

# Gas Laws HOMEWORK

## Lesson 1 Homework

1. Define pressure. *Force that a gas exerts on its container*

2. Convert the following:

a. 150mmHg to atm

b. 880mmHg to atm

c. 2.5atm to torr

d.  $2.1 \times 10^3$ Pa to atm

e. 20Pa to atm

150 mmHg  $\times$  (1 atm / 760 mmHg) = 0.197 atm

880 mmHg  $\times$  (1 atm / 760 mmHg) = 1.159 atm

$2.1 \times 10^3$  Pa  $\times$  (1 atm / 101325 Pa) = 0.0207 atm

2.5 atm  $\times$  (760 torr / 1 atm) = 1900 torr

$2.1 \times 10^3$  Pa  $\times$  (1 atm / 101325 Pa)  $\times$  (101325 Pa / 760 mmHg) = 276 mmHg

3. Calculate the atmospheric pressure in kPa on a day when the pressure is 750mm.

750 mm  $\times$  (101325 Pa / 760 mmHg) = 100,000 Pa  $\rightarrow$  100 kPa

4. Calculate the pressure of a sample of gas (in mmHg) inside an inverted manometer if the mercury column is 30mm higher on the side of the closed tube than on the atmosphere. The atmospheric pressure is 760mm. Draw a picture to illustrate your answer.

760 mm  $\times$  (1 mmHg / 1 mm) = 760 mmHg

760 mmHg  $\times$  (1 mm / 1 mm) = 760 mmHg

*Since pressure should decrease a centimeter with the height of the mercury, there should be atmospheric level of 764 mm.*

764 mmHg  $\times$  (1) = 764 mmHg

5. If a gas at a pressure of 100mm in a 1.0L container has its pressure increased to 400mm, what is the new volume of the container? (Assume temperature is constant.)

$P_1 V_1 = P_2 V_2$

$(100 \text{ mm} \times 1.0 \text{ L}) = (400 \text{ mm} \times V_2)$

$100 = 400 V_2 \rightarrow V_2 = 0.25 \text{ L}$

6. What is the new pressure if a 5.00 closed container with a pressure of 2.0 atm is increased to 8.0L?

$P_1 V_1 = P_2 V_2$

$(2 \text{ atm} \times 5 \text{ L}) = (P_2 \times 8 \text{ L})$

$10 = 8 P_2 \rightarrow P_2 = 1.25 \text{ atm}$

7. When 0.5 L of nitrogen and 0.2 L of hydrogen both at 0°C and 1.0 atm, are pumped into an evacuated 0.8 L rigid container, what is the final pressure in the container at 0°C? *Since temperature doesn't change, you can leave it out of the equation.*

*For final pressure of Nitrogen:*

$P_1 V_1 = P_2 V_2$

$(1 \text{ atm} \times 0.5 \text{ L}) = (P_2 \times 0.8 \text{ L})$

$0.5 = 0.8 P_2$

*For final pressure of Hydrogen:*

$P_1 V_1 = P_2 V_2$

$(1 \text{ atm} \times 0.2 \text{ L}) = (P_2 \times 0.8 \text{ L})$

$0.2 = 0.8 P_2$

*Total Pressure =  $P_1 + P_2 + P_3$*

$1.0 = 0.625 + 0.25 \rightarrow 1.25 \text{ atm}$

*Always write COMBINED the two equations!*

$P_1 V_1 = P_2 V_2$

$(1 \text{ atm} \times 0.5 \text{ L}) = (P_2 \times 0.8 \text{ L})$

$0.5 = 0.8 P_2 \rightarrow P_2 = 0.625 \text{ atm}$

*Then make another volume and write are directly proportional!*

8. A sealed flask contains a gas with pressure P. If the number of moles of the gas is doubled, the absolute temperature is doubled and the volume of the container is quadrupled, what is the new pressure in terms of P?

*Doubling the moles doubles the pressure.*

$P_1 V_1 = P_2 V_2$

*Doubling the volume cuts the pressure in 1/2.*

$P_1 V_1 = P_2 V_2$

*quadrupling volume cuts the pressure in 1/4.*

$(1 \text{ atm} \times 0.5 \text{ L}) = (P_2 \times 2 \text{ L})$

9. If 4 moles of gas are added to a container that already holds 2 moles of gas, how will the pressure change within the container?

$P_1 V_1 = P_2 V_2$

$(2 \text{ moles} \times P_1) = (P_2 \times 2 \text{ moles})$

*Adding three 2 moles to 2 moles results in an increase of pressure by 2 moles!*

10. If a balloon containing 100L of gas at 40°C and 100 mmHg rises to an altitude where the pressure is 50 mmHg and the temperature is 20°C, what is the new volume of the balloon (in L)?

$P_1 V_1 / T_1 = P_2 V_2 / T_2$

$(100 \text{ mmHg} \times 100 \text{ L} / 313 \text{ K}) = (50 \text{ mmHg} \times V_2 / 293 \text{ K})$

$31300 = 170 V_2 \rightarrow V_2 = 184 \text{ L}$

11. A sample of nitrogen gas has a pressure of 87.5 mmHg in a 500. mL flask. What is the pressure of this gas sample when it is transferred to a 225. mL flask at the same temperature?

$P_1 V_1 = P_2 V_2$

$(87.5 \text{ mmHg} \times 500 \text{ mL}) = (P_2 \times 225 \text{ mL})$

$43750 = 225 P_2$

$194.4 = P_2$

12. You have 4.5 L of  $\text{NO}_2$  at a temperature of 22°C. What volume would the  $\text{NO}_2$  occupy at 47°C? (Assume the pressure is constant.)

$V_1 / T_1 = V_2 / T_2$

$(4.5 \text{ L} / 295 \text{ K}) = (V_2 / 320 \text{ K})$

$15.375 = 320 V_2$

$0.048046875 = V_2$

13. You have a sample of a gas in a flask with a volume of 240 mL. At 20°C the pressure of the gas is 100 mmHg. If you decrease the temperature to -50°C, what is the gas pressure at the lower temperature? *Since volume doesn't change, you can leave it out of the equation.*

$P_1 / T_1 = P_2 / T_2$

$(100 \text{ mmHg} / 293 \text{ K}) = (P_2 / 223 \text{ K})$

$33.7883959 = P_2$

$33.8 \text{ mmHg}$

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**G Thomas**



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