Number of moles of O_2 in a cylinder

An internal combustion engine works on the principle that a small volume of fuel is combusted to create a hot gas. When the piston in a 0.5 liter cylinder is compressed the volume is very small (approx. 0.02 liter). This is typical for 6 cylinder 3.0 liter engine. How many moles of O_2 gas are present in that volume at 298 K?

Number of moles of O_2 in a cylinder

How many moles of O_2 are present in 0.02 L at 298 K?

Solution: Use the ideal gas law and solve for n.

$$n = \frac{PV}{RT} = \frac{(0.2\ atm)(0.02\ L)}{\left(0.08206\ \frac{Latm}{molK}\right)(298\ K)}$$

$$= 1.64\ x\ 10^{-4}\ mol$$

Note that we used 0.2 atm for O_2 since that is the partial pressure of O_2 at sea level.