Practice Examination #8

Name: _____ **Date:** _____

Students are to provide explanations for ALL questions.

1. Which equation represents a substitution reaction?

   A. $C_2H_4 + H_2 \rightarrow C_2H_6$

   B. $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

   C. $C_3H_8 + Cl_2 \rightarrow C_3H_7Cl + HCl$

   D. $C_4H_8 + Br_2 \rightarrow C_4H_8Br_2$

2. The equation ${}^{27}_{13}\mathrm{Al} + {}^{4}_{2}\mathrm{He} \rightarrow {}^{30}_{15}\mathrm{P} + {}^{1}_{0}\mathrm{n}$ is an example of

   A. single replacement B. analysis

   C. transmutation D. synthesis

3. The reaction represented by the equation

   $$n\mathrm{C_2H_4} \rightarrow (-\mathrm{C_2H_4^-})_n$$

   is called

   A. saponification B. fermentation

   C. esterification D. polymerization

4. Given the reaction:

   $${}^{27}_{13}\mathrm{Al} + {}^{4}_{2}\mathrm{He} \rightarrow {}^{30}_{15}\mathrm{P} + {}^{1}_{0}\mathrm{n}.$$

   This reaction is best described as

   A. beta decay

   B. artificial transmutation

   C. fission

   D. fusion

5. The Haber process is used to produce

   A. sulfur dioxide B. ammonia

   C. sulfuric acid D. sodium chloride

6. In a reversible chemical reaction, a catalyst changes the rate of

   A. the forward reaction, only

   B. the reverse reaction, only

   C. both the forward and reverse reactions

   D. neither the forward nor reverse reaction

7. In a reversible chemical reaction, a catalyst changes the rate of

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B. the reverse reaction, only

C. both the forward and reverse reactions

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D. neither the forward nor reverse reaction

9. An uncontrolled chain reaction takes place during the

A. operation of a fission nuclear reactor

B. explosion of an atomic bomb

C. production of energy by the Earth's Sun

D. fusion of light nuclei into heavier nuclei

10. Which factors must be equal in a reversible chemical reaction at equilibrium?

A. the concentration of the reactants and products

B. the potential energies of the reactants and products

C. the activation energies of the forward and reverse reactions

D. the rates of reaction of the forward and reverse reactions

11. Which type of reaction is represented by the following equation?

$$Al_2S_3 + 6H_2O \rightarrow 2Al(OH)_3 + 3H_2S$$

A. neutralization B. dehydration

C. electrolysis D. hydrolysis

12. In the balanced equation:

$$H_3PO_4(aq) + NH_3(aq) \rightleftharpoons X(aq) + NH_4^+(aq),$$

the particle represented by X(aq) is

A. $H_2PO_4^-(aq)$ B. $HPO_4^{2-}(aq)$

C. $PO_4^{3-}(aq)$ D. $H_3PO_4(aq)$

13. Which is a product of a condensation reaction?

A. O_2 B. CO_2 C. H_2 D. H_2O

14. Which type of reaction occurs when 50-milliliter quantities of $Ba(OH)_2(aq)$ and $H_2SO_4(aq)$ are combined?

A. hydrolysis B. ionization

C. hydrogenation D. neutralization

15. The reaction $2H_2O(\ell) \rightarrow 2H_2(g) + O_2(g)$ is forced to occur by use of an externally applied electric current. This procedure is called

A. neutralization B. esterification

C. electrolysis D. hydrolysis

16. The corrosion of iron is an example of

A. an oxidation-reduction reaction

B. an addition reaction

C. a substitution reaction

D. a neutralization reaction

17. Given the reaction:

$$C_2H_2 + 2H_2 \rightarrow C_2H_6$$

This reaction represents

A. substitution B. addition

C. esterification D. saponification

18. Which process can be used to separate water from $BaCl_2 \cdot 2H_2O$?

A. dehydration B. condensation

C. sublimation D. filtration

19. The reaction $nC_2H_4 \rightarrow (-C_2H_4-)_n$ is an example of

A. saponification B. esterification

C. polymerization D. fermentation

20. Given the unbalanced equation:

$$Al_2(SO_4)_3 + Ca(OH)_2 \rightarrow Al(OH)_3 + CaSO_4$$

What is the coefficient in front of the $CaSO_4$ when the equation is completely balanced with the smallest whole-number coefficients?

A. 1 B. 2 C. 3 D. 4

21. Given the unbalanced equation

$$Cr^0 + Sn^{2+} \rightarrow Cr^{3+} + Sn^0$$

What is the coefficient in front of the Cr^{3+} when the equation is balanced using *smallest* whole-number coefficients?

