calculate the volume of one mole of oxygen at 27degree centigrade and 4atm pressure. The molar volume of oxygen at NTP is 22.4 litres.

Solution

NTP - Normal Temperature and Pressure - is defined as air at 20°C (293.15 K, 68°F) and 1 atm (101.325 kN/m^2, 101.325 kPa, 14.7 psia, 0 psig, 29.92 in Hg, 760 torr).

One can use the combined gas law:

$$\frac{pV}{T} = const$$

$$\frac{p_1V_1}{T_1} = \frac{p_2V_2}{T_2}$$

As we have 1 mol of gas we can rewrite the last formulae

$$\frac{p_1V_1^m}{T_1} = \frac{p_2V_2^m}{T_2}$$

Where V^m is a molar volume.

$$\frac{1atm \cdot 22.4L}{293K} = \frac{4atm \cdot V_2^m}{(27+273)K}$$

$$V_2^m = \frac{1atm \cdot 22.4L \cdot (27+273)K}{293K \cdot 4atm} = 5.7L$$

Answer: V^m(300K, 4 atm) = 5.7 L