure of Earth and Plate Tectonics

2.1 Multiple Choice

1) Which of the following is the correct order of the layers of the Earth from inside to outside?

- A) inner core, outer core, crust, mantle
- B) inner core, mantle, outer core, crust
- C) crust, inner core, outer core, mantle
- D) inner core, outer core, mantle, crust
- E) mantle, inner core, crust, outer core

Answer: D

Topic: 2.1 Internal Structure of Earth

2) Which of the following best describes the internal structure of the earth?

- A) An orange, it has a thin peel with a solid, but watery inside.
- B) A bowling ball, it is completely solid all the way through.
- C) An egg, it is solid at the core, surrounded by liquid and then a hard outer shell.
- D) A geode, it is hollow at the center with a strong, hard, outside layer.
- E) A chocolate covered cherry, it is solid at the core surrounded by a liquid layer and semi-solid layer, then covered in a thin solid coating.

Answer: E

Topic: 2.1 Internal Structure of Earth

3) What is the difference between the inner and outer core of the Earth?

- A) The inner core is liquid and the outer core is solid.
- B) The inner core is made from magma and the outer core is metal.
- C) The inner core is solid and the outer core is liquid.
- D) The inner core is cool and the outer core is hot.
- E) The inner core is hot and the outer core is cool.

Answer: C

Topic: 2.1 Internal Structure of Earth

4) Which of the following is NOT true about the mantle?

- A) The mantle surrounds the outer core.
- B) It is composed of iron- and magnesium-rich silicate rocks.
- C) The density of the rocks is higher than water.
- D) The density of the rocks is lower than the outer core.
- E) It is mostly liquid

Answer: E

Topic: 2.1 Internal Structure of Earth

- 5) What would be the correct relationship between the crust and the lithosphere?
- A) The crust sits on top of the lithosphere.
 - B) The lithosphere sits on top of the crust.
 - C) The lithosphere and the crust are the same thing.
 - D) The lithosphere contains both the oceans and the continents, the crust only includes continents.
 - E) The lithosphere is liquid, whereas the crust is solid.

Answer: A

Topic: 2.1 Internal Structure of Earth

- 6) How do geologists know about the inside of the Earth?
- A) They have drilled holes into the Earth and sent sensors down to its center.
 - B) They study very large canyons that have been uplifted from the center of the Earth.
 - C) They study the movement of earthquake waves throughout the Earth.
 - D) They study the movement of water waves in the ocean.
 - E) They have built a ship that can dig into the Earth and take a team of scientists to its center.

Answer: C

Topic: 2.2 How We Know about Earth's Internal Structure

- 7) Where are earthquakes generally found?
- A) convergent boundaries
 - B) divergent boundaries
 - C) transform fault boundaries
 - D) hotspots
 - E) Earthquakes are found on all of the above locations

Answer: E

Topic: 2.3 Plate Tectonics

- 8) Which of the following is TRUE about plate tectonics?
- A) Explains that continents drift around the globe.
 - B) Explains that the earth's crust is split into plates that float on the ocean water.
 - C) It is a mostly discredited theory popular in the 1800s.
 - D) Explains that the earth's crust is split into plates that slip on the asthenosphere layer of the earth.
 - E) None of the above are true about plate tectonics.

Answer: D

Topic: 2.3 Plate Tectonics

- 9) What would you NOT expect to see at sites where plates are sinking?
- A) earthquakes
 - B) volcanoes
 - C) magma
 - D) new seafloor
 - E) All of the above occur where plates are sinking.

Answer: D

Topic: 2.3 Plate Tectonics

10) Which of the following is TRUE about the Mid-Atlantic Ridge?

- A) It is in the middle of the ocean.
- B) It is a divergent boundary where tectonic plates move apart.
- C) It is a place where new lithosphere is created.
- D) It is a site of deep sea volcanoes and mountains.
- E) All of the above are true about the Mid-Atlantic Ridge.

