

# Chem 1B Midterm 2

## Practice Test

Credit will only be given for answers on this sheet. Units must be included in your answers and points will be taken off for incorrect or missing units. No partial credit will be awarded. Calculators are allowed. Cell phones may not be used as calculators. **If any of the following occurs you will receive a 0 on your test: 1) your cell phone goes off or if 2) you are not following masking policies.**

| Name: | Perm Number |
|-------|-------------|
|       |             |

**Make sure writing is dark and large enough to be picked up by a scanner. Failure to do this results in the loss of 5 points on the exam.**

**If you are sitting next to someone with the same version of the test you both will lose 5 points.**

| Fundamentals               |                                                                               |
|----------------------------|-------------------------------------------------------------------------------|
| Question<br>(Points)       | Answer                                                                        |
| <b>1</b><br>(5 pts)        | 3.36                                                                          |
| <b>2</b><br>(8 pts)<br>6,2 | $-2,677 \frac{\text{kJ}}{\text{mol}}$                                         |
|                            | <input type="radio"/> Endothermic <input checked="" type="radio"/> Exothermic |
| <b>3</b><br>(7 pts)        | $-56.5 \frac{\text{kJ}}{\text{mol}}$                                          |
| <b>4</b><br>(7 pts)        | 13.43                                                                         |
| <b>5</b><br>(7 pts)        |                                                                               |
| <b>6</b><br>(5 pts)        | -101 KJ                                                                       |

| Challenge Problems   |                                                                                                            |
|----------------------|------------------------------------------------------------------------------------------------------------|
| Question<br>(Points) | Answer                                                                                                     |
| <b>7</b><br>(10 pts) | $-66.8 \frac{kJ}{mol}$                                                                                     |
| <b>8</b><br>(10 pts) | $[Ba^{2+}] = 1.8 \times 10^{-7} M$ $[Sr^{2+}] = 6.1 \times 10^{-4} M$ $[SO_4^{2-}] = 6.1 \times 10^{-4} M$ |

| Multiple Choice       |                                                                                                                                    |
|-----------------------|------------------------------------------------------------------------------------------------------------------------------------|
| Question<br>(Points)  | Answer                                                                                                                             |
| <b>9</b><br>(7 pts)   | <input type="radio"/> A <input type="radio"/> B <input checked="" type="radio"/> C <input type="radio"/> D <input type="radio"/> E |
| <b>10</b><br>(6 pts)  | <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input checked="" type="radio"/> E |
| <b>11</b><br>(7 pts)  | <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input checked="" type="radio"/> E |
| <b>12</b><br>(5 pts)  | <input type="radio"/> A <input type="radio"/> B <input checked="" type="radio"/> C <input type="radio"/> D <input type="radio"/> E |
| <b>13</b><br>(6 pts)  | <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input checked="" type="radio"/> E |
| <b>14</b><br>(10 pts) | <input type="radio"/> A <input type="radio"/> B <input type="radio"/> C <input type="radio"/> D <input checked="" type="radio"/> E |

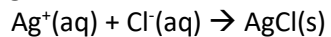
## Fundamental Questions

- 1) 5 pts Calculate the pH of a solution that is 0.60 M HF and 1.00 M KF.
- 2a) 6 pts The reusable booster rockets of the space shuttle use a mixture of aluminum and ammonium perchlorate as fuel. A possible reaction is given below.  
$$3\text{Al}(s) + 3\text{NH}_4\text{ClO}_4(s) \rightarrow \text{Al}_2\text{O}_3(s) + \text{AlCl}_3(s) + 3\text{NO}(g) + 6\text{H}_2\text{O}(g)$$
  
Calculate  $\Delta H^\circ$  for this reaction.
- 2b) 2 pts Is this reaction endothermic or exothermic?
- 3) 7 pts If the heat capacity of a bomb calorimeter is  $44.7 \frac{\text{kJ}}{^\circ\text{C}}$  and the temperature of the water in the calorimeter rises  $25.3^\circ\text{C}$  when 20.0 mol of a substance is combusted. What is  $\Delta E_{\text{com}} \left( \frac{\text{kJ}}{\text{mol}} \right)$  of the substance?

- 4) 7 pts What is the pH of a solution that is made when 150. mL of 1.00 M NaOH is added to 75.0 mL of 1.2 M HNO<sub>2</sub>?
- 5) 7 pts Draw a heating curve (Temperature vs. Heat Supplied) of H<sub>2</sub>O. Make sure to include the value of the temperatures at boiling and freezing, clearly label where H<sub>2</sub>O is a solid, a liquid, and a gas and indicate where  $\Delta H_{\text{vap}}$  and  $\Delta H_{\text{fus}}$  are located.
- 6) 5 pts A certain reaction releases 213 kJ of heat. During the reaction the surrounding does 112 kJ of work. What is the change in internal energy for the reaction?

