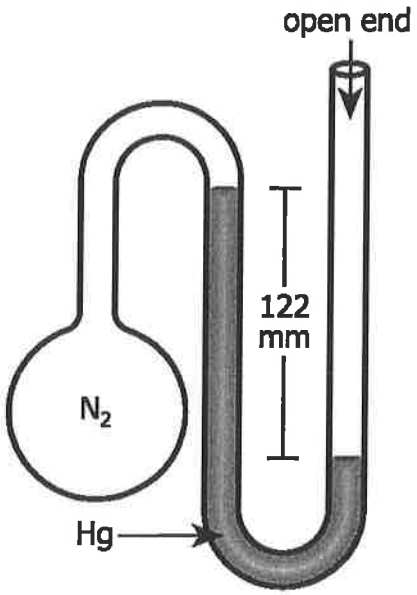
2nd and 3rd Blizzard Pack

Name _____ Date _____

1 .) A vessel connected to an open-end mercury (Hg) manometer contains nitrogen (N_2) gas. The atmospheric pressure is 0.993 atm. The height difference between the two arms of the manometer is 122 mm.

Ch 14



What is the pressure, in mm Hg, of the N_2 gas?

A. 355

B. 633

C. 755

D. 877

2) At 1.00 atm, a sealed weather balloon contains 20.0 L of helium (He) gas at 25.0°C. Assume that none of the He escapes and the pressure is constant. What is the volume, in liters, of He in the weather balloon at 35.0°C ?

Ch 14

A. 40.0

B. 28.0

C. 20.7

D. 14.3

3 Sylvia heats 2.28 g of a liquid until it completely vaporizes. The boiling point of the liquid is 56.3°C. She collects all of the gas in a 750.0 mL vessel. The pressure of the gas is 1.41 atm at 56.3°C. What is the molar mass, in g/mol, of the liquid?

Ch.14

A. 9.97

B. 22.3

C. 58.3

D. 121

4) Which statement correctly describes the melting of a solid?

A. The particles in the solid lose enough kinetic energy to overcome the interactions preventing them from approaching one another.

Ch13

B. The particles in the solid lose enough kinetic energy to overcome the interactions holding them in an organized pattern.

C. The particles in the solid gain enough kinetic energy to overcome the interactions preventing them from approaching one another.

D. The particles in the solid gain enough kinetic energy to overcome the interactions holding them in an organized pattern.

5) At constant temperature, Kelly increases the volume of a fixed amount of a gas. Use the kinetic-molecular theory to explain how increasing the volume affects the pressure of the gas.

A. The pressure decreases because there are fewer collisions between gas molecules and the container walls.

Ch.13

B. The pressure decreases because there are more collisions between gas molecules and the container walls.

C. The pressure increases because there are fewer collisions between gas molecules and the container walls.

D. The pressure increases because there are more collisions between gas molecules and the container walls.

6) The boiling point of pure liquid ethanol is 78.5°C. Which statement correctly describes liquid ethanol while it is boiling?

Ch13

A. Its molecules donate enough kinetic energy to evaporate.

B. Its molecules acquire enough kinetic energy to evaporate.

C. Its vapor pressure is lower than atmospheric pressure.

D. Its vapor pressure is higher than atmospheric pressure.

7) At 1254 m above sea level, the city of Helena, Montana, has an average atmospheric pressure of 0.859 atm. A chemistry student in Helena finds that pure distilled water boils at 95.9°C. Which statement explains the student's results at this high elevation?

Ch 14

A. The boiling point of water increases due to lower atmospheric pressure.

B. The boiling point of water increases due to higher atmospheric pressure.

C. The boiling point of water decreases due to lower atmospheric pressure.

D. The boiling point of water decreases due to higher atmospheric pressure.

8) For a chemistry homework assignment, Beth must consider the effusion rates of methane (CH_4) gas and nitrogen trifluoride (NF_3) gas at 25°C. Effusion occurs as gas particles escape from a container through a small hole. Which statement accurately compares the effusion rates of CH_4 and NF_3 at 25°C ?

