Question #68038, Physics / Molecular Physics

Potassium chlorate is often used to generate oxygen gas in high school laboratory. If 183.7g of $KClO_3$ is completely burnt catalytically, what volume of oxygen gas will be obtained at 39 celsius and 1200 torr pressure?

Solution:

Decomposition of Potassium chlorate:

$$2KClO_3 \rightarrow 2KCl + 3O_2$$

The mol number of O_2 is equal to:

$$2n(KClO_3) = 3n(O_2)$$

$$n(O_2) = \frac{2}{3}n(KClO_3)$$

The mol number of the Potassium chlorate can be calculated from the mass:

$$n(KClO_3) = \frac{m(KClO_3)}{M(KClO_3)} = \frac{183.7g}{122.55\ g/mol} = 1.5\ mol$$

Using Ideal gas law:

$$pV = nRT$$

$$p = 1200\ torr = 159986.8\ Pa$$

$$T = 39℃ = 312.15\ K$$

From this equation volume of O_2:

$$V = \frac{nRT}{p} = \frac{2/3n(KClO_3) \cdot RT}{p}$$

$$V = \frac{\frac{2}{3} \cdot 1.5mol \cdot 8.314\ (cm^3 \cdot MPa/K \cdot mol) \cdot 312.15K}{0.16\ MPa} = 16220\ cm^3 = 16.22\ L$$

Answer: volume of oxygen is 16.22 L