Mr. Bracken
AP Chemistry

Name BRACKEN KEY
Period ____

Atomic Structure Review Problems (2014)

1. Complete the following based on the information in the complete atomic symbols.

$^{40}_{20}Ca^{2+}$

Protons= 20
Electrons= 18
Neutrons= 20

$^{14}_{7}N^{3-}$

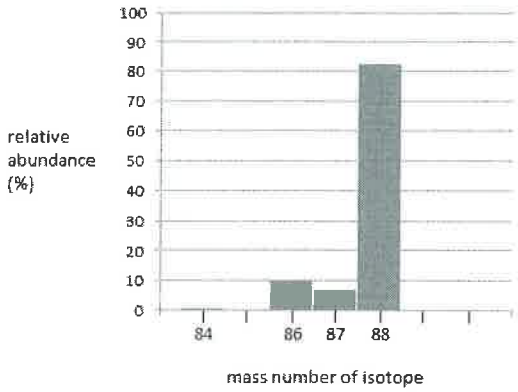
Protons= 7
Electrons= 10
Neutrons= 7

$^{25}_{12}Mg^{2+}$

Protons= 12
Electrons= 10
Neutrons= 13

2.

The mass spectrum for strontium



Isotope Mass (amu)	Abundance
83.913	0.56%
85.909	9.86%
86.909	7.00%
87.906	82.58%

(a) Based on the graph, what is the mass number of the most common isotope of strontium?

Strontium-88 has the largest peak on graph

(b) For each neutral isotope of strontium, write the number of protons, neutrons, and electrons.

Isotope	# Protons	# Neutrons	# Electrons
Strontium-84	38	46	38
Strontium-86	38	48	38
Strontium-87	38	49	38
Strontium-88	38	50	38

(b) Use the data in the table to calculate the average atomic mass of strontium.

$(83.913)(.0056) + (85.909)(.0986) + (86.909)(.0700) + (87.906)(.8258)$

87.6 amu

3. What are isotopes? Be specific.

HAVE THE SAME # PROTONS BUT DIFFERENT #'S OF NEUTRONS

4. Which neutral atom of the following elements is paramagnetic?

(a) Zn
(b) Ca
(c) Ne
(d) S
(e) He

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

[Ar] $4s^2$

$1s^2 2s^2 2p^6$

$1s^2$

S [Ne] $3s^2 3p^4$

3p ← 2 unpaired electrons

← unpaired electrons

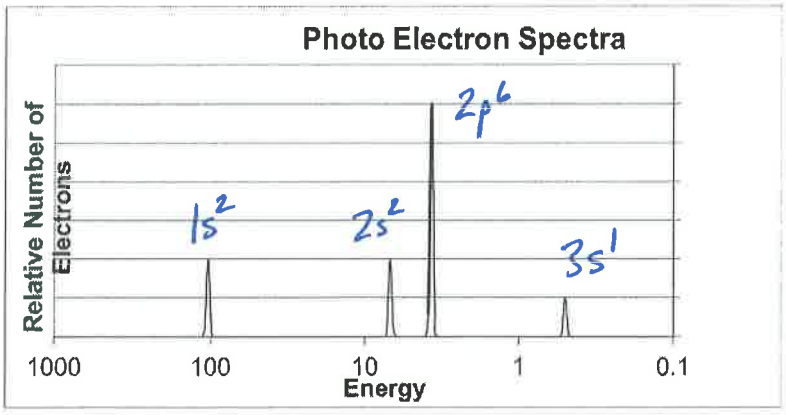
5. How do we know if a substance is diamagnetic?

ALL ELECTRONS ARE "PAIRED UP" INSIDE THE ORBITALS

6. How could a person use a strong magnet to determine if a substance is diamagnetic or paramagnetic?

PARAMAGNETIC SUBSTANCES ARE AFFECTED BY STRONG MAGNETS

7. Take a look at the PES spectrum for **sodium** which is shown below.

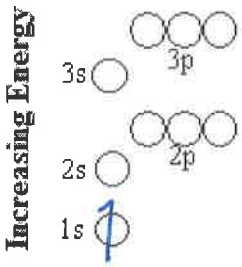


(a) Label each peak in the spectrum. ($1s^2$, $2s^2$, etc.)

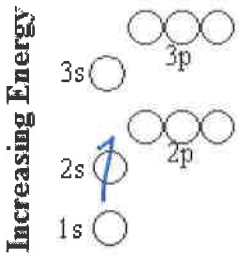
(b) Why does it take less energy to remove the $3s^1$ electron as compared to the $1s^2$ electrons? Be sure to use Coulomb's Law in your explanation.

THE 3s' ELECTRON IS LOCATED VERY FAR FROM THE NUCLEUS SO THE POSITIVE PROTONS CANNOT HOLD ONTO THAT ELECTRON VERY TIGHTLY. THUS, LESS ENERGY IS NEEDED TO REMOVE THE 3s' ELECTRON.

8. Complete the orbital charts for atomic hydrogen, H. (not H_2)



Ground State



Excited State

9. Explain how an atom can achieve its excited state.

ENERGY IS ADDED TO THE ELECTRON AS HEAT OR ELECTRICAL VOLTAGE.

10. When viewed through a diffraction grating, a bright line with the wavelength of 656 nm exists in the atomic emission spectrum of hydrogen.

$656\ nm = 656 \times 10^{-9}$ meters

(a) What is the frequency of this emission line?

$c = \lambda \nu$

$3.00 \times 10^{8} = (656 \times 10^{-9})\,\nu$

$\nu = 4.57 \times 10^{14}\ sec^{-1}$

(b) What is the energy of a photon of light at this wavelength?

$E = h\nu$

$E = (6.63 \times 10^{-34})(4.57 \times 10^{14})$

$E = 3.03 \times 10^{-19}\ \frac{Joules}{photon}$

(c) What is the energy of a mole of photons at this wavelength?

$\left(3.03 \times 10^{-19}\ \frac{Joules}{photon}\right)\left(6.02 \times 10^{23}\ \frac{photons}{mole}\right) = 182000\ \frac{Joules}{mole}$

$182\ \frac{kJ}{mole}$