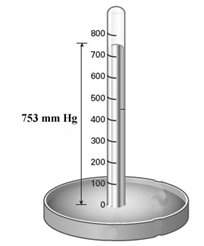
Exam 4

# Part 1: Multiple Choice (2 points each)

## Directions: Please circle the *best* answer for each of the following questions.

1. Examine the barometer shown below. Convert the pressure reading on the barometer to atm and psi.
   1. 0.991 atm; 14.6 psi
   2. 0.991 atm; 3.90 × 102 psi
   3. 5.72 × 103 atm; 14.6 psi
   4. 5.72 × 103 atm; 3.90 × 102 psi
   5. 75.3 atm; 1.11 × 103 psi
2. Which of the following gases should have the largest density at STP?
   1. CH3CH2CH3
   2. C4H10
   3. HCN
   4. Cl2
   5. The density cannot be predicted with the given data.
3. In a gas mixture the partial pressure of helium is 225 torr of neon 375 torr, and of argon 5 torr. What is the total pressure exerted by the mixture.
   1. 605 torr
   2. 4.22 × 105 torr
   3. It cannot be calculated without knowledge of the container volume.
   4. It cannot be calculated without atmospheric pressure.
   5. It cannot be calculated without both the container volume and atmospheric pressure.
4. Which of the following properties of liquids is least affected by the strength of intermolecular forces?
   1. Vapor pressure
   2. Boiling point
   3. Heat of vaporization
   4. Density
   5. Viscosity
5. With all other factors being equal, which of the following correctly lists intermolecular forces in order of increasing strength?
   1. dipole forces < induced dipole forces < hydrogen bonds
   2. hydrogen bonds < dipole forces < induced dipole forces
   3. induced dipole forces < dipole forces < hydrogen bonds
   4. dipole forces < hydrogen bonds < induced dipole forces
   5. induced dipole forces < hydrogen bonds < dipole forces
6. Which of the following correctly applies to the term “solution”?
   1. Heterogeneous mixture
   2. Variable composition
   3. Constant properties
   4. Dissolved particles are usually larger than about 10-7 cm
   5. Exist only in the liquid and gas state
7. When a saturated solution is in equilibrium with undissolved solute:
   1. the solution separated into layers.
   2. dissolving and crystallization stop.
   3. the quantity of dissolved solute equals the quantity of undissolved solute.
   4. the concentration of the solution remains constant.
   5. the temperature increases until more solute dissolves.
8. Which of the following is a characteristic property traditionally associated with an Arrhenius acid?
   1. Turns litmus paper blue
   2. Feels slippery
   3. Tastes bitter
   4. Sour taste
   5. Contain OH- ions
9. Consider the following generalized reaction.



For this reaction, which of the following is correct?

* 1. A is a proton source.
  2. B is a proton remover.
  3. A is an electron pair donor.
  4. B is an electron pair acceptor.
  5. This is a Lewis acid-base reaction.

1. Which type of glassware is labeled “TC”?
   1. Beaker
   2. Volumetric flask
   3. Florence flask
   4. Volumetric pipet
   5. Buret

# Part 2: Short Answer

## Directions: Answer each of the following questions. Be sure to use complete sentences where appropriate. For full credit be sure to show all of your work.

1. A plastic glove when attached to a flask gives the system a flexible volume. See the illustration below. From a starting point of 257 mL at 22 °C, to what volume will the system change if the temperature rises to 137 °C due to the heating by the laboratory burner (5 points)?

V1 = 257 mL

T1 = 22 °C + 273 = 295 K

V2 = ?

T2 = 137 °C + 273 = 410 K

1. Identify each as metallic, covalent network, ionic, or molecular solid (5 points).
   1. CO2 (s) \_\_\_\_\_\_\_\_\_molecular solid
   2. NaCl (s) \_\_\_\_\_\_\_\_\_ionic solid
   3. Ag (s) \_\_\_\_\_\_\_\_\_metallic solid
   4. C (s), diamond \_\_\_\_\_\_\_\_\_covalent network solid
   5. I2 (s) \_\_\_\_\_\_\_\_\_molecular solid
2. Identify three ways in which you can reduce the amount of time required to dissolve a given amount of solute in a fixed quantity of solvent (3 points).

Finely dividing a solid offers more surface area per unit of mass. Stirring or agitating the solution prevents the concentration buildup at the solute surface, which minimizes crystallization rate. All physical processes speed up at higher temperatures because particle movement is more rapid.

1. How does the solubility vary with pressure? Compare the effect of pressure change on gases, liquids, and solids (4 points).

The solubility of liquids and gases is generally not affected by pressure. Gases are always more soluble at high pressures.

1. Assume that 1.50 g of a KClO3/MnO2 mixture (85% KClO3, by weight) was decomposed in an experiment similar to yours and all final measurements were made at 22 °C on a day when the atmospheric pressure was 754 torr (15 points).
   * + - 1. What is the pressure of the O2 if the vapor pressure of water at 22 °C is 19.827 mm Hg?
         2. What is the balanced decomposition reaction if oxygen gas and potassium chloride are the products?

2 KClO3 (s) 2 KCl (s) + 3 O2 (g)

* + - * 1. How many moles of O2 should have been evolved?
        2. What volume of O2 should have been evolved under experimental conditions?

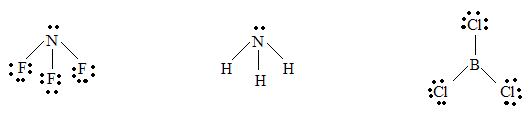
T = 22 °C + 273 = 295 K

* + - * 1. What is the STP volume of this O2?

1. Place the following substances in order of increasing vapor pressure at a given temperature. Explain your order (8 points).

nitrogen trifluoride ammonia boron trichloride

NF3 NH3 BCl3



London-dispersion London-dispersion London-dispersion

Dipole-dipole dipole-dipole

Hydrogen bonding

So, in order of increasing vapor pressure: NH3 < NF3 < BCl3

1. When tin metal is placed in nitric acid a gas is produced. Remember that metals of variable charge generally become +2 ions in solution in single replacement reactions (12 points).
2. Write the balanced chemical equation.

Sn (s) + 2 HNO3 (aq) 🡪 Sn(NO3)2 (aq) + H2 (g)

1. What volume, in milliliters, of 5.00 M nitric acid is required to react with 100.0 g of tin?
2. A solution is made by dissolving 12.50 g of Ba(OH)2, a strong base, in water to produce 2.0 L of solution (14 points).
   * + - 1. What is the molarity of the solution?
         2. What is the molarity of hydroxide ions?
         3. What is the pH of the solution?
         4. What is pOH of the solution?
         5. Is the solution acidic, basic, or neutral? \_\_\_basic\_\_\_\_\_
3. A solution is prepared by dissolving 1.00 g of sodium chloride in enough water to make 10.00 mL of solution (8 points).
4. What is the molarity of the solution?
5. A 1.00 mL portion of this solution is then diluted to a final volume of 10.00 mL. What is the molarity of the final sodium chloride solution?

M1 = 1.71 M NaCl

V1 = 1.00 mL

V2 = 10.00 mL

M2 = ?

1. Name and give the formula for each of the following species (6 points).
2. conjugate base of hydroiodic acid iodide ion, I-
3. conjugate acid of the oxide ion hydroxide ion, OH-
4. conjugate acid of water hydronium ion, H3O+