Ch 14

A. CH_4 effuses 2 times faster than NF_3.

B. CH_4 effuses 4 times faster than NF_3.

C. NF_3 effuses 2 times faster than CH_4.

D. NF_3 effuses 4 times faster than CH_4.

9) At 15°C, 0.252 mol of argon (Ar) gas occupies 174 mL. What is the pressure, in atm, of the Ar gas?

Ch 14

A. 1.78

B. 2.92

C. 12.6

D. 34.2

10) At high temperatures, chlorine (Cl_2) reacts with fluorine (F_2) to produce chlorine trifluoride (ClF_3).

$$Cl_2(g) + 3\ F_2(g) \rightarrow 2\ ClF_3(g)$$

Ch 14

A chemist carries out the reaction of 0.250 mol of F_2 with excess Cl_2. At 250.0°C and 1.00 atm, what is the maximum volume of ClF_3, in liters, that the reaction can produce?

A. 3.42

B. 3.73

C. 7.16

D. 10.7

B

11) Which substance is a solution?

Ch.15

A. Sand

B. Molten gold

C. Graphite

D. Brass

12) While preparing 2.0 L of iced tea, Dora adds 150 g of sucrose ($C_{12}H_{22}O_{11}$). What is the molarity of the $C_{12}H_{22}O_{11}$ in the iced tea?

Ch.15

A. 0.11

B. 0.22

C. 0.44

D. 0.88

13) A biochemistry student prepares a saline solution containing the same concentration of salt as normal human blood. The student adds 2.25 g of sodium chloride (NaCl) to 250.0 g of sterile water (H_2O). What is the percent composition (mass/mass) of the saline solution?

Ch.15

A. 0.884%

B. 0.892%

C. 0.900%

D. 0.908%

14) Yvonne adds 1.0 g of a solid to 1 L of water. The solid does not dissolve, and the mixture is cloudy. Can Yvonne classify this mixture as a true solution, and why?

Ch.15

A. Yes, because the solid is the solute and water is the solvent.

B. Yes, because the solid is distributed uniformly throughout the water.

C. No, because the solid does not settle to the bottom of the mixture.

D. No, because the solid does not dissolve in the solvent.

15) At 25°C, the solubility product constant (K_{sp}) for magnesium fluoride (MgF_2) is 3.70×10^{-8}. During chemistry class, Chenise prepares a saturated aqueous solution of MgF_2 at 25°C. What is the molarity of F^- in the saturated solution?

Ch.15

A. 1.36×10^{-4}

B. 2.10×10^{-3}

C. 3.33×10^{-3}

D. 4.20×10^{-3}

16) Brian investigated the solubility rate of sugar in coffee and recorded his procedure in this table.

Solubility of Sugar in Coffee		
Experiment	Form of sugar	Temperature (°C)
1	cube	95
2	cube	50
3	granulated	95
4	granulated	50

Ch 15

For each experiment, he used 4.0 g of sugar, 250.0 mL of coffee, and an equal amount of mixing. Which experiment most likely had the fastest rate for the sugar dissolving in the coffee?

A. Experiment 1

B. Experiment 2

C. Experiment 3

D. Experiment 4

17) Max must prepare an aqueous solution of magnesium chloride ($MgCl_2$) with a molality of 0.250. How many grams of $MgCl_2$ must he add to 1.40 kg of water (H_2O) ?

Ch 15

A. 5.60

B. 17.0

C. 23.8

D. 33.3

18) A student needs 250.0 mL of aqueous 2.50 M hydrochloric acid (HCl) for an experiment. The student has 150.0 mL of 6.00 M HCl(*aq*). Which procedure can the student use to prepare the required solution?

Ch 15

A. Adding 3.600 mL of 6.00 M HCl(*aq*) to approximately 225 mL of water and diluting to 250.0 mL with water

B. Adding 16.67 mL of 6.00 M HCl(*aq*) to approximately 200 mL of water and diluting to 250.0 mL with water

C. Adding 62.50 mL of 6.00 M HCl(*aq*) to approximately 175 mL of water and diluting to 250.0 mL with water

D. Adding 104.2 mL of 6.00 M HCl(*aq*) to approximately 125 mL of water and diluting to 250.0 mL with water

19)) A student dissolves 2.00 g of sodium hydroxide (NaOH) in enough distilled water to make 250.0 mL of solution. What is the molarity of the resulting solution?

