

HW#2

PHYSICS 406

(due 02/06/12)

Reading

1. Omar (9) Ch. 2
2. Handout 3 (online)

Problems

1. 0 Ch. 2 Q. 1
2. 0 Ch. 2 Q. 5
3. 0 Ch. 2 Q. 10
← problem
4. 0 Ch. 2 Pr. 1
5. 0 Ch. 2 Pr. 3

6. Consider a plane (hkl) in a crystal lattice.

(a) Prove that the reciprocal lattice vector $\vec{G} = h\vec{b}_1 + k\vec{b}_2 + l\vec{b}_3$ is perpendicular to this plane.

(b) Prove that the distance between 2 adjacent parallel planes in this set is: $d_{hkl} = \frac{2\pi}{|\vec{G}|}$

(c) Show that for a sc lattice $d^2 = \frac{a^2}{h^2 + k^2 + l^2}$, where a is the lattice constant.

7. Recall that

$$\begin{cases} \vec{a} = \frac{a}{2} (\hat{y} + \hat{z}), \\ \vec{b} = \frac{a}{2} (\hat{z} + \hat{x}), \\ \vec{c} = \frac{a}{2} (\hat{x} + \hat{y}) \end{cases}$$

define an fcc lattice.

What is the reciprocal lattice of the fcc direct lattice? (ie, what are its basis vectors & what type is it?) What is its lattice constant?

8. What are the main conclusions in Handout 3? (in 4 sentences or more)