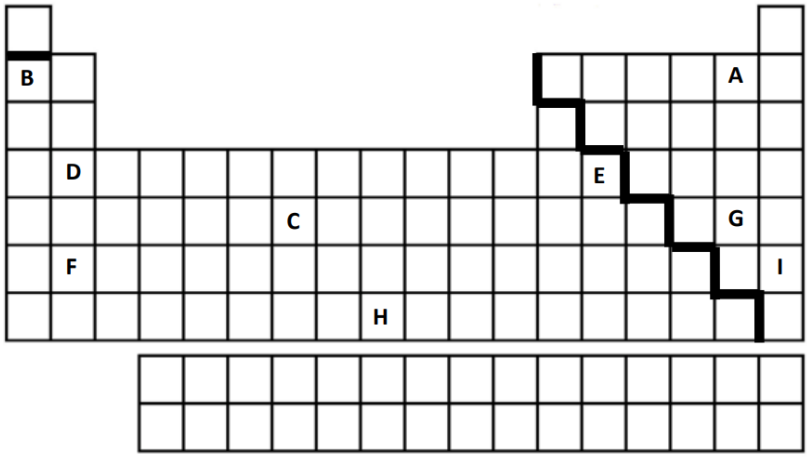
Electron Arrangement Packet

To work on this packet, you will need to first print it out. If you turn it in, you will receive feedback to help you prepare for the test on this material.

Answer the following questions using the periodic table provided.

Examine the hypothetical periodic table shown below. Use this periodic table to answer the questions that follow.



1. Which pair(s) of elements has the same number of valence electrons? _____

2. How many valence electrons do they have? _____

3. Which pair of elements is in the same period? _____

4. If they are in the same period, what do they have in common? _____

5. Which element has the smallest atomic number? _____

6. Which element has the largest atomic number? _____

7. Which element(s) would be classified as a metal? _____

8. Which element(s) would be classified as a nonmetal? _____

9. Which element(s) would be classified as a metalloid? _____

10. Which element would be classified as a noble gas? _____

11. What is the family name for element B? _____

12. How many energy levels does element E have? _____

13. Label the element in group 17, period 6 with the letter "J". _____
Is it a metal, nonmetal, or metalloid?

14. Label the element in group 15, period 4 with the letter "K". _____
Is it a metal, nonmetal, or metalloid?

Periodic Trends

- Atomic radius: "_____ of the atom"
  - Distance from the _____ of an atom to its _____ _____
  - As you go across the Periodic Table from left to right, atomic radius _____
    - WHY? As you move to the right, the elements are increasing in the number of protons and electrons, which creates a greater _____ between them, pulling the electrons closer in. The attraction between protons and electrons is called the effective nuclear charge (Z_{eff}).
  - As you move from top to bottom on the Periodic Table, atomic radius _____
    - WHY? As you move down the Periodic Table, the elements are increasing in the number of _____ _____, which makes the atom bigger.
  - Largest atomic radius: _____
  - Smallest atomic radius: _____

- Ionization Energy: the energy required to _____ an electron from an atom
  - As you move left to right on the Periodic Table, ionization energy _____ (more energy is required to remove an electron) because the number of protons is _____ from left to right, which means more _____/stronger "pull" between protons and electrons
  - As you move top to bottom, ionization energy _____ because the number of outer shells is increasing, meaning electrons are _____ away from the nucleus and easier to remove
  - Highest ionization energy (hardest to remove an electron from): _____
  - Lowest ionization energy (easiest to remove an electron): _____ _____

- Electronegativity: an atom's ability to _____ an electron from another atom
  - As you move left to right on the Periodic Table, electronegativity _____ because the elements have more valence electrons (getting closer to having a _____ outer shell/_____), so they REALLY want another _____ to complete their octet
  - As you move top to bottom, electronegativity _____.
  - Highest electronegativity: _____
  - Lowest electronegativity: _____

- Why do the periodic trends behave as they do across the **period**?

_____

_____

_____

- Why do the periodic trends behave as they do down the **group**?

_____

_____

_____

Periodic Trends Practice

- Arrange the following elements in order of increasing electronegativity:

    a. Selenium, Scandium, Copper

    b. Oxygen, Polonium, Sulfur

    c. Cesium, Rubidium, Francium

- Arrange the following elements in order of decreasing ionization energy:

    a. Germanium, Gallium, Arsenic

    b. Barium, Beryllium, Calcium

    c. Chlorine, Cadmium, Indium

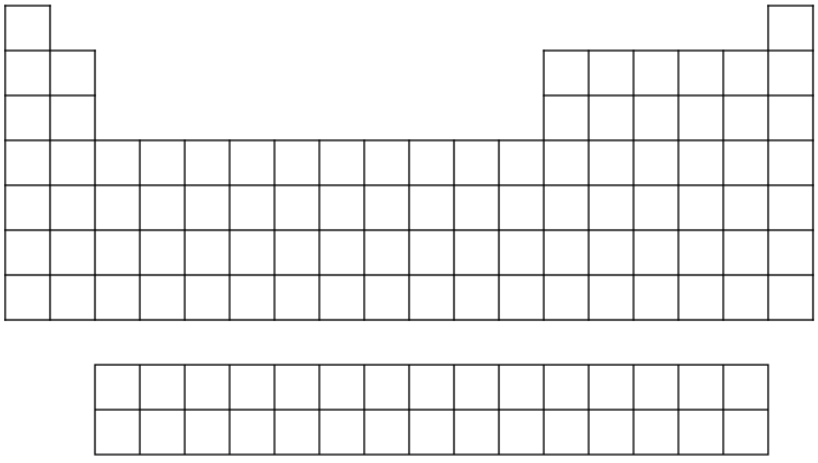
- In each of the following groups of elements, which atom is smallest? Which is largest?

    a. Nickel, Platinum, Copper

    b. Actinium, Phosphorus, Silver

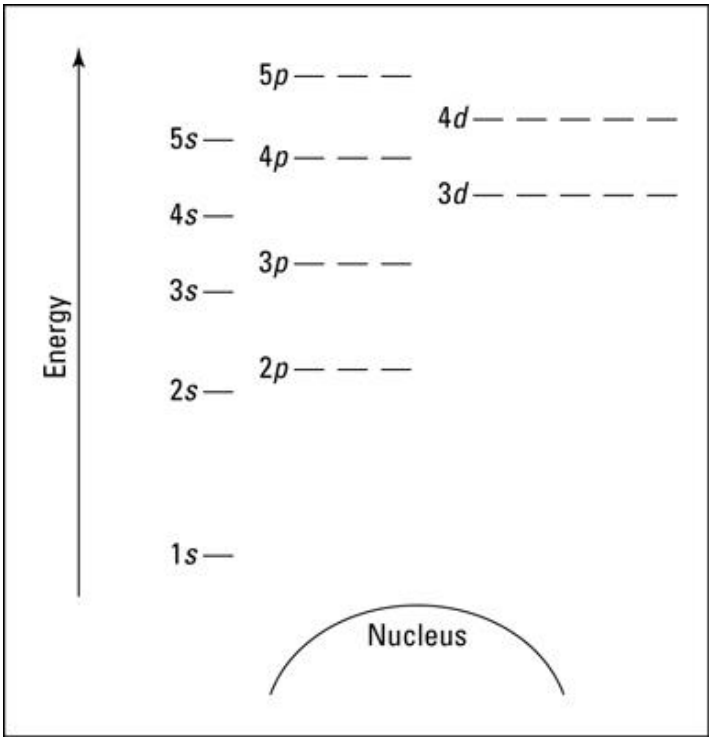
    c. Astatine, Tungsten, Mercury

Use the periodic table below to draw arrows indicating the direction of the three periodic trends.

