Characteristic X-rays & Moseley's law.

(Z = 27)

1. Co target → ch-spectrum → bright → 178.9 pm (K_α)
   faint → 143.5 pm.

a). why diff. b/w K_α wavelength.

b). what is the impurity.

$$\sqrt{\nu} = a(Z-b)$$

$$\sqrt{\frac{c}{\lambda_1}} = a(27-1)$$

$$\sqrt{\frac{c}{\lambda_2}} = a(Z-1)$$

$$\sqrt{\frac{\lambda_2}{\lambda_1}} = \frac{26}{(Z-1)} \Rightarrow \sqrt{\frac{143.5}{178.9}} = \frac{26}{Z-1}$$

$Z = 30$

Zinc → impurity

Finding a & b in Moseley's Law.

	Z	$\lambda_{K\alpha}$
Mo	42	71 pm
Co	27	178.5 pm

$b = 1.1$

$\sqrt{Hz} = Hz^{x}$

$\sqrt{\nu} = a(z-b)$.

$\sqrt{\frac{c}{71\times10^{-12}}} = a(42-b) - (1)$.

$\sqrt{\frac{c}{178.5\times10^{-12}}} = a(27-b) - (2)$.

$(1) \div (2)$

$\sqrt{\frac{178.5}{71}} = \frac{42-b}{27-b}$

$b = 1.37$.

$(1) - (2)$

$\sqrt{\frac{c}{71\times10^{-12}}} - \sqrt{\frac{c}{178.5\times10^{-12}}} = a(42-27)$

$a =$

Q. 50% of X-rays pass thru 0.3mm Al fil.

If $\Delta V \uparrow$ then the fraction of X rays will be →

A) > 50% B) < 50% C) = 50% D) 0

Geometrical optics

1). Spherical Mirrors & lenses

$$\frac{1}{v}+\frac{1}{u}=\frac{1}{f}$$

$$v=\frac{uf}{u-f}$$

$$u=\frac{vf}{v-f}$$

$$m=-v/u=\frac{f}{f-u}=\frac{f-v}{f}$$

f is more prevalent in lenses.

$$\frac{1}{v}-\frac{1}{u}=\frac{1}{f}$$

$$v=\frac{fu}{f+u}$$

$$u=\frac{fv}{f-v}$$

$$m=v/u=\frac{f}{f+u}=\frac{f-v}{f}$$

Spherical surface

$$\frac{\mu_2}{v}-\frac{\mu_1}{u}=\frac{\mu_2-\mu_1}{R}$$

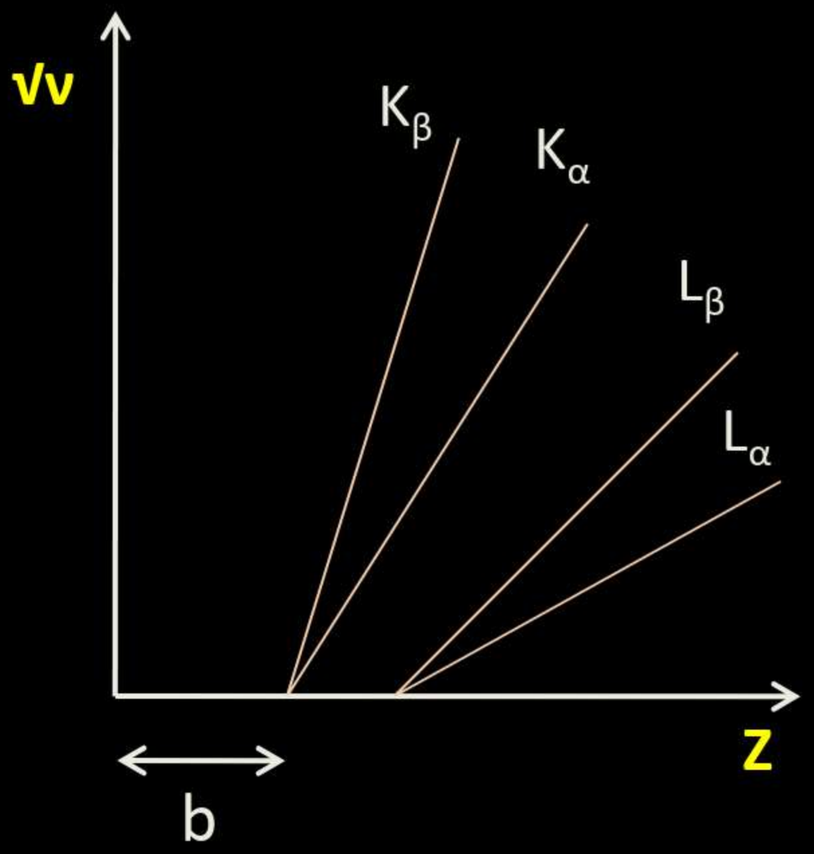
28th Session: Modern Physics – II (X-Rays)

