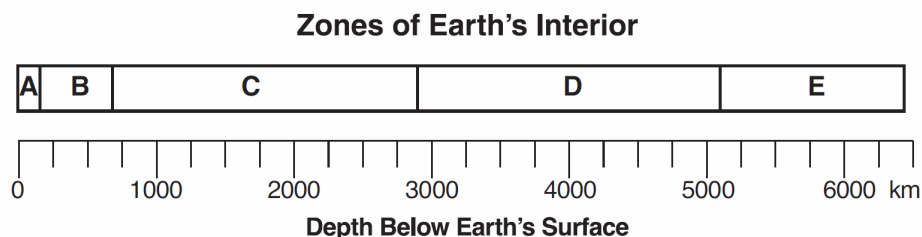


Topic 9 - Dynamic Crust

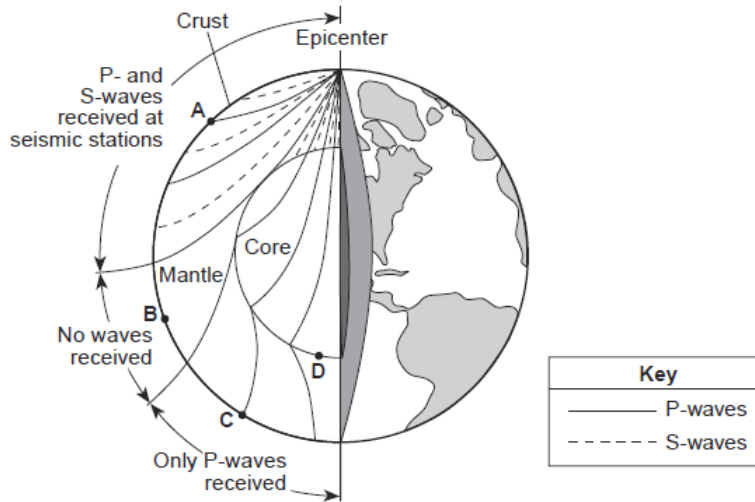
Base your answers to questions 1 through 5 on the diagram below, which represents zones of Earth's interior, identified by letters *A* through *E*. The scale shows depths below Earth's surface, measured in kilometers.



- What is the approximate thickness of zone *C*?
A) 650 km B) 1600 km C) **2250 km** D) 2900 km
 - Which zone of Earth's interior has a density closest to the densities of the other terrestrial planets?
A) zone *A* B) zone *E* C) **zone *C*** D) zone *D*
 - The Moho is a boundary located in zone
A) *A* B) *B* C) *E* D) *D*
 - Which zone is characterized by partially melted rock and large-scale convection currents?
A) zone *A* B) **zone *B*** C) zone *C* D) zone *E*
 - S*-waves produced by an earthquake are transmitted through zones
A) *A* and *B*, but not zones *C*, *D*, and *E* B) ***A*, *B*, and *C*, but not zones *D* and *E***
C) *C*, *D*, and *E*, but not zones *A* and *B* D) *D* and *E*, but not zones *A*, *B*, and *C*
-
- Which part of the Earth is most likely a liquid zone?
A) inner core B) **outer core**
C) mantle D) crust
 - A seismic station recorded the *P*-waves, but no *S*-waves, from an earthquake because *S*-waves were
A) **absorbed by Earth's outer core**
B) transmitted only through liquids
C) weak and detected only at nearby locations
D) not produced by this earthquake
 - Which geologic feature is composed of the youngest crustal bedrock?
A) Peru-Chile Trench
B) **Mid-Atlantic Ridge**
C) Adirondack Mountains
D) San Andreas Fault
 - Which statement most accurately compares Earth's crust and Earth's mantle?
A) **The crust is thinner and less dense than the mantle.**
B) The crust is thinner and more dense than the mantle.
C) The crust is thicker and less dense than the mantle.
D) The crust is thicker and more dense than the mantle.
 - The inferred temperature and pressure of Earth's interior at a depth of 3,000 kilometers are approximately
A) 1000°C and 0.5 million atmospheres
B) 1000°C and 1.0 million atmospheres
C) **5000°C and 1.5 million atmospheres**
D) 5000°C and 3.0 million atmospheres

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11. Base your answer to the following question on the diagram below and on your knowledge of Earth science. The diagram represents a cut-away view of Earth's interior and the paths of some of the seismic waves produced by an earthquake that originated below Earth's surface. Points *A*, *B*, and *C* represent seismic stations on Earth's surface. Point *D* represents a location at the boundary between the core and the mantle.

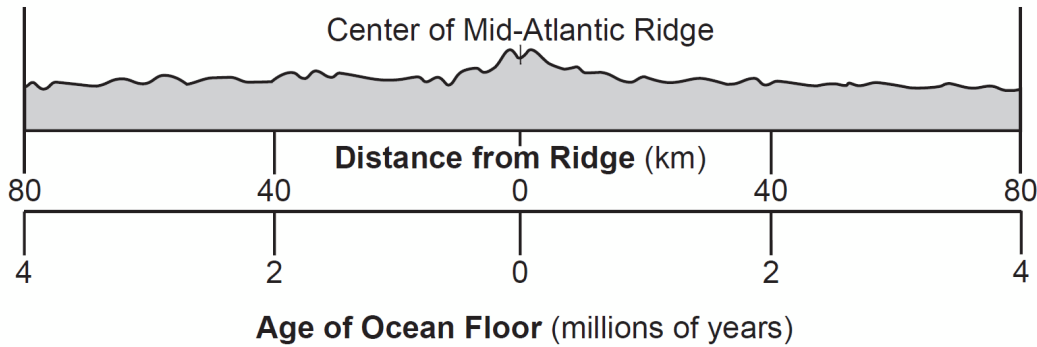


Seismic station *A* is 5000 kilometers from the epicenter. What is the difference between the arrival time of the first *P*-wave and the arrival time of the first *S*-wave recorded at this station?

