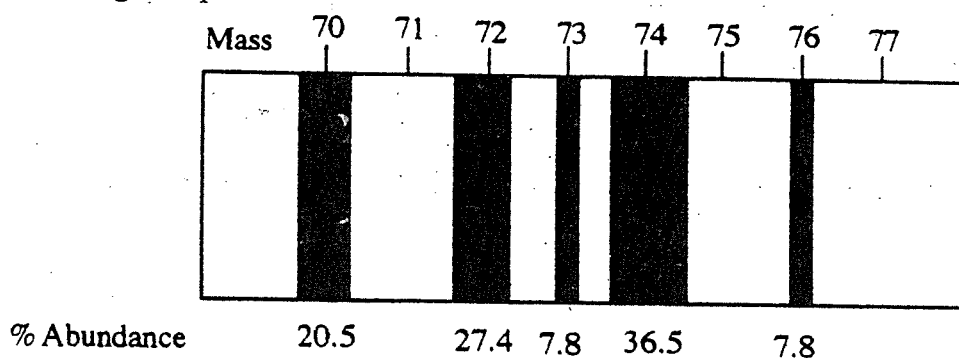


Atomic Models and Subatomic Particles:

1. Complete the following table.

Symbol	Atomic Mass	Atomic Number	Number of Protons	Number of Neutrons	Number of Electrons
Cr	52	24	24	28	24
P	32	15	15	17	15
Te ²⁻	127	52	52	75	54
Fe ³⁺	56	26	26	30	23
Ca	41	20	20	21	20
Hg ²⁺	201	80	80	121	78
Kr	83	36	36	47	36
Br	78	35	35	43	36
Ga ³⁺	70	31	31	39	28
N ³⁻	14	7	7	7	10

2. An element is analyzed by a mass spectrometer and the following spectrum resulted for the naturally occurring isotopes.



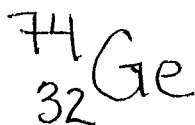
a) Calculate the average atomic mass for this element.

$$\begin{aligned}
 &70 \times 0.205 = 14.35 \\
 &72 \times 0.274 = 19.728 \\
 &73 \times 0.078 = 5.694 \\
 &74 \times 0.365 = 27.01 \\
 &76 \times 0.078 = 5.928
 \end{aligned}
 \left. \vphantom{\begin{aligned} &70 \times 0.205 = 14.35 \\ &72 \times 0.274 = 19.728 \\ &73 \times 0.078 = 5.694 \\ &74 \times 0.365 = 27.01 \\ &76 \times 0.078 = 5.928 \end{aligned}} \right\} = 72.71 \text{ g/mol}$$

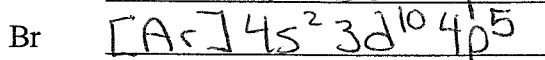
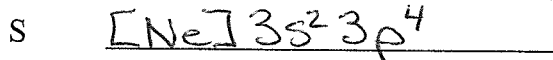
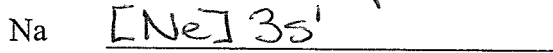
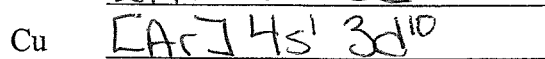
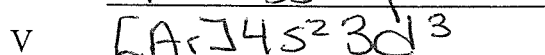
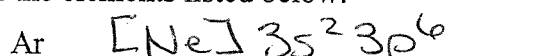
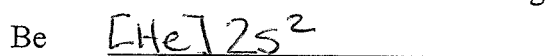
b) What element was analyzed?

Germanium (Ge)

c) Write the symbol for the most abundant isotope of this element, including the atomic mass, and the atomic number.



3. Write the core-notation electron configuration for the elements listed below.



4. Complete the following table.

Symbol	Number of Protons	Number of Neutrons	Number of Electrons	Electron Configuration
⁷⁰ ₃₁ Ga ³⁺	31	39	28	[Ar] 3d ¹⁰
³⁷ ₁₇ Cl	17	20	18	[Ne] 3s ² 3p ⁶
³⁹ ₁₉ K ⁺	19	20	18	[Ne] 3s ² 3p ⁶
⁶⁵ ₂₉ Cu ²⁺	29	36	27	[Ar] 3d ⁹
³² ₁₆ S ²⁻	16	16	18	[Ne] 3s ² 3p ⁶
³⁰ ₁₅ P ³⁻	15	15	18	[Ne] 3s ² 3p ⁶
⁸⁷ ₃₈ Sr ²⁺	38	49	36	[Ar] 4s ² 3d ¹⁰ 4p ⁶
⁵⁹ ₂₇ Co ²⁺	27	32	25	[Ar] 3d ⁷

5. In the table below briefly summarize the MAJOR contribution(s) the scientist made to our understanding of the atom.

Scientist	Major Contribution(s)
Dalton	- atomic theory (atom) - 3 laws
Bohr	- electrons in quantized orbitals
Thompson	- "plum pudding" → protons + electrons
Chadwick	- neutrons
Rutherford	- nucleus

Elements and the Periodic Table:

1. What is a period of the periodic table? - a horizontal row of elements

2. What is a group or family of the periodic table? - a vertical column of elements

3. Complete the following table, stating the name of the family (if we named it), the number of valence electrons and the charge on the ions that are usually produced from the elements in the group.

