

Chapter 4: Reactions in Aqueous Solution

- Which of the following compounds is a *strong electrolyte*?
A) H_2O B) CH_3OH C) $\text{CH}_3\text{CH}_2\text{OH}$ D) HF E) NaF
Ans: E Category: Easy Section: 4.1
- Which of the following compounds is a *weak electrolyte*?
A) HNO_3 B) NaNO_3 C) HNO_2 D) NaNO_2 E) NaOH
Ans: C Category: Easy Section: 4.1
- Which of the following compounds is a *strong electrolyte*?
A) H_2O D) $\text{CH}_3\text{CH}_2\text{OH}$ (ethanol)
B) N_2 E) KOH
C) CH_3COOH (acetic acid)
Ans: E Category: Easy Section: 4.1
- Which of the following compounds is a *weak electrolyte*?
A) HCl D) O_2
B) CH_3COOH (acetic acid) E) NaCl
C) $\text{C}_6\text{H}_{12}\text{O}_6$ (glucose)
Ans: B Category: Easy Section: 4.1
- Which of the following compounds is a *weak electrolyte*?
A) HCl B) NH_3 C) $\text{C}_6\text{H}_{12}\text{O}_6$ (glucose) D) N_2 E) KCl
Ans: B Category: Easy Section: 4.1
- Which of the following compounds is a *nonelectrolyte*?
A) NaF D) NaOH
B) HNO_3 E) $\text{C}_6\text{H}_{12}\text{O}_6$ (glucose)
C) CH_3COOH (acetic acid)
Ans: E Category: Easy Section: 4.1
- Which of the following compounds is a *nonelectrolyte*?
A) NaOH D) KF
B) HNO_3 E) CH_3COOH (acetic acid)
C) $\text{C}_2\text{H}_6\text{O}$ (ethanol)
Ans: C Category: Easy Section: 4.1
- Identify the *major* ionic species present in an aqueous solution of Na_2CO_3 .
A) Na_2^+ , CO_3^{2-} D) Na^+ , C^+ , O^{2-}
B) Na_2^+ , C^{2-} , O_3 E) Na^+ , CO_3^{2-}
C) Na^+ , C^{4+} , O_3^{2-}
Ans: E Category: Easy Section: 4.1

9. Identify the *major* ionic species present in an aqueous solution of K_2SO_4 .
 A) K^{2+}, S^{6+}, O_4^{8-} D) $2K^+, S^{6+}, 4O^{2-}$
 B) $K^{2+}, S^{6+}, 4O^{2-}$ E) $2K^+, SO_4^{2-}$
 C) $2K^+, S^{6+}, O_4^{8-}$
 Ans: E Category: Easy Section: 4.1
10. The *distinguishing* characteristic of all electrolyte solutions is that they
 A) contain molecules. D) always contain acids.
 B) conduct electricity. E) conduct heat.
 C) react with other solutions.
 Ans: B Category: Easy Section: 4.1
11. Based on the solubility rules, which one of the following compounds should be *insoluble* in water?
 A) NaCl B) $MgBr_2$ C) $FeCl_2$ D) AgBr E) $ZnCl_2$
 Ans: D Category: Easy Section: 4.2
12. Based on the solubility rules, which one of the following compounds should be *insoluble* in water?
 A) Na_2SO_4 B) $BaSO_4$ C) $CuSO_4$ D) $MgSO_4$ E) Rb_2SO_4
 Ans: B Category: Easy Section: 4.2
13. Based on the solubility rules, which one of the following compounds should be *insoluble* in water?
 A) $CaCO_3$ B) $(NH_4)_2CO_3$ C) Na_2CO_3 D) K_2CO_3 E) KNO_3
 Ans: A Category: Easy Section: 4.2
14. Based on the solubility rules, which one of the following should be *soluble* in water?
 A) Hg_2Cl_2 B) Na_2S C) Ag_2CO_3 D) Ag_2S E) $BaSO_4$
 Ans: B Category: Easy Section: 4.2
15. Based on the solubility rules, which one of the following should be *soluble* in water?
 A) AgBr B) AgCl C) Ag_2CO_3 D) $AgNO_3$ E) Ag_2S
 Ans: D Category: Easy Section: 4.2
16. Based on the solubility rules, which one of the following should be *soluble* in water?
 A) $(NH_4)_3PO_4$ B) $Ca_3(PO_4)_2$ C) $AlPO_4$ D) Ag_3PO_4 E) $Mg_3(PO_4)_2$
 Ans: A Category: Easy Section: 4.2
17. Based on the solubility rules, which one of the following should be *soluble* in water?
 A) $CaSO_4$ B) $BaSO_4$ C) $PbSO_4$ D) K_2SO_4 E) AgCl
 Ans: D Category: Easy Section: 4.2

18. Based on the solubility rules, which of the following will occur when a solution containing about 0.1 g of $\text{Pb}(\text{NO}_3)_2(\text{aq})$ is mixed with a solution containing 0.1 g of $\text{KI}(\text{aq})$ /100 mL?

- A) KNO_3 will precipitate; Pb^{2+} and I^- are spectator ions.
- B) No precipitate will form.
- C) $\text{Pb}(\text{NO}_3)_2$ will precipitate; K^+ and I^- are spectator ions.
- D) PbI_2 will precipitate; K^+ and NO_3^- are spectator ions.
- E) Pb^{2+} and I^- are spectator ions, and PbI_2 will precipitate.

Ans: D Category: Medium Section: 4.2

19. Based on the solubility rules, which of the following will occur if solutions of $\text{CuSO}_4(\text{aq})$ and $\text{BaCl}_2(\text{aq})$ are mixed?

- A) CuCl_2 will precipitate; Ba^{2+} and SO_4^{2-} are spectator ions.
- B) CuSO_4 will precipitate; Ba^{2+} and Cl^- are spectator ions.
- C) BaSO_4 will precipitate; Cu^{2+} and Cl^- are spectator ions.
- D) BaCl_2 will precipitate; Cu^{2+} and SO_4^{2-} are spectator ions.
- E) No precipitate will form.

Ans: C Category: Medium Section: 4.2

20. Based on the solubility rules, which of the following will occur when solutions of $\text{ZnSO}_4(\text{aq})$ and $\text{MgCl}_2(\text{aq})$ are mixed?

- A) ZnCl_2 will precipitate; Mg^{2+} and SO_4^{2-} will be spectator ions.
- B) ZnSO_4 will precipitate; Mg^{2+} and Cl^- will be spectator ions.
- C) MgSO_4 will precipitate; Zn^{2+} and Cl^- will be spectator ions.
- D) MgCl_2 will precipitate; Zn^{2+} and SO_4^{2-} will be spectator ions.
- E) No precipitate will form.

Ans: E Category: Medium Section: 4.2

21. Which of the following is the correct *net ionic equation* for the reaction that occurs when solutions of $\text{Pb}(\text{NO}_3)_2$ and NH_4Cl are mixed?

