

How many atomic orbitals in  $n = 4$ ?

## Solution



Solution:

Generally!  $\left\{ \begin{array}{l} \text{If } n=4 \rightarrow l = 0, 1, 2 \text{ and } 3 \\ \text{for } l=3 \rightarrow (m_l = 0, \pm 1, \pm 2, \pm 3) \end{array} \right.$

$\leftarrow$  this last  $l$  value must be =  $-1$   
 $= 4-1 = 3$

$\leftarrow$  the last term  $\pm l$  and has  $(2l+1)$  orbitals.

For  $n=4$

- $\rightarrow l=0$  (4s sublevel) :  $m_l = 0$  (1 orbital)
- $\rightarrow l=1$  (4p sublevel) :  $m_l = +1, 0, -1$  (3 orbitals:  $3p_x, 3p_y, 3p_z$ )
- $\rightarrow l=2$  (4d sublevel) :  $m_l = +2, +1, 0, -1, -2$  (5 orbitals:  $3d_{xy}, 3d_{xz}, 3d_{yz}, 3d_{x^2-y^2}$  and  $3d_{z^2}$ )
- $\rightarrow l=3$  (4f sublevel) :  $m_l = +3, +2, +1, 0, -1, -2, -3$  (7 orbitals)

Total orbitals = 16

ie  $(1+3+5+7) = 16$

$\begin{array}{cccc} s & p & d & f \\ | & | & | & | \\ | & | & | & | \\ | & | & | & | \end{array}$