NAME:_____ Section:_____ Student Number:_____

Fall 2012 **Chemistry 1000 Practice Midterm #2A** ____/ 60 marks

INSTRUCTIONS:
1) Please read over the test carefully before beginning. You should have 6 pages of questions and a double-sided formula/periodic table sheet.
2) If your work is not legible, it will be given a mark of zero.
3) Marks will be deducted for incorrect information added to an otherwise correct answer.
4) Marks will be deducted for improper use of significant figures and for missing or incorrect units.
5) Show your work for all calculations. Answers without supporting calculations will not be given full credit.
6) You may use a calculator.
7) You have 90 minutes to complete this test.

Confidentiality Agreement:
I agree not to discuss (or in any other way divulge) the contents of this exam until after 8pm Mountain Time on Monday, November 19th, 2012. I understand that breaking this agreement would constitute academic misconduct, a serious offense with serious consequences. The minimum punishment would be a mark of 0/60 on this exam and removal of the "overwrite midterm mark with final exam mark" option for my grade in this course; the maximum punishment would include expulsion from this university.

Signature: _____ Date: _____
Course: CHEM 1000 (General Chemistry I)
Semester: Fall 2012
The University of Lethbridge

Question Breakdown

Q1	/ 15
Q2	/ 3
Q3	/ 3
Q4	/ 6
Q5	/ 3
Q6	/ 5
Q7	/ 5
Q8	/ 6
Q9	/ 4
Q10	/ 5
Q11	/ 5

Total	/ 60

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1. **[15 marks]**

(a) All ionization energies have a _____ sign.

(b) A carbon atom is _____ in size than an oxygen atom.

(c) Germanium is _____ electronegative than selenium.

(d) Sodium metal is produced by electrolysis of _____ in the _____ state.

(e) Aluminium metal is produced by electrolysis of _____ in the _____ state.

(f) Sodium hydroxide is produced by electrolysis of _____ in the _____ state.

(g) The gas produced when barium carbonate is added to acid is _____.

(h) Lithium and magnesium have similar chemical properties because of _____ _____.

(i) Aluminium is less reactive than one might expect because _____ _____.

(j) Two amphoteric oxides are _____ and _____.

(k) One ion that can make water "hard" is _____.

2. Briefly explain why Cu^{2+} has a smaller atomic radius than Cu^{+}. **[3 marks]**

3. Which element has a larger electron affinity, Ne or F?
Briefly explain your answer. **[3 marks]**

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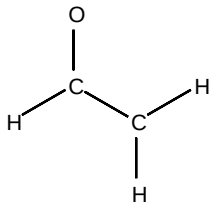
4. Draw one valid Lewis diagram for each of the molecules/ions listed below. **[6 marks]**
Include any non-zero formal charges on the appropriate atoms.

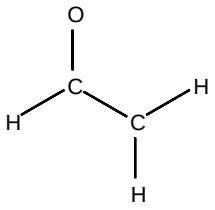
(a) N_2H_4 (b) SF_4

(c) AsO_4^{3-}

5. Is SF_4 a polar or nonpolar molecule? Why? **[4 marks]**

6. There are two valid resonance structures for an anion with the chemical formula $C_2H_3O^-$. The connectivity for this anion is shown below. **[5 marks]**





(a) On the two skeletons above, draw each of the two valid resonance structures. *[4 marks]*
Include any non-zero formal charges on the appropriate atoms.

(b) Circle the better resonance structure (the resonance structure which more closely resembles the true/averaged structure of this anion). *[1 mark]*
You will only obtain credit for part (b) if your answers to part (a) are correct.

