Problem Set #1 Solutions
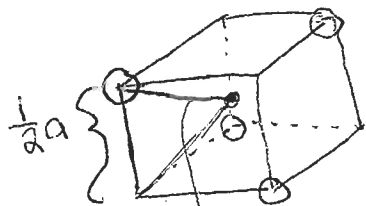
1) **5 pts**
a) Na^+ ions are in contact with Cl^- ions

5 pts b) $L_{edge} = 2(R_{Na^+} + R_{Cl^-})$

2) **5 pts** a) 8 nearest neighbors at $\frac{1}{4} \frac{1}{4} \frac{1}{4}$ site.

5 pts b) 8 such sites in a unit cell.
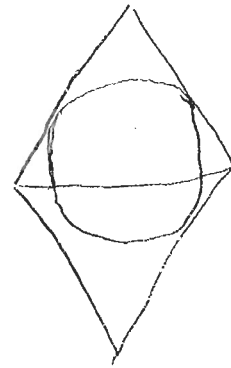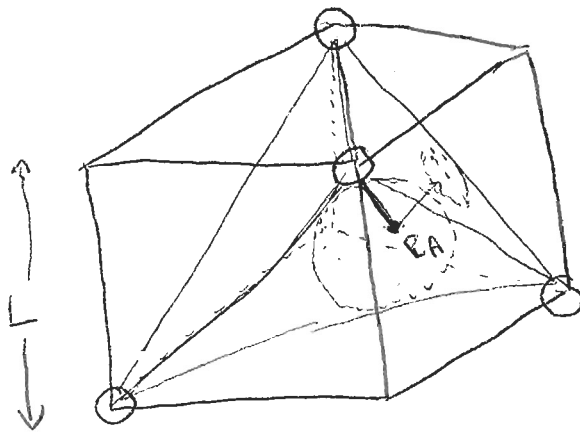
10 pts c)

$a = 2(R_{Na} + R_{Cl})$

$$R_{int} + R_{Cl} = \frac{1}{2}\left(\frac{a}{2}\sqrt{3}\right)$$

$$R_{int} = \frac{a}{4}\sqrt{3} - R_{Cl}$$

$$R_{int} = \frac{1}{4}\left(2(R_{Na} + R_{Cl})\right)\sqrt{3} - R_{Cl}$$

$$R_{int} = \frac{\sqrt{3}}{2}(R_{Na} + R_{Cl}) - R_{Cl}$$

3) 20 pts

$$R_A + R_B = \frac{1}{2} L\sqrt{3} \rightarrow \text{always true.}$$

$$R_B = \frac{L\sqrt{3}}{2} - \frac{L}{2\sqrt{3}} = \frac{2L}{2\sqrt{3}} = \frac{L}{\sqrt{3}}$$

$$\frac{R_A + R_B}{R_B} = \frac{\frac{\sqrt{3}L}{2}}{\frac{L}{\sqrt{3}}} = \frac{3L}{2L} = \frac{3}{2}$$

$$\frac{R_A}{R_B} + 1 = 3/2$$

$$\Rightarrow \frac{R_A}{R_B} = \frac{1}{2}$$