- A) 2 minutes 20 seconds
B) 6 minutes 40 seconds
C) 8 minutes 20 seconds
D) 15 minutes 00 second

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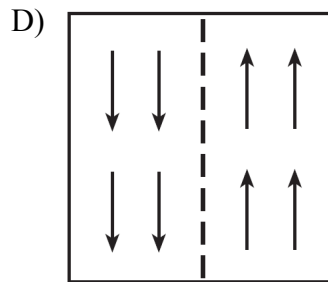
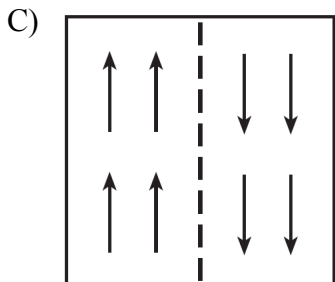
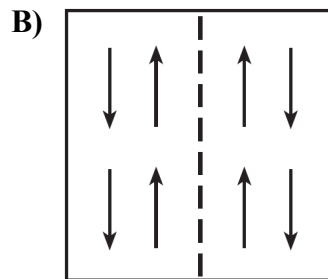
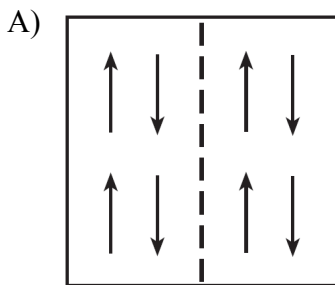
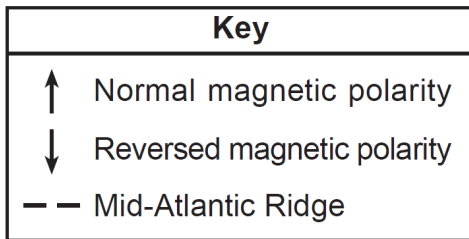
Base your answers to questions 12 and 13 on the cross section below and on your knowledge of Earth science. The cross section represents the distance and age of ocean-floor bedrock found on both sides of the Mid-Atlantic Ridge.



12 According to the cross section, every 1 million years, the ocean floor bedrock moves approximately

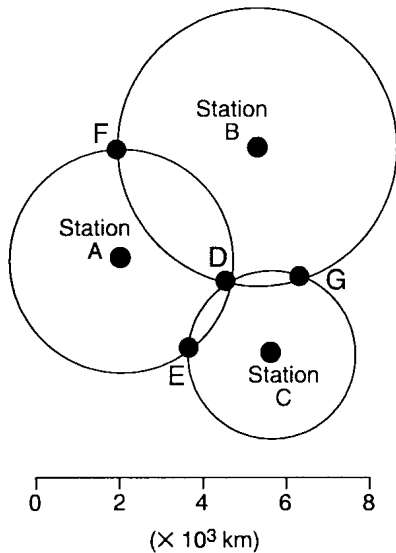
- A) 20 km toward the Mid-Atlantic Ridge
- B) 20 km away from the Mid-Atlantic Ridge**
- C) 40 km toward the Mid-Atlantic Ridge
- D) 40 km away from the Mid-Atlantic Ridge

13. Which map best represents the pattern of magnetic polarity in the minerals of ocean-floor bedrock on each side of the Mid-Atlantic Ridge?



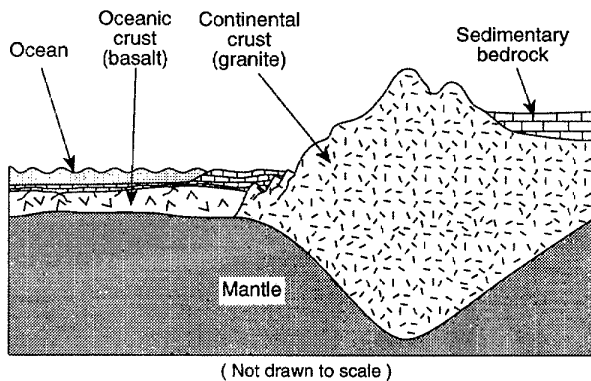
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14. Base your answer to the following question on the diagram below, which represents seismic stations *A*, *B*, and *C*. The distance from each station to an earthquake's epicenter is plotted.



The epicenter is closest to point

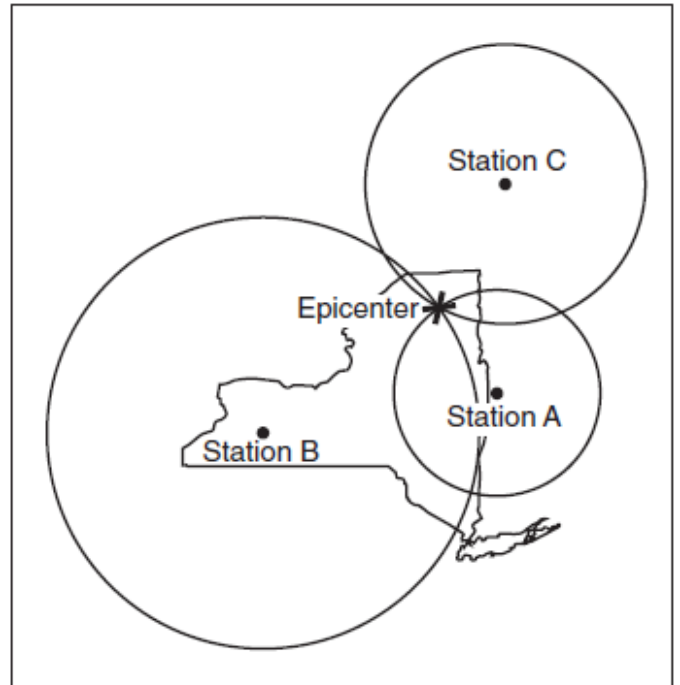
- A) *D* B) *E* C) *F* D) *G*
15. The diagram below represents a cross section of a portion of the Earth's crust.



Which statement about the Earth's crust is best supported by the diagram?

- A) The oceanic crust is thicker than the mantle.
B) The continental crust is thicker than the oceanic crust.
 C) The continental crust is composed primarily of sedimentary rock.
 D) The crust is composed of denser rock than the mantle is.

16. The map below shows the location of an earthquake epicenter in New York State. Seismic stations *A*, *B*, and *C* received the data used to locate the earthquake epicenter.



