

Chapter 7 – Earthquake Hazards Practice Exam and Study Guide

1. Select from the following list, all of the factors that affect the intensity of ground shaking.
 - a. The magnitude of the earthquake
 - b. Rather or not the moon is full
 - c. The distance from the epicenter
 - d. The angle between a fault and the maximum principal stress direction
 - e. The local geological conditions
2. What kinds of materials amplify ground shaking?
 - a. Hard rocks
 - b. Rocks with a foliation
 - c. Plutonic rocks
 - d. Soft soils and sediments
 - e. Metamorphosed sedimentary rocks
3. How far from Mexico City was the epicenter for the so called 1985 Mexico City earthquake?
 - a. ~100 km
 - b. ~200 km
 - c. ~300 km
 - d. ~400 km
 - e. ~500 km
4. Along what kind of a plate boundary did the 1985 Mexico City earthquake occur: convergent, divergent, or transform?
5. What was the magnitude of the 1985 Mexico City earthquake?
 - a. 6.0
 - b. 7.0
 - c. 7.5
 - d. 8.0
 - e. 8.5
6. What kind of a geological feature is Mexico City built on?

7. On the modified Mercalli intensity scale, how large was the 1985 Mexico City earthquake?
 - a. VII
 - b. VIII
 - c. IX
 - d. XI
 - e. X

8. How many lives were lost during the 1985 Mexico City earthquake?
 - a. 5,000
 - b. 9,000
 - c. 10,000
 - d. 9,500
 - e. 8,000

9. The significant proportion of the damage to 2,831 buildings during the 1985 Mexico City earthquake is attributed to _____ of ground shaking by the soft lake bed sediments and overlying soils.

10. What is liquefaction?

11. Select from the following list the factors that must be in place before liquefaction can occur?
 - a. Loose, granular sediment and/or soil must be present
 - b. There must be enough ground water present to saturate sediment and/or soils
 - c. Ground shaking must be sufficiently intense that grains within water saturated sediment and/or soil lose contact with each other
 - d. Hard rocks that ring during ground shaking must be present
 - e. Fractures within hard rock must be filled with ground water

12. What can happen to large structures that are built on materials that liquefy during an earthquake?

13. What was the magnitude of the 1906 San Francisco Earthquake?
- 7.0
 - 7.5
 - 7.7
 - 7.8
 - 7.9
14. In San Francisco and in adjacent communities what was the modified Mercalli intensity level for the 1906 earthquake?
- VI – VII
 - VIII-IX
 - X – XI
 - XI-XII
 - V-VI
15. How many lives were lost during the 1906 San Francisco earthquake?
- 1000
 - 2000
 - 3000
 - 4000
 - 5000
16. What is the likely culprit that broke gas lines and thus started the horrendous fires during the 1906 San Francisco earthquake?
17. Of the total destruction during the 1906 San Francisco earthquake, how much is attributed to fires?
18. What were two areas greatly affected by liquefaction during the 1906 San Francisco earthquake?
- Golden Gate Heights
 - Market Street
 - Mission District
 - Richmond District
 - Sunset District

19. How did liquefaction contribute to the fires in the 1906 San Francisco earthquake?
20. The August 17, 1999, M_w 7.4 Izmit earthquake in Turkey occurred along what fault?
- South Anatolian fault
 - North Anatolian fault
 - East Anatolian fault
 - West Anatolian fault
 - None of the above
21. The August 17, 1999 Izmit earthquake left how many people dead?
- 17,000 – 50,000
 - 10,000 – 40,000
 - 17,000 – 40,000
 - 40,000 – 50,000
 - 30,000 – 40,000
22. List below four different types of manmade and natural objects that were affected by surface ruptures during the August 17, 1999 Izmit earthquake.
23. Where did the M_w 9.3 earthquake of 26 December 2004 originate?
24. How many people lost their lives during the 26 December 2004 Sumatra earthquake and tsunami?
- >500,000
 - <200,000
 - <150,000
 - >225,000
 - <225,000
25. How does NOAA define a tsunami?
26. Major tsunamis are produced by large, greater than _____ magnitude earthquakes with a shallow focus lying less than _____ kilometers deep.

