1. What is the pH at the transition point for an indicator with a K_a of 2.5×10^{-4} ?

A. 2.5×10^{-4}
B. 3.60
C. 7.00
D. 10.40

2. What volume of 0.100 M NaOH is required to completely neutralize 15.00 mL of 0.100 M H_3PO_4 ?

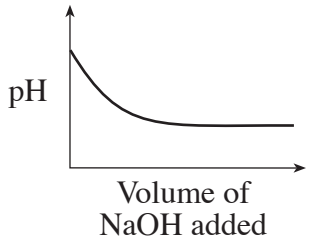
A. 5.00 mL
B. 15.0 mL
C. 30.0 mL
D. 45.0 mL

3. What is the pH of the solution formed when 0.060 moles NaOH is added to 1.00 L of 0.050 M HCl?

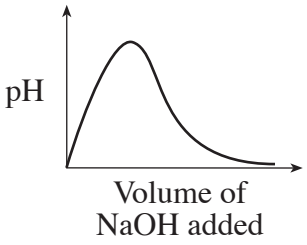
A. 2.00
B. 7.00
C. 12.00
D. 12.78

4. Which of the following graphs describes the relationship between the pH of a buffer and the volume of NaOH added to the buffer?

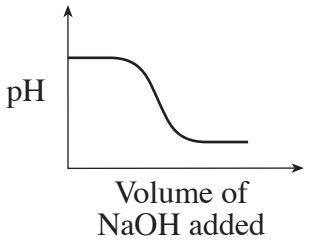
A.



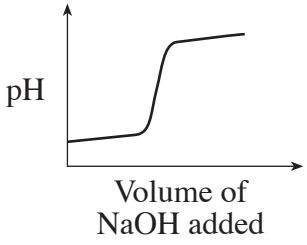
B.



C.



D.



5. A gas which is produced by internal combustion engines and contributes to the formation of acid rain is

A. H_2
B. O_3
C. CH_4
D. NO_2

6. Which of the following titrations will always have an equivalence point at a $pH > 7.00$?

A. weak acid with a weak base
B. strong acid with a weak base
C. weak acid with a strong base
D. strong acid with a strong base

7. What is the approximate K_a value for the indicator chlorophenol red?

A. 1×10^{-14}
B. 1×10^{-8}
C. 1×10^{-6}
D. 1×10^{-3}

8. A buffer solution may contain equal moles of

A. weak acid and strong base.
B. strong acid and strong base.
C. weak acid and its conjugate base.
D. strong acid and its conjugate base.

9. A gas which is produced by burning coal and also contributes to the formation of acid rain is

A. H_2
B. O_3
C. SO_2
D. C_3H_8

10. What is the pH of the solution formed when $0.040\ mol\ NaOH_{(s)}$ is added to $2.00\ L$ of $0.020\ M\ HCl$?

A. 0.00
B. 1.40
C. 1.70
D. 7.00

11. Which of the following applies at the transition point for all indicators, HInd ?

A. $[\mathrm{HInd}] = [\mathrm{Ind}^-]$

B. $[\mathrm{Ind}^-] = [\mathrm{H_3O^+}]$

C. $[\mathrm{H_3O^+}] = [\mathrm{OH}^-]$

D. $[\mathrm{HInd}] = [\mathrm{H_3O^+}]$

12. Identify the indicator that has a K_a of 1.6×10^{-7} ?

A. methyl red
B. thymol blue
C. phenolphthalein
D. bromthymol blue

13. Which of the following acid solutions would require the smallest volume to completely neutralize 10.00 mL of 0.100 M NaOH ?

A. 0.100 M HCl
B. 0.100 M H_3PO_4
C. 0.100 M $H_2C_2O_4$
D. 0.100 M CH_3COOH

14. What is the pH of the solution formed when 0.040 mol $NaOH_{(s)}$ is added to 1.00 L of 0.050 M HCl ?

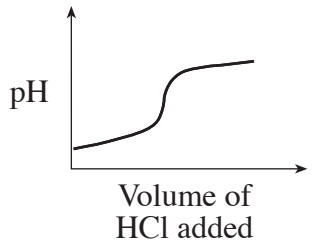
A. 1.30
B. 1.40
C. 2.00
D. 7.00

15. Which of the following titrations will have an equivalence point with a pH less than 7.00 ?

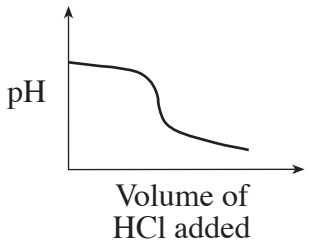
A. H_2SO_4 with NH_3
B. HNO_3 with LiOH
C. H_3PO_4 with KOH
D. HCOOH with NaOH

16. Which of the following graphs describes the relationship between pH of a buffer solution and a volume of HCl added to the buffer?

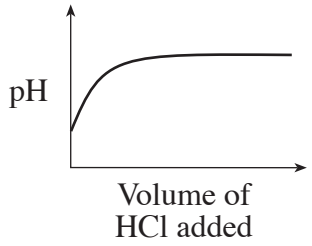
A.



