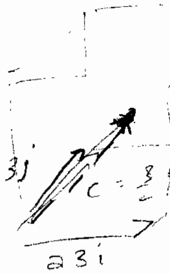
H.W. - 1

1. BCC lattice.

Each side = 3 Å ~~units~~

Volume = 27 $\mathring{A}^3$ ~~units~~ for conventional lattice $b = 3j$



— Body cent. position

Vol. of primitive unit cell $= \frac{1}{2} \times 27 \mathring{A}^3$

$= 13.5 \mathring{A}^3$

2) $\langle 110 \rangle$ = (110), $(1\bar{1}0)$, $[\bar{1}10]$, $(\bar{1}\bar{1}0)$
$[101]$, $[10\bar{1}]$, $[\bar{1}01]$, $[\bar{1}0\bar{1}]$
$[011]$, $[01\bar{1}]$, $[0\bar{1}1]$, $[0\bar{1}\bar{1}]$

$\langle 111 \rangle$ = $[111]$, $[11\bar{1}]$, $(1\bar{1}1)$, $(\bar{1}11)$, $(1\bar{1}\bar{1})$, $(\bar{1}\bar{1}1)$, $(\bar{1}1\bar{1})$, $(\bar{1}\bar{1}\bar{1})$

3) a) In simple cubic lattice,

$$\cos\phi = \frac{h_1h_2 + k_1k_2 + l_1l_2}{\sqrt{h_1^2+k_1^2+l_1^2}\sqrt{h_2^2+k_2^2+l_2^2}} = \frac{1}{\sqrt{3}} \Rightarrow \phi = 54.75^\circ$$

b) $\cos\phi = \frac{-3}{3} = -1 \Rightarrow \phi = 180^\circ$

4) a)

Intercept	2 Å	3 Å	4 Å
Inverse	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{4}$
Rationalize	6	4	3
Plane	(6 4 3)		

b)

Intercept	3 Å	4 Å	3 Å
Intercept in unit	3	4	$\frac{3}{1.5} = 2$
Inverse	$\frac{1}{3}$	$\frac{1}{4}$	$\frac{1}{2}$
Rationalize	4	3	6
Plane	(4 3 6)		

5) $d_{hkl} = \dfrac{a}{\sqrt{h^2+k^2+l^2}}$

$d_{111} = 2\mathring{A} = \dfrac{a}{\sqrt{3}} \Rightarrow a = \sqrt{3} \times 2\ \mathring{A}$

$= \underline{3.464\mathring{A}}$

$\text{Vol.} = (3.46)^3\ \mathring{A}^3$

6) $d_{321} = \dfrac{a}{\sqrt{3^2+2^2+1^2}} = \dfrac{4.21}{\sqrt{14}}\ \mathring{A}$