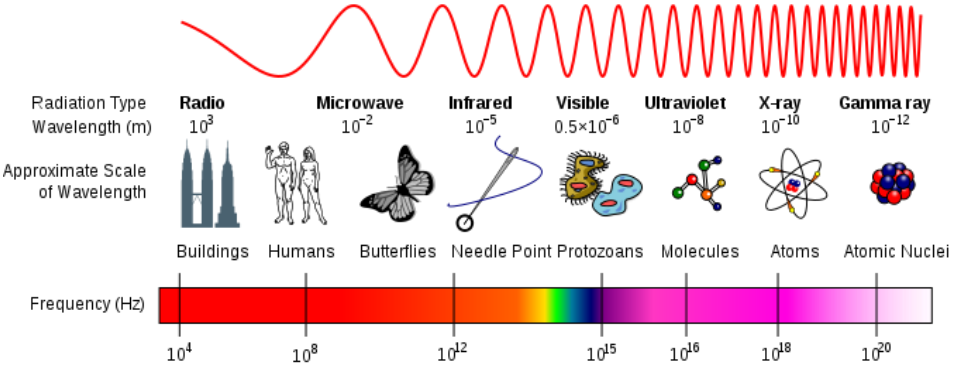
Name: _____ DISC: _____ Score: _____ / 20

Instructions:

- Do your own work.
- Answer the questions below in the space provided.
- Make sure you show all your work and any equations that you use.
- Please place a box around your answers.
- Remember to give the correct units with all numerical answers

Q1	Q2	Q3	Q4
5	5	5	5

1. Below is a chart for the electromagnetic spectrum.



MAGNETIC FLUX	$\Phi = AB\cos\varphi$
EMF ε	$\varepsilon = -\frac{\Delta\Phi}{\Delta t}$
SPEED OF LIGHT	$c = \lambda f$
	$c = \frac{1}{\sqrt{\mu_0\epsilon_0}}$
	$c = 3\times10^{8} m/s$
WAVE PROPOGATION	$E = cB$
	$kx - \omega t = 0$ and the same for y and z.
	$k = 2\pi/\lambda$
DOPPLER EFFECT	$f_o = f_e(1 + \frac{u}{c})$
	$f_o = f_e(1 - \frac{u}{c})$

Useful Information for All Problems

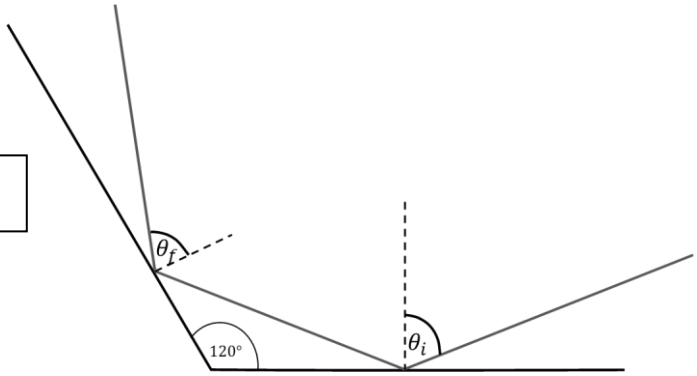
a. If a wave has the same wavelength as a butterfly is long (from wingtip to wingtip) what is the frequency of the wave? Assume your butterfly is $5\ cm$ from wingtip to wingtip.

Frequency (2 pts):

b. You have a flashlight which can produce this wavelength of light (the one as long as the butterfly). How fast would the flashlight have to move to shift the wavelength to see the cells on the butterfly's wings. Use the figure above in your estimate.

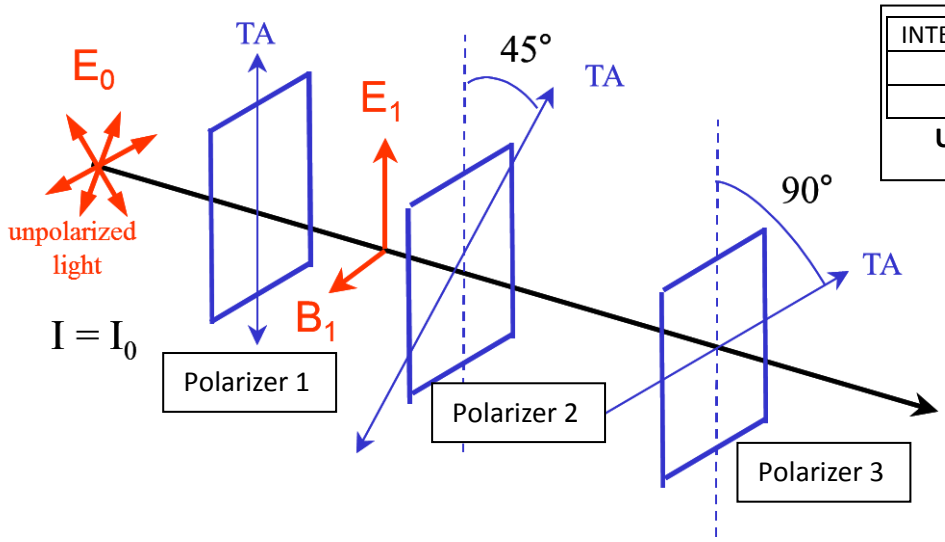
Doppler Shift (3 pts):

2. Two mirrors are attached as shown in the diagram. If light reflects from the first mirror with an incident angle $\theta_i = 50°$, at what angle θ_f does it leave the second mirror?



θ_f (5 pts):

3. Light from an unpolarized source passes through three polarizers as shown below:



INTENSITY	$I_i = I_{i-1}/2$
	$I_i = I_{i-1}\cos^2\theta$

Useful Information for All Problems

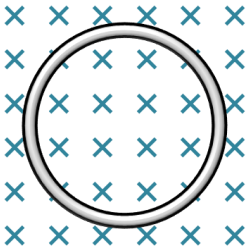
Fill in the following table: ***(Show your work on the attach scratch page)***

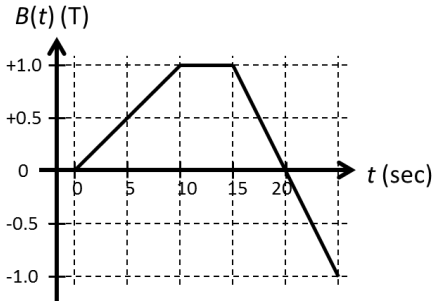
Table (5 pts):

QUANTITY	Without Polarizer 2	With Polarizer 2
I_1 (after polarizer 1)		
I_2(after polarizer 2)		
I_3(after polarizer 3)		

4. Consider the wire loop which is located in a time-varying magnetic field, shown in the graph.

Answers (5 pts):





Fill in the following table:

Time(s) at which $\Phi = 0$	
Time(s) at which $\varepsilon = 0$	
Time(s) at which $\lvert\varepsilon\rvert$ is greatest	
Time(s) at which Φ is greatest	
Direction of current flow in the loop as seen in the diagram between $t = 0$ and $t = 10\ s$.	