

NAME: keyACIDS/BASES/SALTS
PRACTICE PROBLEMS

1. Based on Reference Table F, which of these salts is the best electrolyte?
- (1) sodium nitrate (3) silver chloride
 - (2) magnesium carbonate (4) barium sulfate
2. Which formula represents a compound that is a strong electrolyte?
- (1) $C_6H_{12}O_6$ (3) HNO_2
 - (2) $C_{12}H_{22}O_{11}$ (4) HNO_3
3. Based on Reference Table K, which 0.1 M aqueous solution is the best conductor of electricity?
- (1) HI (3) H_2S
 - (2) HNO_2 (4) H_3PO_4
4. The only positive ion found in an aqueous solution of sulfuric acid is the
- (1) hydroxide ion (3) sulfite ion
 - (2) hydronium ion (4) sulfate ion
5. Which ion is produced when an Arrhenius base is dissolved in water?
- (1) H^+ , as the only positive ion in solution
 - (2) H_3O^+ , as the only positive ion in solution
 - (3) OH^- , as the only negative ion in solution
 - (4) H^- , as the only negative ion in solution
6. Which substance is an Arrhenius acid?
- (1) $LiF(aq)$ (3) $Mg(OH)_2(aq)$
 - (2) $HBr(aq)$ (4) CH_3CHO
7. When HCl is dissolved in water, the only positive ion present in the solution is the
- (1) hydrogen ion (3) hydride ion
 - (2) hydroxide ion (4) chloride ion
8. Which of these pH numbers indicates the highest level of acidity?
- (1) 5 (3) 10
 - (2) 8 (4) 12
9. When the pH of a solution changes from a pH of 5 to a pH of 3, the hydronium ion concentration is
- (1) 0.01 of the original content
 - (2) 0.1 of the original content
 - (3) 10 times the original content
 - (4) 100 times the original content
10. As $HCl(g)$ is added to water, the pH of the water solution
- (1) decreases (3) remains the same
 - (2) increases

11. Which 0.1 M solution has the highest concentration of H_3O^+ ions?
- (1) CH_3COOH (3) KBr
 - (2) $NaCl$ (4) $Ba(OH)_2$
12. As 0.1 M HCl is added to 0.1 M KOH, the pH of the basic solution
- (1) decreases and basicity decreases
 - (2) increases and basicity decreases
 - (3) decreases and basicity increases
 - (4) increases and basicity increases
13. As an acidic solution is added to a basic solution, the pH of the basic solution
- (1) decreases (3) remains the same
 - (2) increases
14. What is the pH of an aqueous solution of $C_6H_{12}O_6$?
- (1) 1 (3) 11
 - (2) 7 (4) 14
15. Which of the following is the *weakest* acid?
- (1) H_2SO_4 (3) HF
 - (2) HNO_3 (4) HI
16. Based on Reference Table K, which of the following 0.1 M solutions is the best conductor of electricity?
- (1) HNO_3 (3) NH_3
 - (2) HNO_2 (4) CH_3COOH
17. Which acid is almost completely ionized in a dilute solution at 298K?
- (1) CH_3COOH (3) H_3PO_4
 - (2) H_2S (4) HNO_3
18. What is the pH of a solution with a hydroxide ion concentration of 0.001 mole per liter?
- (1) 1 (3) 3
 - (2) 7 (4) 11
19. If the $[OH^-]$ equals 1×10^{-10} at 298 K for a given solution, the $[H^+]$ of the solution equals
- (1) 1×10^{-4}
 - (2) 1×10^{-7}
 - (3) 1×10^{-10}
 - (4) 1×10^{-14}
20. Given the equation:
- $$NaOH(s) \rightarrow Na^+(aq) + OH^-(aq)$$
- What is the $OH^-(aq)$ concentration in a 0.001 M solution of NaOH?
- (1) 1 M (3) 0.001 M
 - (2) 2 M (4) 0.002 M

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22. The concentration of hydroxide ions in a given aqueous solution is 10^{-5} mole per liter at 25°C . What is the concentration of hydrogen ions in this solution?
- (1) 10^{-5} mole/liter
 - (2) 10^{-7} mole/liter
 - (3) 10^{-9} mole/liter
 - (4) 10^{-14} mole/liter

23. What is the pH of a 0.00001 molar HCl solution?
- (1) 1
 - (2) 9
 - (3) 5
 - (4) 4

24. The pH of a 0.1 M solution is 11. What is the concentration of H_3O^+ ions, in moles per liter?
- (1) 1×10^{-1}
 - (2) 1×10^{-3}
 - (3) 1×10^{-11}
 - (4) 1×10^{-13}

24. The results of testing a colorless solution with three indicators are shown in the table below.

Indicator	Result
red litmus	blue
blue litmus	blue
phenolphthalein	pink

Which formula could represent the solution tested?

