WebAssign
Lesson 8: Gases (Homework)

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CHM 151, section 001, Spring 2017
Instructor: Tracy Cheatham

Current Score : – / 101 **Due :** Monday, April 24 2017 05:00 PM EDT

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1. –/10 pointsOSGenChem1 9.1.WA.002.

Convert 5.16×10^6 Pa to each of the following.

(a) atm
4.0 50.9 atm

(b) torr
4.0 38700 torr

(c) kPa
4.0 5160 kPa

Supporting Materials

Periodic Table
Constants and Factors
Supplemental Data

2. –/3 pointsOSGenChem1 9.2.WA.001.

A sample of an ideal gas is contained inside a rigid cylinder with a fixed volume. At 213 K, the pressure of the gas in the cylinder is 2.10 atm. At what temperature will the pressure inside the cylinder be 3.20 atm?
4.0 K

Supporting Materials

Periodic Table
Constants and Factors
Supplemental Data

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3. –/3 pointsOSGenChem1 9.2.WA.002.

The temperature of a sample of an ideal gas is doubled. If the pressure and amount of gas remain the same, what will happen to the volume of the gas?

The volume of the gas will be doubled ▼ .

Supporting Materials

Periodic Table
Constants and Factors
Supplemental Data

4. –/3 pointsOSGenChem1 9.2.WA.003.

A balloon contains 401 mL of gas at 21.70°C. A student places the balloon outside, where it sits for several hours at a temperature of 5.35°C. Assuming there is no change in pressure for the balloon, use Charles' law (below) to determine the new volume of the gas.

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

4.0 ☑ [ ] mL

Supporting Materials

Periodic Table
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5. –/3 pointsOSGenChem1 9.2.WA.005.

A gas is placed in a 5.0-mL syringe. It exerts 133 mm Hg of pressure on the inside walls of the syringe. The syringe's plunger is pressed, reducing the volume of the syringe to 2.0 mL. The cap was not removed from the syringe, so none of the gas escapes. Assuming the temperature of the gas does not change, use Boyle's law (below) to determine the pressure of the compressed gas.

$$P_1V_1 = P_2V_2$$

4.0 ☑ [ ] mm Hg

Supporting Materials

Periodic Table
Constants and Factors
Supplemental Data

6. –/3 pointsOSGenChem1 9.2.WA.007.

A student is experimenting with gases. She finds that 0.17 mol of hydrogen gas (H_2) has a volume of 4.8 L. She wants to measure the volume of 0.051 mol of oxygen gas (O_2). What volume should she expect the oxygen gas to have? (Use the equation for Avogadro's law.)

4.0 ☑ [ ] L

Supporting Materials

Periodic Table
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7. –/3 pointsOSGenChem1 9.2.WA.008.

Calcium carbonate, $CaCO_3(s)$, decomposes upon heating to give $CaO(s)$ and $CO_2(g)$. A sample of $CaCO_3$ is decomposed, and the carbon dioxide is collected in a sealed 250 mL flask. After the decomposition is complete, the gas has a pressure of 1.5 atm at a temperature of 33°C. How many moles of CO_2 gas were generated? (Ideal gas equation: $PV = nRT$.)

4.0 ☑ [ ] mol

Supporting Materials

Periodic Table
Constants and Factors
Supplemental Data

8. –/3 pointsOSGenChem1 9.2.WA.009.

A sample of helium gas occupies a volume of 154.0 mL at a pressure of 724.0 mm Hg and a temperature of 314.0 K. What will the volume be at a pressure of 468.0 mm Hg and a temperature of 796.0 K? The combined gas law equation is given below.

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

In this equation, P_1, V_1, and T_1 are the initial pressure, volume, and temperature, respectively, and P_2, V_2, and T_2 are the final pressure, volume, and temperature, respectively.

4.0 ☑ [ ] mL

Supporting Materials

Periodic Table
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Supplemental Data

9. –/3 pointsOSGenChem1 9.2.WA.012.

A balloon containing 0.144 mol Ne gas has a volume of 2.0 L at 1.8 atm and 28°C. How many grams of neon should be added to the balloon to increase the volume to 3.6 L at the same pressure and temperature?