## Challenge Problems

- 7) 10 pts In a coffee cup calorimeter 50.0 mL of 0.100 M  $\text{AgNO}_3$  and 50.0 mL of 0.100 M  $\text{HCl}$  are mixed. The following reaction occurs:



If the two solutions are initially at  $22.60^\circ\text{C}$ , and if the final temperature is  $23.40^\circ\text{C}$ , calculate  $\Delta H$  for the reaction in  $\frac{\text{kJ}}{\text{mol}}$  of  $\text{AgCl}$  formed. Assume a mass of 100.0 g for the combined solution and a specific heat capacity of  $4.18 \frac{\text{J}}{^\circ\text{C}\cdot\text{g}}$ .

- 8) 10 pts Given the  $K_{sp}$  of  $\text{BaSO}_4$  is  $1.1 \times 10^{-10}$  and the  $K_{sp}$  of  $\text{SrSO}_4$  is  $3.8 \times 10^{-7}$ . Calculate  $[\text{Ba}^{2+}]$ ,  $[\text{Sr}^{2+}]$ , and  $[\text{SO}_4^{2-}]$  in a solution that is saturated with both compounds.

## Multiple Choice

- 9) 7 pts How many moles of HCl need to be added to 150.0 mL of 0.50 M NaZ to have a solution with a pH of 6.50? ( $K_a$  of HZ is  $2.3 \times 10^{-5}$ ) Assume negligible volume of the HCl.
- a.  $6.8 \times 10^{-3}$  mol
  - b.  $7.5 \times 10^{-2}$  mol
  - c.  $1.0 \times 10^{-3}$  mol
  - d.  $5.0 \times 10^{-1}$  mol
  - e. None of the above
- 10) 6 pts Which of the following statements is true?
- a. The heat of reaction and change in enthalpy can always be used interchangeably.
  - b. A chemist takes the point of view of the surroundings when determining the sign for work or heat.
  - c. At least two of these statements are true.
  - d. In exothermic reactions, the reactants are lower in potential energy than the products.
  - e. Enthalpy is a state function.
- 11) 7 pts Which of the following will *not* produce a buffered solution?
- a. 100 mL of 0.1 M  $\text{Na}_2\text{CO}_3$  and 50 mL of 0.1 M HCl
  - b. 100 mL of 0.1 M  $\text{NaHCO}_3$  and 25 mL of 0.2 M HCl
  - c. 100 mL of 0.1 M  $\text{Na}_2\text{CO}_3$  and 75 mL of 0.2 M HCl
  - d. 50 mL of 0.2 M  $\text{Na}_2\text{CO}_3$  and 5 mL of 1.0 M HCl
  - e. 100 mL of 0.1 M  $\text{Na}_2\text{CO}_3$  and 50 mL of 0.1 M NaOH
- 12) 5 pts Two blocks have been sitting in a room for an extended period of time. You walk up to the blocks and feel them; one block feels cold and the other block feels warm. You then put an ice cube on each block. Which block will melt the ice first?
- a. The block that feels warm will melt the ice first.
  - b. Both blocks will melt the ice at the same time because the blocks are at the same temperature.
  - c. The block that feels cold will melt the ice first.

- 13) 6 pts Using the information below, calculate  $\Delta H^\circ_f$  for  $\text{CH}_3\text{OH}(l)$ .  
 $2\text{CH}_3\text{OH}(l) + 3\text{O}_2(g) \rightarrow 2\text{CO}_2(g) + 4\text{H}_2\text{O}(l)$ ,  $\Delta H^\circ = -1,453 \text{ kJ}$   
 $\Delta H^\circ_f$  for  $\text{CO}_2(g) = -393.5 \text{ kJ/mol}$   
 $\Delta H^\circ_f$  for  $\text{H}_2\text{O}(l) = -286 \text{ kJ/mol}$
- a.  $-3.38 \times 10^3 \frac{\text{kJ}}{\text{mol}}$
  - b.  $-774 \frac{\text{kJ}}{\text{mol}}$
  - c.  $774 \frac{\text{kJ}}{\text{mol}}$
  - d.  $229 \frac{\text{kJ}}{\text{mol}}$
  - e. None of the above
- 14) 10 pts Calculate the pH at the equivalence point for the titration of 1.0 M ethylamine,  $\text{C}_2\text{H}_5\text{NH}_2$ , by 1.0 M perchloric acid,  $\text{HClO}_4$ . ( $\text{p}K_b$  for  $\text{C}_2\text{H}_5\text{NH}_2 = 3.25$ )
- a. 6.05
  - b. 2.24
  - c. 2.09
  - d. 5.38
  - e. 5.53