Name _____ Chemistry 115 Final Practice Exam

1. Which of the following would not be expected to increase the rate of the reaction?
    a. Increasing the amount of solid catalyst
    b. Increasing the quantity of reactant
    c. Decreasing the surface area of the solid reactant
    d. Increasing temperate
    e. Increasing the surface are of a solid reactant

2. For the reaction: $2A + 3B \rightarrow C$, [A] is found to decrease at a rate of 2.0 M/s. If the rate law is rate = k[A], how fast does [B] decrease under the same conditions?
    a. 0.66 M/s
    b. 1.3 M/s
    c. 2.0 M/s
    d. 2.6 M/s
    e. 3.0 M/s

3. A catalyst increases the rate of a reaction by
    a. Increasing the enthalpy of the reaction
    b. Lowering the activation energy of the reaction
    c. Increasing the activation energy of the reaction
    d. Decreasing the enthalpy of the reaction

4. Determine the rate constant for the first order reaction that has a half-life of 26.7 minutes
    a. 18.5 min^{-1}
    b. 38.5 min^{-1}
    c. 9.25 min^{-1}
    d. 0.026 min^{-1}

5. In the rate limiting approximation for a two-step reaction, the overall rate of the reaction is always equal to the rate of the _____ step in the reaction mechanism.
    a. First
    b. Second
    c. Fastest
    d. Slowest

6. Which of the following examples demonstrate homogeneous catalyst?
    i. $Pt_{(s)}$ catalyzing the reaction of $O_{2(g)}$ with $CO_{(g)}$
    ii. $Cl_{(g)}$ catalyzing the decomposition of $O_{3(g)}$
    iii. $H_2O_{2(aq)}$ decomposition catalyzed by $Br^-_{(g)}$
    a. i only
    b. ii only
    c. i and iii
    d. ii and iii

7. What is the equilibrium expression for this reaction:
    i. $2HgO(s) \Leftrightarrow 2Hg(l) + 0_2(g)$
    a. $K = [Hg][O_2]/[HgO]$
    b. $K = [Hg]^2[O_2]$
    c. $K = [O_2]$
    d. None of the above

8. Gaseous hydrogen and iodine react to produce HI gas. A mixture of hydrogen gas and iodine has are placed in a 1.00L flask and allowed to reach equilibrium. At equilibrium, the flask contains 0.239g of HI, 0.254g of I_2 and 0.00013g of H_2. Calculate the value for K
    a. 1.7×10^4
    b. 5.4×10^1
    c. 3.3×10^3
    d. 1.9×10^{-3}

9. If Q > K then:
    a. The reaction is at equilibrium
    b. The reaction with proceed to the left
    c. The reaction will proceed to the right

10. The equilibrium constant for the following reaction is 3.93 at 1200 K. a system at equilibrium has [CO] = 0.0613 M, $[H_2]$ = 0.1839 M and $[CH_4]$ = 0.0387 M. What is the $[H_2O]$?
    $3H_2(g) + CO(g) \Leftrightarrow CH_4(g) + H_2O(g)$
    a. 0.0323
    b. 0.0387
    c. 0.0276
    d. 0.0201

11. When equilibrium has been reached in the reaction **AE** + **CD** $\rightarrow\leftarrow$ **CE** + **AD** + x kJ in which all substances are in solution,

a. Adding **AE** will increase the concentration of **CE** but not of **AD**.

b. Adding **CD** will increase the concentration of both **AE** and **AD**.

c. Heating will increase the concentration of both **AE** and **CE**.

d. Escape of some **AD** by volatilization will increase the concentration of **CE**.

e. Doubling the pressure will increase the concentration of **CE**.

