**Charles Law Problems:**

1. Gas in a balloon occupies 2.5 L at 300.0 K. The balloon is dipped into liquid nitrogen that is at a temperature of 80 K. What volume will the gas in the balloon occupy at this temperature?

Solution: Charles law is as follows. You simply need to plug the numbers into the equation. The main thing to remember is that the temperatures need to be in K. The conversion for this is K=273+C. Note that these temperatures are already in Kelvins.



Solving for x you get 0.667L. But in proper sig. figs the answer is **0.7 L**

2. A sample of gas occupies 24 ml at 18°C . What volume would the gas occupy at 150°C?

Solution: Charles law is as follows. You simply need to plug the numbers into the equation. The main thing to remember is that the temperatures need to be in K. The conversion for this is K=273+C.



Solving for x you get 34.89mL. But in proper sig. figs the answer is **35 mL**

3. What is the volume of a 75 ml gas with a temperature of 25°C at standard temperature?

Solution: Charles law is as follows. You simply need to plug the numbers into the equation. The main thing to remember is that the temperatures need to be in K. The conversion for this is K=273+C.



Solving for x you get 68.7mL. But in proper sig. figs the answer is **69 mL**

**Boyles Law Problems:**

4. What is the volume of a gas at 790.0 mm Hg, if it has a volume of 30.0 L at 760.0 mm Hg?

Solution: Boyles Law is as follows. You simply need to plug the numbers into the equation. The main thing to remember is that the pressure needs to be in the same units on both sides of the equation. Also, standard pressure is the pressure at sea level.



Solving for x you get 28.8608L. But in proper sig figs the answer is **28.9L**

5. How many liters of gas at standard pressure at sea level, must be compressed to fill an underwater submarine with 20,000,000 L at 20.0 atm?

Solution: Boyles Law is as follows. You simply need to plug the numbers into the equation. The main thing to remember is that the pressure needs to be in the same units on both sides of the equation. Also, standard pressure is the pressure at sea level.



Solving for x you get **400,000,000** L. And this is in proper sig figs!!!

6. A gas has a volume of 750 ml at 90 kPa. What is its new volume at standard pressure?

Solution: Boyles Law is as follows. You simply need to plug the numbers into the equation. The main thing to remember is that the pressure needs to be in the same units on both sides of the equation. Also, standard pressure is the pressure at sea level.



Solving for x you get 666mL. But in proper sig figs the answer is 700mL. But I will not ask for 1 sig fig any questions on test.

**Combined Gas Law Problems:**

7. What would the new volume of 75 ml of a gas at 0°C and 800mmHg be at STP?

Solution: The combined gas law is as follows. You simply need to plug the numbers into the equation. The main thing to remember is that the pressure needs to be in the same units on both sides of the equation. Also, standard pressure is the pressure at sea level. Also, the temperature needs to be in Kelvins. The conversion for this is K=273+C.



Solving for x you get 78.9mL. But in proper sig figs the answer is 80mL. But I will not ask for 1 sig fig any questions on test.

8. A gas has a volume of 7.5 L, a pressure of 2.5 atm, and a temperature of 25 °C. What would the volume change to with a new pressure of 2.0 atm and a temperature of 100°C?

Solution: The combined gas law is as follows. You simply need to plug the numbers into the equation. The main thing to remember is that the pressure needs to be in the same units on both sides of the equation. Also, standard pressure is the pressure at sea level. Also, the temperature needs to be in Kelvins. The conversion for this is K=273+C.



Solving for x you get **11.7L**. But in proper sig figs the answer is 10mL. But I will not ask for 1 sig fig any questions on test.

9. What would the volume of a gas change to if 450 ml had the pressure raised from 14.7 p.s.i. To 20.2 p.s.i. And the temperature changed from 0°C to 200°C?

Solution: The combined gas law is as follows. You simply need to plug the numbers into the equation. The main thing to remember is that the pressure needs to be in the same units on both sides of the equation. Also, standard pressure is the pressure at sea level. Also, the temperature needs to be in Kelvins. The conversion for this is K=273+C.



Solving for x you get **567mL**. But in proper sig figs the answer is 600mL. But I will not ask for 1 sig fig any questions on test.

**Ideal Gas Law:**

10. What is the volume of 30.0g CO2 at STP?

This is an Ideal Gas Law question. You know this because it mentions moles. The ideal gas law is the only formula with moles. The formula is:

PV=nRT

STP stands for standard temp. and pressure. Standard temp. is 0˚C. Standard pressure in atm’s is 1.

R is a constant an always is: 0.0821 (atm x L)/(mol x K)

First, you must convert to moles. Watch for diatomic molecules here. The conversion is:

= 0.682 moles

Now plug the numbers in the equation. The set up is as follows:

(1)V=(0.682)(0.0821)(273)

Solving for V, the answer is **15.3 L**

11. How many moles are in a container of unknown gas that has a volume of 250 ml, a temperature of 75°C, and a pressure of 740 torr?

This is an Ideal Gas Law question. You know this because it mentions moles. The ideal gas law is the only formula with moles. The formula is:

PV=nRT

R is a constant an always is: 0.0821 (atm x L)/(mol x K)

But first you must convert the pressure units to atm. Due to the units on R, it is important that you have atm’s for the pressure. Here is the pressure conversion:

= 0.974 atm

Now plug it into the equation. The set up is:

(0/974)(0.250)) = (x)(0.0821)(348)

Solving for x, the answer is  **0.0085 moles**

12. What is the volume of 7 moles of Hydrogen gas at a pressure of 2.0 atm and a temperature of 25°C?

This is an Ideal Gas Law question. You know this because it mentions moles. The ideal gas law is the only formula with moles. The formula is:

PV=nRT

R is a constant an always is: 0.0821 (atm x L)/(mol x K)

The set up is:

(2)V = (7)(0.0821)(298)

Solving for V, the answer is **85.6 L (I know this is not proper sig figs)**

**Grahams Law of Confusion: (Just kidding, I know it is diffusion.)**

13. How much faster does Helium diffuse than Argon?

In this problem you need to assign you’re a and b. I will make a-He and b-Ar. I generally like my b to be the heavier gas. This creates the following set up:



Notice that I put a 1 as my Rb. This is because you are creating a ratio. It is a good idea to compare the higher rate to the number one. So I recommend assigning a one to the heavier slower gas. Solving for x you get:

X=3.16 So the answer is: **3.16 times faster**

14. How much faster does hydrogen gas diffuse than oxygen gas(O2)?

In this problem you need to assign you’re a and b. I will make a-H2 and b-O2. I generally like my b to be the heavier gas. This creates the following set up:



Notice that I put a 1 as my Rb. This is because you are creating a ratio. It is a good idea to compare the higher rate to the number one. So I recommend assigning a one to the heavier slower gas. Solving for x you get:

X=4 So the answer is: **4 times faster**

15. What is the molar mass of a gas if it travels 3.2 times faster than Krypton?

In this problem you need to assign you’re a and b. I will make a-Kr and b-Unknown. I generally like my b to be the unknown as it places the x in the numerator. Also, pay attention to the ratio of speeds. This gas is faster than Krypton. This means it is lighter than Kr. If your answer is not less than 84, then you have set the problem up incorrectly. Here is the set up for the problem:



Solving for x you get:

X=8.2 So the molar mass is (in proper sig. figs.): **8.2 g/mol**