

Mass Wasting, Tsunamis and Floods: Mastery Check

Learning target: I can explain what controls slope failure, tsunami speed and height, and flood chances, use data to forecast hazards, and match mitigation to the warning time a hazard gives.

Retrieval and mastery check

About 35 min

Individual

MS-ESS3-2 · assesses

MS-ETS1-3 · supports

independent practice

writing

Name _____

Date _____

Period _____

Directions

Answer every item on your own. For multiple-choice items, circle one letter. For numeric items, show your calculation and include units. For the drawing, label every part. Part B asks you to pull the whole chapter together; plan your answer before you write.

You will need: This worksheet, Pencil, Calculator

Part A: Retrieval (items 1-11)

1. Which change would make a hillside **most** likely to fail? 2 pts
 - ☐ A. Planting deep-rooted shrubs across it
 - ☐ B. A week of storms that saturates its soil
 - ☐ C. A long, dry summer
 - ☐ D. Cutting the slope back to a gentler angle
2. Give two ways that saturated soil is weaker than dry or damp soil, and name the force that then moves the slope. 3 pts

3. Fence posts on a hillside lean a little farther downhill each year, and tree trunks curve at their bases. Which kind of mass wasting is this? 2 pts
 - ☐ A. Rock fall
 - ☐ B. Debris flow
 - ☐ C. Creep
 - ☐ D. Storm surge

4. Over ocean about 4,000 m deep, a tsunami travels about 700 km/h. An undersea earthquake strikes at 9:00 p.m. How long will the first wave take to reach an island 2,100 km away across water of that depth, and at what time should it arrive? 3 pts

5. Why does a tsunami grow much taller as it reaches the coast? 2 pts

- ☐ A. Wind near the shore adds energy to it.
- ☐ B. It slows down in shallow water, so the back of the wave catches up with the front and the water piles up.
- ☐ C. The Moon's pull is strongest near land.
- ☐ D. Rivers add their water to it at the coast.

6. Early DART stations had 'data dropouts,' when readings from the seafloor sensor did not reach the buoy. How did engineers make the system reliable? 2 pts

- ☐ A. They moved the pressure sensor up to the ocean surface.
- ☐ B. They combined three fixes: a wider sound beam from the acoustic modem, a tiltmeter to check the sensor's alignment, and software that asks for lost data to be sent again.
- ☐ C. They moved every station into shallow water near the coast.
- ☐ D. They removed the buoys and relied on seismometers alone.

7. In 2011, waves from the earthquake off Japan reached Crescent City, California, about 10 hours after the quake, but they reached the coast of northeastern Japan within minutes. Explain the difference and what it meant for warnings. 3 pts

8. True or false: 'Our river had a 50-year flood last spring, so the chance of a flood that big this year is less than 2 percent.' Circle your answer and explain. 2 pts

☐ True ☐ False Explain your thinking:

9. A streamgage has 39 years of annual peak flows. The third-largest peak in the record has rank $m = 3$. Use $T = (n + 1) \div m$ to find its recurrence interval, then find the chance of a flood at least that big in any one year. 3 pts

10. Draw a cross-section of a hillside above a road after a week of heavy rain. Show and label: the saturated zone in the soil, a clay layer or bedrock below it, the surface along which the slope is likely to slide, an arrow for the direction of movement, and one mitigation (such as a drain or a retaining wall) placed where it would work.

4 pts



11. Which statement is a **forecast**, not an exact prediction?

2 pts

- ☐ A. A debris flow will reach Elm Street at 3:15 a.m. on Tuesday.
- ☐ B. Canyons below this burn scar have a high chance of debris flows this winter if rain falls harder than 24 mm per hour for 15 minutes.
- ☐ C. Landslides never happen in July.
- ☐ D. The next 100-year flood will come in 2124.

Part B: Synthesis (item 12)

12. A coastal California town has a steep, cracked hillside above Main Street, a river running through downtown and a small harbor. Choose **two** of the three hazards it faces (landslide, river flood, tsunami). For each one: (a) name the data scientists would use to forecast it, (b) say how much warning the town could expect, and (c) describe one mitigation that fits that warning time. End with one or two sentences explaining why the town should combine several defenses instead of relying on one.

8 pts

Synthesis planner

Before writing item 12, make a small table on scrap paper with two rows (your two hazards) and three columns: Data, Warning time, Mitigation. For warning time, choose from: none or seconds, minutes, hours, days, or 'where but not when.' Fill every cell with a few words, then turn each row into two or three sentences.

Write a question that fools people

Write one new multiple-choice question about this chapter whose wrong answers are based on real misconceptions, such as 'tidal wave,' 'the flood is due' or 'water lubricates slopes.' Give the correct answer and explain why each wrong option would tempt someone. Then trade with a classmate and check whether their question has exactly one defensible answer.