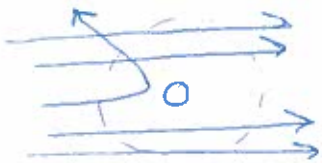
Station Review Unit #1: Structure and Bonding

Station #1

Who is credited for discovering the proton, electron and neutron? Rutherford, Thomson, Chadwick.

Explain the Gold Foil Experiment. Rutherford shown α particles at a piece of gold foil



① most of the particles went through → the atom is mostly empty space

② some particles were deflected → positively charge nucleus

Explain Bohr's contribution to the atom include (emission spectra).

if Rutherford's model was correct we should see a continuous spectrum but instead we see distinct energy bands → electrons are in different energy levels

Station #2

Define the following terms:

Aufbau Principle

each electron occupies the lowest energy orbital available

[1] 1s [ ] 2s

Hund's Rule

when electrons are added to the orbitals of the same energy sublevel, each orbital gets one electron before pairing → same spin

[1] [1] [1]

Pauli exclusion Principle

no two electrons in the same atom can have the same set of 4 quantum numbers → max 2 electrons [↑↓]

Station #3

For n=4, what are all the possible allowed quantum numbers. Include a check to make sure you haven't missed any.

$n = 4$

$l = 0, \ldots n-1$

$= 0, 1, 2, 3$

n^2

4^2

$= 16$

$l = 0 \quad m_l = 0$

$l = 1 \quad m_l = -1, 0, 1$

$l = 2 \quad m_l = -2, -1, 0, 1, 2$

$n = 3 \quad m_l = -3, -2, -1, 0, 1, 2, 3$

Station #4

Write electron configuration for the following elements and their ions

a) **Cr** $24e^-$ $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^4$

$4s^1 3d^5$

Cr^{2+} $22e^-$ $1s^2 2s^2 2p^6 3s^2 3p^6 4s^0 3d^4$

b) **Fe** $26e^-$ $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^6$ Fe^{3+} $23e^-$

Fe^{2+} $24e^-$ $1s^2 2s^2 2p^6 3s^2 3p^6 4s^0 3d^6$ $1s^2 2s^2 2p^6 3s^2 3p^6 4s^0 3d^5$

Write shorthand electron configuration for Sn

Sn $50e^-$ $[Kr]\ 5s^2 4d^{10} 5p^2$

Station #5

Draw the orbital box diagram for Si and explain.

$14e^-$

Fill in order of lowest energy

spin up + spin down in each orbital

same spin (both up) and half fill the orbital before doubling up

Station #6

Summarize the periodic trends:

AR, IE, EA, EN, Reactivity

AR ↓ inc.

IE ↑ inc.

EA ↑ inc

EN ↑ in

metal reactivity ↓ inc.

nonmetal reactivity ↑ inc.

Station #7

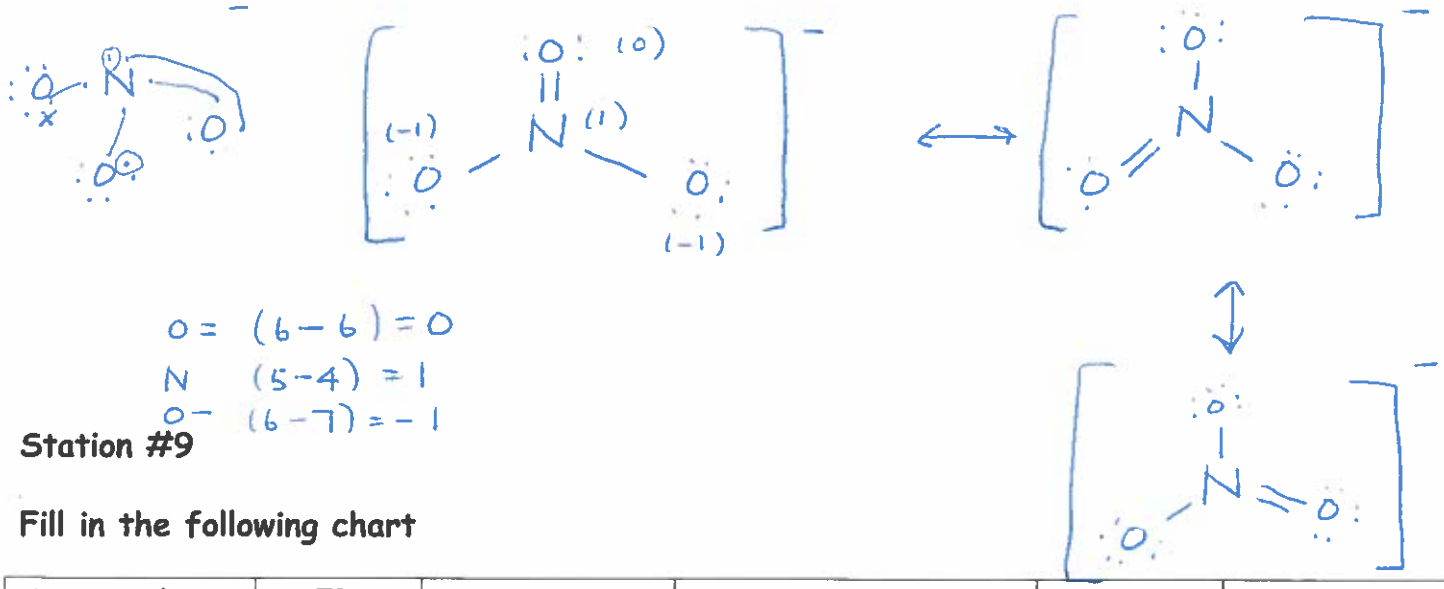
Fill in the following chart:

