

ANSWER KEY

CHARLES' LAW

Name _____

Charles' Law states that the volume of a gas varies directly with the Kelvin temperature, assuming that pressure is constant. We use the following formulas:

$$\frac{V_1}{T_1} = \frac{V_2}{T_2} \text{ or } V_1 \times T_2 = V_2 \times T_1$$

$$K = ^\circ C + 273$$

Solve the following problems assuming a constant pressure.

1. A sample of nitrogen occupies a volume of 250 mL at 25° C. What volume will it occupy at 95° C?
310 mL
2. Oxygen gas is at a temperature of 40° C when it occupies a volume of 2.3 liters. To what temperature should it be raised to occupy a volume of 6.5 liters?
880 K or 610° C
3. Hydrogen gas was cooled from 150° C to 50° C. Its new volume is 75 mL. What was its original volume?
98 mL
4. Chlorine gas occupies a volume of 25 mL at 300 K. What volume will it occupy at 600 K?
50. mL
5. A sample of neon gas at 50° C and a volume of 2.5 liters is cooled to 25° C. What is the new volume?
2.3 L
6. Fluorine gas at 300 K occupies a volume of 500 mL. To what temperature should it be lowered to bring the volume to 300 mL?
180 K or -93° C
7. Helium occupies a volume of 3.8 liters at -45° C. What volume will it occupy at 45° C?
5.3 L
8. A sample of argon gas is cooled and its volume went from 380 mL to 250 mL. If its final temperature was -55° C, what was its original temperature?
331 K or 58° C

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BOYLE'S LAW

Name _____

Boyle's Law states that the volume of a gas varies inversely with its pressure if temperature is held constant. (If one goes up, the other goes down.) We use the formula:

$$P_1 \times V_1 = P_2 \times V_2$$

Solve the following problems (assuming constant temperature).

1. A sample of oxygen gas occupies a volume of 250. mL at 740. torr pressure. What volume will it occupy at 800. torr pressure?
231 mL
2. A sample of carbon dioxide occupies a volume of 3.50 liters at 125 kPa pressure. What pressure would the gas exert if the volume was decreased to 2.00 liters?
219 kPa
3. A 2.0 liter container of nitrogen had a pressure of 3.2 atm. What volume would be necessary to decrease the pressure to 1.0 atm?
6.4 liters
4. Ammonia gas occupies a volume of 450. mL at a pressure of 720. mm Hg. What volume will it occupy at standard pressure?
426 mL
5. A 175 mL sample of neon had its pressure changed from 75 kPa to 150 kPa. What is its new volume?
88 mL
6. A sample of hydrogen at 1.5 atm had its pressure decreased to 0.50 atm producing a new volume of 750 mL. What was its original volume?
250 mL
7. Chlorine gas occupies a volume of 1.2 liters at 720 torr pressure. What volume will it occupy at 1 atm pressure?
1.1 liters
8. Fluorine gas exerts a pressure of 900. torr. When the pressure is changed to 1.50 atm, its volume is 250. mL. What was the original volume?
317 mL

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DALTON'S LAW OF PARTIAL PRESSURES

Name _____

Dalton's Law says that the sum of the individual pressures of all the gases that make up a mixture is equal to the total pressure or: $P_t = P_1 + P_2 + P_3 + \dots$. The partial pressure of each gas is equal to the mole fraction of each gas \times total pressure.

$$P_t = P_1 + P_2 + P_3 + \dots \text{ or } \frac{\text{moles gas}_i}{\text{total moles}} \times P_t = P_i$$

Solve the following problems.

1. A 250. mL sample of oxygen is collected over water at 25° C and 760.0 torr pressure. What is the pressure of the dry gas alone? (Vapor pressure of water at 25° C = 23.8 torr)
736. torr
2. A 32.0 mL sample of hydrogen is collected over water at 20° C and 750.0 torr pressure. What is the volume of the dry gas at STP? (Vapor pressure of water at 20° C = 17.5 torr)
28.7 mL
3. A 54.0 mL sample of oxygen is collected over water at 23° C and 770.0 torr pressure. What is the volume of the dry gas at STP? (Vapor pressure of water at 23° C = 21.1 torr)
49.1 mL
4. A mixture of 2.00 moles of H_2 , 3.00 moles of NH_3 , 4.00 moles of CO_2 and 5.00 moles of N_2 exerts a total pressure of 800 torr. What is the partial pressure of each gas?
 $H_2 = 114 \text{ torr}$, $NH_3 = 171 \text{ torr}$, $CO_2 = 229 \text{ torr}$
5. The partial pressure of F_2 in a mixture of gases where it is 300. torr. What is the mole fraction of F_2 ?
0.395

$$N_2 = 286 \text{ torr}$$

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IDEAL GAS LAW

Name _____

Use the Ideal Gas Law below to solve the following problems.

$$PV = nRT \text{ where } P = \text{pressure in atmospheres}$$

$$V = \text{volume in liters}$$

$$n = \text{number of moles of gas}$$

$$R = \text{Universal Gas Constant}$$

$$0.082 \text{ L} \cdot \text{atm} / \text{mol} \cdot \text{K}$$

$$T = \text{Kelvin temperature}$$

1. How many moles of oxygen will occupy a volume of 2.5 liters at 1.2 atm and 25° C?
0.12 moles
2. What volume will 2.0 moles of nitrogen occupy at 720 torr and 20° C?
51 liters
3. What pressure will be exerted by 25 g of CO_2 at a temperature of 25° C and a volume of 500 mL?
28 atm
4. At what temperature will 5.0 g of Cl_2 exert a pressure of 900. torr at a volume of 750 mL?
154 K or -119° C
5. What is the density of NH_3 at 800 torr and 25° C?
0.73 g/L
6. If the density of a gas is 1.2 g/L at 745. torr and 20° C, what is its molecular mass?
29 g/mol
7. How many moles of nitrogen gas will occupy a volume of 347 mL at 6680 torr and 27° C?
0.124 moles
8. What volume will 454 grams (1 lb) of hydrogen occupy at 1.05 atm and 25° C?
5290 L
9. Find the number of grams of CO_2 that exert a pressure of 785 torr at a volume of 32.5 L and a temperature of 32° C.
59.0 g
10. An elemental gas has a mass of 10.3 g. If the volume is 58.4 L and the pressure is 758 torr at a temperature of 2.5° C, what is the gas?
helium

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