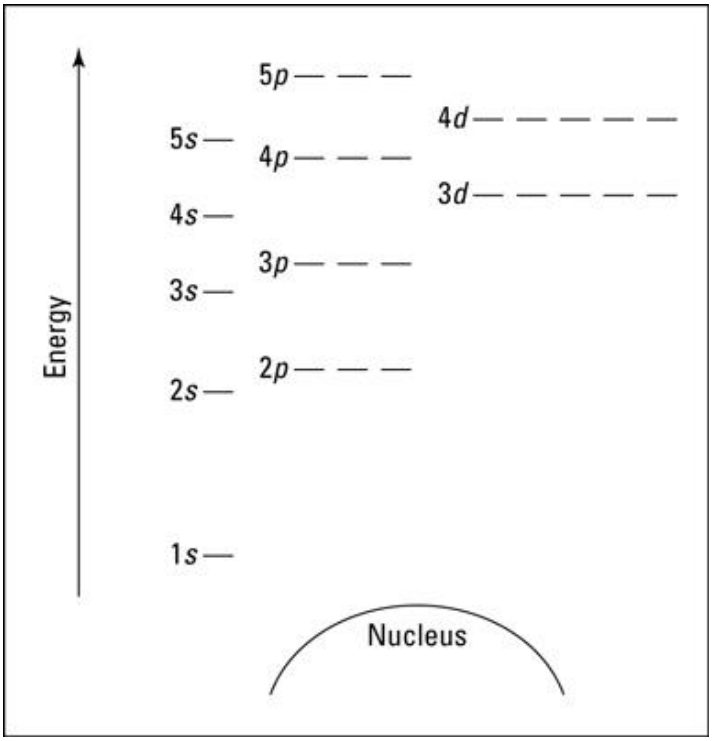


Orbital Diagrams and Electron Configurations

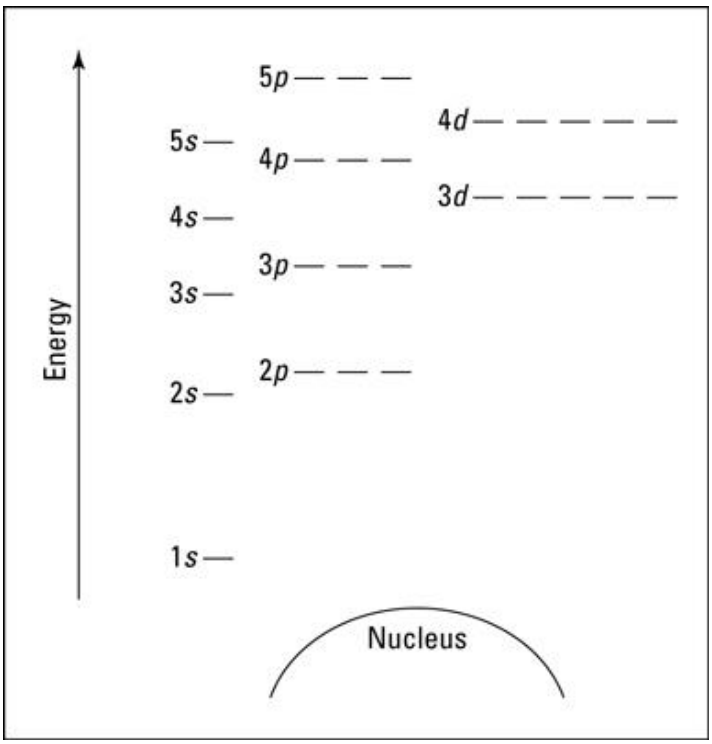
Element: Cobalt
Electron Configuration:



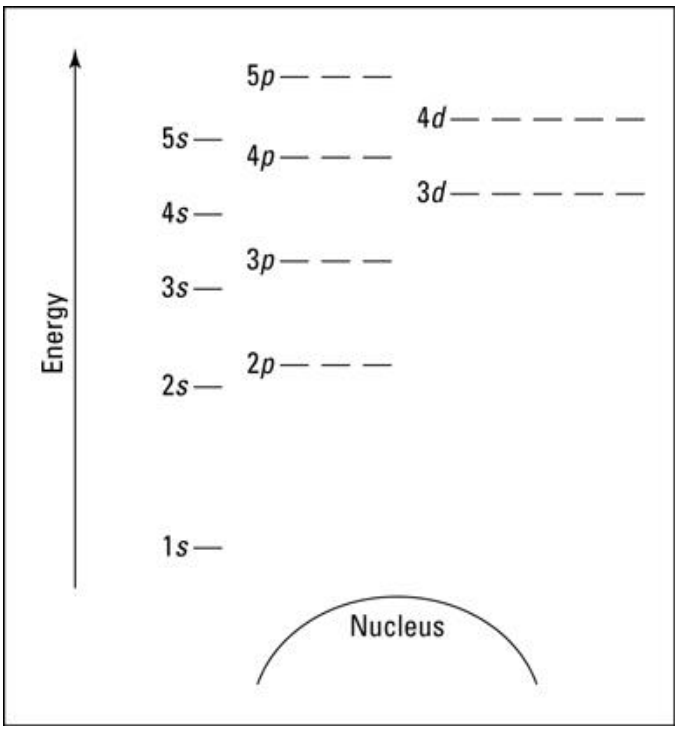
Element: Bromine
Electron Configuration:



Element: Gallium
Electron Configuration:



Element: Argon
Electron Configuration:



Electron Configuration Practice

1. $1s^2 2s^2 2p^6 3s^2 3p^1$ _____
2. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^4$ _____
3. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^5$ _____
4. $1s^2 2s^2 2p^4$ _____
5. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^3$ _____
6. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^3$ _____
7. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^1$ _____

Noble Gas Shorthand

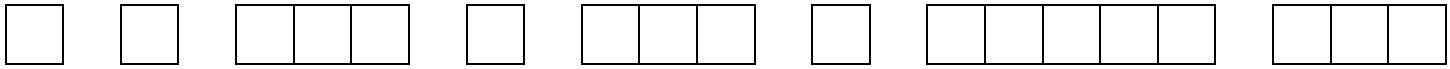
Step 1	Look at the last column on your periodic table, these are called noble gasses	Examples: He, Ne, Ar, Kr, Xe, Rn
Step 2	Find the gas that comes before the element you are writing a configuration before and write it in brackets.	Example: [Ar]
Step 3	Only write out the configuration that comes after the gas	Example: Aluminum $[Ne]3s^2 3p^1$

