GLY 4200C NAME_____

HOMEWORK 11

X-ray Analysis

1. What is the wavelength range of X-radiation? _____ to _____ nm

2. Hard x-rays are at which end of this range? _____

3. Which type (hard or soft) X-radiation is used in X-ray crystallography? _____

4. Which type (hard or soft) X-radiation is more dangerous? _____

5. Calculate the energy (in kV) needed to produce λ values of:
   A. 0.200 nm C. 0.070 nm
   B. 0.125 nm D. 0.050 nm

6. Calculate the shortest wavelength of x-radiation that would be produced for each of the voltages listed below.
   A. 20 kV C. 40 kV
   B. 30 kV D. 50 kV

7. Use the Bragg equation to calculate d if λ = 0.100 nm and theta is as listed below. Assume n = 1.
   A. 10° C. 30°
   B. 20° D. 40°

8. If λ = 0.080 nm and d = 0.170 nm what is θ for each of the values of n listed below. If no reflection exists, state "no reflection possible".
   A. 1 D. 4
   B. 2 E. 5
   C. 3

Show work on another page. Please attach this page as the top page of your assignment.

Homework Grade Summary

Score _____/210

Percent_____

Grade_____

Homework is 10% of your final grade, two-thirds of a midterm.

Homework 11 Answers

1. 10^{-6} to 10^{-1} nm

2. 10^{-6}

3. Soft

4. Soft

5. Formula is $\lambda = 1.24/kV$
a. 6.20 kV
b. 9.92 kV
c. 18 kV
d. 25 kV

Note: For c and d, the wavelengths are expressed to <u>two</u> significant figures. Remember, leading 0's are placeholders. Therefore, the answer should be to two significant figures.

6. Same formula as 1
a. 0.062 nm
b. 0.041 nm
c. 0.031 nm
d. 0.025 nm

7. Formula is the **Bragg equation**: $n\lambda = 2d \sin \theta$.
a. 0.29 nm
b. 0.15 nm
c. 0.10 nm
d. 0.078 nm

Note: All of the voltages are given to two significant figures, so the answers must be two figures as well. For d, since the leading 0 is a placeholder, two significant figures means three decimal places.

8. Use the Bragg equation
a. 14°
b. 28°
c. 45°
d. 70°
e. $\sin \theta = 1.18$ $\therefore$ no reflection possible

Note: The values of lambda are given to two significant figures. Therefore, the answers should be two figures also.