Ch 15

A. 2.00×10^{-4}

B. 8.00×10^{-3}

C. 0.200

D. 8.00

20)) Luis prepares a carbonated beverage using carbon dioxide gas (CO_2), solid sucrose ($C_{12}H_{22}O_{11}$), and liquid water (H_2O). Identify only the solute(s).

Ch 15

A. CO_2

B. H_2O

C. CO_2 and $C_{12}H_{22}O_{11}$

D. $C_{12}H_{22}O_{11}$ and H_2O

21)) A pharmacist prepared a liquid medication and gave instructions to shake the medication well before using. How did the pharmacist most likely formulate the medicine?

Ch 15

A. As a suspension with particles that settled to the bottom of the container

B. As a true solution with particles that settled to the bottom of the container

C. As a colloid with particles that remain unevenly distributed throughout the container

D. As a homogeneous mixture with particles that remain unevenly distributed throughout the container

22)) At 25°C, a chemistry student prepared a saturated solution of silver bromide (AgBr) in water. The molarity of Br^- in the solution was 7.07×10^{-7} M. Calculate the solubility product constant (K_{sp}) for AgBr at 25°C.

Ch 15

A. 5.00×10^{-13}

B. 2.00×10^{-12}

C. 3.54×10^{-7}

D. 1.41×10^{-6}

23)) Evaporation of water (H_2O) from a surface is an efficient way to cool the surface. The heat of vaporization of H_2O is 40.8 kJ/mol. Assume all of the heat comes from the surface. If 36.0 g of H_2O evaporates from the surface, how much heat, in kJ, does the surface lose?

Ch 16

A. 20.4

B. 76.8

C. 81.5

D. 94.8

24)) This equation shows the heat of reaction (ΔH°_{rxn}) for the formation of 1 mol of water (H_2O) from the reaction of hydrogen (H_2) and oxygen (O_2).

Ch 16

$$H_2(g) + \frac{1}{2} O_2(g) \rightleftharpoons H_2O(l);$$

$$\Delta H^\circ_{rxn} = -286 \text{ kJ}$$

25) What is the minimum amount of energy, in kJ, required to produce 1 mol of O_2 through the decomposition of H_2O ?

A. 572

B. 286

C. −286

D. −572

26)) A student observes the combustion of propane (C_3H_8). Because of the heat and light it generates, the student concludes that the reaction has NO activation energy. Is the student's conclusion correct, and why?

A. Yes; because the propane is flammable, there is no activation energy.

Ch 16

B. Yes; because the reaction generates heat, there is no activation energy.

C. No; because the reaction requires an ignition source, it does have an activation energy.

D. No; because the reaction generates light, it does have an activation energy.

27)) Which chemical reaction involves the largest increase in entropy?

Ch 16

A. $CO_2(g) \rightarrow CO_2(s)$

B. $2\ Mg(s) + O_2(g) \rightarrow 2\ MgO(s)$

C. $2\ NaN_3(s) \rightarrow 2\ Na(l) + 3\ N_2(g)$

D. $Pb(NO_3)_2(aq) + 2\ KI(aq) \rightarrow PbI_2(s) + 2\ KNO_3(aq)$

28) According to collision theory, what is the name of the unstable arrangement of atoms that exists at the peak of the activation energy barrier for a chemical reaction?

