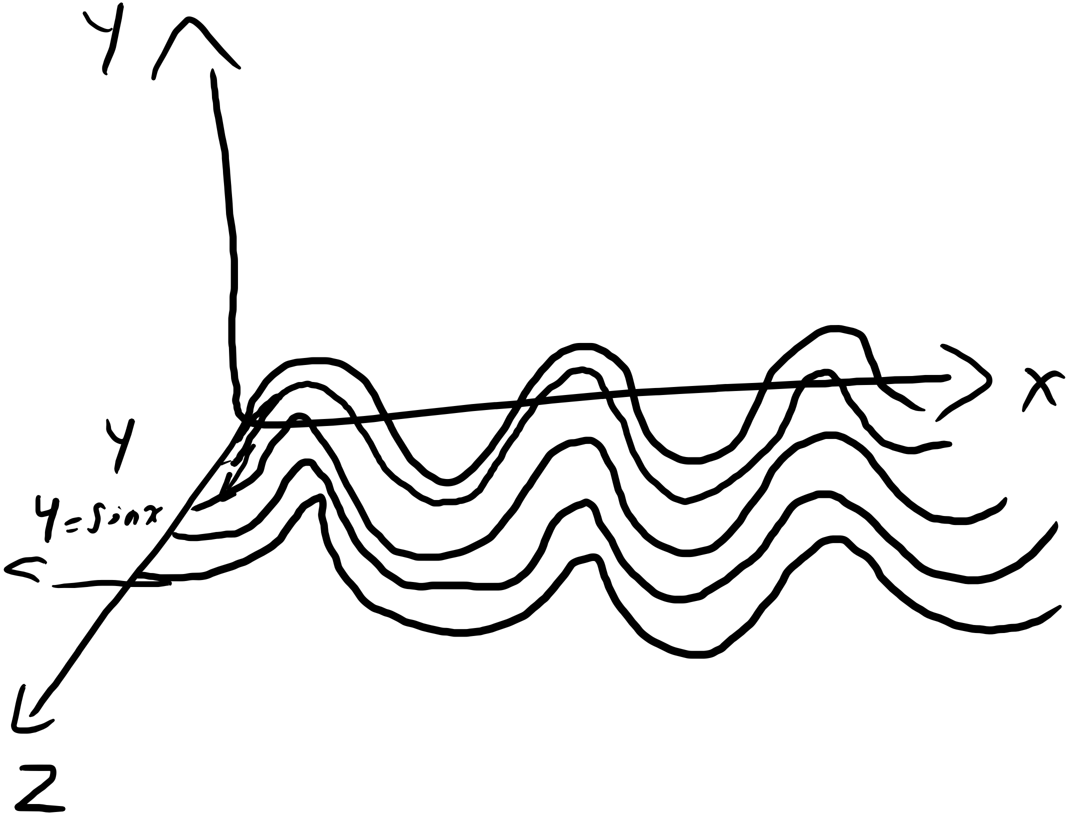
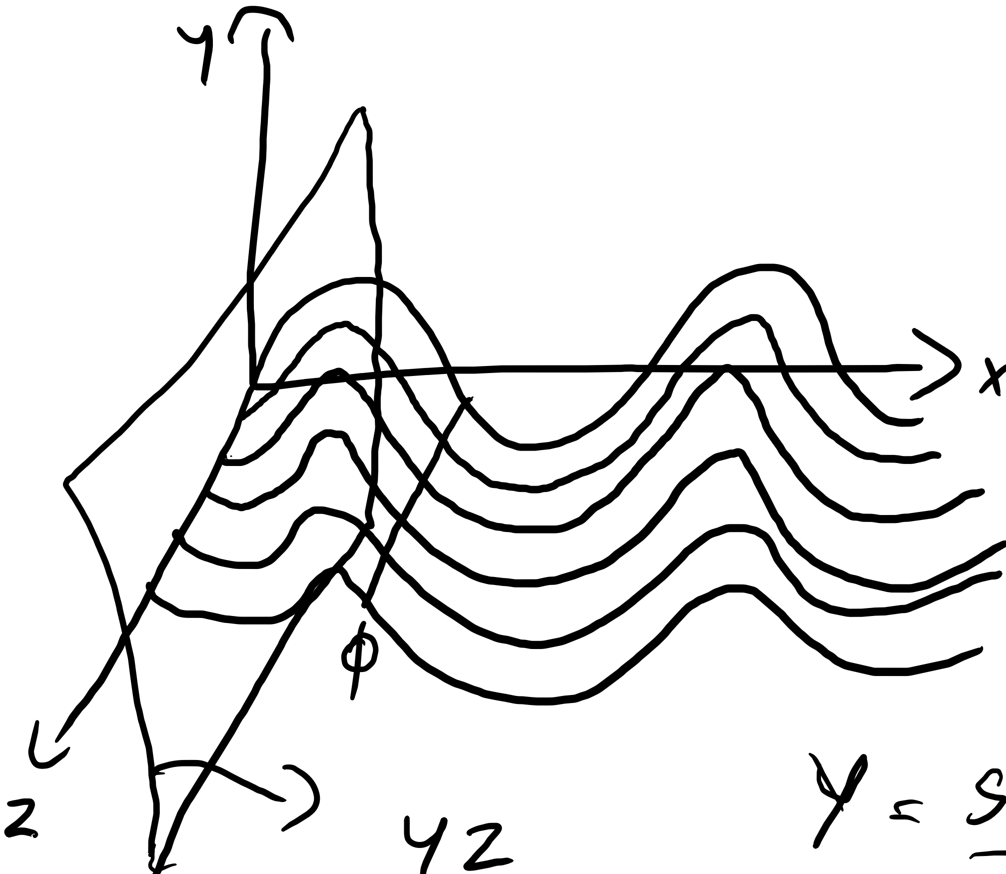


