

Часть 1

Олимпиада: **Химия 11 класс (1 часть)**

Шифр: **21300668**

ID профиля: **381888**

Вариант 2

2 задание

определить А, Б, Х, Y; $\omega(A)$ и $\omega(B)$; pH

Решение

$$t = 20^{\circ}\text{C} \rightarrow T = 293\text{K}$$

$$p = 740 \text{ мм рт.ст.}$$

$$pV = \nu RT$$

$$\nu = \frac{pV}{RT}; \quad \nu = \frac{740 \cdot 101,3 \cdot 44,848}{760 \cdot 8,314 \cdot 293} = 1,816 \text{ моль.}$$

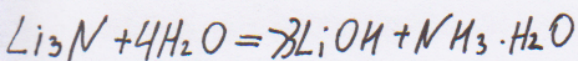
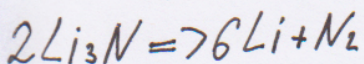
$$m(\text{Li}) = 1,816 \cdot 12,7122 = 23,27 \text{ г}; \quad g(\text{X}) = 1,251 \cdot 10^{-3} \frac{\text{г}}{\text{мл}} = 1,251 \frac{\text{г}}{\text{мл}}$$

$$M = g \cdot V_m = 1,251 \cdot 22,4 = 28,0224 \frac{\text{г}}{\text{моль}}$$

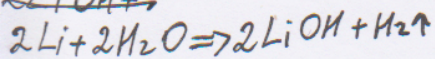
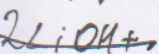
ответ:
X - (N_2)

Y - Li тк масса карминовокрасная

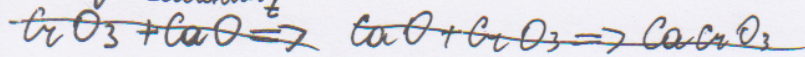
Б - Li_3N



среда щелочная pH

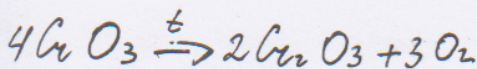


1 Задача: Решения, Определить А; Б; В; Г; Д; Е; Ж; р-ции 1; 2; 3; 4.



$$\begin{array}{l} \text{Ar O}_x \\ \text{Br O}_n \end{array} \quad y=1; x=3 \Rightarrow Ar(A) = \frac{3 \cdot 16}{0,48} = 3 \cdot 16 = 52 - \text{Cr} \Rightarrow \text{Cr}_2\text{O}_3$$

$$M = \frac{1002}{\text{моль}}$$



$$V(\text{O}_2) = \frac{6,72}{22,4} = 0,3 \text{ моль}$$

$$V(\text{Cr}_2\text{O}_3) = \frac{40}{100} = 0,4 \text{ моль} \quad \left. \begin{array}{l} \text{согласно описанию Б} - \text{Cr}_2\text{O}_3 \\ \text{Е} - \text{Cr}_2\text{O}_3 \end{array} \right\}$$

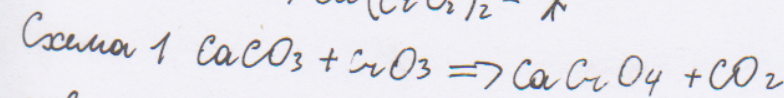
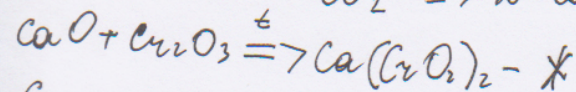
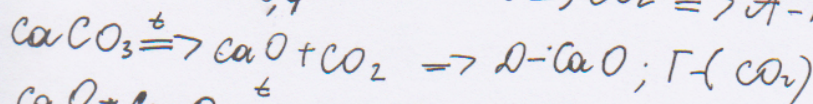
$$m(\text{Cr}_2\text{O}_3) = M \cdot V; V(\text{Cr}_2\text{O}_3) = \frac{1}{2} V(\text{O}_2) = \frac{0,4}{2} = 0,2 \text{ моль.}$$

