> Nature is neutral. Man has wrested from Nature the power to make the world a desert or to make deserts bloom. There is no evil in the atom; only in the hearts of men.
> --Adlai Stevenson

Unit 7 Sample Test

The test will be similar in format to previous tests. There will be two required problems and your choice of one of two options. Recall that you will still have a choice of two out of four reactions to complete and write balanced net-ionic equations for. You will also need to identify the type of reaction. Values for the gas constant **R** will be provided for pressure units of kPa, mmHg and atmospheres.

The following are representative of typical multiple choice questions but do not necessarily indicate topics to be addressed on your actual test.

_____ 1. The molecules of a *real* gas
a. occupy zero volume
b. exert no forces on one another
c. all have the same speed
d. cannot be compressed to zero volume

_____2. Two identical flasks at the same temperature contain 4 g of helium and hydrogen, respectively. The ratio of the number of atoms of helium to molecules of hydrogen is
a. 1:1 b. 1:2 c. 1:4 d. 2:1 e. 4:1

_____3. A graph of pressure vs. volume for a contained gas (at constant temperature) will show that
a. as the pressure increases, the volume increases
b. as the pressure increases, the volume decreases
c. as the volume decreases, the pressure decreases
d. none of the above

_____4. A graph of temperature vs. volume for a contained gas (at constant pressure) shows what type of a proportion?
a. direct b. inverse c. both direct and inverse d. cannot tell from this information

_____5. Real gases behave most ideally under the following conditions:
a. high pressure and high temperature
b. low pressure and low temperature
c. high pressure and low temperature
d. low pressure and high temperature

The next section consists of representative problems which might be found in the required section. All students are expected to work on both of the required problems.

6. When hydrochloric acid and zinc metal react, the gas produced is collected in a closed container which has been initially sealed at atmospheric pressure (100.1 kPa). After the system has returned to room temperature (27.2^{o}C), the pressure in the container is 350 mmHg higher than originally. The volume of the container is 255 mL. Assume that the zinc and hydrochloric acid occupy negligible volume.

_____a. How many moles of gas have been collected?

b. Write the chemical reaction:

_____

c. Assuming that the zinc has been completely consumed, how many grams of zinc were used in this reaction?

7. 100 mL (to the nearest 1 mL) of oxygen are collected over water at 25^{o}C and the pressure in the container is 107 kPa. The vapor pressure of water at this temperature is 3.17 kPa.

_____a. What is the partial pressure of the oxygen?

_____b. How many moles of oxygen have been collected?

The next section consists of representative problems such as might be found in the "options" section. Each student is expected to select one problem from this section to work on.

8. *Sketch* a phase diagram for a substance with triple point 60^{o}C and 20 kPa, critical point 400^{o}C and 200 kPa. When freezing the liquid solidifies from the bottom up. Label the areas occupied by each phase, the triple point, critical point and the <u>normal</u> melting and boiling points.

_____9. What is the molar mass of a gas if 14.7 g of it occupies 5700 mL (to the nearest 1 mL) at STP?

_____10. A mixture of 3.86 g of CCl_4 and 1.92 g of C_2H_4 at 450^oC (to the nearest degree) exerts how many mmHg pressure inside a 30 mL sphere?

_____b. What would be the partial pressure of the CCl_4?

The next section consists of representative reactions to complete and write balanced net-ionic equations for. Note that some reactions do not occur in aqueous solution and thus molecular equations are all that would be needed. Each student is expected to choose two from this section.

11. For each of the following, complete the word equation, write a balanced net-ionic reaction and tell what type of reaction it is. (*all occur in water solution*)

a. calcium metal + hydrogen iodide → _____

_____

_____

type:_____

b. sodium phosphate + barium nitrate → _____

_____

_____

type:_____

c. lithium metal + water → _____

_____

_____

type:_____

d. uranium(IV) ion reacts with permanganate ion in basic solution; the uranyl ion (UO_2^{2+}) and manganese(II) ion are among the products

_____

_____

The final section of the test will consist of one essay question selected from the following topics:

pressure equalization technique used in the lab
real gases vs. ideal gases
the barometer

Answers