**Exam 1 General Chemistry 1114 Alfred State College A**

Your name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (1 pt) \_\_\_\_/100 pts

1. **Introductions (3 pts)**
2. From what California university did Doc Fong receive a B.Sc. in Chemistry ? \_\_\_\_\_UC Berkeley\_
3. How many cats at home does Doc Fong act as servant to? \_\_\_\_2\_\_\_\_
4. What corporation did Doc Fong work at before becoming an impoverished chemistry professor?

\_\_\_\_\_Corning Inc.\_\_\_\_\_\_\_\_\_\_\_\_

* 1. **Atomic dimensions and scaling (6 pts)**
1. What is the approximate ratio of the mass of the proton/mass of electron? \_\_\_2000\_\_\_\_\_\_\_\_\_
2. What is the ~ratio of an electron orbit diameter to an atomic nucleus diameter?\_\_\_100,000:1\_\_\_\_\_\_\_\_
3. If you wanted to make an accurate scale model of the hydrogen atom and decided the nucleus would have a diameter of 1 mm, what would be the diameter of the entire model ? \_100,000\_\_\_\_\_\_ mm
4. A softball is about 10 cm in diameter. If we assume the softball is a nucleus, which distance below is closest to representing the diameter of the nearest electronic orbit ? (circle your choice)
5. Distance across a football field (~ 10,000 cm)

**3 pts**

1. Distance across a pizza (~100 cm)
2. Diameter of the Earth (~1,000,000,000 cm)
3. Distance from Alfred Bell Tower to Alfred Pizza and Sub (~100,000 cm)
4. Distance from Almond to Hornell ( 1,000,000 cm)
5. Distance to the Sun (~10,000,000,000,000 cm)
	1. **Element Symbols and Names 18 pts total**
6. Circle all the symbolic representations of atomic elements below that are **incorrect:**

 (must circle all for credit)

**KR U Co Kr UuU bE h 2 pts**

 b) Write the correct name or symbol for the elements listed below: (1 pt for each correct answer)

 Ag \_silver\_\_\_\_ Mg \_\_magnesium\_\_\_\_\_ Arsenic\_As\_\_ d)Gold \_Au\_\_\_

Manganese\_\_Mn\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_ Mercury\_Hg\_ h) Pb\_\_\_lead\_\_\_\_\_\_\_\_\_\_\_\_\_

 **c)**  How many neutrons are present in neutral Fe-57 ? \_\_\_31\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 d) What is the electron count for neutral Phosphorus-31 ? \_\_15\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 e)How many protons(**p**), neutrons(**n**) and electrons(**e**) are in the neutral atoms of the two elements below ?

 **199Au 34S**

**6 pts** total

 **p=\_\_79\_ n=\_\_120\_\_\_\_ e=\_79\_\_ p=\_\_16\_\_\_ n=\_\_18\_\_\_\_ e=\_\_16\_\_**

**\_\_\_/28 (includes name pt)**

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**1.3 Atomic Body Part Count ( 8 pts/ 2 pts per line)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Atomic # | mass # | element symbol  | #p | #n | #e | atom charge |
| **12** | **23** | **Mg** | 12 | 11 | 12 | **0** |
| **31** | **69** | **Ga** | 31 | **38** | **31** | **0** |
| 16 | 32 | S | **16** | **16** | 16 | **0** |
| 18 | 38 | Ar | 18 | **20** | **18** | **0** |

* 1. **Let There be Light (5 pts)**

**a)Sort the equations and statements below (by #) into those connected to the classical or new theory of light:**

1)Energy of light is in amplitude 2) light requires an ether medium 3)E=hf

4) Amplitude ? What amplitude ? 5) light is a massless bullet called 6) light is a wave

 a photon

OLD THEORY of LIGHT \_\_\_\_1,2,6\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**4 pts**

NEW THEORY of LIGHT \_\_\_\_3,4,5\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**b)The photoelectric effect experiment is most connected to:**

1) Dalton’s sphere model of atoms

2) E=hf and the destruction of the old theory of light

3) Rutherford’s gold leaf experiment

4) Bohr’s prediction of the emission lines of the sun from pure theory

5) Mendeleev’s creation of the Periodic Table

**1.5 Calculations and Numbers ala’ Carte (11 pts total)**

**Number conversions:**

 a) Convert 0.00045 to scientific notation \_\_4.5\*10-4\_\_\_\_\_\_\_\_\_\_

 b) Convert 6.54\*10-2 to decimal notation \_\_\_\_0.0654\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 c) Which is bigger: 0.0000000000056 or 5.6\*10-11 (circle your answer)

