Color Coding the Periodic Table
Student Information Sheet

The Periodic Table is a list of all the known elements. It is organized by increasing atomic number. There are two main groups on the periodic table: metals and nonmetals. The left side of the table contains elements with the greatest metallic properties. As you move from the left to the right, the elements become less metallic with the far right side of the table consisting of nonmetals. The elements in the middle of the table are called "transition" elements because they are changed from metallic properties to nonmetallic properties. A small group whose members touch the zigzag line are called metalloids because they have both metallic and nonmetallic properties.

The table is also arranged in vertical columns called "groups" or "families" and horizontal rows called "periods." Each arrangement is significant. The elements in each vertical column or group have similar properties. Group 1 elements all have 1 electron in their outer shell. This gives them similar properties. Group 2 elements all have 2 electrons in their outer shells. This also gives them similar properties. Not all of the groups, however, hold true for this pattern. The elements in the first period or row all have 1 shell. The elements in period 2 all have 2 shells. The elements in period 3 have 3 shells and so on.

There are a number of major groups with similar properties. They are as follows:

Hydrogen: This element does not match the properties of any other group so it stands alone. It is placed above group 1 or group 17 but it is not part of either group. Sometimes it is placed by itself at the top of the periodic table. It is a very reactive, colorless, odorless gas at room temperature. (1 outer level electron)

Group 1: Alkali Metals – These metals are extremely reactive and are never found in nature in their pure form. They are silver colored and shiny. Their density is extremely low so that they are soft enough to be cut with a knife. (1 outer level electron)

Group 2: alkaline earth Metals – Slightly less reactive than alkali metals. They are silver colored and more dense than alkali metals. (2 outer level electrons)

Groups 3 – 12: transition **Metals** – These metals have a wide range of reactivity and a wide range of properties. In general, they are shiny and good conductors of heat and electricity. They also have higher densities and melting points than groups 1 & 2. Most ~~are~~ _____ ~~or~~ have more than one charge. (1 or 2 outer level electrons)

Lanthanides **and** actinides **:(** inner transition **metals)** These are also transition metals that were taken out and placed at the bottom of the table so the table wouldn't be so wide. The elements in each of these two periods share many properties. The lanthanides are shiny and reactive. The actinides are *all* radioactive and are therefore unstable. Elements 95 through 103 do not exist in nature but have been created in the lab.

Group 13: Borons **Group** – Contains one metalloid and 4 metals. Reactive. Aluminum is in this group. It is also the most abundant metal in the earth's crust. (3 outer level electrons)

Group 14: Carbon **Group** – Contains 1 nonmetal, 2 metalloids, and 2 metals. Varied reactivity. (4 outer level electrons)

Group 15: Nitrogen **Group** – Contains 2 nonmetals, 2 metalloids, and 1 metal. Varied reactivity. (5 outer level electrons)

Group 16: oxygen **Group** – [illegible] Contains 3 nonmetals, 1 ~~metalloid~~, and 1 metal. Reactive group. (6 outer level electrons)

Groups 17: Halogens – All nonmetals. Very reactive. Poor conductors of heat and electricity. Tend to form salts with metals. Ex. NaCl: sodium chloride also known as "table salt". (7 outer level electrons)

Groups 18: Noble gases – all nonmetals. All are colorless, odorless gases at room temperature. All found in earth's atmosphere in small amounts. (8 outer level electrons)

Aleksza NHHS-Chemistry 2013-14

Periodic Table Families Quiz
(adapted from the Family Ties WS & Instructions)

NAME:_____ MOD:_____

Follow the instructions below to label the major groups and divisions of the periodic table. (2 pts each)

