Worksheet 5: Quantum numbers, Electronic Configurations and Periodic Trends

1. The following table describes selected orbits of a single atom. Fill in the missing values.

n	l	m_l	m_s
1			+1/2
1			
2		-1	
2		-1	+1/2
2	0		-1/2
3		-2	-1/2
3	0		+1/2
4		3	+1/2

2. Write either the corresponding electron configuration for each element or the neutral element described by the given configuration.

(a) Tc _____

(b) Br^- _____

(c) Cu _____

(d) As^+ _____

(e) O^{2-} _____

(f) Cr _____

(g) _____ [He] $2s^2\ 2p^5$

(h) _____ [Ne] $3s^2\ 3p^6$

(i) Al^{3+} _____

(j) Nd^{3+} _____

(k) S^{2-} _____

(l) Ni^{3+} _____

(m) _____ [Ar] $4s^2\ 3d^7$

(n) _____ [Ne] $3s^2\ 3p^5$

(o) _____ $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6\ 5s^1\ 4d^4$

3 Electrons are described most often by the orbit in which they reside. Write the orbit associated with each set of quantum numbers (3s, 2d, etc.).

$n = 3, l = 0, m_l = 0, m_s = -1/2$ Orbit: _____

$n = 2, l = 1, m_l = 0, m_s = +1/2$ Orbit: _____

$n = 1, l = 0, m_l = 0, m_s = -1/2$ Orbit: _____

$n = 3, l = 2, m_l = -1, m_s = -1/2$ Orbit: _____

$n = 5, l = 3, m_l = -3, m_s = -1/2$ Orbit: _____

$n = 3, l = 0, m_l = 0, m_s = -1/2$ Orbit: _____

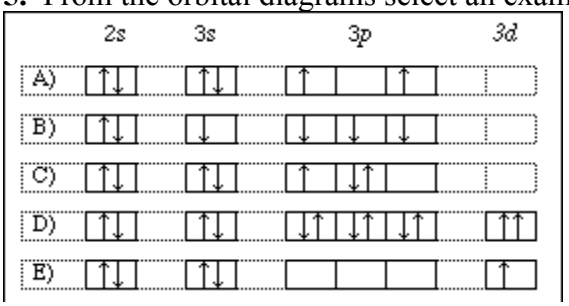
$n = 7, l = 2, m_l = 0, m_s = -1/2$ Orbit: _____

$n = 3, l = 2, m_l = -1, m_s = +1/2$ Orbit: _____

$n = 2, l = 1, m_l = 0, m_s = -1/2$ Orbit: _____

$n = 4, l = 1, m_l = -1, m_s = +1/2$ Orbit: _____

5. From the orbital diagrams select an example(s) which demonstrates:



(a) A violation of Hund's rule

(b) A violation of the Pauli exclusion principle

(c) A violation of the Aufbau principle

6. Consider an electron in the orbitals given and rank them from most attracted to the nucleus to least attracted to the nucleus by comparing their effective nuclear charges.

(i) 2p in Mg (ii) 4s in Ca (iii) 2p in O^- (iv) 2s in K^+

(i) 2s in N (ii) 3p in Sc (iii) 3s in S (iv) 2p in Fe^{2+}

7. Write down the periodic trends for each of each property. Write down any exceptions or complications.:

Metallic character:

Trend

Complication

Atomic radius

Trend

Complication

Ionic radius

Trend

Complication

Electronegativity

Trend

Complication

Ionization potential

Trend

Complication

8. For each trend, select your own four elements or ions and rank them from most to least:
Metallic character:

Atomic radius:

Ionic radius:

Electronegativity:

Ionization potential:

9. Calculate the ΔEN for each pair of atoms:

H-H ΔEN = C-H ΔEN = F-C ΔEN = LiF ΔEN =