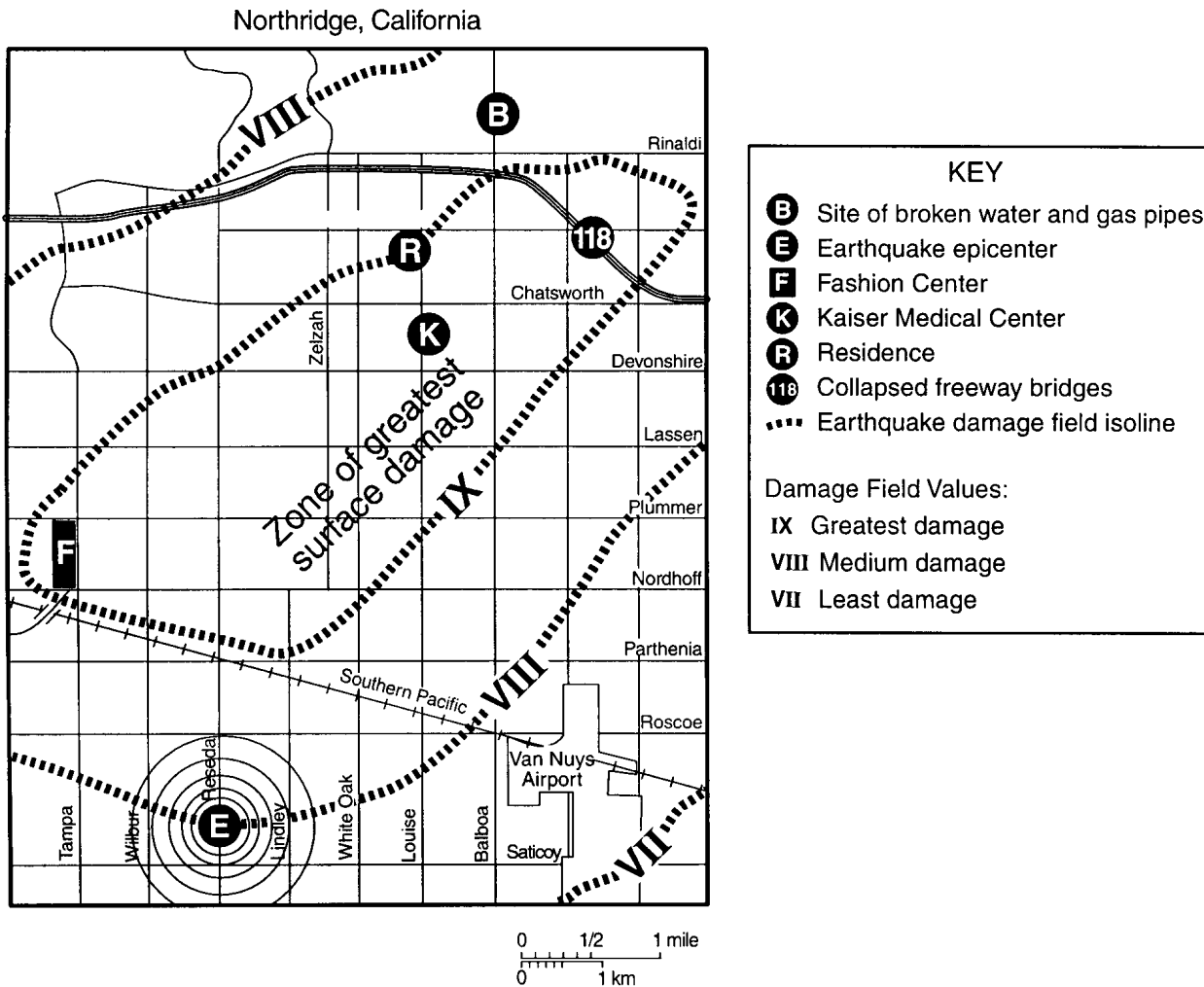
The seismogram recorded at station *A* would show the

- A) arrival of *P*-waves, only
B) earliest arrival time of *P*-waves
 C) greatest difference in the arrival times of *P*-waves and *S*-waves
 D) arrival of *S*-waves before the arrival of *P*-waves
17. What is Earth's inferred interior pressure, in millions of atmospheres, at a depth of 3500 kilometers?

- A) **1.9** B) 2.8 C) 5500 D) 6500
18. Earth's outer core is best inferred to be
- A) liquid, with an average density of approximately 4 g/cm^3
B) liquid, with an average density of approximately 11 g/cm^3
 C) solid, with an average density of approximately 4 g/cm^3
 D) solid, with an average density of approximately 11 g/cm^3

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19. Base your answer to the following question on the map below which shows part of the earthquake damage field that resulted from the earthquake that occurred in Northridge, in southern California, in January 1994. Several sites associated with the earthquake and earthquake damage are shown.