12. For the exothermic reaction: $4NH_3(g) + 7O_2(g) \Leftrightarrow 4NO_2(g) + 6H_2O(g)$ which change will increase the quantity of NO_2

a. Increasing temperature

b. Decreasing container volume

c. Removing oxygen

d. Adding neon gas

e. Adding gaseous water

13. $H_2CO_3(aq) + H_2O(l) \Leftrightarrow HCO_3^-(aq) + H_3O^+(aq)$

$HCO_3^-(aq) + H_2O(l) \Leftrightarrow CO_3^{2-}(aq) + H_3O^+(aq)$

According to the preceding equations, which is the conjugate base of bicarbonate?

a. H_2CO_3

b. H_2O

c. H_3O^+

d. CO_3^{2-}

14. A solution of lye (NaOH) has a hydronium ion concentration of 6.3×10^{-12}M. What is the pH of the lye solution?

a. 10.20

b. 12.60

c. 11.20

d. 11.80

15. All are potential Lewis bases **except**

a. NH_3

b. H_2O

c. CH_4

d. CN^-

16.What is the pH of a solution of 0.31 M acid and 0.65 M of its conjugate base if the ionization constant is 5.22×10^{-7}

a. 6.60

b. 7.21

c. 7.00

d. 6.81

17.All are examples of Lewis acid-base reactions except

a. $Cu^{2+}(aq) + 4NH_3(aq) \rightleftarrows [Cu(NH_3)_4]^{2+}(aq)$

b. $HCl(g) + NH_3(g) \rightarrow NH_4Cl(s)$

c. $H^+(aq) + OH^-(aq) \rightleftarrows H_2O(l)$

d. $2Na(s) + Cl_2(g) \rightarrow 2NaCl(s)$

18.Given the following Ka values, determine which species is the strongest base.

H_2SO_3 1.2×10^{-2}

HNO_2 4.5×10^{-4}

HCNO 3.5×10^{-4}

a. HSO_3^-

b. H_2SO_3

c. NO_2^-

d. CNO^-

19. After 0.512 g of an unknown monoprotic acid is dissolved in enough water to produce 35.0 mL of solution, the solution is titrated and 40.0 mL of 0.100 M KOH is required to reach the equivalence point. Calculate the molar mass of the acid.

a. 81.0 g/mol

b. 128 g/mol

c. 37.0 g/mol

d. 211 g/mol

20. Calculate the pH of a solution containing 1.5 M acetic acid and 0.025 M sodium acetate. For acetic acid, Ka = 1.8×10^{-5}

a. 6.30

b. 11.00

c. 2.97

d. 1.23

21. Which of the following salts will produce a basic solution when dissolved in water?

a. NaCl

b. KNO_3

c. NaBr

d. NaCN

e. KI

22. Which is a proper description of chemical equilibrium?

a. The frequencies of reactant and of product collisions are identical.

b. The concentrations of products and reactants are identical.

c. The velocities of product and reactant molecules are identical

d. Reactant molecules are forming products as fast as product molecules are reacting to form reactants

e. The numbers of moles of reactants and products are equal.

23. The solubility of $Ba(IO_3)_2$ is 0.26 g/L. What is the solubility product constant?

a. 6.1×10^{-10}

b. 1.0×10^{-7}

c. 2.5×10^{-4}

d. 4.2×10^{-8}

24. A saturated solution of which salt will have the highest [Ag+]?

a. AgCl ($K_{sp} = 1.8 \times 10^{-10}$)

b. Ag_2CrO_4 ($K_{sp} = 1.1 \times 10^{-12}$)

c. Ag_3PO_4 ($K_{sp} = 1.8 \times 10^{-21}$)

d. Ag_2S ($K_{sp} = 1.1 \times 10^{-51}$)

25. Three metals A, B, and C are tested in a voltaic cell with their respective cations. The following results were obtained.