4.0 ☑ [ ] g

Supporting Materials

Periodic Table
Constants and Factors
Supplemental Data

10.–/12 pointswas OSGenChem1 9.2.WA.RE.001.

A sample of an ideal gas is contained inside a rigid cylinder with a fixed volume. At 251 K, the pressure of the gas in the cylinder is 2.30 atm. At what temperature will the pressure inside the cylinder be 3.18 atm?

Step 1 of 3

Write the equation describing the relationship between pressure and temperature.
Gay-Lussac's law is represented by the following equation.

$\frac{P_1}{T_1} = \frac{P_2}{T_2}$

- $P_1 + T_1 = P_2 + T_2$
- $P_1 - T_1 = P_2 - T_2$
- $P_1 T_1 = P_2 T_2$

In this equation, P_1 and P_2 are the initial and final pressures of the gas, respectively, and T_1 and T_2 are the initial and final temperatures of the gas, respectively.

(Note that this equation can also be expressed as $P = kT$, where k is a constant.)

Step 2 of 3

Rearrange the equation for Gay-Lussac's law to isolate the desired variable.
The initial pressure (P_1) and temperature (T_1) of gas, as well as the final pressure (P_2) are given. We are asked to solve for the final temperature (T_2). To isolate T_2, cross-multiply and then divide both sides by P_1.

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$

$$P_1 T_2 = P_2 T_1$$

$$\frac{P_1 T_2}{P_1} = \frac{P_2 T_1}{P_1}$$

The term P_1 now appears in the numerator and denominator of the fraction on the left side of the equation, which cancel to give the following.

- $T_2 = P_2 \frac{P_1}{T_1}$
- $T_2 = \frac{P_2 T_1}{P_1}$
- $T_2 = P_2 \frac{T_1}{P_1}$
- $T_2 = \frac{P_1 P_2}{T_1}$

Step 3 of 3

Substitute the given values and solve.

We know P_1 = 2.30 atm, P_2 = 3.18 atm, and T_1 = 251 K. Substitute these values and solve.

$$T_2 = \frac{P_2 T_1}{P_1}$$

$$= \frac{(3.18\ \text{~~atm~~})(251\ \text{K})}{(2.30\ \text{~~atm~~})}$$

= 4.0 ☑ [ ] K

This answer ---Select--- ▼ logical; we expect pressure to increase as temperature ---Select--- ▼ at constant volume.

Determine the number of significant figures for a calculation.

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11. –/9 pointsOSGenChem1 9.3.WA.011.

A chemist combines 11.0 L N_2 gas, 33.6 L O_2 gas, and 18.0 L Br_2 gas in a reaction vessel at STP. The gases react according to the following equation.

$$N_2(g) + O_2(g) + Br_2(g) \rightarrow 2\ NOBr(g)$$

How many moles of each gas are initially present in the vessel, before any reaction occurs?

N_2 4.0 ☑ [ ] mol

O_2 4.0 ☑ [ ] mol

Br_2 4.0 ☑ [ ] mol

Supporting Materials

Periodic Table
Constants and Factors
Supplemental Data

12. –/9 pointsOSGenChem1 9.3.WA.012.

A large rectangular vessel is divided by a partition into two compartments of identical shape, size, and temperature. One mole of carbon dioxide gas is placed in the left compartment and one mole of chlorine gas is placed in the right compartment. You may assume that both gases behave ideally.

(a) Which compartment has the greater pressure?

- The left compartment has the greater pressure.
- The right compartment has the greater pressure.
- Both compartments have the same pressure.

(b) Which compartment has the greater density?

- The left compartment has the greater density.
- The right compartment has the greater density.
- Both compartments have the same density.

(c) If the partition separating the two compartments is removed and the system is allowed to come to equilibrium, how will the pressure of each compartment compare with its original pressure?

- The pressure in the left compartment will decrease, and the pressure in the right compartment will increase.
- The pressure in the left compartment will increase, and the pressure in the right compartment will decrease.
- The pressure in both compartments will remain unchanged.

(d) If the partition separating the two compartments is removed and the system is allowed to come to equilibrium, how will the density of each compartment compare with its original density?

- The density in the left compartment will be lower and the density in the right compartment will be higher than the original density.
- The density in the left compartment will be higher and the density in the right compartment will be lower than the original density.
- The densities in both compartments will remain unchanged.

