# Chemistry 20 - Unit 2 - Unit Conversions and Boyle's Law

Name: ___________________________________________

Complete all of the following problems to the best of your ability. Ensure that you show all of your work, including the formula used and the substitution of numerical values. Write legibly, and make sure that your name is on this sheet. If you have any questions, please refer to your notes or chapter four of your textbook. Good luck!

You may find the following formulas and constants useful:

$$P_1V_1 = P_2V_2$$

760.000 mmHg = 101.325 kPa = 1.00000 atm

1000 mL = 1.000 L

1. Complete the following table by making the necessary unit conversions.

| Pressure (mmHg) | Pressure (kPa) | Pressure (atm) |
|---|---|---|
| $1.10 \times 10^{-5}$ | $1.47 \times 10^{-6}$ | $1.45 \times 10^{-8}$ |
| 1010 | 134.6 | 1.328 |
| $1.10 \times 10^{-3}$ | $1.47 \times 10^{-4}$ | $1.45 \times 10^{-6}$ |
| $9.82 \times 10^{-6}$ | $1.31 \times 10^{-6}$ | $1.29 \times 10^{-8}$ |
| 1699 | 226.5 | 2.235 |
| $7.46 \times 10^{-2}$ | $9.94 \times 10^{-3}$ | $9.81 \times 10^{-5}$ |

2. A 2.5 L party balloon at a pressure of 98 kPa is taken to the top of a mountain where the pressure is 75 kPa. What is the new volume of the balloon in litres?

$P_1 = 98\text{ kPa}$

$V_1 = 2.5\text{ L}$

$P_2 = 75\text{ kPa}$

$V_2 = ??\ (\text{L})$

$$P_1V_1 = P_2V_2$$

$$V_2 = \frac{P_1V_1}{P_2} = \frac{(98\text{ kPa})(2.5\text{ L})}{75\text{ kPa}} = \boxed{3.3\text{ L}}$$

3. A small oxygen canister contains 110 mL of gas at a pressure of 3.0 atm. All of the oxygen is released into a balloon with a final pressure of 202.650 kPa. What is the new volume of the gas in litres?

$P_1 = 3.0\text{atm}$

$V_1 = 110\text{mL} \times \frac{1\text{L}}{1000\text{mL}} = 0.110\text{L}$

$P_2 = 202.650\text{kPa} \times \frac{1.0000\text{atm}}{101.325\text{kPa}} = 2.0000\text{atm}$

$V_2 = ??(\text{L})$

$V_2 = \frac{P_1 V_1}{P_2}$

$= \frac{(3.0\text{atm})(0.110\text{L})}{(2.0000\text{atm})}$

$\boxed{= 0.17\text{L}}$

4. A weather balloon containing 35.0 L of helium at 98.0 kPa is released and rises. Assuming that the temperature is constant, find the volume of the balloon when the atmospheric pressure is 15.0 kPa at a height of ~~25.0 km~~. ← Not important

$V_1 = 35.0\text{L}$

$P_1 = 98.0\text{kPa}$

$P_2 = 15.0\text{kPa}$

$V_2 = ?$

$V_2 = \frac{P_1 \cdot V_1}{P_2} = \frac{(98.0\text{kPa})(35.0\text{L})}{15.0\text{kPa}}$

$\boxed{= 229\text{L}}$

5. A 2.5 L party balloon at a pressure of 1.10 atm is taken to the bottom of a mountain where the pressure is 900 Torr. What is the new volume of the balloon in mL?

$V_1 = 2.5\text{L} \times \frac{1000\text{mL}}{1\text{L}} = 2.5 \times 10^3\text{mL}$

$P_1 = 1.10\text{atm}$

$P_2 = 900\text{Torr} \times \frac{1.0000\text{atm}}{760.00\text{Torr}} = 1.18\text{atm}$

$V_2 = ?$

$V_2 = \frac{P_1 V_1}{P_2} = \frac{(1.10\text{atm})(2.5 \times 10^3\text{mL})}{1.18\text{atm}}$

$= 2.3 \times 10^3\text{mL}$

6. A small oxygen canister contains 215 mL of gas at a pressure of 765 mmHg. If the oxygen gas is allowed to expand to a volume of 0.350 L, what pressure *in kilopascals* must be exerted on the canister?

$V_1 = 215\text{mL}$

$P_1 = 765\text{mmHg} \times \frac{101.325\text{kPa}}{760.00\text{mmHg}} = 102\text{kPa}$

$V_2 = 0.350\text{L} = 350\text{mL}$

$P_2 = ?(\text{kPa})$

$P_2 = \frac{P_1 V_1}{V_2} = \frac{(102\text{kPa})(215\text{mL})}{(350\text{mL})}$

$\boxed{= 62.7\text{kPa}}$