A. 1 B. 2 C. 3 D. 6

22. When the equation $H_2O_2 \rightarrow H_2O + O_2$ is completely balanced, the sum of all the coefficients will be

A. 5 B. 8 C. 3 D. 4

23. Given the unbalanced equation:

$$2MnO_4^- + 16H^+ + \_\_\_\_ Cl^- \rightarrow 2Mn^{2+} + 8H_2O + \_\_\_\_ Cl_2$$

What is the coefficient in front of the Cl^- when the equation is completely balanced using whole numbers?

A. 1 B. 2 C. 5 D. 10

24. In the balanced equation $2Na + 2H_2O \rightarrow H_2 + 2X$, the compound represented by X is

A. Na_2O B. Na_2O_2

C. NaOH D. NaH

25. Given the reaction:

$$\_\_\_\_ Fe^{3+} + \_\_\_\_ Sn^{2+} \rightarrow \_\_\_\_ Fe^{2+} + \_\_\_\_ Sn^{4+}$$

When the reaction is completely balanced using *smallest* whole numbers the coefficient of Fe^{3+} will be

A. 1 B. 2 C. 3 D. 4

26. Given the balanced equation:

$$2Na + 2H_2O \rightarrow 2X + H_2$$

What is the correct formula for the product represented by the letter *X*?

A. NaO B. Na_2O

C. NaOH D. Na_2OH

27. When the equation $NH_3 + O_2 \rightarrow HNO_3 + H_2O$ is completely balanced using smallest whole numbers, the coefficient of O_2 would be

A. 1 B. 2 C. 3 D. 4

28. Given the unbalanced equation:

$$Ca^0 + Al^{3+} \rightarrow Ca^{2+} + Al^0$$

When the equation is completely balanced with the smallest whole-number coefficients, what is the coefficient of Ca^0?

A. 1 B. 2 C. 3 D. 4

29. When the equation $C_2H_4 + O_2 \rightarrow CO_2 + H_2O$ is balanced using smallest whole numbers, what is the coefficient of the O_2?

A. 1 B. 2 C. 3 D. 4

30. When the equation

$$Hg + \_\_\_\_ Ag^+ \rightarrow \_\_\_\_ Ag + Hg^{2+}$$

is correctly balanced using smallest whole numbers, the coefficient in front of the Ag^+ will be

A. 5 B. 2 C. 3 D. 4

31. When the equation

$$\_\_\_\_ Fe^{2+} + ClO_3^- + 6H^+ \rightarrow$$
$$\_\_\_\_ Fe^{3+} + Cl^- + 3H_2O$$

is completely balanced, the coefficient of the Fe^{2+} will be

A. 7 B. 6 C. 5 D. 4

32. When the equation

$$\_\_\_\_Na(s) + \_\_\_\_H_2O(\ell) \rightarrow$$
$$\_\_\_\_NaOH(aq) + \_\_\_\_H_2(g)$$

is correctly balanced using smallest whole numbers, the coefficient of the water is

A. 1 B. 2 C. 3 D. 4

33. Given the reaction:

$$\_\_\_\_Cu(s) + \_\_\_\_HNO_3(aq) \rightarrow \_\_\_\_Cu(NO_3)_2(aq) + \_\_\_\_NO_2(g) + \_\_\_\_H_2O(\ell)$$

When the reaction is completely balanced using smallest whole numbers, the coefficient of $HNO_3(aq)$ will be

A. 1 B. 2 C. 3 D. 4

34. Which equation is correctly balanced?

A. $Zn + Ag^+ \rightarrow Zn^{2+} + Ag$

B. $Cu + Au^{3+} \rightarrow Cu^{2+} + Au$

C. $Al + Sn^{2+} \rightarrow Al^{3+} + Sn$

D. $Ca + Mg^{2+} \rightarrow Ca^{2+} + Mg$

35. Given the equation:

$$\_\_\_\_Cr_2O_7^{2-} + \_\_\_\_H_2SO_3 + \_\_\_\_H^+ \rightarrow \_\_\_\_Cr^{3+} + \_\_\_\_HSO_4^- + \_\_\_\_H_2O$$

When the equation is completely balanced using smallest whole numbers, the coefficient of the $Cr_2O_7^{2-}$ will be

A. 1 B. 5 C. 3 D. 4

36. Given the unbalanced equation:

$$\_\_\_\_C_3H_8(g) + \_\_\_\_O_2(g) \rightarrow \_\_\_\_H_2O(g) + \_\_\_\_CO_2(g)$$

When the equation is completely balanced using smallest whole numbers, the coefficient of O_2 is

A. 5 B. 2 C. 3 D. 10

37. Given the reaction:

$$Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2\,.$$

How many moles of H_2O are needed to exactly react with 2.0 moles of Ca?

