

Units 13 & 14 Review

Part 1 - Tell whether each of the following properties describes an acid (A), a base (B), or both (AB).

- | | |
|---|---|
| <u>B</u> 1. taste bitter | <u>A</u> 6. 1 st element in formula is usually H |
| <u>A</u> 2. lose a proton (B-L Theory) | <u>AB</u> 7. conduct electricity |
| <u>B</u> 3. feel slippery | <u>A</u> 8. taste sour |
| <u>AB</u> 4. change color of indicators | <u>B</u> 9. gain a proton (B-L Theory) |
| <u>B</u> 5. 2 nd part of formula is usually OH | <u>A</u> 10. react with metals to form H ₂ gas |

Part 2 - Acid Nomenclature - Write the name or the formula for the following acids.

- | | |
|---|---|
| 11. HI hydroiodic acid | 14. hydrobromic acid HBr |
| 12. HNO ₂ nitrous acid | 15. carbonic acid H₂CO₃ |
| 13. H ₃ PO ₄ phosphoric acid | 16. sulfurous acid H₂SO₃ |

Part 3 - Answer the following questions.

17. According to the Arrhenius theory, acids increase H⁺ ion concentration in aqueous solution.

Bases increase OH⁻ ion concentration

18. List the six (6) strong acids

HCl, HBr, HI, HClO₄, H₂SO₄, HNO₃

19. How do you know if a base is strong or weak (in Arrhenius theory)?

strong base = group 1 or group 2 (except Be)

20. The stronger a base is, the weaker its conjugate acid.

21. Which is a stronger base, ClO₄⁻¹ or S⁻²?

weak CA HClO₄ → HS⁻

22. Which is a weaker base, I⁻¹ or SO₄⁻²?

strong CA HI HSO₄⁻
strong. weak

23. What does it mean if a compound is said to be amphoteric?

can act as an acid or a base (B-L theory)

24. Can SO₄⁻² be amphoteric? Why or why not?

No. It cannot act as an acid because it doesn't have an H⁺¹ to give away

25. What is the conjugate base of... **acting like an acid**

(A) NH₃ **NH₂⁻** (B) H₂SO₄ **HSO₄⁻** (C) H₂PO₄⁻ **HPO₄⁻²**

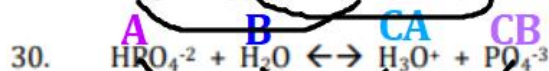
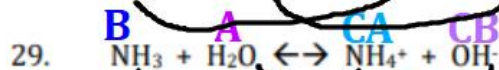
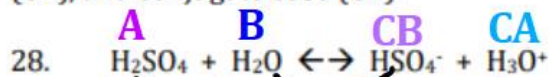
26. What is the conjugate acid of...

(A) H₂PO₄⁻ **H₃PO₄** (B) HSO₄⁻ **H₂SO₄** (C) HCO₃⁻ **H₂CO₃**

27. When an acid and a base react with each other, what are the two (2) products?

a salt + water

Part 4 - Draw lines between the conjugate acid-base pairs and label the acid (A), base (B), conjugate acid (CA), and conjugate base (CB).



B

CA

A

CB

Part 5 - Solve the following problems.

31. What is the pH of a solution whose $[\text{OH}^-]$ is $3.08 \times 10^{-3} \text{ M}$? **11.49**

32. What is the $[\text{OH}^-]$ of a solution whose $[\text{H}^+]$ is $5.92 \times 10^{-2} \text{ M}$? **$1.69 \times 10^{-13} \text{ M}$**

33. What is the concentration (molarity) of NaOH if 15.3 mL are needed to completely neutralize 20.4 mL of 2.50 M **H_2SO_4** ? **6.67 M**

34. What volume of 1.50 M $\text{Ca}(\text{OH})_2$ is needed to reach the endpoint of a titration using 17.2 mL of 3.00 M H_3PO_4 ? **$3 \cdot 3.00 \cdot 17.2 = 2 \cdot 1.50 \cdot x$**

$$x = 51.6 \text{ mL}$$

Part 6 - Fill in the following chart.

pOH	pH	$[\text{OH}^-]$	$[\text{H}^+]$	A, B, or N
4.63	9.37	$2.34 \times 10^{-5} \text{ M}$	$4.27 \times 10^{-10} \text{ M}$	B
2.25	11.75	0.00562 M	$1.78 \times 10^{-12} \text{ M}$	B
7.53	6.47	$2.96 \times 10^{-8} \text{ M}$	$3.39 \times 10^{-7} \text{ M}$	A
8.28	5.72	$5.25 \times 10^{-9} \text{ M}$	$5.27 \times 10^{-9} \text{ M}$	A

1. Given the equilibrium equation at 25°C: **$\text{A}_2 (\text{g}) + \text{B}_2 (\text{g}) \leftrightarrow 2 \text{AB} (\text{g})$**

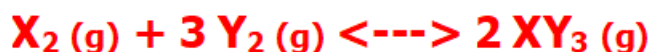
If, at equilibrium, the concentrations are as follows: $[\text{A}_2] = 3.45 \text{ M}$, $[\text{B}_2] = 5.67 \text{ M}$, and $[\text{AB}] = 0.67 \text{ M}$

(A) Write the K_{eq} expression.

(B) Find value of K_{eq} .

$$K_{\text{eq}} = \frac{[\text{AB}]^2}{[\text{A}_2][\text{B}_2]}$$

$$K_{\text{eq}} = \frac{[0.67]^2}{[3.45][5.67]} = 0.023$$



2. Given the equilibrium equation at a temperature of 50°C

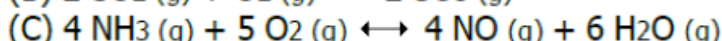
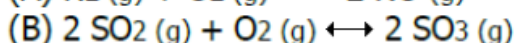
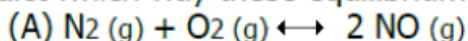
it is found that when equilibrium is reached that: $[X_2] = 0.37 \text{ M}$, $[Y_2] = 0.53 \text{ M}$, and $[XY_3] = 0.090 \text{ M}$

(A) Write K_{eq} expression. $K_{eq} = \frac{[XY_3]^2}{[X_2][Y_2]^3}$

(B) Find value of K_{eq} .

$$K_{eq} = \frac{[0.090]^2}{[0.37][0.53]^3} = 0.15$$

3. Predict which way these equilibrium systems will shift when the total pressure is increased.

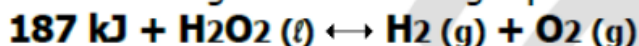


(A) no shift; 2 moles of gas on each side of the equation

(B) right; left side has 3 moles of gas, right side has 2

(C) left; left side has 9 moles of gas, right side has 10

4. Hydrogen peroxide decomposes according to the following equation:



Predict the direction of equilibrium shift by each of these changes:

(A) Increase the $[H_2]$

(B) Decrease the $[O_2]$

(C) Decrease the total pressure

(D) Increase the temperature

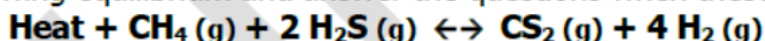
(A) left

(B) right

(C) right

(D) right

5. Consider the following equilibrium and answer the questions when these changes are made.



Event	Eq shift?	$[CH_4]$?	$[H_2S]$?	$[CS_2]$?	$[H_2]$?
add CH_4	right	—	decrease	increase	increase
remove CS_2	right	decrease	decrease	—	increase
add H_2	left	increase	increase	decrease	—
incr temp	right	decrease	decrease	increase	increase