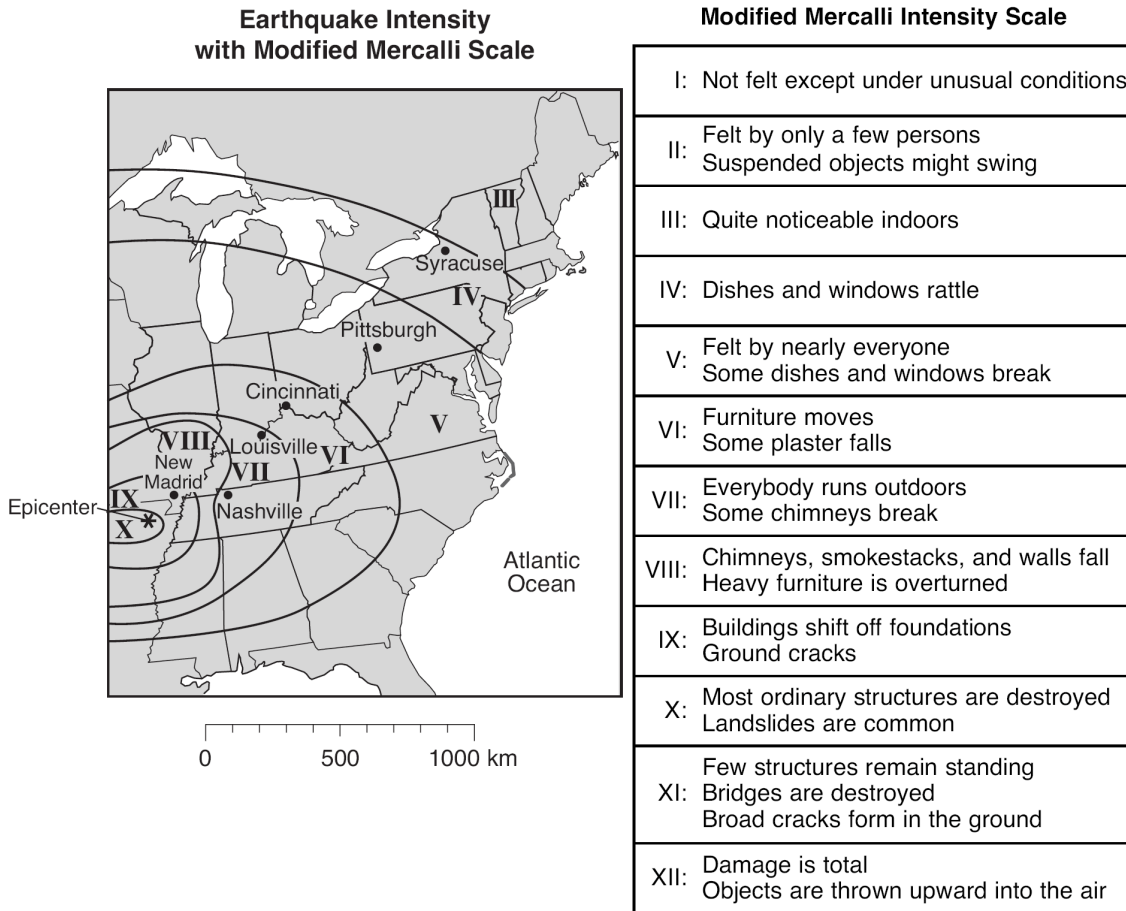


This earthquake provides evidence for the existence of

- A) Earth's solid outer core B) convection cells in Earth's outer core
 C) **faulting of bedrock at Northridge** D) magnetic field reversals at Northridge
-
20. A strong earthquake that occurs on the ocean floor could result in the formation of
- A) **a tsunami** B) a delta
 C) an El Niño event D) an ocean current
21. Which type of tectonic plate boundary is found between the South American Plate and the Scotia Plate?
- A) **transform**
 B) convergent
 C) divergent
 D) complex or uncertain

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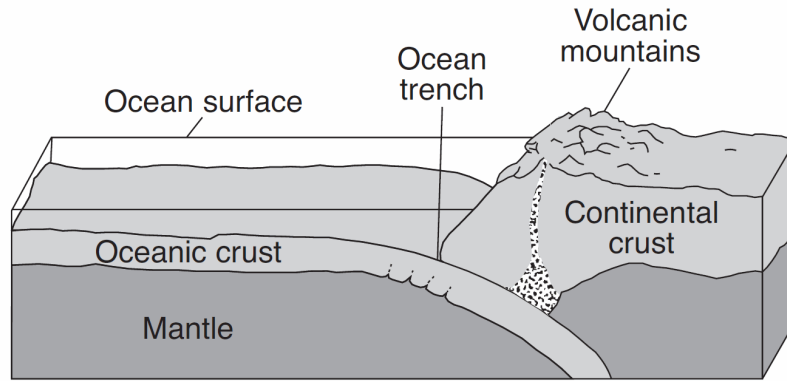
Base your answers to questions 22 and 23 on the map and the modified Mercalli scale shown below. The map shows the intensities of the earthquake that occurred slightly southwest of New Madrid, Missouri, on December 16, 1811. The epicenter of this earthquake is represented by *. The Roman numerals on the map show zones of earthquake intensities determined by using the modified Mercalli scale.



22. Which location would most probably have issued the report: "Many structures shifted off foundations"?
- A) New Madrid B) Syracuse C) Pittsburgh D) Nashville
23. The intensity numbers shown on the map were determined by
- A) the arrival time of the first *P*-wave recorded at each city
 B) the recorded time difference in the arrival of the first *P*-wave and *S*-wave at each city
 C) **observations made at different locations during and after the earthquake**
 D) observations made only at the earthquake epicenter

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24. The block diagram below shows the boundary between two tectonic plates.

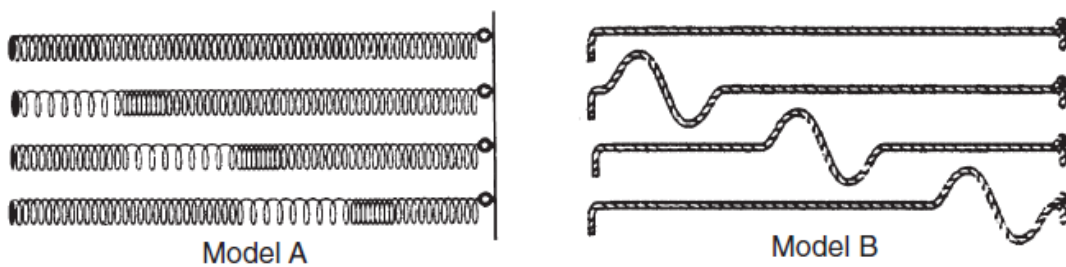


(Not drawn to scale)

Which type of plate boundary is shown?

- A) divergent **B) convergent** C) transform D) complex

25. Base your answer to the following question on the diagram below, which shows models of two types of earthquake waves.