- Recap
- Moseley's Law
- Bragg's Law
- Uses of X-Rays

Constants in Moseley's Law

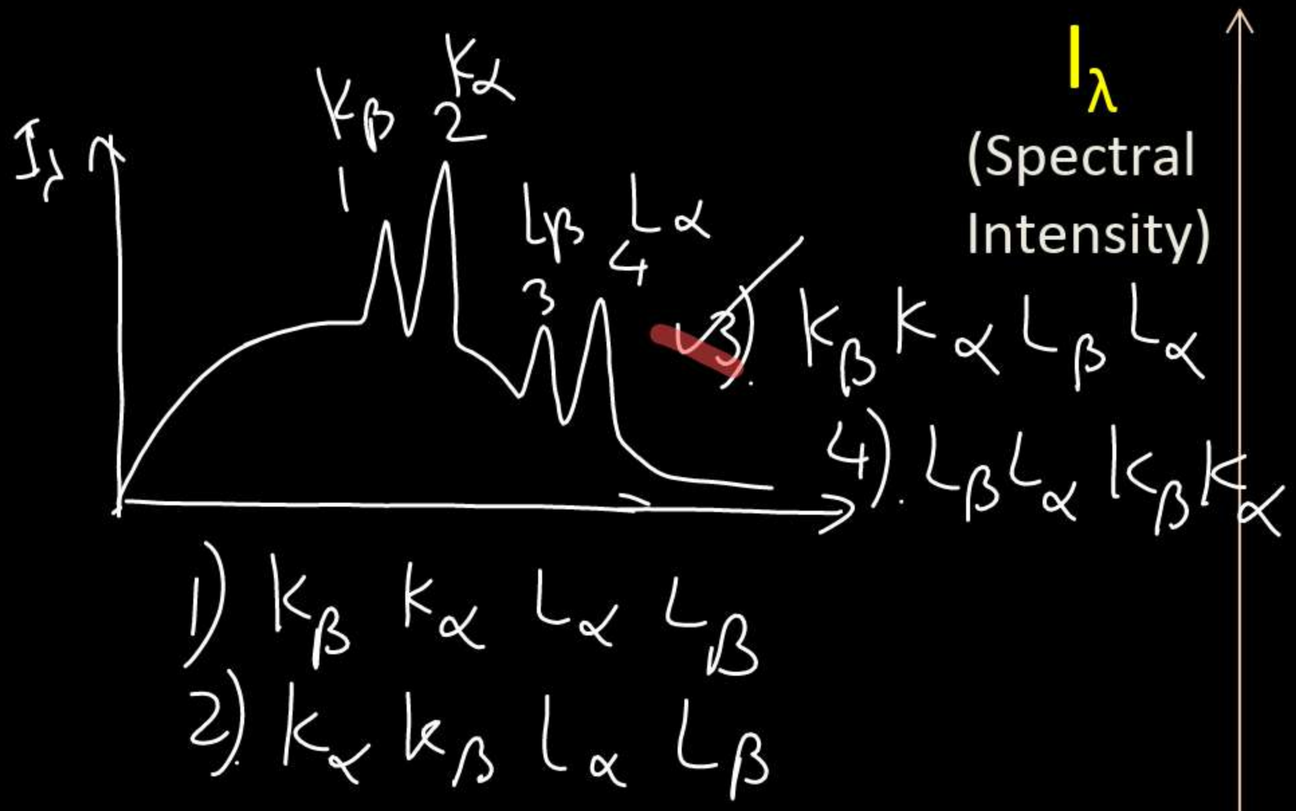
$\sqrt{\nu} = a(z-b)$ (K_α)

- a & b are
  - positive constants
  - independent of material type
  - depend only on type of Ch X-Ray
  - a → slope of lines
  - b → horizontal intercept



Mnemonic:
K to L, slope ↓
α to β, slope ↑

Q 1). Which atomic number is greater?

