

ACIDS AND BASES

TEST

General Test – 50 Test Questions

Date: _____

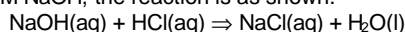
- In a titration, 15.0 cm³ of 0.100 M hydrochloric acid neutralizes 30.0 cm³ of a solution of calcium hydroxide. What is the molarity of the calcium hydroxide solution?
A) 0.0125 B) 0.0250 C) 0.0500 D) 0.200
- In the reaction $2 \text{HCO}_3^- \leftrightarrow \text{H}_2\text{CO}_3 + \text{CO}_3^{2-}$ the hydrogen carbonate ion, HCO_3^- is functioning as
A) a Bronsted-Lowry acid only.
B) a Bronsted-Lowry base only.
C) both a Bronsted-Lowry acid and a Bronsted-Lowry base.
D) neither a Bronsted-Lowry acid nor a Bronsted-Lowry base.
- Which pair of species consists of a Lewis acid followed by a Lewis base?
A) $\text{Cl}^-(\text{aq})$, $\text{Ag}^+(\text{aq})$ B) $\text{NH}_3(\text{g})$, $\text{BF}_3(\text{g})$
C) $\text{SO}_4^{2-}(\text{aq})$, $\text{HSO}_4^+(\text{aq})$ D) $\text{H}^+(\text{aq})$, $\text{OH}^-(\text{aq})$
- Calculate the pH of a solution made by mixing 150 cm³ of 0.10 M $\text{NaC}_2\text{H}_3\text{O}_2$ and 250 cm³ of 0.10 M $\text{HC}_2\text{H}_3\text{O}_2$. K_a of $\text{HC}_2\text{H}_3\text{O}_2 = 1.8 \times 10^{-5}$
A) 2.37 B) 4.52 C) 4.74 D) 4.97
- The solubility product constant, K_{sp} , of Ag_3PO_4 is 1.8×10^{-18} . What is the molar solubility of Ag_3PO_4 in water? Neglect any hydrolysis.
A) 1.6×10^{-5} B) 8.4×10^{-7}
C) 1.3×10^{-9} D) 4.5×10^{-19}
- When performing an acid-base titration, which procedure would NOT introduce an error into the experimental results?
A) adding an unmeasured amount of water to the carefully measured acid sample which is being titrated.
B) failing to rinse the burettes with the appropriate reactants after cleaning and rinsing with water.
C) failing to remove bubbles of air from the tips of the burettes before beginning the titration.
D) using an indicator that changes color at a pH considerably removed from the pH at the equivalence point of the titration.
- 25.0 cm³ of a 0.050 M solution of formic acid, HCOOH , was neutralized with 25.0 cm³ of a 0.050 M solution of sodium hydroxide, NaOH . What is the pH of the resulting solution? K_a of $\text{HCOOH} = 2.1 \times 10^{-4}$
A) 5.96 B) 6.61 C) 7.39 D) 8.04
- The pH of a solution of vinegar is 3.00. The concentration of OH^- ion in this solution is
A) 3.00 M B) 1×10^{-3} M C) 1×10^{-11} M D) 17 M
- A human patient suffering from a duodenal ulcer may show a hydrochloric acid concentration of 0.080 mol/liter in his gastric juice. It is possible to neutralize this acid with aluminum hydroxide, $\text{Al}(\text{OH})_3$, which reacts with HCl according to the balanced chemical equation
$$\text{Al}(\text{OH})_3 + 3 \text{HCl} \Rightarrow \text{AlCl}_3 + 3 \text{H}_2\text{O}$$

If the patient's stomach receives 3.0 liters of gastric juice per day, how much aluminum hydroxide must he consume per day to counteract the acid?
A) 6.2 g B) 19 g C) 26 g D) 78 g
- How many liters of hydrogen gas at STP can be produced by the reaction of 9.00 g of Al with excess dilute H_2SO_4 ?
$$2 \text{Al}(\text{s}) + 3 \text{H}_2\text{SO}_4(\text{aq}) \Rightarrow 3 \text{H}_2(\text{g}) + \text{Al}_2(\text{SO}_4)_3$$

A) 5.61 L B) 11.2 L C) 33.6 L D) 67.2 L
- In the Arrhenius picture of acids and bases, the reaction of an acid with a base always results in the formation of
A) H^+ B) OH^- C) CO_2 D) H_2O
- A standard solution of 0.165 M HCl is being used to determine the concentration of an unknown NaOH solution. If 25.5 mL of the acid solution are required to neutralize 15.0 mL of the base, what is the molarity of the NaOH solution?
A) $(0.165) / (25.5 + 15.0)$ M B) $(15.0) / (0.165) (25.5)$ M
C) $(0.165) (15.0 / 25.5)$ M D) $(0.165) (25.5 / 15.0)$ M
- The indicator ravishing red has a color change from yellow to red in the pH range 6.5- 7.5. This indicator would be used to titrate
A) a weak acid with a strong base
B) a strong acid with a weak base
C) a weak acid with a weaker acid
D) a strong acid with a strong base
- If the K_a of a weak acid is 5×10^{-4} , the pH of a 0.2 M solution of the acid will be about
A) 0.7 B) 2.0 C) 3.3 D) 7.0
- A 1.20 liter sample is drawn from a bottle labeled "86.0% by weight H_2SO_4 , density 1.787 g/mL". What is the molarity of the sample?
A) 8.78 M B) 10.5 M C) 15.7 M D) 18.2 M
- 2.80 grams of a monoprotic weak acid, HX , was dissolved in water. Titration of the acid to its equivalence point required 29.2 mL of 0.500 M NaOH solution. What is the molecular weight of the acid, HX ?
A) 192 g/mol B) 164 g/mol C) 96.0 g/mol D) 5.21 g/mol