1. The vertical columns on the periodic table are called groups.
2. The horizontal rows on the periodic table are called periods.
3. Most of the elements in the periodic table are classified as metals.
4. The elements that touch the zigzag line are classified as metalloids.
5. The elements in the far upper right corner are classified as nonmetals.
6. Elements in the first group have one outer shell electron and are extremely reactive. They are called alkali metals.
7. The elements in the first group have a +1 ionic charge.
8. Elements in the second group have 2 outer shell electrons and are also very reactive. They are called alkaline earth metals.
9. Elements in the second group have a +2 ionic charge.
10. Elements in groups 3 through 12 have many useful properties and are called transition metals.
11. Elements in group 14 have a +/- 4 ionic charge.
12. Elements in group 15 have a -3 ionic charge.
13. Elements in group 17 are known as "salt formers". They are called halogens.
14. Elements in group 17 have a -1 ionic charge.
15. Elements in group 18 are very unreactive. They are said to be "inert". We call these the noble gases.
16. Elements in group 18 have a — ionic charge.
17. Elements in group 16 have a -2 ionic charge.
18. The elements at the bottom of the table were pulled out to keep the table from becoming too long. The first period at the bottom called the lanthanides.
19. The second period at the bottom of the table is called the actanides.
20. Elements in group 13 have a +3 ionic charge.

Chemistry
Periodicity #1

CLASSWORK: Circle the correct answer:

1.	Lowest EN	Be	Ca	Sr	Ra
2.	Highest IE	Cs	W	Pb	At
3.	Highest AR	Na	Al	P	Cl
4.	~~Lowest IR~~	V	Ga	Se	Br
5.	Highest IE	Be	Mg	Sr	Ba
6.	Highest EN	O	S	Se	Te
7.	Highest AR	Nb	Al	Cl	Fr
8.	Lowest IE	O	Al	Mn	Cs
9.	Highest AR	K	V	Ga	Br
10.	Lowest IE	Li	K	Cs	Fr
11.	Highest EN	Cl	K	Te	Cs
12.	Highest AR	Rb	Ag	Sn	Xe
13.	~~Highest IR~~	Be	Mg	Sr	Ba
14.	Highest AR	Ne	Si	Fe	Rb
15.	Lowest EN	O	Ge	Mo	Ba
16.	~~Highest IR~~	F	Cl	I	At
17.	~~Lowest IR~~	N	As	Sb	Bi
18.	Lowest IE	N	P	Sb	Bi

Chemistry #2
Periodicity

CLASSWORK: Circle the correct answer:

1.	Highest IR	Be	Ca	Sr	Ra
2.	Lowest AR	Cs	W	Pb	At
3.	Highest EN	Na	Al	P	Cl
4.	Lowest IE	V	Ga	Se	Br
5.	Highest AR	Be	Mg	Sr	Ba
6.	Highest IR	O	S	Se	Te
7.	Highest IE	Nb	Al	Cl	Fr
8.	Lowest IE	O	Al	Mn	Cs
9.	Highest IR	K	V	Ga	Br
10.	Lowest AR	Li	K	Cs	Fr
11.	Highest EN	Cl	K	Te	Cs
12.	Highest IE	Rb	Ag	Sn	Xe
13.	Highest EN	Be	Mg	Sr	Ba
14.	Highest AR	Ne	Si	Fe	Rb
15.	Lowest IR	O	Ge	Mo	Ba
16.	Highest IE	F	Cl	I	At
17.	Lowest AR	N	As	Sb	Bi
18.	Lowest IE	N	P	Sb	Bi

Worksheet

Date

answer the following questions.

1. Rank the following elements by increasing atomic radius: carbon, aluminum, oxygen, potassium.

low → high

oxygen, carbon, aluminum, potassium

2. Rank the following elements by increasing electronegativity: sulfur, oxygen, neon, aluminum.

~~Ne~~ Neon, aluminum, sulfur, oxygen

3. Why does fluorine have a higher ionization energy than iodine?

Smaller atom so the electrons are held closer to the nucleus, requiring more energy to remove an electron

4. Why do elements in the same family generally have similar properties?

same # of valence electrons

5. Indicate whether the following properties increase or decrease from left to right across the periodic table.
   a. atomic radius decrease
   b. first ionization energy increase
   c. electronegativity (excluding noble gases) increase

6. What trend in atomic radius occurs across the periodic table? What causes this trend?

decreases because more protons pull the electrons closer to the nucleus

7. What trend in ionization energy occurs across a period on the periodic table? What causes this trend?

increases because the size of the atom decreases so the electrons are being held onto more tightly, requiring more energy to remove them

8. Circle the atom in each pair that has the largest radius.
   a. Al or B
   b. Na or Al
   c. S or O
   d. O or F
   e. Br or Cl
   f. Mg or Ca
   G. Na or Na^{+1}
   H. K^{+1} or Mg^{+2}
   I. O or O^{-2}
   J. Cl^{-1} or Br^{-1}

Name _____ Date _____

9. Circle the atom in each pair that has the greater ionization energy.
   a. Li or Be
   b. Ca or Ba
   c. Na or K
   d. P or Ar
   e. Cl or Si
   f. Li or K

10. Define electronegativity.
   the ability to attract an electron

11. Circle the atom in each pair that has the greater electronegativity.
   a. Ca or Ga
   b. Br or As
   c. Li or O
   d. Ba or Sr
   e. Cl or S
   f. O or S

Bohr's Model of the Hydrogen Atom

1. What wavelength of light is emitted when an electron relaxes from n=4 to n=2?

   486nm

2. What wavelength of light is emitted when an electron relaxes from n=5 to n=3?

   1282nm

3. An electron moves from n=3 to n=5. Is energy emitted or absorbed?

   absorbed

4. An electron moves from n=2 to n=1. Is energy emitted or absorbed?

   emitted

5. What electron transformation(s) cause(s) red light to be emitted?

   $3 \rightarrow 2$

6. What electron transformation(s) cause(s) UV light to be emitted?

   $2 \rightarrow 1$
   $3 \rightarrow 1$
   $4 \rightarrow 1$

LIGHT WORKSHEET, WAVELENGTH, FREQUENCY AND ENERGY

Name_____ Date_____ Period_____

Useful Information You May Need:
Red 700 - 650 nm
Orange 649 - 580 nm
Yellow 579 - 575 nm
Green 574 - 490 nm
Blue 489 - 455 nm
Indigo 454 - 425 nm
Violet 424 - 400 nm

1. Which has the greater λ blue or indigo light?

blue

2. Which has the greater ν red or yellow light?

yellow

3. Which has the greater energy, a photon of yellow light or a photon of green light?

green

_____4. Which has the longer wavelength, light with a frequency of 7.32×10^{14} Hz or light with a frequency of 6.0×10^{14} Hz?

6.0×10^{14} Hz

_____5. Which has higher energy, λ of 674 nm or 480 nm?

480nm

_____6. Which has a higher frequency, orange light or indigo light?

Indigo

_____7. A certain red light has a wavelength of 725 nm and another red light has a frequency o
4.28×10^{14} /sec. Which would have higher energy per photon?

_____8. Which would have the higher frequency, light of wavelength of 521 nm or light with a wavelength of 605 nm?

521 nm

_____9. Which would have the longer wavelength, light with a frequency of 4.5×10^{14} Hz or lig
with a frequency of 6.19×10^{14} Hz?

4.5×10^{14} Hz

_____10. Which would have the longer wavelength, a photon with energy of 4.59×10^{-19} J
photon with energy of 3.01×10^{-19} J?

3.01×10^{-19} J

Electron Configuration Classwork

A. *Write the complete electron configuration for the following:*

1. Na: $1s^2 2s^2 2p^6 3s^1$
2. Sb: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^3$
3. Sr: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2$
4. Zr: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^2$
5. N: $1s^2 2s^2 2p^3$
6. Ag: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^9$
7. Ti: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^2$
8. Ca: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$
9. Cl: $1s^2 2s^2 2p^6 3s^2 3p^5$
10. Mg: $1s^2 2s^2 2p^6 3s^2$
11. sodium $1s^2 2s^2 2p^6 3s^1$
12. iron $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^6$
13. bromine $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^5$
14. barium $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^6 6s^2$
15. Palladium $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^8$

