Combination Gas Laws

PV = nRT	Combined Gas Law $P_1V_1/T_1 = P_2V_2/T_2$ T = Kelvin

1. A flask contains $O_{2(g)}$, first at STP and then at 100°C. How many moles and grams of gas are in the flask?

$PV=nRT \quad \frac{PV}{RT}=n \quad \frac{1.1\,L}{.0821 \cdot 273} = .5\,mol \quad \frac{32\,g}{1\,mol} = 16\,g\ O_2$

2. Aerosol containers often carry the warning that they should not be heated. Suppose such a container were filled with a gas at 2.5 atm and 22°C, and suppose that the container may rupture if the pressure exceeds 8.0 atm. At what temperature is the rupture likely to occur.

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ V = constant $T_2 = \frac{P_2T_1}{P_1} \quad \frac{8 \cdot 295}{2.5} = 944K$

$273+22=295$ $671\,^{\circ}C$

3. What is the pressure exerted by 0.508 mol O_2 in a 15.0L container at 303K?

$PV = nRT$

$P = \frac{nRT}{V} \quad \frac{.508 \cdot .0821 \cdot 303K}{15L} = 0.84\,atm$

4. What is the volume occupied by 16.0g ethane gas (C_2H_6) at 720 torr (760 T = 1atm) at 18°C?

$18+273=291K$ $720/760 = .94\,atm$

C_2H_2 $30\,g/mol$

$16g \left| \frac{1\,mol}{30\,g} \right. = 0.53\,mol$

$PV=nRT$

$V = \frac{nRT}{P} \quad \frac{.53 \cdot .0821 \cdot 291K}{.94\,atm} = 13.4L$

5. A balloon of 1.5L at 25C and 1ATM is brough to the bottom of a cold lake where the temperature is 20° colder and under a pressure of 1.75 atm.

$\hookrightarrow 5^{\circ}C \longrightarrow 278K$

   a. Will the balloon shrink or expand? Shrink

   b. After the balloon changed size, what is the pressure
      - Outside of the balloon? 1.75
      - Inside of the balloon? 1.75
      - What is the new volume of the balloon?

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2} \quad \frac{P_1V_1T_2}{T_1P_2} = V_2 \quad \frac{1 \cdot 1.5 \cdot 278}{298 \cdot 1.5} = .93L$

6. A student notices her tires were a little low in the winter at -12C. So, she filled them up with more air. The pressure gage read 40 lbs/in^2. In the middle of summer, the she was driving the same tires on hot pavement. The tire reached a temperature of 65°C when the tire exploded. What was the pressure in lbs/in^2 that caused the explosion?

$-12+273=261$

$65+273=338$

$\frac{P_1T_1}{T_1} = \frac{P_2T_2}{T_2}$

$\frac{P_1T_2}{T_1} = P_2 \quad \frac{40 \cdot 338}{261} = 51\,\frac{lbs}{in^2}$