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7. Lithium carbonate (Li_2CO_3, 25.33 g) is heated to 1400 °C and releases carbon dioxide. **[5 marks]**

(a) Write a balanced chemical equation describing this reaction. Include states of matter. *[1 mark]*

(b) The carbon dioxide is collected in a container at 23.7 °C and 0.956 bar ambient pressure. Under these conditions, what volume of carbon dioxide is formed? *[4 marks]*

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8. Write a balanced chemical equation for each of the following reactions. Include states of matter. If no reaction occurs, write "NO REACTION" instead. **[6 marks]**

(a) Barium (Ba) is added to liquid bromine. *[1 mark]*

(b) Lithium is added to aqueous HCl. *[1 mark]*

(c) Beryllium is added to water. *[1 mark]*

(d) Magnesium is reacted with oxygen. *[1 mark]*

(e) Aluminium is added to concentrated aqueous NaOH. *[2 marks]*

9. Complete the following table. **[4 marks]**

Chemical Formula	**Name**
MnO_2	
CaF_2	
	sodium sulfide
	magnesium nitride

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10. Give the **name** and **symbol** for each of the elements below: **[5 marks]**

	name	**symbol**
i.	$Z = 4$	
ii.	$Z = 14$	
iii.	$Z = 17$	
iv.	$Z = 27$	
v.	$Z = 31$	

Partial Periodic Table (copied from data sheet)

1																	**18**
1.0079 **H** 1	**2**											**13**	**14**	**15**	**16**	**17**	4.0026 **He** 2
6.941 **Li** 3	4											5	12.011 **C** 6	14.0067 **N** 7	15.9994 **O** 8	18.9984 **F** 9	20.1797 **Ne** 10
22.9898 **Na** 11	24.3050 **Mg** 12	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	13	14	15	16	17	39.948 **Ar** 18
39.0983 **K** 19	20	44.9559 **Sc** 21	22	50.9415 **V** 23	51.9961 **Cr** 24	54.9380 **Mn** 25	55.847 **Fe** 26	27	58.693 **Ni** 28	63.546 **Cu** 29	30	31	72.61 **Ge** 32	74.9216 **As** 33	78.96 **Se** 34	79.904 **Br** 35	83.80 **Kr** 36
85.4678 **Rb** 37	87.62 **Sr** 38	88.9059 **Y** 39	91.224 **Zr** 40	92.9064 **Nb** 41	95.94 **Mo** 42	(98) **Tc** 43	101.07 **Ru** 44	102.906 **Rh** 45	106.42 **Pd** 46	107.868 **Ag** 47	112.411 **Cd** 48	114.82 **In** 49	118.710 **Sn** 50	121.757 **Sb** 51	127.60 **Te** 52	126.905 **I** 53	131.29 **Xe** 54
132.905 **Cs** 55	137.327 **Ba** 56	**La-Lu**	178.49 **Hf** 72	180.948 **Ta** 73	183.85 **W** 74	186.207 **Re** 75	190.2 **Os** 76	192.22 **Ir** 77	195.08 **Pt** 78	196.967 **Au** 79	200.59 **Hg** 80	204.383 **Tl** 81	207.19 **Pb** 82	208.980 **Bi** 83	(210) **Po** 84	(210) **At** 85	(222) **Rn** 86
(223) **Fr** 87	226.025 **Ra** 88	**Ac-Lr**	(261) **Rf** 104	(262) **Db** 105	(263) **Sg** 106	(262) **Bh** 107	(265) **Hs** 108	(266) **Mt** 109	(281) **Dt** 110	(283) **Rg** 111							

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11. The ions Br^-, Rb^+, Se^{2-} and Sr^{2+} all have the same electron configuration. Their ionic radii are 132, 166, 182 and 184 pm (not necessarily in that order). **[5 marks]**

(a) Give the electron configuration for these ions. Do not use the noble gas abbreviation. *[1 mark]*

(b) Give the electron configuration for these ions using the noble gas abbreviation. *[1 mark]*

(c) Assign which ion has which radius. *[1 mark]*

Br^-_____ pm Rb^+_____ pm Se^{2-}_____ pm Sr^{2+}_____ pm

(d) **Briefly** explain why you assigned each radius in part (c). *[2 marks]*

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Some Useful Constants and Formulae

