**Exam 3: Introduction to Chemistry Spring 2015**

Monday 4 May 2015

Your name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1) Write the complete molecular reaction for the compounds below assuming that AgCl is the only species formed as a final precipitate. (2 pts)

Ag(HSO3)(aq) + LiCl(aq)-🡪

2) Write the equivalent complete ionic reaction for the reaction above: (note: Ag is +1

HSO3 is -1, Li is +1 and Cl is -1) (2 pts)

3) Write the equivalent net ionic reaction for the reaction above: (2 pts)

4) Balance and write the complete molecular reaction occurring between CaCl2 and K2SO4.

The charges on the various ions are: Ca2+, Cl-1, K+1 andf (SO4)2-. The final Calcium salt formed

can be presumed to be a solid. (2 pts)

5) Using the solubility rules provided, decide whether the following compounds are soluble (aq) or insoluble (s) in water: (1 pt each)

a) Ag2S aq s

b) Ca(C2H3O2)2 aq s

c) Na2O aq s

d) PbCO3  aq s

e) KCl aq s

\_\_\_/15

**Exam 3: Introduction to Chemistry Spring 2015 (cont.) p. 2/4**

6) Complete and balance the acid-base reactions below: 2 pts each

H(NO3)(aq) + LiOH(aq) 🡪

H2SO4(aq) + Mg(OH)2(aq) 🡪

\_\_HNO3(aq) + Ca(OH)2(aq) 🡪

(needs a coefficient)

7) A Brnsted base is a(n) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

8) An Arrhenius base is a(n) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

9) What are the acid(A), base(B) , conjugate acid (CA) and conjugate base (CB) in the reactions below? (Write A, B, CB and CB above appropriate species below)

HPO42- + CO32- -🡪 PO42- + HCO3- (2 pts)

HClO4 + H(SO4)- 🡪 ClO4- + H2(SO4) (2 pts)

H(CrO4)‑ + H2PO3- 🡪 H2CrO4 +HPO32- (2 pts)

10) Complete the water-splitting hydrolysis reaction proposed by Brnsted below: (2 pts)

CO32- + H-OH 🡪

11) Which species in the list below are Brnsted bases ? ( 2 pts) [circle your choice(s)]

**HCl OH- Na PO43- K+**

12a) gaining electrons means \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

12b) oxidation means\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ electrons

13) What is the oxidation number for each element (per element) in the compounds below:

H2O CO2 H3PO4

H=\_\_\_ C=\_\_\_ H=\_\_\_ O=\_\_\_\_

O=\_\_\_ O=\_\_\_ P= \_\_\_

\_\_\_/27

**Exam 3: Introduction to Chemistry Spring 2015 (cont.) p. 3/4**

14) Who is oxidized in the reaction below ?

C + O2 -🡪 CO2 \_\_\_\_\_\_\_ is oxidized (2 pts)

15) What is reduced in the reaction below ?

Mgo + 2HCl 🡪 H2 + MgCl2 \_\_\_\_\_\_\_\_ is reduced (2 pts)

15) Name two problems with the Rutherford atom model

problem 1:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

problem 2:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

For the next 5 problems assume:

**The speed of light, c=3\*108 m/s. Planck’s constant, h=6.63\*10-34 J\*s**

**(3 pts each)**

16) If a wave has a frequency of 6\*105 cycles per second, what is the wavelength, λ in meters (m):

λ= \_\_\_\_\_\_\_\_\_\_\_\_\_ m

17) If a wave has a wavelength of 1.5\*10-3 m, what is its frequency f in cycles pers second (1/s)?

f= \_\_\_\_\_\_\_\_\_\_\_ cps

18) What is the energy of light with a frequency f= 6.032\*1034 ?

E= \_\_\_\_\_\_\_\_\_\_\_\_ J

19) What is the energy of light with a wavelength of 9.945 meters (m) ?

E= \_\_\_\_\_\_\_\_\_\_\_\_ J

20) A photon has an energy of 1.989\*10-21 J. What is the wavelength of the photon in m ?

λ= \_\_\_\_\_\_\_\_\_\_\_\_\_ m

\_\_\_/21

**Exam 3: Introduction to Chemistry Spring 2015 (cont.) p. 4/4**

21) Use the Periodic Table provided to describe the complete electronic configuration of:

(3 pts each)

O

Mg

S

22) Use the Periodic Table provide to describe the abbreviated electronic configuration of:

(2 pts each)

Al

Ca

Cl

Zn

(remember to d-s switch)

23) Draw the correct pigeonhole configurations for the various species below. (Make sure to correct for

charges; a (+1) means the element has lost 1 electron from its usual count.) (2 pts each)

**Fe2+  [Ar]**

**Cu [Ar]**

**Cu1+ [Ar]**

**Ru3+ [Kr]**

**Mn2+ [Ar]**

24) Provide the correct Lewis dot structures for: (1 pt each)

N Ca Ar

25) Provide the correct Lewis structures for the compounds below. Include lone pairs ! ( 2 pt each)

**H2O CO2 N2**

**\_\_/37**