Chemistry Exam Review Part I

5

Atomic Theory and Atomic Structure

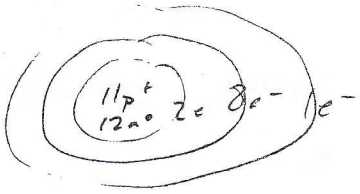
Dalton	Today, Modern
Matter is composed of very tiny or microscopic particles called "Atoms". An indivisible particle which can never be created nor destroyed.	Matter is composed of tiny particles, which we ~~are not~~ know very little about. But the atom is in fact divisible
Atoms of an element are identical in size, shape, mass, and in other properties.	Different versions of an element exist, called isotopes
Atoms of different elements are different in their properties.	True, differ by ~~atomic~~ #
Atoms combine with each other in small whole numbers.	True

Person	Experiment	Focus
Democritus		"Atom"
Dalton		Atomic Theory
J. J. Thomson	Cathode ray tube	Negative and positive regions, electrons exist
Rutherford	Gold Foil	Small, positively charged center (nucleus)
Bohr		Electrons in specific energy levels
Chadwick		neutron
Milliken	Oil Drop	Electron's exact charge and mass
Newest Model = Quantum Model		Electrons are in an electron cloud

1. What did Rutherford's gold foil experiment tell us about the structure of the atom?

   Small, dense, positive nucleus

2. Draw the Bohr Model of the atom for sodium. Na $11p^+$ $12n^0$ $11e^-$



3. Distinguish between mass number and atomic number.

   Sum of p^+ and n^0 # of p^+

4. List the subatomic particles with charge, location, and approximate mass.

	charge	location	mass
p^+	+	nucleus	1 AMU
n^0	∅	nucleus	1 AMU
e^-	−	cloud	1/2000 AMU

5. Why is there an average atomic mass on the periodic table?

   Sum of the masses of all naturally occuring isotopes

6. Complete the following table.

Hyphen notation	Element	# of Protons	Mass #	# of Electrons	Atomic Number	# of Neutrons	Isotope, Ion, or Neutral
H	Hydrogen	1	1	1	1	0	neutral
C-14	Carbon	6	14	6	6	8	neutral
K^+	potassium	19	39	18	19	20	ion
Li	lithium	3	7	3	3	4	neutral
Cl-37	chlorine-37	17	35	18		18	Ion, isotope

a. For n = 1 an electron is at its ground state if it jumps up to level 4, what state is it? Excited

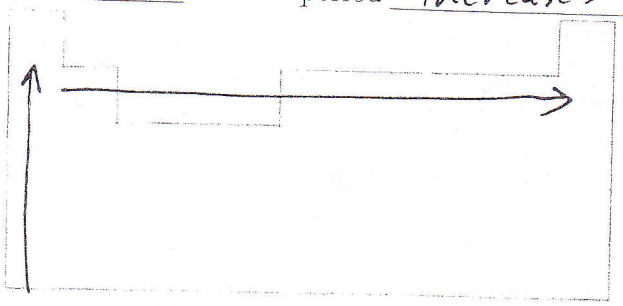
b. If the same electron drops back to its ground state, the light energy emitted is in which general region of the Electromagnetic spectrum UV (97nm)

c. Where is visible light located in the region of the electromagnetic spectrum in meters? 400-700nm

The Periodic Table and Periodic Trends

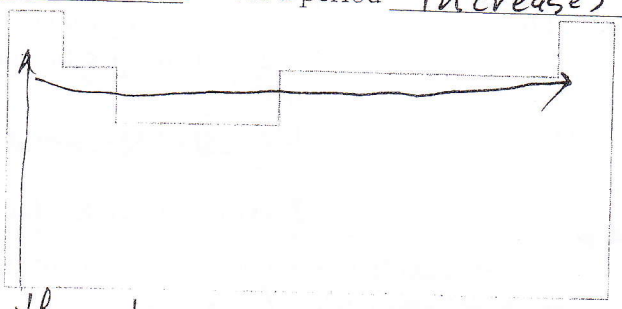
A. Electronegativity – Description of how strongly an atom attracts electrons

Trend: down a group decreases across a period increases



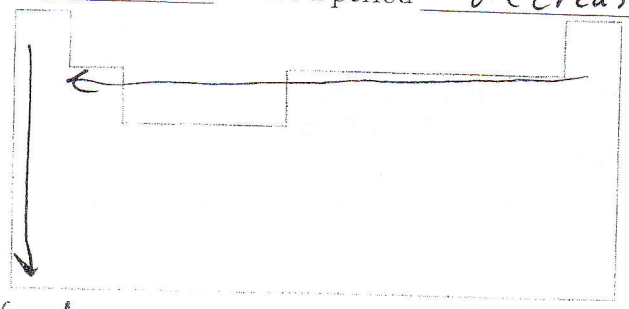
B. Ionization energy – Energy needed to remove e^- (form cation)