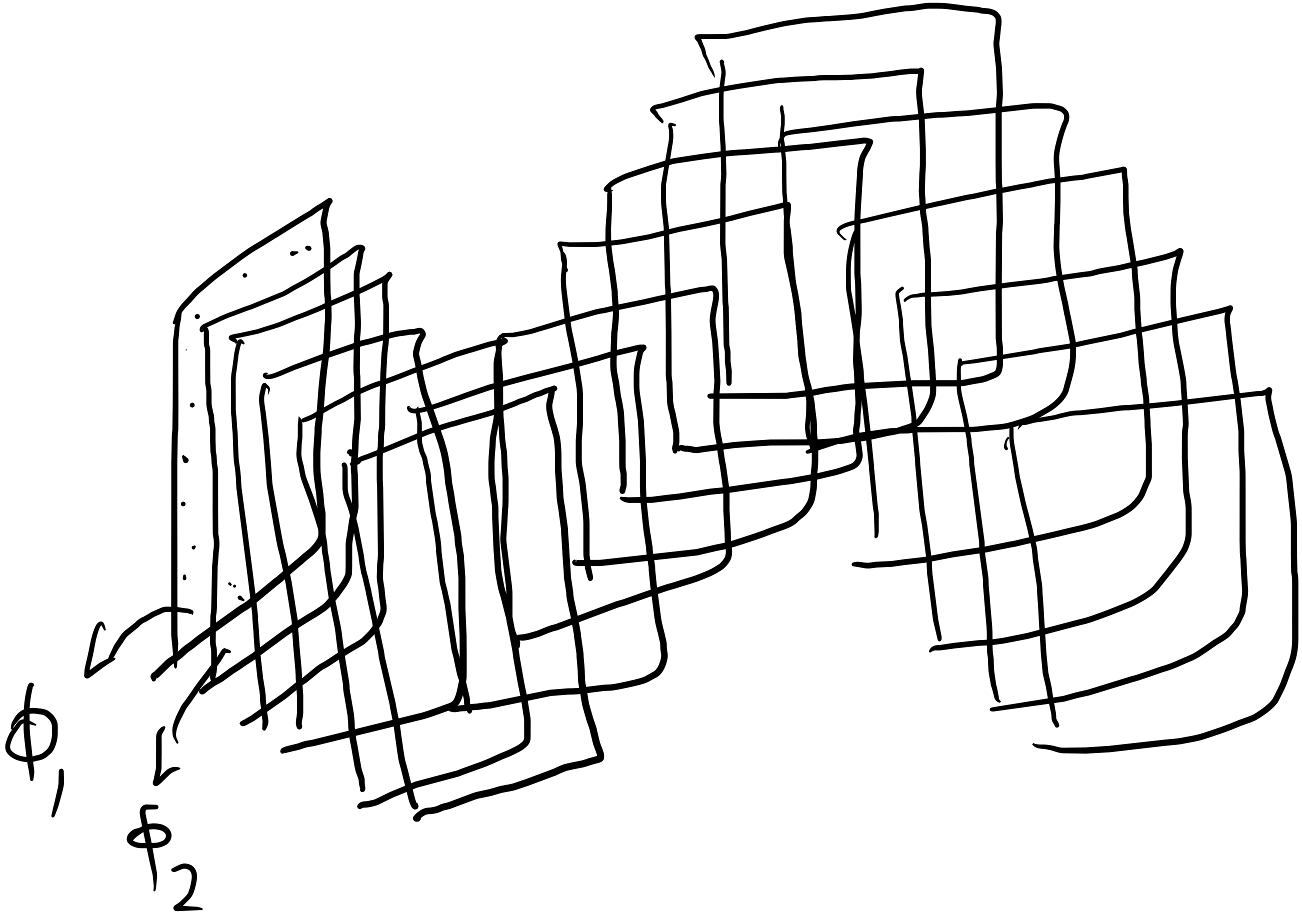
Y
X
Y
y=sinx
Z



$y = \sin x$

YZ

plane waves



ϕ_1
ϕ_2

$$v = \sqrt{\frac{K \to}{\rho \to}}$$

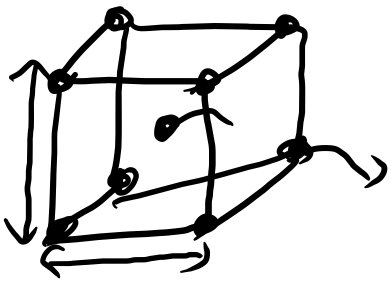
56 g Fe 1 mole

6.023×10^{23}

$$\rho = \frac{M}{V} = \frac{M_{Fe}}{\quad}$$

$$M_{Fe} = \frac{56}{6.023 \times 10^{23}} \text{ g}$$

$$\rho = \frac{2 \times M_{Fe}}{a^3_{bcc}}$$



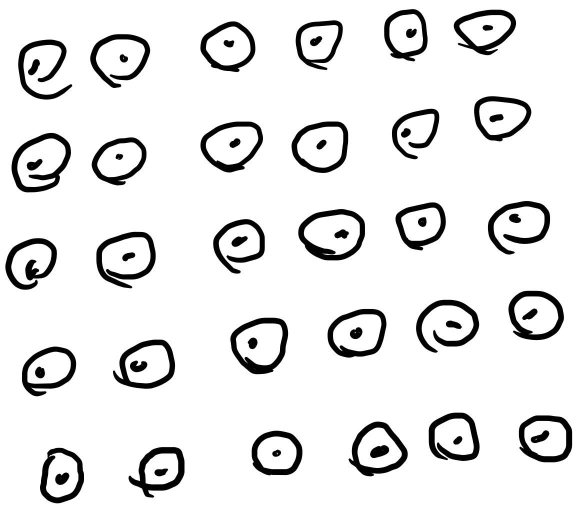
V

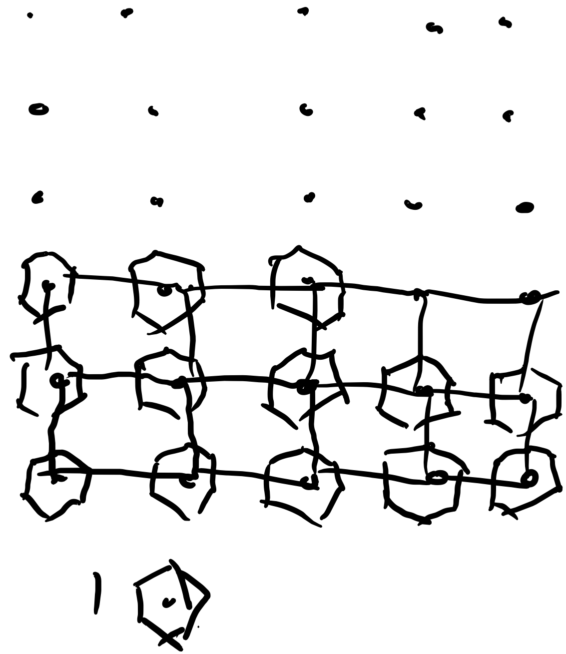
$V = a^3$

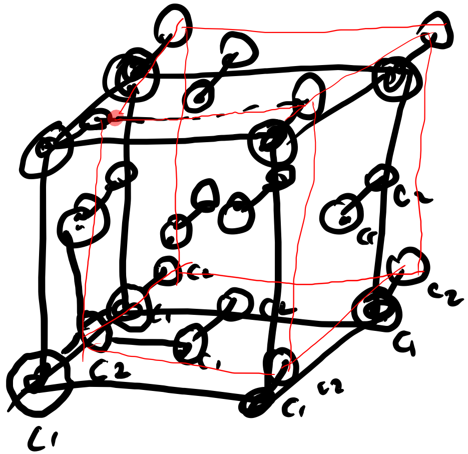
$$\rho = \frac{4\, M_{Fe}}{a^3_{fcc}}$$

Crystal = Lattice + basis

