

Practise Exam Chapter 4

1. Which one of the following is a nonelectrolyte?
 - A) aqueous barium nitrate solution
 - B) aqueous calcium chloride solution
 - C) aqueous lithium phosphate solution
 - D) aqueous methyl alcohol solution
 - E) aqueous potassium sulfate solution

2. Which one of the following is an electrolyte?
 - A) aqueous maple syrup solution
 - B) aqueous calcium chloride solution
 - C) aqueous sucrose solution
 - D) aqueous acetone solution
 - E) aqueous ethyl alcohol solution

3. Given the following set of solutions
 - A: aqueous sodium perchlorate
 - B: aqueous methyl alcohol
 - C: aqueous glucose
 - D: aqueous calcium chloride
 - E: aqueous nickel sulfateWhich of these solutions are electrolyte solutions?
 - A) A and E, only
 - B) C, D and E, only
 - C) A and D, only
 - D) A, D and E, only
 - E) B, D and E, only

4. Which statement below is correctly worded and states a fact?
 - A) Ionic acids are strong electrolytes and ionize completely when dissolved in water.
 - B) Ionic bases are weak electrolytes and ionize completely when dissolved in water.
 - C) Ionic bases are strong electrolytes and ionize completely when dissolved in water.
 - D) Ionic salts are strong electrolytes and dissociate completely when dissolved in water.
 - E) Ionic salts are weak electrolytes and ionize partially when dissolved in water.

5. Which one of the following compounds produces 4 ions per formula unit by dissociation when dissolved in water?
- A) $\text{K}_2\text{C}_2\text{O}_4$
 - B) $\text{Al}(\text{NO}_3)_3$
 - C) $\text{Hg}_2(\text{NO}_3)_2$
 - D) NaBrO_3
 - E) $\text{Na}_2\text{S}_2\text{O}_3$
6. Which one of the following compounds produces 3 ions per formula unit by dissociation when dissolved in water?
- A) Hg_2SO_4
 - B) NaClO_2
 - C) LiClO_4
 - D) KClO
 - E) $(\text{NH}_4)_2\text{SO}_4$
7. In the reaction, $\text{K}_2\text{SO}_4(\text{aq}) + \text{Ba}(\text{NO}_3)_2(\text{aq}) \rightarrow \text{BaSO}_4(\text{s}) + 2 \text{KNO}_3(\text{aq})$, which ions are the spectator ions?
- A) Ba^{2+} and SO_4^{2-}
 - B) Ba^{2+} and K^+
 - C) Ba^{2+} and NO_3^-
 - D) K^+ and SO_4^{2-}
 - E) K^+ and NO_3^-
8. The equation for the reaction, $\text{AgNO}_3(\text{aq}) + \text{K}_2\text{CrO}_4(\text{aq}) \rightarrow \text{Ag}_2\text{CrO}_4(\text{s}) + \text{KNO}_3(\text{aq})$, can be written as an ionic equation. In this ionic equation, the spectator ions are
- A) Ag^+ and K^+
 - B) Ag^+ and CrO_4^{2-}
 - C) K^+ and CrO_4^{2-}
 - D) K^+ and NO_3^-
 - E) CrO_4^{2-} and NO_3^-
9. Which one of the following compounds is insoluble in water?
- A) Na_2CO_3
 - B) NH_4NO_3
 - C) CaCO_3
 - D) CaCl_2
 - E) LiClO_4

