Key

GAS PRACTICE

1.) 1.0 liter of air at 22° C is heated to 5000° C by a thermonuclear explosion. What volume does the gas expand to? $V_1 = 1.0\ L$ $V_2 = ?$ $T_1 = 295K$ $T_2 = 5273K$

$\frac{V_1}{T_1} = \frac{V_2}{T_2}$ $V_2 = \frac{V_1 T_2}{T_1} = \frac{1.0L \cdot 5273K}{295K} = 17.9\ L$

2.) Your on the beach at Sauvie Island on a warm 37.0° C summer day with a pressure of 765 Torr, enjoying a beverage of your choice (non-alcoholic of course). You decide you would like to blow up your rubber raft, which holds 275 liters of air, and go out and play chicken with the barges. How would the volume of the raft change when you set it in the river which cools the air in the raft to 18° C? Pressure remains constant.

$\frac{V_1}{T_1} = \frac{V_2}{T_2}$ $T_1 = 310K$ $T_2 = 291K$ $V_1 = 275\ L$ $V_2 = ?$

$V_2 = \frac{V_1 T_2}{T_1} = \frac{275\ L \cdot 291K}{310K} = 258\ L$

3.) A quantity of gas has a volume of 850 ml when measured at 27.0°C and 730 Torr. Determine its volume at STP.(STP stands for standard temperature and pressure which equals 0.0°C and 1.0 atm)

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ $V_1 = 850ml$ $V_2 = ?$ $T_1 = 300K$ $T_2 = 273K$ $P_1 = 730torr$ $P_2 = 760torr$

$V_2 = \frac{850ml \cdot 730torr \cdot 273K}{760\ Torr \cdot 300K} = 743ml$

4.) A given quantity of gas occupies a volume of 875 ml at 42.0°C and 730 torr. Calculate the volume the gas would occupy at 350 K and 12.0 atm. pressure?

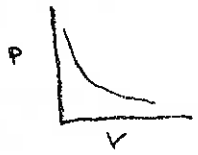
$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ $V_1 = 875ml$ $V_2 = ?$ $T_1 = 315K$ $T_2 = 350K$ $P_1 = .961atm$ $P_2 = 12\ Atm$

$V_2 = \frac{875ml \cdot .961atm \cdot 350K}{12\ Atm \cdot 315K} = 77.9\ ml$

5.) 500 ml of a gas is at a pressure X. If the volume of the gas doubled and the temperature remained constant, what would be the pressure on the gas?

$\frac{1}{2}X$

6.) Draw a graph that represents the relationship of pressure to volume according to Boyles Law.



7.) 25.0 ml of CO_2 at STP is cooled to -20.0 °C and the volume is lowered to 18.0 ml. What is the final pressure on the gas.

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ $V_1 = 25ml$ $V_2 = 18ml$ $T_1 = 273K$ $T_2 = 253K$ $P_1 = 1atm$ $P_2 = ?$

$P_2 = \frac{1Atm \cdot 25ml \cdot 253K}{18ml \cdot 273K} = 1.29\ atm$

Key

8) 9.86 liters of H_2 gas at 27.0°C and 1.5 atmospheres is allowed to expand to 18.7 liters at 765 Torr. What is the final temperature of the gas at this new volume and pressure?

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ $V_1 = 9.86L$ $V_2 = 18.7L$ $T_1 = 300K$ $T_2 = ?$ $P_1 = 1.5atm$ $P_2 = 1.01atm$

$T_2 = \frac{1.01atm \cdot 18.7L \cdot 300K}{1.5atm \cdot 9.86L} = 382K$

9) 150 ml of Xenon gas exerts a pressure of 790 mmHg . How many liters of gas would there be if the pressure were decreased to 100.4 kPa at constant temp?

$P_1V_1 = P_2V_2$ $V_1 = 150ml$ $V_2 = ?$ $P_1 = 790mmHg$ $P_2 = 753mmHg$

$V_2 = \frac{150mL \cdot 790mmHg}{753mmHg} = 157mL$

10) A sample of an unknown gas was collected in a 10.7 liter container at 25.0 °C and 791 mmHg pressure. What is the final temperature of the gas if the volume is increased to 16.9 liters and the pressure is increased to 2.0 atmospheres?

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ $V_1 = 10.7L$ $V_2 = 16.9L$ $T_1 = 298K$ $T_2 = ?$ $P_1 = 791mmHg$ $P_2 = 1520mmHg$

$T_2 = \frac{1520mmHg \cdot 16.9L \cdot 298K}{791mmHg \cdot 10.7L} = 904K$

11) To what volume would you have to change 85.0 liters of gas at 104.4 kPa in order to decrease its pressure to 21.0 kPa? Assume temp. is constant.

$P_1V_1 = P_2V_2$ $P_1 = 104.4kPa$ $V_1 = 85.0L$ $P_2 = 21kPa$ $V_2 = ?$

$V_2 = \frac{104.4kPa \cdot 85.0L}{21kPa} = 423L$

12) Determine the volume of each of the following gases at standard temperature. Assume the pressure is constant.

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

a) 5.93 ml at 492 K — 3.29 ml

b) 2.27 cm^3 at 9 °C — 2.20 cm^3

13)At STP,the volume of a gas is 325 dm^3. What volume does it occupy at 20.0 °C and 93.3 kPa?

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

$V_2 = \frac{P_1V_1T_2}{P_2T_1} = \frac{101.3kPa \cdot 325dm^3 \cdot 293K}{93.3kPa \cdot 273K} = 379dm^3$

14) If a scuba diver is to remain submerged for 1 hour, what pressure must be applied to force sufficient air into the tank to be used? Assume 0.500 dm^3 of air per breath at standard atmospheric pressure, a respiration rate of 38 breaths per minute, and a tank capacity of 30.0 dm^3.

$P_1V_1 = P_2V_2$ $P_1 = 1atm$ $P_2 = ?$ $V_1 = 30dm^3$

$\frac{38\ br}{min} \times 60min \times \frac{.500dm^3}{br} = 1140dm = V_1$

$P_2 = \frac{1atm \cdot 1140dm^3}{30dm^3} = 38atm$

15) A gas of volume V is placed in a container. Determine the new volume if conditions are changed in each of the following ways. Express your answer in terms of V; for instance, 2V, 1/4 V, and so on.

a) The pressure is doubled. — 1/2 V

b) The Kelvin temperature is doubled. — 2V

c) The pressure is 1/4 the original pressure. — 4V

d) The absolute temperature is reduced to 2/3 the original temperature. — 2/3 V

e) The pressure and absolute temperature are both doubled. — V

f) The pressure is doubled, and the absolute temperature is halved. — 1/4 V

g) The absolute temp. is reduced to 3/4 the original temp., and the pressure is reduced to 1/2 the original pressure. — 1 1/2 V

h) The absolute temp is increased to 11/4 times the original temp and the pressure decreased 1/4 the original pressure. — 5V