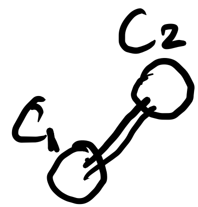
atoms







$+$



$$v = \sqrt{\frac{K}{\rho}}$$

FCC

4 Lattice points $*$

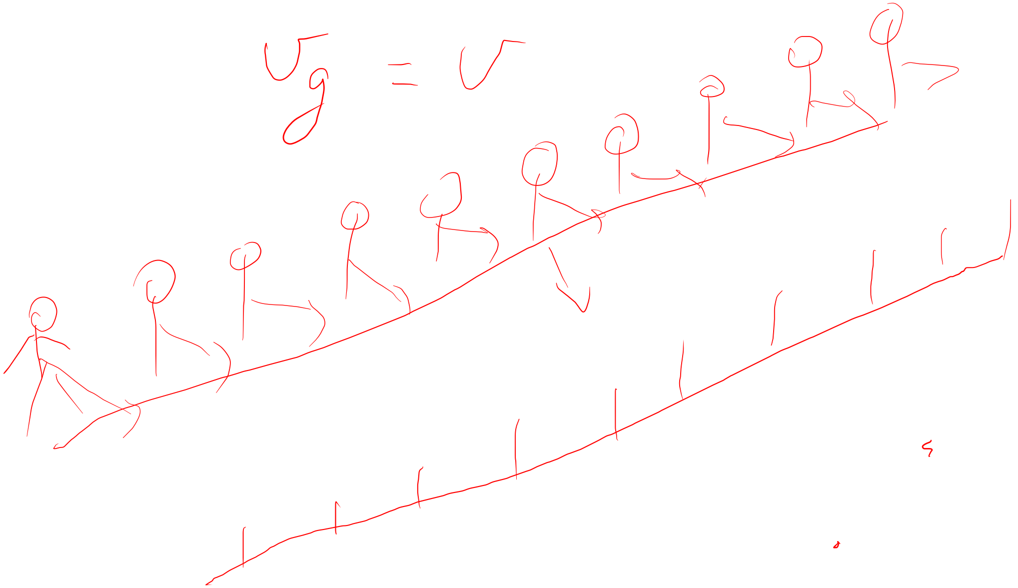
2 atom per lattice points

$$v^2 = \frac{K}{\rho}$$

$$K = v^2 \rho$$

8C

$v_g = v$

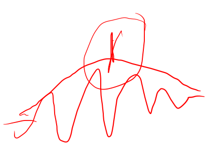


t_1

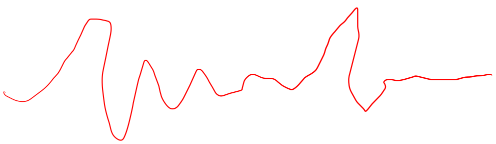
v_3

v_1

v_2



v_g



$$\underbrace{v_g = \frac{d\omega}{dk}}$$

$$y = \sin\omega_1 t + \sin\omega_2 t + \sin + \sin$$

$$\omega \propto k$$

$$\omega = ck$$

$$\omega(k)$$

$\omega \propto k^2$ $\omega \propto f(k)$

