1-AMALIY TOPSHIRIQ

Mavzu: Ideal gazlarning holat tenglamasi

1-masala

 16 kg havoning bosimi **P = 0,24 MPa** va harorati **t = 36 ^{o}S** bo'lgandagi hajmi topilsin.

Yechish:

quyidagi holat tenglamasidan **PV = MRT** havoning hajmini topamiz:

$$V = \frac{M \cdot R \cdot T}{P} = \frac{16 \cdot 287 \cdot (36 + 273)}{0,24 \cdot 10^6} = 5,9 \ \ \text{m}^3$$

   bu yerda $R = \left(\frac{8314}{29}\right) = 287$ J/kg ^{o}S

   μ = 29 mol [ilova, jadval 1].

2-masala

Hajmi 60 m^3 bo'lgan idishning ichidagi karbonat angidridining (CO_2) harorati **t = 17 ^{0}S** va bosimi **P = 7,5 MPa** ga teng. Gazning massasini aniqlang.

Yechish:

   Ideal gazning holat tenglamasidan gazning massasini topamiz:

$$M = \left(\frac{P \cdot V}{R \cdot T}\right) = \frac{7,5 \cdot 10^6 \cdot 60}{189 \cdot 290} = 8200 \ \ \text{kg,}$$

   bu yerda $R = \frac{8314}{\mu} = \frac{8314}{44} = 189$ J/kg ^{o}S

   μ = *44* mol [ilova, jadval 1].

3-masala

   Hajmi **45 litr** idish ichidagi gazning harorati **t = 6 ^{0}S,** bosimi **P= 1,7 MPa** va massasi **M= 66 kg.** Idish ichidagi gazning turini aniqlang.

Yechish:

Idish ichidagi gazning turini uning molekulyar massasi yordamida aniqlash mumkin. Buning uchun holat tenglamasidan gazning molekulyar massasini topamiz:

$$\mu = \frac{8314 \cdot M \cdot T}{P \cdot V} = \frac{8314 \cdot 66 \cdot 279}{1,7 \cdot 10^6 \cdot 45} = 2 \, \text{mol}$$

Demak, idish ichida vodorod ekan.

1-vazifa

Sig'imi **V...** litr ballon ichidagi gazning bosimi P_1, **MPa** va harorati $t \, ^0 S$. Gazning bir qismi ishlatilgandan keyin ballon ichidagi bosim P_2 ,**MPa** va harorati t_2 ^0S.

Ishlatilgan gazning massasi aniqlansin. Masalani yechish uchun ma'lumotlar 1-jadvalda keltirilgan. 1-jadval

Shifrning oxirgi soni	Gaz	V l	P_1 MPa	t_1 ^0S	Shifrning oxiridan oldingi soni	P_2 MPa	t_2 ^0S
0	CO_2	60	0,8	27	0	0,6	20
1	xavo	110	1,2	54	1	0,4	18
2	O_2	20	7,0	85	2	0,7	8
3	CO	70	4,3	11	3	1,4	4
4	H_2	20	2,0	90	4	0,9	40
5	CN_4	140	0,6	21	5	0,2	7
6	O_2	10	3,2	34	6	1,7	18
7	H_2	40	1,0	85	7	0,5	42
8	N_2	90	1,8	36	8	1,0	20
9	SO_2	200	9,0	40	9	4,5	20

1.1. Gazlar aralashmasi

4-masala

Gazlar aralashmasining massaviy tarkibi quyidagilardan iborat:

$H_2 = 8,4$ % ; $CO_2 = 17$ % ; $O_2 = 48$ % ; $N_2 = 26,6$ % . Uning gaz doimiysi, tuyulma molekulyar massasi va hajmiy ulushlari topilsin.

Yechish:

Aralashmaning gaz doimiysini quyidagi formuladan aniqlaymiz:

$$R_{ap} = \sum_{i=1}^{n} m_i \cdot R_i, \ \text{J/kg.}^0\text{S}$$

$$R_{ap} = m_{H_2} \cdot R_{H_2} + m_{CO_2} \cdot R_{CO_2} + m_{O_2} \cdot R_{O_2} + m_{N_2} \cdot R_{N_2} =$$

$$= 0,084 \cdot \frac{8314}{2} + 0,17 \cdot \frac{8314}{44} + 0,48 \cdot \frac{8314}{32} + 0,266 \cdot \frac{8314}{28} = 584,2 \ \text{kJ/kg.}^0\text{S}$$