10. Which one of the following compounds is soluble in water?
- A) PbCO_3
 - B) AgBr
 - C) CaCO_3
 - D) MgCl_2
 - E) BaSO_4
11. Which set of compounds below is a set in which all members are considered soluble in water?
- A) BaCO_3 , NaBrO_3 , Ca(OH)_2 , and PbCl_2
 - B) NaCl , BaCl_2 , NH_4NO_3 , and LiClO_4
 - C) NiCO_3 , PbSO_4 , AgCl , and Mg(OH)_2
 - D) NaCl , AgBr , Na_2CO_3 , and $\text{Hg}_2(\text{NO}_3)_2$
 - E) PbCl_2 , $\text{Pb(NO}_3)_2$, AgClO_4 , and HgCl_2
12. Which one of the equations below represents what occurs when $\text{HC}_2\text{H}_3\text{O}_2$ is dissolved in some water?
- A) $\text{HC}_2\text{H}_3\text{O}_2 + \text{H}_2\text{O} \rightarrow \text{H}_3\text{O}^+(\text{aq}) + \text{C}_2\text{H}_3\text{O}_2^-(\text{aq})$
 - B) $\text{HC}_2\text{H}_3\text{O}_2 + \text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{O}^+(\text{aq}) + \text{C}_2\text{H}_3\text{O}_2^-(\text{aq})$
 - C) $\text{HC}_2\text{H}_3\text{O}_2 + \text{H}_2\text{O} \rightleftharpoons \text{C}_2\text{H}_3\text{O}_2^+(\text{aq}) + \text{OH}^-(\text{aq})$
 - D) $\text{HC}_2\text{H}_3\text{O}_2 + \text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{O}^-(\text{aq}) + \text{C}_2\text{H}_3\text{O}_2^+(\text{aq})$
 - E) $\text{HC}_2\text{H}_3\text{O}_2 + \text{H}_2\text{O} \rightleftharpoons 2 \text{H}^+(\text{aq}) + \text{OH}^-(\text{aq}) + \text{C}_2\text{H}_3\text{O}_2^-(\text{aq})$
13. Which one of the following is the acid anhydride for the acid, HClO_4 ?
- A) ClO
 - B) ClO_2
 - C) ClO_3
 - D) ClO_4
 - E) Cl_2O_7
14. Which one of the following species is a weak electrolyte?
- A) $\text{HClO}_4(\text{aq})$
 - B) $\text{HCl}(\text{aq})$
 - C) $\text{NaOH}(\text{aq})$
 - D) $\text{NH}_3(\text{aq})$
 - E) $\text{LiOH}(\text{aq})$

15. Which one of the following acids is NOT a known strong acid?
- A) $\text{HBr}(aq)$
 - B) $\text{HCl}(aq)$
 - C) $\text{HClO}_3(aq)$
 - D) $\text{HF}(aq)$
 - E) $\text{HI}(aq)$
16. Which one of the following listed solutions is the least acidic (contains the lowest concentration of hydronium ions due to small degree of ionization)?
- A) 1.0 molar $\text{HF}(aq)$
 - B) 1.0 molar $\text{HCl}(aq)$
 - C) 1.0 molar $\text{HClO}_3(aq)$
 - D) 1.0 molar $\text{HBr}(aq)$
 - E) 1.0 molar $\text{HI}(aq)$
17. Which one of the following choices represents the net reaction which actually takes place in solution when $\text{HC}_2\text{H}_3\text{O}_2(aq)$ is added to $\text{Ba}(\text{OH})_2(aq)$?
- A) $\text{HC}_2\text{H}_3\text{O}_2(aq) + \text{Ba}(\text{OH})_2(aq) \rightarrow \text{Ba}(\text{C}_2\text{H}_3\text{O}_2)_2(aq) + \text{H}_2\text{O}(l)$
 - B) $\text{H}^+(aq) + \text{OH}^-(aq) \rightarrow \text{H}_2\text{O}(l)$
 - C) $\text{HC}_2\text{H}_3\text{O}_2(aq) + \text{OH}^-(aq) \rightarrow \text{C}_2\text{H}_3\text{O}_2^-(aq) + \text{H}_2\text{O}(l)$
 - D) $\text{H}^+(aq) + \text{Ba}(\text{OH})_2(aq) \rightarrow \text{Ba}^{2+}(aq) + \text{H}_2\text{O}(l)$
 - E) $\text{HC}_2\text{H}_3\text{O}_2(aq) + \text{Ba}^{2+}(aq) \rightarrow \text{Ba}(\text{C}_2\text{H}_3\text{O}_2)_2(aq) + \text{H}^+(aq)$
18. Which one of the following choices represents the net reaction which actually takes place in solution when $\text{HNO}_3(aq)$ is added to $\text{Mg}(\text{OH})_2(s)$?
- A) $\text{HNO}_3(aq) + \text{Mg}(\text{OH})_2(s) \rightarrow \text{Mg}(\text{NO}_3)_2(aq) + \text{H}_2\text{O}(l)$
 - B) $\text{H}^+(aq) + \text{OH}^-(aq) \rightarrow \text{H}_2\text{O}(l)$
 - C) $\text{HNO}_3(aq) + \text{OH}^-(s) \rightarrow \text{NO}_3^-(aq) + \text{H}_2\text{O}(l)$
 - D) $\text{H}^+(aq) + \text{Mg}(\text{OH})_2(s) \rightarrow \text{Mg}^{2+}(aq) + \text{H}_2\text{O}(l)$
 - E) $\text{HNO}_3(aq) + \text{Mg}^{2+}(aq) \rightarrow \text{Mg}(\text{NO}_3)_2(aq) + \text{H}^+(aq)$
19. 66.7 mL of 18.0 molar sulfuric acid solution was dissolved in enough water to make 500 mL of solution. The molarity of the diluted mixture is
- A) 2.40 molar
 - B) 0.135 molar
 - C) 36.0 molar
 - D) 9.00 molar
 - E) 0.00741 molar