27. Along what kind of plate boundary do major tsunamis form?
28. During subduction, does the subducting plate always slide smoothly beneath the overriding plate?
29. What happens when the stress around the stuck interface between the subducting and overriding plates exceeds the resistance to shearing along this interface?
30. What kinds of faults are common along convergent margins: strike-slip, normal, or reverse?
31. During displacement along a reverse fault in a submarine subduction zone setting, what happens to the sea floor?
32. As the hanging wall moves up and over the footwall block along a major subduction zone fault, what happens to the sea surface immediately above the rising sea floor?
33. A tsunami is a series of waves radiating outward from a central disturbance of the sea surface. What is the series of waves radiating outward called?
34. In the deep oceans wavelengths for tsunami range from
 - a. 100 m to over 500 km
 - b. 50 m to over 1 km
 - c. 100 m to ~10 km
 - d. 1000 m to ~10 km
 - e. 20 m to 1000 m
35. In the deep oceans periods for tsunami range from
 - a. 10 minutes to 2 hours
 - b. 5 minutes to a half hour
 - c. 30 minutes to an hour
 - d. 5 hours
 - e. None of the above

36. In the deep oceans wave heights are typically less than
- 3 m
 - 2 m
 - 1 m
 - 10 m
 - 12 m
37. What does the following formula represent: $s = (g*d)^{1/2}$?
- Wave height in shallow water
 - Wave height in deep water
 - Speed of a tsunami
 - Period of a tsunami
 - None of the above
38. The speed of a tsunami in deep water can exceed _____ km/hour.
39. What does the following formula represent: $H_s = (S_d/S_s)^{1/2} * H_d$?
40. Will the speed of a tsunami in shallow water ever be greater than its speed in deep water?
41. Will the ratio S_d/S_s ever be less than 1?
42. What does your answer to question #41 imply about the height of a tsunami in shallow water relative to its height in deep water?
43. What is the period of a tsunami?
44. Does the period change as a tsunami moves from deep to shallow water?
45. Another way to define the speed of a tsunami is as follows: λ/P . If the period does not vary but the speed of a tsunami decreases in shallow water, then what has to happen to its wavelength, λ ?

46. What is drawdown?
47. What is runup?
48. What low lying seaside community was nearly completely destroyed by runup during the December 2004 Sumatra tsunami?
49. Where did the 1964 M_w 9.2 Good Friday earthquake occur?
50. How much uplift was associated with the Good Friday earthquake?
51. What is the largest recorded earthquake to ever occur in North America?
52. How many people were killed by tsunamis generated by the earthquake?
- 10
 - 20
 - 100
 - 106
 - None
53. What was the wave height of the largest tsunami, and where did it occur?
54. The tsunami generated by the 1964 Good Friday earthquake traveled across the Pacific Ocean at speeds of _____ per hour.
55. How many waves came ashore at Crescent City, California as a result of the 1964 Good Friday earthquake?
- 1
 - 2
 - 3
 - 4
 - 5

56. How long did it take the tsunami generated by the 1964 Good Friday earthquake to reach Crescent City?
- 1.1 hour
 - 2.1 hours
 - 3.1 hours
 - 4.1 hours
 - 5.1 hours
57. The four waves making up the wave train of the tsunami generated by the 1964 Good Friday earthquake arrived at Crescent City, California at different times. How much time had lapsed between the first and fourth waves coming ashore at Crescent City?
- 1 hour
 - 2 hours
 - 3 hours
 - 4 hours
 - 5 hours
58. The four waves making up the wave train of the tsunami generated by the 1964 Good Friday earthquake all had different wave heights. The fourth wave turned out to be the largest. What was its wave height?
- ~1 m
 - ~3 m
 - ~6 m
 - ~8 m
 - ~10 m
59. How many people lost their lives at Crescent City during the Good Friday 1964 tsunami?
- 2
 - 4
 - 6
 - 11
 - 13
60. Has Crescent City been struck by other tsunamis? Is it safe from future tsunamis?
61. What two plates does the Cascadia Subduction Zone separate?

