

**B** 98. A sample of gas occupies 40.0 mL at  $-123^{\circ}\text{C}$ . What volume does it occupy at  $27^{\circ}\text{C}$ ?

- A) 182 mL
- B) 8.80 mL
- C) 80.0 mL
- D) 20.0 mL

*Convert to K!*

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$V_2 = \frac{V_1 T_2}{T_1} = \frac{40(300)}{150} = 8.8 \text{ mL}$$

**A** 99. What does the ideal gas law allow a scientist to calculate that the other laws do not?

- A) number of moles
- B) pressure
- C) volume
- D) temperature

$$PV = nRT$$

**B** 100. Under laboratory conditions of  $25.0^{\circ}\text{C}$  and  $99.5 \text{ kPa}$ , what is the maximum number of liters of ammonia that could be produced from 1.50 L of nitrogen according to the following equation?

- A) 3.22 L
- B) 3.00 L
- C) 2.70 L
- D) 3.33 L

$$\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g})$$

$$PV = nRT$$

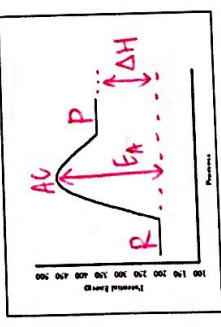
$$0.06 \text{ mol N}_2 \times \frac{2 \text{ mol NH}_3}{1 \text{ mol N}_2} = 0.12 \text{ mol NH}_3$$

$$V = \frac{nRT}{P} = \frac{0.12 \text{ mol} (298)}{99.5 \text{ kPa}} = 0.36 \text{ L}$$

**Standard 2.2 Analyze chemical reactions in terms of quantities, product formation, and energy.**

**A** 101. How does collision theory explain the effect of changing the concentration of reactants on the rate of a reaction?

- a. Decreasing the concentration decreases the rate of the reaction because there are few reactants to take part in collisions.
- b. Decreasing the concentration increases the rate of the reaction because there is more room for particles to collide.
- c. Decreasing the concentration increases the rate of reaction because there is more room for particles to rebound after colliding.
- d. The collision theory cannot explain the effect of changing the concentration of reactants.



102. On the diagram to the right, label the following: reactants, products, activated complex, activation energy, enthalpy of reaction ( $\Delta H$ )

103. Is the reaction shown in the diagram to the right exothermic or endothermic and how do you know? **Endothermic; heat was gained**

**C** 104. Which of the following is a chemical property?

- I. reactivity of a metal (according to the activity series)
- II. flammability
- III. mass
- IV. density

- A) I only
- B) II only
- C) I and II only
- D) II and IV only
- E) I, II and IV

**C** 105. During a lab experiment, a gas is produced in a test tube. A flaming wooden splint is held near the opening of the test tube and a loud pop is heard. The gas must be

- A) oxygen
- B) carbon dioxide
- C) hydrogen
- D) chlorine

**A** 106. During another lab experiment, a gas is produced in a test tube. When a glowing wooden splint is held near the opening of the test tube, it bursts into flame. The gas must be

- A) oxygen
- B) carbon dioxide
- C) hydrogen
- D) chlorine

**D** 107. During a lab experiment, a piece of zinc is submerged in silver nitrate solution. It looks like something fuzzy is forming on the piece of zinc. What is the "fuzzy" stuff?

- A) mold
- B) hydrogen gas
- C) nitrogen gas
- D) silver crystals



\*Write out reaction:

108. A zinc bar is dropped into a beaker of aqueous hydrochloric acid. \*Look @ Activity Series



109. Ethane ( $\text{C}_2\text{H}_6$ ) undergoes complete combustion.



110. Aqueous solutions of lead (II) nitrate and sodium chloride are mixed.



LOOK @ solubility rules  
- Insoluble = precipitate (solid)

$\frac{58.8g}{12.01g} = 4.9$   
 $\frac{9.8gH}{1.01g} = 9.7$   
 $\frac{31.4gO}{16.0g} = 1.96$   
 $4.9 : 9.7 : 1.96 \approx 5 : 10 : 2$   
 $C_5H_{10}O_2$

123. If the percent composition of a compound is found to be 58.8% C, 9.8% H, and 31.4% O, what will be the empirical formula of the compound?  
 A)  $C_5H_{10}O_2$   
 B)  $C_5H_8O_3$   
 C)  $C_4H_9O_2$   
 D)  $C_2H_5O$

