Name: _____ Class: _____ Date: _____ ID: A

Earthquakes Short Study Guide

Multiple Choice

Identify the letter of the choice that best completes the statement or answers the question.

____ 1. ____ and the amount of strain released during the last quake are used in earthquake probability studies.
a. Seismic belts
b. Strain accumulation
c. Fault scarps
d. Tsunamis

____ 2. On a seismometer, vibrations of the ground do not move the ____.
a. frame
b. spring
c. recording drum
d. suspended mass

____ 3. A ____ fault forms as a result of horizontal compression.
a. blind
b. normal
c. strike-slip
d. reverse

____ 4. The San Andreas Fault, a result of horizontal shear, is a ____ fault.
a. blind
b. normal
c. strike-slip
d. reverse

____ 5. The locations of seismic belts are determined by plotting ____.
a. earthquake epicenters
b. seismic gaps
c. earthquake foci
d. epicentral distances

____ 6. A numerical scale of earthquake magnitude that takes into account the size of the fault rupture is the ____.
a. Richter scale
b. modified Mercalli scale
c. moment magnitude scale
d. epicentral distance scale

____ 7. Deaths associated with earthquake deaths in sloping areas can result from ____.
a. tsunamis
b. landslides
c. formation of fault scarps
d. surface ruptures

Matching

Match each item with the correct description below. You may use a term more than once.

a. surface wave
b. P-wave
c. S-wave

____ 8. Does not pass through Earth's liquid outer core
____ 9. Does not pass through Earth's interior at all
____ 10. Squeezes and pulls rocks in same direction as the save travels
____ 11. Is refracted by Earth's core
____ 12. Absence of this kind of waves results in a shadow zone

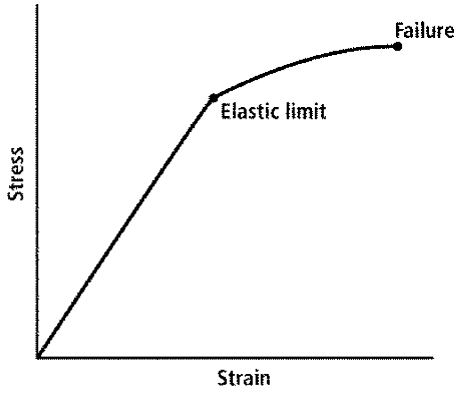
Short Answer

13. Explain the relationship between elastic strain, ductile deformation, and failure.
14. Explain how earthquake magnitude differs from intensity, and which value is more important to a community.
15. In terms of strain, explain why an earthquake is more likely at a seismic gap than at another location.
16. What are the two main factors that determine the probability that an earthquake will occur, and why are they important?

Compare and contrast each pair of related terms or phrases.

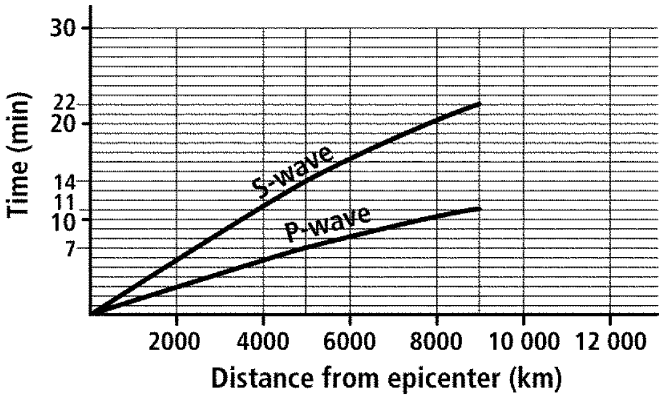
17. primary wave, secondary wave
18. Richter scale, moment-magnitude scale

