

## Homework 4

*Wave models, interference and diffraction*

*Due Friday Feb 2 at 5pm*

### 1. Frequency and wavelength

Q1B.3 from Chpt 1 of Unit Q, 3<sup>rd</sup> Edition

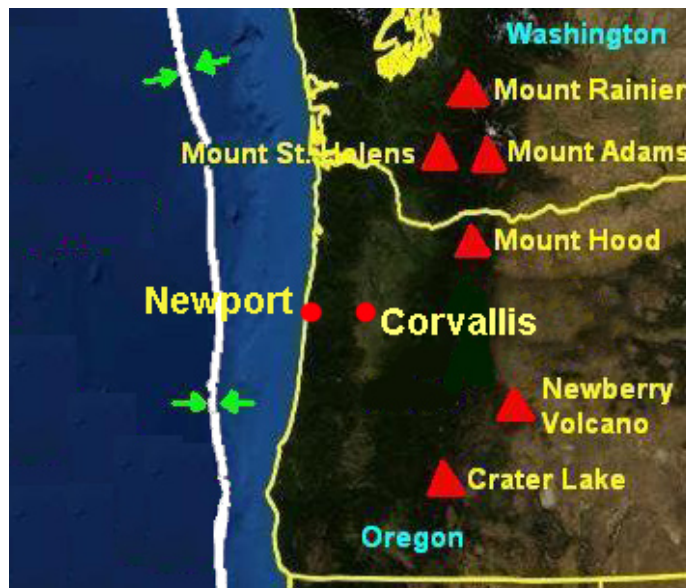
### 2. Phase speed

Q1B.6 from Chpt 1 of Unit Q, 3<sup>rd</sup> 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 3 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. The S-wave speed is typically about 60% 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 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. 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, 3<sup>rd</sup> Edition

**5. Superposition (basic)**

Q2B.1 from Chpt 2 of Unit Q, 3<sup>rd</sup> Edition

**6. Concert flute**

Q2M.1 from Chpt 2 of Unit Q, 3<sup>rd</sup> Edition

**7. Public Address (PA) Speakers**

Q3M.1 from Chpt 3 of Unit Q, 3<sup>rd</sup> Edition

**8. Flash lights**

Q3M.3 from Chpt 3 of Unit Q, 3<sup>rd</sup> Edition

**9. Two-slit interference versus N-slit interference**

Q3D.3 from Chpt 3 of Unit Q, 3<sup>rd</sup> Edition