CHAPTER 1

1. The vectors $\hat{\mathbf{x}} + \hat{\mathbf{y}} + \hat{\mathbf{z}}$ and $-\hat{\mathbf{x}} - \hat{\mathbf{y}} + \hat{\mathbf{z}}$ are in the directions of two body diagonals of a cube. If θ is the angle between them, their scalar product gives $\cos \theta = -1/3$, whence $\theta = \cos^{-1} 1/3 = 90° + 19°\,28' = 109°\,28'$.

2. The plane (100) is normal to the x axis. It intercepts the a' axis at 2a' and the c' axis at 2c'; therefore the indices referred to the primitive axes are (101). Similarly, the plane (001) will have indices (011) when referred to primitive axes.

3. The central dot of the four is at distance
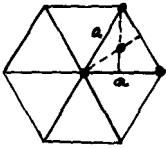
$$a\frac{\cos 60°}{\cos 30°} = a \text{ ctn } 60° = \frac{a}{\sqrt{3}}$$

from each of the other three dots, as projected onto the basal plane. If the (unprojected) dots are at the center of spheres in contact, then

$$a^2 = \left(\frac{a}{\sqrt{3}}\right)^2 + \left(\frac{c}{2}\right)^2,$$

or

$$\frac{2}{3}a^2 = \frac{1}{4}c^2; \quad \frac{c}{a}\sqrt{\frac{8}{3}} = 1.633.$$