- (1) $\text{NaOH}(\text{aq})$
 - (2) $\text{HCl}(\text{aq})$
 - (3) $\text{C}_6\text{H}_{12}\text{O}_6(\text{aq})$
 - (4) $\text{C}_{12}\text{H}_{22}\text{O}_{11}(\text{aq})$
25. Which solution when mixed with a drop of bromthymol blue will cause the indicator to change from blue to yellow?
- (1) 0.1 M HCl
 - (2) 0.1 M NH_3
 - (3) 0.1 M CH_3OH
 - (4) 0.1 M NaOH

26. The ability of $\text{H}_2\text{SO}_4(\text{aq})$ to change blue litmus red is mainly due to the presence of

- (1) SO_2 molecules
- (2) H_2O molecules
- (3) $\text{H}_3\text{O}^+(\text{aq})$ ions
- (4) $\text{SO}_4^{2-}(\text{aq})$ ions

27. When tested, a solution turns red litmus to blue. This indicates that the solution contains more

- (1) H^+ than OH^- ions
- (2) H_3O^+ ions than OH^- ions
- (3) OH^- ions than H_3O^+ ions
- (4) H^+ and OH^- ions than H_2O molecules

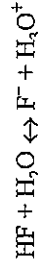
28. Red litmus will turn blue when placed in an aqueous solution of

- (1) KCl
- (2) KOH
- (3) CH_3OH
- (4) CH_3COOH

29. According to "alternative theory" of acids and bases, an acid is any species that

- (1) releases hydroxide ions into solution
- (2) releases oxide ions into solution
- (3) donates protons to another species
- (4) accepts protons from another species

30. Given the reaction:



Which species is acting as the acid in the reverse reaction?

- (1) HF
- (2) H_2O
- (3) F^-
- (4) H_3O^+

31. According to Reference Table L, which can act only as a Brønsted-Lowry acid?

- (1) HCl
- (2) S^{2-}
- (3) H_2PO_4^-
- (4) HSO_4^-

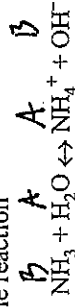
32. Which Brønsted acid has a conjugate base that has amphoteric properties?

- (1) HCl
- (2) HNO_3
- (3) H_3O^+
- (4) HSO_4^-

33. Which reaction illustrates amphoterism?

- (1) $\text{H}_2\text{O} + \text{H}_2\text{O} \rightarrow \text{H}_3\text{O}^+ + \text{OH}^-$
- (2) $\text{HCl} + \text{H}_2\text{O} \rightarrow \text{H}_3\text{O}^+ + \text{Cl}^-$
- (3) $\text{NaCl} \rightarrow \text{Na}^+ + \text{Cl}^-$
- (4) $\text{NaOH} \rightarrow \text{Na}^+ + \text{OH}^-$

34. In the reaction



A conjugate acid-base pair is

- (1) NH_3 and H_2O
- (2) NH_3 and OH^-
- (3) H_2O and NH_4^+
- (4) H_2O and OH^-