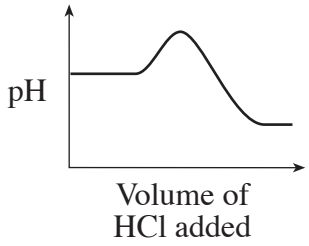
B.



C.



D.



17. Which of the following ions will produce an acidic solution when added to water?

A. O^{2-}
B. Na^{+}
C. NH_4^{+}
D. HCO_3^{-}

18. What is the $\left[H_3O^{+}\right]$ at the transition point for an indicator with a K_a of 3.9×10^{-8} ?

A. 1.0×10^{-14} M
B. 3.9×10^{-8} M
C. 1.0×10^{-7} M
D. 2.6×10^{-7} M

19. What is the pH of the solution formed when 0.040 mol KOH is added to 2.00 L of 0.020 M HCl ?

A. 0.00
B. 7.00
C. 12.00
D. 12.30

20. The pH of normal rainwater is a result of the presence of dissolved

A. SO_2
B. CO_2
C. NO_2
D. ClO_2

21. What colour would 1.0 M HCl be in an indicator mixture consisting of phenol red and thymolphthalein?

A. red
B. blue
C. yellow
D. colourless

22. During a titration, what volume of 0.500 M KOH is necessary to completely neutralize 10.0 mL of 2.00 M CH_3COOH ?

A. 10.0 mL
B. 20.0 mL
C. 25.0 mL
D. 40.0 mL

23. Which indicator has a $K_a = 1.0 \times 10^{-6}$?

A. neutral red
B. thymol blue
C. thymolphthalein
D. chlorophenol red

24. Acid is added to a buffer solution. When equilibrium is reestablished the buffering effect has resulted in $\left[H_3O^+\right]$

A. increasing slightly.
B. decreasing slightly.
C. increasing considerably.
D. decreasing considerably.

25. A buffer solution will form when 0.10 M NaF is mixed with an equal volume of

A. 0.10 M HF
B. 0.10 M HCl
C. 0.10 M NaCl
D. 0.10 M NaOH

26. Which of the following will dissolve in water to produce an acidic solution?

A. CO_2
B. CaO
C. MgO
D. Na_2O

27. Which of the following will dissolve in water to produce an acidic solution?

A. CO_2
B. CaO
C. MgO
D. Na_2O

28. The complete neutralization of 15.0 mL of KOH requires 0.025 mol H_2SO_4. The [KOH] was

A. 1.50 M
B. 1.67 M
C. 3.33 M
D. 6.67 M

29. What is the $\left[H_3O^+\right]$ at the equivalence point for the titration between HBr and KOH ?

A. 1.0×10^{-9} M
B. 1.0×10^{-7} M
C. 1.0×10^{-5} M
D. 0.0 M

30. Which of the following would form a buffer solution when equal moles are mixed together?

A. HCl and NaCl
B. HCN and NaCN
C. KNO_3 and KOH
D. Na_2SO_4 and NaOH

31. Which of the following oxides dissolves to form a solution with a pH greater than 7 ?

A. SO_2
B. CO_2
C. N_2O
D. K_2O

32. The pH of acid rain could be

A. 5.0
B. 7.0
C. 9.0
D. 11.0

33. At pH = 4.0, methyl red solution will be

A. red and $[\text{HInd}] > \left[\text{Ind}^-\right]$
B. red and $[\text{HInd}] < \left[\text{Ind}^-\right]$
C. yellow and $[\text{HInd}] > \left[\text{Ind}^-\right]$
D. yellow and $[\text{HInd}] < \left[\text{Ind}^-\right]$

34. Methyl red is orange in a 0.10 M solution of an acid. The acid could be

A. HI
B. HCl
C. HCN
D. H_2SO_4

35. How many moles of KOH are necessary to completely neutralize 42.0 mL of 3.00 M HCl?

A. 0.0630 moles
B. 0.126 moles
C. 0.252 moles
D. 3.00 moles

36. At the equivalence point, the titration of HCl with NH_3 will form a solution which is

A. basic with pH > 7.
B. acidic with pH < 7.
C. acidic with pH > 7.
D. neutral with pH = 7.

37. Which of the following could be added to an equal number of moles of $NaCH_3COO$ to prepare a buffer solution?

A. HCl
B. HNO_3
C. NaOH
D. CH_3COOH

38. Which of the following equations describes the reaction that occurs when MgO is added to water?

A. $MgO + H_2O \rightarrow Mg(OH)_2$
B. $MgO + H_2O \rightarrow MgO_2 + H_2$
C. $MgO + H_2O \rightarrow MgH_2 + O_2$
D. $2MgO + 2H_2O \rightarrow 2MgOH + H_2 + O_2$

39. Which would produce a yellow solution at a pH = 4.0 ?

A. methyl red
B. methyl violet
C. indigo carmine
D. chlorophenol red

40. How many moles of NaOH are required to react completely with 100.0 mL of 2.5 M HNO_3 ?

A. 0.0063 mol
B. 0.25 mol
C. 2.5 mol
D. 250 mol

41. The net ionic equation for the reaction between HCl and KOH is

A. $H^+ + OH^- \rightleftarrows H_2O$
B. $HCl + KOH \rightleftarrows H_2O + KCl$
C. $H^+ + Cl^- + K^+ + OH^- \rightleftarrows H_2O + KCl$
D. $H^+ + Cl^- + K^+ + OH^- \rightleftarrows H_2O + K^+ + Cl^-$

