

### Modern Atomic Theory Review Sheet

1. Summarize the following terms and scientific accomplishments: Refer to notes
- Electromagnetic Radiation –
  - Quantized –
  - Orbital –
  - Louis DeBroglie –
  - Erwin Schrödinger –
  - Werner Heisenberg –
  - Quantum Numbers –
  - Aufbau Principle –
  - Pauli Exclusion Principle –
  - Hund's Rule –

2. When an atom is in an excited state, it emits a photon and returns to the ground state.

3. Put the following in order of increasing wavelength (smallest to largest):

Infrared      Gamma      Radiowave      X-Ray      Visible Light

Gamma      X-Ray      UV      Visible Light      Infrared      Radiowave

4. Complete the table about the 4 quantum numbers.

	Name	Possible Values	What does it indicate about an electron in an atom?
$n$	Principal	1, 2, 3, 4, 5, 6, 7	Size / Energy Level
$l$	Angular Momentum	$s=0, p=1, d=2, f=3$ $l \leq n-1$	Shape (s, p, d, f) / subshell
$m_l$	Magnetic	$-l \rightarrow +l$	Orientation $\begin{matrix} \uparrow & \downarrow & \uparrow & \downarrow \\ s & p & d & f \end{matrix}$ etc.
$m_s$	Spin	$+\frac{1}{2} \quad -\frac{1}{2}$	Spin up / spin down

4. When  $n = 3$ , what are possible values for  $l$ ? 0, 1, 2

$$l \leq n-1 \leq 3-1 \leq 2$$

5. When  $l = 1$ , what are possible values for  $m_l$ ?

$$m_l = -l \rightarrow +l \Rightarrow -1, 0, 1$$

6. What is wrong with the set of quantum numbers below?

$$n = 4 \quad l = 1 \quad \boxed{m_l = 2} \quad m_s = \frac{1}{2}$$

$$m_l \neq l$$

$$m_l = -1, 0, 1 \text{ only}$$

5. What four wavelengths of visible light are emitted by hydrogen?

656nm, 486nm, 434nm, 410nm  
 red green blue purple

6. Draw the shape(s) of each of the following orbitals:

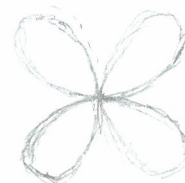
s



p



d



7. How many orientations for each of the following orbitals?

s: 1 p: 3 d: 5 f: 7

8. If hydrogen and helium only have electrons in the first energy level, do they absorb and release the same amount of energy? Justify your answer. Refer to quiz responses

9. Draw (1) electron configuration, (2) orbital configuration, (3) shell configuration, and (4) provide the quantum number of the last electron for each of the following:

<p><b>Arsenic</b> <math>1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^3</math></p> <p>Orbital configuration:  <math>1s \uparrow\downarrow \quad 2s \uparrow\downarrow \quad 2p \uparrow\downarrow \uparrow\downarrow \uparrow\downarrow \quad 3s \uparrow\downarrow \quad 3p \uparrow\downarrow \uparrow\downarrow \uparrow\downarrow \quad 4s \uparrow\downarrow \quad 3d \uparrow\downarrow \uparrow\downarrow \uparrow\downarrow \uparrow\downarrow \uparrow\downarrow \uparrow\downarrow \quad 4p \uparrow \uparrow \uparrow</math></p> <p>Shell configuration:  <math>2 \quad 8 \quad 18 \quad 5</math></p> <p>Quantum number of last electron:  <math>\{4, 1, 1, \frac{1}{2}\}</math></p>	<p>s: 0                  p: 1                  d: 2                  f: 3</p>
<p><b>Tungsten</b> <math>1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^6 6s^2 4f^{14} 5d^4</math></p> <p>Orbital configuration:  <math>1s \uparrow\downarrow \quad 2s \uparrow\downarrow \quad 2p \uparrow\downarrow \uparrow\downarrow \uparrow\downarrow \quad 3s \uparrow\downarrow \quad 3p \uparrow\downarrow \uparrow\downarrow \uparrow\downarrow \quad 4s \uparrow\downarrow \quad 3d \uparrow\downarrow \uparrow\downarrow \uparrow\downarrow \uparrow\downarrow \uparrow\downarrow \quad 4p \uparrow\downarrow \uparrow\downarrow \uparrow\downarrow \quad 5s \uparrow\downarrow \quad 4d \uparrow\downarrow \uparrow\downarrow \uparrow\downarrow \uparrow\downarrow \uparrow\downarrow \quad 5p \uparrow\downarrow \uparrow\downarrow \uparrow\downarrow \quad 6s \uparrow\downarrow \quad 4f \uparrow \uparrow \uparrow \uparrow \quad 5d \uparrow \uparrow \uparrow \uparrow</math></p> <p>Shell configuration:  <math>2 \quad 8 \quad 18 \quad 32 \quad 12 \quad 2</math></p> <p>Quantum number of last electron:  <math>\{5, 2, 1, \frac{1}{2}\}</math></p>	

10. Write the complete electron configuration for an atom of the following:



11. Write the noble gas electron configuration for an atom of the following:



