Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Block \_\_\_\_ Binder Page # \_\_\_\_

***P-Wave and S-Wave Travel Time Practice (Tutorial)***

**1) Travel Time** of a P-wave or S-wave, given the distance.

(a) Find distance on X-axis, go up to the correct curve

(b) Go over to the Y-axis and find **travel time**

Ex 1. How long does it take a P-wave to travel 4,000 km? \_\_\_\_\_\_\_\_ Minutes \_\_\_\_\_\_\_\_ seconds

Ex 2. How long does it take an S-wave to travel 4,000 km? \_\_\_\_\_\_\_\_ Minutes \_\_\_\_\_\_\_\_ seconds

Ex 3. How long does it take a P-wave to travel 8,000 km? \_\_\_\_\_\_\_\_ Minutes \_\_\_\_\_\_\_\_ seconds

Ex 4. How long does it take an S-wave to travel 8,000 km? \_\_\_\_\_\_\_\_ Minutes \_\_\_\_\_\_\_\_ seconds

**2) Epicenter Distance** a P-wave or S-wave traveled, given travel time

(a) Go to travel time on Y-axis and go over to correct curve

(b) Go down to X-axis to determine distance

Ex 5. How far can an S-wave travel in 9 minutes? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ km

Ex 6. How far can a P-wave travel in 9 minutes? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ km

Ex 7. How far can an S-wave travel in 6 minutes 40 seconds? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ km

Ex 8. How far can a P-wave travel in 6 minutes 40 seconds? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ km

**3) Origin Time** (the time the earthquake occurred)….

1. Determine **travel time** of the given wave
2. ***Subtract* arrival time given** minus **travel time**

Ex 9. If a P-wave arrives at a station 8,000 km away at 12:15:00, what time did the earthquake originate?

\_\_\_\_\_\_\_\_:\_\_\_\_\_\_\_\_\_:\_\_\_\_\_\_\_\_\_

- \_\_\_\_\_\_\_\_:\_\_\_\_\_\_\_\_\_:\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_ : \_\_\_\_\_\_\_\_ : \_\_\_\_\_\_\_\_

Ex 10. If an S-wave arrives at a station 4,400 km away at 07:45:00, what time did the earthquake originate?

\_\_\_\_\_\_\_\_:\_\_\_\_\_\_\_\_\_:\_\_\_\_\_\_\_\_\_

* \_\_\_\_\_\_\_\_:\_\_\_\_\_\_\_\_\_:\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_ : \_\_\_\_\_\_\_\_ : \_\_\_\_\_\_\_\_

**4) Difference in Arrival Time** between P-waves and S-waves, given the epicenter **distance**

1. Line up paper vertically on the distance given
2. Mark paper where S and P waves intersect

(c) Line up paper on Y-axis, P wave on 0 minute mark

(d) S-wave mark indicates the difference in arrival time

Ex 11. An epicenter station is 5,000 km away. How long after the first P-wave did the first S-wave arrive?

\_\_\_\_\_\_\_\_ Minutes \_\_\_\_\_\_\_\_ seconds

Ex 12. An epicenter station is 7,600 km away. How long after the first P-wave did the first S-wave occur?

\_\_\_\_\_\_\_\_ Minutes \_\_\_\_\_\_\_\_ seconds

**5) Epicenter Distance using the difference in arrival time of P-wave and S-wave**

(a) Find difference in clock time between P-wave and S-wave by subtracting the given times

(b) Use Y-axis (time travel) and scrap paper to mark the time difference

(c) Slide scrap paper along graph to find location where the interval is touching both the P and S wave line

(d) Find epicenter distance by going down to the X-axis

Ex 12. The first P-wave arrived at a seismic station at 10:00:00. The first S-wave arrived at the same seismic station at 10:08:40. How far is this seismic station from the epicenter?

\_\_\_\_\_\_\_\_:\_\_\_\_\_\_\_\_\_:\_\_\_\_\_\_\_\_\_

- \_\_\_\_\_\_\_\_:\_\_\_\_\_\_\_\_\_:\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_ : \_\_\_\_\_\_\_\_ : \_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ km

Ex 13. The first P-wave arrived at a seismic station at 06:32:20. The first S-wave arrived at the same seismic station at 06:30:20. How far is this seismic station from the epicenter?

\_\_\_\_\_\_\_\_:\_\_\_\_\_\_\_\_\_:\_\_\_\_\_\_\_\_\_

- \_\_\_\_\_\_\_\_:\_\_\_\_\_\_\_\_\_:\_\_\_\_\_\_\_\_\_

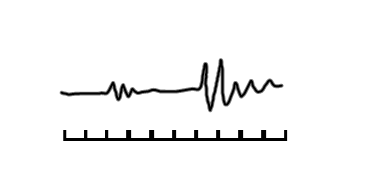
\_\_\_\_\_\_\_\_ : \_\_\_\_\_\_\_\_ : \_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ km

6) Use seismograms to determine the distance of an earthquake.

(a) Identify and Mark the arrival of the P and S waves

(b) Determine the lag time between the P and S wave

(c) Use the lag time to determine the distance from the epicenter

Ex. 14

Lag time between P and S waves

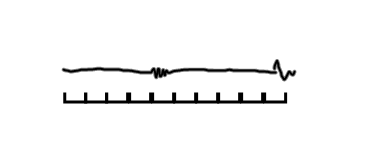
Distance from earthquake

Ex. 15

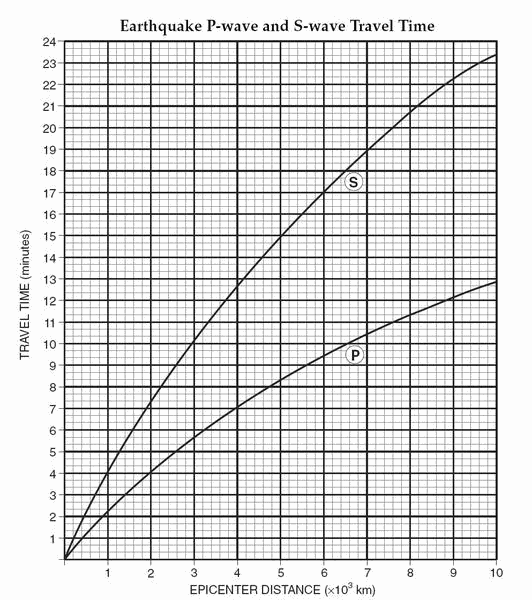
Lag time between P and S waves

Distance from earthquake

Ex. 16

Lag time between P and S waves

Distance from earthquake

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