Homework 4

Wave models, interference and diffractions

Due Friday February 1 at 5pm

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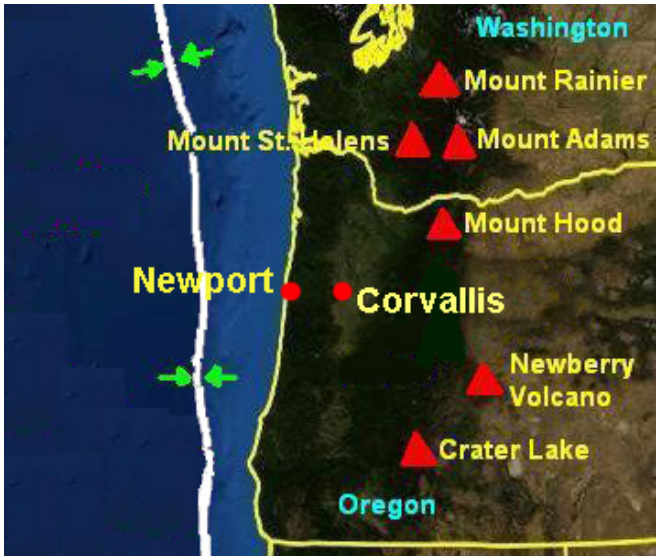
1. Frequency and wavelength
Q1B.3 from Chpt 1 of Unit Q, 3rd Edition

2. Phase speed
Q1B.6 from Chpt 1 of Unit Q, 3rd Edition

3. Earthquake warning system
A typical earthquake produces two types of seismic waves. P ("primary") seismic waves are longitudinal waves that move through the earth's upper crust with speed anywhere from 3 km/s to 5 km/s (the exact speed depends on the local composition of the earth's crust). S ("secondary") waves are transverse waves that move slower than P waves. The S-wave speed is typically $^3/_5$ of the P-wave speed in any given material. The map below shows the Cascadia subduction zone (white line) just off the coast of Oregon. In the next 50 years, there is a 30% chance that a very large earthquake will occur with an epicenter on this white line.



a) Assume there is an earthquake centered on the Cascadia subduction zone directly west of Corvallis. Estimate the time delay between the arrival of P waves and the arrival of S waves in Corvallis. Give a range of possible time delays.

> Sense making: Is this time delay long enough for our class to evacuate Weniger Hall before the arrival of S waves? (S waves are more destructive than P waves).

b) Rather than rely on P waves as a warning system, what about using standard telecommunication technology? Imagine there was a P-wave sensor in Newport that "instantly" sent a warning to Corvallis (signals can't go faster than the speed of light). Estimate the time delay between triggering the sensor and the arrival of S waves in Corvallis.

4. Dimensional analysis
Q1M.6 from Chpt 1 of Unit Q, 3rd Edition

5. Superposition (basic)
Q2B.1 from Chpt 2 of Unit Q, 3rd Edition

6. Concert flute
Q2M.1 from Chpt 2 of Unit Q, 3rd Edition

7. Public Address (PA) Speakers
Q3M.1 from Chpt 3 of Unit Q, 3rd Edition

8. Flash lights
Q3M.3 from Chpt 3 of Unit Q, 3rd Edition