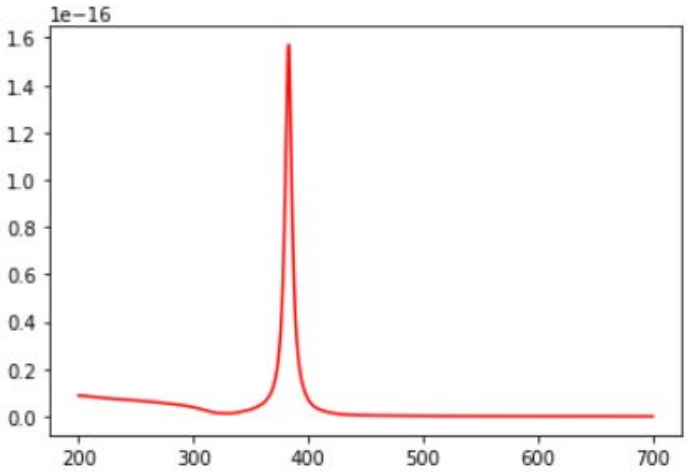
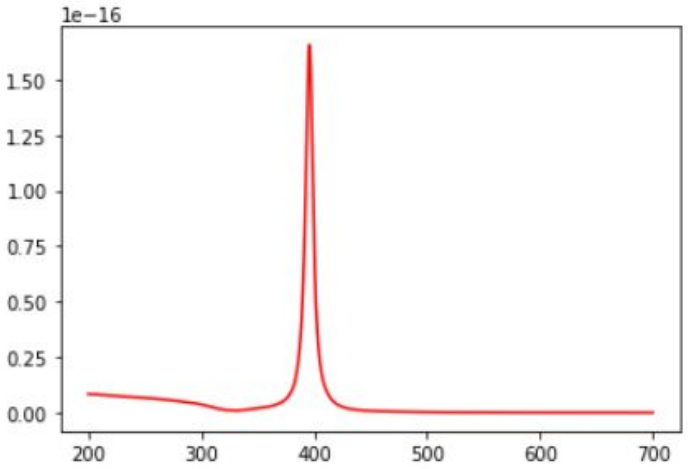
Question 1:

How does the spectrum change as you increase the dielectric constant of the surrounding materials? Try n = 1.45 for glass and n = 1.76 for alumina.

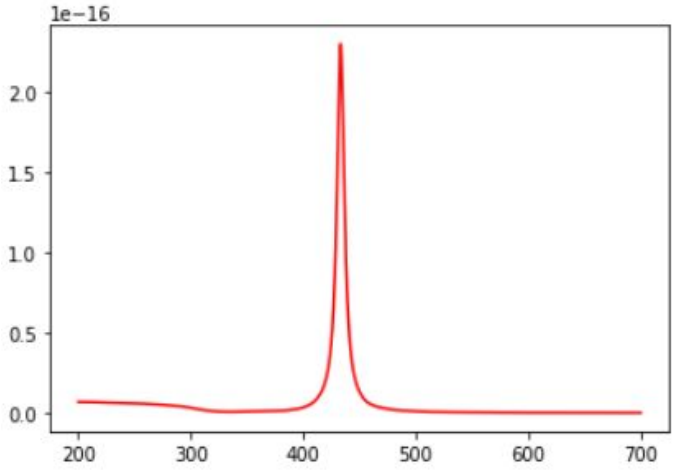
As the dielectric constant (n) of the surrounding media increases, the absorption peak is red-shifted. As seen in the spectra of silver below, water (n = 1.33) has a max absorbance just below 400 nm, glass (n = 1.45) is shifted to about 400 nm, and alumina (n = 1.76) is closer to 450 nm.