A and B: A is the cathode

B and C: C is the cathode

A and C: A is the anode

What is the order of the reduction potentials from highest to lowest for the cations of these metals?

a. A > B > C

b. B > C > A

c. C > A > B

d. A > C > B

26. In which pair of substances do the nitrogen atoms have the same oxidation state?

a. HNO_3 and N_2O_5

b. NO and HNO_2

c. N_2 and N_2O

d. HNO_2 and HNO_3

27. In the equation below, which species acts as the oxidizing agent?

$PbS(s) + PbO_2(s) + 2H^+(aq) + 2HSO_4^-(aq) \rightarrow 2PbSO_4(s) + 2H_2O(l)$

a. Pb(s)

b. $PbO_2(s)$

c. $H^+(aq)$

d. $HSO_4^-(aq)$

28. A standard voltaic cell is constructed using Cu metal in 1.0 M copper(II) nitrate and an unknown metal in a 1.0 M solution of its nitrate salt. The cell voltage is 0.47 V when the copper half cell is the cathode. What is the standard reduction potential of the unknown metal (E^o Cu = 0.34V)

a. −0.81V

b. −0.13V

c. 0.81V

d. 0.13V

29. A voltaic cell is constructed with the overall reaction: $Sn^{2+}(aq) + 2Ag^{+}(aq) \rightarrow Sn^{4+}(aq) + 2Ag(s)$. Which change will increase the voltage of the cell?

a. Increasing $[Sn^{2+}]$

b. Increasing $[Sn^{4+}]$

c. Decreasing $[Ag^{+}]$

d. Reducing the size of Ag electrode

30. The E^{o} at 25°C for the following reaction is 2.097 V. Calculate the G^{o} in kJ

$2K(s) + 2H_2O(l) \rightarrow 2K^{+}(aq) + H_2(g)$

a. −202.3

b. −303.4

c. −404.7

d. −352.4

31. Which of the following ions is least likely to form colored complex ions?

a. Zn^{2+}

b. Mn^{2+}

c. Fe^{3+}

d. Cr^{3+}

32. When sodium hydroxide solution is added to magnesium sulfate solution, a white precipitate of magnesium hydroxide is obtained. When sodium hydroxide solution is added to an “unknown” solution, a white precipitate is obtained. To conclude that the unknown solution contains magnesium ion, it must be assumed

that

a. NaOH is more soluble than $Mg(OH)_2$.

b. Na_2SO_4 is soluble in water.

c. $Mg(OH)_2$ is insoluble in water.

d. NaOH forms no white precipitate with any other ion except Mg^{2+}.

e. Zn^{2+}, which forms white $Zn(OH)_2$, is not present in the unknown.

33. Which one of the following processes results in an increase of entropy?

a. Freezing

b. Sublimation

c. Crystallization

d. Cooling a gas

e. Condensation

34. What is the electron configuration for zirconium?

a. [Kr] $5s^2 3d^1$

b. [Ar] $4s^2 3d^1$

c. [Kr] $5s^2 4d^2$

d. [Ar] $5s^2 3d^1$

35. In a complex ion, the metal atom acts as a(n)

a. Lewis acid

b. Arrhenius acid

c. Bronsted-Lowry base

d. Lewis base

36. What is the coordination number for an octahedral complex?

    a. 5

    b. 8

    c. 4

    d. 6

37. What is the name for the complex ion $[Fe(OH_2)_5Cl]^{2+}$

    a. chloroaquairon(II) ion

    b. chloropentaaquairion(II) ion

    c. pentaaquachloroiron(III) ion

    d. aquapentachloroiron(II) ion

38. the prefix “cis” places an isomer into which one of the following classes of isomers.

    a. Geometric isomers

    b. Coordination isomers

    c. Optical isomers

    d. Linkage isomers

39. In the complex ion ML_6^{n+}, M^{n+} has four d electrons and L is a weak field ligand. According to crystal field theory the magnetic

properties of this complex ion correspond to the presence of how many unpaired electrons?

a. 1

b. 2

c. 3

d. 4

40. How many carbons does propane have?

a. 1

b. 3

c. 5

d. 4

41. The ending –ene at the end of an organic compound indicates that

a. The compound is optically active

b. There is a functional group attached to the carbon chain

c. There is a double bond in the carbon chain

d. The carbon compound has aromatic properties

42. In Breaking Bad, the major precursor to making methamphetamine is methylamine. What is the major functionality in this precursor?

a. NH_3

b. $C_2H_4O_2$

c. H_2N^-

d. $C_3H_6O_2$

e. Long Live Heisenberg