20. Potassium nitrate, KNO_3 , has a formula weight of 101.10. What is the molar concentration of a solution prepared by dissolving 7.58 grams of potassium nitrate in enough water to prepare 250 mL of the solution?
- A) 0.0937 molar
 - B) 0.300 molar
 - C) 1.895 molar
 - D) 3.065 molar
 - E) 3.34 molar
21. A 2.710 g sample contains some CaCl_2 , which is inert to $\text{HCl}(aq)$ and also some CaO , which reacts: $\text{CaO}(s) + \text{HCl}(aq) \rightarrow \text{CaCl}_2(aq) + \text{H}_2\text{O}(l)$. It took 32.05 mL of 2.445 molar $\text{HCl}(aq)$ to react completely with all the CaO in the sample. The percent, by weight, of CaO in the sample is
- A) 35.15 %
 - B) 61.67 %
 - C) 77.62 %
 - D) 81.08 %
 - E) 84.17 %
22. An ore containing lead carbonate, PbCO_3 , was analyzed. All the lead in a 1.836 gram sample was converted to $\text{PbSO}_4(s)$ using a standard procedure involving treatment with $\text{HNO}_3(aq)$ followed by treatment with Na_2SO_4 solution. The lead sulfate which was recovered weighed 333 mg. What is the percent, by weight, of lead in the ore?
- A) 1.99 %
 - B) 12.4 %
 - C) 16.0 %
 - D) 18.1 %
 - E) 20.6 %
23. How many ions per formula unit are produced in solution by dissociation when Hg_2SO_4 dissolves in water? _____
24. Oxidation is defined as
- A) gain of a proton
 - B) loss of a proton
 - C) gain of an electron
 - D) loss of an electron
 - E) capture of an electron by a neutron

25. What is the oxidation number of each oxygen atom in the compound, BaO_2 ?
- A) -1
 - B) -2
 - C) +1
 - D) +2
 - E) +3
26. What is the oxidation number of each carbon atom in the compound, $\text{K}_2\text{C}_2\text{O}_4$?
- A) 0
 - B) -4
 - C) +3
 - D) +4
 - E) +6
27. What is the oxidation number of the vanadium atom in the compound, $(\text{NH}_4)_3\text{VO}_4$?
- A) +2
 - B) +3
 - C) +5
 - D) +6
 - E) +7
28. What is the oxidation number of the arsenic atom in the AsO_4^{3-} ion?
- A) +1
 - B) +3
 - C) +4
 - D) +5
 - E) +6
29. Which one of the following processes represents an oxidation?
- A) $\text{Ba}^{2+}(\text{aq}) + \text{CrO}_4^{2-}(\text{aq}) \rightarrow \text{BaCrO}_4(\text{s})$
 - B) $2 \text{H}^+(\text{aq}) + \text{CO}_3^{2-}(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l}) + \text{CO}_2(\text{g})$
 - C) $\text{Fe}^{3+}(\text{aq}) \rightarrow \text{Fe}^{2+}(\text{aq})$
 - D) $\text{MnO}_2(\text{s}) \rightarrow \text{MnO}_4^-(\text{aq})$
 - E) $2 \text{CrO}_4^{2-}(\text{aq}) + 2 \text{H}^+(\text{aq}) \rightarrow \text{Cr}_2\text{O}_7^{2-}(\text{aq}) + \text{H}_2\text{O}(\text{l})$