Type of Solids	Properties
Ionic NaCl	• crystal lattice • high mp • hard but brittle • dissolves in water • conducts electricity when dissolved in water or molten.
Covalent – Molecular Solid H_2O CO_2 sugar	• lower mp • poor conductors as solids & liquids • like dissolves like.
Covalent – Network Solid Carbon SiO_2 silicon carbide	• very high mp • hard material • not soluble in water • poor conductors
Metallic Al Fe Cu	• mp varies • very conductive as solid or liquid • malleable, ductile • shiny

Station #8

Draw the Lewis Structure for NO_3^- and calculate the formal charge on each atom.

and resonance

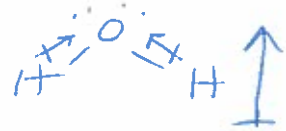
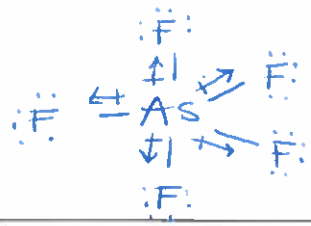


O = (6 − 6) = 0
N (5 − 4) = 1
O− (6 − 7) = −1

Station #9

Fill in the following chart

Compound Rough Work	VSEPR Code	Geometric Shape	Lewis Structure with Shape	Polarity (add dipoles)	Intermolecular Forces Present
HCN H—C—N	AX_2	linear	H—C≡N:	polar	DDF LDF

BF_3	AX_3	trigonal planar		nonpolar	LDF
H_2O	AX_2E_2	bent		polar	HB LDF
AsF_5	AX_5	trigonal bipyramidal		nonpolar	LDF

Predict the order of increasing melting points in the above substances.

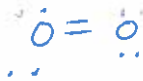
BF_3	AsF_5	HCN	H_2O
LDF	LDF ↳ but larger	DDF LDF	HB LDF

Station #10

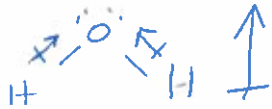
What intermolecular forces are involved in the following situations?

a) **oxygen dissolved in water**

b) **magnesium chloride dissolved in water**

a) 

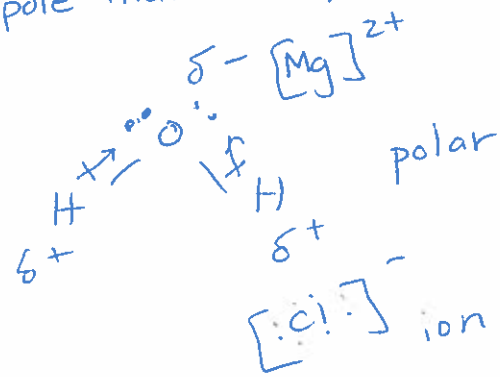
nonpolar



polar

dipole induced dipole

b) $[Mg]^{2+}\ 2[:\ddot{Cl}:]^-$



polar

ion – dipole