Name_____

Do yourself a solid.

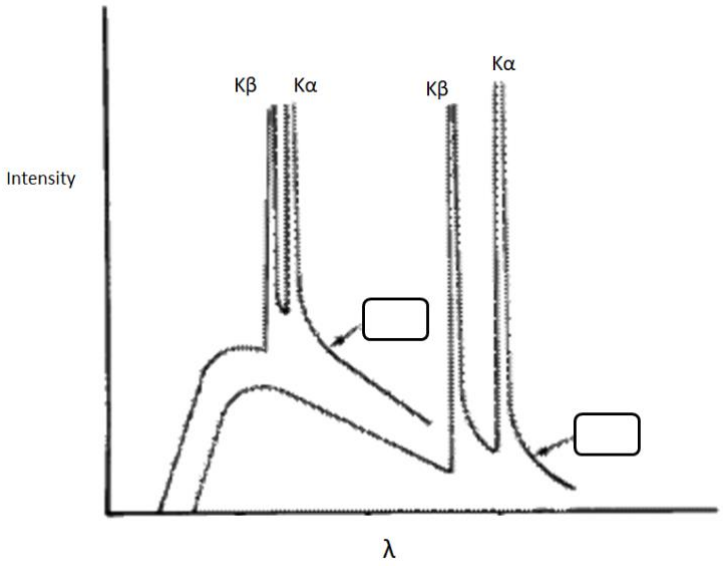
3.091 Introduction to Solid State Chemistry

Fall Term 2018

Quiz 7 (A)

11/07/2018

1. You shoot energetic beams of electrons at molybdenum and copper samples and receive the emitted x-ray spectra shown below.



a. The samples were irradiated with beams with different amounts of energy. Draw an arrow to the curve that was irradiated with higher energy. (1 point)

b. Unfortunately, you forgot to label which spectrum came from which metal. Please fill in the boxes above with the correct metal. (1 point)

c. On the x-ray spectra above, draw in the characteristic peak corresponding to the copper Lα energy transition. (1 point)

2. a. What planes would produce the first three peaks you would see for a BCC crystal structure? What about for FCC? Give the planes in the form of (hkl). (2 points)

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b. Express $\frac{sin^2\theta_n}{sin^2\theta_1}$ in terms of Miller indices h_1, k_1, l_1 and h_n, k_n, and l_n where θ_n is the angle of the nth peak; h_1, k_1, and l_1 are the Miller plane indices of the first peak; and h_n, k_n, and l_n are the miller plane indices of the nth peak. Hint: take the ratio of two Bragg's law equations. (2 points)

You are given an XRD plot. Let's try to find the lattice parameter of the mystery pure metal. (We do not have polonium in the lab.)

c. Fill out the table below in which the peaks are at 2θ = 20°, 28.4°, and 35.04°. (1 points)

Peak	**2θ**	$\frac{sin^2\theta_n}{sin^2\theta_1}$
1	20°	
2	28.4°	
3	35.04°	

d. Using the relationship derived in part b, what crystal structure is your mystery pure metal? (1 points)

e. Calculate the lattice parameter if the x-ray source has a wavelength of 1.7 Å. (10^{10} Å = 1 m). (1 points)

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