

NAMUNAVIY MASALALAR

1-MASALA. v_{kv} va bosim bog'lanishi

Ideal gazning zichligi $\rho = 0,9 \text{ kg/m}^3$. Molekulalarning o'rtacha kvadratik tezligi $v_{kv} = 600 \text{ m/s}$.

Topilsin: gaz bosimi p .

Yechim

Bosimning molekulyar formulasi:

$$p = (1/3) \rho v_{kv}^2$$

$$p = (1/3) \cdot 0,9 \cdot (600)^2$$
$$(600)^2 = 360000$$

$$p = 0,3 \cdot 360000 = 108000 \text{ Pa}$$

Javob:

$$p = 1,08 \cdot 10^5 \text{ Pa}.$$

2-MASALA. Harorat orqali tezliklar nisbati

Bir xil gazning molekulalari $T_1 = 300 \text{ K}$ va $T_2 = 1200 \text{ K}$ haroratlarda.

Topilsin: $\frac{v_{kv_2}}{v_{kv_1}}$.

Yechim

$$v_{kv} \sim \sqrt{T}$$

$$\frac{v_{kv_2}}{v_{kv_1}} = \sqrt{(T_2 / T_1)} = \sqrt{(1200 / 300)} = \sqrt{4} = 2$$

Javob:

$$\frac{v_{kv_2}}{v_{kv_1}} = 2.$$

3-MASALA. Ideal gazdan molekulalar soni

Hajmi $V = 5 \text{ L}$ bo'lgan idishda $p = 200 \text{ kPa}$ bosim ostida $T = 400 \text{ K}$ haroratdagi ideal gaz bor.

$$(k = 1,38 \cdot 10^{-23} \text{ J/K})$$

Topilsin: molekular soni N.

Yechim

Ideal gaz tenglamasi:

$$pV = N k T$$

$$V = 5 \text{ L} = 5 \cdot 10^{-3} \text{ m}^3$$

$$p = 2 \cdot 10^5 \text{ Pa}$$

$$N = pV / (kT)$$

$$N = (2 \cdot 10^5 \cdot 5 \cdot 10^{-3}) / (1,38 \cdot 10^{-23} \cdot 400)$$

Yuqori qism: 1000

Pastki qism: $5,52 \cdot 10^{-21}$

$$N \approx 1,81 \cdot 10^{23}$$

Javob:

$$N \approx 1,8 \cdot 10^{23} \text{ molekula.}$$

4-MASALA. Gaz aralashmasida qisman bosim

Idishda $T = 300 \text{ K}$ da 3 mol N_2 va 1 mol O_2 bor. Umumiy bosim $p = 400 \text{ kPa}$.

Topilsin: O_2 ning qisman bosimi.

Yechim

Umumiy mol soni:

$$n = 3 + 1 = 4$$

Molyar ulush:

$$X_{\text{O}_2} = 1 / 4$$

Dalton qonuni:

$$p_{\text{O}_2} = X_{\text{O}_2} \cdot p = 0,25 \cdot 400 \text{ kPa} = 100 \text{ kPa}$$

Javob:

$$p_{\text{O}_2} = 100 \text{ kPa.}$$

5-MASALA. Ichki energiyani topish

2 mol ikki atomli ideal gaz $T = 500 \text{ K}$ haroratda bo'lib turibdi.

($R = 8,31 \text{ J/(mol} \cdot \text{K)}$)

Topilsin: ichki energiya U .

Yechim

Ikki atomli gaz uchun:

$$f = 5$$

$$U = (f/2) n R T$$

$$U = (5/2) \cdot 2 \cdot 8,31 \cdot 500$$

$$U = 5 \cdot 8,31 \cdot 500 = 20775 \text{ J}$$

Javob:

$$U \approx 2,08 \cdot 10^4 \text{ J.}$$

6-MASALA. Ichki energiya o'zgarishi

1 mol bir atomli ideal gaz 300 K dan 900 K gacha qizdirildi.

Topilsin: ΔU .

Yechim

Bir atomli gaz:

$$f = 3$$

$$\Delta U = (f/2) n R \Delta T$$

$$\Delta T = 600 \text{ K}$$

$$\Delta U = (3/2) \cdot 1 \cdot 8,31 \cdot 600$$

$$\Delta U \approx 7479 \text{ J}$$

Javob:

$$\Delta U \approx 7,5 \cdot 10^3 \text{ J.}$$

7-MASALA. Molyar massa orqali tezlik

Gaz harorati $T = 300 \text{ K}$. $v_{kv} = 400 \text{ m/s}$.

($R = 8,31 \text{ J/(mol} \cdot \text{K)}$)

Topilsin: gazning molyar massasi M .

Yechim

$$v_{kv} = \sqrt{3RT / M}$$

$$M = 3RT / v_{kv}^2$$

$$M = (3 \cdot 8,31 \cdot 300) / (400)^2$$

$$M = 7479 / 160000 \approx 0,0467 \text{ kg/mol}$$

Javob:

$M \approx 47 \text{ g/mol}$.

8-MASALA. Zichlikdan haroratni topish

Ideal gaz bosimi $p = 100 \text{ kPa}$, zichligi $\rho = 1,25 \text{ kg/m}^3$, molyar massasi $M = 0,029 \text{ kg/mol}$.

Topilsin: harorat T .

Yechim

Zichlik formulasi:

$$\rho = (pM)/(RT)$$

$$T = (pM)/(\rho R)$$

$$T = (10^5 \cdot 0,029) / (1,25 \cdot 8,31)$$

$$T \approx 279 \text{ K}$$

Javob:

$T \approx 280 \text{ K}$.

9-MASALA. Molekulalar energiyasi

Ideal gaz harorati $T = 500 \text{ K}$.

Topilsin: bitta molekulaning oʻrtacha kinetik energiyasi.

($k = 1,38 \cdot 10^{-23} \text{ J/K}$)

Yechim

$$\langle E \rangle = (3/2) kT$$

$$\langle E \rangle = 1,5 \cdot 1,38 \cdot 10^{-23} \cdot 500$$

$$\langle E \rangle = 1,04 \cdot 10^{-20} \text{ J}$$

Javob:

$$\langle E \rangle \approx 1,0 \cdot 10^{-20} \text{ J}.$$

10-MASALA. Ikki gaz tezliklarini solishtirish (IPhO uslub)

Bir xil haroratda vodorod (H_2 , $M = 0,002 \text{ kg/mol}$) va azot (N_2 , $M = 0,028 \text{ kg/mol}$) gazlari bor.

Topilsin: $v_{kv}(H_2) / v_{kv}(N_2)$.

Yechim

Bir xil T da:

$$v_{kv} \sim 1 / \sqrt{M}$$

$$v_{kv}(H_2) / v_{kv}(N_2) = \sqrt{\frac{M_{N_2}}{M_{H_2}}}$$

$$= \sqrt{\frac{0,028}{0,002}} = \sqrt{14} \approx 3,74$$

Javob:

$$v_{kv}(H_2) \approx 3,7 \text{ marta katta.}$$