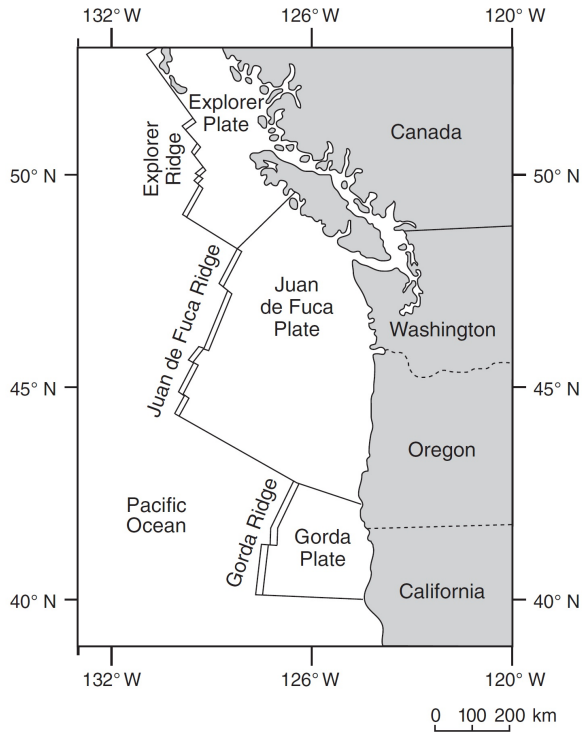


Model *A* best represents the motion of earthquake waves called

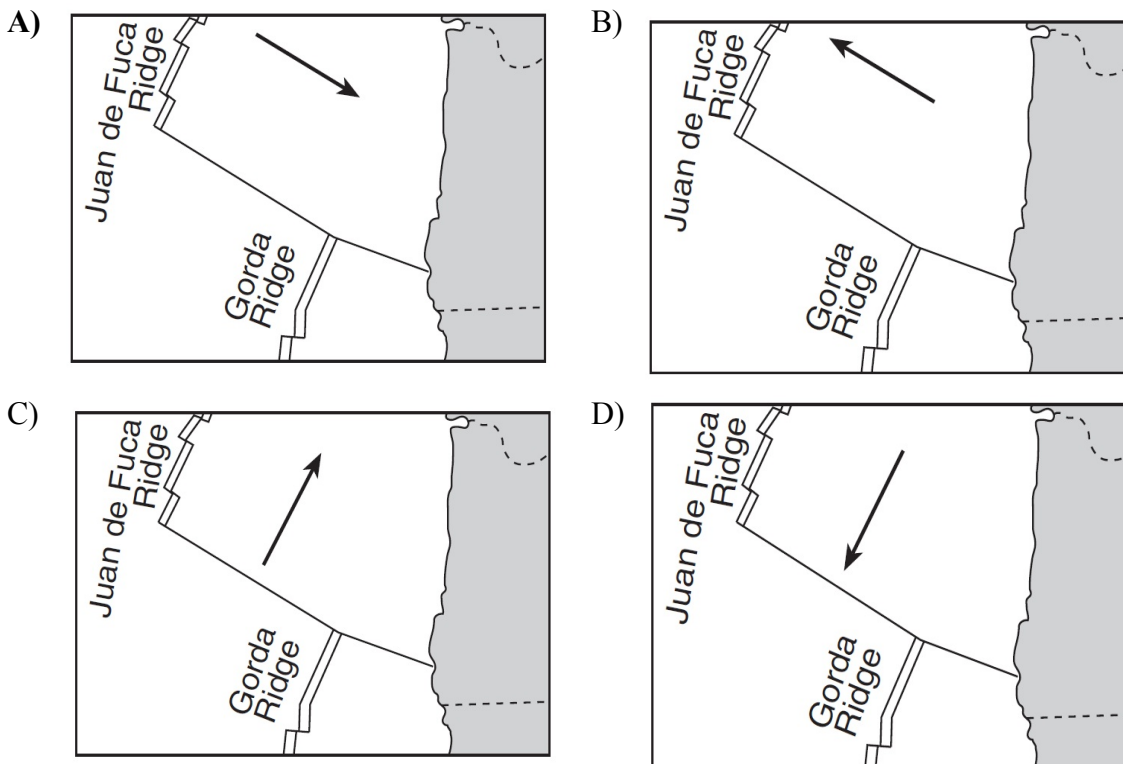
- A) *P*-waves (compressional waves) that travel faster than *S*-waves (shear waves) shown in model *B*
B) *P*-waves (compressional waves) that travel slower than *S*-waves (shear waves) shown in model *B*
C) *S*-waves (shear waves) that travel faster than *P*-waves (compressional waves) shown in model *B*
D) *S*-waves (shear waves) that travel slower than *P*-waves (compressional waves) shown in model *B*

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Base your answers to questions **26** and **27** on the map below and on your knowledge of Earth science. The map shows the coast of the northwestern United States. The Explorer and Gorda ridges and plates are parts of the Juan de Fuca tectonic system.



26. The arrow on which map best shows the direction of movement of the Juan de Fuca Plate in relation to the Juan de Fuca Ridge?

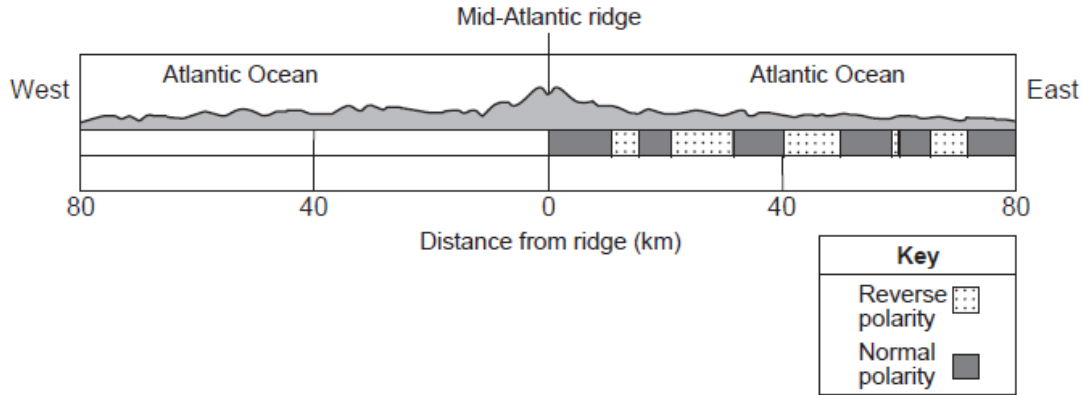


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27. The Explorer Ridge is the boundary between the Explorer Plate and the

- A) North American Plate
- B) **Pacific Plate**
- C) Juan de Fuca Plate
- D) Gorda Plate

28. The cross section below represents a pattern of magnetic field reversals preserved in the igneous bedrock of the oceanic crust east of the Mid-Atlantic ridge.