17. A standard solution of 0.154 M HCl is used to determine the concentration of a NaOH solution whose concentration is unknown. If 33.5 mL of the acid solution are required to neutralize 25.0 mL of the base solution, the concentration of the NaOH in moles/liter is
- A) $25.0 / (0.154)(33.5)$ B) $(0.154)(25.0) / 33.5$
 C) $(33.5 + 25.0) / 0.514$ D) $(0.514)(33.5) / 25.0$
18. A species which acts as an acid according to the Bronsted model of acids and bases is
- A) O^{2-} B) NH_4^+ C) CH_4 D) NH_2^-
19. The hydrogen ion concentration corresponding to a pH of 8.64 is
- A) 5.36 B) 4.4×10^{-8} C) 4.4×10^{-9} D) 2.3×10^{-9}
20. What is the molarity of acid in vinegar containing 4.0% acetic acid by weight and having a density of 1.02 g/mL?
- A) 0.50 M B) 0.68 M C) 0.75 M D) 1.36 M
21. A "buffered" solution
- A) contains an insoluble solid.
 B) resists a change in its pH.
 C) contains a salt of a strong acid and a strong base.
 D) contains a concentrated strong acid
22. What volume of 0.284 M NaOH is needed to titrate 100.00 mL of 0.124 M HCl to the equivalence point?
- A) 35.2 mL B) 40.8 mL C) 43.7 mL D) 229 mL
23. What is the maximum amount of $MgCl_2$ that can be prepared from the reaction of 10.0g of HCl with 10.0 of $Mg(OH)_2$? $2HCl + Mg(OH)_2 \Rightarrow MgCl_2 + 2 H_2O$
- A) 9.26 g B) 13.1 g C) 16.3 g D) 17.5 g
24. An aqueous solution containing 1.00 mol H_2SO_4 is mixed with an aqueous solution containing 1.00 mol NaOH. The mixture is then evaporated to dryness. What solid remains after evaporation?
- A) H_2SO_4 B) NaOH C) $NaHSO_4$ D) Na_2SO_4
25. What is the molarity of HCl if 450 mL of 2.3 M HCl is diluted to 1250 mL?
- A) 0.36 M B) 0.50 M C) 0.83 M D) 1.8 M
26. Which compound, when dissolved in water, conducts electricity and forms a basic solution?
- A) HCl B) CH_3COOH C) CH_3OH D) KOH
27. When 80.00 mL of 0.200 M HNO_3 is added to 120.00 mL of 0.150 M KOH, the reaction $HNO_3(aq) + KOH(aq) \Rightarrow KNO_3(aq) + H_2O(l)$ occurs and the resulting solution is
- A) 0.0160 M KNO_3
 B) 0.0180 M KNO_3
 C) 0.0800 M KNO_3 and 0.0100 M KOH
 D) 0.0160 M KNO_3 and 0.0200 M KOH
28. Which pair constitutes a buffer?
- A) HCl and KCl B) NaOH and NaCl
 C) HNO_2 and $NaNO_2$ D) HNO_3 and NH_4NO_3
29. Which oxide dissolves in water to give the strongest acid?
- A) SO_3 B) CaO C) P_4O_{10} D) CO_2
30. Which is the strongest Bronsted base?
- A) NH_2^- B) Cl^- C) PO_4^{3-} D) NO_2^-
31. Which forms a basic aqueous solution?
- A) NaI B) KNO_3 C) $BaCl_2$ D) Na_2CO_3
32. The best acid for preparing a buffer of pH = 3.2 has a K_a near
- A) 2.0×10^{-5} B) 6.0×10^{-4} C) 3.2×10^{-2} D) 4.0×10^{-6}
33. What is the pH of a 2.0×10^{-3} M HCl solution ?
- A) 2.40 B) 2.70 C) 3.00 D) 11.30
34. The K_{sp} values for $CaSO_4$, $BaSO_4$, and Ag_2SO_4 are 2.0×10^{-4} , 1.5×10^{-9} , and 1.5×10^{-5} respectively. If 0.010 M Na_2SO_4 is slowly added to a solution that contains Ca^{2+} , Ba^{2+} , and Ag^+ (each 0.10M), which solid will precipitate last?
- A) $CaSO_4$
 B) Ag_2SO_4
 C) $BaSO_4$
 D) More information is required
35. The K_{sp} of AgCl is 1.8×10^{-10} . If 10.00 mL of 0.0010 M NaCl is combined with 20.00 mL of 0.0050 M $AgNO_3$
- A) no reaction occurs
 B) a precipitate forms
 C) an initial precipitate forms which dissolves upon stirring.
 D) the silver ion concentration remains as 0.005 M.
36. The solubility of which salt is not pH dependent?
- A) CaF_2 B) $CaCO_3$ C) CaC_2O_4 D) $CaCl_2$

37. When 50.0 mL of 0.200 M HCl is mixed with 150.0 mL of 0.100 M NaOH, the reaction is as shown.



What is the concentration of the resulting solution?