B. Identify the following elements:

16. $1s^2\ 2s^2 2p^6\ 3s^2 3p^6\ 4s^2\ 3d^{10}\ 4p^4$: Se
17. $1s^2\ 2s^2 2p^6\ 3s^2 3p^6\ 4s^2\ 3d^8$: Ni
18. $1s^2\ 2s^2 2p^6\ 3s^2 3p^6\ 4s^2\ 3d^{10}\ 4p^6\ 5s^2\ 4d^{10}\ 5p^6\ 6s^2$: Ba

C. *In the space below, write the Noble Gas (abbreviated) electron configurations of the following elements:*

1) cobalt [Ar] $4s^2 3d^7$

2) Molybdenum [Kr] $5s^2 4d^4$

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

4) radium [Rn] $7s^2$

5) zinc [Ar] $4s^2 3d^{10}$

D. *Determine what elements are denoted by the following electron configurations:*

6) $1s^2 2s^2 2p^6 3s^2 3p^4$ Sulfur

7) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^1$ Rubidium

8) [Kr] $5s^2 4d^{10} 5p^3$ Antimony

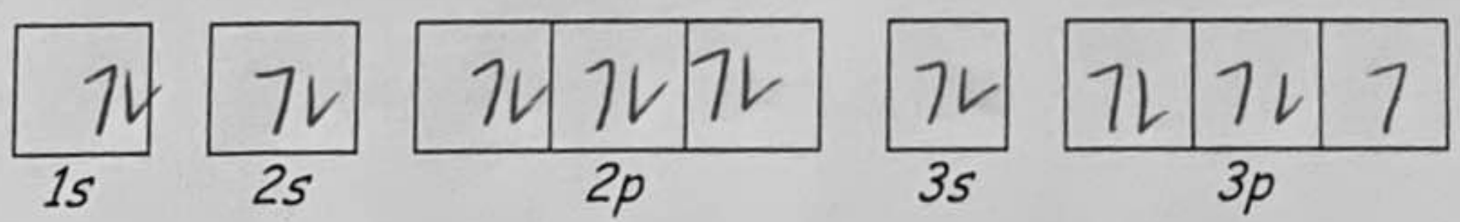
9) [Xe] $6s^2 4f^{14} 5d^6$ Rhenium

10) [Kr] $5s^2 4d^5$ Technetium

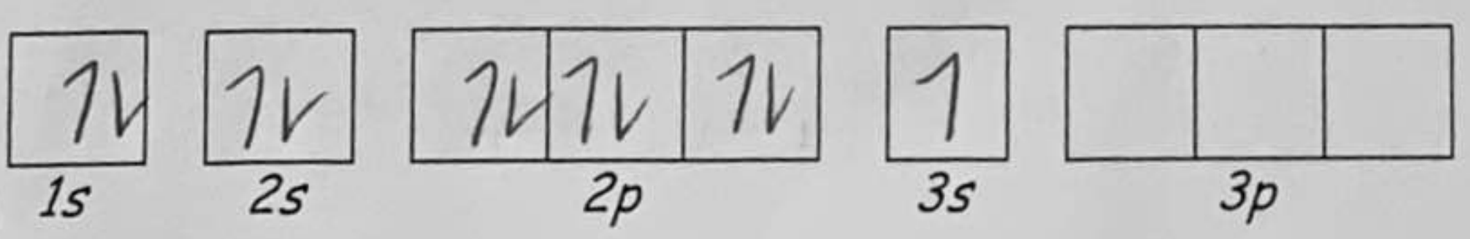
E. *Write the full electron configuration, short-hand electron configuration, and fill in the orbital diagrams, for the following elements.*