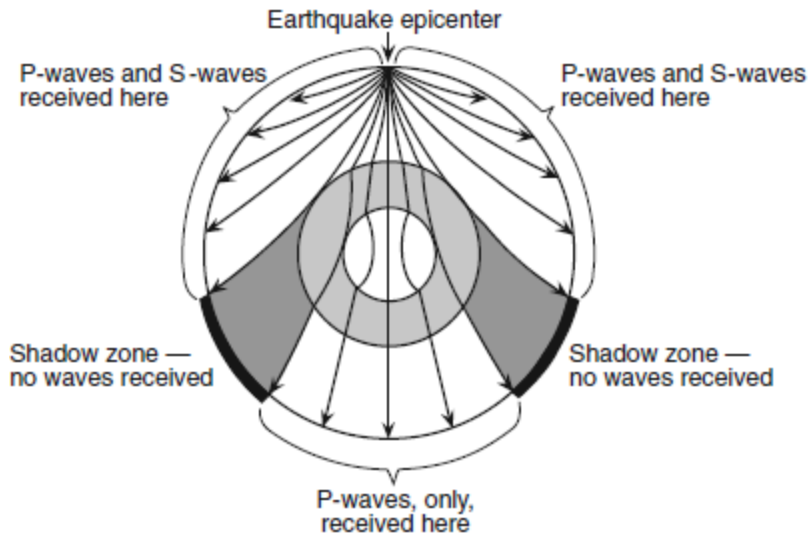


Which cross section best represents the magnetic field pattern west of the Mid-Atlantic ridge?

- A)
- B)
- C)
- D)

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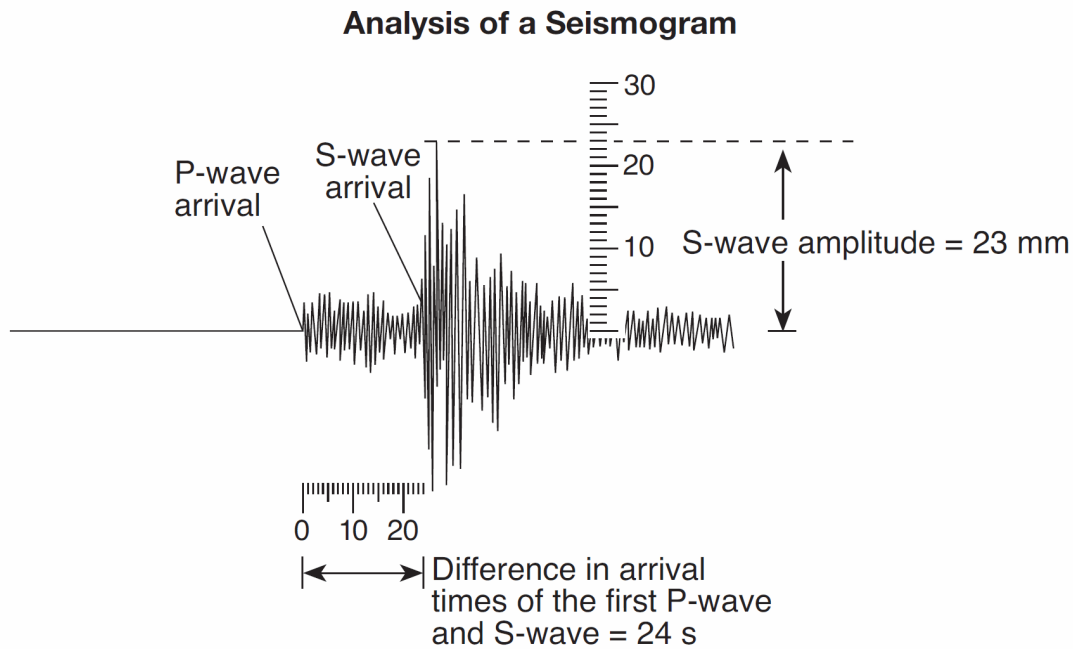
29. Base your answer to the following question on the cross section below, which shows the paths of seismic waves traveling from an earthquake epicenter through the different layers of Earth's interior.



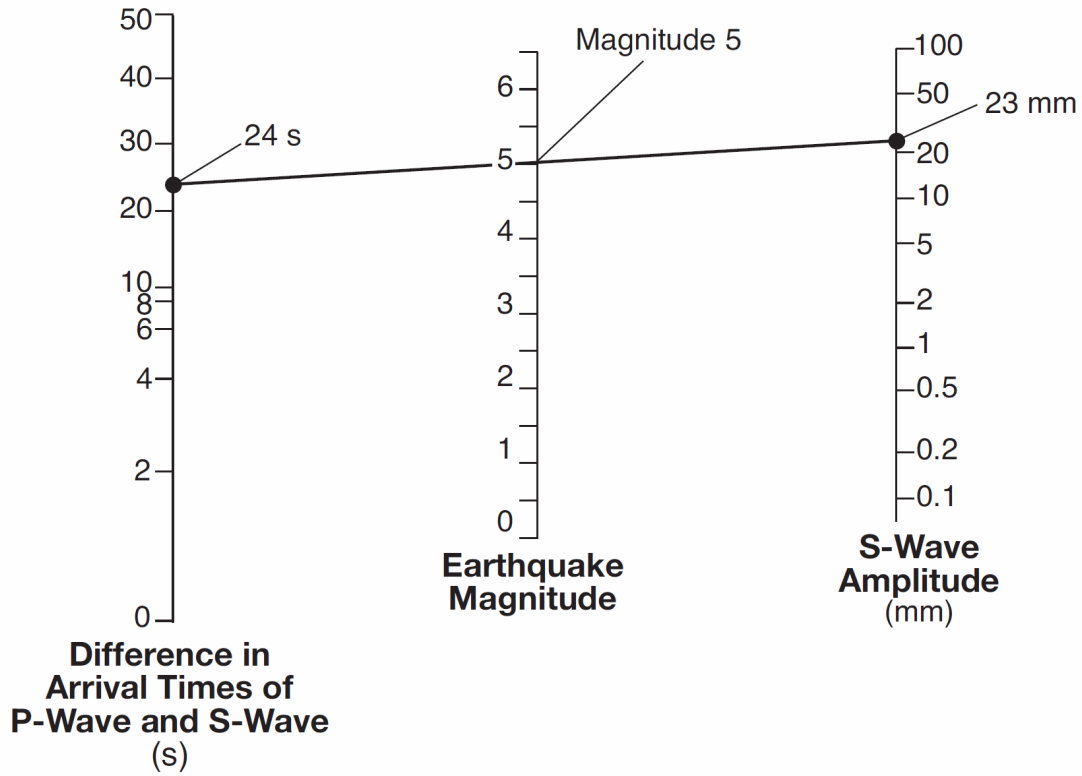
No *P*-waves or *S*-waves are received in the shadow zone because

