1. A sample containing 0.614mol of a gas at 12°C occupies a volume of 12.9L. What pressure (in mmHg) does the gas exert?

2. 15.0g of dry ice are placed in balloon which is then sealed. The dry ice is allowed to sublimate according to the following reaction:
   $CO_2(s) \rightarrow CO_2(g)$
   What is the volume (in L) of the balloon at 22.0°C and 1.04atm after all of the dry ice has sublimated?

3. A vacuum line used in a research lab has a volume of 1.013L. The temperature in the line is 23.7°C, and the vacuum line is evacuated to a pressure of 1.00×10^{-6}torr. How many molecules of the gas remain?

4. 10.0g propane, C_3H_8, are completely combusted. What volume (in cm^3) will the steam produced occupy at 820torr and 163°C?

5. When 0.500L H_2 reacts with 0.500L O_2, how many L of steam will be produced at 126kPa and 350°C?

6. 30.0g nonane, C_9H_{20}, react with 100g oxygen. How many L of steam should be produced at 650°C and 2.47atm?

7. 0.500L of nitrogen gas effuse in 2.00min, while it takes 5.00min for 0.995L of an unknown gas to effuse under the same conditions. Is the unknown gas, dinitrogen tetroxide, carbon dioxide, or oxygen gas?

8. If it takes 3.40min for 1.50L of hydrogen gas to effuse, how many minutes and seconds will it take for 4.00L of nitrogen gas to effuse under the same conditions?

9. Argon effuses 250mL in 3.00min at STP. Under the same conditions, a sample of neon effuses in 5.00min. How many moles of neon effused?

Answers:

1. 846 mmHg
2. 7.94 L CO_2
3. 3.29×10^{13} molecules
4. 3.01×10^4 cm^3 H_2O
5. 0.917 L H_2O
6. 68.4 L H_2O
7. CO_2
8. 33 min 48 s
9. 0.0262 mol Ne

For numbers 1-5:

- □ **state the law to which the problem refers**
- □ **show the formula used**
- □ **show all work in solving the problem…remember to include units**

1. A sealed balloon filled with 3.39g of helium gas has a volume of 20.0L at a pressure of 1atm and a temperature of 15.0°C. What will be the volume (in L) of a the balloon if the temperature rises to 80°C, and the pressure remains constant? (8 pts.)

2. A steel sphere with a diameter of 15.0cm contains nitrogen gas. If the pressure inside the sphere is 765torr at 23°C, what will the pressure be (in torr) when the sphere's contents are heated to a temperature of 100°C? (8 pts.)

3. Another sealed balloon with a volume of 785mL of air is squeezed to make the volume 525mL and the pressure 1.18atm. Provided that the temperature is constant, what was the initial pressure in mmHg? (8 pts.)

4. A cylinder with a piston is designed to maintain a static pressure. Within this cylinder, there are 25.0g of oxygen gas with a volume of 2.50L. There is a tiny hole through which the oxygen may leak, and the piston responds to the leak by decreasing the volume as the amount of oxygen decreases. Assume that the volume of the cylinder decreases to 1.10L. How many moles of the oxygen gas will have leaked out of the cylinder at the final volume? (10 pts.)

5. It takes 3.00min for 15.0mL of chlorine gas to effuse, while it takes 3min and 25s for the same volume of an unknown gas to effuse. Is the unknown gas carbon monoxide, carbon dioxide, or dinitrogen tetroxide? (8 pts.)

For the following problem, you may use either the combined gas law or the ideal gas law.

6. A bunch of bananas emits 41.75g of ethylene gas, C_2H_4, collected in a sealed chamber over a period of a week. (Ethylene is the gas that fruits and vegetables emit upon ripening. It's also the stuff that is sprayed on unripe veggies to make them appear ripe to our eyes…devious, isn't it?)
    a. Write a balanced reaction for the complete combustion of ethylene. (8 pts.)
    b. Show all work in determining the number of liters of oxygen required to completely combust the ethylene at STP. (5 pts.)
    c. Show all work in determining the number of liters of oxygen required to completely combust the ethylene at a more realistic 20.0°C and 0.989atm. (7 pts.)
    d. Explain whether the changes in temperature and pressure from those of ideal conditions were conducive to the calculated change in volume. That is, think about whether the changes in both T and P favored the change in V from STP conditions. Give rationale for your thoughts. (2 pts.)

Answers

1. Charles; 24.5 L He
2. Gay-Lussac; 964 torr
3. Boyle; 600 mmHg
4. Avogadro; 0.437 mol O_2 leaked out
5. Graham; N_2O_4
6. a. $C_2H_4 + 3O_2 \rightarrow 2CO_2\ 2H_2O$

   b. 100 L O_2 at STP

   c. 108 L O_2

   d. T increased and V increased; P decreased and V increased. Both are conducive.