Trend: down a group decreases across a period increases



C. Atomic radius – size of the atom

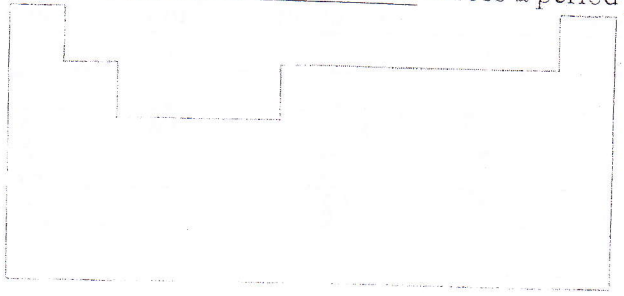
Trend: down a group increases across a period decreases



D. Ionic radius – size of the ion

Trend for positive ion: down a group ~~decre~~ increases across a period _____

Trend for negative ion: down a group _____ across a period _____



Reasoning Behind Periodic Trends:

Down a group – more energy levels, electrons farther away from positive nucleus, pulled less tightly

Across a period – same energy level, but more protons, protons pull electrons in more tightly, increased effective nuclear charge

Applying Trends:

Put the following elements in order from largest to smallest according to the specified trend.

A. Electronegativity – P, Ga, O, Ba O, P, Ga, Ba

B. Ionization Energy – Cl, Mg, Si, Sr Cl, Si, Mg, Sr

C. Atomic Radii – C, Rb, F, Na Rb, Na, C, F

How does a cation's size compare to the size of its parent atom?

Li Bigger Li^+

How does an anion's size compare to the size of its parent atom?

N N^{3-} Bigger

Groups, Periods

1							18
1A							8A
	2	13	14	15	16	17	
	2A	3A	4A	5A	6A	7A	2 He
1/+1	2/+2		3/+3	4/+4	5/-3	6/-2	7/-1	8/0

A groups (groups 1-2, 13-18) are called the Main Group Elements

B groups (groups 3-12) are called the Transition Elements

List the group number for each of the following:

alkali metals 1

alkaline earth metals 2

halogens 17

noble gases 18

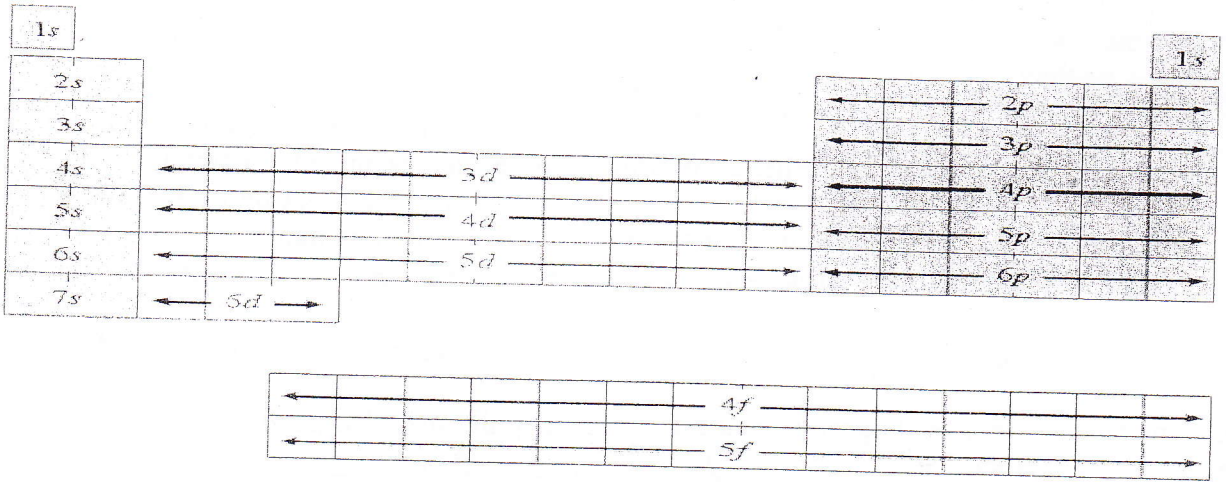
How many valence electrons are in each of the following?

Na 1 K 1 B 3 N 5 O 6 Se 6 Cl 7

What is the oxidation number of each of the following?

Na	K	B	N	O	Se	Cl
+1	+1	+3	-3	-2	-2	-1

Electron Configuration



What element?

$1s^1$ H $1s^2 2s^2 2p^6 3s^2 3p^5$ Cl [He]$2s^1$ Li [Ar]$4s^2 3d^8$ Ni

How many valence electrons?

$1s^2$ 2 $1s^2 2s^2 2p^6 3s^2 3p^6$ 8 [Ne]$3s^2$ 2 [Ar]$4s^2 3d^{10} 4p^3$ 5

What oxidation number?

$1s^1$ +1 $1s^2 2s^2 2p^4$ -2 [He]$2s^1$ +1 [Ar]$4s^2 3d^8$ +2

Number of electrons lost or gained to make a stable ion?

$1s^2 2s^2 2p^6 3s^2 3p^5$ -1 [Ne]$3s^2$ +2 [Ar]$4s^2 3d^{10} 4p^3$ -3

Write the electron configuration and draw the electrons for the orbital notation of NITROGEN

$1s^2$ $2s^2$ $2p^3$

1s↿⇂ 2s↿⇂ $2p_x^{\uparrow}$ $p_y^{\uparrow}$ $p_z^{\uparrow}$ ____ ____ ____