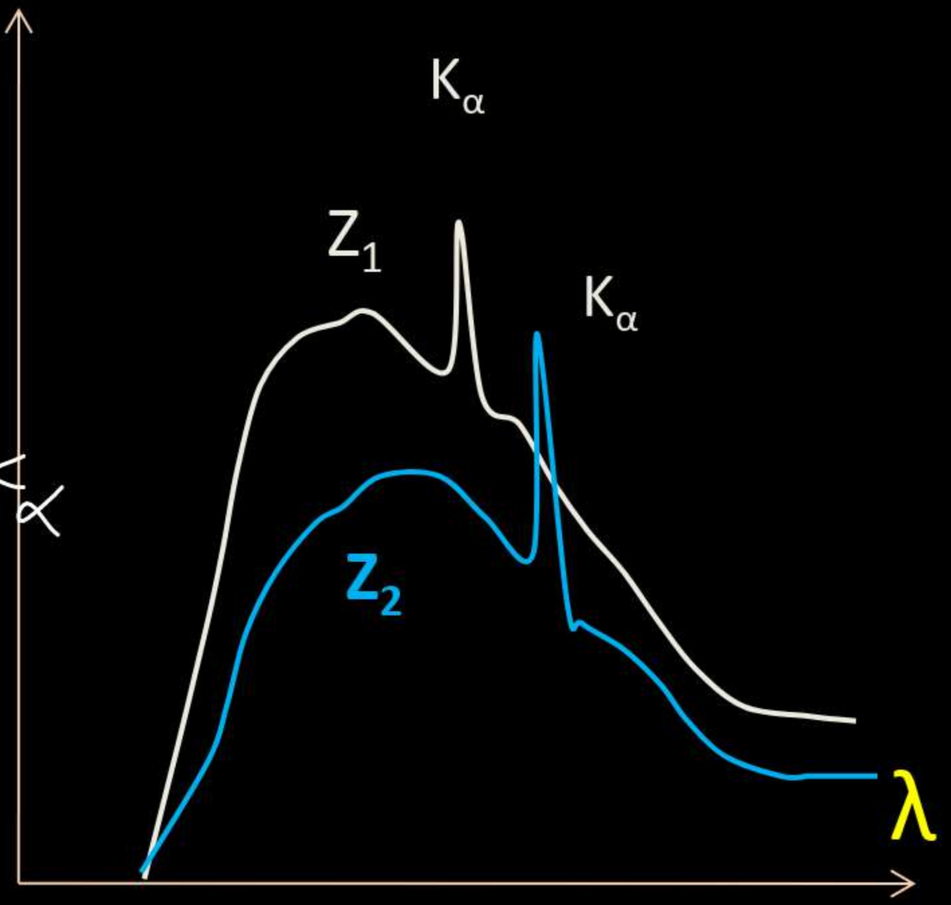


1) $K_\beta\ K_\alpha\ L_\alpha\ L_\beta$

2) $K_\alpha\ K_\beta\ L_\alpha\ L_\beta$

3) $K_\beta\ K_\alpha\ L_\beta\ L_\alpha$

4) $L_\beta\ L_\alpha\ K_\beta\ K_\alpha$



X-ray Diffraction: Bragg's Law

↳ (0.1 Å – 100 Å)