- A) *P*-waves are absorbed and *S*-waves are refracted by Earth's outer core
- B) *P*-waves are refracted and *S*-waves are absorbed by Earth's outer core**
- C) both the *P*-waves and *S*-waves are refracted by Earth's outer core
- D) both the *P*-waves and *S*-waves are absorbed by Earth's outer core

30. The diagram below represents the analysis of a seismogram used to calculate an earthquake's magnitude on the Richter Scale. This seismogram shows the difference in arrival times, in seconds, of the first P-wave and S-wave and the amplitude of the S-wave in millimeters.



The diagram below represents how the earthquake's magnitude is determined by drawing a line connecting the difference in arrival times of the P-wave and the S-wave, and the S-wave amplitude.

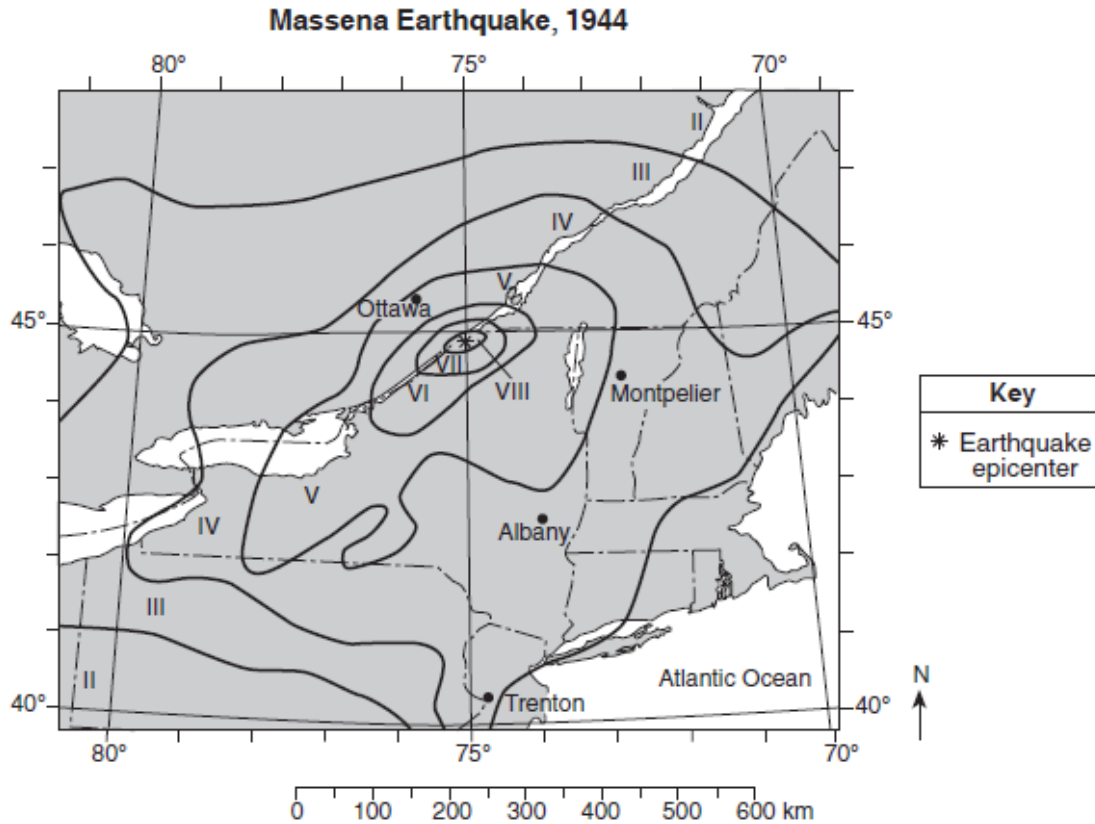


What is the magnitude of a recorded earthquake if the difference in arrival times of the first P-wave and S-wave is 2 seconds and the S-wave amplitude is 20 millimeters?

- A) 3.8 B) 2.0 C) 3.0 D) 4.8

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Base your answers to questions 31 and 32 on the map and table below and on your knowledge of Earth science. The map shows the zones of observed effects reported after a 1944 earthquake that occurred near Massena, New York. The isolines on the map are boundaries between zones of observed effects described in the Modified Mercalli Scale table. Four cities are labeled on the map.



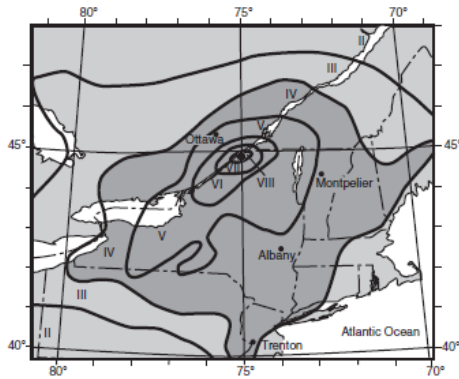
Modified Mercalli Scale

Intensity Value	Description of Observed Effects
I	Usually detected only by instruments
II	Felt by a few persons at rest, especially on upper floors
III	Hanging objects swing; vibration like passing of truck; noticeable indoors
IV	Felt indoors by many, outdoors by few; sensation like heavy truck striking building; parked automobiles sway
V	Felt by nearly everyone; sleepers awakened; liquids disturbed; unstable objects overturned; some dishes and windows broken
VI	Felt by all; many frightened and run outdoors; some heavy furniture moved; glassware broken; books off shelves; damage slight
VII	Difficult to stand; noticed in moving automobiles; damage to some masonry; weak chimneys broken at roofline
VIII	Partial collapse of masonry; chimneys, factory stacks, columns fall; heavy furniture overturned; frame houses moved on foundations

