

## 4 • Equilibrium & Acids & Bases

### P R A C T I C E T E S T

Describe these household substances:

- a) acidic
- b) basic
- c) neutral

1. Sugar water \_\_\_\_\_
2. Vinegar \_\_\_\_\_
3. Rubbing Alcohol \_\_\_\_\_
4. Milk of Magnesia \_\_\_\_\_
5. Household ammonia \_\_\_\_\_

### Questions 6 - 10

Match the household chemical with its formula

- |                       |  |
|-----------------------|--|
| ___6. Vinegar         | a) NaOH  |
| ___7. Pool Acid       | b) NaHCO <sub>3</sub>                            |
| ___8. Rubbing Alcohol | c) HCl   |
| ___9. Drano           | d) HC <sub>2</sub> H <sub>3</sub> O <sub>2</sub> |
| ___10. Baking Soda    | e) C <sub>3</sub> H <sub>7</sub> OH              |

11. According to Svante Arrhenius, acids are substances that

- a) increase the [H<sup>+</sup>]
- b) increase the [OH<sup>-</sup>]
- c) decrease the [H<sup>+</sup>]
- d) decrease the [OH<sup>-</sup>]

12. A substance that turns cabbage juice blue and only slightly lights up a light bulb is a:

- a) strong acid
- b) strong base
- c) weak acid
- d) weak base

13. Which of the following substances is a base?

- a) H<sub>2</sub>O
- b) HC<sub>2</sub>H<sub>3</sub>O<sub>2</sub>
- c) Ca(OH)<sub>2</sub>
- d) H<sub>2</sub>SO<sub>4</sub>

14. When an acid and a base react, the products are

- a) salt and water
- b) salt and base
- c) base and acid
- d) water and acid

15. When NaOH is mixed with H<sub>2</sub>SO<sub>4</sub>, one of the products is

- a) NaSO<sub>4</sub>
- b) H<sub>2</sub>OH
- c) H<sub>2</sub>
- d) Na<sub>2</sub>SO<sub>4</sub>

16. A property of acids are that they

- a) taste sour
- b) taste bitter
- c) feel slippery
- d) neutralize water

17. How many grams of sodium hydroxide pellets, NaOH, are required to prepare 50.0 mL of a 0.150 M solution?

- a) 0.300
- b) 2.00
- c) 3.00
- d) 200.

18. If 50 mL of a 200 mL sample of 0.10 M sodium chloride solution is spilled, what is the concentration of the remaining solution?

- a) 0.20 M
- b) 0.10 M
- c) 0.075 M
- d) 0.025 M

19. A 100 mL sample of a solution with a concentration of 5.00 M is diluted by adding 300 mL of distilled water. The new concentration will be

- a) 1.25 M
- b) 20.0 M
- c) 1.66 M
- d) 15.0 M

20. A common laundry bleach is 0.700 M sodium hypochlorite, NaOCl. Which one of the following statements is true?
- NaOCl is the solvent.
  - The solution can be made by mixing 0.700 moles of NaOCl with 1.00 liter of water.
  - A 0.500 Liter sample of bleach would contain 0.350 moles of NaOCl.
  - Each of these statements is true.
21. What is the hydrogen ion concentration, [H<sup>+</sup>], of a solution in which the pH is 5?
- $5 \times 10^2 \text{ M}$
  - $1 \times 10^5 \text{ M}$
  - $5 \times 10^{-1} \text{ M}$
  - $1 \times 10^{-5} \text{ M}$
22. What is the molarity of a solution of sodium hydroxide, NaOH, if 15 mL of this base neutralizes 45 mL of 0.10 M hydrochloric acid, HCl?
- 0.10 M
  - 0.15 M
  - 0.20 M
  - 0.30 M
23. When an acid is added to a solution of a base, what change in pH of the solution could be observed?
- An increase from 7 to 8
  - An increase from 3 to 8
  - A decrease from 7 to 6
  - A decrease from 9 to 5
24. What is the pH of 0.001 M HCl, assuming complete ionization?
- 1
  - 2
  - 3
  - 4
25. Which expression represents the equilibrium constant,  $K_{eq}$ , for this equation?
- $$2 \text{NO(g)} + \text{O}_2\text{(g)} \rightleftharpoons 2 \text{NO}_2\text{(g)}$$
- $\frac{[\text{NO}][\text{O}_2]}{[\text{NO}_2]}$
  - $\frac{[\text{NO}]^2 + [\text{O}_2]}{[\text{NO}_2]^2}$
  - $\frac{[\text{NO}_2]^2}{[\text{NO}]^2[\text{O}_2]}$
  - $\frac{[\text{NO}_2]}{[\text{NO}][\text{O}_2]}$
26. Consider the reaction system,  
 $\text{CoO(s)} + \text{H}_2\text{(g)} \rightleftharpoons \text{Co(s)} + \text{H}_2\text{O(g)}$ .  
 The equilibrium constant expression is
- $\frac{[\text{CoO}][\text{H}_2]}{[\text{Co}][\text{H}_2\text{O}]}$
  - $\frac{[\text{Co}][\text{H}_2\text{O}]}{[\text{CoO}][\text{H}_2]}$
  - $\frac{[\text{Co}][\text{H}_2\text{O}]}{[\text{H}_2]}$
  - $\frac{[\text{H}_2]}{[\text{H}_2\text{O}]}$
  - $\frac{[\text{H}_2\text{O}]}{[\text{H}_2]}$
27. In this equation  
 $\text{N}_2\text{(g)} + 3 \text{H}_2\text{(g)} \rightleftharpoons 2 \text{NH}_3\text{(g)} + \text{heat}$   
 decreasing the temperature of the total system causes the equilibrium to shift to produce
- more  $\text{NH}_3\text{(g)}$ .
  - more  $\text{N}_2\text{(g)}$ .
  - more  $\text{N}_2\text{(g)}$  and  $\text{H}_2\text{(g)}$ .
  - no change in either reactants or products.
28. For which of the following systems at equilibrium will decreasing the volume cause the equilibrium to shift to the right?
- $2\text{NO(g)} + \text{O}_2\text{(g)} \rightleftharpoons 2\text{NO}_2\text{(g)}$
  - $2\text{H}_2\text{O(g)} \rightleftharpoons 2\text{H}_2\text{(g)} + \text{O}_2\text{(g)}$
  - $2\text{SO}_3\text{(g)} \rightleftharpoons 2\text{SO}_2\text{(g)} + \text{O}_2\text{(g)}$
  - $\text{CaCO}_3\text{(s)} \rightleftharpoons \text{CaO(s)} + \text{CO}_2\text{(g)}$
  - $\text{H}_2\text{(g)} + \text{F}_2\text{(g)} \rightleftharpoons 2\text{HF(g)}$