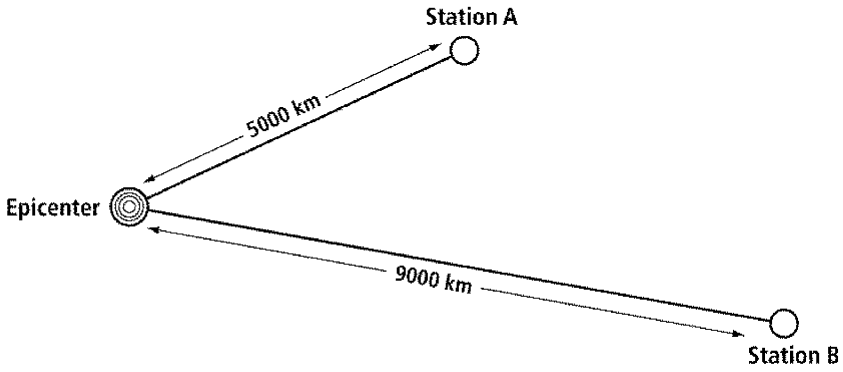
Study the diagram. Then answer the questions.



19. Describe what the graph shows. Then identify what the straight and curved segments of the line represent.
20. Explain how scientists have inferred the physical states of Earth's inner and outer cores using seismic data.
21. Describe the global pattern of earthquake distribution and what causes it.

An earthquake occurred, and seismic waves were detected by seismic stations A and B as shown below. Examine the diagram and the travel-time graph. Then answer the questions.





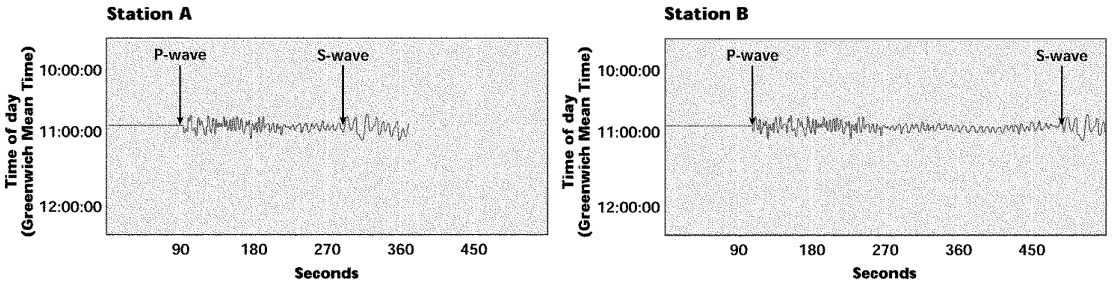
22. About how long did it take for the first P-waves to reach station A?
23. About how long did it take for the first S-waves to reach station A?
24. About how long did it take for the first P-waves to reach station B?
25. Can the exact location of the earthquake be determined from the data reported by the two stations? Why or why not?

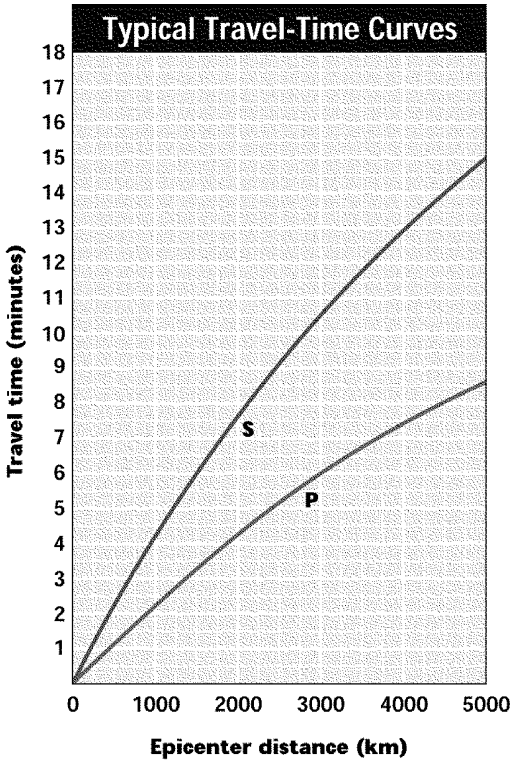
Based on the observations and related facts from the Completion section, how should the scientist answer the following questions? Support your answers with the appropriate observations and related facts about earthquakes.