$$v_g = \frac{d\omega}{dk}$$

velocity of the wave in the medium

$$= \frac{d}{dk}(v k)$$

$$v_g = k\frac{dv}{dk} + v\,\cancel{\frac{dk}{dk}}^{\,1}$$

$$\underline{\underline{v_g}} = \underbrace{v_p} + k\frac{dv}{dk}$$

$$v_g = v_p + k\frac{dv}{dk}$$

$$= v_p + k\frac{dv}{d\lambda}\frac{d\lambda}{dk}$$

$$v_g = v_p + \cancel{k}\frac{dv}{d\lambda}\left(-\frac{\lambda}{\cancel{k}}\right)$$

$$\left\{ v_g = v_p - \lambda\frac{dv}{d\lambda} \right\}$$

$$v_g - v_p = -ive$$

$$\lambda = \frac{2\pi}{k}$$

$$\frac{d\lambda}{dk} = -\frac{2\pi}{k^2}$$

$$\frac{d\lambda}{dk} = \frac{-\cancel{2\pi}}{k\left(\frac{\cancel{2\pi}}{\lambda}\right)}$$

$$\boxed{\frac{d\lambda}{dk} = -\frac{\lambda}{k}}$$

$$v = \lambda v$$

$$\omega \propto k$$

$$\omega \propto k^2$$

$$\frac{d\omega}{dk} = Ak \leftarrow$$

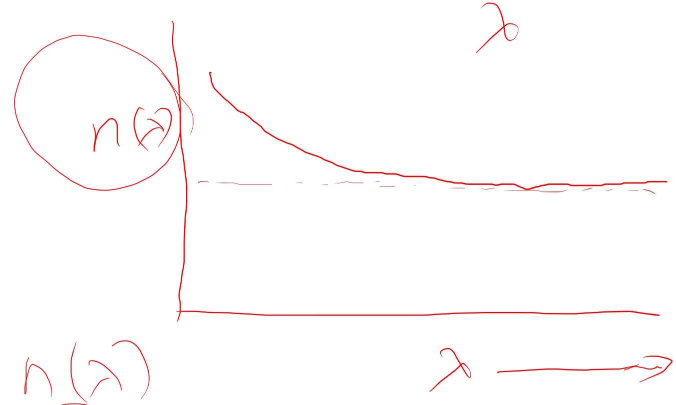
$$\frac{d\omega}{dk} = v$$

$$v = \frac{c}{n}$$

$n(\lambda)$

$$v_g = v_p - \lambda \frac{dv}{d\lambda}$$

$$v = \frac{\text{OP. path}}{\Delta t}$$



$$\frac{c}{n} \Delta t = \underbrace{\text{Op path}}$$

$n(\lambda)$

1

$$\frac{dn}{d\lambda}$$

$n(\lambda)$