Surname (last name):_____

Given name (first name):_____

Student number:_____

Lab Section:_____

Lab TA: _____

Chemistry 1311 C
Test 1
October 2006

Please keep your work covered and keep your eyes on your own paper! Cheating or any appearance of cheating will result in an F in the course and possible expulsion from the University.

There are 10 pages of questions in this exam. A periodic table and formula sheet are provided at the end. You may rip these two pages off of the exam and use them to cover your work during the exam.

Any scratch work should be on the back of the exam pages and should be handed in with your exam.

Please show all work to receive partial credit.

You have 80 minutes to complete the exam.

For each question, please write your final answer in the space provided.

Page	Maximum	Mark	TA initial
3	9		
4	9		
5	7		
6	7		
7	6		
8	10		
Total	48		

1. Gaseous iodine pentafluoride, IF_5, can be prepared by the reaction of solide iodine and gaseous fluorine:

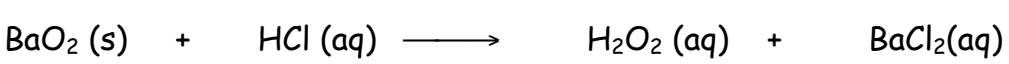
   a) Balance the chemical reaction: (1 points)

   $I_2(s) + F_2(g) \longrightarrow IF_5(g)$

   b) A 5.00 L flask containing 10.0 g I_2 is charged with 10.0 g F_2, and the reaction proceeds until one of the reagents is completely consumed. After the reaction is complete, the temperature of the flask is 125 °C. What is the pressure of IF_5 in the flask? (6 points)

   c) What is the mole fraction of IF_5 in the flask? (2 points)

2. Small quantities of hydrogen peroxide, H_2O_2, can be prepared by the action of an acid on an alkaline earth metal peroxide, such as barium peroxide, BaO_2.
    a) Balance the chemical equation: (1 points)



    b) What amount of H_2O_2 (in grams) should result when 1.5 g of barium peroxide is treated with 25 ml of HCl (0.0272 g/ml). What mass of which reagent is left. (8 points)

Mass of H_2O_2_____

Which reagent is left?_____; Mass_____

3. An element consists of 1.4 % of an isotope with mass 203.9730 amu, 24.1% of an isotope with mass 205.9745, 22.10% of an isotope with mass 206.9759, 52.4 % of an isotope with mass 207.9766.
    a) Calculate the average atomic mass. (3 points)

Average atomic mass:_____

b) What is this element (1 point)?_____

c) A common ion of this element is M^{2+} (3 points).
How many protons does M^{2+} have?_____

How many neutrons does the most abundant isotope of

M^{2+} have?_____

How many electrons does M^{2+} have?_____

4. The specific heat capacity of silver is 0.24 J C^{-1} g^{-1}.
    a) Calculate the energy to raise the temperature of 150.0 g of silver from 0 to 25 °C(2 points).

Energy required:_____

    b) Calculate the energy required to raise the temperature of 1.0 moles of Ag by 1.0 °C (i.e. the molar heat capacity) (2 points).

Energy required:_____

    c) If it takes 1.25 kJ of energy to heat a sample of pure silver from 12.0 to 15.2 °C. Calculate the number of moles and the mass in kilograms of silver in the sample (3 points).

Moles of silver in sample:_____

Mass of silver in sample :_____

5. Calculate the molarity, molality and weight percent of sulphuric acid, H_2SO_4, solution having a mole fraction 0.53. The density of the solution is 1.7904 g/ml.

Molarity: (2 points)_____

Molality: (2 points)_____

Weight % H_2SO_4: (2 points)_____

6. An organic compound was found to contain only C, H, and Cl. When a 1.499 g sample of the compound was completely combusted in air, 2.2 L of CO_2 (g) was collected over water at 25 °C and 700 mm Hg. In a separate experiment the chlorine in a 1.00 g sample of the compound was converted to 1.27 g of AgCl. Determine the empirical formula of the compound. (Vapour pressure of water at 25 °C is 23.76 torr). (10 points)

Empirical formula:_____

EQUATIONS SHEET

$\Delta H^o_{rxn} = \Sigma n\Delta H^o_f$ (products) – $\Sigma m\Delta H^o_f$ (reactants)

$\Delta G^o_{rxn} = \Sigma n\Delta G^o_f$ (products) – $\Sigma m\Delta G^o_f$ (reactants)

$\Delta S^o_{rxn} = \Sigma nS^o$ (products) – ΣmS^o (reactants)

$PV = nRT$ $\Delta G = \Delta H - T\Delta S$ $\Delta G^o = -RT\ln K$

$\upsilon_{rms} = (3RT/MM)^{1/2}$ $\Delta E = q + w$ $\Delta G = \Delta G^o + RT\ln Q$

$$\left(P + \frac{an^2}{V^2}\right)(V - nb) = nRT$$ $q = ms\Delta T$ $q = C\Delta T$

$w = -P\Delta V$ $[A] = -kt + [A]_o$ $t_{1/2} = 0.693/k$

$$\ln\left(\frac{k_2}{k_1}\right) = \frac{E_a}{R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$$ $1/[A] = kt + 1/[A]_o$ $\ln[A] = -kt + \ln[A]_o$

$P_A = X_A P_A^o$ $P_A = X_A P_{Total}$ $P_{total} = P_1 + P_2 + ...$ $K_P = K_C(RT)^{\Delta n}$