Ch 17

A. Activated complex

B. Activated intermediate

C. Discrete complex

D. Discrete intermediate

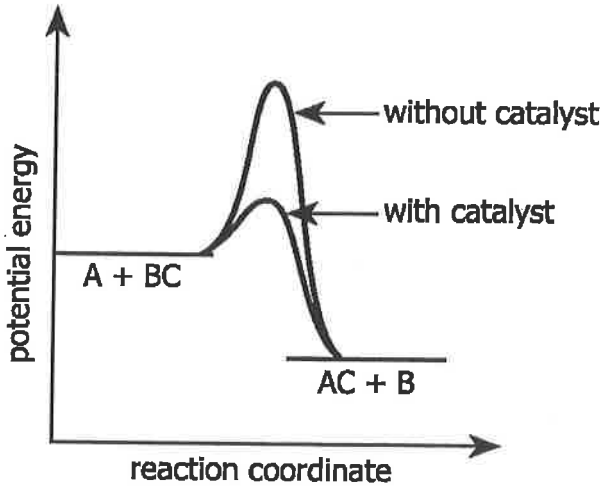
29) In chemistry class, Kim and Feng studied this reaction.

$$A + BC \rightarrow AC + B$$

They carried out the reaction with a catalyst and without a catalyst. Then, they displayed their results in this Potential Energy Diagram.

Potential Energy Diagram

Ch 17



30) Which statement correctly describes their results?

A. Adding a catalyst decreased the activation energy of the reaction.

B. Adding a catalyst increased the activation energy of the reaction.

C. Adding a catalyst decreased the potential energy of the reaction products.

D. Adding a catalyst increased the potential energy of the reaction products.

31) Which statement correctly describes the role of a catalyst in a chemical reaction?

Ch 17

A. It is consumed during the reaction.

B. It increases the rate of the reaction.

C. It does not change the pathway of the reaction.

D. It decreases the equilibrium constant for the reaction.

32)) Phosgene ($COCl_2$) decomposes to produce carbon monoxide (CO) and chlorine (Cl_2) in this equilibrium reaction.

$$COCl_2(g) \rightleftharpoons CO(g) + Cl_2(g)$$

A chemist performs this reaction in a 2 L container and obtains a 7.0% yield of Cl_2. How can the chemist improve the percent yield of Cl_2 in this equilibrium reaction?

Ch 18

A. By reducing the volume of the container

B. By increasing the volume of the container

C. By using a smaller amount of $COCl_2$

D. By using a larger amount of $COCl_2$

33)) What is the correct equilibrium law expression for this chemical equilibrium?

Ch 18

$$4\ NH_3(g) + 3\ O_2(g) \rightleftharpoons 6\ H_2O(g) + 2\ N_2(g)$$

A. $\dfrac{[H_2O] + [N_2]}{[NH_3] + [O_2]}$

B. $\dfrac{[H_2O] - [N_2]}{[NH_3] - [O_2]}$

C. $\dfrac{[H_2O]^6 \times [N_2]^2}{[NH_3]^4 \times [O_2]^3}$

D. $\dfrac{6[H_2O]^6 \times 2[N_2]^2}{4[NH_3]^4 \times 3[O_2]^3}$

34)) In a closed container at standard temperature and pressure, a chemistry student carries out the reaction of hydrogen (H_2) with iodine (I_2) to produce hydrogen iodide (HI), as shown in this chemical equilibrium.

Ch 18

$$H_2(g) + I_2(g) \rightleftharpoons 2\ HI(g)$$

This equilibrium reaction is endothermic. Use Le Châtelier's principle to determine how the student can maximize the production of HI in this equilibrium reaction.

A. By adding $HI(g)$ to the reaction

B. By removing $I_2(g)$ from the reaction

C. By decreasing the pressure

D. By increasing the temperature

35) Ben has a saturated aqueous solution of calcium fluoride (CaF_2). At 25°C, the solubility product constant (K_{sp}) for CaF_2 is 3.90×10^{-11}. What is the molarity of Ca^{2+} in Ben's solution at 25°C ?

Ch 18

A. 3.39×10^{-4}

B. 2.14×10^{-4}

C. 6.25×10^{-6}

D. 4.42×10^{-6}

36) During chemistry class, James studied the equilibrium reaction between Compound D and Compound X in water.

$$2\ D(aq) + 3\ X(aq) \rightleftharpoons D_2X_3(aq)$$

He studied the reaction at 4 different temperatures, and he measured the molarity of each chemical species at equilibrium. James recorded his results in this table.

