Exercise 4.3a

Box Orbital Notation – Answers

Name: _____

Date: _____ Per: _____

DIRECTIONS: Write each of the following rules in your own words.

Aufbau Principle: *Electrons in their ground state occupy the lowest energy orbitals available. Lower energy orbitals/sublevels must be filled before electrons occupy higher energy orbitals/sublevels.*

Hund's Rule: *Electrons will fill equal energy orbitals in such a way that a maximum number of unpaired electrons result.*

Pauli Exclusion Principle: *No 2 electrons may have the same set of 4 quantum numbers. Maximum 2 electrons per orbital and electrons must have opposing spins.*

DIRECTIONS: Fill in the diagrams below with the appropriate arrows. Follow all three rules above.

Ar = 18 electrons

1s	2s	2p			3s	3p			4s	3d					4p			5s	4d				
↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓															

Cl = 17 electrons

1s	2s	2p			3s	3p			4s	3d					4p			5s	4d				
↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑															

Mg^{2+} = 10 electrons

1s	2s	2p			3s	3p			4s	3d					4p			5s	4d				
↑↓	↑↓	↑↓	↑↓	↑↓																			

Mo = 42 electrons *(exception to Aufbau Principle - e^- promotion occurs between 5s and 4d sublevels)*

1s	2s	2p			3s	3p			4s	3d					4p			5s	4d				
↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑	↑	↑	↑	↑	↑

P^{3-} = 18 electrons

1s	2s	2p			3s	3p			4s	3d					4p			5s	4d				
↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓															

Ni^{2+} = 26 electrons

1s	2s	2p			3s	3p			4s	3d					4p			5s	4d				
↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑	↑	↑	↑									

DIRECTIONS: Below each of the following write the name of the rule that is violated in the diagram.

1s	2s	2p			3s	3p			4s	3d					4p			5s	4d				
↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↑	↑	↑															

Rule(s) = Pauli Exclusion Principle

1s	2s	2p			3s	3p			4s	3d					4p			5s	4d				
↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑	↑	↑														

Rule(s) = Aufbau Principle

1s	2s	2p			3s	3p			4s	3d					4p			5s	4d				
↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓																	

Rule(s) = Hund's Rule

DIRECTIONS: On the back side of the page, make box orbital diagrams for:

a) Si^{4+} b) O^{2-} c) K^+ d) Li^+ e) Cl^- f) Mn^{3+} g) C^{4+}

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Date: _____ Per: _____

a) Si^{4+} ($10e^-$)

1s	2s	2p			3s	3p			4s	3d					4p			5s	4d				
↑↓	↑↓	↑↓	↑↓	↑↓																			

b) O^{2-} ($10e^-$)

1s	2s	2p			3s	3p			4s	3d					4p			5s	4d				
↑↓	↑↓	↑↓	↑↓	↑↓																			

c) K^+ ($18e^-$)

1s	2s	2p			3s	3p			4s	3d					4p			5s	4d				
↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓															

d) Li^+ ($2e^-$)

1s	2s	2p			3s	3p			4s	3d					4p			5s	4d				
↑↓																							

e) Cl^- ($18e^-$)

1s	2s	2p			3s	3p			4s	3d					4p			5s	4d				
↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓															

f) Mn^{3+} ($22e^-$)

1s	2s	2p			3s	3p			4s	3d					4p			5s	4d				
↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑	↑												

g) C^{4+} ($2e^-$)

1s	2s	2p			3s	3p			4s	3d					4p			5s	4d				
↑↓																							