30. Which one of the following processes represents a reduction?
- A) $\text{Ba}^{2+}(\text{aq}) + \text{CrO}_4^{2-}(\text{aq}) \rightarrow \text{BaCrO}_4(\text{s})$
 - B) $2 \text{H}^+(\text{aq}) + \text{CO}_3^{2-}(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l}) + \text{CO}_2(\text{g})$
 - C) $\text{CrO}_4^{2-}(\text{aq}) \rightarrow \text{Cr}^{3+}(\text{aq})$
 - D) $\text{MnO}_2(\text{s}) \rightarrow \text{MnO}_4^-(\text{aq})$
 - E) $2 \text{CrO}_4^{2-}(\text{aq}) + 2 \text{H}^+(\text{aq}) \rightarrow \text{Cr}_2\text{O}_7^{2-}(\text{aq}) + \text{H}_2\text{O}(\text{l})$
31. What is the change in oxidation of each chromium atom in the process,
 $\text{K}_2\text{CrO}_4 \rightarrow \text{Cr}_2(\text{SO}_4)_3$
- A) -1
 - B) -6
 - C) +3
 - D) -3
 - E) +6
32. What is the change in oxidation of each manganese atom in the process,
 $\text{KMnO}_4 \rightarrow \text{MnSO}_4$
- A) +3
 - B) -3
 - C) -6
 - D) -5
 - E) +1
33. What is the change in oxidation of each iodine atom in the process,
 $\text{KI} \rightarrow \text{KIO}_3$
- A) +3
 - B) -1
 - C) +6
 - D) -6
 - E) +4
34. Balance the half reaction, $\text{H}_2\text{S}(\text{aq}) \rightarrow \text{S}(\text{s})$, taking place in acidic media. Which answer below describes how many electrons are needed to balance the half reaction?
- A) 2 electrons, left side
 - B) 2 electrons, right side
 - C) 4 electrons, left side
 - D) 4 electrons, right side
 - E) 8 electrons, right side

35. Balance the half reaction, $\text{C}_5\text{O}_5^{2-}(g) \rightarrow \text{CO}_3^{2-}(aq)$, taking place in basic media. Which answer below describes how many hydroxide ions are needed to balance the half reaction?
- A) 8 ions, left side
 - B) 12 ions, right side
 - C) 12 ions, left side
 - D) 20 ions, left side
 - E) 20 ions, right side
36. Balance the half reaction, $\text{C}_8\text{H}_{10}(l) \rightarrow \text{C}_8\text{H}_4\text{O}_4^{2-}(aq)$, taking place in basic media. Which answer below describes how many electrons are needed to balance the half reaction?
- A) 4 electrons, left side
 - B) 8 electrons, right side
 - C) 8 electrons, left side
 - D) 12 electrons, left side
 - E) 12 electrons, right side
37. When you balance the redox equation,
 $\text{C}_4\text{H}_{10}(l) + \text{Cr}_2\text{O}_7^{2-}(aq) + \text{H}^+(aq) \rightarrow \text{H}_6\text{C}_4\text{O}_4(s) + \text{Cr}^{3+}(aq) + \text{H}_2\text{O}(l)$
the oxidizing agent is
- A) $\text{C}_4\text{H}_{10}(l)$
 - B) $\text{Cr}_2\text{O}_7^{2-}(aq)$
 - C) $\text{H}^+(aq)$
 - D) $\text{H}_6\text{C}_4\text{O}_4(s)$
 - E) $\text{Cr}^{3+}(aq)$
38. When the balancing of the equation for the reaction,
 $\text{C}_8\text{H}_{10}(l) + \text{NtO}_4^{2-}(aq) + \text{H}^+(aq) \rightarrow \text{C}_8\text{H}_4\text{O}_4^{2-}(aq) + \text{Nt}^{2+}(aq) + \text{H}_2\text{O}(l)$
taking place in acidic media is completed, what is the sum of ALL the coefficients in the equation?
- A) 12
 - B) 20
 - C) 24
 - D) 26
 - E) 32