124. If a compound has an empirical formula of  $CH_3O$  and a molar mass of 62 g/mol, what is its molecular formula?  
 $12 + 3(1.01) + 16 = 31.03$   
 $62 / 31.03 = 2$   
 B)  $C_2H_6O_2$

125. If 6.54 g of zinc are reacted with excess hydrochloric acid at STP how much hydrogen gas is produced?  
 $Zn + 2HCl \rightarrow ZnCl_2 + H_2$   
 $\frac{6.54g}{65.38g} \times \frac{1mol Zn}{1mol Zn} \times \frac{1mol H_2}{1mol Zn} \times \frac{22.4L}{1mol} = 2.24L$   
 A) 2.24 L

126. How much copper metal would have to be reacted with excess  $AgNO_3$  in order to obtain 10.0 g of silver?  
 $Cu + 2AgNO_3 \rightarrow Cu(NO_3)_2 + 2Ag$   
 $\frac{10g Ag}{107.87g} \times \frac{1mol Ag}{2mol Ag} \times \frac{1mol Cu}{1mol Ag} \times 63.55g = 2.94g$   
 A) 2.94 g

Standard 3.1 Understand the factors affecting rate of reaction and chemical equilibrium.

127. How does a catalyst speed up a chemical reaction?  
 A) by lowering the activation energy  
 B) by increasing the concentration of ions in the reaction vessel  
 C) by providing spectator ions that cheer the other ions on  
 D) by forming an activated complex  
 E) by producing enzymes in the cell

128. When a chemical reaction reaches equilibrium, which of the following is true?  
 I. There are more products than reactants  
 II. There is an equal amount of products and reactants  
 III. The rate of the forward reaction equals the rate of the reverse reaction  
 IV. The amount of reactants and products does not change  
 D) III and IV only

129. Le Chatelier's principle states that if a system is in equilibrium and a condition is changed, the equilibrium will  
 A) remain unchanged  
 B) shift to minimize the amount of reactants  
 C) shift to minimize the amount of products  
 D) shift to restore equilibrium

113.  $2HCl(aq) + Zn(s) \rightarrow ZnCl_2 + H_2$   
 114.  $HCl(aq) + Ag(s) \rightarrow AgCl + H_2$

205. An acid-base neutralization reaction is what type of reaction?  
 A) redox  
 B) single replacement  
 C) double replacement  
 D) synthesis  
 E) decomposition

$Al_2(SO_4)_3(aq) + 6NaOH(aq) \rightarrow 3Na_2SO_4(aq) + 2Al(OH)_3(s)$   
 7 mol

115. If 2.0 moles of aluminum sulfate are to be reacted, how many moles of aluminum hydroxide will be formed?  
 $2.0 mol Al_2(SO_4)_3 \times \frac{2 mol Al(OH)_3}{1 mol Al_2(SO_4)_3} = 4.0 mol$

116. What is the molar mass of aluminum hydroxide?  
 $27 + 3(17) = 78.03 g/mol$

117. How many moles of sodium sulfate are 35.5 g of sodium sulfate?  
 $\frac{35.5g}{142.05} = 0.25 mol Na_2SO_4$

118. How many atoms are in one formula unit of aluminum sulfate?  
 $2 Al + 3 S + 12 O = 17 atoms$

119. Hydrazine (dinitrogen tetrahydride) is used as a liquid rocket fuel. Hydrazine reacts with oxygen gas to produce nitrogen and water.  
 $N_2H_4 + O_2 \rightarrow N_2 + 2H_2O$

a) Write a balanced chemical equation for this reaction.  
 $640g N_2H_4 + O_2 \rightarrow N_2 + 2H_2O$

b) If 640 g of hydrazine is reacted in the presence of 10 moles of oxygen gas, how many grams of nitrogen gas are produced?  
 $588.9 g N_2$

120. 25g of zinc chloride reaction with 25 grams of sodium nitrate. What is the limiting reagent? What is the theoretical yield?  
 $25g ZnCl_2 \times \frac{1mol}{136.3g} = 0.183 mol$   
 $25g NaNO_3 \times \frac{1mol}{85.01g} = 0.294 mol$   
 $ZnCl_2 + 2NaNO_3 \rightarrow Zn(NO_3)_2 + 2NaCl$   
 Theoretical yield:  $17.2g NaCl$

121. Carbon disulfide,  $CS_2$ , is what percent carbon by mass?  
 A) 76%  
 B) 16%  
 C) 42%  
 D) 84%

122. Which of the following is NOT an empirical formula?  
 A)  $NaC_2H_3O_2$   
 B)  $C_2H_4$   
 C)  $CO_2$   
 D)  $CO$

