States of Matter Problem Set

1. That the volume of a given mass of an ideal gas at constant temperature varies inversely with its pressure is given by:

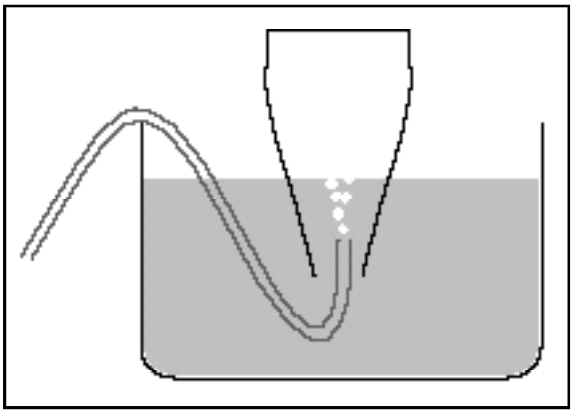
   a. Boyle's law
   b. Combined gas law
   c. Ideal gas law
   d. all of the above

2. Which of the following statements is not true?

   a. Equal numbers of molecules are contained in equal volumes of gases under the same conditions of temperature an pressure.
   b. The internal energy of an ideal gas depends only upon the kinetic energy of its particles.
   c. An ideal gas occupies zero volume at absolute zero.
   d. all of the above are true

The following passage pertains to questions 3 - 7.

The apparatus at right is used to collect a sample of a gaseous substance in the laboratory. In the initial state (not shown here) the flask is completely filled with water. The atmospheric pressure on the water in the surrounding tank enables the water in the flask to be thus suspended. Gas is collected by displacing the water in the flask until the state illustrated at right is attained, in which the level of the water in the flask equals the level in the tank and the collection is completed.



3. After the the collection of gas is first initiated, and the level of water in the flask begins to fall:

   a. the pressure of the gaseous phase in the flask is greater than 760 torr.
   b. the pressure of the gaseous phase in the flask is less than 760 torr.
   c. the pressure of the gaseous phase in the flask equals 760 torr.
   d. the pressure of the gaseous phase is decreasing.

4. When the level of the water in the flask equals the level of the water in the tank:

   a. the pressure of the gas collected is greater than 1 atm.
   b. the pressure of the gas collected is less than 1 atm.
   c. the pressure of the gas collected equals 1 atm.
   d. the pressure of the gas collected could be all of the above.

5. Suppose that the temperature in the laboratory is 33°C (in which case the vapor pressure of water is 37.7 torr.) If the volume of the gaseous phase in the flask is one liter when the water levels draw even, what is the mole fraction of the collected gas in the mixture? (one mole of gas 33°C and 760 torr occupies 25.1 liters. Assume ideal gas behavior.)

   a. 3.8×10^{-2} mol
   b. 24/25
   c. 1/25
   d. .95

6. If student A collects methane gas (CH_4) in this manner and student B collects propane gas (C_3H_8), after each had collects one gram of substance:

   a. the gaseous phase in student A's flask has greater volume.
   b. the gaseous phase in student B's flask has greater volume.
   c. the volume of the gaseous phases of both flasks are equal.
   d. the gaseous phase in student A's flask has greater density.

7. If the temperature in the laboratory were to increase between experiments:

   a. the number of moles of gas which could be collected in a given flask would be less than before.
   b. the mole fraction of water vapor in the flask would be less than before.
   c. the volume of the gaseous phase would be greater than before.
   d. more than one of the above is correct.

   The remaining questions are independent of any passage and independent of each other.

8. When a liquid attains such a temperature that its vapor pressure equals the atmospheric pressure:

   a. the liquid and its vapor achieve a state of dynamic equilibrium
   b. it boils
   c. the kinetic energy of the molecules is not great enough to overcome the van der Waals forces.
   d. more than one of the above is correct.

9. Which of the following crystal structures is capable of greatest density?

   a. face-centered cubic structure
   b. body-centered cubic structure
   c. primitive cubic structure
   d. all can be equally dense