

Name:

Chem 110

Fall 2002

Exam III

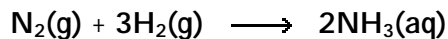
### The Periodic Table

<i>IA</i>										<i>VIIIA</i>												
H 1 1.01																					He 2 4.00	
<i>IIA</i>												<i>IIIA</i>		<i>IVA</i>		<i>VA</i>		<i>VIA</i>		<i>VIIA</i>		
Li 3 6.94	Be 4 9.01											B 5 10.81	C 6 12.01	N 7 14.01	O 8 16.00	F 9 19.00	Ne 10 20.18					
Na 11 22.99	Mg 12 24.31											Al 13 26.98	Si 14 28.09	P 15 30.97	S 16 32.07	Cl 17 35.45	Ar 18 39.95					
		<i>IIIB</i>		<i>IVB</i>		<i>VB</i>		<i>VIB</i>		<i>VII B</i>		<i>VIII B</i>		<i>VIII B</i>		<i>VIII B</i>		<i>IB</i>		<i>IIB</i>		
K 19 39.10	Ca 20 40.08	Sc 21 44.96	Ti 22 47.88	V 23 50.94	Cr 24 52.00	Mn 25 54.94	Fe 26 55.85	Co 27 58.93	Ni 28 58.69	Cu 29 63.55	Zn 30 65.39	Ga 31 69.72	Ge 32 72.61	As 33 74.92	Se 34 78.96	Br 35 79.90	Kr 36 83.80					
Rb 37 85.47	Sr 38 87.62	Y 39 88.91	Zr 40 91.22	Nb 41 92.91	Mo 42 95.94	Tc 43 (97.9)	Ru 44 101.07	Rh 45 102.91	Pd 46 106.42	Ag 47 107.87	Cd 48 112.41	In 49 114.82	Sn 50 118.71	Sb 51 121.76	Te 52 127.60	I 53 126.90	Xe 54 131.29					
Cs 55 132.91	Ba 56 137.33	La 57 138.91	Hf 72 178.49	Ta 73 180.95	W 74 183.85	Re 75 186.21	Os 76 190.2	Ir 77 192.22	Pt 78 195.08	Au 79 197.97	Hg 80 200.59	Tl 81 204.38	Pb 82 207.2	Bi 83 208.98	Po 84 (209)	At 85 (210)	Rn 86 (222)					
Fr 87 223.02	Ra 88 226.03	Ac 89 227.03	Rf 104 (261)	Db 105 (262)	Sg 106 (263)	Bh 107 (262)	Hs 108 (265)	Mt 109 (266)														

Ce 58 140.12	Pr 59 140.91	Nd 60 144.24	Pm 61 (145)	Sm 62 150.36	Eu 63 152.97	Gd 64 157.25	Tb 65 158.93	Dy 66 162.50	Ho 67 164.93	Er 68 167.26	Tm 69 168.93	Yb 70 173.04	Lu 71 174.97
Th 90 232.04	Pa 91 231.04	U 92 238.03	Np 93 237.05	Pu 94 (240)	Am 95 243.06	Cm 96 (247)	Bk 97 (248)	Cf 98 (251)	Es 99 252.08	Fm 100 257.10	Md 101 (257)	No 102 259.10	Lr 103 262.11

Question 1  
(9 points)

Using average bond energies the enthalpy change associated with the following reaction:



Was determined to be  $-93 \text{ kJ}\cdot\text{mol}^{-1}$ . Knowing that the  $\Delta H_f^0$  of for the elements in their standard state is 0 and  $\Delta H_f^0 \text{ NH}_3(\text{aq}) = -80 \text{ kJ}\cdot\text{mol}^{-1}$ . Using heats of formation data, determine the enthalpy change for the reaction.

Do Not  
Write Here

Give a simple explanation for the difference in values obtained. Which value do you think is closer to the real value?

Question 2  
(24 points)

For each of the following molecules give the **electron-pair** geometry, the **number of lone pairs** around the central atom and the **molecular geometry**.

A.  $\text{NO}_3^-$

electron-pair geometry \_\_\_\_\_

lone pairs \_\_\_\_\_

molecular geometry \_\_\_\_\_

B.  $\text{NO}_2^+$

electron-pair geometry \_\_\_\_\_

lone pairs \_\_\_\_\_

molecular geometry \_\_\_\_\_

C.  $\text{NF}_3$

electron-pair geometry \_\_\_\_\_

lone pairs \_\_\_\_\_

molecular geometry \_\_\_\_\_

D.  $\text{CS}_2$

electron-pair geometry \_\_\_\_\_

lone pairs \_\_\_\_\_

molecular geometry \_\_\_\_\_

Do Not  
Write Here

Name:

Question 3 Classify each of the following molecules as **Polar** or **Non Polar**.  
(8 points)

Do Not  
Write Here

- A.  $\text{NO}_3^-$  \_\_\_\_\_
- B.  $\text{NO}_2^+$  \_\_\_\_\_
- C.  $\text{NF}_3$  \_\_\_\_\_
- D.  $\text{CS}_2$  \_\_\_\_\_

Question 4 Circle the intermolecular forces that are applicable to the following:  
(10 Points)

Do Not  
Write Here

- A. The solute-solvent interactions when **calcium chloride** dissolves in water are primarily of the type:  
dipole-induced dipole    ion-dipole    ion-ion    dipole-dipole    hydrogen bonding
- B. The solute-solvent interactions when **O<sub>2</sub>** dissolves in water are primarily of the type:  
dipole-induced dipole    ion-dipole    ion-ion    dipole-dipole    hydrogen bonding
- C. The type(s) of intermolecular forces expected between **Cl<sub>2</sub>** molecules:  
dispersion    ion-dipole    ion-ion    dipole-dipole    hydrogen bonding
- D. The type(s) of intermolecular forces expected between **HF** molecules:  
dispersion    ion-dipole    ion-ion    dipole-dipole    hydrogen bonding

Circle the molecule that is expected to have the higher boiling point.

$\text{CH}_4$      $\text{CH}_3\text{OH}$      $\text{CH}_3\text{CH}_3$      $\text{CH}_3\text{CH}_2\text{OH}$      $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$

Question 5 The equilibrium constant,  $K_c$ , for the following reaction is  $1.67 \times 10^{-2}$  at **1180 K**:  
(5 Points)  $2 \text{SO}_3(\text{g}) \rightleftharpoons 2 \text{SO}_2(\text{g}) + \text{O}_2(\text{g})$

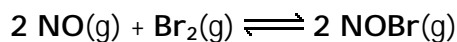
Calculate  $K_c$  at this temperature for:



Do Not  
Write Here

Question 6  
(5 Points)

Consider the following reaction:

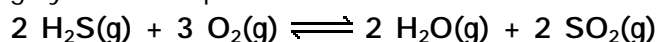


If **0.580** moles of **NOBr(g)**, **0.567** moles of **NO**, and **0.446** moles of **Br<sub>2</sub>** are at equilibrium in a **8.8 L** container at **452K**, the value of the equilibrium constant

Do Not  
Write Here

Question 7  
(5 Points)

Consider the following system at equilibrium:



The production of **H<sub>2</sub>O** by this reaction would be favored by:  
(Circle those that apply)

Do Not  
Write Here

- A. removing **H<sub>2</sub>S**
- B. removing **SO<sub>2</sub>**
- C. adding **SO<sub>2</sub>**
- D. adding **H<sub>2</sub>S**
- E. adding **O<sub>2</sub>**

Question 8  
(8 Points)

A. The formula for the **conjugate acid** of **CO<sub>3</sub><sup>2-</sup>** is. \_\_\_\_\_

B. The formula for the **conjugate base** of **HPO<sub>4</sub><sup>2-</sup>** is. \_\_\_\_\_

C. The formula for the **conjugate base** of **H<sub>3</sub>PO<sub>4</sub>** is \_\_\_\_\_

D. The formula for the **conjugate acid** of **NH<sub>3</sub>** is \_\_\_\_\_

Do Not  
Write Here

Question 9  
(8 points)

The **[H<sub>3</sub>O<sup>+</sup>]** in an aqueous solution is **5.58x10<sup>-9</sup> M**.

The **[OH<sup>-</sup>]** in the solution is \_\_\_\_\_ M.

The pH of this solution is \_\_\_\_\_ and the pOH is \_\_\_\_\_.

This solution is \_\_\_\_\_. (Acidic or Basic)

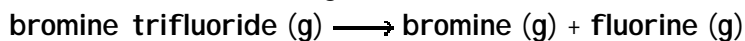
Do Not  
Write Here

**Name:**

Question 10 (5 points) You need to make an aqueous solution of **0.160 M potassium bromide** for an experiment in lab, using a **500 mL** volumetric flask. How much solid **potassium bromide** should you add?

Do Not  
Write Here

Question 11 (6 Points) According to the following reaction, how many moles of **bromine trifluoride** are necessary to form **0.387** moles **fluorine gas**?



Do Not  
Write Here

Question 12 (7 points) How many grams of solid **potassium hydroxide** are needed to exactly neutralize **25.1 mL** of a **0.642 M hydrochloric acid** solution ? Assume that the volume remains constant.

Do Not  
Write Here

<p><u>Score:</u></p> <p>Do Not Write Here</p>	<p><u>Note:</u></p> <p>Do Not Write Here</p>
---	--