- A) $\text{Pb}(\text{NO}_3)_2(\text{aq}) + 2\text{NH}_4\text{Cl}(\text{aq}) \rightarrow \text{NH}_4\text{NO}_3(\text{aq}) + \text{PbCl}_2(\text{s})$
- B) $\text{Pb}^{2+}(\text{aq}) + 2\text{Cl}^-(\text{aq}) \rightarrow \text{PbCl}_2(\text{s})$
- C) $\text{Pb}^{2+}(\text{aq}) + 2\text{NO}_3^-(\text{aq}) + 2\text{NH}_4^+(\text{aq}) + 2\text{Cl}^-(\text{aq}) \rightarrow 2\text{NH}_4^+(\text{aq}) + 2\text{NO}_3^-(\text{aq}) + \text{PbCl}_2(\text{s})$
- D) $\text{NH}_4^+(\text{aq}) + \text{NO}_3^-(\text{aq}) \rightarrow 2\text{NH}_4\text{NO}_3(\text{s})$
- E) No reaction occurs when the solutions are mixed.

Ans: B Category: Medium Section: 4.2

22. The common constituent in all acid solutions is

- A) H_2 B) H^+ C) OH^- D) H_2SO_4 E) Cl^-

Ans: B Category: Easy Section: 4.3

23. Which of the following compounds is a *weak acid*?

- A) HF B) HCl C) HBr D) HI E) HClO_4

Ans: A Category: Easy Section: 4.1

24. Identify the *major* ions present in an aqueous LiOH solution.
 A) Li^{2+} , O^- , H^- B) Li^+ , OH^- C) LiO^- , H^+ D) Li^+ , O^{2-} , H^+ E) Li^- , OH^+
 Ans: B Category: Easy Section: 4.3
25. Identify the *major* ions present in an aqueous HNO_3 solution.
 A) HN^+ , O^{2-} B) OH^- , NO_3^- C) OH^- , NO D) H^+ , N^{3-} , O^{2-} E) H^+ , NO_3^-
 Ans: E Category: Easy Section: 4.3
26. Identify the *major* ionic species present in an aqueous solution of H_2SO_4 .
 A) S^{6+} , O_3^{6-} (plus H_2O as a neutral species)
 B) H^+ , OH^- , S^{6+} , 3O^{2-}
 C) 2H^+ , S^{6+} , 4O^{2-}
 D) H^+ , HSO_4^-
 E) 2H^+ , SO_4^{2-}
 Ans: D Category: Medium Section: 4.3
27. What is the correct formula of the salt formed in the neutralization reaction of hydrochloric acid with calcium hydroxide?
 A) CaO B) CaCl_2 C) CaH_2 D) CaCl E) CaClH
 Ans: B Category: Medium Section: 4.3
28. What is the chemical formula of the salt produced by the neutralization of hydrobromic acid with magnesium hydroxide?
 A) MgBr B) Mg_2Br_3 C) Mg_3Br_2 D) Mg_2Br E) MgBr_2
 Ans: E Category: Medium Section: 4.3
29. What is the chemical formula of the salt produced by the neutralization of nitric acid with calcium hydroxide?
 A) CaNO_3 B) $\text{Ca}_2(\text{NO}_3)_3$ C) $\text{Ca}_3(\text{NO}_3)_2$ D) Ca_2NO_3 E) $\text{Ca}(\text{NO}_3)_2$
 Ans: E Category: Medium Section: 4.3
30. What is the chemical formula of the salt produced by the *complete* neutralization of sodium hydroxide with sulfuric acid?
 A) Na_2SO_4 B) $\text{Na}_2(\text{SO}_4)_3$ C) $\text{Na}(\text{SO}_4)_2$ D) NaSO_3 E) Na_3SO_4
 Ans: A Category: Medium Section: 4.3
31. What is the chemical formula of the salt produced by the neutralization of potassium hydroxide with sulfuric acid?
 A) KSO_3 B) $\text{K}_2(\text{SO}_4)_3$ C) K_2SO_4 D) $\text{K}(\text{SO}_4)_2$ E) KSO_4
 Ans: C Category: Medium Section: 4.3
32. The oxidation number of N in NaNO_3 is
 A) +6 B) +5 C) +3 D) -3 E) None of the above.
 Ans: B Category: Medium Section: 4.4

33. The oxidation number of S in K_2SO_4 is
A) +6 B) +4 C) +2 D) -1 E) None of the above.
Ans: A Category: Medium Section: 4.4
34. The oxidation number of Mn in KMnO_4 is
A) +8 B) +7 C) +5 D) -7 E) -8
Ans: B Category: Medium Section: 4.4
35. The oxidation number of Fe in $\text{K}_3\text{Fe}(\text{CN})_6$ is
A) +3 B) +2 C) +1 D) -3 E) -4
Ans: A Category: Medium Section: 4.4
36. The oxidation number of Cr in $\text{Cr}_2\text{O}_7^{2-}$ is
A) -12 B) -7 C) -2 D) +6 E) +7
Ans: D Category: Medium Section: 4.4
37. The oxidation number of Cl in ClO_3^- is
A) -1 B) +7 C) +5 D) +3 E) None of the above.
Ans: C Category: Medium Section: 4.4
38. The oxidation number of Cl in ClO_4^- is
A) -1 B) +1 C) +3 D) +5 E) None of the above.
Ans: E Category: Medium Section: 4.4
39. The highest possible oxidation number of nitrogen is
A) +8 B) +5 C) +3 D) +1 E) -3
Ans: B Category: Medium Section: 4.4
40. For which one of the following acids is chlorine in the +5 oxidation state?
A) HCl B) HClO C) HClO_2 D) HClO_3 E) HClO_4
Ans: D Category: Medium Section: 4.4
41. The highest possible oxidation number of carbon is
A) +8 B) +6 C) +4 D) +2 E) -4
Ans: C Category: Medium Section: 4.4
42. Select the compound in which sulfur has its highest possible oxidation number.
A) H_2S B) SO_2 C) SCl_2 D) H_2SO_3 E) Na_2SO_4
Ans: E Category: Medium Section: 4.4
43. The oxidation number of N in N_2H_4 is
A) +4 B) -4 C) +2 D) -2 E) 0
Ans: D Category: Medium Section: 4.4

44. Which choice gives the correct oxidation numbers for all three elements in Rb_2SO_3 in the order that the elements are shown in the formula?

A) $-2, +6, -2$ B) $-1, +4, -3$ C) $+2, +4, -2$ D) $+1, +4, -2$ E) $+1, +6, -6$

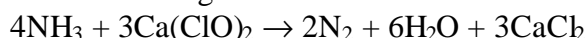
Ans: D Category: Medium Section: 4.4

45. Which choice gives the correct oxidation numbers for all three elements in $\text{Ca}(\text{ClO})_2$ in the order that the elements are shown in the formula?

A) $+2, +1, -2$ B) $+2, -2, +1$ C) $+2, -3, +2$ D) $-2, +2, -1$ E) $-2, +3, -2$

Ans: A Category: Medium Section: 4.4

46. In the following redox reaction



which element is oxidized and which is reduced?