$$m(\text{Cr}_2\text{O}_3) = 0,2 \cdot 152 = 30,4$$

$$m(\text{D}) = m(\text{Ж}) - m(\text{Е}) = 52,8 - 30,4 = 22,4$$

$$V(\Gamma) = \frac{V}{V_m} = \frac{8,96}{22,4} = 0,4 \text{ моль.}; m(\Gamma) = 40 - 22,4 = 17,6 \text{ по схеме 2.}$$

$$M(\Gamma) = \frac{m}{V} = \frac{17,6}{0,4} = 44 \frac{\text{г}}{\text{моль}} \Rightarrow \text{CO}_2 \Rightarrow \text{А} - \text{карбонат} \Rightarrow \text{А} - \text{CaCO}_3$$



Ответ: А - ~~CaCO3~~ CaCO3

Б - Cr2O3

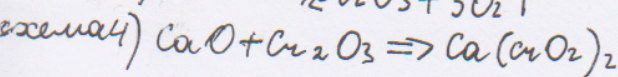
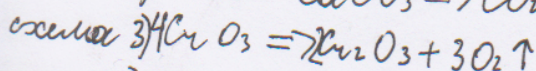
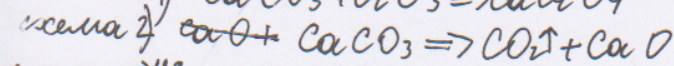
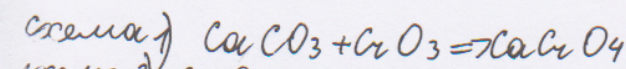
В - CaCrO4

Г - CO2

Д - CaO

Е - Cr2O3

Ж - Ca(CrO2)2



Истовик

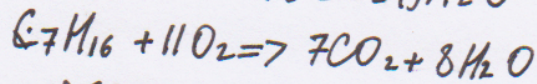
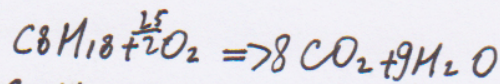
Химия 11 класс.

③ Задача:

Определить ОЧ; $V(H_2)$; можно ли заменить.

Решение:

$$\begin{aligned}\Delta H(\text{изокт}) &= 208 \frac{\text{кДж}}{\text{моль}} \\ \Delta H(\text{гепт}) &= 224 \frac{\text{кДж}}{\text{моль}} \\ \Delta H(CO_2) &= 393 \frac{\text{кДж}}{\text{моль}} \\ \Delta H(H_2O) &= 285,8 \frac{\text{кДж}}{\text{моль}} \\ Q &= 3333,8 \text{ кДж.}\end{aligned}$$



$$x - V(C_8H_{18}) - \text{моль}; m(C_8H_{18}) = 114x$$

$$y - V(C_7H_{16}) - \text{моль}; m(C_7H_{16}) = 100y.$$

$$V(C_8H_{18}) = \frac{114x}{0,690 \frac{\text{г}}{\text{см}^3}} = 165,217x \text{ мл}$$

$$V(C_7H_{16}) = \frac{100y}{0,684 \frac{\text{г}}{\text{см}^3}} = 146,199y \text{ мл.}$$

$$165,217x + 146,199y = 100$$

$$\Delta H_p = 8x \Delta H_f(CO_2) + 9x \Delta H_f(H_2O) - x \Delta H_f(C_8H_{18}) = 8 \cdot 393,5x + 9 \cdot 285,8x - 208x = 5512,2x \text{ кДж.}$$

$$\Delta H_p = 7y \Delta H_f(CO_2) + 8y \Delta H_f(H_2O) - y \Delta H_f(C_7H_{16}) = 2754,5y + 2286,4y - 224y = 4816,9y$$