1. Nitrogen $1s^2 2s^2 2p^3$ [He] $2s^2 2p^3$

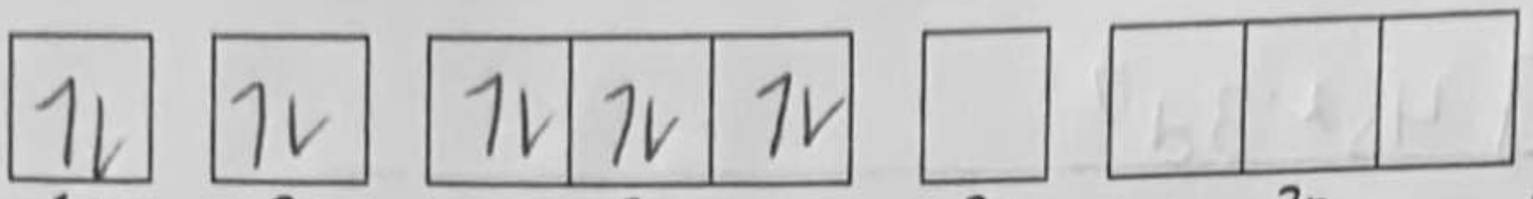
2. Chlorine $1s^2 2s^2 2p^6 3s^2 3p^5$ [Ne] $3s^2 3p^5$



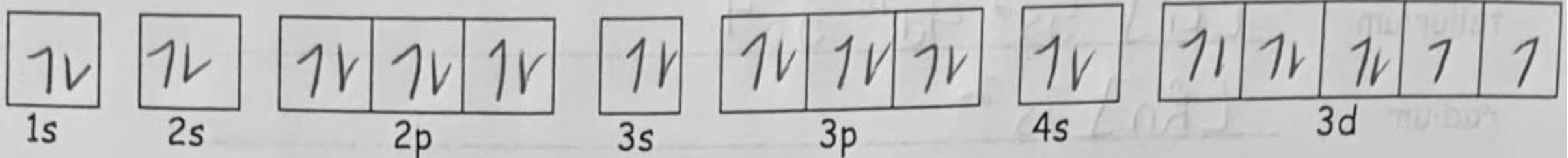
3. Sodium $1s^2 2s^2 2p^6 3s^1$ [Ne] $3s^1$



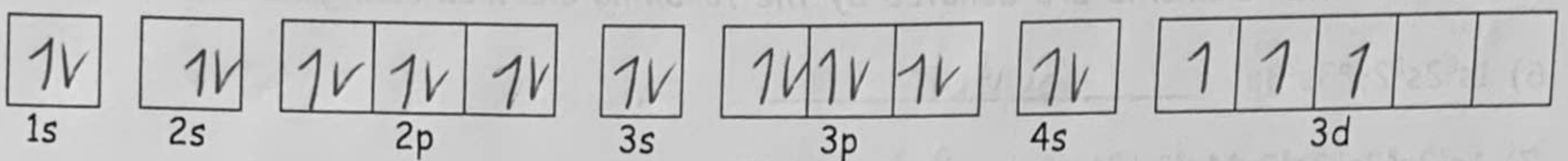
4. Neon $1s^2\ 2s^2\ 2p^6$ $[He]\ 2s^2\ 2p^6$



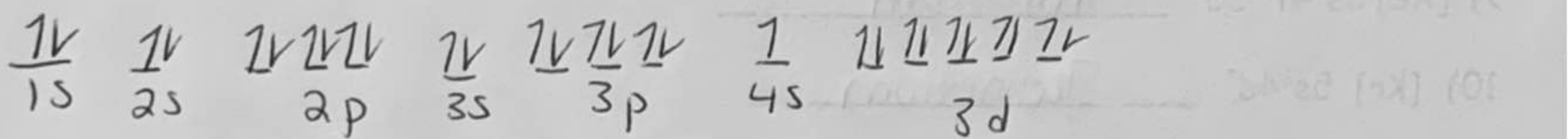
5. Nickel $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^8$ $[Ar]\ 4s^2 3d^8$