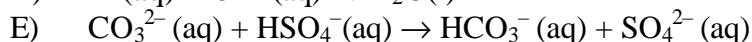
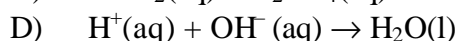
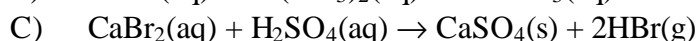
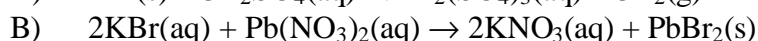
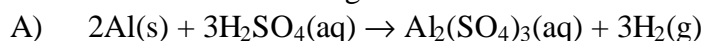
A) H is oxidized and N is reduced D) Cl is oxidized and O is reduced

B) N is oxidized and Cl is reduced E) Cl is oxidized and N is reduced

C) N is oxidized and O is reduced

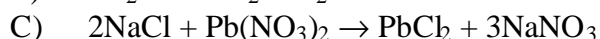
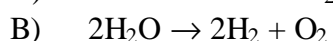
Ans: B Category: Medium Section: 4.4

47. Which one of the following is a *redox* reaction?



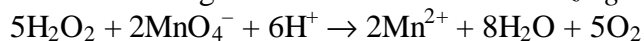
Ans: A Category: Medium Section: 4.4

48. Which of the following equations does *not* represent an oxidation-reduction reaction?



Ans: C Category: Medium Section: 4.4

49. In the following chemical reaction the *oxidizing agent* is



A) H_2O_2 B) MnO_4^- C) H^+ D) Mn^{2+} E) O_2

Ans: B Category: Difficult Section: 4.4

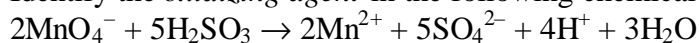
50. In the following chemical reaction the *oxidizing agent* is



A) S B) N_2 C) KNO_3 D) CaSO_4 E) CaCO_3

Ans: C Category: Difficult Section: 4.4

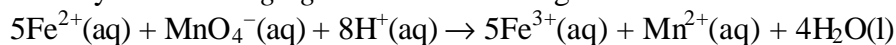
51. Identify the *oxidizing agent* in the following chemical reaction.



A) MnO_4^- B) H_2SO_3 C) Mn^{2+} D) SO_4^{2-} E) H^+

Ans: A Category: Difficult Section: 4.4

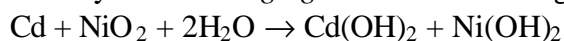
52. Identify the *reducing agent* in the following chemical reaction.



A) Fe^{2+} B) MnO_4^- C) H^+ D) Mn^{2+} E) Fe^{3+}

Ans: A Category: Difficult Section: 4.4

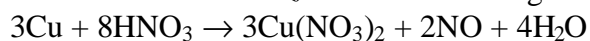
53. Identify the *reducing agent* in the following chemical reaction.



A) Cd B) NiO_2 C) H_2O D) $\text{Cd}(\text{OH})_2$ E) $\text{Ni}(\text{OH})_2$

Ans: A Category: Difficult Section: 4.4

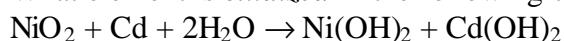
54. What element is *oxidized* in the following chemical reaction?



A) Cu B) H C) N D) O E) H_2O

Ans: A Category: Medium Section: 4.4

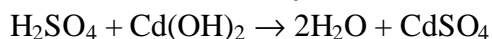
55. What element is *oxidized* in the following chemical reaction?



A) Ni B) Cd C) O D) H E) This is not a redox reaction.

Ans: B Category: Medium Section: 4.4

56. What element is *oxidized* in the following chemical reaction?



A) H B) S C) O D) Cd E) this is not a redox reaction

Ans: E Category: Medium Section: 4.4

57. What element is *reduced* in the following chemical reaction?



A) Cu B) H C) S D) O E) H_2O

Ans: C Category: Medium Section: 4.4

58. Identify the elements that are oxidized and reduced in the following reaction.



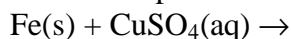
A) Br is oxidized and Cl is reduced D) O is oxidized and Cl is reduced

B) Cl is oxidized and H is reduced E) Cl is oxidized and Br is reduced

C) H is oxidized and O is reduced

Ans: A Category: Medium Section: 4.4

59. Predict the products of the following single replacement reaction.



- A) $\text{Cu}(s) + \text{FeSO}_4(aq)$ D) $\text{FeCuSO}_4(aq)$
 B) $\text{Fe}(s) + \text{Cu}(s) + \text{SO}_4(aq)$ E) $\text{FeO}(s) + \text{CuSO}_3(aq)$
 C) $\text{CuS}(s) + \text{Fe}_2\text{SO}_4(aq)$

Ans: A Category: Medium Section: 4.4

60. Which of the following is an example of a *disproportionation reaction*?

- A) $2\text{C}_2\text{H}_6(g) + 7\text{O}_2(g) \rightarrow 4\text{CO}_2(g) + 6\text{H}_2\text{O}(l)$
 B) $2\text{KBr}(aq) + \text{Cl}_2(g) \rightarrow 2\text{KCl}(aq) + \text{Br}_2(l)$
 C) $2\text{H}_2\text{O}_2(aq) \rightarrow 2\text{H}_2\text{O}(l) + \text{O}_2(g)$
 D) $\text{CaBr}_2(aq) + \text{H}_2\text{SO}_4(aq) \rightarrow \text{CaSO}_4(s) + 2\text{HBr}(g)$
 E) $2\text{Al}(s) + 3\text{H}_2\text{SO}_4(aq) \rightarrow \text{Al}_2(\text{SO}_4)_3(aq) + 3\text{H}_2(g)$

Ans: C Category: Medium Section: 4.4

61. Which of the following represents a *metal displacement reaction*?

- A) $2\text{NaN}_3(s) \rightarrow 2\text{Na}(s) + 3\text{N}_2(g)$
 B) $\text{Fe}_2\text{O}_3(s) + 2\text{Al}(s) \rightarrow 2\text{Fe}(s) + \text{Al}_2\text{O}_3(s)$
 C) $3\text{NO}_2(g) + \text{H}_2\text{O}(l) \rightarrow 2\text{HNO}_3(aq) + \text{NO}(g)$
 D) $2\text{P}(s) + 3\text{Cl}_2(g) \rightarrow 2\text{PCl}_3(g)$
 E) $2\text{ZnS}(s) + 3\text{O}_2(g) \rightarrow 2\text{ZnO}(s) + 2\text{SO}_2(g)$

Ans: B Category: Easy Section: 4.4

62. Which of the following represents a *halogen displacement reaction*?

- A) $2\text{KBr}(aq) + \text{Cl}_2(g) \rightarrow 2\text{KCl}(aq) + \text{Br}_2(l)$
 B) $2\text{Na}(s) + 2\text{H}_2\text{O}(l) \rightarrow 2\text{NaOH}(aq) + \text{H}_2(g)$
 C) $\text{CaBr}_2(aq) + \text{H}_2\text{SO}_4(aq) \rightarrow \text{CaSO}_4(s) + 2\text{HBr}(g)$
 D) $2\text{KNO}_3(s) \rightarrow 2\text{KNO}_2(s) + \text{O}_2(g)$
 E) $2\text{LiOH}(aq) + \text{H}_2\text{SO}_4(aq) \rightarrow \text{Li}_2\text{SO}_4(aq) + 2\text{H}_2\text{O}(l)$