Answer: E

Topic: 2.3 Plate Tectonics

11) The energy for plate tectonics comes from

- A) the magnetic field of the earth.
- B) heat from the sun.
- C) gravity between the earth and moon.
- D) ocean currents.
- E) heat from the earth's core.

Answer: E

Topic: 2.3 Plate Tectonics

12) The Himalayas are associated with which of the following plate boundaries?

- A) ocean-continent convergence
- B) ocean-ocean convergence
- C) continent-continent convergence
- D) divergent
- E) transform fault

Answer: C

Topic: 2.3 Plate Tectonics

13) Why aren't volcanoes associated with continent-continent convergence?

- A) Both plates are too buoyant to sink into the asthenosphere.
- B) The continental plate isn't hot enough to cause volcanoes.
- C) Volcanoes are not associated with convergent plate boundaries.
- D) Rising magma from melted plates can't break through continental crust.
- E) Volcanoes only occur on islands in the ocean and not on land.

Answer: A

Topic: 2.3 Plate Tectonics

14) If you wanted to draw the boundaries of plates on a globe, which of the following maps would give you the most complete information?

- A) map of active volcanoes
- B) map of mid-ocean ridges
- C) map of earthquake distribution
- D) map of the edge of continental shelves
- E) map of hotspots

Answer: C

Topic: 2.3 Plate Tectonics

15) The Hawaiian Islands are an example of

- A) two ocean plates converging.
- B) two continental plates converging.
- C) diverging plates.
- D) hotspots.
- E) transform fault boundary.

Answer: D

Topic: 2.3 Plate Tectonics

16) What is paleomagnetism?

- A) the study of the magnetism of rocks at their origin
- B) the study of magnetism during ice ages
- C) the study of magnetism at the Earth's core
- D) the study of magnetism of new magma
- E) the study of magnetism of the Earth's poles

Answer: A

Topic: 2.3 Plate Tectonics

17) What is the importance of magnetic reversals to the theory of plate tectonics?

- A) It causes earthquakes.
- B) It provides evidence for seafloor spreading.
- C) It causes volcanic eruptions.
- D) It provides a mechanism for plate tectonics.
- E) It explains times of rapid change on the Earth's surface.

Answer: B

Topic: 2.3 Plate Tectonics

18) The youngest seafloor rocks are found

- A) nearest to the mid-ocean ridges.
- B) nearest to the continental shelves.
- C) evenly distributed throughout the ocean.
- D) underneath the continents.
- E) where the ocean is the flattest.

Answer: A

Topic: 2.3 Plate Tectonics

19) Where would you find ridge push?

- A) at a convergent boundary
- B) at a divergent boundary
- C) at a transform fault boundary
- D) at a hotspot
- E) between a continent and an ocean plate

Answer: B

Topic: 2.4 Mechanisms That Move Plates

- 20) Volcanic eruptions along the west coast of North America are due to
- A) hotspot plume activity in the mantle.
 - B) divergent plate boundaries resulting in a spreading ridge.
 - C) collision zones that result in mountain building.
 - D) convergent plate boundaries where subduction occurs and generates melts.
 - E) transform plate boundary where plates slide past one another.

Answer: D

Topic: 2.5 Plate Tectonics and Hazards

- 21) Scientists believe that the inner core of the Earth is
- A) a rocky solid, composed of iron and magnesium-rich silicates.
 - B) liquid, comprising molten iron.
 - C) a metallic solid, composed of nickel.
 - D) solid metal, composed of mostly iron.
 - E) a molten alloy of iron and nickel.

