

Example(7): The density of a gaseous compound is 3.38 g L^{-1} at 40°C and 1.97 atm . When is its molar mass? Based on molar mass, predict the name of gas which is either carbon monoxide or carbon dioxide.

$$(C = 12, O = 16, R = 0.0821\text{ L atm K}^{-1}\text{ mol}^{-1})$$

Solution: :

$$d = 3.38\text{ g L}^{-1}$$

$$T = 40^\circ\text{C} + 273 = 313\text{ K}$$

$$P = 1.97\text{ atm}$$

$$R = 0.0821\text{ L atm K}^{-1}\text{ mol}^{-1}$$

$$M = ?$$

$$M = \frac{dRT}{P} = \frac{3.38\text{ g L}^{-1} \times 0.0821\text{ L atm K}^{-1}\text{ mol}^{-1} \times 313\text{ K}}{1.97\text{ atm}} = 44.09\text{ g mol}^{-1}$$

molar mass of $\text{CO} = 12 + 16 = 28\text{ g mol}^{-1}$; molar mass of $\text{CO}_2 = 12 + (2 \times 16) = 44\text{ g mol}^{-1}$.

Thus, the name of gas is carbon dioxide.