Ans: A Category: Easy Section: 4.4

63. Which of the following represents a *precipitation reaction*?

- A) $2\text{H}_2(g) + \text{O}_2(g) \rightarrow 2\text{H}_2\text{O}(l)$
 B) $\text{CaBr}_2(aq) + \text{H}_2\text{SO}_4(aq) \rightarrow \text{CaSO}_4(s) + 2\text{HBr}(g)$
 C) $2\text{KNO}_3(s) \rightarrow 2\text{KNO}_2(s) + \text{O}_2(g)$
 D) $2\text{KBr}(aq) + \text{Cl}_2(g) \rightarrow 2\text{KCl}(aq) + \text{Br}_2(l)$
 E) $2\text{Al}(s) + 3\text{H}_2\text{SO}_4(aq) \rightarrow \text{Al}_2(\text{SO}_4)_3(aq) + 3\text{H}_2(g)$

Ans: B Category: Easy Section: 4.2

64. Which of the following represents an *acid-base neutralization reaction*?

- A) $2\text{Al}(\text{s}) + 3\text{H}_2\text{SO}_4(\text{aq}) \rightarrow \text{Al}_2(\text{SO}_4)_3(\text{aq}) + 3\text{H}_2(\text{g})$
- B) $\text{SO}_2(\text{g}) + \text{H}_2\text{O}(\text{l}) \rightarrow \text{H}_2\text{SO}_3(\text{g})$
- C) $\text{LiOH}(\text{aq}) + \text{HNO}_3(\text{aq}) \rightarrow \text{LiNO}_3(\text{aq}) + \text{H}_2\text{O}(\text{l})$
- D) $2\text{KBr}(\text{aq}) + \text{Cl}_2(\text{g}) \rightarrow 2\text{KCl}(\text{aq}) + \text{Br}_2(\text{l})$
- E) $\text{CaBr}_2(\text{aq}) + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow \text{CaSO}_4(\text{s}) + 2\text{HBr}(\text{g})$

Ans: C Category: Medium Section: 4.4

65. Which of the following represents a *hydrogen displacement reaction*?

- A) $2\text{C}_2\text{H}_6(\text{g}) + 7\text{O}_2(\text{g}) \rightarrow 4\text{CO}_2(\text{g}) + 6\text{H}_2\text{O}(\text{l})$
- B) $2\text{KBr}(\text{aq}) + \text{Cl}_2(\text{g}) \rightarrow 2\text{KCl}(\text{aq}) + \text{Br}_2(\text{l})$
- C) $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g})$
- D) $\text{CaBr}_2(\text{aq}) + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow \text{CaSO}_4(\text{s}) + 2\text{HBr}(\text{g})$
- E) $2\text{Al}(\text{s}) + 3\text{H}_2\text{SO}_4(\text{aq}) \rightarrow \text{Al}_2(\text{SO}_4)_3(\text{aq}) + 3\text{H}_2(\text{g})$

Ans: E Category: Medium Section: 4.4

66. Which of the following represents a *combustion reaction*?

- A) $2\text{C}_2\text{H}_6(\text{g}) + 7\text{O}_2(\text{g}) \rightarrow 4\text{CO}_2(\text{g}) + 6\text{H}_2\text{O}(\text{l})$
- B) $\text{LiOH}(\text{aq}) + \text{HNO}_3(\text{aq}) \rightarrow \text{LiNO}_3(\text{aq}) + \text{H}_2\text{O}(\text{l})$
- C) $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g})$
- D) $2\text{Na}(\text{s}) + 2\text{H}_2\text{O}(\text{l}) \rightarrow 2\text{NaOH}(\text{aq}) + \text{H}_2(\text{g})$
- E) $2\text{Al}(\text{s}) + 3\text{H}_2\text{SO}_4(\text{aq}) \rightarrow \text{Al}_2(\text{SO}_4)_3(\text{aq}) + 3\text{H}_2(\text{g})$

Ans: A Category: Easy Section: 4.4

67. What mass of K_2CO_3 is needed to prepare 200. mL of a solution having a potassium ion concentration of 0.150 M?

- A) 4.15 g B) 10.4 g C) 13.8 g D) 2.07 g E) 1.49 g

Ans: D Category: Medium Section: 4.5

68. What mass of Na_2SO_4 is needed to prepare 350. mL of a solution having a sodium ion concentration of 0.125 M?

- A) 3.11 g B) 24.9 g C) 12.4 g D) 6.21 g E) 8.88 g

Ans: A Category: Medium Section: 4.5

69. What mass of Li_3PO_4 is needed to prepare 500. mL of a solution having a lithium ion concentration of 0.175 M?

- A) 6.75 g B) 10.1 g C) 19.3 g D) 30.4 g E) 3.38 g

Ans: E Category: Medium Section: 4.5

70. A 50.0 mL sample of 0.436 M NH_4NO_3 is diluted with water to a total volume of 250.0 mL. What is the ammonium nitrate concentration in the resulting solution?

- A) 21.8 M B) 0.459 M C) 2.18×10^{-2} M D) 8.72×10^{-2} M E) 0.109 M

Ans: D Category: Medium Section: 4.5

Chapter 4: Reactions in Aqueous Solution

71. A 20.00 mL sample of 0.1015 M nitric acid is introduced into a flask, and water is added until the volume of the solution reaches 250. mL. What is the concentration of nitric acid in the final solution?

- A) 1.27 M
 B) 8.12×10^{-3} M
 C) 0.406 M
 D) 3.25×10^{-2} M
 E) 5.08×10^{-4} M

Ans: B Category: Medium Section: 4.5

72. A 3.682 g sample of KClO_3 is dissolved in enough water to give 375. mL of solution. What is the chlorate ion concentration in this solution?

- A) 3.00×10^{-2} M
 B) 4.41×10^{-2} M
 C) 0.118 M
 D) 1.65×10^{-2} M
 E) 8.01×10^{-2} M

Ans: E Category: Medium Section: 4.5

73. A 4.691 g sample of MgCl_2 is dissolved in enough water to give 750. mL of solution. What is the magnesium ion concentration in this solution?

- A) 3.70×10^{-2} M
 B) 1.05×10^{-2} M
 C) 6.57×10^{-2} M
 D) 4.93×10^{-2} M
 E) 0.131 M

Ans: C Category: Medium Section: 4.5

74. A 0.9182 g sample of CaBr_2 is dissolved in enough water to give 500. mL of solution. What is the calcium ion concentration in this solution?

- A) 9.19×10^{-3} M
 B) 2.30×10^{-3} M
 C) 2.72×10^{-3} M
 D) 4.59×10^{-3} M
 E) 1.25×10^{-3} M

Ans: A Category: Medium Section: 4.5

75. 35.0 mL of 0.255 M nitric acid is added to 45.0 mL of 0.328 M $\text{Mg}(\text{NO}_3)_2$. What is the concentration of nitrate ion in the final solution?

- A) 0.481 M B) 0.296 M C) 0.854 M D) 1.10 M E) 0.0295 M

Ans: A Category: Difficult Section: 4.5

76. 17.5 mL of a 0.1050 M Na_2CO_3 solution is added to 46.0 mL of 0.1250 M NaCl . What is the concentration of sodium ion in the final solution?

