

## 7 • Atomic Structure

### QUANTUM NUMBER PRACTICE

1. Summarize:

The principal quantum number,  $n$ , can have the values of: \_\_\_ \_\_\_ \_\_\_ \_\_\_ \_\_\_, etc.

The angular momentum quantum number,  $l$ , can have integer values from \_\_\_ to \_\_\_.

The magnetic quantum number,  $m_l$ , can have integer values from \_\_\_ to \_\_\_.

2. When
- $n = 3$
- ,
- $l$
- can have values of \_\_\_\_\_.

For the 3d orbital,  $l$  has a value of \_\_\_.

When  $n = 4$ ,  $l$  can have values of \_\_\_\_\_.

For the 4p orbital,  $l$  has a value of \_\_\_.

When  $n = 2$ ,  $l$  can have values of \_\_\_\_\_.

For the 2s orbital,  $l$  has a value of \_\_\_.

3. Summarize:

orbital	s	p	d	f
value of $l$				

4. There are five 4d orbitals. List the quantum numbers for each orbital.

$n$	$l$	$m_l$

### Questions from the textbook (answers in the book)

5. Rank the following orbitals in the H atom in order of increasing energy: 3s, 2s, 2p, 4s, 3p, 1s, and 3d.  
[Check answer in book #76]
6. How many orbitals in an atom can have the following quantum number or designation?
- |           |            |
|-----------|------------|
| a) 3p     | e) 5d      |
| b) 4p     | f) 5f      |
| c) $4p_x$ | g) $n = 5$ |
| d) 6d     | h) 7s      |

7. Answer the following questions as a summary quiz on the chapter. [Check answer in book #78]
- The quantum number  $n$  describes the \_\_\_\_\_ of an atomic orbital.
  - The shape of an atomic orbital is given by the quantum number \_\_\_\_\_.
  - A photon of orange light has \_\_\_\_\_ (less or more) energy than a photon of yellow light.
  - The maximum number of orbitals that may be associated with the set of quantum numbers  $n=4$  and  $\ell=3$  is \_\_\_\_\_.
  - The maximum number of orbitals that may be associated with the quantum number set  $n=3$ ,  $\ell=2$ , and  $m_\ell = -2$  is \_\_\_\_\_.
  - Label each of the orbital pictures found in question 78 (page 329) with the appropriate letter:
  - When  $n=5$ , the possible values of  $\ell$  are \_\_\_\_\_.
  - The maximum number of orbitals that can be assigned to the  $n=4$  shell is \_\_\_\_\_.

8. Suppose you live in a different universe where a different set of quantum numbers is required to describe the atoms of that universe. These quantum numbers have the following rules:

N, principal    1, 2, 3, ...  $\infty$

L, orbital        = N

M, magnetic    -1, 0, +1

How many orbitals are there altogether in the first three electron shells? [Check answer in book #80]

9. Assume an electron is assigned to the 1s orbital in the H atom. Is the electron density zero at a distance of 0.40 nm from the nucleus? \_\_\_\_\_ (See *A Closer Look: Atomic Orbitals*)