Water: n = 1.33



Glass: n = 1.45

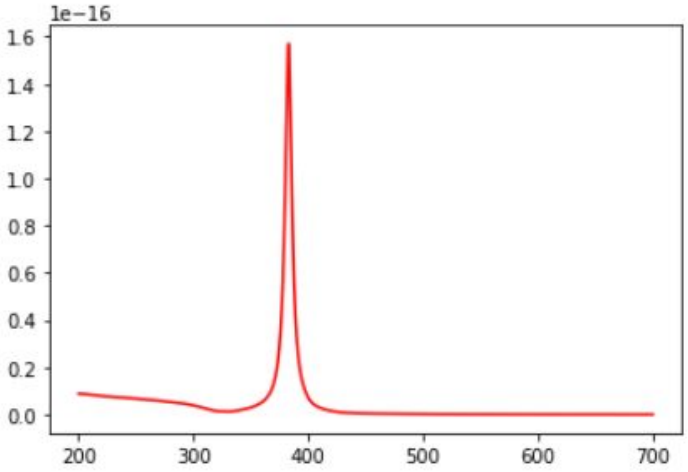


Alumina: n = 1.76

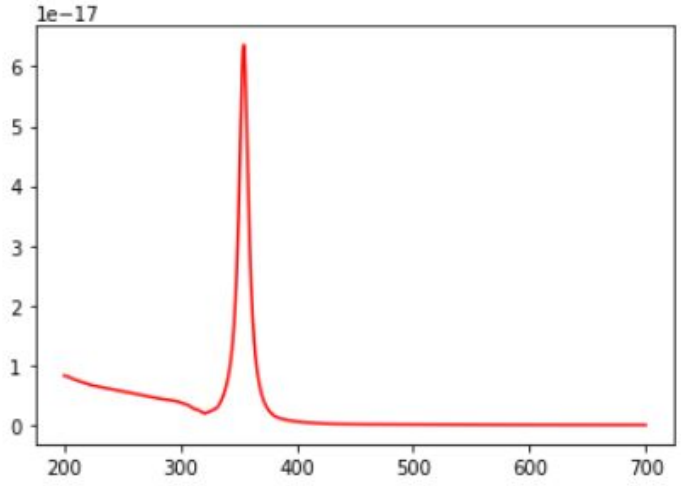
Question 2:

How does the spectrum change as you decrease the dielectric constant of the surrounding materials? Try n = 1.0 for air.¶

As the dielectric constant (n) of the surrounding media is reduced, the absorption peak is blue-shifted. As seen in the spectra of silver below, water (n = 1.33) has a max absorbance just below 400 nm, while air (n = 1.00) has a max absorbance around 350 nm.



