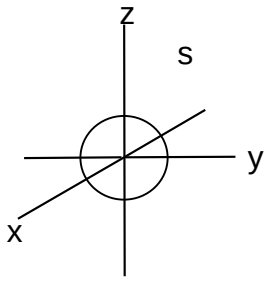
Sketching Atomic Orbitals: a Primer for Chemistry 1000

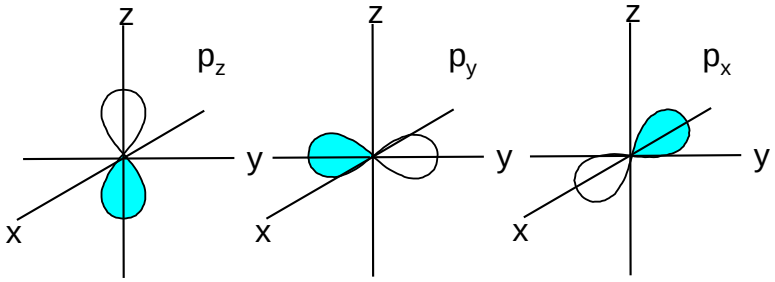
s orbitals are *all* spherical; in sketching them we *ignore* any inner nodes that distinguish 1*s* from 2*s*, etc.



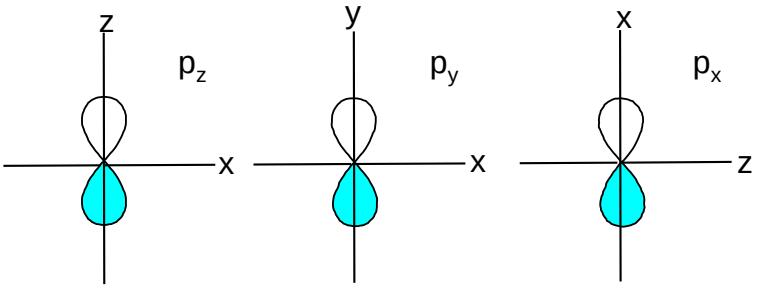
Similarly, for all the more complex orbitals, we draw *only the simplest version*, so that for *p* we sketch 2*p*, and for *d* we sketch 3*d*. Beyond this it gets too complicated, and we will *not* ask you to learn the *f* orbital shapes. One reason for this is that the *f* orbitals are very little used in any chemical bonds.

p orbitals all have the same "barbell" shape, but differ in orientation.

There are two approaches to drawing *p* orbitals. (1) Drawing on an *xyz* grid in a *perspective* mode emphasizes their differing orientations simultaneously:

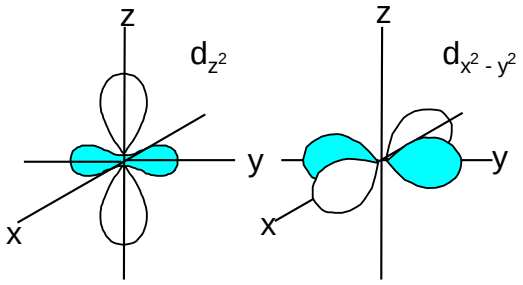


(2) Draw them in two dimensions, by alternating the **axis labels** (*be sure to maintain a right-hand coordinate system!*)

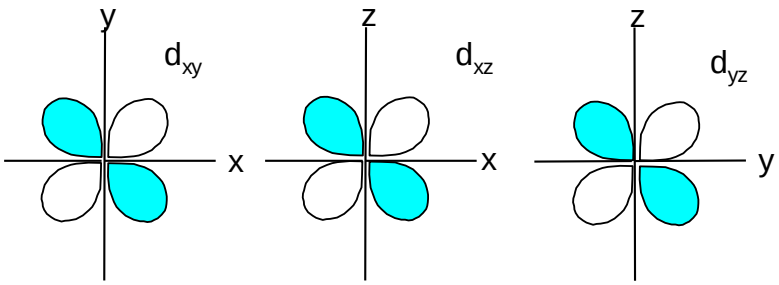


d orbitals come in two distinct types, those that are *on* the axes, and those that are *between* the axes. They present a challenge to draw in three dimensions, so it is much easier to draw the "between" ones only in two dimensions.

The on-axes orbitals are $d_{x^2-y^2}$ and the d_{z^2} orbitals:



The between-axes orbitals are the d_{xy}, d_{xz} and d_{yz} orbitals:



Test yourself using the blank grids supplied below.