

AR Chemistry Final Review Set 3

1. You have a container of fixed volume filled with gas. What:
 - a. causes the pressure on the inside of the container?
 - b. is the definition for pressure?
 - c. will happen to the pressure if the temperature of the sample is increased
 - d. will happen to the pressure inside if the average kinetic of the sample is lowered?
2. You have a sample of gas in a container
 - a. Are all the molecules moving at the same speed?
 - b. What is the name and shape for the distribution of molecules in a sample at a given temperature?
 - c. The gas exerts equal pressure in all directions because the motions of the molecules are ???
3. You pop a Helium balloon in a closed room:
 - a. Where will the helium end up?
 - b. Why does the helium end up as described in (a)?
 - c. What is the term for gases or liquids mixing together by themselves? Why does this happen?
4. You have two balloons in a room, one filled with 3.0 moles of Hydrogen and the other with 3.0 moles of air (a mixture of nitrogen, oxygen, carbon dioxide, water vapor, and trace gases).
 - a. Which balloon, if either, is larger?
 - b. Which bag, if either, has molecules with a greater average kinetic energy?
 - c. What volume will the hydrogen balloon have if the temperature in the room is 25.0 C and the air pressure is 0.900 atm? ($R = 0.0821 \text{ L atm / mol K}$)
 - d. What will the volume of the balloon of air be if you pump in 3.0 more moles of air under the same conditions as in problem c?
5. What are the shapes of the curves for and the equations for:
 - a. pressure and volume of a gas at constant temperature?
 - b. volume and temperature of a gas at constant pressure?
 - c. pressure and temperature of a gas at constant volume?
 - d. What does the x-intercepts for graphs b and c indicate?

Solutions

6. The following compounds and elements are dissolved in water. Show how they dissolve in water.
 - a. $\text{HCl}_{(g)} \rightarrow \text{H}_2\text{O}$
 - b. $\text{NaCl}_{(s)} \rightarrow \text{H}_2\text{O}$
 - c. $\text{AlBr}_3_{(s)} \rightarrow \text{H}_2\text{O}$
 - d. $\text{C}_{12}\text{H}_{22}\text{O}_{11(s)} \rightarrow \text{H}_2\text{O}$
 - e. $\text{NH}_4\text{NO}_3_{(s)} \rightarrow \text{H}_2\text{O}$
 - f. $\text{Br}_{2(l)} \rightarrow \text{H}_2\text{O}$
 - g. $\text{CaCO}_3_{(s)} \rightarrow \text{H}_2\text{O}$
 - h. $\text{Al}_2(\text{SO}_4)_3_{(s)} \rightarrow \text{H}_2\text{O}$
7. Answer the following questions for ionic compounds?
 - a. Do they have members who are solid, liquid, and / or gas at room temperature?
 - b. Do they conduct electricity as solids? Liquids? Water solutions?
 - c. Are they made from metals and nonmetals or nonmetals and nonmetals?
8. Answer the questions above for covalently bonded compounds (molecular compounds).
9. Answer the questions above (a and b) for substances that have metallic bonds (metals).
10. Answer the questions above for substances that have covalent network bonds (SiO_2 / sand, C / diamond)

11. You have a 1.30 M CaCl_2 aqueous solution
- What chemical is the solute? the solvent?
 - Describe how the water dissolves (not reacts) the CaCl_2 .
 - How many grams of CaCl_2 would be in 100. mL of this solution? grams / Liter?
12. You dissolve 200. grams of sugar ($\text{C}_{12}\text{H}_{22}\text{O}_{11}$) into 980. grams of water to make 1.00 Liter of solution (the volume doesn't increase by 200 mL because of the density of the sugar and the fact that the sugar dissolved into the "empty spaces" between the water molecules).
- What is the molarity of the 1.0 L solution?
 - What is the percentage mass sugar of the solution?
13. You are trying to dissolve a solid into water. What will happen to the speed of dissolving if:
- the temperature is raised?
 - the solid is broken into smaller pieces?