Supporting Materials

Periodic Table
Constants and Factors
Supplemental Data

13. –/3 pointsOSGenChem1 9.3.WA.013.

1.20 g of a gas in a 4.99 L container exerts a pressure of 0.353 atm at 227.4°C. Calculate the molar mass of the gas.

4.0 ☑ [ ] g/mol

Supporting Materials

Periodic Table
Constants and Factors
Supplemental Data

14. –/3 pointsOSGenChem1 9.3.WA.014.

How many grams of solid calcium carbonate must decompose to produce solid calcium oxide and 542.0 mL carbon dioxide gas at 298°C and 733 torr?

4.0 ☑ [ ] g

Supporting Materials

Periodic Table
Constants and Factors
Supplemental Data

15. –/3 pointsOSGenChem1 9.3.WA.017.

A piece of magnesium reacts with an aqueous solution of HCl to produce H_2 gas. The hydrogen gas is collected over the HCl solution at a temperature of 22.0°C. If the total pressure of the system is 0.989 atm, and the volume of gas collected is 710. mL, what are the partial pressure and the mass of H_2 produced? (You may assume that the dissolved HCl has no effect on the vapor pressure of water, which is 19.8 torr at 22.0°C.)

partial pressure 4.0 ☑ [ ] atm

mass 4.0 ☑ [ ] g

Supporting Materials

Periodic Table
Constants and Factors
Supplemental Data

16. –/5 pointsOSGenChem1 9.3.WA.020.

A sample of nitric oxide gas (NO) is at a pressure of 1.25 atm and a temperature of 75°C.

(a) Calculate the density of the gas.

4.0 ☑ [ ] g/L

(b) How would the density change if the pressure is increased at constant temperature?

- increase
- decrease

(c) How would the density change if the temperature is increased at constant pressure?

- increase
- decrease

Supporting Materials

Periodic Table
Constants and Factors
Supplemental Data

17. –/5 pointsOSGenChem1 9.3.WA.021.

A gas mixture consists of 0.415 mol hydrogen (H_2), 0.674 mol carbon dioxide (CO_2), and 1.930 mol nitrogen (N_2). If the total pressure of the mixture is 2.40 atm, calculate the partial pressure of each component gas in the mixture.

H_2 4.0 ☑ [ ] atm

CO_2 4.0 ☑ [ ] atm

N_2 4.0 ☑ [ ] atm

Supporting Materials

Periodic Table
Constants and Factors
Supplemental Data

18. –/12 pointsOSGenChem1 9.3.WA.023.

A rigid container whose volume can be varied with the use of a piston contains 2.80 mol H_2 gas at STP.

(a) What is the volume of the gas?

4.0 ☑ [ ] L

(b) The container is cooled to 230 K. The piston is held fixed so the volume does not change. What is the new pressure inside the container?

4.0 ☑ [ ] atm

(c) The temperature of the container is held at 230 K and 1.58 mol He gas is added to the container. The pressure inside the container is held constant, but the piston is released so the volume of the container can vary. What is the final volume of the container?

4.0 ☑ [ ] L

(d) What are the partial pressures of H_2 and He in the container in part (c)?

H_2: 4.0 ☑ [ ] atm

He: 4.0 ☑ [ ] atm

(e) The piston on the container in part (c) is set to maintain a constant pressure of 1 atm. The container is then heated from 230 K to 365 K. What is the minimum amount of heat that must be added to the container for it to reach 365 K?

4.0 ☑ [ ] J

Supporting Materials

Periodic Table
Constants and Factors
Supplemental Data

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19. –/5 pointsOSGenChem1 9.5.WA.002.

Explain pressure based on the kinetic-molecular theory of gases.

Pressure is the result of the [---Select---] particles of gas [---Select---] moving and [---Select---] with the sides of their container.

Supporting Materials

Periodic Table
Constants and Factors
Supplemental Data

20. –/1 pointsOSGenChem1 9.5.WA.003.

Explain temperature based on the kinetic-molecular theory of gases.

Absolute temperature is ---Select--- ▼ proportional to the average kinetic energy of the particles in a gas.

Supporting Materials

Periodic Table
Constants and Factors
Supplemental Data