MPHS U7 L3A CFU: Charles, Boyles & Gay-Lussac's Laws

1 atm = 760.0 mm Hg = 101.3 kPa= 760 .0 torr

K = °C + 273
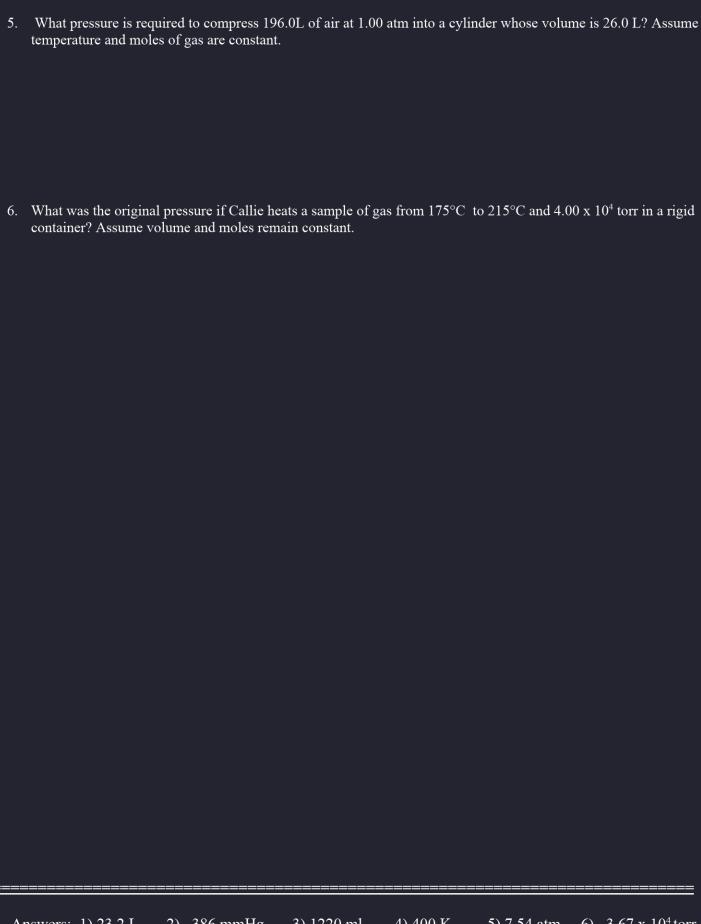
$$\frac{V_1 P_1}{n_1 T_1} = \frac{V_2 P_2}{n_2 T_2}$$

1. If 22.5 L of nitrogen at 748 mmHg are compressed to 725 mm Hg at constant temperature. What is the new volume assuming moles and temperature are constant?

2. The pressure of a basketball is 414 mm Hg when the temperature is 25°C. If Andrew takes the basketball outside in the winter where the temperature is 5.0°C, what will the new pressure be assuming moles and volume remain constant.

3. A gas occupies 900.0 mL at a temperature of 27.0 °C. What is the volume at 132.0 °C? Assume pressure and moles remain constant.

4. A container containing 5.00 L of a gas is collected at 100. K and then allowed to expand to 20.0 L. What must the new temperature be in order to maintain the same pressure ?Assume pressure & moles remain constant.

5. What pressure is required to compress 196.0L of air at 1.00 atm into a cylinder whose volume is 26.0 L? Assume temperature and moles of gas are constant.

6. What was the original pressure if Callie heats a sample of gas from 175°C to 215°C and 4.00×10^4 torr in a rigid container? Assume volume and moles remain constant.

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Answers: 1) 23.2 L   2) 386 mmHg   3) 1220 ml   4) 400.K   5) 7.54 atm   6) 3.67×10^4 torr

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Avogadro's Law

1. If Sample #1 contains 2.3 moles of chlorine gas in a 3.5 liter balloon at the same conditions as sample #2 which contains 1.2 moles of chlorine gas, what is the volume of the balloon that contains sample #2?

2. If I fill a balloon with 5.2 moles of gas and it creates a balloon with a volume of 23.5 liters, how many moles are in a balloon at the same temperature and pressure that has a volume of 14.9 liters?

3. Sally adds 3.13 moles of argon to a 5.29 liter balloon that already contained 2.51 moles of argon. What is the volume of the balloon after the addition of the extra gas?

Answers: 1) 1.8 L   2) 3.3 mol   3) 11.9 L

Combined Gas Law Problems:

4. A gas balloon has a volume of 106 liters when the temperature is 45.0 °C and the pressure is 740.0 mm of mercury. What will its volume be at 20.0 °C and 780. mm of mercury pressure?

5. If 10.0 liters of oxygen at STP are heated to 512 °C, what will be the new volume of gas if the pressure is also increased to 1520.0 mm of mercury?

6. A gas is heated from 263.0 K to 298.0 K and the volume is increased from 24.0 liters to 35.0 liters by moving a large piston within a cylinder. If the original pressure was 1.00 atm, what would the final pressure be?

7. The pressure of a gas is reduced from 1200.0 mm Hg to 850.0 mm Hg as the volume of its container is increased by moving a piston from 85.00 mL to 350.0 mL. What would the final temperature be if the original temperature was 90.0 °C?

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Answers: 4)   92.7 L   5)   14.4 L   6)   0.778 atm   7) 1059 K