$$\Delta H_{обг} = -Q = -3333,8 \text{ кДж.}$$

$$3333,8 = 4816,9y + 5512,2x$$

$$x = \frac{100 - 146,199y}{165,217} \Rightarrow 5512,2 \left(\frac{100 - 146,199y}{165,217} \right) + 4816,9y = 3333,8$$

$$\frac{551220}{165,217} - 4877,7y + 4816,9y = 3333,8$$

$$60,8y = 2,54$$

$$y = 0,04178 \text{ моль} - \text{н-гептан}$$

$$x = 0,5683 \text{ моль} - \text{изоктан}$$

$$OЧ = \frac{0,5683}{0,5683 + 0,04178} \cdot 100\% = \frac{0,5683}{0,61} \cdot 100\% = 93\%$$

$$Q(40 \text{ л бензина}) = 3333,8 \cdot \frac{40}{0,1} = 13335200 \text{ кДж.}$$

$$V(H_2) = \frac{13335200}{285,8} = 46659 \text{ моль}$$

$$V(H_2) = 1045166 \text{ л} = 1045,2 \text{ м}^3 - \text{н.г.}; m(H_2) = 316,4 \cdot 2 = 632,8 \text{ г.}$$

Заменить бензин водородом считаю нецелесообразно, т.к. $m(H_2)$ много меньше m самого бензина.

$$Q(1 \text{ баллон}) = 316,4 \cdot 285,8 = 90438 \text{ кДж.}$$

Для замены 40 л бензина требуется много баллонов.

Ответ: ОЧ = 93%.

Заменить нецелесообразно

$$V(H_2) = 1045,2 \text{ м}^3$$

(2)

3 задание

Черновик.

$$\Delta H(\text{углерод}) = 208 \frac{\text{кДж}}{\text{моль}}$$

$$\Delta H(\text{метан}) = 224 \frac{\text{кДж}}{\text{моль}}$$

$$\Delta H(\text{CO}_2) = 393 \frac{\text{кДж}}{\text{моль}}$$

$$\Delta H(\text{H}_2\text{O}) = 285,8 \frac{\text{кДж}}{\text{моль}}$$

$$\Delta Q = 3333,8 \text{ кДж}$$

$$x = 165,217x + 146,199y = 100$$

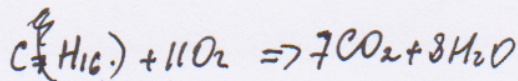
$$\Delta H_{1p} = 8x \Delta H_f(\text{CO}_2) + 9x \Delta H_f(\text{H}_2\text{O}) - x \Delta H_f(\text{C}_8\text{H}_{18}) = 8 \cdot 393,5x + 9 \cdot 285,8x - 208x = 3148x + 2572,2x - 208x = 5512,2x \text{ кДж}$$

$$\Delta H_{2p} = 7y \Delta H_f(\text{CO}_2) + 8y \Delta H_f(\text{H}_2\text{O}) - y \Delta H_f(\text{C}_7\text{H}_{16}) = 2754,5y + 2286,4y - 224y = 4816,9y$$

$$\Delta H_{\text{общ}} = -Q = -3333,8 \text{ кДж}$$

$$\Delta H_{\text{общ}} = \Delta H_{1p} + \Delta H_{2p}$$

$$-3333,8 = 4816,9y + 5512,2x$$



$$x - \nu(\text{C}_8\text{H}_{18}) - \text{моль}$$

$$y - \nu(\text{C}_7\text{H}_{16}) - \text{моль}; m(\text{C}_8\text{H}_{18}) = 114x; m(\text{C}_7\text{H}_{16}) = 100y$$

$$m(\text{C}_8\text{H}_{18}) = \frac{114x}{0,6902} = 165,217x \text{ г}$$

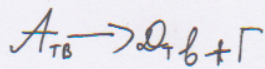
$$\nu(\text{C}_7\text{H}_{16}) = \frac{100y}{0,684} = 146,199y \text{ г}$$

Черновик

Химия 11 класс.