Fundamental Constants and Conversion Factors

Atomic mass unit (u)	$1.660\,539 \times 10^{-27}$ kg	Planck's constant	$6.626\,070 \times 10^{-34}$ J·Hz^{-1}
Avogadro's number	$6.022\,141 \times 10^{23}$ mol^{-1}	Proton mass	1.007 277 u
Bohr radius (a_0)	$5.291\,772 \times 10^{-11}$ m	Neutron mass	1.008 665 u
Electron charge (e)	$1.602\,177 \times 10^{-19}$ C	Rydberg Constant (R_H)	$2.179\,872 \times 10^{-18}$ J
Electron mass	$5.485\,799 \times 10^{-4}$ u	Speed of light in vacuum	$2.997\,925 \times 10^{8}$ m·s^{-1}
Ideal gas constant (R)	8.314 462 J·mol^{-1}·K^{-1} 8.314 462 m^3·Pa·mol^{-1}·K^{-1}	Standard atmospheric pressure	1 bar = 100 kPa

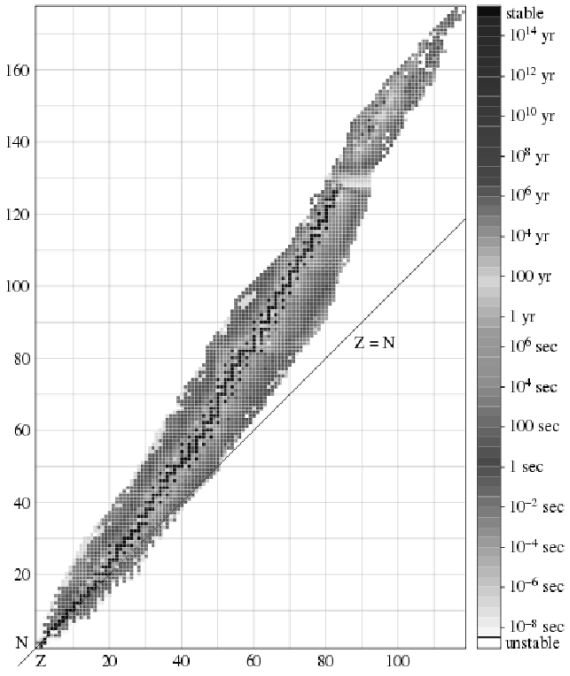
Formulae

$c = \nu\lambda$ $\quad E = h\nu$ $\quad p = mv$ $\quad \lambda = \frac{h}{p}$ $\quad \Delta x \cdot \Delta p > \frac{h}{4\pi}$

$r_n = a_0 \frac{n^2}{Z}$ $\quad E_n = -R_H \frac{Z^2}{n^2}$ $\quad E_k = \frac{1}{2}mv^2$ $\quad PV = nRT$

$\Delta E = \Delta m c^2$ $\quad A = -\frac{\Delta N}{\Delta t}$ $\quad A = kN$ $\quad \ln\left(\frac{N_2}{N_1}\right) = -k(t_2 - t_1)$ $\quad \ln(2) = k \cdot t_{1/2}$

Band of Stability Graph



The graph at the right shows the band of stability. Stable isotopes are in black. Isotopes that exist but are not stable are shown in varying shades of gray with the shades of gray corresponding to different half-lives.

The original version of the graph used a rainbow colour scale.
http://commons.wikimedia.org/wiki/File:Isotopes_and_half-life_eo.svg

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CHEM 1000 Partial Periodic Table

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138.906 **La** 57	140.115 **Ce** 58	140.908 **Pr** 59	144.24 **Nd** 60	(145) **Pm** 61	150.36 **Sm** 62	151.965 **Eu** 63	157.25 **Gd** 64	158.925 **Tb** 65	162.50 **Dy** 66	164.930 **Ho** 67	167.26 **Er** 68	168.934 **Tm** 69	173.04 **Yb** 70	174.967 **Lu** 71
227.028 **Ac** 89	232.038 **Th** 90	231.036 **Pa** 91	238.029 **U** 92	237.048 **Np** 93	(240) **Pu** 94	(243) **Am** 95	(247) **Cm** 96	(247) **Bk** 97	(251) **Cf** 98	(252) **Es** 99	(257) **Fm** 100	(258) **Md** 101	(259) **No** 102	(260) **Lr** 103

Developed by Prof. R. T. Boeré