

Homework 4

Wave models, interference and diffractions

Due Friday February 1 at 5pm

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 about 60% less than 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