

Homework 1

Due Thursday, January 31st in class

Read Chapter 1 of Jespersen and Fitz-Randolph's "From Sundials to Atomic Clocks: Understanding Time and Frequency".

Questions to think about and answer numerically. Put your answers in scientific notation, and in the units asked for:

1. How many seconds are there in a year? Show the steps in your calculations.
2. A relationship for sine waves that we will encounter is $v = f \cdot \lambda$, relating:
v: velocity (the speed of the wave, *i.e.* the distance over time that it travels),
f: frequency (the number of complete cycles of the wave per unit time),
 λ : wavelength (the distance of one complete cycle of the wave).

Two common wave velocities are that of sound in air, $v_{\text{sound}} = 344 \text{ m/s}$, and that of light in the vacuum, $c = 3.00 \times 10^8 \text{ m/s}$.

For the table below, calculate the numbers for the values left blank.

Wave	frequency	wavelength
Concert A Sound	440 Hz	18.2 cm
Lowest pitch we hear	20 Hz	m
Bat Sonar	kHz	4.30 mm
Red light	THz	623 nm
Microwave oven	2.45 GHz	mm

The best of science is an artful combination of clear argumentation, quantitative computations, and thoughtful English presentation. When you answer these questions you should strive for this high bar. It is almost never a good idea to present a computation with no words surrounding it, instead you always want to fit computations into an argument or explanation, as if you are telling the story of you answering the question.