- A) 0.205 M B) 0.119 M C) 0.539 M D) 0.148 M E) 0.165 M

Ans: D Category: Difficult Section: 4.5

77. 25.0 mL of a 0.2450 M NH_4Cl solution is added to 55.5 mL of 0.1655 M FeCl_3 . What is the concentration of chloride ion in the final solution?

- A) 0.607 M B) 0.418 M C) 1.35 M D) 0.190 M E) 0.276 M

Ans: B Category: Difficult Section: 4.5

Chapter 4: Reactions in Aqueous Solution

78. When 38.0 mL of 0.1250 M H₂SO₄ is added to 100. mL of a solution of PbI₂, a precipitate of PbSO₄ forms. The PbSO₄ is then filtered from the solution, dried, and weighed. If the recovered PbSO₄ is found to have a mass of 0.0471 g, what was the concentration of iodide ions in the original solution?
- A) 3.10×10^{-4} M D) 3.11×10^{-3} M
B) 1.55×10^{-4} M E) 1.55×10^{-3} M
C) 6.20×10^{-3} M
- Ans: D Category: Difficult Section: 4.6
79. When 50.0 mL of a 0.3000 M AgNO₃ solution is added to 50.0 mL of a solution of MgCl₂, an AgCl precipitate forms immediately. The precipitate is then filtered from the solution, dried, and weighed. If the recovered AgCl is found to have a mass of 0.1183 g, what as the concentration of magnesium ions in the original MgCl₂ solution?
- A) 0.300 M D) 2.06×10^{-5} M
B) 8.25×10^{-3} M E) 4.13×10^{-3} M
C) 1.65×10^{-2} M
- Ans: B Category: Difficult Section: 4.6
80. When 20.0 mL of a 0.250 M (NH₄)₂S solution is added to 150.0 mL of a solution of Cu(NO₃)₂, a CuS precipitate forms. The precipitate is then filtered from the solution, dried, and weighed. If the recovered CuS is found to have a mass of 0.3491 g, what was the concentration of copper ions in the original Cu(NO₃)₂ solution?
- A) 3.65×10^{-3} M D) 4.87×10^{-2} M
B) 1.22×10^{-2} M E) 2.43×10^{-2} M
C) 3.33×10^{-2} M
- Ans: E Category: Difficult Section: 4.6
81. 34.62 mL of 0.1510 M NaOH was needed to neutralize 50.0 mL of an H₂SO₄ solution. What is the concentration of the original sulfuric acid solution?
- A) 0.0229 M B) 0.218 M C) 0.0523 M D) 0.209 M E) 0.105 M
- Ans: C Category: Medium Section: 4.7
82. The concentration of oxalate ion (C₂O₄²⁻) in a sample can be determined by titration with a solution of permanganate ion (MnO₄⁻) of known concentration. The net ionic equation for this reaction is
- $$2\text{MnO}_4^- + 5\text{C}_2\text{O}_4^{2-} + 16\text{H}^+ \rightarrow 2\text{Mn}^{2+} + 8\text{H}_2\text{O} + 10\text{CO}_2$$
- A 30.00 mL sample of an oxalate solution is found to react completely with 21.93 mL of a 0.1725 M solution of MnO₄⁻. What is the oxalate ion concentration in the sample?
- A) 0.02914 M B) 0.4312 M C) 0.1821 M D) 0.3152 M E) 0.05044 M
- Ans: D Category: Medium Section: 4.8

83. One method of determining the concentration of hydrogen peroxide (H_2O_2) in a solution is through titration with iodide ion. The net ionic equation for this reaction is

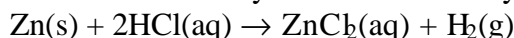


A 50.00 mL sample of a hydrogen peroxide solution is found to react completely with 37.12 mL of a 0.1500 M KI solution. What is the concentration of hydrogen peroxide in the sample?

- A) 5.568×10^{-2} M D) 0.4041 M
 B) 0.2227 M E) 0.1114 M
 C) 0.1010 M

Ans: A Category: Medium Section: 4.8

84. Zinc dissolves in hydrochloric acid to yield hydrogen gas:

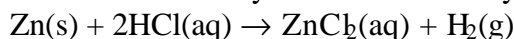


What mass of hydrogen gas is produced when a 7.35 g chunk of zinc dissolves in 500. mL of 1.200M HCl?

- A) 0.605 g B) 0.113 g C) 0.302 g D) 0.453 g E) 0.227 g

Ans: E Category: Medium Section: 4.8

85. Zinc dissolves in hydrochloric acid to yield hydrogen gas:



When a 12.7 g chunk of zinc dissolves in 500. mL of 1.450M HCl, what is the concentration of hydrogen ions remaining in the final solution?

- A) 0.776 M B) 0.388 M C) 0.674 M D) 1.06 M E) 0 M

Ans: C Category: Medium Section: 4.8

86. Lithium metal dissolves in water to yield hydrogen gas and aqueous lithium hydroxide.

What is the final concentration of hydroxide ions when 5.500 g of lithium metal is dropped into 750. mL of water?

- A) 1.06 M B) 0.528 M C) 2.11 M D) 0.792 M E) 0.943 M

Ans: A Category: Medium Section: 4.8

87. When solid iron(II) hydroxide is added to water, the resulting solution contains 1.4×10^{-3} g of dissolved iron(II) hydroxide per liter of solution. What is the hydroxide ion concentration in this solution?

- A) 7.8×10^{-6} M D) 3.1×10^{-5} M
 B) 1.6×10^{-5} M E) 4.0×10^{-3} M
 C) 2.5×10^{-10} M

Ans: D Category: Difficult Section: 4.5

88. A 250. mL sample of 0.0328M HCl is partially neutralized by the addition of 100. mL of 0.0245M NaOH. Find the concentration of hydrochloric acid in the resulting solution.