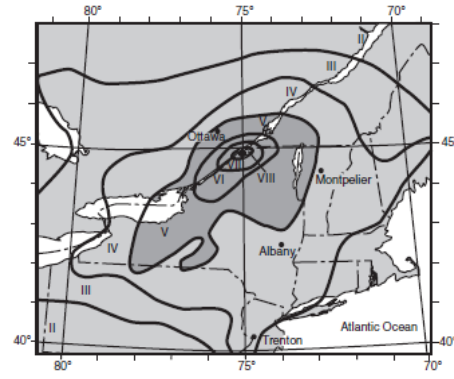
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30. Based on the Modified Mercalli Scale, the darker shading on which map shows the area where the Massena earthquake was felt by nearly everyone?

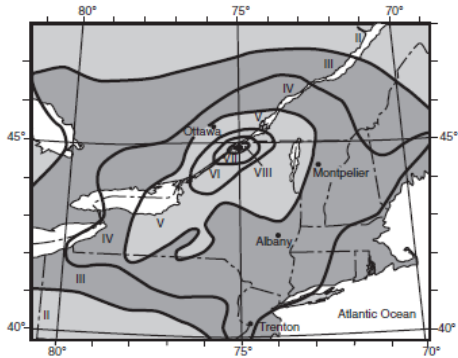
A)



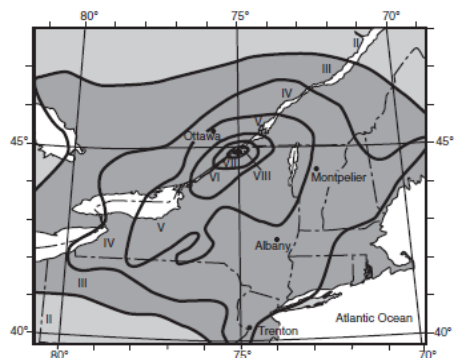
B)



C)



D)



32. How long did it take for the first *P*-wave to travel from the epicenter of this earthquake to a seismic station in Trenton, New Jersey?

A) 1 minute 10 seconds

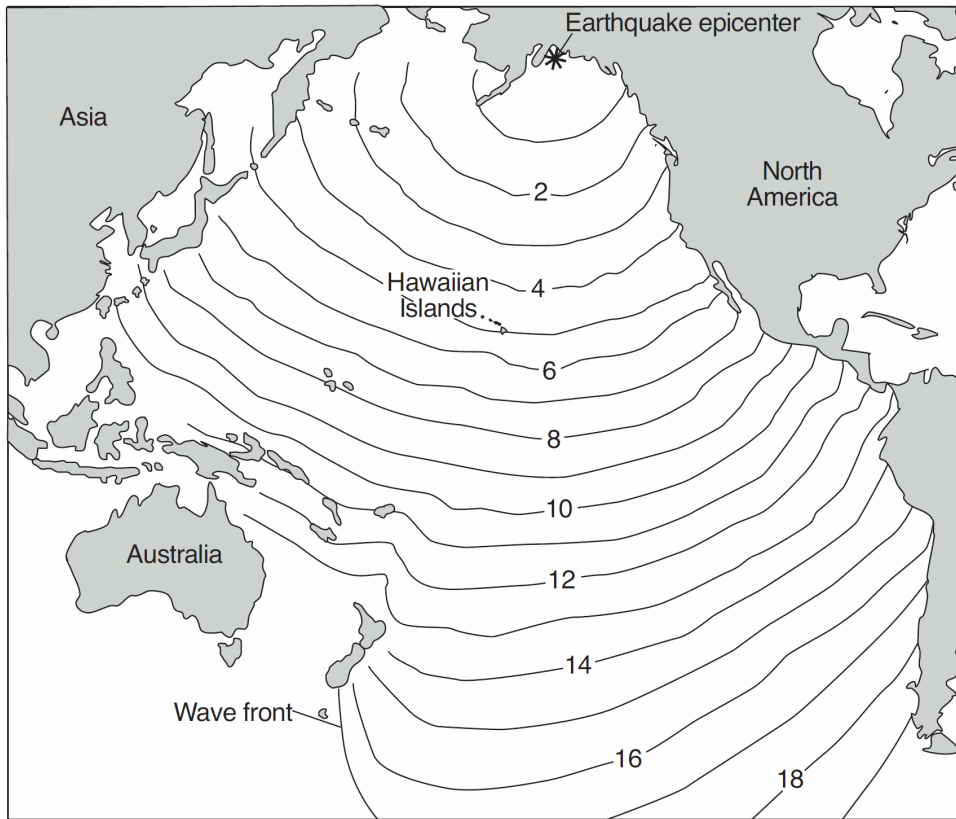
B) 2 minutes 10 seconds

C) 3 minutes 20 seconds

D) 4 minutes 20 seconds

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33. The map below shows changes in the position of the tsunami wave front produced by the 1964 Alaskan earthquake. The numbers indicate the time, in hours, for the wave front to reach the positions indicated by the isolines.



If the wave front reached the Hawaiian Islands at 10:30 p.m., at approximately what time did the earthquake occur?

- A) 1:30 p.m. **B) 5:30 p.m.** C) 3:30 p.m. D) 4:30 p.m.

Answer Key
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1. **C**
 2. **C**
 3. **A**
 4. **B**
 5. **B**
 6. **B**
 7. **A**
 8. **B**
 9. **A**
 10. **C**
 11. **B**
 12. **B**
 13. **B**
 14. **A**
 15. **B**
 16. **B**
 17. **A**
 18. **B**
 19. **C**
 20. **A**
 21. **A**
 22. **A**
 23. **C**
 24. **B**
 25. **A**
 26. **A**
 27. **B**
 28. **A**
 29. **B**
 30. **C**
 31. **B**
 32. **A**
 33. **B**
-