

CH301H – Principles of Chemistry I: Honors
Fall 2011, Unique 51040

Quiz 4

The angular part of the wavefunctions for $l = 1$ are as follows:

$$Y_{px} = \left(\frac{3}{4\pi}\right)^{1/2} \sin\theta \cos\phi$$

$$Y_{py} = \left(\frac{3}{4\pi}\right)^{1/2} \sin\theta \sin\phi$$

$$Y_{pz} = \left(\frac{3}{4\pi}\right)^{1/2} \cos\theta$$

In words, explain why the angular part of the $2p_z$ orbital depends only on θ , not ϕ .

The p_z orbital is pointed along the z axis. In

Spherical polar coordinates θ is the angle off the z axis.

Since the p_z orbital has no amplitude in the xy plane, its shape is determined entirely by θ , and distance from the nucleus by r .