KEY

Review Chapter 14/15: Acids/Bases Worksheet

A 1. Whose definition of acids and bases emphasizes the role of the proton?
a. Brønsted-Lowry b. Lewisc. Arrhenius d. Faraday.

D 2. A conjugate base is the species that:
a. remains after a base has given up a proton.
b. is formed by the addition of a proton to an acid.
c. is formed by the addition of a proton to a base.
d. remains after an acid has given up a proton.

C 3. What is the pH of a neutral solution at 25°C?
a. 0 b. 1 c. 7 d. 14

C 4. A solution whose pH is 4:
a. is always neutral b. is always basic
c. is always acidic d. might be neutral, basic, or acidic

D 5. If $[H_3O^+] = 1.70 \times 10^{-3}$, what is the pH of the solution?
a. 1.81 b. 2.13 c. 2.42 d. 2.77

6. Identify each of the following using the reversible reactions:
a. $HCN + H_2O \Leftrightarrow H_3O^+ + CN^-$
acid: HCN base: H_2O
conjugate acid: H_3O^+ conjugate base: CN^-

b. $H_2O + HSO_4^- \Leftrightarrow SO_4^{-2} + H_3O^+$
acid: HSO_4^- base: H_2O
conjugate acid: H_3O^+ conjugate base: SO_4^{2-}

7. Find the pH of the following:
a. 0.001 M HCl 3
b. 3×10^{-3} M HCl 2.5
c. $[H_3O^+] = 2 \times 10^{-4}$ 3.7
d. 0.01 M HCl 2
e. $[OH^-] = 7.53 \times 10^{-5}$ 9.9

8. Determine the pOH of the following:
a. $[OH^-] = 9.2 \times 10^{-6}$ 5.0
b. pH = 1.39 12.61
c. $[H_3O^+] = 4.1 \times 10^{-4}$ 10.6

9. Determine the amount of $[H_3O^+]$ from the following pH values:
a. pH = 3.0 1.0×10^{-3} M
b. pH = 8.15 7.0×10^{-9} M

11. Determine the pH and pOH of each of the following and label each as an acid, base, or neutral solution.

a. $[H^+] = 1 \times 10^{-8}$ pH: 8 pOH: 6 Label: base
b. $[OH^-] = 1 \times 10^{-3}$ pH: 11 pOH: 13 Label: base
c. $[H^+] = 7.3 \times 10^{-1}$ pH: .14 pOH: 13.86 Label: acid
d. $[H^+] = 1 \times 10^{-7}$ pH: 7 pOH: 7 Label: neutral

12. Determine the $[OH^-]$ from each of the following:

a. pOH = 3.4 3.98×10^{-4}
b. $[H^+] = 2.9 \times 10^{-6}$ 3.0×10^{-9} 3.59×10^{-9}

13. Summarize the three main acid-base theories in the table below.

	Acid	Base
Arrhenius	releases H^+ or H_3O^+ in H_2O	releases OH^- in H_2O
Brønsted-Lowry	donates proton (H^+)	accepts proton (H^+)
Lewis	accept electron pr	donate electron pr

14. Give the conjugate base for each of the following Brønsted-Lowry acids.

a. HCl Cl^- b. H_2O OH^-

15. Give the conjugate acid for each of the following Brønsted-Lowry bases.

a. OH^- H_2O b. Br^- HBr

16. The pH of an acidic solution is lower than 7.
17. The pH of a basic solution is higher than 7.
18. Acids will taste sour and turn litmus paper red.
19. Bases will feel slippery and turn litmus paper blue.

20. What is the general formula for a neutralization reaction?

ACID + BASE $\longrightarrow$ SALT + H_2O

21. List 3 strong acids and explain why these acids are considered strong acids.

HCl, HNO_3, H_2SO_4
they completely dissociate in a reaction

22. List 3 weak acids and explain why these acids are considered weak acids.

HF, HBr, $HC_2H_3O_2$
they do not completely dissociate in a reaction

23. List 2 strong bases and explain why these bases are considered strong bases.

NaOH, KOH
they completely dissociate in a reaction

24. List 1 weak base and explain why it is considered a weak base.

NH_3 it does not completely dissociate in a reaction

25. Write the correct chemical formula or chemical name for each of the following acids and bases.

a. aluminum hydroxide $Al(OH)_3$
b. sulfurous acid H_2SO_3
c. calcium hydroxide $Ca(OH)_2$
d. hydrobromic acid HBr
e. HCH_3COO acetic acid
f. H_2CO_3 carbonic acid
g. KOH potassium hydroxide
h. HCl hydrochloric acid

i. What do the acid formulas have in common? they start with H

j. Which of the above bases would be considered Arrhenius bases?
$Ca(OH)_2$; $Al(OH)_3$ KOH has OH^-

26. Define an amphoteric substance. Give an example.

can be an acid or a base depending on the reaction ; water

27. What is the molarity of a solution that has 4.0 g of sodium hydroxide in 120 mL of solution? What is the pH of this solution?

$\frac{4.0\text{g NaOH}}{40\text{g}} = .1\text{mol NaOH}$ / $.120\text{L}$ = .833 M NaOH

Since 1 OH in 1 NaOH $[OH^-] = .833M$

$pOH = .079$ $pH = 13.92$

28. According to the Arrhenius theory of acids, what do citric acid in oranges and acetic acid in vinegar contain in their aqueous solutions?

H^+

29. Use an (A) to indicate an acid only, (B) to indicate a base only, and (C) to indicate both.

A Turns litmus paper red
A Has a pH of 3
A Tastes sour
B Feels slippery
B Tastes bitter
C Is a good conductor
B Produced when sodium reacts with water
A Reacts with zinc to produce hydrogen gas
B Turns pink with phenolphthalein
A Reacts with carbonates to produce CO_2

30. A standardized solution of 0.65 M HCl is titrated with a saturated solution of calcium hydroxide to determine its molarity. It takes 25.0 mL of acid to neutralize 10.0 mL of the base. Write the balanced equation for this neutralization reaction and determine the molarity of the $Ca(OH)_2$ solution.

$2HCl + Ca(OH)_2 \rightarrow 2H_2O + CaCl_2$

$0.65\text{ M HCl} = \frac{x}{.025\text{L}} = .01625\text{ moles HCl} \,/\, 2\text{HCl} = .008125\text{ mol Ca(OH)}_2 / .010\text{L} = .8125\text{ M Ca(OH)}_2$

31. By titration, 17.6 ml of aqueous H_2SO_4 neutralized 27.4ml of 0.165M LiOH solution. What was the molarity of the aqueous acid solution

$2LiOH + H_2SO_4 \rightarrow H_2O + Li_2SO_4$

$0.165\text{ M LiOH} = \frac{x}{.0274} = .004521\text{ moles LiOH} \,/\, 2\text{LiOH} = .0022605\text{ mol } H_2SO_4 / .0176\text{L} = .128\text{ M } H_2SO_4$