Chem. 1A Midterm 2
Practice Test 1

Name__________________________________________

Student Number __________________________________

All work must be shown on the exam for partial credit. Points will be taken off for incorrect or no units. Calculators are allowed. Cell phones may not be used for calculators. On short answer problems you must show your work in order to receive credit for the problem. If your cell phone goes off during the exam you will have your exam removed from you.

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**Fundamental Questions**

Each of these fundamental chemistry questions is worth 5 points. **You must show work to get credit.** Little to no partial credit will be rewarded. Make sure your answer includes the proper units.

1) **6 pts** How much 9.0 M HCl is needed to prepare 10.0 L of 0.50 M HCl?

2) **6 pts** A 36.4 L volume of methane gas is heated from 25°C to 88°C at constant pressure. What is the final volume of gas?

3) **6 pts** When the equilibrium is disturbed, in which direction will the reaction proceed? Circle the correct answer.

\[
2\text{CO(g)} + \text{O}_2(g) \rightleftharpoons 2\text{CO}_2(g) \quad \text{exothermic}
\]

- Remove CO\(_2\)  Reactants  Products  No Change
- Reduce the volume  Reactants  Products  No Change
- Increase the temperature  Reactants  Products  No Change
- Add Ne  Reactants  Products  No Change
- Add O\(_2\)  Reactants  Products  No Change
4) 6 pts  Write the net ionic equation that occurs when the following are mixed. If no reaction occurs write no reaction:
   a) NH₄Cl(aq) and H₂SO₄(aq)
   b) Pb(NO₃)₂(aq) and SnCl₂(aq)

5) 6 pts  Is a mixture of 0.0205 mol NO₂(g) and 0.0750 mol N₂O₄(g) in a 5.25 L flask at 25°C at equilibrium? If not, in which direction will the reaction proceed, toward product or reactants? You must show your work to get credit.
   \[ \text{N}_2\text{O}_4(g) \rightleftharpoons 2\text{NO}_2(g) \]  K=4.61×10⁻³

6) 6 pts  Determine the concentration of NaOH if 10.0 mL of the solution took 11.5 mL of 2.0 M H₂SO₄ to reach the equivalence point in a titration.
Short Answer Questions

Each of the following short answer questions are worth the noted points. Partial credit will be given. Make sure to show your work and include the proper units on your answer.

1) 17 pts A mixture of H₂(g) and O₂(g) is prepared by electrolyzing 1.32 g water, and the mixture of gases is collected over water at 30.°C and 748 mmHg. The volume of “wet” gas obtained in 2.90 L. What must be the vapor pressure of water at 30.°C?

\[ 2H_2O(l) \rightarrow 2H_2(g) + O_2(g) \]
2) 18 pts  The partial pressures of an equilibrium mixture of N₂O₄(g) and NO₂(g) are 

\[ P_{N_2O_4} = 0.34\, atm \] and \[ P_{NO_2} = 1.20\, atm \] at a certain temperature. The volume of the container is doubled. Find the partial pressures of the two gases when a new equilibrium is established.
Multiple Choice Questions

Each of the following multiple choice questions are worth 5 points. **Your answers need to be filled in on the Scantron provided.**

Note: Your Scantrons will not be returned to you, therefore, for your records, you may want to mark your answers on this sheet.

On the Scantron you need to fill in your perm number, test version, and name. Failure to do any of these things will result in the loss of 1 point. Your perm number is placed and bubbled in under the “ID number”. Do not skip boxes or put in a hyphen. In addition, leave bubbles blank under any unused boxes. The version number (A) is bubbled in under the “test form.”

1. When the equation \( \text{Cl}_2 \rightarrow \text{Cl}^- + \text{ClO}_3^- \) (basic solution) is balanced using the smallest whole-number coefficients, what is the coefficient of \( \text{OH}^- \)?
   A) 2
   B) 4
   C) 1
   D) 3
   E) None of the above

2. Consider three 1.0-L flasks at STP. Flask A contains He gas, flask B contains O\(_2\) gas, and flask C contains H\(_2\) gas. In which flask do the gas particles have the lowest average kinetic energy?
   A) Flask B
   B) Flask C
   C) Flask A
   D) All are the same

3. Consider the following van der Waals coefficients:

<table>
<thead>
<tr>
<th>Gas</th>
<th>(a, \text{L}^2\text{-atm\cdot mol}^{-2})</th>
<th>(b, \text{L\cdot mol}^{-1})</th>
</tr>
</thead>
<tbody>
<tr>
<td>helium</td>
<td>0.034</td>
<td>0.0237</td>
</tr>
<tr>
<td>hydrogen</td>
<td>0.244</td>
<td>0.0266</td>
</tr>
<tr>
<td>neon</td>
<td>0.211</td>
<td>0.0171</td>
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<tr>
<td>krypton</td>
<td>2.32</td>
<td>0.0398</td>
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<tr>
<td>xenon</td>
<td>4.19</td>
<td>0.0511</td>
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<tr>
<td>chlorine</td>
<td>6.49</td>
<td>0.0562</td>
</tr>
<tr>
<td>carbon dioxide</td>
<td>3.59</td>
<td>0.0427</td>
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<tr>
<td>ammonia</td>
<td>4.17</td>
<td>0.0371</td>
</tr>
<tr>
<td>water</td>
<td>5.46</td>
<td>0.0305</td>
</tr>
</tbody>
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Which of the following gases has the largest attractive forces?
   A) Helium
   B) Water
   C) Ammonia
   D) Neon
   E) Chlorine
4. The empirical formula of a gas is CH$_3$O. If 2.77 g of the gas occupies 1.00 L at exactly 0°C at a pressure of 760 Torr, what is the molecular formula of the gas?
   A) C$_3$H$_9$O$_3$
   B) C$_5$H$_{15}$O$_5$
   C) C$_4$H$_{12}$O$_4$
   D) C$_2$H$_6$O$_2$
   E) CH$_3$O

5. For the reaction 2H$_2$(g) + O$_2$(g) $\rightleftharpoons$ 2H$_2$O(g), what is the relationship between $K$ and $K_p$ at temperature $T$?
   A) $K = K_p(RT)^2$
   B) $K = K_p(RT)$
   C) $K = K_p$
   D) $K_p = K(RT)$
   E) None of the above

6. For the hypothetical reactions 1 and 2, $K_1 = 10^2$ and $K_2 = 10^{-4}$.
   1. A$_2$(g) + B$_2$(g) $\rightleftharpoons$ 2AB(g)
   2. 2A$_2$(g) + C$_2$(g) $\rightleftharpoons$ 2A$_2$C(g)
   3. A$_2$C(g) + B$_2$(g) $\rightleftharpoons$ 2AB(g) + (1/2)C$_2$(g)

   What is the value for $K$ for reaction 3?
   A) $10^2$
   B) $10^{-2}$
   C) $10^4$
   D) $10^6$
   E) None of the above