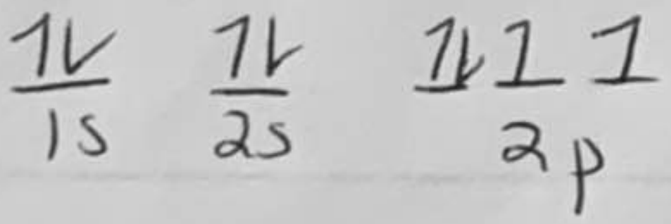
6) Vanadium $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^3$ $[Ar]\ 4s^2 3d^3$



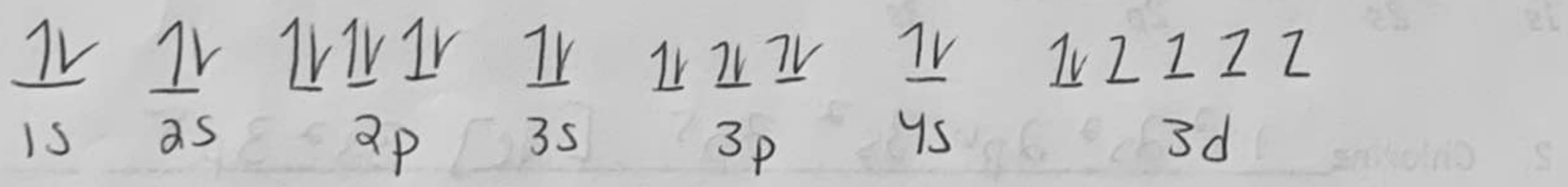
7) Copper $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1\ 3d^{10}$ $[Ar]\ 4s^1 3d^{10}$



8) Oxygen $1s^2 2s^2\ 2p^4$ $[He]\ 2s^2 2p^4$

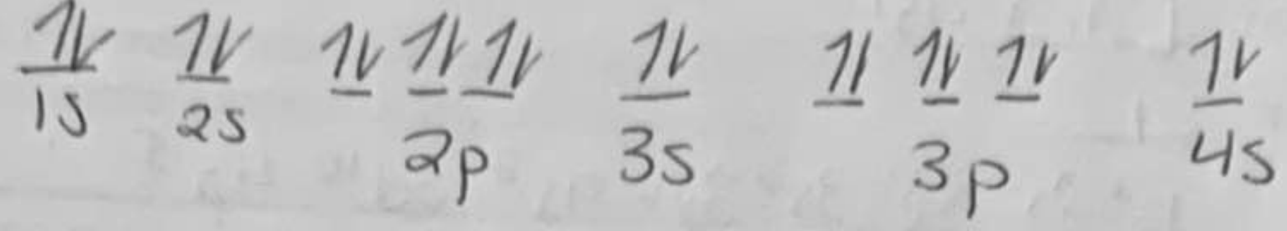


9) Iron $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^6$ $[Ar]\ 4s^2 3d^6$

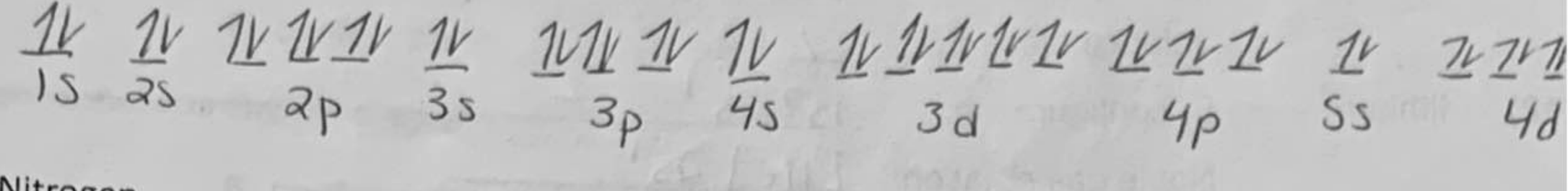


Part 3. Write the orbital notation for the following elements.