① Задача.

№11.



определить A, Б, В, Г, Д, Е, Ж.

А возможно сульфит/сульфат.

написать уравнения 1, 2, 3, 4

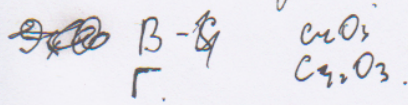
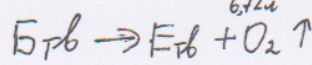


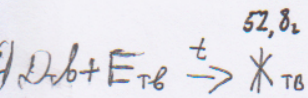
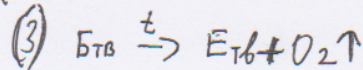
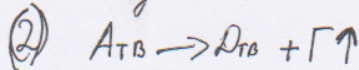
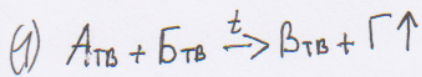
схема 3



$$\frac{6,72}{22,4} = 0,3 \text{ моль.}$$

по УХР $N(B) = 0,3 \text{ моль}$, и $N(E) = 0,3 \text{ моль}$.② Задача $V(O_2) = V(O_{\text{вб}}) = 0,3 \text{ моль.}$

Размещаются



$$\frac{6,72}{22,4} = 0,3$$

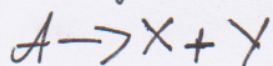
$$\frac{8,96}{22,4} = 0,4 \text{ моль.}$$

X_{TB} вещество.
D - окисл?
E

③ Задача:

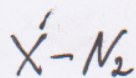
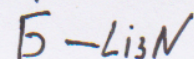
2) Задача

Черновик.

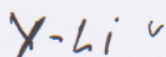
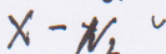
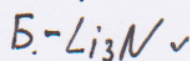
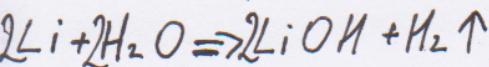


$$\rho(X) = 1,251 \cdot 10^{-3} \frac{\text{г}}{\text{см}^3} \\ = 1,251 \frac{\text{г}}{\text{см}^3}$$

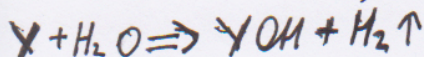
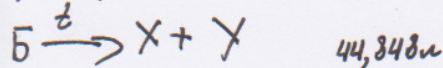
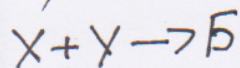
A -



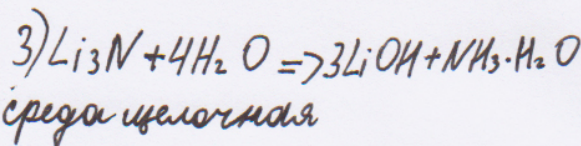
Y - Liтк карминово-красный цвет: 1) A - ?



~~А~~



$$pV = \nu RT$$



среда щелочная

$$t = 20^\circ \Rightarrow T = 20 + 273 = 293 \text{ К}$$

$$p = 740 \text{ мм}$$

$$V = \frac{pV}{RT}$$

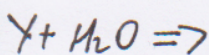
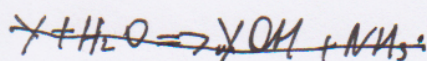
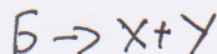
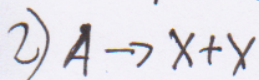
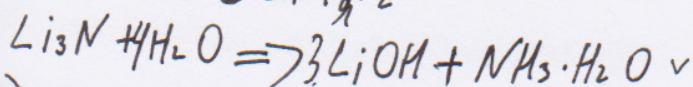
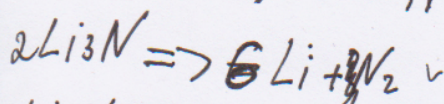
$$V = \frac{740 \cdot 101,3 \cdot 44,848}{760 \cdot 8,314 \cdot 293} = 1,815 \text{ моль}$$

$$m(Li) = 1,815 \cdot 7 = 12,705 \text{ г}$$

$$M = 8 \cdot V_m = 1,815 \cdot 1,251 = 2,270565$$

$$M = 8 \cdot V_m = 1,815 \cdot 22,4 = 40,656$$

$$M = 8 \cdot V_m = 1,251 \cdot 22,4 = 28,0224 \frac{\text{г}}{\text{моль}} \Rightarrow N_2$$



1 Задача.