Energy

14. For the reaction: $\text{A} + \text{B} \rightarrow \text{C} + \text{D}$
- You are told that the reaction is exothermic. What is the sign of ΔH ? Which side will "Heat" be placed in the reaction above (on the left / reactants or on the right / products)
 - You are told that the reaction is endothermic. What is the sign of ΔH ? Which side will "Heat" be placed in the reaction above (on the left / reactants or on the right / products)
15. $\text{Heat} + \text{NH}_4\text{Cl}_{(s)} \xrightarrow{-\text{H}_2\text{O}} \text{NH}_4\text{Cl}_{(aq)}$
- Is the reaction above exothermic or endothermic?
 - Is the reaction above an example of a physical change or chemical change?
 - What is the term for the type of chemical reaction above?
 - What happens to the temperature of the water during the process above?
16. Chemical Hot packs are made with anhydrous magnesium sulfate and water. When the magnesium sulfate dissolves in water the following reaction occurs.
- $$\text{MgSO}_4_{(s)} \xrightarrow{-\text{H}_2\text{O}} \text{MgSO}_4_{(aq)} + \text{Heat}$$
- Is the reaction above exothermic or endothermic?
 - Is the reaction above an example of a physical change or chemical change?
 - What is the term for the type of chemical reaction above?
 - What happens to the temperature of the water during the process above?
17. You have a sample of wax. Is heat absorbed or released when:
- the wax melts?
 - the vapor condenses on your skin?
 - the solid freezes?
 - the liquid vaporizes?
18. Chemical XY has a liquid specific heat of 2.0 J / g K, a heat of vaporization of 750 J/g and a boiling point of 68 °C.
- How many joules are required to warm 30. grams of XY from 20. C to 65 C?
 - How many joules are released when 5.6 grams of XY condense?
 - How many joules are required to convert 14.7 grams of XY from liquid at 45 C to gas at 68 C?

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- You have a container of fixed volume filled with gas. What:
 - causes the pressure on the inside of the container? **collisions with the walls**
 - is the definition for pressure? **$P = \text{Force} / \text{Area}$**
 - will happen to the pressure if the temperature of the sample is increased **increases**
 - will happen to the pressure inside if the average kinetic of the sample is lowered? **decreases**
- You have a sample of gas in a container
 - Are all the molecules moving at the same speed? **no, Poisson Distribution**
 - What is the name and shape for the distribution of molecules in a sample at a given temperature? **Poisson**
 - The gas exerts equal pressure in all directions because the motions of the molecules are ??? **random**
- You pop a Helium balloon in a closed room:
 - Where will the helium end up? **evenly spread throughout the room**
 - Why does the helium end up as described in (a)? **random motion**
 - What is the term for gases or liquids mixing together by themselves? Why does this happen? **diffusion / random**
- You have two balloons in a room, one filled with 3.0 moles of Hydrogen and the other with 3.0 moles of air (a mixture of nitrogen, oxygen, carbon dioxide, water vapor, and trace gases).
 - Which balloon, if either, is larger? **both the same—same moles, same volume**
 - Which bag, if either, has molecules with a greater average kinetic energy? **neither, at same temperature**
 - What volume will the hydrogen balloon have if the temperature in the room is 25.0 C and the air pressure is 0.900 atm? ($R = 0.0821 \text{ L atm} / \text{mol K}$) **81.6 L**
 - What will the volume of the balloon of air be if you pump in 3.0 more moles of air under the same conditions as in problem c? **double moles, double volume, 163**
- What are the shapes of the curves for and the equations for:
 - pressure and volume of a gas at constant temperature? **hyperbola**
 - volume and temperature of a gas at constant pressure? **straight line, slope > 0**
 - pressure and temperature of a gas at constant volume? **straight line, slope > 0**
 - What does the x-intercepts for graphs b and c indicate? **absolute zero, (no pressure, no volume)**