35. According to Reference Table L, which of the following is the strongest Brønsted-Lowry base?

- (1) HS^-
- (2) S^{2-}
- (3) HSO_4^-
- (4) SO_4^{2-}

38. According to Reference Table L, what is the conjugate acid of the hydroxide ion (OH^-)?
- (1) O_2
 (2) H^+
 (3) H_2O
 (4) H_3O^+
39. According to Reference Table L, the *weakest* Brønsted acid is
- (1) NH_3
 (2) NH_4^+
 (3) H_2O
 (4) OH^-
40. Which compound could serve as a reactant in a neutralization reaction?
- (1) NaCl (3) CH_3OH
 (2) KOH (4) CH_3CHO
41. Which reaction occurs when hydrogen ions react with hydroxide ions to form water?
- (1) substitution (3) ionization
 (2) saponification (4) neutralization
42. Which equation represents a neutralization reaction?
- (1) $\text{Na}_2\text{CO}_3 + \text{CaCl}_2 \rightarrow 2 \text{NaCl} + \text{CaCO}_3$
 (2) $\text{Ni}(\text{NO}_3)_2 + \text{H}_2\text{S} \rightarrow \text{NiS} + 2 \text{HNO}_3$
 (3) $\text{NaCl} + \text{AgNO}_3 \rightarrow \text{AgCl} + \text{NaNO}_3$
 (4) $\text{H}_2\text{SO}_4 + \text{Mg}(\text{OH})_2 \rightarrow \text{MgSO}_4 + 2 \text{H}_2\text{O}$
43. Equal volumes of 0.1 M NaOH and 0.1 M HCl are thoroughly mixed. The resulting solution has a pH closest to
- (1) 5 (3) 3
 (2) 7 (4) 9
44. Which equation represents a neutralization reaction?
- (1) $\text{H}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{H}_2\text{O}(\ell)$
 (2) $\text{Ag}^+(\text{aq}) + \text{I}^-(\text{aq}) \rightarrow \text{AgI}(\text{s})$
 (3) $\text{Zn}(\text{s}) + 2 \text{HCl}(\text{aq}) \rightarrow \text{ZnCl}_2(\text{aq}) + \text{H}_2(\text{g})$
 (4) $\text{NaCl}(\text{aq}) + \text{AgNO}_3(\text{aq}) \rightarrow \text{NaNO}_3(\text{aq}) + \text{AgCl}(\text{s})$
45. An aqueous solution of $\text{NaC}_2\text{H}_3\text{O}_2$ is basic. The salt $\text{NaC}_2\text{H}_3\text{O}_2$ can be derived from the reaction of a
- (1) strong acid with a weak base
 (2) strong acid with a strong base
 (3) weak acid with a weak base
 (4) weak acid with a strong base
46. An acid solution exactly neutralized a base solution according to the equation acid + base \rightarrow salt + water. If the neutralized mixture contained the salt KCl, the pH of the aqueous mixture would be closest to
- (1) 9 (3) 3
 (2) 7 (4) 11

45. A water solution of which compound will turn blue litmus red?
- (1) K_2CO_3 (3) NaOH
 (2) ZnCl_2 (4) NaCl

46. How many hydroxide ions are needed to completely neutralize 1.0 liter of 0.50 M HCl?

- (1) 1.5×10^{23} ions
 (2) 3.0×10^{23} ions
 (3) 6.0×10^{23} ions
 (4) 12×10^{23} ions

47. When 50. milliliters of an HNO_3 solution is exactly neutralized by 150 milliliters of a 0.50 M solution of KOH, what is the concentration of HNO_3 ?

- (1) 1.0 M (3) 3.0 M
 (2) 1.5 M (4) 0.5 M

48. When $\text{HCl}(\text{aq})$ is exactly neutralized by $\text{NaOH}(\text{aq})$, the hydrogen ion concentration in the resulting mixture is

- (1) always less than the concentration of the hydroxide ions
 (2) always greater than the concentration of the hydroxide ions
 (3) always equal to the concentration of the hydroxide ions
 (4) sometimes greater and sometimes less than the concentration of the hydroxide ions

49. During a titration, a student used 50 milliliters of 0.1 M acid. How many moles of acid, expressed to proper significance, were used?

- (1) 0.005 (3) 0.00500
 (2) 0.0050 (4) 0.005000

$$.1M = \frac{x}{1} \Rightarrow x = 0.05L$$

50. The table below shows the color of an indicator in specific pH ranges.

Color	pH Range
Red	1-4
Orange	5-6
Green	6-7
Blue	8-10
Violet	11-14

If this indicator is used when titrating an unknown strong base by adding a strong acid, the color of the indicator will change from

- (1) blue to green (3) orange to green
 (2) green to blue (4) green to orange

51. As the concentration of NH_4Cl in a solution increases, the pH of the solution

- (1) decreases (3) remains the same
 (2) increases



52. A solution of K_2CO_3 would have a pH closest to

- (1) 1 (3) 3
 (2) 5 (4) 8

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