26. Does the town have a high probability of experiencing an earthquake in the near future?
27. Should the proposed road system go through as planned? If not, what do you suggest should be done differently?
28. Compared to existing ones, how should the construction of new structures be altered, and why?
29. How might existing structures built in the newer part of town fare during an earthquake, and why?

Problem

30. A single earthquake produced seismograms at two different stations, A and B, as shown below.





Which station was closer to the earthquake, and how can you tell? Use the travel-time curve to estimate the distance from each station to the earthquake's epicenter.

Earthquakes Short Study Guide
Answer Section

MULTIPLE CHOICE

1. B
2. D
3. D
4. C
5. A
6. C
7. B

MATCHING

8. C
9. A
10. B
11. B
12. B

SHORT ANSWER

13. Low stresses applied to a material result in elastic strain—deformation that is reversible. When stress exceeds a certain value, the material undergoes permanent ductile deformation. If stress is increased to a point beyond the strength of the material, the material fails.
14. Magnitude is a measure of the energy released by the earthquake, while intensity is a measurement that reflects the damage done to structures involved. Intensity would be of more concern to a community because it reflects damage to buildings and other structures, which may cause loss of life.
15. A seismic gap lies along an active fault line. Therefore strain is accumulating at a steady rate and at some point, strain will become too great and an earthquake will occur.
16. The probability of an earthquake is a function of the history of earthquakes in the area and the rate at which strain builds up in the rocks. Knowledge of these two factors aids in the study of earthquake predictions, which someday may be commonplace, thus reducing the number of injuries and deaths.
17. A primary wave is a seismic wave that squeezes and pulls rock in the same direction along which the wave travels. A secondary wave causes rock to move at right angles to the direction along which the wave travels.
18. The Richter scale rates magnitude based on the size of the largest seismic waves generated, while the moment-magnitude scale takes into account the size of the fault rupture, the amount of movement along a fault, and the stiffness of the rock.
19. The graph shows a stress-strain curve, which represents the stress applied to a material plotted against the resulting strain. The straight segment represents the elastic strain of the material, and the curved segment represents its ductile deformation.

20. S-waves are not transmitted through liquid, and the observation that S-waves disappear as they strike the outer core led scientists to infer that the outer core is liquid. Studies of the refraction and reflection of P-waves by the inner core have indicated that the inner core is solid.
21. Most of the world's earthquakes are located in relatively narrow seismic belts associated with tectonic plate boundaries. Forces that cause plate motion exert stress on the rocks making up the plates. To relieve this stress, the rocks bend and sometimes snap, causing earthquakes.
22. 7 minutes
23. 14 minutes
24. 11 minutes
25. No; each station's data can only indicate how far away the earthquake was, thus contributing a set of possible locations lying on a circle centered around each station. The intersection of two such circles would produce two possible earthquake locations. Data from a third station are needed to pinpoint the epicenter.
26. Yes; most earthquakes occur in seismic belts, and the town is located in one. The area has experienced one earthquake per century, on average, and it has been more than 100 years since the last one. Earthquakes are the result of strain, and the area's seismic gap suggests that significant strain has accumulated.
27. No; elevated roads should not be built on fill, which amplifies seismic waves. The roads could be rerouted, or the elevated portions could be redesigned to run at ground level.
28. New construction should take seismic risk into account. For example, buildings might be reinforced or built on rubber structures that absorb vibrations, or built of wood, which is more resilient and less brittle than concrete.
29. Most structures would probably be badly damaged because the wet, sandy soils they are built on likely would undergo liquefaction during an earthquake.

PROBLEM

30. The seismograms show that Station A recorded the P-wave sooner than Station B. The P-S separation at Station A is less than at station B. Station A is closer to the earthquake than Station B. The epicenter distance is determined by calculating the P-S separation for each station on the seismograms. These must be then converted from seconds into minutes. By comparing P-S separations for each station on the travel-time curve, it can be determined that Station A is about 2 000 km from the earthquake's epicenter, while station B is about 5 000 km from the epicenter.