Problem 7

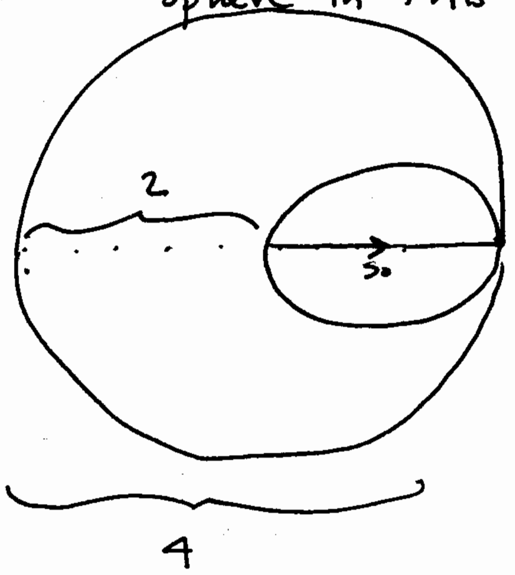
(a) The sphere has radius 1, so l_{max} can be found: (looking at side view)

$$l a^* = l_{max} \frac{\lambda}{a} = l_{max}\left(\frac{1.54178}{10}\right) \leq 1$$

$$l_{max} \leq 6.461$$

So the max l will be $\underline{6}$

(b) We can find h_{max} be looking at the side view and remembering the limiting sphere in this orientation has a radius of 2



$$h a^* = h_{max} \frac{\lambda}{a} \leq 2$$

$$h_{max}\left(\frac{1.54178}{10}\right) \leq 2$$

$$h_{max} \leq 12.97$$

So $\underline{h_{max} = 12}$

(c) Area of limiting sphere $= \pi (2)^2$
Area of unit cell in 2-D $= a^{*2} = \left(\frac{\lambda}{a}\right)^2$

$$\text{\# of points in sphere} = \frac{4\pi}{\left(\frac{\lambda}{a}\right)^2} = \frac{4\pi a^2}{\lambda^2} = \frac{1256.637}{(1.54178)^2}$$

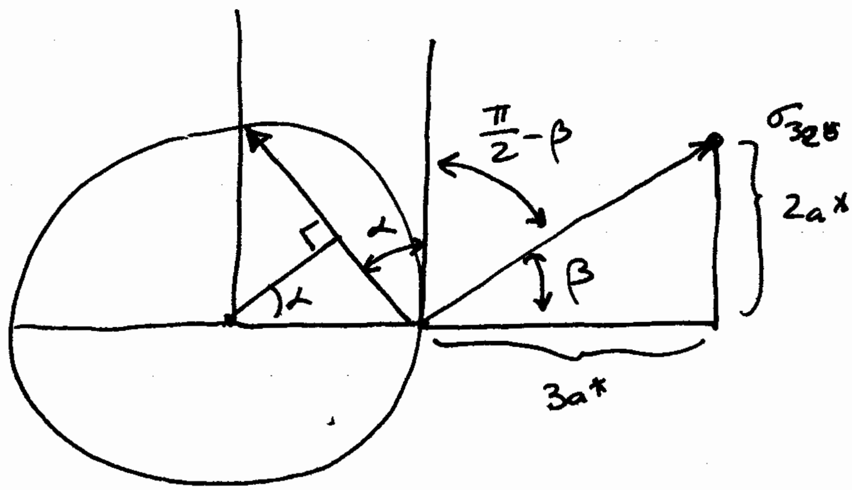
$$= 528.65$$

Problem 7

(c) con't

- So there are about 528 reciprocal lattice points that are within the limiting sphere.
- But each point passes through the Ewald sphere twice, so there will be about 1056 diffraction peaks

(d)



$$|\sigma_{320}| = \left[(3a^*)^2 + (2a^*)^2\right]^{1/2}$$

So we have to rotate this vector σ_{320} so it touches the sphere of reflection.

So the total angle is $\frac{\pi}{2} - \beta + \alpha$

$$\tan^{-1}\left(\frac{2a^*}{3a^*}\right) = \beta \implies \beta = 0.5880^{\text{Rads}} \ (= 33.69^\circ)$$

$$\frac{\pi}{2} - 0.5880 = 0.9828 \ (56.31^\circ)$$

$$\sin\alpha = \frac{|\sigma_{320}|}{2} = \frac{\left[(3a^*)^2 + (2a^*)^2\right]^{1/2}}{2}$$

Problem 7

(d) con't

$$\sin\alpha = \frac{\left[(3\times 0.154178)^2 + (2\cdot 0.154178)^2\right]^{1/2}}{2}$$

$$\sin\alpha = \frac{(0.21394 + 0.09508)^{1/2}}{2}$$

$$\alpha = \sin^{-1}\left[\frac{(0.30902)^{1/2}}{2}\right]$$

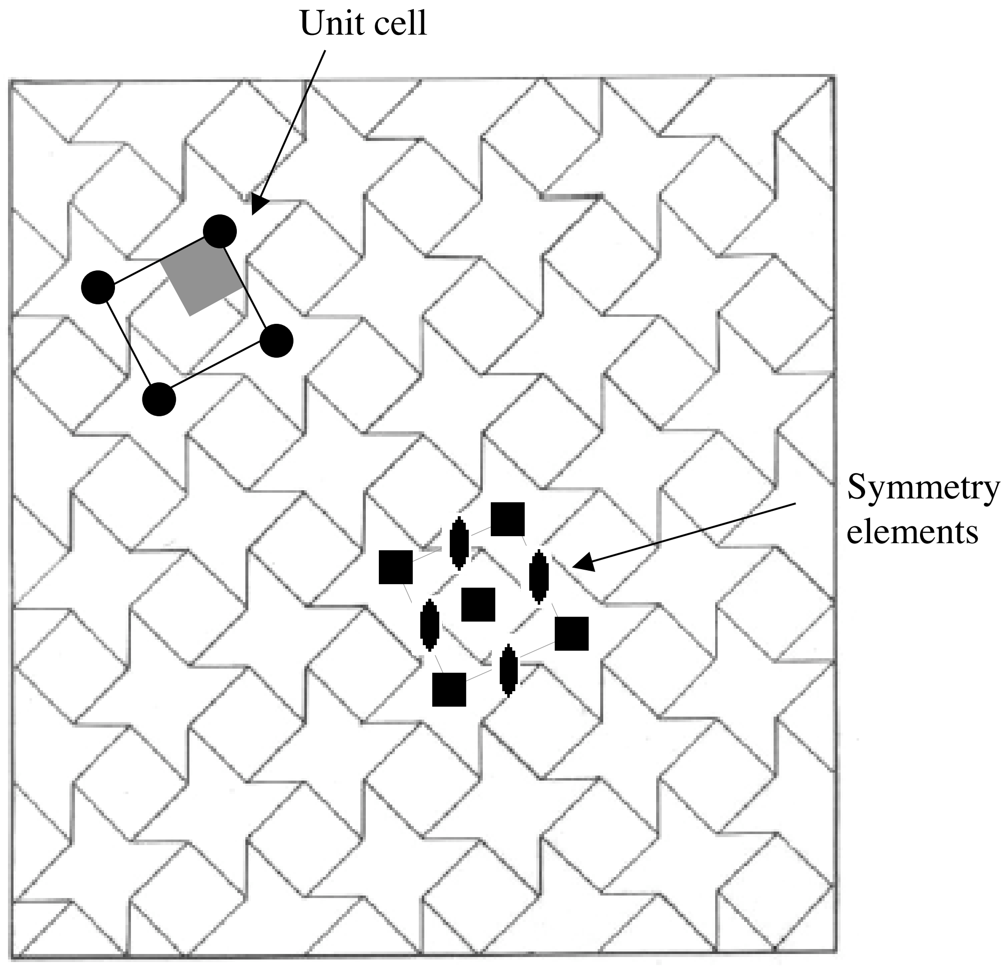
$$\alpha = 0.2817 \quad (= 16.138°)$$

So the total angle is

$$\frac{\pi}{2} - 0.5880 + 0.2817 = \underline{1.2645} \quad (\underline{72.45°})$$

Problem 8

Plane Group: p4



Problem 8

Plane Group: p4gm