

## AR Chemistry Final Review Set 4

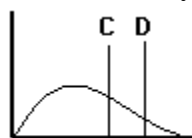
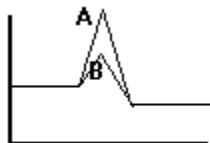
You check several solutions for pH and electrical conductivity. Your results were tabulated below

Property	Solution A	Solution B	Solution C	Solution D	Solution E
Conductivity	Yes	No	Yes	Yes	No
pH	7.0	7.0	4.0	10.0	10.0

- Which solutions above could be:
  - Hydrochloric Acid solution
  - Sodium Hydroxide solution
  - Salt Solution (eg. NaCl, KI, NaNO<sub>3</sub>)
  - Sugar Solution (eg. C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>, C<sub>12</sub>H<sub>22</sub>O<sub>11</sub>)
  - Distilled Water
  - Tap Water
- Identify the following observations as either defining an acid, base, or salt.
  - A solid precipitate forms with magnesium ions are added
  - Hydrogen gas is evolved when zinc metal is placed in the solution
  - The solution has a pH of 8
  - The solution has a pH of 5
  - The solution has  $[H^{+1}] = 2.5 \times 10^{-4}$
  - The solution has  $[OH^{-1}] = 3.4 \times 10^{-8}$
  - Litmus paper turns pink in the solution
  - The pH is 7.00 and there is good electrical conductivity
- Strong acids and bases ionize 100% while weak acids and bases ionize less than 100% (double equilibrium arrow). Show the first ionization for the following acids and bases.
  - HCl -->
  - HNO<sub>2</sub> <-- -->
  - NaOH
  - H<sub>2</sub>SO<sub>4</sub>
  - H<sub>2</sub>CO<sub>3</sub>

## Reaction Rates

- You are running a chemical reaction and it is taking a long time. Would the following changes increase the rate, decrease the rate, or have no effect on the rate of reaction?
  - Increasing the pressure on gaseous reactants (gases that are reacting)?
  - Decreasing the temperature of the system
  - Increasing the concentration of the reactants?
  - Decreasing the concentration of the products?
  - Increasing the surface area of one of the reactants?
- Concerning catalysts:
  - What do they lower to allow a reaction to occur more quickly?
  - Which lines in the diagrams below would show the effect of a catalyst (a or b, c or d)?



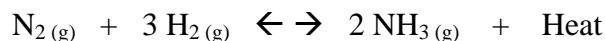
3. Concerning a single step reaction:
  - a. What two things are required for two reactants to form a product?
  - b. What is the name for the intermediate form between reactants and products that have part a?
4. The following data were collected from a chemical reaction

Chemical	Time = 0	Time = 10 min	Time = 20 min	Time = 30 min	Time = 40 min
Reactant A	8.0 M	4.0 M	2.0 M	1.0 M	0.50 M
Reactant B	4.0 M	2.0 M	1.0 M	0.50 M	0.25 M
Product C	0.0 M	2.0 M	3.0 M	3.5 M	3.75 M

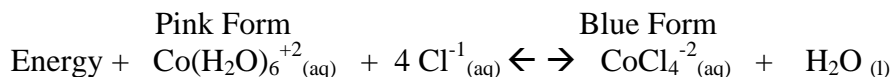
- a. What is the rate of reaction for reactant A in the first 20 minutes?
- b. What is the rate of reaction for product C in the first 20 minutes? 30 minutes?
- c. What is happening to the rate of reaction over time?
- d. Why is the rate of reaction changing over time as answered in c?

## Equilibrium

Answer the following questions in regards to the Haber Equation for the synthesis of ammonia



1. Which reaction (forward  $\rightarrow$  or reverse  $\leftarrow$ ) will be favored when the following changes to the system occur.
  - a. The temperature of the system is increased
  - b. The volume of the system is decreased
  - c. Nitrogen is removed from the system
2. Cobalt Chloride has a complex equilibrium shown below:



- Which of the following changes would lead to the blue form of the equilibrium?
- a. Raising the Temperature?
  - b. Removing  $\text{Cl}^{-1}$
  - c. Adding Water
  - d. Increasing the Container Size
  - e. Removing Heat
  - f. Increasing the Pressure

## AR Chemistry Final Review Set 4

You check several solutions for pH and electrical conductivity. Your results were tabulated below

Property	Solution A	Solution B	Solution C	Solution D	Solution E
Conductivity	Yes	No	Yes	Yes	No
pH	7.0	7.0	4.0	10.0	10.0

1. Which solutions above could be:

- |  |  |
|--|--|
| a. Hydrochloric Acid solution  | <b>acid pH &lt; 7, conducts electricity, C</b>       |
| b. Sodium Hydroxide solution   | <b>base pH &gt; 7, conducts electricity, D</b>       |
| c. Salt Solution (eg. NaCl, KI, NaNO <sub>3</sub> )  | <b>conducts electricity, A, C, D</b>                 |
| d. Sugar Solution (eg. C <sub>6</sub> H <sub>12</sub> O <sub>6</sub> , C <sub>12</sub> H <sub>22</sub> O <sub>11</sub> ) | <b>doesn't conduct electricity, non acid/base, B</b> |
| e. Distilled Water   | <b>doesn't conduct electricity, non acid/base, B</b> |
| f. Tap Water   | <b>conducts electricity, slightly acidic, A</b>      |

