

Name Key Date _____

Acids and Bases Exam Review

There are 4 types of reactions that you should know:

1. Ionization of acid in water: *H
- ₃
- O
- ⁺
- is a product*

ex) Write the equation for the dissociation of acetic acid in water. (Hint: acetic acid is a weak acid)

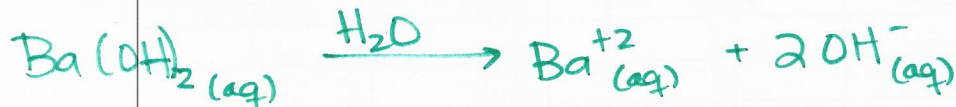


ex) Write the equation for the dissociation of sulfuric acid in water.



2. Ionization of base in water: *OH
- ⁻
- is a product* *H
- ₂
- O is written over the arrow*

ex) Write the equation for the dissociation of KOH in water.

ex) Write the equation for the dissociation of Ba(OH)₂ in water.

3. Acids react with active metals: *H
- ₂
- is a product*

ex) Nitric acid reacts with Zn metal.



ex) Hydrochloric acid reacts with Mg metal.

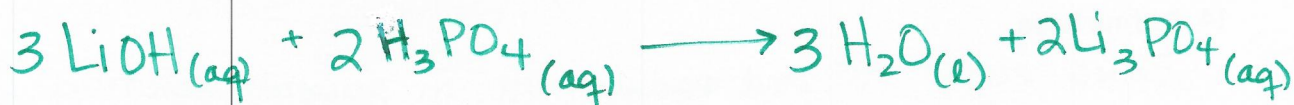


4. Neutralization Reactions: *Acid + Base → H
- ₂
- O + Salt*

ex) Write the balanced equation for the reaction between magnesium hydroxide and hydrobromic acid.



ex) Write the balanced equation for the reaction between lithium hydroxide and phosphoric acid.



5. Write the 4 equations for calculating pH, pOH, $[H_3O^+]$ and $[OH^-]$.

*How can you find $[H_3O^+]$ if you know the pH? $[H_3O^+] = 10^{-pH}$

- $pH = -\log [H_3O^+]$
- $pH + pOH = 14$
- $[H_3O^+][OH^-] = 1 \times 10^{-14}$
- $pOH = -\log [OH^-]$

6. How can you describe the taste of an acid? sour

7. List five properties of acids and bases (5 each)

| Acids | Bases |
|--|--|
| 1. pH: 0-7 | 1. pH: 7-14 |
| 2. sour taste | 2. taste bitter |
| 3. react w/ active metals to form H_2 | 3. feel slippery when diluted |
| 4. react w/ bases to produce salt + H_2O | 4. react w/ acids to produce salt + H_2O |
| 5. Strong acids = strong electrolytes | 5. Strong bases = strong electrolytes |

8. Name 3 different indicators and what happens when each contacts an acid, base, or neutral solution.

| | Indicator | Acid | Base | Neutral |
|----|-----------------|-----------|------|-----------|
| 1. | red litmus | red | blue | red |
| 2. | blue litmus | red | blue | blue |
| 3. | phenolphthalein | colorless | pink | colorless |

9. Which acid is found in vinegar? acetic acid

10. What two acids are found in sodas like 7-Up, Sprite, and Squirt? citric acid, carbonic acid

11. Which is a stronger electrolyte, a strong base or a weak base? Why?

Strong bases dissociate completely into ions in aqueous solution and therefore are strong electrolytes.

12. What does amphoteric mean? Give an example of an amphoteric substance.

Amphoteric substances can act as either an acid or a base.

ex) H_2O , HSO_4^- , HCO_3^-

13. Define acid.

Acids donate H^+ and produce H_3O^+ in aqueous solution

14. Define base.

Bases accept H^+ and produce OH^- in aqueous solution

15. Does each of the following conditions describe a solution that is acidic, alkaline, or neutral?

a. $[H_3O^+] < [OH^-]$ alkaline

d. $pH = 2.5$ acidic

b. $pH = 12$ alkaline

e. $pOH = 10$ acidic

c. $[H_3O^+] = [OH^-]$ neutral

f. $[H_3O^+] > [OH^-]$ acidic

16. Name these chemicals:

a. $RbOH$ rubidium hydroxide

f. NH_3 ammonia

b. $Ca(OH)_2$ calcium hydroxide

g. $[H_3O^+]$ hydronium

c. H_2SO_3 sulfurous acid

h. $[OH^-]$ hydroxide

d. HNO_3 nitric acid

i. HNO_2 nitrous acid

e. HI hydroiodic acid

j. CH_3COOH acetic acid

Calculations:

17. A solution has a $pOH = 4$

$pH = 10$

$[OH^-] = 1 \times 10^{-4} M$

$[H_3O^+] = 1 \times 10^{-10} M$

18. A solution has $[H_3O^+] = 1 \times 10^{-2} M$.

$pH = 2$

$pOH = 12$

$[OH^-] = 1 \times 10^{-12} M$

19. What is the pH of a $1 \times 10^{-4} M H_2SO_4$ solution?

$$\frac{1 \times 10^{-4} \text{ mol } H_2SO_4}{L} \times \frac{2 \text{ mol } H_3O^+}{1 \text{ mol } H_2SO_4} = \frac{2 \times 10^{-4} \text{ mol}}{L}$$



