

## MOOLARVUTUS REAKTSIOONIVÖRRANDI JÄRGI

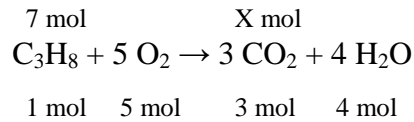
### Alkaanid

**1. Mitu liitrit ja mitu grammi süsihappegaasi tekib 7 mooli propaani täielikul põlemisel?**

$$n(\text{C}_3\text{H}_8) = 7 \text{ mol}$$

$$V(\text{CO}_2) - ?$$

$$m(\text{CO}_2) - ?$$



$$X = \frac{7 \text{ mol} \cdot 3 \text{ mol}}{1 \text{ mol}} = 21 \text{ mol}$$

$$n(\text{CO}_2) = 21 \text{ mol}$$

$$V = n \cdot V_M$$

$$V(\text{CO}_2) = 21 \text{ mol} \cdot 22,4 \text{ dm}^3/\text{mol} = 470,4 \text{ dm}^3 \sim \underline{470 \text{ l}}$$

$$m = n \cdot M$$

$$M(\text{CO}_2) = 44 \text{ g/mol}$$

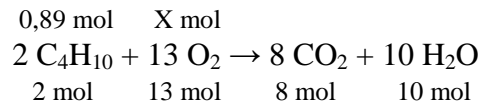
$$M(\text{CO}_2) = 21 \text{ mol} \cdot 44 \text{ g/mol} = 924 \text{ g} \sim \underline{920 \text{ g}}$$

**2. Mitu liitrit õhku, mis sisaldab ruumalaliselt ca 20% hapnikku, kulub 20 liitri butaani täielikuks põlemiseks?**

$$V(\text{C}_4\text{H}_{10}) = 20 \text{ l} = 20 \text{ dm}^3$$

$$\%(\text{O}_2) = 20\%$$

$$V(\text{õhk}) - ?$$



$$n[\text{C}_4\text{H}_{10}] = \frac{20 \text{ dm}^3}{22,4 \text{ dm}^3/\text{mol}} = 0,89 \text{ mol}$$

$$X = \frac{0,89 \text{ mol} \cdot 13 \text{ mol}}{2 \text{ mol}} = 5,79 \text{ mol}$$

$$n(\text{O}_2) = 5,79 \text{ mol}$$

$$V = n \cdot V_M$$

$$V(\text{O}_2) = 5,79 \text{ mol} \cdot 22,4 \text{ dm}^3/\text{mol} = 130 \text{ dm}^3$$

$$V(\text{O}_2) \leftrightarrow 20\%$$

$$V(\text{õhk}) \leftrightarrow 100\%$$

$$V[\text{õhk}] = \frac{130 \text{ dm}^3 \cdot 100}{20} = 650 \text{ dm}^3$$

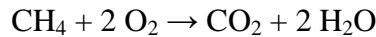
$$V(\text{õhk}) = 650 \text{ dm}^3 = \underline{650 \text{ l}}$$

**3. Mitu g pentaani saab täielikult põletada sama suures koguses hapnikus, milles põleb täielikult 5,6 l metaani?**

$$V(\text{CH}_4) = 5,6 \text{ l} = 5,6 \text{ dm}^3$$

$$m(\text{C}_5\text{H}_{12}) - ?$$

$$0,25 \text{ mol } X \text{ mol}$$

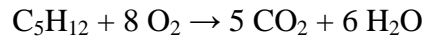


$$n[\text{CH}_4] = \frac{5,6 \text{ dm}^3}{22,4 \text{ dm}^3/\text{mol}} = 0,25 \text{ mol}$$

$$X = \frac{0,25 \text{ mol} \cdot 2 \text{ mol}}{1 \text{ mol}} = 0,5 \text{ mol}$$

$$n(\text{O}_2) = 0,5 \text{ mol}$$

$$X \text{ mol } 0,5 \text{ mol}$$



$$X = \frac{0,5 \text{ mol} \cdot 1 \text{ mol}}{8 \text{ mol}} = 0,0625 \text{ mol}$$

$$n(\text{C}_5\text{H}_{12}) = 0,0625 \text{ mol}$$

$$m = n \cdot M$$

$$M(\text{C}_5\text{H}_{12}) = 72 \text{ g/mol}$$

$$m(\text{C}_5\text{H}_{12}) = 0,0625 \text{ mol} \cdot 72 \text{ g/mol} = \underline{4,5 \text{ g}}$$