- A) 0.00700 M B) 0.0164 M C) 0.0383 M D) 0.0230 M E) 0.0575 M

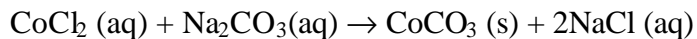
Ans: B Category: Difficult Section: 4.7

89. A 350. mL sample of 0.276M HNO_3 is partially neutralized by 125 mL of 0.0120M Ca(OH)_2 . Find the concentration of nitric acid in the resulting solution.
 A) 0.210 M B) 0.00632 M C) 0.203 M D) 0.0240 M E) 0.197 M
 Ans: E Category: Difficult Section: 4.7
90. 158 mL of a 0.148M NaCl solution is added to 228 mL of a 0.369M NH_4NO_3 solution. The concentration of ammonium ions in the resulting mixture is
 A) 0.157 M B) 0.218 M C) 0.625 M D) 0.369 M E) 0 M
 Ans: B Category: Medium Section: 4.5
91. 1.40 g of silver nitrate is dissolved in 125 mL of water. To this solution is added 5.00 mL of 1.50M hydrochloric acid, and a precipitate forms. Find the concentration of silver ions remaining in solution.
 A) 5.7×10^{-3} M D) 0.121M
 B) 6.34×10^{-2} M E) 5.9×10^{-3} M
 C) 5.77×10^{-2} M
 Ans: A Category: Difficult Section: 4.6
92. Calcium sulfate dihydrate (commonly known as gypsum) dissolves in cold water to the extent of 0.241 g per 100. cm^3 . What is the concentration of calcium ions in this solution?
 A) 1.77×10^{-2} M D) 3.54×10^{-2} M
 B) 2.80×10^{-2} M E) 1.40×10^{-2} M
 C) 1.77×10^{-3} M
 Ans: E Category: Difficult Section: 4.5
93. Calcium nitrate tetrahydrate dissolves in cold water to the extent of 266 g per 100. cm^3 . What is the concentration of nitrate ions in this solution?
 A) 32.4M B) 22.5M C) 11.3M D) 16.2M E) 8.10M
 Ans: B Category: Difficult Section: 4.5
94. Define *solution*, *solute*, and *solvent*.
 Ans: A *solution* is a homogeneous mixture of two or more substances.
 The substance present in a smaller amount is called the *solute*, while the substance present in the larger amount is called the *solvent*.
 Category: Easy Section: 4.1
95. Identify the following compound as an *electrolyte* or *nonelectrolyte*: NaOH .
 Ans: electrolyte
 Category: Easy Section: 4.1
96. Identify the following compound as an *electrolyte* or *nonelectrolyte*: H_2SO_4 .
 Ans: electrolyte
 Category: Easy Section: 4.1

97. Identify the following compound as an *electrolyte* or *nonelectrolyte*: Methanol (CH_3OH).
Ans: nonelectrolyte
Category: Easy Section: 4.1
98. Identify the following compound as an *electrolyte* or *nonelectrolyte*: $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ (sucrose).
Ans: nonelectrolyte
Category: Easy Section: 4.1
99. Identify the following compound as an *electrolyte* or *nonelectrolyte*: MgCl_2 .
Ans: electrolyte
Category: Easy Section: 4.1
100. Identify the following compound as a *strong electrolyte*, *weak electrolyte*, or *nonelectrolyte*: CH_3OH (methanol).
Ans: nonelectrolyte
Category: Easy Section: 4.1
101. Identify the following compound as a *strong electrolyte*, *weak electrolyte*, or *nonelectrolyte*: CH_3COOH .
Ans: weak electrolyte
Category: Easy Section: 4.1
102. Identify the following compounds as a *strong electrolytes*, *weak electrolytes*, or *nonelectrolytes*: KNO_3 , KNO_2 , HNO_3 , HNO_2 ,
Ans: KNO_3 , KNO_2 , and HNO_3 are strong electrolytes; HNO_2 is a weak electrolyte.
Category: Medium Section: 4.3
103. Identify the following compound as a *strong electrolyte*, *weak electrolyte*, or *nonelectrolyte*: NH_3 .
Ans: weak electrolyte
Category: Medium Section: 4.1
104. Identify the following compound as a *strong electrolyte*, *weak electrolyte*, or *nonelectrolyte*: NH_4Cl .
Ans: strong electrolyte
Category: Easy Section: 4.1
105. Define and illustrate with an example the difference between an *electrolyte* and a *nonelectrolyte*.
Ans: (Answers will vary.) An electrolyte is a substance that, when dissolved in water, results in a solution that can conduct electricity. An example is sodium hydrogen carbonate. A nonelectrolyte does not conduct electricity when dissolved in water. An example would be sugar.
Category: Medium Section: 4.1

106. Define *precipitate* and illustrate with an example.

Ans: (Answers will vary.) A precipitate is an insoluble solid that separates from a solution.



In this reaction, CoCO_3 is a precipitate.

Category: Medium Section: 4.2

107. Give an example of a *monoprotic acid*.

Ans: HNO_3 (for example)

Category: Easy Section: 4.3

108. Give an example of a *diprotic acid*.

Ans: H_2CO_3 (for example)

Category: Easy Section: 4.3

109. Name and give the formulas for six *strong acids*.

Ans: hydrochloric acid, HCl ; hydrobromic acid, HBr ; hydroiodic acid, HI ; nitric acid, HNO_3 ; sulfuric acid, H_2SO_4 ; perchloric acid, HClO_4

Category: Easy Section: 4.3

110. Give an example of a *triprotic acid*.

Ans: H_3PO_4

Category: Easy Section: 4.3

111. Write the *net ionic equation* for the following reaction. Aqueous iron(III) sulfate is added to aqueous sodium sulfide to produce solid iron(III) sulfide and aqueous sodium sulfate.



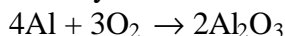
Category: Medium Section: 4.2

112. Determine the oxidation number of each of the elements in $\text{Cs}_2\text{Cr}_2\text{O}_7$?

Ans: the oxidation number of Cs is +1; the oxidation number of Cr is +6; the oxidation number of O is -2

Category: Easy Section: 4.4

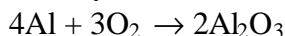
113. Identify the element being oxidized in the following reaction.



Ans: Al

Category: Medium Section: 4.4

114. Identify the element being reduced in the following reaction.



Ans: O

Category: Medium Section: 4.4

115. Identify the oxidizing agent in the following reaction.
 $4\text{Al} + 3\text{O}_2 \rightarrow 2\text{Al}_2\text{O}_3$
 Ans: O_2
 Category: Medium Section: 4.4
116. Identify the reducing agent in the following reaction.
 $4\text{Al} + 3\text{O}_2 \rightarrow 2\text{Al}_2\text{O}_3$
 Ans: Al
 Category: Medium Section: 4.4
117. Identify the element being oxidized in the following reaction.
 $2\text{KBr} + \text{F}_2 \rightarrow \text{Br}_2 + 2\text{KF}$
 Ans: Br
 Category: Medium Section: 4.4
118. Identify the element being reduced in the following reaction.
 $2\text{KBr} + \text{F}_2 \rightarrow \text{Br}_2 + 2\text{KF}$
 Ans: F
 Category: Medium Section: 4.4
119. Identify the oxidizing agent in the following reaction.
 $2\text{KBr} + \text{F}_2 \rightarrow \text{Br}_2 + 2\text{KF}$
 Ans: F_2
 Category: Medium Section: 4.4
120. Identify the reducing agent in the following reaction.
 $2\text{KBr} + \text{F}_2 \rightarrow \text{Br}_2 + 2\text{KF}$
 Ans: Br^- (or KBr)
 Category: Medium Section: 4.4
121. Determine the oxidation number of each of the elements BaNaPO_4 ?
 Ans: the oxidation number of Ba +2; the oxidation number of Na is +1; the oxidation number of P is +5; the oxidation number of O is -2
 Category: Easy Section: 4.4
122. Determine the oxidation number of each of the elements in K_2TaF_7 ?
 Ans: the oxidation number of K is +1; the oxidation number of Ta is +5; the oxidation number of F is -1
 Category: Easy Section: 4.4
123. Thorium metal is prepared by reacting thorium oxide with calcium.
 $\text{ThO}_2 + 2\text{Ca} \rightarrow \text{Th} + 2\text{CaO}$
 Which substance is reduced in this process?
 Ans: Th^{4+} is reduced
 Category: Medium Section: 4.4