$[H_3O^+] = 2 \times 10^{-4} M$

20. If 40mL of H_2SO_4 reacts with 65mL of 0.053M $Ca(OH)_2$, what is the molarity of H_2SO_4 ?

$$X_1 M_1 V_1 = X_2 M_2 V_2$$

$$(2)(M_1)(40) = (2)(0.053)(65)$$

$M_1 = 0.09 M H_2SO_4$

21. What is the molarity of NaOH if 12mL of NaOH neutralizes 15mL of 0.62M HCl?

$$X_1 M_1 V_1 = X_2 M_2 V_2$$

$$(1)(0.62)(15) = (1)(M_2)(12)$$

$M_2 = 0.78 M NaOH$

Buffers

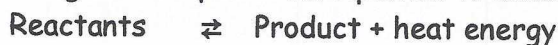
22. Your body must maintain a consistent blood pH in order to maintain homeostasis. The following reaction takes place in the blood stream.



- What is a "buffer"? *A substance that resists changes in pH to a solution despite adding an acid or base.*
- What is the name of the buffer that helps maintain the pH of your blood? *bicarbonate (HCO_3^-)*
- What is the normal pH of the blood? *~7.4*
- Which two organ systems help regulate the pH of your blood? *lungs, kidney*
- What happens to the pH of your blood if you smoke cigarettes (increase or decrease)? Why? *buildup of CO_2 = alkalosis*
- What happens to the pH of your blood during an anaerobic workout, like lifting weights (increase or decrease)? Why? *lactic acid produced in the muscles is removed by the blood = $\uparrow [\text{H}^+] = \downarrow \text{pH}$*
- What is the name of the molecule that is produced when H_2O combines with CO_2 in the blood? *carbonic acid (H_2CO_3)*

Equilibrium Review

1. Use this general equilibrium equation to answer the following question:



decrease

a. If the reaction shifts to the right, will the concentration of the reactant increase, decrease, or stay the same?

reverse

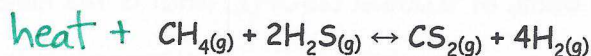
b. If extra product is introduced, which reaction will be favored?

forward

c. If the temperature of the system decreases, which reaction will be favored?

2. What does it mean for the system to be at equilibrium? *The rate of the forward reaction = the rate of the reverse reaction.*

3. For the reaction below, which change would cause the equilibrium to shift to the right?



a. Decrease the concentration of dihydrogen sulfide.

left

b. Increase the pressure on the system.

left

c. Increase the temperature of the system.

right

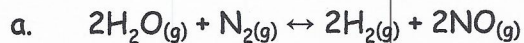
d. Increase the concentration of carbon disulfide.

left

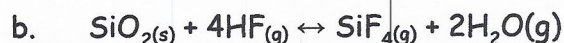
e. Decrease the concentration of methane.

left

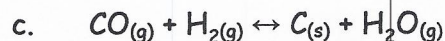
4. Predict the effect of decreasing the volume of the container for each equilibrium equation.



left



right

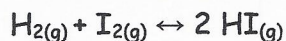


right

5. In a given reaction: $a\text{A} + b\text{B} \rightleftharpoons c\text{C} + d\text{D}$, what is the K_{eq} ?

$$K_{eq} = \frac{[\text{C}]^c [\text{D}]^d}{[\text{A}]^a [\text{B}]^b}$$

6. For the following reaction the equilibrium concentrations are experimentally determined to be $[\text{HI}] = 0.009988$, $[\text{H}_2] = 0.000867$ and $[\text{I}_2] = 0.00264$. Determine the equilibrium constant.



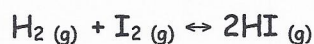
$$K_{eq} = \frac{[\text{HI}]^2}{[\text{H}_2][\text{I}_2]} = \frac{(0.009988)^2}{(0.000867)(0.00264)} = \boxed{43.5}$$

7. Consider the following equilibrium process at 700°C : $2\text{H}_{2(g)} + \text{S}_{2(g)} \leftrightarrow 2\text{H}_2\text{S}_{(g)}$

Analysis shows that at equilibrium there are 2.50 moles of H_2 , 1.35×10^{-5} mole of S_2 , and 8.70 moles of H_2S present in a 12.0 L flask. Calculate the equilibrium constant K_{eq} for the reaction.

$$K_{eq} = \frac{[\text{H}_2\text{S}]^2}{[\text{H}_2]^2 [\text{S}_2]} = \frac{(0.725)^2}{(0.208)^2 (1.125 \times 10^{-6})} = \boxed{1.07 \times 10^7}$$

8. 0.0175 mol of H_2 and I_2 are placed in a 1.00L flask at 1000K. When equilibrium has been reached, 0.0276 mol of HI has been formed. Calculate K_{eq} at 1000K for this reaction. Are products or reactants favored?



$$K_{eq} = \frac{[\text{HI}]^2}{[\text{H}_2][\text{I}_2]} = \frac{(0.0276)^2}{(0.0037)(0.0037)} = \boxed{55.6}$$

products are favored because $K_{eq} > 1$

$$\text{@ Equil: } [\text{H}_2] = [\text{I}_2] = \underset{\text{start}}{0.0175} - \underset{\text{used}}{(0.0276/2)} = 0.0037 \text{ mol / 1L}$$

| |
|------|
| 1000 |
| 1000 |
| 1000 |

2. In a given reaction...



3. For the following reaction...



4. Consider the following reaction...

Analyze the reaction...



5. Consider the following reaction...



6. Consider the following reaction...



7. Consider the following reaction...