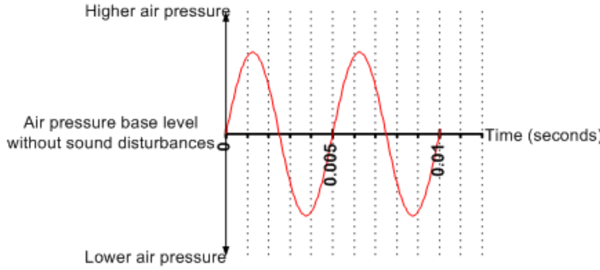
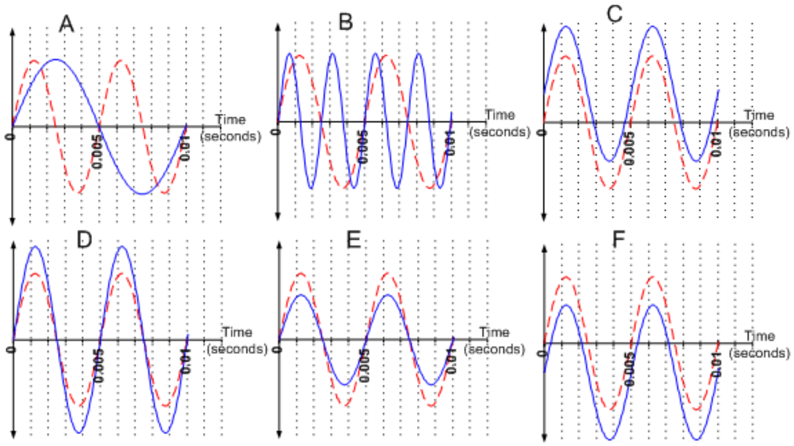
Physics test review 4/15/2020



In the graphs of pressure versus time below, the dashed red line indicates the original 200 Hz tone.



Lightning sound problem: You see lightning strike in the distance and then hear thunder 2.8 seconds later. How many meters away did the lightning strike? How many miles?

Echo sound problem: You can't see the bottom of a well but want to know how deep it is. You take a big rock and drop it to time how long it takes for the echo of the rock landing to reach you. If the sound reaches you 3.1 seconds after dropping the rock, how deep is the well?

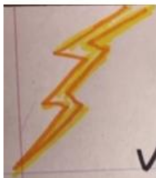
SNELL's law problems:

1) Define critical angle and draw a model to show the critical angle between water and air.

2) When light passes from water into diamond at an angle of 45° from the normal, what is the angle of refraction?

3) A block of amber is placed in water and a laser beam travels from the water through the amber. The angle of incidence is 35° while the angle of refraction is 24°. What is the index of refraction of amber?

4) In an experiment, a block of cubic zirconia is placed in water. A laser beam is passed from the water through the cubic zirconia. The angle of incidence is 50°, and the angle of refraction is 27°. What is the index of refraction of this cubic zirconia?



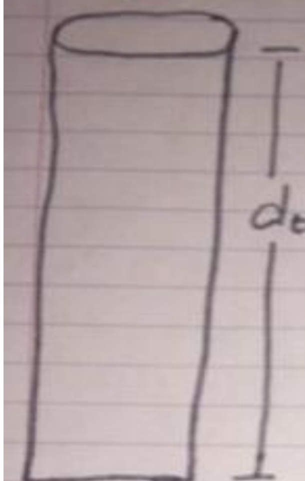
$\Delta t_{sound} = 2.8s$

$V_s = \frac{d}{t}$

$d = (343 m/s)(2.8s) =$

Echo Problem

← Rock $v_i = 0$



$t_{total} = 3.1s$

$t_t = t_d + t_s$ → $t_s = 3.1s - t_d$

$d_t = d_d + d_s$

$d_d = \frac{1}{2} a t_d^2$

$d_s = v_s t$

$d_d = d_s$

$\frac{1}{2} a t_d^2 = v_s t_s$

$4.9 t_d^2 = 343(3.1 - t_d)$

$4.9x^2 = 1063.3 - 343x$

$\underset{a}{4.9}x^2 + \underset{b}{343} - \underset{c}{1063.3} = 0$

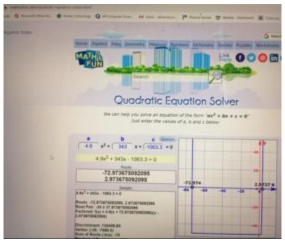
$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $x = -72.97s$ or $x = 2.9737s = t_d$

$d_d = \frac{1}{2}(9.8 m/s^2)(2.9737s)^2 =$ **43m to drop**

check for sound back up?

$t_s = \frac{d_s}{v_s} = \frac{43m}{343 m/s} = .1254$ sec

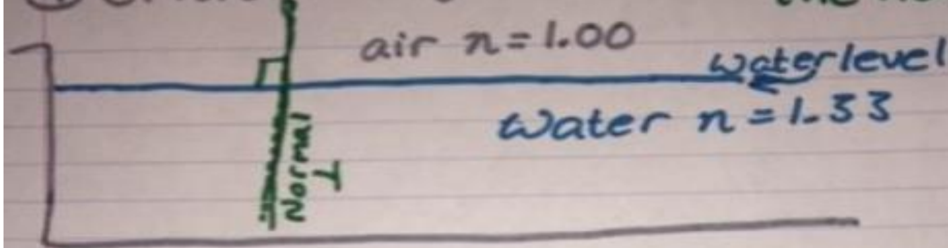
$2.974s + .1254s = 3.099s =$ **3.1s** :) ✓



Snell's Law

① Critical Angle

The angles they talk about are always in reference to the normal



2) Water to diamond $\theta = 45°$

$$n_w \sin\theta_w = n_d \sin\theta_d$$

$$1.33(\sin 45°) = 2.42(\sin\theta_d)$$

$$1.33(.707107) = 2.42(\sin\theta_d)$$

$$.94045 = 2.42(\sin\theta_d)$$

$$\sin\theta_d = .3886165$$

$$\theta_d = \sin^{-1}(.3886165) = \boxed{22.9°}$$

3) $n_a \sin\theta_a = n_w \sin\theta_w$ (from water to amber)

incidence = refraction

$$n_w \sin\theta_w = n_a \sin\theta_a$$

$$1.33(\sin 35°) = n_a(\sin 24°)$$

$$n_a = \frac{.7628567}{.40674} = \boxed{1.88}$$

4) Water to CZ. $n_w(\sin\theta_w) = n_{cz}(\sin\theta_{cz})$

$$1.33(\sin 50°) = n(\sin 27°)$$

$$n = \frac{1.33(\sin 50°)}{\sin(27°)} = \boxed{2.24}$$