

Mastery Check: Evidence, Plates and Rates

Learning target: I can recall the key evidence, structures and processes of plate tectonics, compute distances from plate rates, and explain how the evidence turned a hypothesis into a theory.

Retrieval and mastery check

About 40 min

Individual

MS-ESS2-3 · assesses

MS-ESS2-2 · supports

MS-ETS1-1 · practice

independent practice

writing

Name _____

Date _____

Period _____

Directions

Work alone. Part A has twelve short items of mixed types; answer every one, and show all calculations with units. Part B is one short synthesis paragraph. Multiple-choice items have exactly one best answer. Where a sketch is asked for, label it clearly; neatness is not graded, accuracy is.

You will need: This worksheet, Pencil, Calculator

Part A: Retrieval (12 items)

1. In the 1920s most geologists set Wegener's continental drift hypothesis aside mainly because:

- ☐ A. his fossil evidence turned out to be fake
- ☐ B. he could not explain what force could move a continent
- ☐ C. the continents do not actually fit together
- ☐ D. nobody had found matching rocks on different continents

2. Which of the following was **not** available to Wegener as evidence in 1915?

- ☐ A. The same fossil reptile in South America and Africa
- ☐ B. Old rock belts that match across the Atlantic
- ☐ C. Drill cores showing seafloor ages increasing away from the ridge
- ☐ D. The rough fit of the coastlines of South America and Africa

3. True or false: The mantle beneath the lithosphere is liquid magma, and the plates float on it. Explain your answer in one sentence.

- ☐ True ☐ False Explain your thinking:

4. Name **two** seafloor structures that sonar mapping revealed, and for each say what it tells us about plate motion.

5. Volcanic rocks at Pinnacles National Park in California formed about 23 million years ago and have since been carried about 315 km along the San Andreas Fault from rocks of the same age that stayed on the other side. Calculate the average rate of motion in kilometers per million years, then convert it to centimeters per year. Show every step.

6. A drilling ship cores the seafloor at the crest of a mid-ocean ridge, 300 km from it, and 900 km from it. Which core holds the **youngest** volcanic rock?

- ☐ A. The core from 900 km away, because it has had the most time to form
- ☐ B. The core from 300 km away, because it is in the middle
- ☐ C. The core from the crest, because new seafloor forms there
- ☐ D. They are all the same age, because the ocean floor formed at once

7. The southern Red Sea is widening at about 15 mm per year. How much wider will it be in 2 million years? Give your answer in kilometers and show the conversion (1 km = 1,000,000 mm).

8. Fill in the three boundary types: where plates move apart, the boundary is ____; where they move toward each other, it is ____; where they slide past each other, it is ____.

9. A team designing a seafloor drill ship writes two statements: (i) 'The ship must be able to pull up a core without breaking it or mixing its layers.' (ii) 'The ship must be built with the drilling technology that exists this year.' Label each one a **criterion** or a **constraint** and explain the difference in one sentence.

10. Sketch a cross-section from a mid-ocean ridge on the left to a trench on the right. Label the ridge, the trench, the youngest seafloor, the oldest seafloor, and draw arrows showing the direction the seafloor moves on each side of the ridge.



11. Which statement best describes the difference between continental drift and plate tectonics?
- ☐ A. Continental drift is a theory; plate tectonics is a hypothesis.
 - ☐ B. Continental drift says the continents moved; plate tectonics also explains how, through plates that form at ridges and sink at trenches.
 - ☐ C. They are the same idea with two names.
 - ☐ D. Plate tectonics says the continents are fixed and only the ocean floor moves.
12. New seafloor forms at mid-ocean ridges all the time. Explain in two sentences why Earth is not getting bigger, naming the structure and the process involved.

Part B: Synthesis

13. In four to six sentences, explain how the idea that continents move went from a hypothesis to a theory. Your paragraph must name at least **three** different lines of evidence (choose from fossils, rock belts, continental shapes, earthquake belts, seafloor structures and seafloor ages), state what each one shows, and explain what the seafloor evidence added that Wegener did not have.

Rate problems in one pattern

Every rate problem on this sheet is the same pattern: $\text{distance} = \text{rate} \times \text{time}$, or $\text{rate} = \text{distance} \div \text{time}$. Write the three quantities with their units before you calculate, decide which one is missing, and do the unit conversion as a separate line. For q5 you have distance (315 km) and time (23 million years) and want the rate. For q7 you have the rate (15 mm per year) and the time (2 million years) and want the distance.

Check the textbook

Our textbook gives the rate of motion along the San Andreas Fault as about 5 millimeters per year, while the U.S. Geological Survey gives about 5 centimeters per year for the Pacific and North American plates moving past each other. Using your Pinnacles answer from q5, decide which figure is more believable, and explain your reasoning. Then explain why the Pinnacles rate (an average over 23 million years along one fault) could still be lower than the USGS plate rate even if both numbers are correct.