Family Members	Family Name	Number of Valence Electrons	Charge on the Ions Usually Formed
Li, Na, K, Rb, Cs, Fr	Alkali Metals	1	+1
B, Al, Ga, In, Tl		3	+3
F, Cl, Br, I, At	Halogens	7	-1
Be, Mg, Ca, Sr, Ba, Ra	Alkaline-Earth Metals	2	+2
N, P, As, Sb, Bi		5	-3
He, Ne, Ar, Kr, Xe, Rn	Noble gases	8	0
O, S, Se, Te, Po		6	-2

4. Define the following terms:

a) Atomic Radius:

- distance from the centre of the nucleus to the outer most electrons

b) Ionization Energy:

- energy required to remove an electron

c) Electronegativity:

- ability to attract an electron in a chemical bond

5. Correctly fill in the blanks below with either "increases" or "decreases"

a) As you move from left to right across the periodic table:

Atomic radius decreases

Ionization Energy Increases

Electronegativity Increases

b) As you move down the periodic table:

Atomic radius Increases

Ionization Energy decreases

Electronegativity decreases

6. a) Which of the following has the LARGEST atomic radius?

i) Li, Na, K, Rb Rb

ii) Na, Mg, Al, Si Na

iii) Mg, Os, Cl Os

iv) Na^+ , Mg^{2+} , Al^{3+} Na^+

v) P^{3-} , S^{2-} , Cl^- P^{3-}

vi) N, O, F, Cl Cl

b) Which of the following has the LARGEST ionization energy?

i) Li, Na, K, Rb Li

ii) Na, Mg, Al, Si Si

iii) Mg, Os, Cl Cl

iv) Na^+ , Mg^{2+} , Al^{3+} Al^{3+}

v) P^{3-} , S^{2-} , Cl^- Cl^-

vi) N, O, F, Cl F

c) Which of the following has the SMALLEST electronegativity value?

i) Li, Na, K, Rb Rb

ii) Na, Mg, Al, Si Na

iii) Mg, Os, Cl Os

vi) N, O, F, Cl N/Cl

\uparrow have same

Chemical Bonding:

1. a) Define valence electrons: - electrons in outer most electron orbital shell ; involved in bonding

b) How many valence electrons does each of the following families contain?

i. Alkali metals: 1

ii. Alkaline earth metals: 2

iii. The Boron family: 3

iv. The Carbon family: 4

v. The Nitrogen family: 5

vi. The Oxygen family: 6

vii. The Halogens: 7

viii. The Noble gases: 8

2. Describe what is happening to the electrons involved in a:

a) Covalent bond: - electrons (2 of them) are being shared equally

b) Polar-covalent bond: - 2 electrons are being shared unequally between 2 atoms because of electronegativity differences

c) Ionic bond: - electrons have been completely transferred from one atom to another forming ions that are attracted to each other electrostatically

3. Name the two types of intermolecular bonds:

dipole-dipole (Hydrogen) and London Forces

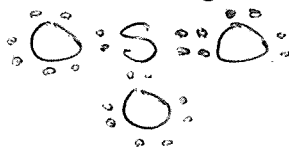
4. Draw the electron dot diagrams and Lewis structures for each of the following:

a) Al



g) SO_3

$24e^-$

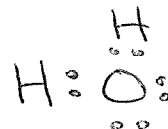


b) Ca

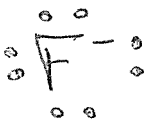


h) H_2O

$8e^-$



c) F^-

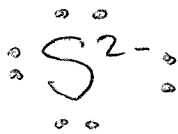


i) C_2H_2

$10e^-$

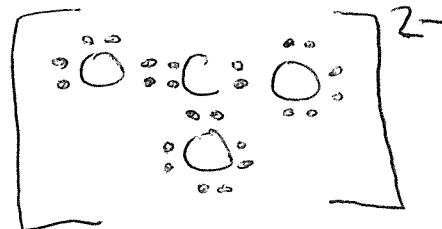


d) S^{2-}



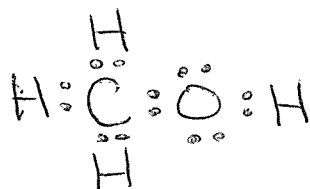
j) CO_3^{2-}

$24e^-$



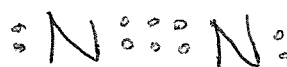
e) CH_3OH

$14e^-$



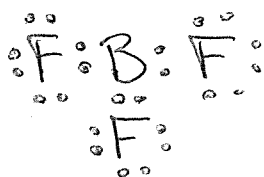
k) N_2

$10e^-$



f) BF_3

$24e^-$



l) C_2HBr_3

$30e^-$

