CHEMISTRY 101
FINAL EXAM(121)

Name:_____

Date: 14/01/2013

Student no. _____

Section:_____

Useful Information:

$h=6.6\times10^{-34}$ Js; $A= 2.18\times10^{-18}$ J;   Rydberg's constant$= 1.1\times10^{-2}$ nm^{1-}, $c=3\times10^{8}$ m/s
General gas constant $R=8.314$ J/mol.K$=0.0821$ atm.L/mol.K; $N_{avogadro}=6.02\times10^{23}$ mol^{-1}
1atm=760 torr=101325 Pa.

H¹ 1.000																	He² 4
Li³ 6.941	Be⁴ 9.012											B⁵ 10.81	C⁶ 12.01	N⁷ 14.01	O⁸ 16	F⁹ 19	Ne¹⁰ 20.18
Na¹¹ 22.99	Mg¹² 24.31											Al¹³ 26.98	Si¹⁴ 28.09	P¹⁵ 30.97	S¹⁶ 32.06	Cl¹⁷ 35.45	Ar¹⁸ 39.95
K¹⁹ 39.10	Ca²⁰ 40.08	Sc²¹ 44.96	Ti²² 47.9	V²³ 50.94	Cr²⁴ 51.99	Mn²⁵ 54.94	Fe²⁶ 55.85	Co²⁷ 58.93	Ni²⁸ 58.71	Cu²⁹ 63.54	Zn³⁰ 65.37	Ga³¹ 69.72	Ge³² 72.59	As³³ 74.92	Se³⁴ 78.96	Br³⁵ 79.9	Kr³⁶ 83.8
Rb³⁷ 85.47	Sr³⁸ 87.62	Y³⁹ 88.91	Zr⁴⁰ 91.22	Nb⁴¹ 92.91	Mo⁴² 95.94	Tc⁴³ 99.91	Ru⁴⁴ 101.1	Rh⁴⁵ 102.91	Pd⁴⁶ 106.4	Ag⁴⁷ 107.87	Cd⁴⁸ 112.4	In⁴⁹ 114.8	Sn⁵⁰ 118.69	Sb⁵¹ 121.75	Te⁵² 127.6	I⁵³ 126.9	Xe⁵⁴ 131.3
Cs⁵⁵ 132.9	Ba⁵⁶ 137.3	57-71 *	Hf⁷² 178.5	Ta⁷³ 180.9	W⁷⁴ 183.85	Re⁷⁵ 186.2	Os⁷⁶ 190.2	Ir⁷⁷ 192.2	Pt⁷⁸ 195.1	Au⁷⁹ 196.97	Hg⁸⁰ 200.6	Tl⁸¹ 204.37	Pb⁸² 207.2	Bi⁸³ 208.98	Po⁸⁴ 210	At⁸⁵ 210	Rn⁸⁶ 222

Write the best fit answer of the following questions in this table:

Q1 *(1.5 pt)*	Q2 *(1.5 pt)*	Q3 *(2 pts)*	Q4 *(1.5 pt)*	Q5 *(1.5 pt)*	Q6 *(1.5 pt)*	Q7 *(2 pts)*	Q8 *(2 pts)*	Q9 *(1.5 pt)*
Q10 *(1.5 pt)*	**Q11** *(1.5 pt)*	**Q12** *(2 pts)*	**Q13** *(2 pts)*	**Q14** *(1.5 pt)*	**Q15** *(2 pt)*	**Q16** *(1.5 pt)*	**Q17** *(3 pts)*	**Q18** *(2 pt)*
Q19 *(1.5 pt)*	**Q20** *(1.5 pt)*	**Q21** *(1.5 pt)*	**Q21** *(2 pt)*	**Q23** *(1.5 pt)*	**Q24** *(2 pts)*	**Q25** *(3 pts)*	**TOTAL (40)**	

1. A 3.664 g sample of a **diprotic** acid was dissolved in water. It took 20.27 mL of 0.1578 M sodium hydroxide solution (NaOH) to neutralize the acid. The molar mass of the acid is:

   a. 2290 g/mol   b. 1145 g/mol   c. 22.9 g/mol   d. 114.5 g/mol

2. Calculate the mass of KI required to prepare 500 mL of 2.80 M solution:

   a. 464.8 g   b. 232.4 g   c. 2.324×10^5 g   d. 118.6 g

3. A sample of 4.0 g NH_3 reacted with 14.0 g of F_2 to produce N_2F_4 according to the following equation: $2NH_{3(g)} + 5 F_2(g) \longrightarrow N_2F_{4\,(g)} + 6\,HF_{\,(g)}$

   If 4.8 g of N_2F_4 is obtained.

I. The limiting reactant is………………………….

II. The mass of the excess reactant which did not react is……………………

III. The percentage yield of the reaction is……………………………..

4. The total Volume of sea-water is 1.5×10^{21} L. Assume that sea-water contains 3.1 % NaCl by mass and its density is 1.03 g/mL calculate the mass of NaCl exist in sea-water:

   a. 4.8×10^{22} kg   b. 9.60×10^{20} k g   c. 1.54×10^{21} kg   d. 4.80×10^{19} kg