Ch 18

Reaction of Compound D with Compound X			
Temperature (°C)	D (M)	X (M)	D_2X_3 (M)
25.0	0.350	0.400	0.250
35.0	0.280	0.310	0.340
45.0	0.220	0.270	0.360
55.0	0.210	0.280	0.360

37) Use the data in the table to determine the temperature of the reaction with the largest equilibrium constant.

A. 25°C

B. 35°C

C. 45°C

D. 55°C

38) Chemists produce hydrogen (H_2) gas using this exothermic reaction.

$$CO(g) + H_2O(g) \rightleftharpoons CO_2(g) + H_2(g)$$

Ch 18

Assuming that the reaction is at equilibrium, which change will result in an increase in the amount of H_2 formed?

A. Removing CO_2 from the reaction

B. Removing CO from the reaction

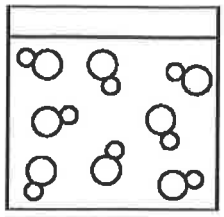
C. Increasing the temperature

D. Adding a catalyst

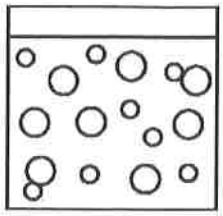
39) Hydroiodic acid, HI, is a strong acid. Which of the following diagrams best represents the degree of dissociation of HI in water? (Note: Individual H_2O molecules have been omitted from the diagram)

.19

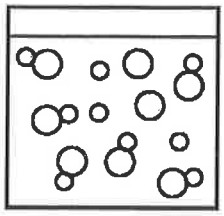
A.



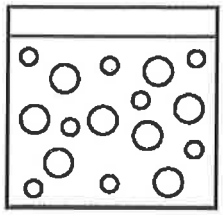
C.



B.



D.



40.) Which of the following acids is a strong acid?

.19

A. HBr
B. HCN
C. H_2O
D. H_2S

41.) Which of the following bases is a weak base?

.19

A. LiOH
B. KOH
C. NH_4OH
D. $Ca(OH)_2$

42) As the pH of an aqueous solution increases from 5 to 9, what happens?

.19

A. The concentrations of H^+ and OH^- both decrease.
B. The concentrations of H^+ and OH^- both increase.
C. The concentration of H^+ decreases, and the concentration of OH^- increases.
D. The concentration of H^+ increases, and the concentration of OH^- decreases.

43.) At 25°C, an aqueous solution of lithium hydroxide (LiOH) has a molarity of 0.025 M. What is the pH of this solution?

.19

A. 1.60
B. 2.40
C. 12.40
D. 13.60

44) Peroxidase is an enzyme that breaks down peroxides.

Dr. Cortez performs an experiment to determine how pH affects the ability of peroxidase to break down peroxides. She performs the experiment at 37°C and records her results in this table. Dr. Cortez defines peroxidase activity as a measure of its ability to break down peroxides.

CR 19

Effects of pH on Peroxidase Activity	
pH	Peroxidase activity
2	none
4	low
6	medium
7	high

45) At 37°C, Dr. Cortez adjusts the pH of a peroxidase sample from 5.0 to 7.0. What effect, if any, would this pH change have on the ability of peroxidase to break down peroxides?

A. It would stop the breakdown.

B. It would reduce the breakdown.

C. It would increase the breakdown.

D. It would have no effect on the breakdown.

46) Drain cleaners often contain sodium hydroxide (NaOH), which helps to remove organic wastes in the drain. If a student adds 2.00 g of NaOH to 250.0 mL of pure water in the drain of the laboratory sink, which value is closest to the resulting pOH of the water?

CR 19

A. 0.7

B. 3.7

C. 10.3

D. 13.3

47) Consider this balanced oxidation-reduction reaction.

c.20

$$6\ Sb + 10\ HNO_3 \rightarrow 3\ Sb_2O_5 + 10\ NO + 5\ H_2O$$

Which statement correctly describes how the oxidation number of the reducing agent changes in this reaction?