Answer: D

Topic: 2.1 Internal Structure of Earth

- 22) Which of the following, forms the thickest layer on the interior of the earth?
- A) lithosphere
 - B) mantle
 - C) outer core
 - D) crust
 - E) inner core

Answer: B

Topic: 2.1 Internal Structure of Earth

- 23) The Mohorovicic discontinuity, or Moho, is the boundary that marks density contrast between which two layers of the Earth's interior?
- A) the mantle and outer core
 - B) the Asthenosphere and mantle
 - C) the lithosphere and mantle
 - D) the mantle and crust
 - E) the inner core and outer core

Answer: D

Topic: 2.1 Internal Structure of Earth

- 24) Oceanic Plates migrate and move at a rate of _____ per year.
- A) one metre
 - B) several metres
 - C) almost insignificant amounts
 - D) only a few millimetres
 - E) several centimetres

Answer: E

Topic: 2.3 Plate Tectonics

25) The oldest oceanic crust on the seafloor is approximately no older than _____ years old.

- A) 4.3 billion
- B) 200 million
- C) 10 million
- D) 100 million
- E) 1 billion

Answer: B

Topic: 2.3 Plate Tectonics

26) The high risk of a mega-quake (mag 8.5 - 9.0) in Vancouver, British Columbia is due to what type of movement, relative to the North American Plate?

- A) the subduction of the Juan de Fuca Plate
- B) the spreading of the Pacific Plate
- C) the subduction of the Pacific Plate
- D) Movement along the San Andreas Fault
- E) collision with the Pacific Plate

Answer: C

Topic: 2.1 Internal Structure of Earth

27) The Earth's magnetic field is generated by

- A) convection of hot iron-rich fluid around a solid core.
- B) convection of magma in the Earth's mantle.
- C) the natural rotation of the Earth.
- D) gamma radiation emitted from the Sun.
- E) the iron-rich magnetic core.

Answer: A

Topic: 2.3 Plate Tectonics

28) Which of the following volcanoes sits above the Cascadia subduction zone?

- A) Iceland
- B) Hawaii
- C) Mount Fuji
- D) Mount St. Helens
- E) Mount Etna

Answer: D

Topic: 2.3 Plate Tectonics

29) Which modern mountain chain is the site of the continent-continent collision?

- A) the Rockies
- B) the Andes
- C) the Appalachians
- D) Japan
- E) the Himalayas

Answer: E

Topic: 2.3 Plate Tectonics

- 30) Mantle "hotspots" underlie
- A) Mount St. Helens and Mount Lassen.
 - B) the San Andreas Fault and Mount Lassen.
 - C) Yellowstone and Mauna Loa.
 - D) the Cascadia subduction zone.
 - E) Yellowstone and Mount St. Helens.

Answer: C

Topic: 2.3 Plate Tectonics

- 31) The lithosphere is the rigid outer layer of solid Earth, which includes
- A) the crust plus the entire mantle.
 - B) only the oceanic crust.
 - C) the crust plus the uppermost mantle.
 - D) the crust plus the asthenosphere.
 - E) both the continental crust and the oceanic crust.

Answer: C

Topic: 2.1 Internal Structure of Earth

- 32) Which of the following statements about the lithosphere is FALSE?
- A) It is hot and relatively gooey and allows the crust to move.
 - B) It includes the upper part of the Earth's mantle.
 - C) It is broken into a series of plates.
 - D) It is rigid and strong.
 - E) It includes both crust and upper mantle.

Answer: A

Topic: 2.1 Internal Structure of Earth

- 33) Mount St. Helens is a volcano associated with which type of lithospheric plate boundary?
- A) convergent boundary
 - B) divergent boundary
 - C) transform boundary
 - D) hotspot boundary
 - E) continental collision boundary

Answer: A

Topic: 2.3 Plate Tectonics

- 34) The release of water and carbon dioxide from a subducting oceanic plate causes
- A) sea levels to rise.
 - B) pooling of liquid water and carbon dioxide in chambers below the Earth's surface.
 - C) an increase in rock density in the overriding lithospheric plate.
 - D) an increase in the temperature of the magma.
 - E) the rocks in the overriding lithospheric plate to melt.