Water: n = 1.33

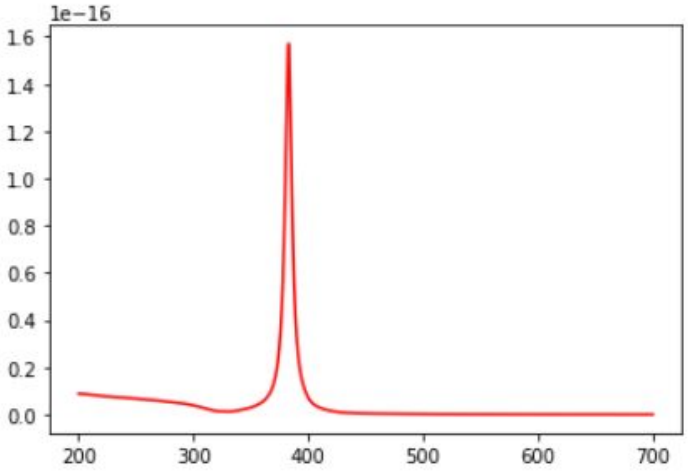


Air: n = 1.00

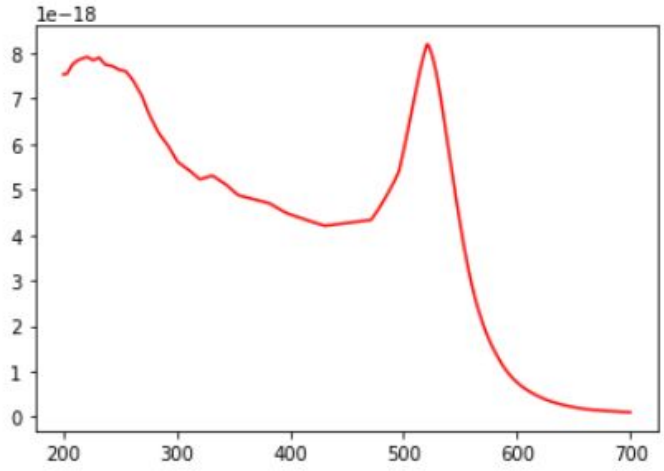
Question 3:

How does the spectrum change if you use Au instead of Ag?

For the same dielectric constant (water: n = 1.33), the absorbance max on the spectra of gold is red-shifted from below 400 nm (for silver) to above 500 nm. Strong interband transitions are also observed in the 200 nm region, which is not as prominent in the silver spectrum.



Silver

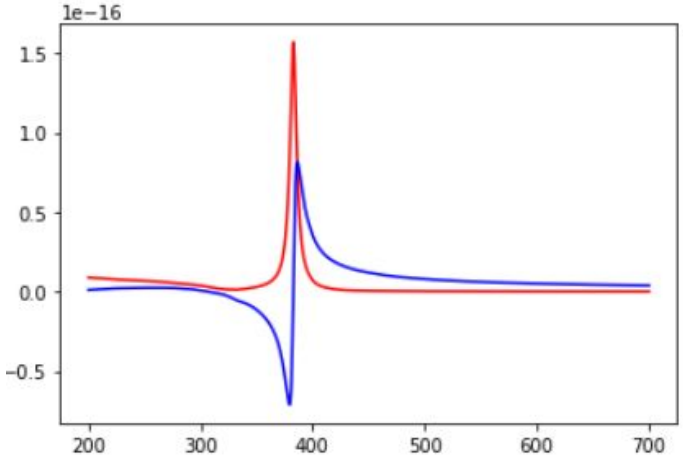


Gold

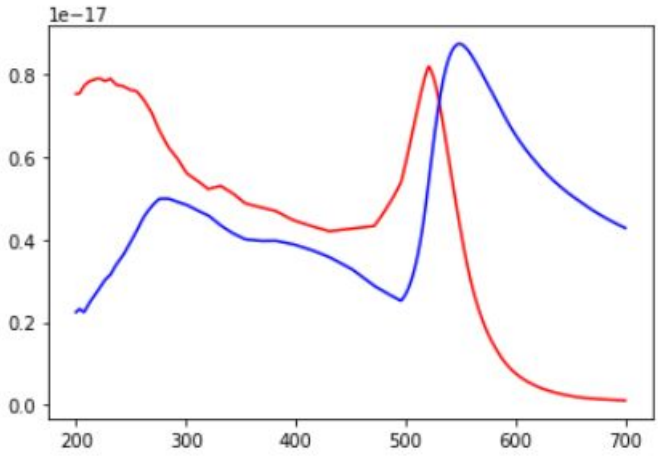
Question 4:

Plot the real and imaginary parts of the dielectric function of Au and Ag as a function of wavelength; what do you notice about the values in the vicinity of the plasmon resonance (i.e. at wavelengths where the strong absorption peak is observed)?

At the plasmon peak of the real function, a sharp dip followed by a sharp spike is observed for the imaginary function. As seen in the graphs below, the spectra are much cleaner for silver than they are for gold. Also, the baseline of both functions for the silver are at zero, whereas the gold spectra show a secondary peak just before 300 nm, which is also accompanied by the subsequent spike in the imaginary function.



Silver: red = real; blue = imaginary



Gold: red = real; blue = imaginary