Using Density in the Ideal Gas Law

What is the density of oxygen, O_2, in grams per liter at 25 °C and 0.850 atm?

Solution:
Because density equals mass per unit volume, calculating the mass of 1 L (exact) of gas will give you the density of the gas.

P = 0.850 atm
V = 1 L
T = 25°C + 273 = 298 K
n = ?

$PV = nRT \qquad n = \frac{PV}{RT}$

$$n = \frac{0.850\ \text{atm} * 1\ \text{L}}{0.0821\ \frac{\text{L atm}}{\text{mol K}} * 298\ \text{K}} = 0.0347\ \text{mol } O_2$$

Now you can convert moles of O_2 to grams:

0.0347 mol O_2 X 32.0 g/mol = 1.11 grams O_2 that had been in the 1.00 L OR

You can solve the entire problem by substituting grams/Mwt for moles in the Ideal Gas Law Equation.

Since $n = \frac{\text{mass}}{\text{Mwt}}$ and $PV = n\,RT$ $\qquad PV = \frac{\text{mass } RT}{\text{Mwt}}$ and $\text{mass} = \frac{PV\ \text{Mwt}}{RT}$

The Molecular weight of O_2 can be found on the Periodic Table adding to the factors already known.

$$\text{mass} = \frac{0.850\ \text{atm} * 1\ \text{L} * 32.0\ \text{g/mol}}{0.0821\ \frac{\text{L atm}}{\text{mol K}} * 298\ \text{K}} = \boxed{1.11\ \text{g/L}}$$