Answer: E

Topic: 2.3 Plate Tectonics

- 35) The Himalayas are associated with which type of plate boundary?
- A) convergent boundary: oceanic plate subducting beneath continental plate
 - B) divergent boundary
 - C) transform boundary
 - D) convergent boundary: continent - continent collision
 - E) convergent boundary: oceanic plate subducting beneath oceanic plate

Answer: D

Topic: 2.3 Plate Tectonics

- 36) What phenomenon of the ocean crust led scientists to propose the idea of sea-floor spreading?

- A) volcanoes in Japan
- B) symmetrically magnetized stripes of rock on the ocean floor
- C) earthquakes in the middle of the ocean
- D) mountain chains around the Pacific Ocean
- E) the San Andreas fault

Answer: B

Topic: 2.3 Plate Tectonics

2.2 True/False

- 1) The asthenosphere layer of the Earth is liquid.

Answer: FALSE

Topic: 2.1 Internal Structure of Earth

- 2) The inside of the Earth is composed of layers that have different properties.

Answer: TRUE

Topic: 2.1 Internal Structure of Earth

- 3) The crust of the earth is considered the thinnest layer of the earth.

Answer: TRUE

Topic: 2.1 Internal Structure of Earth

- 4) The ocean crust of the Earth is older than the continents.

Answer: FALSE

Topic: 2.1 Internal Structure of Earth

- 5) Geologists have samples of rock from the Earth's core.

Answer: FALSE

Topic: 2.2 How We Know about Earth's Internal Structure

- 6) Tectonic plates are defined by the location of continents and oceans.

Answer: FALSE

Topic: 2.3 Plate Tectonics

7) Plates are constantly in motion and moving very quickly.

Answer: FALSE

Topic: 2.3 Plate Tectonics

8) During subduction, one plate sinks under another tectonic plate.

Answer: TRUE

Topic: 2.3 Plate Tectonics

9) The ocean floor is younger than the rocks on the continents.

Answer: TRUE

Topic: 2.4 Mechanisms That Move Plates

10) At 3000 km thickness, the mantle is the thickest section in the interior of the Earth.

Answer: TRUE

Topic: 2.1 Internal Structure of Earth

11) Vancouver, British Columbia is at great risk of a serious mega-quake due to movement along the Cascadian Subduction Zone.

Answer: TRUE

Topic: 2.1 Internal Structure of Earth

12) The Mohorovicic discontinuity separates rocks of the lithosphere from the asthenosphere.

Answer: FALSE

Topic: 2.1 Internal Structure of Earth

13) The cool, strong, outermost layer of the solid Earth is referred to as the lithosphere.

Answer: TRUE

Topic: 2.1 Internal Structure of Earth

14) The Earth remains a constant size due to the balance of plate destruction in subduction zones and production of new lithosphere at spreading ridges.

Answer: TRUE

Topic: 2.3 Plate Tectonics

15) The Wadati-Benioff Zone marks the boundary between crust and mantle.

Answer: FALSE

Topic: 2.3 Plate Tectonics

16) Divergent plate boundaries occur on remote seafloor spreading ridges and do not present any hazards for populated areas.

Answer: FALSE

Topic: 2.3 Plate Tectonics

17) Subduction zones commonly feature submarine trenches which have some of the deepest ocean waters, reaching several kilometres in depth.

Answer: TRUE

Topic: 2.3 Plate Tectonics

18) Continent-continent collisions are responsible for all mountain building events on Earth.

Answer: FALSE

Topic: 2.3 Plate Tectonics

19) The Hawaiian emperor chain of volcanic islands are a result of a mantle hotspot that is migrating in an easterly trajectory.

Answer: FALSE

Topic: 2.3 Plate Tectonics

20) Iron-bearing minerals in volcanic rocks formed at spreading ridges can align with the Earth's magnetic field.

Answer: TRUE

Topic: 2.3 Plate Tectonics

21) Most of the world's earthquakes and volcanoes occur at or near plate boundaries.

