Problem Set 4 Chem 115 Summer 2014 for Exam 4

Specific heat of ice = 2.09 J/g·ºC Specific heat of water = 4.18 J/g·ºC Specific heat of steam = 2.03 J/g·ºC Heat of fusion of water = 334 J/g Heat of vaporization of water =2260 J/g

R=0.0821 L atm/mol K=62.4 L torr/mol K

1. Explain why it is necessary to add air to a car’s tires during the winter?
2. The pressure of a sample of neon gas is 578 torr. What is the pressure in atmospheres?
3. A sample of nitrogen gas occupies a volume of 362 mL at 15oC. What is the volume of the nitrogen gas if the temperature is increased to 55oC?
4. A 3.48 L sample of methane gas contains methane at 2.94 atm pressure and 25.0oC. What is the mass of the gas?
5. The atmosphere of a newly discovered planet is composed of nitrogen (364 mm Hg), methane gas (632 mm Hg), and bromine gas (499 mm Hg). What is the atmospheric pressure on this planet?
6. Given the reaction 4 NH3(g) + 5 O2(g) 🡪 4 NO(g) + 6 H2O(g). How many L of water will be produced by the reaction of 16.8 L of ammonia (NH3) in excess oxygen at 25oC and 1.14 atm pressure?
7. An experiment shows that a 364 mL gas sample has a mass of 0.747 g at a pressure of 0.644 atm and a temperature of 37oC. What is the molar mass of the gas?
8. Classify these molecules as polar or nonpolar.

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| CCl4: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | H2O: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | CO2: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| H2: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | HF: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | CH3Cl: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

1. The four major attractive forces between particles are ionic bonds, dipole-dipole attractions, hydrogen bonds, and dispersion forces.
   1. Classify each compound by its predominant attractive or intermolecular force among atoms or molecules of the same type.

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| MgF2: **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** | HF: **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |
| HBr: **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** | N2: **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |

* 1. Based upon the intermolecular forces present, rank the substances according to the expected viscosity for the substance from highest to lowest boiling point.

1. Classify each process as endothermic or exothermic.

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| Evaporation: **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** | Freezing: **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** | Condensation: **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |
| Melting: **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** | Sublimation: **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |  |

1. Place the following substances in order of increasing vapor pressure at a given temperature (It may help to draw the Lewis structure of the molecules). Explain your order (it may help to list all IMF’s of each molecule).

Nitrogen trifluoride , ammonia, sulfur trioxide

1. Explain why ethyl alcohol (C2H5OH) has a higher boiling point (78.40 C) than methyl alcohol (CH3OH; 64.70 C).

1. Rank the following by from lowest to highest anticipated boiling point: C2H4, CH4, Ne, H3COCH3. Explain Answer

1. How much energy is needed to heat a 35.5g sample of ice at -17.5ºC to liquid water at 77.3ºC?
2. How much energy is needed to heat a 68.9g sample of water at 88.5ºC to steam at 103.7ºC?
3. A solution is prepared by dissolving 83.45 grams of potassium bicarbonate (KHCO3) in 524.6 grams of water Calculate the mass percent potassium bicarbonate in the solution.
4. Calculate the molarity of a solution prepared by dissolving 53.2 grams of Li2SO4(109.94 g/mol) in enough water to make 450.0 mL of solution.
5. Calculate the number of grams of silver nitrate required to prepare 250.0 mL of a 0.3714 M solution AgNO3.
6. What volume of 3.523 M CaCl2(110.98 g/mol) is required to prepare 750.0 mL of 0.8442 M CaCl2?
7. Given the reaction

2 K3PO4(aq) + 3 Ni(NO3)2(aq) 🡪 Ni3(PO4)2(s) + 6 KNO3(aq)

* 1. How many mL of a 4.235 M solution of nickel(II) nitrate are required to react with 0.1800 mol of potassium phosphate?
  2. How many grams of nickel(II) phosphate (366.0 g/mol) will be produced by the reaction of 38.95 mL of 4.235 M nickel(II) nitrate with excess potassium nitrate?

1. The solubility of carbon dioxide in water at 3.5 atm is 0.12 M. Calculate the solubility of carbon dioxide in water at a pressure of 7.2 atm.