**Given that λ\*f = c:**

1. Calculate c given λ=1\*10-5 and f = 3\*1013 : c= \_\_\_\_\_3EE8\_\_\_\_\_\_\_\_ m/s
2. Calculate λ given f= 6\*1014 and c= 3\*108 : λ=\_\_\_\_\_\_5EE-7\_\_\_\_\_\_\_\_ m
3. Calculate f given λ=4.2857\*10-5 and c = 3\*108: f=\_\_\_\_\_\_ 7EE12\_\_\_\_\_\_\_\_\_\_\_ s-1

**Given E = hf = hc/λ in Joules (J) : (h=6.63\*10-34 Joule sec ; c= 3\*108 m/s) [2 pts each]**

1. **Calculate E given f= 4.522\*108 s-1 E = \_\_\_\_3EE-25\_\_\_\_\_\_ J**
2. **Calculate E given λ = 1.326\*10-5 m E = \_\_\_1.5EE-20\_\_\_\_\_ J**
3. **Calculate f given E= 1.989\*10‑19 J f= \_\_\_\_3EE14\_\_\_\_\_\_ s-1**

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**1.6. Bohr’s Theory of the atom ( 6 pts)**

**Name two new ideas Bohr introduced to describe the H atom**

**1)\_\_\_\_\_\_\_applying wave notion to atoms\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**2)\_\_\_\_\_\_\_\_quantum leap (jump) idea\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Name two successes of the Bohr theory of the atom**

**1)\_\_\_\_\_\_\_explained why electron and nucleus don’t collapse into each other\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**2)\_\_\_\_\_\_\_\_\_\_\_H atom (sun emission) spectrum perfectly predicted\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Name two failures of the Bohr theory of the atom**

**1)\_\_\_\_\_\_\_Unable to explain spectrum of atoms othe than H\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**2)\_\_\_\_\_\_\_Failed to predict Zeeman splitting due to magnetic field when applied to H\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**1.7. Electronic Configurations of the Atoms (using the Periodic Table provided during exam) 22 pts**

**Write the complete electronic configurations for the elements below (2 pts each)**

1. **Na 1s22s22p63s1**
2. **Cl \_\_1s22s22p63s23p5\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
3. **Mg \_\_\_1s22s22p63s2\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
4. **Si \_\_\_\_1s22s22p63s23p2\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Write the correct abbreviated electronic configurations for the elements below, making sure to pay attention to all the rules associated with d electrons if they are present. (2 pts each)**

1. **P \_\_\_\_[Ne]3s23p3\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
2. **Mn \_\_\_\_[Ar] 3d54s2\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
3. **Cr+1 \_\_\_\_\_[Ar]3d54so \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
4. **V \_\_\_\_\_[Ar] 3d54so or 3d34s2  both accepted\_\_\_\_**

**Write the correct pigeonhole (orbital) diagrams for the elements below, making sure to pay attention to all the rules associated with d electrons if they are present, and including the correct inert gas core. (2 pts each)**

**a) Cr [ Ar] ]**

**b) Ni [ ]**

**c) Ag+1 [ ]**

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**1.8 Periodic Table Predictions and Vocabulary (13 pts total)**

**a) fill** in the blank spaces below assuming that X and Z are in the same column and the unknown element (???) lies between them : (5 pts)

***element # p atomic mass #n/#p density (g/cm3****) mp (oC)*

**X 130 299 1.3 1.9 1200**

**?? 150 345 1.3 2.2 1300**

**Z 170 391 1.3 2.5 1400**

**b) fill-in the required term or region name ( 8 pts)**

Sodium is in this group column \_\_\_alkali metal\_\_\_\_\_\_\_\_\_\_

Example of an alkaline earth metal\_\_\_Be,Mg, Ca,Sr, Ba\_\_\_\_\_\_\_\_\_

The Periodic Table is composed of metals, non-metals and \_\_\_metalloids\_\_(semi-metals)\_\_\_\_\_\_\_\_\_\_

Example of a noble metal\_\_\_Au,Ag,Pt (Cu)\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

These gases are completely un-reactive and all reside on the far right of the Periodic Table\_\_\_Noble gases

Another name for elements in the `d’ block \_\_\_\_\_transition metals\_\_\_\_\_\_\_\_\_\_\_\_\_

Another name for elements in the `p’ block\_\_\_\_\_\_representative, non-metals\_\_\_\_\_\_\_

Fluorine is in this group’s column\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_halogens\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**1.9 This, that and the other things (7 pts)**

1. What experiment first established the dimensions of the atom ? \_\_\_\_\_\_gold leaf\_\_\_\_\_\_\_\_\_\_\_\_
2. German who won the Nobel Prize with Einstein and got his name on the constant **h**\_Max Planck\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Besides 1/sec or cycles per second, another name for the units of frequency is\_\_\_\_\_\_\_\_\_

**True or False**

Bohr’s theory of the atom is good for all the elements. T F

Elements are distinguished by proton count T F

The specific mixture of s, p,d for an element’s valence electrons decides its chemical character T F

Any day doing chemistry is a good day. T T

\_\_\_/20