

## Musical Instrument PBL - Summer 2008

- All waves carry energy from one place to another.
  - material/matter is NOT carried from one place to another.
  - All waves require a source of vibration! (even light - vibrating electrons)
- Students know how to identify transverse and longitudinal waves in mechanical media, such as springs, ropes, and on the earth.
  - suspended slinky to show difference
  - transverse: strings
  - longitudinal: sound waves in air (pressure) in tubes/wind instruments
  - why do we represent long waves as transverse, and make sure students don't get too confused about it
  - (get wave animations to Zach? color code one molecule for transverse/long waves)
  - identifying medium in which wave is traveling
- Students can solve problems involving wave speed, frequency, and wavelength using the equation  $v = (\lambda)f$ 
  - Musical Instrument station labs - strings, pipes, etc to get basic inverse relationship between lambda and frequency.
  - Speed of sound lab (in air)
  - use speed of sound, def of wavelength and def of frequency to derive wave equation
  - Use boundary conditions to identify nodes/antinodes to determine wave fractions in a standing wave in a tube or string.
  - Instrument design! Use wavelength/frequency relation to design the instrument.
- Students know sound is a longitudinal wave whose speed depends on the medium in which it propagates
  - see transverse/longitudinal standard
  - why we represent longitudinal waves as transverse...
  - identify medium in which wave travels
  - ex: tension in a stretched slinky or phone cord - more tension = faster wave
- Students know how to identify characteristic properties of waves: interference (beats), diffraction, refraction, Doppler effect, and polarization.
  - Diffraction:
    - diffraction from record, CD, DVD, blu-ray DVD
    - Wave tank for diffraction - demo or station on a station day
    - constant tone through two speakers - have students maybe stand in spots where it's loudest? would you see the patterns? to show diffraction and interference both - do in conjunction with wave tank
    - images of diffraction of ocean waves on a jetty?
  - Interference (Beats):
    - Waveport for beats, in conjunction with guitar tuning (preferably electric)
    - Tuning fork with adjustable masses to adjust the relative frequency of the two tines...
    - See wave tank/two speaker thing above
  - Refraction
    - save it for light
  - Doppler effect
    - big misconception is: things get LOUDER or SOFTER when they move
    - videos?
  - Polarization:

- N/A
- F/T (fuck that)

flight of conchords as part of entry

Next Steps:

make a rubric

take out the xylophone as an option, unless a student really wants to do it.

Figure out how to teach students to write group contracts:

- Group tasks/roles
- norms for behavior in group work (including - what happens if you are absent)
- interventions/firing a band member
- pacing charts? weeklong calendar (part of contract could be "adheres to pacing charts")
- contracts/behavior needs to be assessed/accountability
- Norm setting (this is REALLY important, as part of the contract)
- see examples

[www.swcp.com/~gants/Sandia\\_ACTS\\_PBL\\_Workshop.html](http://www.swcp.com/~gants/Sandia_ACTS_PBL_Workshop.html) Kevin Gant's workshop with examples of rubrics, etc and how to assess a PBL project

Parts of lesson study:

Entry event/entry doc/application probably not so much

Know/need to know/next steps definitely!

rubric building

maybe contract building

musical instrument stations lab

Unit timeline

Day 1:

Entry event presentation

Entry event hard copy document

fill out group applications - collect at the end

Know/need to know start - assign as homework

Day 2:

Know/need to know - review ideas from students

Next steps list: choose several of the need to know and have them start researching