$$\mu_{H_2} = 2 \quad \text{моль}$$

$$\mu_{CO_2} = 44 \quad \text{моль}$$

$$\mu_{O_2} = 32 \quad \text{моль}$$

$$\mu_{N_2} = 28 \quad \text{моль}$$

2. Aralashmaning tuyulma molekulyar massasini quyidagi formuladan aniqlaymiz.

$$\mu_{ap} = \frac{1}{\sum_{i=1}^{n} \dfrac{m_i}{\mu_i}}$$

$$\mu_{ap} = \frac{1}{\dfrac{m_{H_2}}{\mu_{H_2}} + \dfrac{m_{CO_2}}{\mu_{CO_2}} + \dfrac{m_{O_2}}{\mu_{O_2}} + \dfrac{m_{N_2}}{\mu_{N_2}}} =$$

$$= \frac{1}{\dfrac{0,084}{2} + \dfrac{0,17}{44} + \dfrac{0,48}{32} + \dfrac{0,266}{28}} = 14,3 \ \text{mol}$$

3. Aralashmaning hajmiy ulushlarini quyidagi formuladan aniqlaymiz:

$$r_i = \cfrac{\cfrac{m_i}{\mu}}{\displaystyle\sum_{i=1}^{n}\cfrac{m_i}{\mu_i}}$$

$$r_{H_2} = \cfrac{\cfrac{0,084}{2}}{\cfrac{0,084}{2}+\cfrac{0,17}{44}+\cfrac{0,48}{32}+\cfrac{0,266}{28}} = 0,597 \quad \%$$

$$r_{CO_2} = \cfrac{\cfrac{0,17}{44}}{\cfrac{0,084}{2}+\cfrac{0,17}{44}+\cfrac{0,48}{32}+\cfrac{0,266}{28}} = 0,055 \quad \%$$

$$r_{O_2} = \cfrac{\cfrac{0,48}{32}}{\cfrac{0,084}{2}+\cfrac{0,17}{44}+\cfrac{0,48}{32}+\cfrac{0,266}{28}} = 0,213 \quad \%$$

$$r_{N_2} = \cfrac{\cfrac{0,266}{28}}{\cfrac{0,084}{2}+\cfrac{0,17}{44}+\cfrac{0,48}{32}+\cfrac{0,266}{28}} = 0,135 \quad \%$$

2-vazifa

Hajmi **V** bo'lgan idishning ichidagi gazlarning aralashmasini hajmiy tarkibi quyidagilardan iborat: N_2, CO, CO_2, N_2, SO_2.

Aralashmaning harorati t va bosimi P bo'lganda uning solishtirma gaz doimiysi, tuyulma malekulyar massasi, massaviy ulushlari, parsial bosimlari va massasi topilsin.

Masalani yechish uchun ma'lumotlar 2-jadvalda berilgan.

2-jadval

Shifr oxirgi soni	V, m^3	P, MPa	t, ^{o}S	shifr oxiri-dan ol-dingi soni	H$_2$, %	CO, %	CO$_2$, %	N$_2$, %	SO$_2$, %
0	200	0,10	15	0	7,0	27,6	2,0	4,8	58,6
1	220	0,15	17	1	45,0	22,5	7,0	13,5	12,0
2	240	0,20	20	2	20,0	20,0	15,0	30,0	15,0
3	230	0,25	27	3	57,0	6,0	23,0	2,0	12,0
4	210	0,30	0	4	50,0	18,0	2,0	10,0	20,0
5	180	0,40	10	5	48,0	10,0	5,0	5,0	32,0
6	160	0,10	12	6	30,0	15,0	9,5	5,5	40,0
7	140	0,20	25	7	19,5	18,0	10,5	5,0	17,0
8	170	0,35	29	8	9,6	10,5	15,5	10,0	54,5
9	150	0,45	18	9	14,5	22,5	18,5	6,5	38,0

Nazorat savollari va topshiriqlar

1. Termodinamika nimani o'rganadi ? Qishloq va suv xo'jaligi ishlab chiqarishi sohalarida amaliy masalalar yechishda texnikaviy termodinamikaning ahamiyatini ta'riflang. 2. Termodinamika tizimi nima ? 3. Holat parametrlari tavsifini va aniqlanishini keltiring. Mos hollarda misollar keltiring. 4. Holat issiqlik parametrlari asosiy ma'lumotlarini gapirib bering. 5. Ideal va real ishchi jism uchun holat parametrlari orasidagi funksional bog'lanishlarni keltiring. Gaz doimiysi

nima? Gaz aralashmasi uchun holat tenglamasini keltiring va tenglamaga kiritilgan har bir kattaliklar fizik ma'nosini ayting. 6. Gaz aralashmasi uchun parsial bosim va parsial hajm qanday aniqlanadi? Gaz aralashmasi uchun gaz doimiysi, komponentlarning massaviy va xajmiy ulushlari qanday aniqlanadi?