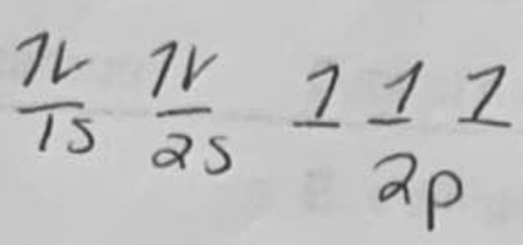
1. Calcium



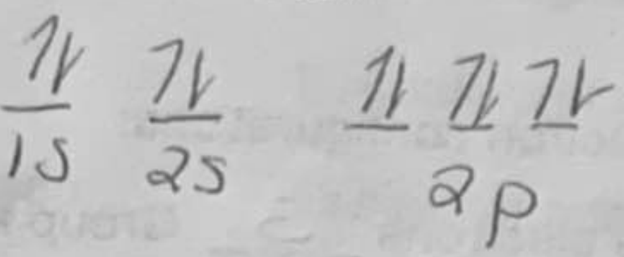
2. Silver



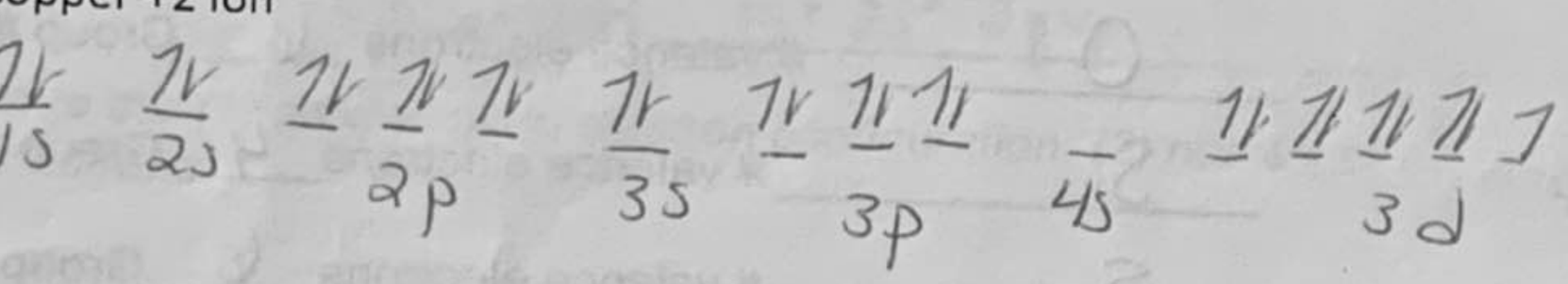
3. Nitrogen



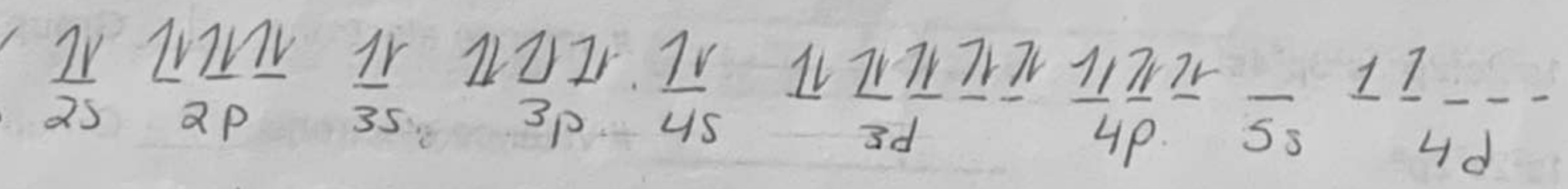
4. Aluminum +3 ion



5. Copper +2 ion



6. Zirconium +2 ion



Write the complete electron configuration for the following ions:

11) O^{2-}: $1s^2 2s^2 2p^6$

12) Fe^{2+}: $1s^2 2s^2 2p^6 3s^2 3p^6 3d^6$

13) B^{3+}: $1s^2$

14) Ni^{2+}: $1s^2 2s^2 2p^6 3s^2 3p^6 3d^8$

15) K^{+}: $1s^2 2s^2 2p^6 3s^2 3p^6$

16) Co^{3+}: $1s^2 2s^2 2p^6 3s^2 3p^6 3d^6$