5. What is the percentage by mass of oxygen in ethanol (C_2H_6O):

   a. 11.1 %   b. 30.7 %   c. 34.7 %   d. 39.2 %

6. If 0.20 g of $H_{2(g)}$ and 1.60 g of $O_{2(g)}$ react completely to give water, librates 28.2 kJ of heat, then the heat of formation of water in (kJ/mol) is:

   a. -286 kJ/mol   b. -28.2 kJ/mol   c. -282 kJ/mol   d. -2.82 kJ/mol

7. Given the following thermochemical equations:

   $H_{2(g)} + ½ O_{2(g)} \longrightarrow H_2O_{(l)}$ ΔH= **-286 kJ**

   $S_{(s)} + 3/2\ O_{2(g)} \longrightarrow SO_{3(g)}$ ΔH= **-395 kJ**

   Then, for the following reaction

   $3H_{2(g)} + SO_{3(g)} \longrightarrow S_{(s)} + 3\ H_2O_{(l)}$ **ΔH   is:**

   a. -463 kJ/mol   b. +463 kJ/mol   c. +926 kJ/mol   d. -926 kJ/mol

8. A metal with a mass of 70.00 grams at an original temperature of 95.2 °C is dropped into a calorimeter with 100.00 grams of water at an original temperature of 25.1 °C. The final temperature of the water and the metal is 28.6 °C. Calculate:

   I.   The heat capacity of the metal……………………………….

   II.   Specific heat of the metal………………………...

9. Calculate the energy emitted when an electron move from fourth to the first energy level:

   a. -2.04 x 10^{-18} J   b. +2.04 x 10^{-18} J   c. 1.63 x 10^{-18} J   d. – 1.63 x 10^{-18} J

10.   The oxidation number of chlorine (Cl) in calcium perchlorate $Ca(ClO_4)_2$ is:

   a. -1   b. +1   c. -7   d. +7

11.   The maximum number of electrons that can be occupied in $\ell = 3$ sublevel and n =4 main level respectively is:

   a. 14, 32 electrons   b. 10, 14 electrons   c. 6, 8 electrons   d. 10, 24 electrons

12.   Boron (B) has tow isotopes ^{10}B and ^{11}B, if the average atomic mass of Boron is 10.8. Calculate the percentage composition (natural abundance) of the tow isotopes…………………………………….

13. Assume you place 0.167 g of gaseous compound in 0.346 L flask. It exerts a pressure of 0.427 atm. At 30 °C. The correct formula of the compound is:

   a. C_2H_6 b. C_2H_2 c. C_2H_4 d. C_6H_6

14. Elemental Ni is combined with CO (carbon monoxide) to give a compound with the formula of $Ni(CO)_X$. If 0.125 g of Ni combined with CO to give 0.364 g of $Ni(CO)_X$. What is the value of **x:**

   a.   1   b. 2   c. 3   d. 4

15. If the pressure of a confined gas sample is doubled, while the volume is held constant. What will happen to the temperature:

   a. halved   b. doubled   c. it went up by the factor of 4   d. no change

16. The element which has highest electron affinity is:

        a. Ge   b. Ga   c. As   d. Ca

17. Fill in the blank:

    I. The formula of barium peroxide is…………………………………….

    II. The name of Hg_2Cl_2 is…………………………………………………

    III. The electronic configuration of Ag is……………………………..

    IV. The mass of one nitrogen atom is…………………………………….

    V. Maleic acid has the empirical formula of CHO. Its molar mass is 116.1 g/mol, what is its

       molecular formula……………………………………………..

    VI. The temperature (in °C) at STP is…………………………

18. Which of the following compounds has 120° bond angle:

        a. BCl_3 b. BF_4^- c. H_2O d. NH_3

19. What is the geometry of IBr_5:

        a. Tetrahedron   b. square pyramidal   c. square planer   d. octahedron

20. Which of the following sets of quantum numbers (n, ℓ, m_ℓ, m_s) could represent the last electron in the electron configuration of ^{35}Br:

    a. 4, 0 , 0, +1/2   b. 3, 1, 1, +1/2   c. 4, 1, 1, +1/2   d. 4, 2, 1, -1/2

21. Which of the following is the preferred Lewis structure for NNO is:

    a. $|\overline{N}=\overline{N}-\underline{\overline{O}}|$ b. $|N\equiv N-\underline{\overline{O}}|$ c. $|\overline{N}-\overline{N}=\underline{\overline{O}}$ d. $|\underline{\overline{N}}-N-\underline{\overline{O}}|$

22. Which comparison of electronegativities is not correct:

        a. Ge > Ga   b. Ba > S   c. O > N   d. B > C

23. Arrange the following ions in order of increasing the ionic radii:

a. $Cl^- > S^{-2} > P^{-3} > K^+ > Ca^{+2}$

b. $P^{-3} > S^{-2} > Cl^- > K^+ > Ca^{+2}$

c. $P^{-3} > S^{-2} > Ca^{+2} > Cl^- > K^+$

d. $S^{-2} > P^{-3} > Cl^- > K^+ > Ca^{+2}$

24. Based on the Lewis structures of the following molecules (CO_2, HCN, CH_3Cl, $COCl_2$) answer the given questions:

- The molecule which has the same hybridization of C which exists in CH_4 is……………………………………………………………………………….

- The molecule that has **only one** π bond is……………………………………………

- The molecule(s) which has (have) sp hybridization of carbon atom is (are)………

- The molecule which has a bond angle of 109.5 ° is………………………..

- The longest bond formed by carbon is……….………In……………Molecule

25. Draw all possible resonance structures of NO_2, then indicate which resonance structure(s) is (are) preferred……………………………………………………………………………………………

…………………………………………………………………………………………

…………………………………………………………………………………………

………………………………………………………………………………………..

-GOOD LUCK-