Черновик.

Часть 2

Олимпиада: **Химия 11 класс (2 часть)**

Шифр: **21300668**

ID профиля: **381888**

Вариант 2

4 задание

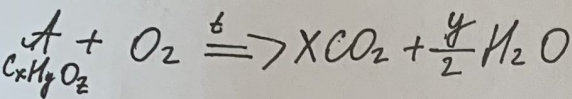
Истовик 2 часть.

Химия 11 класс

2 вариант.

Определить А; Б; В; Г; Д
уравнения р-ций.
синтез А из СМ₄

Решение:



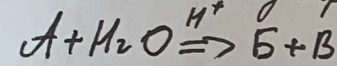
$$V(CO_2) = \frac{11,2}{22,4} = 0,5 \text{ моль}; V(C) = V(CO_2) = 0,5 \text{ моль}; m(C) = 0,5 \cdot 12 = 6 \text{ г}.$$

$$V(H_2O) = \frac{m}{M}; m(H_2O) = 9 \text{ г}; V(H_2O) = \frac{9}{18} = 0,5 \text{ моль}; V(H) = 2V(H_2O) = 1 \text{ моль}; m(H) = 1 \text{ г}.$$

$$m(O) = 10,2 - 6 - 1 = 3,2 \text{ г}; V(O) = \frac{3,2}{16} = 0,2 \text{ моль}.$$

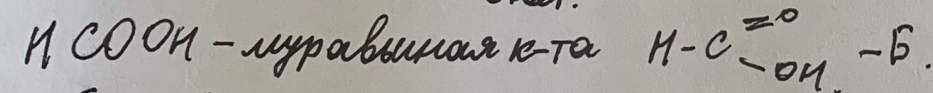
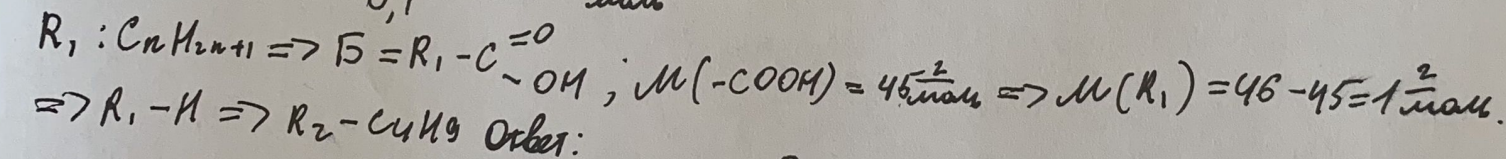
$$C_xH_yO_z - ?; x:y:z = 0,5:1:0,2 = 5:10:2.$$

С₅H₁₀O₂ - молекулярная формула. M_р = 102 г/моль.