A. 1.0 B. 2.0 C. 0.50 D. 4.0

38. Magnesium was reacted with an excess of dilute hydrochloric acid and the hydrogen gas produced collected in an eudiometer. The volume of hydrogen in the eudiometer was corrected to conditions of STP. If 94.1 milliliters of hydrogen was produced, how much magnesium reacted in this experiment?

A. 0.01 g B. 0.10 g C. 0.05 g D. 0.50 g

39. In the reaction $N_2 + 3H_2 \rightarrow 2NH_3$, how many grams of H_2 are needed to produce exactly 1 mole of ammonia?

A. 1 g B. 2 g C. 3 g D. 4 g

40. Given the reaction:

$$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$$

What is the total number of moles of NaOH needed to react completely with 2 moles of H_2SO_4?

A. 1 B. 2 C. 0.5 D. 4

41. Given the reaction: $2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$ What is the total number of CO_2 molecules produced when one mole of C_2H_6 is consumed?

A. 6.02×10^{23} B. $2(6.02 \times 10^{23})$

C. $3(6.02 \times 10^{23})$ D. $4(6.02 \times 10^{23})$

42. Given the reaction:

$$2Na + 2H_2O \rightarrow 2NaOH + H_2$$

What is the total number of moles of hydrogen produced when 4 moles of sodium react completely?

A. 1 B. 2 C. 3 D. 4

43. The maximum number of grams of potassium that can be obtained from 100 grams of $KHCO_3$ is

A. 19.0 g B. 39.0 g C. 58.0 g D. 100 g

44. Given the equation:

$$Zn + 2HCl \rightarrow ZnCl_2 + H_2$$

How many moles of HCl would be required to produce a total of 2 moles of H_2?

A. 0.5 B. 2 C. 3 D. 4

45. Given the reaction:

$$C_8H_{16+12O_2} \rightarrow 8CO_2 + 8H_2O$$

How many moles of H_2O are produced when 11.2 liters of C_8H_{16} gas, measured at STP, reacts completely?

A. 8.00 B. 10.0 C. 30.0 D. 4.00

46. In the reaction $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$, what is the total number of moles of CO used to produce 112 grams of iron?

A. 1.0 B. 2.0 C. 3.0 D. 4.0

47. $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

In this reaction, how many grams of Fe_2O_3 are required to completely react with 84 grams of CO?

A. 64 g B. 80 g

C. 160 g D. 1400 g

48. $\mathbf{Mg_3N_2(s) + 6H_2O(l) \longrightarrow}$

$$\mathbf{2NH_3(aq) + 3Mg(OH)_2(s)}$$

If 54.0 grams of water are mixed with excess magnesium nitride, then how many grams of ammonia are produced?

A. 1.00 B. 17.0 C. 51.0 D. 153

49. A mass of 5.4 grams of aluminum (Al) reacts with an excess of copper (II) chloride ($CuCl_2$) in solution, as shown below.

$3CuCl_2 + 2Al \rightarrow 2AlCl_3 + 3Cu$

What mass of solid copper (Cu) is produced?

A. 0.65 g B. 8.5 g C. 13 g D. 19 g

50. Base your answer(s) to the following question(s) on the information below and on your knowledge of chemistry.

Many breads are made by adding yeast to dough, causing the dough to rise. Yeast is a type of microorganism that produces the catalyst zymase, which converts glucose, $C_6H_{12}O_6$, to ethanol and carbon dioxide gas. The balanced equation for this reaction is shown below.

$$C_6H_{12}O_6(aq) \xrightarrow{\text{zymase}} 2C_2H_5OH(aq) + 2CO_2(g)$$

Determine the total mass of ethanol produced when 270. grams of glucose reacts completely to form ethanol and 132 grams of carbon dioxide.

51. Given the balanced equation representing a reaction:

$$CaO(s) + CO_2(g) \rightarrow CaCO_3(s) + \text{heat}$$

What is the total mass of CaO(s) that reacts completely with 88 grams of $CO_2(g)$ to produce 200. grams of $CaCO_3(s)$?

A. 56 g B. 88 g C. 112 g D. 288 g

52. Base your answer(s) to the following question(s) on the information below.

A 1.0-gram strip of zinc is reacted with hydrochloric acid in a test tube. The unbalanced equation below represents the reaction.

$$Zn(s) + HCl(aq) \rightarrow H_2(g) + ZnCl_2(aq)$$

Balance the equation for the reaction of zinc and hydrochloric acid, using the smallest whole-number coefficients.

53. Given the balanced equation representing a reaction:

$$C_3H_8(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(g)$$

What is the total number of moles of $O_2(g)$ required for the complete combustion of 1.5 moles of $C_3H_8(g)$?