Practice Problems:

1. Silver _____
2. Fluorine _____
3. Boron _____
4. Arsenic _____
5: Scandium _____
6. Zinc _____
7. Manganese _____

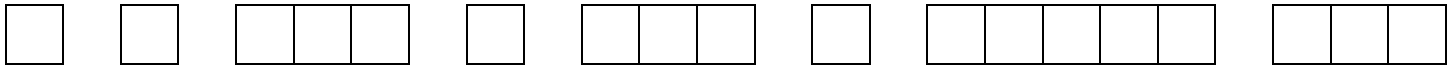
Orbital diagrams (not all blocks will be used):

Phosphorus:



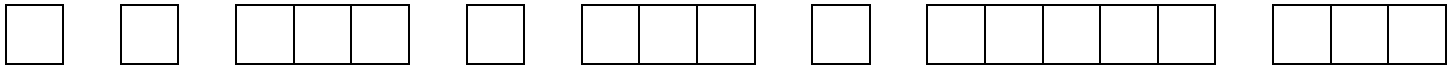
Full electron configuration - _____

Nickel:



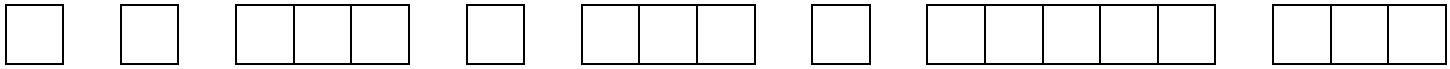
Full electron configuration - _____

Bromine:



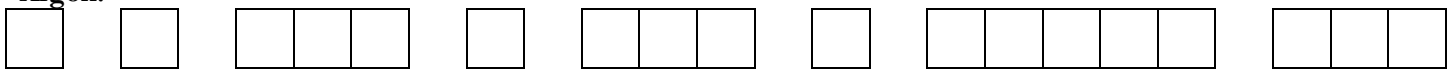
Full electron configuration - _____

Potassium:



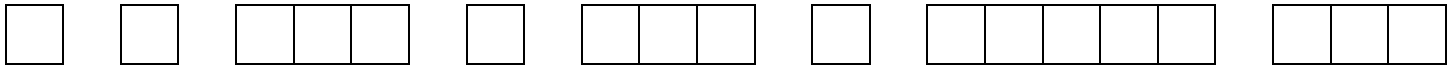
Full electron configuration - _____

Argon:



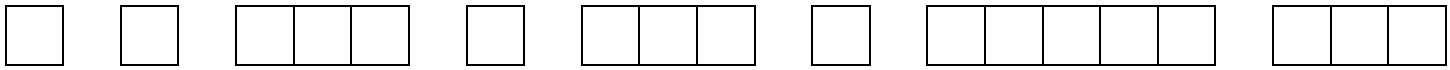
Full electron configuration - _____

Chlorine:



Full electron configuration - _____

Aluminum:



Full electron configuration - _____

Governing Rules for Electron Arrangement: Circle the rule that is stated in each of the following statements. Also, give an example of an element VIOLATING each of them.

1. When assigning electrons in orbitals, each electron will first half-fill all the orbitals of the same energy before pairing with another electron in a half-filled orbital.

   (A) Aufbau Principle (B) Hund's Rule (C) Pauli Exclusion Principle

   Example of violation:

2. Electrons enter orbitals of lowest energy first.

   (A) Aufbau Principle (B) Hund's Rule (C) Pauli Exclusion Principle

   Example of violation:

3. If two electrons occupy the same suborbital they must have opposite spins, meaning no two electrons can have the same set of four quantum numbers.

   (A) Aufbau Principle (B) Hund's Rule (C) Pauli Exclusion Principle

   Example of violation:

Describe the four quantum numbers:

- Principle Quantum Number:

- Orbital Quantum Number:

- Magnetic Quantum Number:

- Spin Quantum Number:

Subshell	Number of Suborbitals	Max Number of Electrons
s		
p		
d		
f		

Configuration Practice (write the name or symbol of the element represented below):

$1s^2 2s^2 2p^6 3s^2 3p^4$ _____

$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 4d^{10} 4p^5$ _____

$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^1$ _____

$1s^2 2s^2 2p^6 3s^2 3d^5$ _____

$[Kr] 5s^2 4d^{10} 5p^3$ _____

$[Ra] 7s^2 5f^8$ _____

$[Xe] 6s^2 4f^{14} 5d^6$ _____

$[Kr] 5s^2 4d^{10} 5p^5$ _____

$[Rn] 7s^2 5f^{11}$ _____