124. Thorium metal is prepared by reacting thorium oxide with calcium.
 $\text{ThO}_2 + 2\text{Ca} \rightarrow \text{Th} + 2\text{CaO}$
What is the reducing agent in this process?
Ans: Ca
Category: Medium Section: 4.4
125. Thorium metal is prepared by reacting thorium oxide with calcium.
 $\text{ThO}_2 + 2\text{Ca} \rightarrow \text{Th} + 2\text{CaO}$
Which substance is oxidized in this process?
Ans: Ca
Category: Medium Section: 4.4
126. Thorium metal is prepared by reacting thorium oxide with calcium.
 $\text{ThO}_2 + 2\text{Ca} \rightarrow \text{Th} + 2\text{CaO}$
What is the oxidizing agent in this process?
Ans: ThO_4
Category: Medium Section: 4.4
127. Batteries in our cars generate electricity by the following chemical reaction.
 $\text{Pb} + \text{PbO}_2 + 2\text{H}_2\text{SO}_4 \rightarrow 2\text{PbSO}_4 + 2\text{H}_2\text{O}$
Which substance is reduced in this process?
Ans: Pb^{4+}
Category: Medium Section: 4.4
128. Batteries in our cars generate electricity by the following chemical reaction.
 $\text{Pb} + \text{PbO}_2 + 2\text{H}_2\text{SO}_4 \rightarrow 2\text{PbSO}_4 + 2\text{H}_2\text{O}$
What is the reducing agent in this process?
Ans: Pb
Category: Medium
129. Batteries in our cars generate electricity by the following chemical reaction.
 $\text{Pb} + \text{PbO}_2 + 2\text{H}_2\text{SO}_4 \rightarrow 2\text{PbSO}_4 + 2\text{H}_2\text{O}$
Which substance is oxidized in this process?
Ans: Pb
Category: Medium Section: 4.4
130. Batteries in our cars generate electricity by the following chemical reaction.
 $\text{Pb} + \text{PbO}_2 + 2\text{H}_2\text{SO}_4 \rightarrow 2\text{PbSO}_4 + 2\text{H}_2\text{O}$
What is the oxidizing agent in this process?
Ans: PbO_2
Category: Medium Section: 4.4

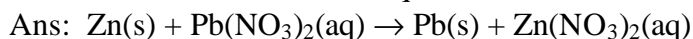
131. Describe the procedure used to make 3.0 liters of a 2.0 M KCl solution, starting with solid KCl and water.
Ans: Determine the molar mass of KCl, which is 74.55 g/mol; weigh out 447.3 grams (6 mol) of KCl; dissolve the KCl in enough water to form exactly 3 liters of solution.
Category: Medium Section: 4.5
132. What is the molarity of a solution that contains 5.0 moles of solute in 2.00 liters of solution?
Ans: 2.5 M
Category: Easy Section: 4.5
133. The solubility of $\text{Ba}(\text{NO}_3)_2$ is 130.5 grams per liter at 0°C . How many moles of dissolved salt are present in 4.0 liters of a saturated solution of $\text{Ba}(\text{NO}_3)_2$ at 0°C ?
Ans: 2.0 moles
Category: Medium Section: 4.5
134. What is the molar concentration of chloride ions in a solution prepared by mixing 100. mL of 2.0 M KCl with 50. mL of a 1.5 M CaCl_2 solution?
Ans: 2.3 M
Category: Difficult
135. What volume of concentrated nitric acid (15.0 M) is required to make 100. mL of a 3.0 M nitric acid solution?
Ans: 20. mL
Category: Medium Section: 4.5
136. During a titration the following data were collected. A 10. mL portion of an unknown monoprotic acid solution was titrated with 1.0 M NaOH; 40. mL of the base were required to neutralize the sample. What is the molarity of the acid solution?
Ans: 4.0 M
Category: Medium Section: 4.7
137. During a titration the following data were collected. A 10. mL portion of an unknown monoprotic acid solution was titrated with 1.0 M NaOH; 40. mL of the base were required to neutralize the sample. How many moles of acid are present in 2.0 liters of this unknown solution?
Ans: 8.0 moles
Category: Medium Section: 4.7
138. If 145 grams of potassium nitrate were added to water to make 1,500 mL of solution, what would be the molarity of the resulting solution?
Ans: 0.956 M
Category: Medium Section: 4.5

139. During a titration the following data were collected. A 50.0 mL portion of an HCl solution was titrated with 0.500 M NaOH; 200. mL of the base was required to neutralize the sample. How many grams of HCl are present in 500. mL of this acid solution?
Ans: 36.5 g
Category: Medium Section: 4.7
140. Identify the following as either a *good* or *poor* conductor of electricity: a crystal of Na_2SO_4 .
Ans: poor
Category: Easy Section: 4.1
141. Identify the following as either a *good* or *poor* conductor of electricity: an aqueous solution of Na_2SO_4 .
Ans: good
Category: Easy Section: 4.1
142. Identify the following as either a *good* or *poor* conductor of electricity: gasoline (C_8H_{18}).
Ans: poor
Category: Easy Section: 4.1
143. Which substance is acting as a Brønsted acid in the following reaction?
 $\text{HSO}_4^- + \text{NH}_4^+ \rightarrow \text{H}_2\text{SO}_4 + \text{NH}_3$
Ans: NH_4^+
Category: Medium Section: 4.3
144. Identify the Brønsted acid in the following reaction.
 $\text{NH}_3 + \text{H}_2\text{O} \rightarrow \text{NH}_4^+ + \text{OH}^-$
Ans: H_2O
Category: Medium Section: 4.3
145. Write balanced molecular and net ionic equations for the reaction that would occur between $\text{CaCl}_2(\text{aq})$ and $\text{Na}_2\text{CO}_3(\text{aq})$. Be sure to include the correct states in your final equations. If no reaction is expected, write “no reaction.”
Ans: Molecular equation: $\text{CaCl}_2(\text{aq}) + \text{Na}_2\text{CO}_3(\text{aq}) \rightarrow \text{CaCO}_3(\text{s}) + 2\text{NaCl}(\text{aq})$
Net ionic equation: $\text{Ca}^{2+}(\text{aq}) + \text{CO}_3^{2-}(\text{aq}) \rightarrow \text{CaCO}_3(\text{s})$
Category: Medium Section: 4.2
146. Write balanced molecular and net ionic equations for the acid-base neutralization reaction between $\text{H}_3\text{PO}_4(\text{aq})$ and $\text{Ba}(\text{OH})_2(\text{aq})$. Be sure to include the correct states in your final equations. If no reaction is expected, write “no reaction.”
Ans: Molecular equation: $2\text{H}_3\text{PO}_4(\text{aq}) + 3\text{Ba}(\text{OH})_2(\text{aq}) \rightarrow \text{Ba}_3(\text{PO}_4)_2(\text{s}) + 6\text{H}_2\text{O}(\text{l})$
Net ionic equation: $2\text{H}_3\text{PO}_4(\text{aq}) + 3\text{Ba}^{2+}(\text{aq}) + 6\text{OH}^-(\text{aq}) \rightarrow \text{Ba}_3(\text{PO}_4)_2(\text{s}) + 6\text{H}_2\text{O}(\text{l})$
Category: Difficult Section: 4.3