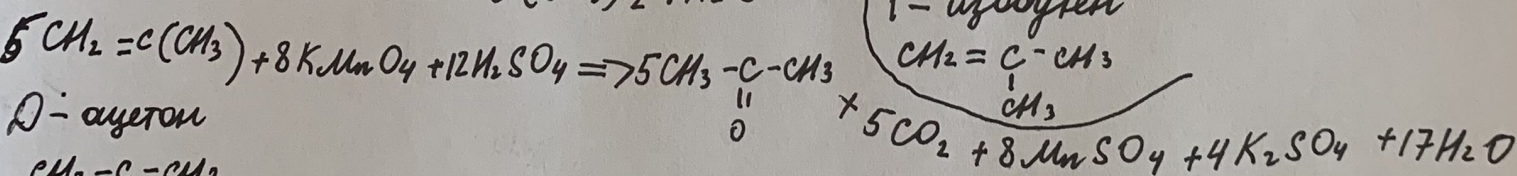
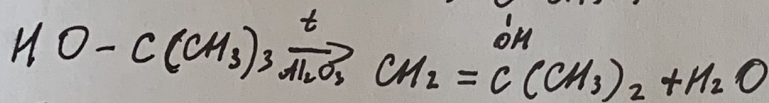
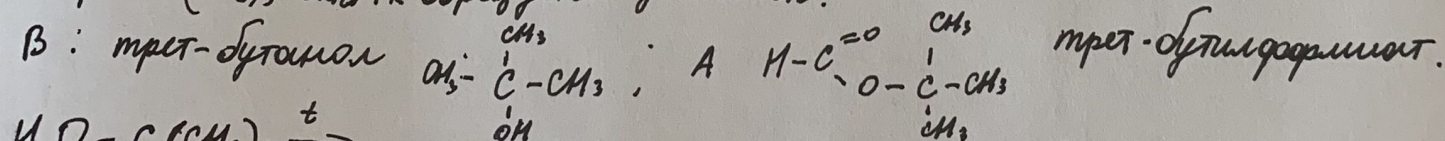


$$V(A) = \frac{10,2}{102} = 0,1 \text{ моль} \Rightarrow V(B) = 0,1 \text{ моль}; V(B) = 0,1 \text{ моль}.$$

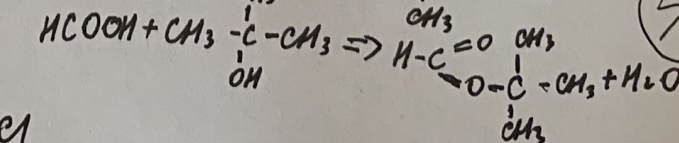
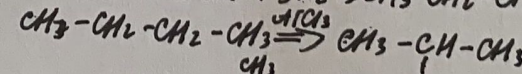
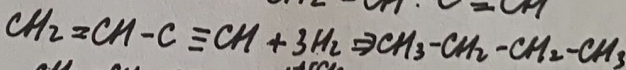
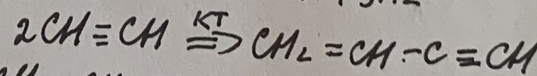
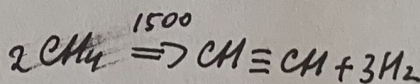
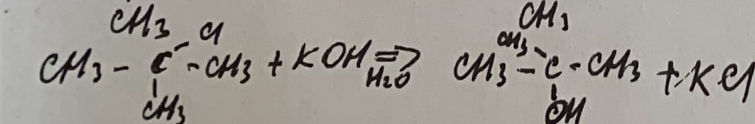
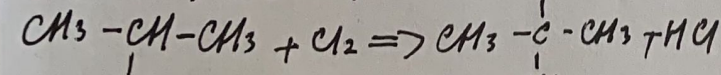
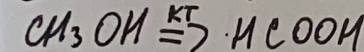
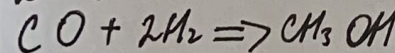
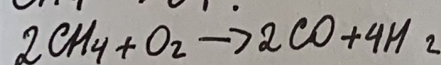
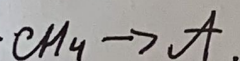
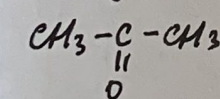
$$M(B) = \frac{m}{n} = \frac{4,6}{0,1} = 46 \frac{\text{г}}{\text{моль}}$$



берём (СН₃)₃-СМ₃ тк образуется один кетон.



