H.W.2

1) Take print outs

2) FCC & HCP : i) Same packing fraction (calculate)

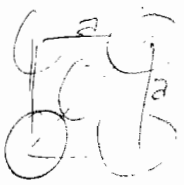
ii) FCC is ABC arrangement
HCP is ABAB arrangement.

iii) Use L(b) to show equivalence

FCC

$4R = \sqrt{2}\,a$

$\Rightarrow R = \frac{\sqrt{2}\,a}{4}$



Any face

Packing fraction: $\frac{4 \cdot \frac{4}{3}\pi R^3}{a^3}$

$= \frac{16}{3} \cdot \pi \times \frac{2\sqrt{2}}{64} a^3$

$= \frac{\sqrt{2}\,\pi}{6} = 0.74 \approx 74\%$

HCP:

Check $c^2 = \frac{8}{3} a^2$

Efficiency = $\frac{6 \text{ spheres}}{\text{Volume}}$

$= \frac{6 \cdot \frac{4}{3}\pi R^3}{24\sqrt{2} R^3} = \frac{\pi}{3\sqrt{2}} = 0.74 \rightarrow 74\%$

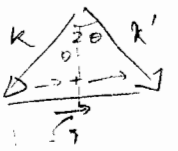
3)

	X-rays	electrons
Wavelength	λ	λ (de Broglie wavelength)
wavevector is more than 1	$2\pi/\lambda$	$2\pi/\lambda$
	h/λ	h/λ. Also: $\frac{p^2}{2m} = eV$
		$\Rightarrow p = \sqrt{2eV}$
Energy	$\frac{hc}{\lambda}$	$\frac{p^2}{2m} = eV = \frac{h^2}{2m\lambda^2}$ / $\because p$

↳ Discuss de-Broglie for $e^{\ominus}$

HW-2

4) Laue Eq^n: $\Delta \vec{K} = \vec{G}$



Now $\vec{G} = \frac{2\pi n}{d_{hkl}}$ & $\Delta k = 2|\vec{k}| \sin\theta$

$\Rightarrow 2 \cdot \frac{2\pi}{\lambda} \sin\theta = \frac{2\pi}{d_{hkl}} n$

$\Rightarrow \boxed{2 d_{hkl} \sin\theta = n\lambda}$

Bragg law.