2. Identify the following observations as either defining an acid, base, or salt.

- |  |   |
|--|---|
| a. A solid precipitate forms with magnesium ions are added           | <b>base</b>                                   |
| b. Hydrogen gas is evolved when zinc metal is placed in the solution | <b>acid</b>                                   |
| c. The solution has a pH of 8  | <b>base, greater than 7</b>                   |
| d. The solution has a pH of 5  | <b>acid, lower than 7</b>                     |
| e. The solution has $[H^{+1}] = 2.5 \times 10^{-4}$                  | <b>acid, <math>H^{+1} &gt; 10^{-7}</math></b> |
| f. The solution has $[OH^{-1}] = 3.4 \times 10^{-8}$                 | <b>acid, <math>H^{+1} &gt; 10^{-7}</math></b> |
| g. Litmus paper turns pink in the solution                           | <b>acid</b>                                   |
| h. The pH is 7.00 and there is good electrical conductivity          | <b>salt</b>                                   |

3. Strong acids and bases ionize 100% while weak acids and bases ionize less than 100% (double equilibrium arrow). Show the first ionization for the following acids and bases.

- |                                       |   |
|---------------------------------------|---|
| a. HCl -->                            | <b>H<sup>+1</sup> + Cl<sup>-1</sup></b>   |
| b. HNO <sub>2</sub> <-- -->           | <b>H<sup>+1</sup> + NO<sub>2</sub><sup>-1</sup></b>   |
| c. NaOH →                             | <b>Na<sup>+1</sup> + OH<sup>-1</sup></b>  |
| d. H <sub>2</sub> SO <sub>4</sub> →   | <b>2 H<sup>+1</sup> + SO<sub>4</sub><sup>-2</sup> (actually, 1<sup>st</sup> H is 100% ionization, second one isn't)</b> |
| e. H <sub>2</sub> CO <sub>3</sub> ← → | <b>H<sup>+1</sup> + HCO<sub>3</sub><sup>-1</sup> ← → H<sup>+1</sup> + CO<sub>3</sub><sup>-2</sup></b>                   |

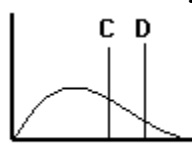
## Reaction Rates

1. You are running a chemical reaction and it is taking a long time. Would the following changes increase the rate, decrease the rate, or have no effect on the rate of reaction?

- |  |                                      |
|--|--------------------------------------|
| a. Increasing the pressure on gaseous reactants (gases that are reacting)? | <b>increase rate (collisions up)</b> |
| b. Decreasing the temperature of the system?                               | <b>decrease rate</b>                 |
| c. Increasing the concentration of the reactants?                          | <b>increase rate</b>                 |
| d. Decreasing the concentration of the products?                           | <b>increase rate</b>                 |
| e. Increasing the surface area of one of the reactants?                    | <b>increase rate</b>                 |

2. Concerning catalysts:

- |   |                              |
|---|------------------------------|
| a. What do they lower to allow a reaction to occur more quickly?  | <b>Ea, activation energy</b> |
| b. Which lines in the diagrams below would show the effect of a catalyst (a or <u>b</u> , <u>c</u> or d)? |                              |



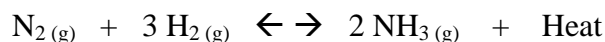
3. Concerning a single step reaction:
- What two things are required for two reactants to form a product? **Ea, correct alignment**
  - What is the name for the intermediate form between reactants and products that have part a?  
**activated complex**
4. The following data were collected from a chemical reaction

Chemical	Time = 0	Time = 10 min	Time = 20 min	Time = 30 min	Time = 40 min
Reactant A	8.0 M	4.0 M	2.0 M	1.0 M	0.50 M
Reactant B	4.0 M	2.0 M	1.0 M	0.50 M	0.25 M
Product C	0.0 M	2.0 M	3.0 M	3.5 M	3.75 M

- What is the rate of reaction for reactant A in the first 20 minutes? **-0.30 M/min**
- What is the rate of reaction for product C in the first 20 minutes? 30 minutes? **+0.15 M/min**
- What is happening to the rate of reaction over time? **slowing down**
- Why is the rate of reaction changing over time as answered in c? **losing reactants**

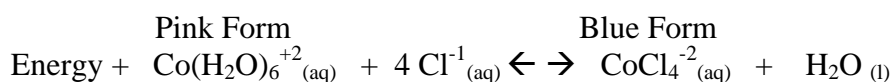
## Equilibrium

Answer the following questions in regards to the Haber Equation for the synthesis of ammonia



- Which reaction (forward  $\rightarrow$  or reverse  $\leftarrow$ ) will be favored when the following changes to the system occur.
  - The temperature of the system is increased  **$\leftarrow$  remove heat from the right**
  - The volume of the system is decreased  **$\rightarrow$  shift to side with less gas**
  - Nitrogen is removed from the system  **$\leftarrow$  shift to replace the nitrogen**

2. Cobalt Chloride has a complex equilibrium shown below:



Which of the following changes would lead to the blue form of the equilibrium?

- Raising the Temperature? **shifts to endo on the left, makes more Pink**
- Removing  $\text{Cl}^{-1}$  **shifts to left to replace the  $\text{Cl}^{-1}$ , makes more Pink**
- Adding Water **water is pure, not in equilibrium constant, no shift**
- Increasing the Container Size **shifts to increase pressure, go gases, no shift**
- Removing Heat **shifts to increase temperature, shifts to left, more Pink**
- Increasing the Pressure **no gases, no shift**