Find LR  

$640g N_2H_4$	1 mol	1 mol	28g $N_2$
	38.06g	1 mol	1 mol $N_2$
			588.9g

10 mol $O_2$	1 mol $N_2$	28g
	1 mol $O_2$	1 mol $N_2$
		280g





130. Write the equilibrium constant expression ( $K_{eq}$ ) for this reaction.  $K_{eq} = \frac{[\text{NOCl}]^2}{[\text{NO}]^2[\text{Cl}_2]}$

131. If the system is in equilibrium and more chlorine gas is added, which way will the equilibrium shift? **right**

132. If the system is in equilibrium and NOCl is removed, which way will the equilibrium shift? **right**

133. If the pressure on the system is increased, which way will the equilibrium shift? **right**

134. If chlorine gas is removed from the system, which way will the equilibrium shift? **left**

135. What is the hydrogen ion concentration of a solution with a pH of 7.5?

- A)  $7.5 \times 10^{-13}$  M  
 B)  $3.2 \times 10^{-8}$  M  
 C)  $3.2 \times 10^{-7}$  M  
 D) 0.88 M

$$[\text{H}^+] = 10^{-\text{pH}} = 10^{-7.5}$$

136. If it takes 35.0 mL of a 0.1 N HCl solution to neutralize 25.0 mL of a NaOH solution, what is the concentration of the base? **TITRATION**

- A) 1.4 N  
 B) 0.07 N  
 C) 0.14 N  
 D) 0.7 N

$$M_a V_a = M_b V_b$$

$$M_b = \frac{M_a V_a}{V_b} = \frac{0.1(35 \text{ mL})}{25 \text{ mL}}$$

137. How many grams of potassium dichromate would be needed to make 500.0 mL of a 1.500 M solution?

- A) 145.5 g  
 B) 194.0 g  
 C) 220.5 g  
 D) 441.0 g

$$M = \frac{g}{\text{mol}}$$

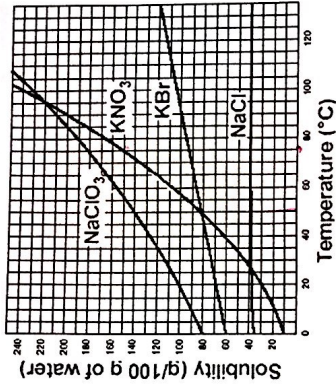
$$\frac{1.5 \text{ mol}}{\text{L}} \mid 0.5 \text{ L} = \frac{0.75 \text{ mol}}{\text{L}} \mid \frac{284.17 \text{ g}}{1 \text{ mol K}_2\text{Cr}_2\text{O}_7} = 213 \text{ g}$$

138. A 10.0 mL aliquot from a 6.0 M HCl solution is diluted to 50.0 mL. What is the concentration of the new solution?

- A) 1.2 M  
 B) 3.0 M  
 C) 8.3 M  
 D) 12.0 M  
 E) 30.0 M

139. Which of the following is NOT an electrolyte?

- A)  $\text{SnCl}_4$   
 B)  $\text{SO}_2$  — **molecular**  
 C)  $\text{NiNO}_3$   
 D)  $\text{MgCl}_2$   
 E) all of the above are electrolytes



80g in 100ml

Use the graph above to answer # 253-255.

140. How much potassium bromide is in 500 mL of a saturated solution at 50 °C? **400g**

141. How would you describe a solution of 155 g of KNO<sub>3</sub> dissolved in 100 g of water at 75°C? **supersat.**

141. An unknown substance is found. It dissolves in water and the solution conducts electricity, has a slippery feel and turns litmus paper blue. The substance must be

- A) a base  
 B) an acid  
 C) a salt  
 D) there is not enough information to tell

142. Mark each of the following A for an acid, B for a base, S for a salt and N for neither.

- A) A a)  $\text{HC}_2\text{H}_3\text{O}_2$   
 B) B b)  $\text{K}_2\text{SO}_4$   
 C) S c)  $\text{NH}_4\text{OH}$   
 D) S d)  $\text{Ca}(\text{OH})_2$   
 E) N e)  $\text{H}_2\text{CO}_3$   
 f) N f)  $\text{N}_2\text{O}_5$

143. Another name for a solution is

- A) a heterogeneous mixture  
 B) a homogeneous mixture  
 C) the Tyndall effect  
 D) an alloy  
 E) supersaturated