39. When the balancing of the equation for the reaction,
 $\text{HSO}_3^-(aq) + \text{MnO}_4^-(aq) \rightarrow \text{MnO}_2(s) + \text{HSO}_4^-(aq)$
 taking place in slightly acidic media is properly completed, what is the sum of ALL the coefficients in the equation?
 A) 7
 B) 9
 C) 13
 D) 15
 E) 19
40. When the balancing of the equation for the reaction,
 $\text{CrO}_4^{2-}(aq) + \text{Br}^-(aq) \rightarrow \text{CrO}_2^-(aq) + \text{BrO}_3^-(aq)$
 taking place in basic solution media is properly completed, what is the sum of ALL the coefficients in the equation?
 A) 6
 B) 8
 C) 9
 D) 10
 E) 14
41. In terms of activity, the series in increasing order for metals is found to be,
 $\text{Au} < \text{Ag} < \text{Cu} < \text{Sn} < \text{Cd} < \text{Zn} < \text{Al} < \text{Mg} < \text{Na} < \text{Cs}$
 Which reaction below *occurs spontaneously* upon mixing the reagents shown?
 A) $\text{Sn}(s) + \text{Zn}^{2+}(aq) \rightarrow \text{Sn}^{2+}(aq) + \text{Zn}(s)$
 B) $\text{Ag}(s) + \text{Mg}^{2+}(aq) \rightarrow \text{Ag}^+(aq) + \text{Mg}(s)$
 C) $\text{Zn}(s) + \text{Au}^{3+}(aq) \rightarrow \text{Zn}^{2+}(aq) + \text{Au}(s)$
 D) $\text{Ag}(s) + \text{Mn}^{2+}(aq) \rightarrow \text{Ag}^+(aq) + \text{Mn}(s)$
 E) $\text{Sn}(s) + \text{Al}^{3+}(aq) \rightarrow \text{Sn}^{2+}(aq) + \text{Al}(s)$
42. In terms of activity, the series in increasing order for metals is found to be,
 $\text{Au} < \text{Ag} < \text{Cu} < \text{Sn} < \text{Cd} < \text{Zn} < \text{Al} < \text{Mg} < \text{Na} < \text{Cs}$
 Based on this list, which one of the elements presented below would undergo oxidation least readily?
 A) Mg
 B) Al
 C) Cu
 D) Cd
 E) Zn

43. When the hydrocarbon, C_8H_{16} , undergoes complete combustion, which is an oxidation-reduction reaction, a specific set of products are formed. If you write the equation for the reaction and balance it, the sum of the coefficients for the reagents in the balanced equation will be
- A) 17
 - B) 19
 - C) 21
 - D) 26
 - E) 29
44. When the carbohydrate, $C_{12}H_{22}O_{11}$, undergoes complete combustion, which is an oxidation-reduction reaction, a specific set of products are formed. If you write the equation for the reaction and balance it, the sum of the coefficients for the reagents in the balanced equation will be
- A) 24
 - B) 35
 - C) 36
 - D) 47
 - E) 83
45. Is the process, $Cr_2O_7^{2-}(aq) \rightarrow Cr^{3+}(aq)$ an oxidation or a reduction? _____
46. When the equation, $Zn(s) + NO_3^-(aq) \rightarrow NH_4^+(aq) + Zn^{2+}(aq)$ is balanced, the Zn/NO_3^- ratio is _____
47. The reaction, $AgNO_3(aq) + NH_4Br(aq) \rightarrow AgBr(s) + NH_4NO_3(aq)$, involves changes in oxidation number and is therefore classified as a redox reaction. ____
- A) True
 - B) False
48. What is the oxidation number of each sulfur atom in the compound, $Rb_2S_2O_4$?
- A) -2
 - B) +1
 - C) +3
 - D) +5
 - E) +6

49. What is the oxidation number of the chlorine atom in the HClO_4 molecule?
- A) -1
 - B) +3
 - C) +5
 - D) +7
 - E) +9
50. Balance the half reaction, $\text{C}_5\text{O}_5^{2-}(\text{g}) \rightarrow \text{CO}_3^{2-}(\text{aq})$, taking place in basic media. Which answer below describes how many electrons are needed to balance the half reaction?
- A) 4 electrons, left side
 - B) 8 electrons, right side
 - C) 8 electrons, left side
 - D) 12 electrons, left side
 - E) 12 electrons, right side

Answer Key

1. D
2. B
3. D
4. D
5. B
6. E
7. E
8. D
9. C
10. D
11. B
12. B
13. E
14. D
15. D
16. A
17. C
18. D
19. A
20. B
21. D
22. B
23. 2
24. D
25. A
26. C
27. C
28. D
29. D
30. C
31. D
32. D
33. C
34. B
35. D
36. E
37. B
38. D
39. C
40. C
41. C
42. C
43. E
44. C

- 45. reduction
- 46. 4:1
- 47. B
- 48. C
- 49. D
- 50. E