Solubility = $k_H P_{gas}$ $KE = (3/2)\ RT$ $d = [P(MM)/RT]$

$pH = -\log[H_3O^+]$ $pOH = -\log[OH^-]$ $pH + pOH = 14$

$K_w = K_a \times K_b$

$$pH = pKa + \log\frac{[\text{conjugate base}]}{[\text{acid}]}$$

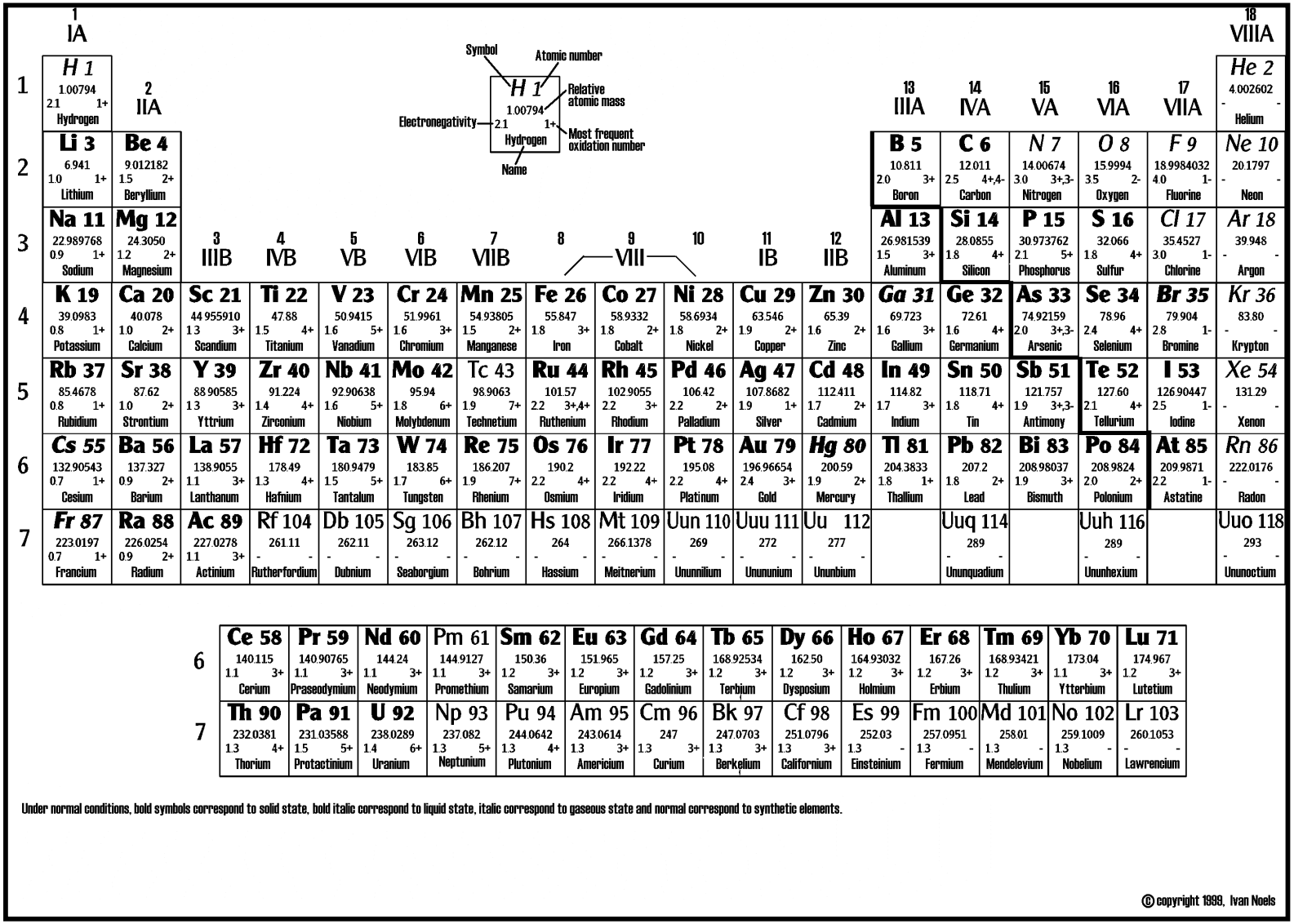
$E^o_{cell} = E^o_{reduction} + E^o_{oxidation}$ Charge (C) = current (A) x time (s)

$E^o = (0.0257/n)\ln K$ $E = E^o - (0.0257/n)\ln Q$ $\Delta G = -nFE_{cell}$

$E = hc/\lambda$ $E = h\nu$ $c = \lambda\nu$

$$\Delta E = R_H\left(\frac{1}{n_i^2} - \frac{1}{n_f^2}\right)$$

Constants:		Conversion Factors :
Avogadro's Number (N_A)	6.02×10^{23}	$1\ A = 1\ C\ s^{-1}$
Faraday's constant (F)	96,500 C/mol e^-	$1\ C = 1\ J\ V^{-1}\ mol^{-1}$
Universal Gas Constant (R)	8.314 J $mol^{-1}\ K^{-1}$	
	8.314 kg $m^2\ mol^{-1}\ K^{-1}\ s^{-2}$	
	0.08206 L atm $mol^{-1}\ K^{-1}$	$1\ nm = 10^{-9}\ m$
Planck's constant (h)	6.626×10^{-34} J s	1 atm = 760 torr
Rydberg Constant (R_H)	2.18×10^{-18} J	= 760 mm Hg
Speed of light(c)	3.00×10^8 m/s	= 101.3 kPa



Under normal conditions, bold symbols correspond to solid state, bold italic correspond to liquid state, italic correspond to gaseous state and normal correspond to synthetic elements.