CHEMISTRY 101
FINAL EXAM

Name:_____ **Date: 19/05/2012**

Student no. _____ **Section:**_____

Useful Information:

Rydberg's constant= 1.1×10^{-2} nm^{-1} *A= 2.18×10^{-18} J; c=3×10^{8} m/s; h=6.6×10^{-34} Js;* *$N_{avogadro}=6.02\times10^{23}$ mol^{-1}* *General gas constant R=8.314 J/mol.K=0.0821 atm.L/mol.K; 1atm=760 torr=101325 Pa*

H 1.000																	He 4
Li 6.941	Be 9.012											B 10.81	C 12.01	N 14.01	O 16	F 19	Ne 20.18
Na 22.99	Mg 24.31											Al 26.98	Si 28.09	P 30.97	S 32.06	Cl 35.45	Ar 39.95
K 39.10	Ca 40.08	Sc 44.96	Ti 47.9	V 50.94	Cr 51.99	Mn 54.94	Fe 55.85	Co 58.93	Ni 58.71	Cu 63.54	Zn 65.37	Ga 69.72	Ge 72.59	As 74.92	Se 78.96	Br 79.9	Kr 83.8
Rb 85.47	Sr 87.62	Y 88.91	Zr 91.22	Nb 92.91	Mo 95.94	Tc 99.91	Ru 101.1	Rh 102.91	Pd 106.4	Ag 107.87	Cd 112.4	In 114.8	Sn 118.69	Sb 121.75	Te 127.6	I 126.9	Xe 131.3
Cs 132.9	Ba 137.3	57-71 *	Hf 178.5	Ta 180.9	W 183.85	Re 186.2	Os 190.2	Ir 192.2	Pt 195.1	Au 196.97	Hg 200.6	Tl 204.37	Pb 207.2	Bi 208.98	Po 210	At 210	Rn 222

Q1 (1.5 pt)	Q2 (1.5 pt)	Q3 (1.5 pt)	Q4 (1.5 pt)	Q5 (1.5 pt)	Q6 (1.5 pt)	Q7 (1 pt)	Q8 (1pt)
Q9 (1.5 pt)	**Q10 (1.5 pt)**	**Q11 (1.5 pt)**	**Q12 (1.5 pt)**	**Q13 (3 pts)**	**Q14 (1 pt)**	**Q15 (1.5 pt)**	**Q16 (1.5 pt)**
Q17 (1.5 pt)	**Q18 (1.5 pt)**	**Q19 (1.5 pt)**	**Q20 (1 pt)**	**Q21 (2 pts)**	**Q22 (1 pt)**	**Q23 (1.5 pt)**	**Q24 (1.5 pt)**
Q25 (1.5 pt)	**Q26 (1.5 pt)**	**Q27 (1.5 pt)**	**Q28 (3 pts)**	**Total (40)**			

Circle the best fit answer of each of the following questions:

1. Calculate the number of oxygen atoms in 3 g $K_2Cr_2O_7$.
   a. 6.14×10^{21} b. 1.02×10^{22} c. 4.30×10^{22} d. 7.12×10^{22}

2. 40.0 mL of an H_2SO_4 solution was titrated with 0.215 M NaOH. If 27 mL of the NaOH solution was required to exactly neutralize the H_2SO_4 solution, what was the concentration of the acid?
   a. 0.073 M b. 0.095 M c. 0.145 M d. 0.19 M

3. Given the balanced equation: $\mathbf{2\,ZnS + 3\,O_2 \rightarrow 2\,ZnO + 2\,SO_2}$
   If 227g of ZnS, and 255g of O_2 are mixed together, what is the amount (in grams) of SO_2 that can be formed?
   a. 128.0 g b. 149.1 g c. 214.8 g d. 340 .0 g

4. What volume of 0.1 M HCl must be added to 50 mL 0.2 M HCl to give 0.18 M HCl solution?
   a. 12.5 mL b. 50 mL c. 100 mL d. 200 mL

5. A sample of Chloroform (consists of C, H, and Cl) is found to contain 24.0 g of C, 212 g of Cl, and 2.02 g of H. If a second sample of Chloroform is found to contain 30.0 g of C, what is the total mass of the second sample of Chloroform?
   a. 598 g b. 299 g c. 149 g d. 1000 g

6. The element with highest first ionization energy is
   a. S b. P c. Al d. Na

7. Which one of the following sets of quantum numbers in an atom is **not** possible
   a. $n = 3;\ \ell = 2;\ m_\ell = -1$ b. $n = 3;\ \ell = 1;\ m_\ell = -1$
   c. $n = 3;\ \ell = 0;\ m_\ell = 0$ d. $n = 3;\ \ell = 3;\ m_\ell = -1$

8. What is the energy of one photon that has a wavelength of 500 nm?
   a. 2.18×10^{-18} J b. 1.63×10^{-18} J c. 3.96×10^{-19} J d. 2.83×10^{-19} J

9. Hydrogen peroxide decomposes according to the following thermochemical reaction

$$\Delta H=-98.2 \text{ kJ} \quad H_2O_{2(\ell)} \rightarrow H_2O_{(\ell)} + \tfrac{1}{2} O_{2(g)}$$