A. The oxidation number of H changes from +1 to −1.

B. The oxidation number of N changes from +5 to +2.

C. The oxidation number of O changes from −2 to −1.

D. The oxidation number of Sb changes from 0 to +5.

48) Many portable electronic devices contain rechargeable nickel-cadmium (Ni-Cd) batteries. The voltaic cell in a Ni-Cd battery contains half-cells with these half-reactions.

c.21

Half-reaction	Standard reduction potential ($E°$)
$Ni^{2+}(aq) + 2\ e^- \rightarrow Ni(s)$	−0.25 V
$Cd^{2+}(aq) + 2\ e^- \rightarrow Cd(s)$	−0.40 V

49) Use the standard reduction potentials of the half-reactions to determine the standard cell potential ($E°_{cell}$), in V, for the Ni-Cd battery, and determine if the overall reaction in the Ni-Cd battery is spontaneous.

A. +0.15, spontaneous

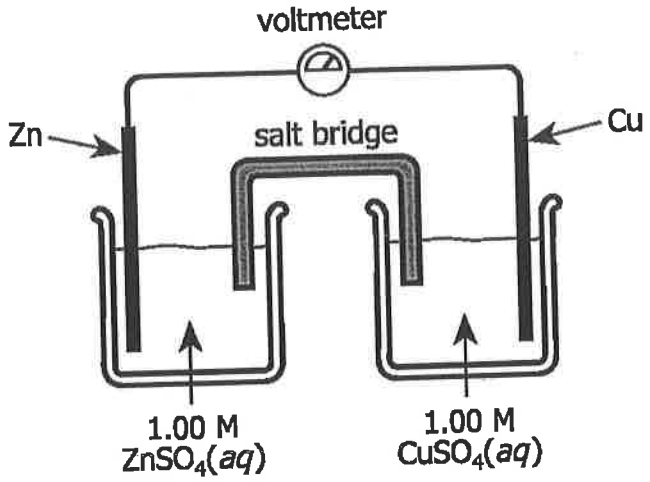
B. +0.15, not spontaneous

C. −0.15, spontaneous

D. −0.15, not spontaneous

50) This diagram shows a voltaic cell. One half-cell contains a zinc (Zn) electrode in 1.00 M aqueous zinc sulfate ($ZnSO_4$). The other half-cell contains a copper (Cu) electrode in 1.00 M aqueous copper(II) sulfate ($CuSO_4$).

q21

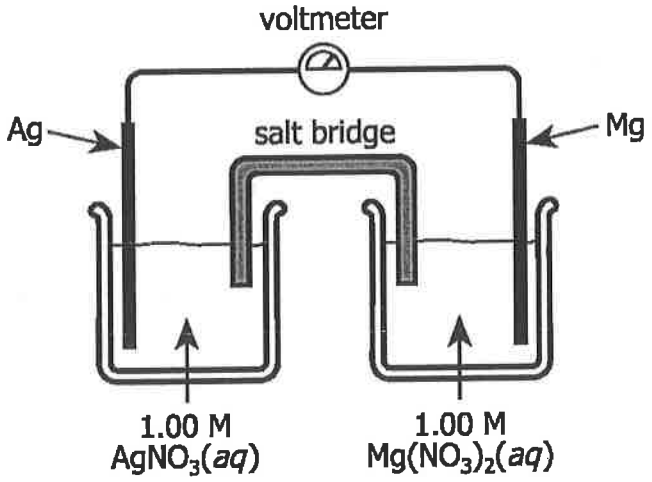


During normal operation, this voltaic cell produces a voltage of +1.10 V. If a chemist removes the salt bridge, what voltage (V) will the voltaic cell produce?

A. −1.10
B. 0.00
C. +0.55
D. +1.10

51) This diagram shows a voltaic cell containing silver (Ag) and magnesium (Mg) electrodes.

q21



Use the standard reduction potentials ($E°$) in the table to determine the standard cell potential ($E°_{cell}$), in V, for this voltaic cell.

Half-reaction	Standard reduction potential ($E°$)
$Ag^+(aq) + 1\ e^- \rightarrow Ag(s)$	+0.80 V
$Mg^{2+}(aq) + 2\ e^- \rightarrow Mg(s)$	−2.37 V

A. −1.57
B. −0.77
C. +3.17
D. +3.97

14