A. 0.30 mol B. 1.5 mol

C. 4.5 mol D. 7.5 mol

54. Given the balanced equation representing a reaction:

$$2H_2 + O_2 \rightarrow 2H_2O$$

What is the total mass of water formed when 8 grams of hydrogen reacts completely with 64 grams of oxygen?

A. 18 g B. 36 g C. 56 g D. 72 g

55. Given the balanced equation representing a reaction:

$$2CO(g) + O_2(g) \rightarrow 2CO_2(g)$$

What is the mole ratio of $CO(g)$ to $CO_2(g)$ in this reaction?

A. 1 : 1 B. 1 : 2 C. 2 : 1 D. 3 : 2

56. Equal volumes of 0.5 M HCl and 0.5 M NaOH are mixed. The total volume of the resulting mixture is 2 liters. The pH of the resulting solution is

A. 1 B. 2 C. 7 D. 4

57. The pH of a 0.1 M CH_3COOH solution is

A. less than 1

B. greater than 1 but less than 7

C. equal to 7

D. greater than 7

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C. equal to 7

D. greater than 7

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A. less than 1

B. greater than 1 but less than 7

C. equal to 7

D. greater than 7

60. The H_3O^+ ion concentration of a solution is 1×10^{-5} mole per liter. This solution is

A. acidic and has a pH of 5

B. acidic and has a pH of 9

C. basic and has a pH of 5

D. basic and has a pH of 9

61. How many milliliters of 5.0 M NaOH are needed to exactly neutralize 40 milliliters of 2.0 M HCl?

A. 8.0 B. 10 C. 16 D. 40

62. A 0.1 M HCl solution *differs* from a 0.1 M NaOH solution in that the HCl solution

A. has a lower pH

B. turns litmus blue

C. contains H_3O^+ ions

D. does not contain OH^-

63. What is the pH of a 0.001 M solution of HCl?

A. 1 B. 7 C. 3 D. 11

64. Which statement best describes a solution with a pH of 3?

A. It has an H_3O^+ ion concentration of 1×10^3 mol/L and is acidic.

B. It has an H_3O^+ ion concentration of 1×10^{-3} mol/L and is acidic.

C. It has an H_3O^+ ion concentration of 1×10^3 mol/L and is basic.

D. It has an H_3O^+ ion concentration of 1×10^{-3} mol/L and is basic.

65. What is the H_3O^+ concentration of a solution that has an OH^- concentration of 1×10^{-3} M?

A. 1×10^{-3} M
B. 1×10^{-7} M
C. 1×10^{-11} M
D. 1×10^{-14} M

66. What is the $[H_3O^+]$ of a 0.001 M NaOH solution?

A. 1×10^{-1}
B. 1×10^{-7}
C. 1×10^{-11}
D. 1×10^{-14}

67. As 0.1 M HCl is added to 0.1 M KOH, then pH of the basic solution

A. decreases and basicity decreases
B. increases and basicity decreases
C. decreases and basicity increases
D. increases and basicity increases

68. As the H_3O^+ ion concentration of a solution increases, the pH of the solution

A. decreases
B. increases
C. remains the same

69. If the concentration of hydroxide ions in an aqueous solution is 1×10^{-5} mole per liter at 298 K, the concentration of the hydronium ions must be

A. 1×10^{-5} mole per liter
B. 1×10^{-7} mole per liter
C. 1×10^{-6} mole per liter
D. 1×10^{-14} mole per liter

70. When the pH of a solution is 8, what is the OH^- ion concentration in moles per liter?

A. 1×10^{-6}
B. 1×10^{-7}
C. 1×10^{-8}
D. 1×10^{-14}

71. A 0.1 M solution of HCl contains

A. fewer H_3O^+ ions than OH^- ions
B. more H_3O^+ ions than OH^- ions
C. an equal number of H_3O^+ and OH^- ions
D. neither H_3O^+ ions nor HO^- ions

72. The ionization constant (K_a) of HF is 6.7×10^{-4}. Which is true in a 0.1 M solution of this acid?

A. [HF] is greater than $[H^+][F^-]$

B. [HF] is less than $[H^+][F^-]$

C. [HF] is equal to $[H^+][F^-]$

D. [HF] is equal to $[H^+] + [F^-]$

73. The ionization constant, K_a, for acetic acid at 1 atmosphere and 298 K is

A. 2.5×10^{-11} B. 2.1×10^{-8}

C. 1.8×10^{-5} D. 1.3×10^{-2}

74. What is the K_w of water at 1 atm and 298 K?

A. 1.0×10^{-14} B. 1.0×10^{-7}

C. 1.0×10^{14} D. 1.0×10^{7}

75. A 0.1 M acid solution at 298 K would conduct electricity best if the acid had a K_a value of

A. 1.0×10^{-7} B. 1.8×10^{-5}

C. 6.7×10^{-4} D. 1.7×10^{-2}