**4. Ühe leiukoha maagaas sisaldab mahu järgi 90% metaani, 5% etaani, 3% süsinikdioksiidi ja 2% lämmastikku. Kui suurt ruumala õhku on tarvis 1 m<sup>3</sup> sellise gaasi põletamiseks?**

$$\%(\text{CH}_4) = 90\%$$

$$\%(\text{C}_2\text{H}_6) = 5\%$$

$$\%(\text{CO}_2) = 3\%$$

$$\%(\text{N}_2) = 2\%$$

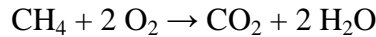
$$V(\text{gaas}) = 1 \text{ m}^3 = 1000 \text{ dm}^3$$

$$V(\text{õhk}) - ?$$

$$V(\text{CH}_4) = 0,9 \cdot 1000 \text{ dm}^3 = 900 \text{ dm}^3$$

$$n[\text{CH}_4] = \frac{900 \text{ dm}^3}{22,4 \text{ dm}^3/\text{mol}} = 40,2 \text{ mol}$$

$$40,2 \text{ mol } X \text{ mol}$$



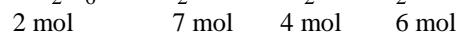
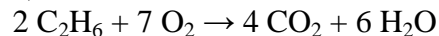
$$X = \frac{40,2 \text{ mol} \cdot 2 \text{ mol}}{1 \text{ mol}} = 80,4 \text{ mol}$$

$$n_1(\text{O}_2) = 80,4 \text{ mol}$$

$$V(\text{C}_2\text{H}_6) = 0,05 \cdot 1000 \text{ dm}^3 = 50 \text{ dm}^3$$

$$n[\text{C}_2\text{H}_6] = \frac{50 \text{ dm}^3}{22,4 \text{ dm}^3/\text{mol}} = 2,23 \text{ mol}$$

$$2,23 \text{ mol } X \text{ mol}$$



$$X = \frac{2,23 \text{ mol} \cdot 7 \text{ mol}}{2 \text{ mol}} = 7,8 \text{ mol}$$

$$n_2(\text{O}_2) = 7,8 \text{ mol}$$

$$n(\text{kokku O}_2) = 80,4 \text{ mol} + 7,8 \text{ mol} = 88,2 \text{ mol}$$

$$V(\text{O}_2) = 88,2 \text{ mol} \cdot 22,4 \text{ dm}^3/\text{mol} = 1976 \text{ dm}^3$$

$$V[\text{õhk}] = \frac{1976 \text{ dm}^3 \cdot 100}{20} = 9880 \text{ dm}^3 = 9,9 \text{ m}^3$$

$$V(\text{õhk}) = \underline{9,9 \text{ m}^3}$$

$$V(\text{O}_2) \leftrightarrow 20\%$$

$$V(\text{õhk}) \leftrightarrow 100\%$$

5. Reaktiivlennuk Boeing 737-500 kulutab kiirusel 800 km/h ~2,2 tonni kütust tunnis. Sellise kiiruse juures lendab lennuk üle Eesti ~ 30 minutiga.

A. Arvutage, mitu kuupmeetrit süsinikdioksiidi eraldub selle aja jooksul, kui kütusena kasutatav undekaan ( $C_{11}H_{24}$ ) põleb täielikult.

B. 1 hektar metsa seob keskmiselt  $25 \text{ m}^3$  süsinikdioksiidi ööpäevas. Mitme ööpäevaga suudab 1 hektar metsa siduda sellise süsinikdioksiidi koguse, mis tekib lennuki ülelennul Eestist?

$$\begin{array}{l} t (\text{üle Eesti}) = 30 \text{ min} = 0,5 \text{ h} \\ m (\text{kütus } 1 \text{ h}) = 2,2 \text{ t} = 2200 \text{ kg} \\ V (1 \text{ ha metsa seob } CO_2) = 25 \text{ m}^3 \end{array}$$

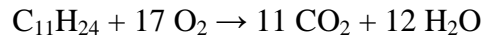
$$\begin{array}{l} V (CO_2) - ? \\ t (1 \text{ ha metsa seob lennu } CO_2) - ? \end{array}$$

$$m (C_{11}H_{24} \text{ üle Eesti}) = 2200 \text{ kg} : 2 = 1100 \text{ kg}$$

$$M(C_{11}H_{24}) = 156 \text{ g/mol} = 156 \text{ kg/kmol}$$

$$n[C_{11}H_{24}] = \frac{1100 \text{ kg}}{156 \text{ kg/kmol}} = 7,05 \text{ kmol}$$

$$\begin{array}{ccc} 7,05 \text{ kmol} & & X \text{ kmol} \end{array}$$



$$X = \frac{7,05 \text{ kmol} \cdot 11 \text{ mol}}{1 \text{ mol}} = 77,55 \text{ kmol}$$

$$n (CO_2) = 77,55 \text{ kmol}$$

$$V (CO_2) = 77,55 \text{ kmol} \cdot 22,4 \text{ m}^3/\text{kmol} = 1737 \text{ m}^3 \sim \underline{1740 \text{ m}^3}$$

$$t[1 \text{ ha metsa seob ülelennu } CO_2] = \frac{1737 \text{ m}^3}{25 \text{ m}^3} = 69,5 \text{ ööpäeva}$$

$$t = \underline{69,5 \text{ ööpäeva}}$$