Answer: TRUE

Topic: 2.4 Mechanisms That Move Plates

2.3 Short Answer/Essay

1) Give a description of the lithosphere, crust, asthenosphere, and mantle and explain the relationships between them.

Topic: 2.1 Internal Structure of Earth

2) Explain the concept of convection. Describe how convection may work in the mantle of the Earth.

Topic: 2.1 Internal Structure of Earth

3) Explain how the seafloor expands and then explain why the Earth does not get any bigger or smaller.

Topic: 2.3 Plate Tectonics

4) Explain why the location of volcanoes does not give a complete picture of the location of the plate boundaries.

Topic: 2.3 Plate Tectonics

5) Explain the importance of paleomagnetism in understanding plate tectonics.

Topic: 2.3 Plate Tectonics

6) Describe how the Hawaiian Islands were formed and explain how they are evidence for plate motion.

Topic: 2.3 Plate Tectonics

7) Describe the theory of continental drift and explain how it relates to plate tectonics.

Topic: 2.3 Plate Tectonics

8) Describe the mechanisms of ridge push and slab pull and explain which one is the more important process in driving plate tectonics.

Topic: 2.4 Mechanisms That Move Plates

9) What is plate tectonics?

Answer: Plate tectonics refers to the movement of lithosphere plates, including ocean basins and continents, in response to mantle convection that result in the creation, destruction and movement of plates.

Topic: 2.3 Plate Tectonics

10) Describe the balance between the birth and destruction of crust on the seafloor.

Answer: The Earth's size remains constant despite movement of the lithosphere. New crust generated at spreading ridges and centres are balanced by plate destruction at subduction zones.

Topic: 2.3 Plate Tectonics

11) Briefly describe the Wadati-Benioff Zone.

Answer: The W-B Zone is defined as a dipping zone of earthquakes associated with the descending plate of a subduction zone. This zone is discernable only through the study of seismology and is strong evidence of subduction of rigid, breakable lithosphere at convergent plate boundaries.

Topic: 2.3 Plate Tectonics

2.4 Essay

1) Volcanic activity can result from hotspot activity and divergent plate boundaries. Explain where and how the magma for each of these volcanoes comes from and how it rises to the surface. In this explanation, briefly describe the layers of the Earth and how convection is a mechanism for plate tectonics.

Topic: 2.3 Plate Tectonics

2) Magnetic reversals have happened throughout the Earth's history. Explain how these magnetic reversals have been used as evidence for Seafloor Spreading. If there had not been magnetic reversals, suggest some other pieces of evidence that might be used to support the idea of Seafloor Spreading.

Topic: 2.3 Plate Tectonics

3) Compare and contrast the mantle and crust.

Answer: The crust is the outermost layer of the solid Earth and the mantle lies below the crust and above the outer core. The mantle is nearly 3000 km thick and consists mostly of soft plastic to solid material composed of Fe and Mg-rich silicate minerals with a density of 4.5 g/cm³. The crust is composed of cooler solid rock material, is only several km thick (max. 4 km) and is much less dense - 2.8 g/cm³. This density contrast defines their boundaries as marked by the Mohorovicic discontinuity, or Moho.

Topic: 2.1 Internal Structure of Earth

4) Describe the three types of plate boundaries. Identify the types of associated hazards and explain how they are generated.

Answer:

1. Divergent plate boundaries - plates break and move apart resulting in the generation of new crust and typified by ridges such as the mid-Atlantic ridge. These are centres of seismic activity associated with transverse faulting. More significant is the frequent volcanism, as evidenced by Iceland.

2. Convergent plate boundaries - plates collide, resulting in subduction and generation of melts leading to volcanism; subduction slab can also release energy in the form of mega-quakes and associated tsunamis. Continent-continent collisions lead to the development of suture zones and mountain building events.

3. Transform boundaries - occur where plates slide horizontally past each other as in the case of the San Andreas Fault of North America. Hazards are limited to earthquakes and associated tsunamis, while volcanism is rare.

Topic: 2.3 Plate Tectonics