62. On January 26, 1700 approximately how much of the Juan de Fuca microplate slipped suddenly beneath the overriding North American plate?
- a. 5 m
 - b. 10 m
 - c. 15 m
 - d. 20 m
 - e. 25 m
63. The earthquake produced by January 26, 1700 Cascadia Subduction Zone event is estimated to have been between an _____ and _____ magnitude.
64. The largest earthquake to have ever affected the continental United States occurred where and when?
65. Did the 1700 Cascadia Subduction Zone earthquake generate a tsunami? If so, then what distant island did it strike?
66. It is estimated that over the last 3,500 years *great* earthquakes may have occurred at least seven times in the Cascadia Subduction Zone. This would represent a recurrence interval of about 300-600 years. When is the next great earthquake expected in the offshore region of Seattle and Tacoma, Washington?

Answers

1. a. The magnitude of the earthquake, c. The distance from the epicenter, e. The local geologic conditions
2. d. Soft soils and sediments
3. d. ~400 km
4. convergent
5. d. 8.0
6. an ancient lake bed
7. c. IX
8. d. 9,500
9. amplification
10. The process by which a solid takes on a liquid-like state.

11. a. Loose, granular sediment and/or soil must be present, b. There must be enough ground water present to saturate sediment and/or soil, c. Ground shaking must be sufficiently intense that grains within water saturated sediment and/or soil lose contact with each other
12. They commonly partially sink into it, resulting in a tilted or leaning structure.
13. d. 7.8
14. b. VIII-IX
15. c. 3000
16. ground shaking
17. 90%
18. b. Market Street, c. Mission District
19. It resulted in broken water lines, and thus inhibited the ability to fight the fires
20. b. North Anatolian fault
21. c. 17,000 – 40,000
22. Tree trunks were split, and roads, fences, and lines of trees were offset
23. Off the NW shore of Sumatra
24. d. >225,000
25. According to NOAA a tsunami is a set of ocean waves caused by any large, abrupt disturbance of the sea-surface.
26. 7.0, 30
27. Convergent
28. No, it sometimes sticks
29. The subducting plate commonly slides abruptly downward.
30. Reverse
31. It rises toward the sea surface
32. It is suddenly and abruptly raised
33. A wave train
34. a. 100 m to over 500 km
35. a. 10 minutes to 2 hours
36. c. 1 m
37. c. Speed of a tsunami
38. 966
39. The height of a tsunami in shallow water
40. No, the tsunami always slows down in shallow water
41. No – the speed of a tsunami in deep water, S_d , will always be greater than its speed in shallow water, S_s .
42. The height of the tsunami in shallow water, H_s , will always be greater than its height in deep water, H_d .
43. The period is the time it takes for two successive troughs or crests to pass a stationary point.
44. No, the period does not change
45. The wavelength, λ , is the distance between two successive crests of a tsunami. If the period does not change, but the speed decreases, then according to the formula speed = λ /Period, the wavelength must decrease.

46. Drawdown is the sudden drop in sea level as a tsunami approaches a shoreline.
47. Runup is the maximum vertical height above normal high tide reached by a tsunami as it travels over the land surface.
48. Banda Aceh, NW tip of Sumatra.
49. Alaska and specifically northern Prince William Sound.
50. 15 meters
51. The 1964 Good Friday earthquake with a M_w of 9.2 is the largest ever recorded in North America.
52. d. 106
53. The wave height of the largest tsunami was ~67 meters or ~220 feet. It occurred in Shoup Bay.
54. ~666 km or ~600 miles
55. d. 4
56. d. 4.1 hours
57. b. 2 hours
58. c. ~6 m (~20-21 feet)
59. d. 11
60. Yes, Crescent City has been struck by tsunami prior to the 1964 event and most recently in 2006. It is not safe from such events, and will continue to be struck by tsunamis generated by earthquakes in distant subduction zones like those lying offshore Alaska and Japan.
61. The Juan de Fuca microplate and the North American plate
62. d. ~20 m
63. 8.7, 9.2
64. January 26, 1700 in the Cascadia Subduction Zone
65. Yes, the earthquake generated a tsunami that traveled across the Pacific Ocean where it caused some damage in Japan.
66. The next *great* earthquake is expected anytime between 2000 and 2300.