Solutions

- The following compounds and elements are dissolved in water. Show how they dissolve in water.
 - $\text{HCl}_{(g)} \rightarrow \text{H}^{+}_{(aq)} + \text{Cl}^{-}_{(aq)}$
 - $\text{NaCl}_{(s)} \rightarrow \text{Na}^{+}_{(aq)} + \text{Cl}^{-}_{(aq)}$
 - $\text{AlBr}_3_{(s)} \rightarrow \text{Al}^{+3}_{(aq)} + 3 \text{Br}^{-1}_{(aq)}$
 - $\text{C}_{12}\text{H}_{22}\text{O}_{11(s)} \rightarrow \text{C}_{12}\text{H}_{22}\text{O}_{11(aq)}$
 - $\text{NH}_4\text{NO}_3_{(s)} \rightarrow \text{NH}_4^{+1}_{(aq)} + \text{NO}_3^{-1}_{(aq)}$
 - $\text{Br}_2_{(l)} \rightarrow \text{Br}_2_{(aq)}$
 - $\text{CaCO}_3_{(s)} \rightarrow \text{doesn't dissolve}$
 - $\text{Al}_2(\text{SO}_4)_3_{(s)} \rightarrow 2 \text{Al}^{+3}_{(aq)} + 3 \text{SO}_4^{-2}_{(aq)}$
- Answer the following questions for ionic compounds?
 - Do they have members who are solid, liquid, and / or gas at room temperature? **solids only**
 - Do they conduct electricity as solids? Liquids? Water solutions? **solids no, liquids yes, aqueous yes**
 - Are they made from metals and nonmetals or nonmetals and nonmetals? **metals and nonmetals**
- Answer the questions above for covalently bonded compounds (molecular compounds). **{solids,liquids,gases} no, no**
- Answer the questions above (a and b) for substances that have metallic bonds (metals). **{solids, liquids}, yes, don't dissolve**
- Answer the questions above for substances that have covalent network bonds (SiO_2 / sand, C / diamond) **{solids}, no, no**

11. You have a 1.30 M CaCl_2 aqueous solution
- What chemical is the solute? the solvent? **solute = CaCl_2 solvent = water**
 - Describe how the water dissolves (not reacts) the CaCl_2 . **polar ends of water surround ions**
 - How many grams of CaCl_2 would be in 100. mL of this solution? grams / Liter? **14.4 g, 144 g/L**
12. You dissolve 200. grams of sugar ($\text{C}_{12}\text{H}_{22}\text{O}_{11}$) into 980. grams of water to make 1.00 Liter of solution (the volume doesn't increase by 200 mL because of the density of the sugar and the fact that the sugar dissolved into the "empty spaces" between the water molecules).
- What is the molarity of the 1.0 L solution? **1.11 M**
 - What is the percentage mass sugar of the solution? **17 %**
13. You are trying to dissolve a solid into water. What will happen to the speed of dissolving if:
- the temperature is raised? **increases**
 - the solid is broken into smaller pieces? **increases**

Energy

14. For the reaction: $\text{A} + \text{B} \rightarrow \text{C} + \text{D}$
- You are told that the reaction is exothermic. What is the sign of ΔH ? (-) Which side will "Heat" be placed in the reaction above (on the left / reactants or **on the right / products**)
 - You are told that the reaction is endothermic. What is the sign of ΔH ? (+) Which side will "Heat" be placed in the reaction above (**on the left / reactants** or on the right / products)
15. $\text{Heat} + \text{NH}_4\text{Cl}_{(s)} \xrightarrow{-\text{H}_2\text{O}} \text{NH}_4\text{Cl}_{(aq)}$
- Is the reaction above exothermic or endothermic? **endothermic**
 - Is the reaction above an example of a physical change or chemical change? **physical, formula is the same**
 - What is the term for the type of chemical reaction above? **dissolving, dissolution**
 - What happens to the temperature of the water during the process above? **colder, water loses energy**
16. Chemical Hot packs are made with anhydrous magnesium sulfate and water. When the magnesium sulfate dissolves in water the following reaction occurs.
- $$\text{MgSO}_{4(s)} \xrightarrow{-\text{H}_2\text{O}} \text{MgSO}_{4(aq)} + \text{Heat}$$
- Is the reaction above exothermic or endothermic? **exothermic**
 - Is the reaction above an example of a physical change or chemical change? **physical, formula is the same**
 - What is the term for the type of chemical reaction above? **dissolving, dissolution**
 - What happens to the temperature of the water during the process above? **warmer, gains energy**
17. You have a sample of wax. Is heat absorbed or released when:
- the wax melts? **absorbed**
 - the vapor condenses on your skin? **released**
 - the solid freezes? **released**
 - the liquid vaporizes? **absorbed**
18. Chemical XY has a liquid specific heat of 2.0 J / g K, a heat of vaporization of 750 J/g and a boiling point of 68 °C.
- How many joules are required to warm 30. grams of XY from 20. C to 65 C? **cmt = 2700 J**
 - How many joules are released when 5.6 grams of XY condense? **mh = 4200 J**
 - How many joules are required to convert 14.7 grams of XY from liquid at 45 C to gas at 68 C? **cmt + mh = 11,700 J**