$2d\sin\theta = n\lambda$

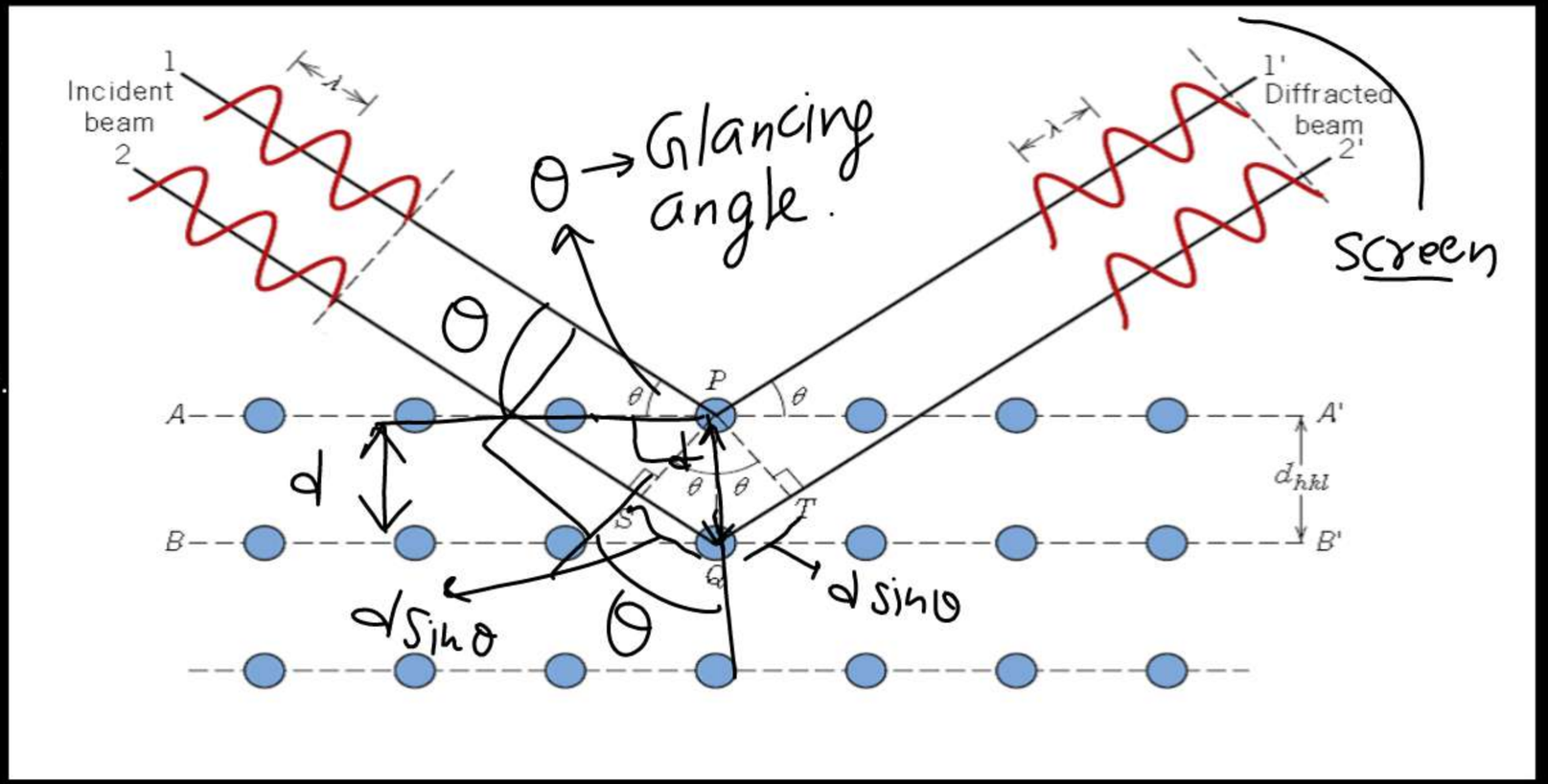
↑ Glancing angle

↓ inter planar dist

≈

↳ wave length

Monochromatic
X-Ray beam required



Uses of X-Rays

- Medical Diagnosis (fracture, radiograph, studying tooth decay)
- Medical therapy (e.g. for cancer)
- Structural health monitoring
- Studying a crystal structure
- Inspection at security counters
- CRT monitors emit X-Rays which can be harmful to eyes