42. Which of the following titrations would have a pH > 7 at the equivalence point?

A. HI with KOH
B. $HClO_4$ with NH_3
C. HCl with $Sr(OH)_2$
D. HCOOH with NaOH

43. A buffer can be made from equal moles of

A. HCl and NaCl
B. HCN and KOH
C. HNO_3 and NH_3
D. CH_3COOH and $NaCH_3COO$

44. Which of the following dissolves in water to produce a basic solution?

A. O_2
B. SO_2
C. NO_2
D. MgO

45. The pH at which an indicator changes colour is known as its

A. standard point.
B. transition point.
C. equivalence point.
D. stoichiometric point.

46. An indicator is blue at a pH of 12.0 and colourless at a pH of 1.0 .
Identify the indicator and determine its K_a value.

	Indicator	K_a
A.	thymolphthalein	1×10^{-10}
B.	thymolphthalein	3×10^{-7}
C.	bromthymol blue	2×10^{-7}
D.	bromthymol blue	3×10^{-7}

47. A $10.0\,\text{mL}$ sample of H_2SO_3 is completely neutralized by titration with $18.6\,\text{mL}$ of $0.10\,\text{M}$ NaOH . Calculate the concentration of the acid.

A. $0.093\,\text{M}$
B. $0.19\ \text{M}$
C. $0.37\ \text{M}$
D. $0.74\ \text{M}$

48. A common source of NO_2 is

A. a fuel cell.
B. a lead smelter.
C. an aluminum smelter.
D. an automobile engine.

49. The pH at the stoichiometric point for the complete neutralization of a strong acid by a weak base will be

A. equal to 7.0
B. equal to 7.2
C. less than 7.0
D. greater than 7.2

50. A buffer solution can be prepared by dissolving equal moles of

A. a weak base and a strong base.
B. a weak acid and its conjugate base.
C. a strong base and its conjugate acid.
D. a strong acid and its conjugate base.

51. The chemical indicator bromthymol blue changes from yellow to blue as a result of the addition of

A. 1.0 M HCl
B. 1.0 M HNO_2
C. 1.0 M K_2CO_3
D. 1.0 M NH_4Cl

52. A chemical indicator has a $K_a = 1.0 \times 10^{-6}$. Determine the identity of this indicator.

A. phenol red
B. thymol blue
C. phenolphthalein
D. chlorophenol red

53. Pure sodium hydrogen phthalate is used to standardize a solution of NaOH for use in an acid-base titration. What term is used to describe the sodium hydrogen phthalate?

A. titrant base
B. standard buffer
C. equivalent base
D. primary standard

54. Calculate the volume of 0.500 M NaOH required to completely neutralize 25.0 mL of 0.450 M H_2SO_4.

A. 9.00 mL
B. 11.3 mL
C. 22.5 mL
D. 45.0 mL

55. Which of the following is the net ionic equation for the neutralization of CH_3COOH with NaOH ? **(1)**

A. $CH_3COO^-_{(aq)} + OH^-_{(aq)} \rightarrow CH_3COOH_{(aq)} + O^{2-}_{(aq)}$

B. $CH_3COOH_{(aq)} + OH^-_{(aq)} \rightarrow H_2O_{(\ell)} + CH_3COO^-_{(aq)}$

C. $CH_3COOH_{(aq)} + NaOH_{(aq)} \rightarrow NaCH_3COO_{(aq)} + H_2O_{(\ell)}$

D. $CH_3COO^-_{(aq)} + H^+_{(aq)} + Na^+_{(aq)} + OH^-_{(aq)} \rightarrow Na^+_{(aq)} + CH_3COO^-_{(aq)} + H_2O_{(\ell)}$

56. The pH of normal rainwater is

A. less than 7.0 due to dissolved $SO_{2(g)}$

B. less than 7.0 due to dissolved $CO_{2(g)}$

C. greater than 7.0 due to dissolved $CO_{2(g)}$

D. equal to 7.0 due to dissolved N_2 and O_2

57. Consider the following equilibrium for the chemical indicator phenol red, HInd, at a pH = 7.3 (orange) .

$$\underset{\text{yellow}}{HInd} + H_2O \rightleftarrows H_3O^+ + \underset{\text{red}}{Ind^-}$$

When some NaOH is added, what stress is imposed on the equilibrium and what colour change occurs?

	Stress	Indicator Colour Change
A.	increased $[H_3O^+]$	turns red
B.	decreased $[H_3O^+]$	turns red
C.	increased $[H_3O^+]$	turns yellow
D.	decreased $[H_3O^+]$	turns yellow

58. A chemical indicator has a $K_a = 2.5 \times 10^{-5}$. Determine the pH at the transition point.

A. 2.30
B. 4.60
C. 7.00
D. 9.40