Quantum Numbers: Problem Set

1. Fill in the following table:

Orbital	s	p	d	f
Value of ℓ	0	1	2	3

2. Provide the quantum numbers for each 4d orbital:

n	ℓ	m_ℓ
4	2	-2
4	2	-1
4	2	0
4	2	1
4	2	2

3. Which orbital has the most orientations in space? And how many orientations does this orbital have?

   f orbital, 7 orientations

4. How many d orbitals are filled with electrons in a ground state silver atom?

   10 d orbitals (the 3d and 4d orbitals)

5. Provide the maximum number of orbitals for:

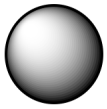
   a. $n = 4, \ell = 1$ 3
   b. $n = 2, \ell = 1$ 3
   c. $n = 3, \ell = 2$ 5
   d. $n = 5, \ell = 1, m_\ell = -1$ 1

6. Which orbitals cannot exist, a 2p, 3p, 4d, 3f, 6s, or 2d?

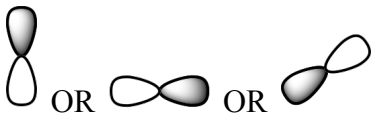
   3f and 2d

7. Draw the shape of the orbital for an electron defined by the following quantum numbers.

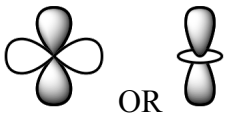
   a. $n = 3, \ell = 0, m_\ell = 0$



   b. $n = 2, \ell = 1, m_\ell = 1$



   c. $n = 4, \ell = 2, m_\ell = -1$



   d. $n = 3, \ell = 3, m_\ell = 2$

      f orbital, which I don't expect you to draw

   e. $n = 3, \ell = 1, m_\ell = 2$

      none

8. What is the total number of electrons allowed in a $\ell = 1$ sublevel?

   6 (2 in p_x, 2 in p_y, and 2 in p_z)

9. What are the possible magnetic quantum numbers (m_ℓ) for a 3p electron?

   -1, 0, 1

10. What are the possible orbitals for n = 3?

    s, p, and d orbitals

11. How many electrons can be contained in the third principal level of a given atom?

    18 electrons

12. In which orbital would an electron (on average) be farthest from the nucleus, a 1s, 4f, 3s, 3d, or 2p orbital?

    4f

13. In which orbital would an electron (on average) be closest to the nucleus, a 2p, 4s, 2s, 5d, 3p orbital?

    2p