29. For the reaction system,  

$$\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g}) + \text{heat}$$
 the conditions that would most favor the formation of products would be
- high temperature and high pressure
  - high temperature, pressure unimportant
  - high temperature and low pressure
  - low temperature and high pressure
  - low temperature and low pressure

Consider the household product:

Vinegar,  $\text{HC}_2\text{H}_3\text{O}_2$

- Is it an **acid** or a **base**? \_\_\_\_\_
- Circle** the portion of the formula that makes it an acid or a base.
- Write an **equation** that shows why it is an acid or a base. (dissociation)  
 \_\_\_\_\_
- This substance \_\_\_\_\_ (weak/strong)
- A solution has an  $[\text{H}^+] = 0.000100 \text{ M}$ . What is the  $[\text{OH}^-]$ ? \_\_\_\_  
 a)  $1 \times 10^{-3}$                       c)  $1 \times 10^{-14}$   
 b)  $1 \times 10^{-4}$                       d)  $1 \times 10^{-10}$
- A  $1 \times 10^{-3} \text{ M}$  NaOH solution has an  $[\text{H}^+] =$  \_\_\_\_  
 a)  $1 \times 10^{-3}$                       c)  $1 \times 10^{-11}$   
 b)  $1 \times 10^{-7}$                       d)  $1 \times 10^{-14}$
- A  $1 \times 10^{-2} \text{ M}$  HCl solution has an pH = \_\_\_\_  
 a) 2      b) 3      c) 7      d) 12
- Write an equation that shows how  $\text{Ba}(\text{OH})_2$  neutralizes  $\text{HNO}_3$ .

**Questions 38 - 40** refer to the following data collected in a titration experiment.

Titration Data:	
molarity of base	0.185 <u>M</u>
final volume of acid	22.75 mL
initial volume of acid	12.75 mL
final volume of base	25.25 mL
initial volume of base	3.50 mL

Calculate the **concentration** of the **acid**.

**Show all work** including:

- the mathematical formula used
- values substituted into the formula
- units on all numbers, and a box around the answer.

Answers:

1.	<input type="text"/>	11.	<input type="text"/>	21.	<input type="text"/>	31.	<input type="text"/>
2.	<input type="text"/>	12.	<input type="text"/>	22.	<input type="text"/>	32.	<input type="text"/>
3.	<input type="text"/>	13.	<input type="text"/>	23.	<input type="text"/>	33.	<input type="text"/>
4.	<input type="text"/>	14.	<input type="text"/>	24.	<input type="text"/>	34.	<input type="text"/>
5.	<input type="text"/>	15.	<input type="text"/>	25.	<input type="text"/>	35.	<input type="text"/>
6.	<input type="text"/>	16.	<input type="text"/>	26.	<input type="text"/>	36.	<input type="text"/>
7.	<input type="text"/>	17.	<input type="text"/>	27.	<input type="text"/>	37.	<input type="text"/>
8.	<input type="text"/>	18.	<input type="text"/>	28.	<input type="text"/>	38.	<input type="text"/>
9.	<input type="text"/>	19.	<input type="text"/>	29.	<input type="text"/>	39.	<input type="text"/>
10.	<input type="text"/>	20.	<input type="text"/>	30.	<input type="text"/>	40.	<input type="text"/>