The change in enthalpy (ΔH) when 1.00 g of hydrogen peroxide decomposes is

a. -98.2 kJ b. -289 J c. +2.89 kJ d. -2.89 kJ

10. When a 1.00 g sample of hydrazine (N_2H_4) is burned in a bomb calorimeter, the temperature rises from 24.62ºC to 28.16ºC. If the heat capacity of the bomb calorimeter is 5.856 kJ/ºC, the energy of combustion (ΔE) of one-gram sample is

a. +20.7 kJ/g b. -20.7 J/g c. +169.8 J/g d. -17 kJ/g

11. Calculate $\Delta H°$ of the following **unbalanced** reaction

$$PCl_{5(g)} + H_2O_{(g)} \rightarrow POCl_{3(g)} + HCl_{(g)}$$

Given the following heats of formation: $\Delta H_f^o(PCl_{5(g)})=-287$ kJ/mol; $\Delta H_f^o(H_2O_{(g)})=-242$ kJ/mol; $\Delta H_f^o(HCl_{(g)})=-92$ kJ/mol; $\Delta H_f^o(POCl_{3(g)})=-559$ kJ/mol

a. +214 kJ/mol b. +122 kJ/mol c. -122 kJ/mol d. -214 kJ/mol

12. A 24 L container filled with O_2 at a given temperature has a pressure of 6.0 atm. If the oxygen is allowed to expand to 36 L, then the new pressure at the same temperature is

a. 8 atm b. 6 atm c. 4 atm d. 2 atm

13. Fill in the blanks:

a. The name of $Cr(HSO_3)_2$ is _____
b. The formula of ferrous chlorite is _____
c. The electron configuration of Cu is _____
d. The oxidation number of Cl in NaOCl is _____
e. A binary ionic compound is known to contain a cation with 56 proton and 54 electrons. The anion contains 17 proton and 18 electrons. The name of the compound is_____
f. Which of the following sublevels (1s, 1p, 7d, 9s, 3f, 4f, 2d) is (are) ***incorrect***_____

14. The bond angle in ICl_2^- is

a. 90º b. 109.5º c. 120º d. 180º

15. The correct order of increasing ionic size is

a. $Ba^{2+} < Cs^{+} < Te^{2-} < I^{-}$ b. $Cs^{+} < Ba^{2+} < Te^{2-} < I^{-}$

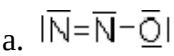
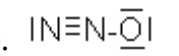
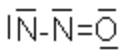
c. $Ba^{2+} < Cs^{+} < I^{-} < Te^{2-}$ d. $Cs^{+} < Ba^{2+} < I^{-} < Te^{2-}$

16. The correct order of increasing ionic character (polarity) of the bond is

a. N-O < Br-Br < C-F < K-F b. Br-Br < K-F < N-O < C-F

c. Br-B r < C-F < N-O < K-F d. Br-Br < N-O < C-F < K-F

17. The preferred Lewis structure for the molecule (NNO) is

a.  b.  c.  d. 

18. What is the molecular geometry (shape) of the molecule $XeOF_2$?

a. Trigonal pyramidal b. T-shaped c. Triangualr planar d. V-shaped

19. The correct order of increasing bond angle in the following molecules is:

a. $SO_2 < SO_3 < SO_3^{2-} < SO_4^{2-}$ b. $SO_4^{2-} < SO_3^{2-} < SO_2 < SO_3$

c. $SO_3^{2-} < SO_4^{2-} < SO_3 < SO_2$ d. $SO_3^{2-} < SO_4^{2-} < SO_2 < SO_3$

20. Which one of the following molecules is polar?

a. $CHCl_3$ b. XeF_2 c. XeF_4 d. BCl_3

21. Based on the Lewis structures of the following molecules (N_2, N_2H_4, N_2F_2) answer the given questions:

a. The hybridization of the N-atom in N_2F_2 is ……

b. The molecule that has the longest N-N bond is ……

c. The molecule that has **<u>two</u>** π bonds is ……

d. The formal charge on nitrogen in N_2H_4 is ……

22. What is the volume of a 5.750×10^3 mg object that has a density of 3.97 g/ml?

a. 1.44 cm^3 b. 1448 cm^3 c. 1.45 cm^3 d. 0.690 cm^3

23. Which **<u>one</u>** of the following species has the **<u>maximum</u>** number of **<u>unpaired</u>** electrons:

a. Fe^{3+} b. Mo c. O^{-} d. Ar

24. Element X forms both a Dichloride (XCl_2) and TeraChloride (XCl_4). Treatment of 10.0 g of XCl_2 with excess Cl_2 forms 12.55 g of XCl_4. What is the element X? (Hint: Calculate the Atomic Mass of X)

a. Pb b. Cr c. Mn d. Co

25. What mass of NaOH is contained in 250.0 ml of a 0.4 M sodium hydroxide a aqueous solution?

a. 2.3 g b. 2.5 g c. 4000 g d. 4.0 g

26. At 0 ºC A 1.0 L flask contains 0.00468 mole of N_2 and 150 mg of O_2. What is the partial pressure of O_2 in the flask ?

a. 0.105 atm b. 0.21atm c. 0.314 atm d. 105 atm

27. Calculate ΔH for the reaction:

$$\boldsymbol{FeO_{(s)} + CO_{(g)} \longrightarrow Fe_{(s)} + CO_{2(g)}}$$

Given the following reactions and their respective enthalpy changes:

	ΔH/kJ
$Fe_2O_{3(S)} + 3\,CO_{(g)} \longrightarrow 2\,Fe_{(s)} + \mathbf{3}\,CO_{2(g)}$	-23
$3\,Fe_2O_{3(S)} + CO_{(g)} \longrightarrow 2\,Fe_3O_{4(S)} + CO_{2(g)}$	-39
$Fe_3O_{4(S)} + CO_{(g} \longrightarrow 3FeO_{(S)} + CO_{2(g)}$	+18

a. 11 kJ b. -11 kJ c. 1 2 kJ d. -1 kJ

28. Draw the most stable lewis structure of the following species then draw the resonance structures if exist:

a. $POCl_3$_____-

b. O_3 _____

c. NO_4^{3-}_____

29. This exam is: a. Easy b. Very easy c. Average d. Difficult

-GOOD LUCK-