- A) 0.0500 M NaCl
- B) 0.100 M NaCl
- C) 0.0500 M NaCl and 0.0250 M NaOH
- D) 0.0500 M NaCl and 0.0500 M NaOH

38. Which would you expect to be the strongest acid?

- A) HBrO_3
- B) HIO_3
- C) HClO_3
- D) all should be equally strong.

39. Which 0.500 M solution has the lowest pH?

- A) $\text{HC}_2\text{H}_3\text{O}_2$ ($K_a = 1.8 \times 10^{-5}$)
- B) NaCN ($K_b = 2.5 \times 10^{-5}$)
- C) NH_3 ($K_b = 1.8 \times 10^{-5}$)
- D) HN_3 ($K_a = 2.0 \times 10^{-5}$)

40. 0.2 M hypochlorous acid ($\text{p}K_a = 7.51$) is titrated with 0.2 M sodium hydroxide solution. Which indicator of those with ranges listed would be most appropriate for marking the endpoint of this titration?

- A) methyl orange pH = 3.2-4.4
- B) bromocresol purple pH = 5.2-6.8
- C) cresol red pH = 7.0-8.8
- D) alizarin yellow pH = 10.1-12.0

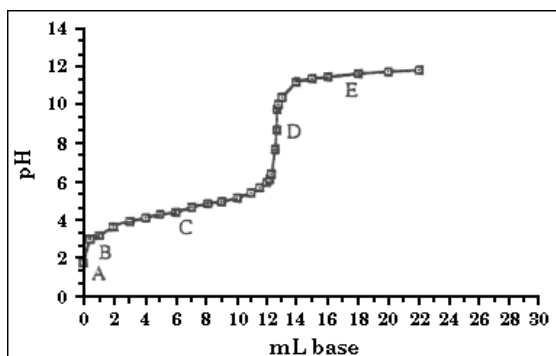
41. An aqueous solution of which salt would be expected to have the most basic pH?

- A) Na_2CO_3
- B) $\text{NaC}_2\text{H}_3\text{O}_2$
- C) NaCl
- D) NH_4Cl

42. What is the approximate pH of an aqueous 1×10^{-9} M HCl solution?

- A) 1
- B) 5
- C) 7
- D) 9

Use the titration curve below to answer questions 43-45.



43. Which point indicates the region where the solution behaves as a buffer?

- A) A
- B) B
- C) C
- D) D

44. Which point indicates the equivalence point of the titration?

- A) E
- B) B
- C) C
- D) D

45. The titration curve best describes a titration between

- A) a strong acid and a strong base.
- B) a strong acid and weak base.
- C) a weak acid and a strong base
- D) a weak acid and a weak base.

46. Which is a base under the Arrhenius, Bronsted-Lowry and Lewis theories?

- A) NH_3
- B) OH
- C) O^{2-}
- D) H_2O

47. A saturated solution of Mg(OH)_2 has a molar solubility of 1.44×10^{-4} M. What is its solubility product constant, K_{sp} ?

- A) 1.2×10^{-11}
- B) 2.1×10^{-8}
- C) 3.0×10^{-12}
- D) 4.2×10^{-8}

48. The K_{sp} for $\text{Fe(IO}_3)_3$ is 1.0×10^{-14} . A solution containing Fe^{3+} is mixed with a solution containing IO_3^- and at the instant of mixing, $[\text{Fe}^{3+}] = 10^{-4}$ M and $[\text{IO}_3^-] = 10^{-5}$ M. Which statement is accurate?

- A) A precipitate forms, because $Q_{sp} > K_{sp}$.
- B) A precipitate forms, because $Q_{sp} < K_{sp}$.
- C) No precipitate forms, because $Q_{sp} > K_{sp}$.
- D) No precipitate forms, because $Q_{sp} < K_{sp}$.

49. How many moles of NH_4Cl must be dissolved in 1 L of 1 M NH_3 solution to prepare a buffer with a pH of 10? $K_b = 2 \times 10^{-5}$ for NH_3 (Assume no volume change)

- A) 0.1
- B) 0.2
- C) 0.3
- D) 0.4

50. One molar of HCN ionizes 0.01% at 20°C . Which is the dissociation constant of HCN?

- A) 1×10^{-4}
- B) 1×10^{-5}
- C) 1×10^{-7}
- D) 1×10^{-8}

YOUR ANSWER

1		11		21		31		41
2		12		22		32		42
3		13		23		33		43
4		14		24		34		44
5		15		25		35		45
6		16		26		36		46
7		17		27		37		47
8		18		28		38		48
9		19		29		39		49
10		20		30		40		50