

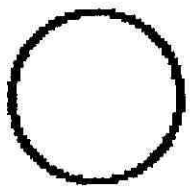
Problem Set #1

PI.1

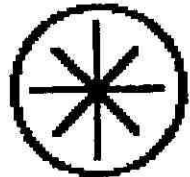
- ① & ② are exercises given in the preceding page.
- ③ Draw pictures (radial & angular) for the (a) $4d_{z^2}$ (recall z^2 is short-hand for $2z^2 - x^2 - y^2$) (b) $4d_{xz}$ (c) $5f_x(y^2 - z^2)$ orbitals.
- ④ Draw a picture for z^2 (an angular picture) where $z^2 = z^2$ not $2z^2 - x^2 - y^2$. How does it differ from the $2z^2 - x^2 - y^2$ picture?
- ⑤ Using the methods outlined in class draw the places where the $4d_{x^2-y^2}$ "orbital" would have sand accumulate in a Chladni type picture.
- ⑥ Draw the orbitals (angular picture only) (a) $1 + 2x$ (b) 1 (c) $x + y$. Using the s, p & d notation find names for these orbitals. For example $d_{xz+yz} = p_z + s$ would be a name for an orbital in the s, p & d notation. Find two different names in the case of $x + y$.
- ⑦ For the atomic orbitals we could draw a picture for the different energies of the orbitals
- | | | | |
|-----|------|------|--------|
| E ↑ | — 3s | — 3p | |
| | — 2s | — 2p | etc... |
| | — 1s | | |

⑦ continued. For a drum the following modal patterns ^{PI.2} & energy (note energy \propto frequency) were found. Please draw an E diagram for drum modes.

Diagram (Mode designation) Relative Frequency
Frequency \propto E



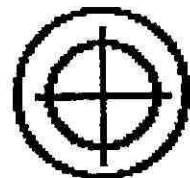
(0, 1) 1.000 **1S**



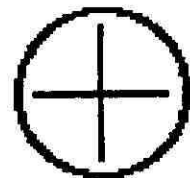
(4, 1) 3.156



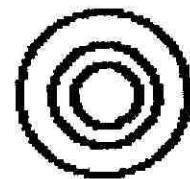
(1, 1) 1.594 **2P**



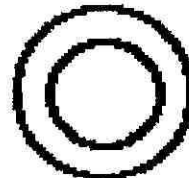
(2, 2) 3.501



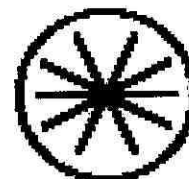
(2, 1) 2.136 **3d**



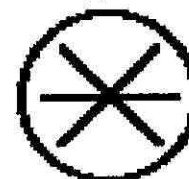
(0, 3) 3.600



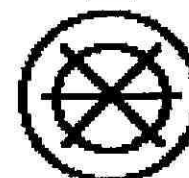
(0, 2) 2.296 **2S**



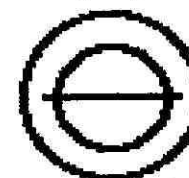
(5, 1) 3.652



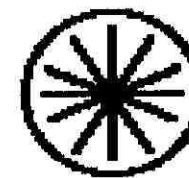
(3, 1) 2.653



(3, 2) 4.060



(1, 2) 2.918 **3P**



(6, 1) 4.154