147. Write balanced molecular and net ionic equations for the reaction that would occur between Al(s) and Co(NO₃)₂(aq). Be sure to include the correct states in your final equations. If no reaction is expected, write “no reaction.”
Ans: Molecular equation: $2\text{Al(s)} + 3\text{Co(NO}_3)_2\text{(aq)} \rightarrow 2\text{Al(NO}_3)_3\text{(aq)} + 3\text{Co(s)}$
Net ionic equation: $2\text{Al(s)} + 3\text{Co}^{2+}\text{(aq)} \rightarrow 2\text{Al}^{3+}\text{(aq)} + 3\text{Co(s)}$
Category: Medium Section: 4.4
148. Write balanced molecular and net ionic equations for the reaction that would occur between CuCl₂(aq) and Pb(s). Be sure to include the correct states in your final equations. If no reaction is expected, write “no reaction.”
Ans: Molecular equation: $\text{CuCl}_2\text{(aq)} + \text{Pb(s)} \rightarrow \text{Cu(s)} + \text{PbCl}_2\text{(s)}$
Net ionic equation: $\text{Cu}^{2+}\text{(aq)} + 2\text{Cl}^-\text{(aq)} + \text{Pb(s)} \rightarrow \text{Cu(s)} + \text{PbCl}_2\text{(s)}$
Category: Difficult Section: 4.4
149. A piece of copper metal was added to an aqueous solution of silver nitrate, and within a few minutes it was observed that a grey crystalline solid formed on surface of the copper and the solution turned a blue color characteristic of copper(II) ions.
Write the balanced chemical equation for this reaction.
Ans: $\text{Cu(s)} + 2\text{AgNO}_3\text{(aq)} \rightarrow 2\text{Ag(s)} + \text{Cu(NO}_3)_2\text{(aq)}$
Category: Medium Section: 4.4
150. A piece of copper metal was added to an aqueous solution of silver nitrate, and within a few minutes it was observed that a grey crystalline solid formed on surface of the copper and the solution turned a blue color characteristic of copper(II) ions.
Write the net ionic equation for this reaction.
Ans: $\text{Cu(s)} + 2\text{Ag}^+\text{(aq)} \rightarrow \text{Cu}^{2+}\text{(aq)} + 2\text{Ag(s)}$
Category: Medium Section: 4.4
151. A piece of lead metal was added to an aqueous solution of copper(II) nitrate, and within a few minutes it was observed that the lead turned black and crumbled, and the blue solution characteristic of copper(II) ions faded. (NOTE: Lead forms a 2+ ion when it reacts.)
Write the balanced chemical equation for this reaction.
Ans: $\text{Pb(s)} + \text{Cu(NO}_3)_2\text{(aq)} \rightarrow \text{Cu(s)} + \text{Pb(NO}_3)_2\text{(aq)}$
Category: Medium Section: 4.4
152. A piece of lead metal was added to an aqueous solution of copper(II) nitrate, and within a few minutes it was observed that the lead turned black and crumbled, and the blue solution characteristic of copper(II) ions faded. (NOTE: Lead forms a 2+ ion when it reacts.)
Write the net ionic equation for this reaction.
Ans: $\text{Pb(s)} + \text{Cu}^{2+}\text{(aq)} \rightarrow \text{Pb}^{2+}\text{(aq)} + \text{Cu(s)}$
Category: Medium Section: 4.4

153. A piece of zinc metal was added to an aqueous solution of lead(II) nitrate. After some time it was observed that the zinc metal had appeared to fall apart and a solid had accumulated at the bottom of the reaction vessel.

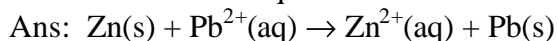
Write the balanced chemical equation for this reaction.



Category: Difficult Section: 4.4

154. A piece of zinc metal was added to an aqueous solution of lead(II) nitrate. After some time it was observed that the zinc metal had appeared to fall apart and a solid had accumulated at the bottom of the reaction vessel.

Write the net ionic equation for this reaction.



Category: Difficult Section: 4.4

155. The following experiments were carried out and observations recorded.

Expt. #1: copper metal was added to an aqueous solution of silver nitrate

Observation: The copper become coated with a substance.

Expt. #2: lead metal was added to an aqueous solution of copper(II) nitrate

Observation: The lead turned black and crumbled.

Expt. #3: zinc metal was added to an aqueous solution of lead(II) nitrate

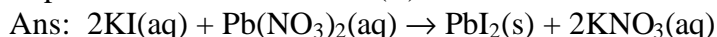
Observation: The zinc appeared to fall apart.

Rank the metals from most active to least active.

Ans: most active Zn, next most active Pb, next most active Cu, least active Ag

Category: Difficult Section: 4.4

156. Write a balanced molecular equation for the reaction that occurs when aqueous solutions of potassium iodide and lead(II) nitrate are combined.



Category: Medium Section: 4.2

157. If 73.5 mL of 0.200 M KI(aq) was required to precipitate all of the lead(II) ion from an aqueous solution of lead(II) nitrate, how many moles of Pb^{2+} were originally in the solution?

Ans: 7.35×10^{-3} moles of Pb^{2+}

Category: Medium Section: 4.6

158. Sugar dissolves in water, therefore it is a strong electrolyte.

Ans: False Category: Medium Section: 4.1

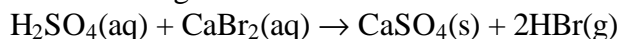
159. Silver chloride (AgCl) has an extremely low solubility in water; therefore, it is a weak electrolyte.

Ans: False Category: Medium Section: 4.1

160. Most compounds containing chlorides, bromides, and iodides are soluble except those containing Ag^+ , Hg_2^{2+} , and Pb^{2+} .

Ans: True Category: Easy Section: 4.2

161. The following reaction is an acid-base neutralization reaction.

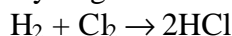


Ans: False Category: Easy Section: 4.3

162. The oxidation number of N in NO is +7.

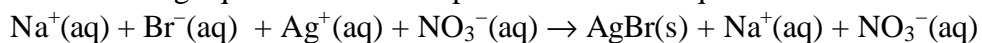
Ans: False Category: Easy Section: 4.4

163. Hydrogen is oxidized in the following chemical reaction.



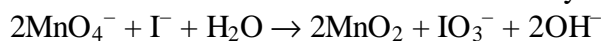
Ans: True Category: Medium Section: 4.4

164. The following equation is an example of a net ionic equation.



Ans: False Category: Medium Section: 4.2

165. The oxidation number of iodine increases by 6 in the following reaction.

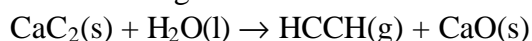


Ans: True Category: Medium Section: 4.4

166. A weak acid or a weak base ionizes completely.

Ans: False Category: Medium Section: 4.3

167. The following reaction is a redox reaction.



Ans: False Category: Medium Section: 4.4