Д - ацетон



(1)

(4)

черновик

$$M(\text{Co}) = 59$$

Fe и Co. пометки
Cu

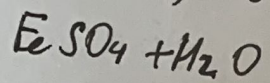
Задача 6.

$$m_{\text{р-ра}} = 1250,6 \text{ г}$$

$$m(\text{FeSO}_4) = 60,8 \text{ г}$$

$$m(\text{CuSO}_4) = 64 \text{ г}$$

$$m(\text{CoSO}_4) = 62 \text{ г}$$



Задача 5.

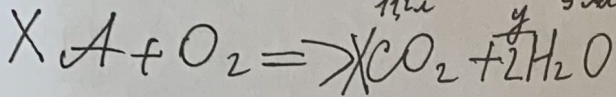
Задание 6.

порядок $\frac{1}{2}$ Си-Со-Ев.

Черновик
задание 4.

запах мамины А.

3 г.
11 г.
9 г.



$$m(A) = 10,2 \text{ г.}$$

$$V(CO_2) = \frac{11,2}{22,4} = 0,5 \text{ моль.}$$

$$V(H_2O) = \frac{9}{18} = 0,5 \text{ моль.}$$

$$V(C) = V(CO_2) = 0,5 \text{ моль}$$

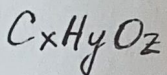
$$V(C) = 0,5 \cdot 12 = 6 \text{ г.}$$

$$V(H) = 2 V(H_2O) = 1 \text{ моль.}$$

$$m(H) = 1 \cdot 1 = 1 \text{ г.}$$

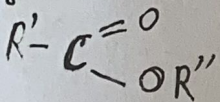
$$m(O) = 10,2 - 6 - 1 = 3,2 \text{ г.}$$

$$V(O) = 0,2 \text{ моль.}$$

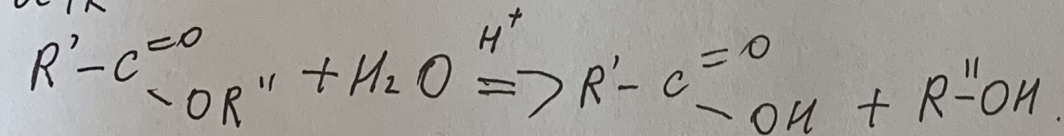


$$x : y : z = 0,5 : 1 : 0,2 = 2,5 : 5 : 1 = 5 : 10 : 2$$

Сложный эфир тк ~~не~~ имеет запах мамины и исп-ся в ароматиз
уш.



и ТК



$$w(O_4) = 27,59 = 0,2759$$

$$w = \frac{m_{\text{в.ва}}}{m_{\text{м.}}} =$$

Определить А В В Г Д

А ✓

Б ✓

В ✓

Г ✓

Д ✓

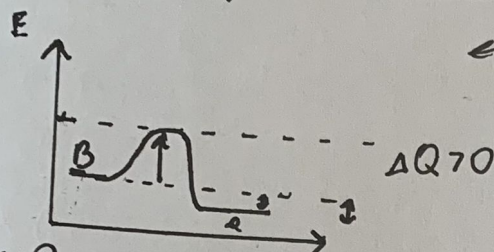
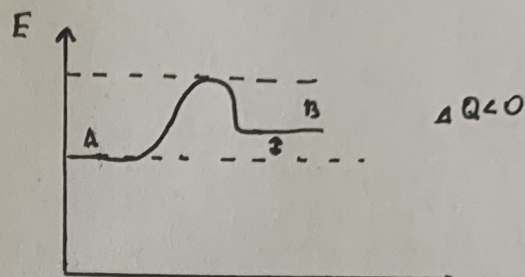
Задание 5 Чистовик
 Определить Q
 изобразить график
 соотношение:

Химия 11 класс

Решение:

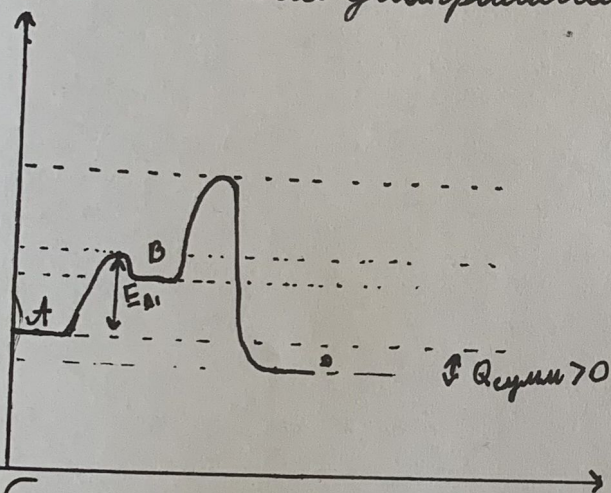
$A \rightarrow B$ - поглощение теплоты $\rightarrow$

$B \rightarrow D$ - выделение теплоты $\leftarrow$



$$\Delta Q_{\text{сум}} = \frac{1}{3} Q_1 + 1,5 \frac{1}{3} Q_1 = \frac{2}{3} \cdot \frac{3}{2} \cdot E_{a1} = E_{a1}$$

энергетическая диаграмма процесса $A \rightarrow D$



Общий эффект - экзотермический

$$\frac{K_2}{K_1} = \frac{\Delta B}{E_{a1}}$$

$$E(A) + E_{a1} = E(B) + E_{a2}$$

$$E(A) - E(B) = -Q_1; E_{a1} - \Delta Q_1 = E_{a2} - \frac{2}{3} E_{a1}$$

$$\frac{K_2}{K_1} = \frac{1}{3}$$

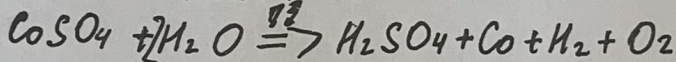
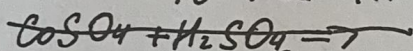
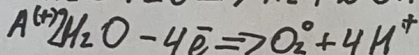
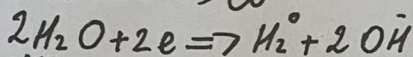
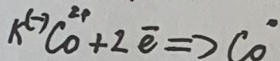
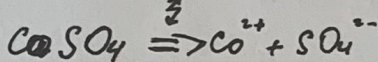
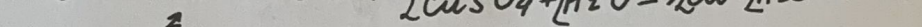
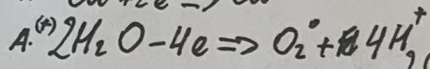
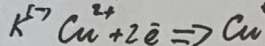
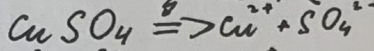
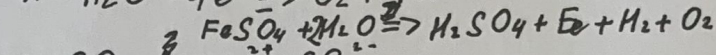
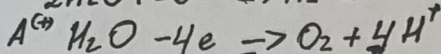
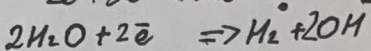
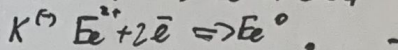
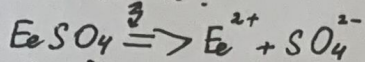
6 Задача:

$$\begin{aligned} m(\text{FeSO}_4) &= 60,8 \text{ г} \\ m(\text{CuSO}_4) &= 64 \text{ г} \\ m(\text{CoSO}_4) &= 62 \text{ г} \\ t_{\text{з}} &= 10 \text{ ч } 43 \text{ мин.} \\ I &= 3 \text{ А} \\ m_{\text{выпущ}} \text{ } 2\text{O}_2 \\ V_{\text{к}} &= 200 \text{ мл} \\ m_{\text{р-ра}} &= 1250,6 \text{ г} \end{aligned}$$

Чистовик

Химия 11 класс

Решение:



Электролиз будет проходить так: $(\text{Cu} - 2) \text{Co} - 3) \text{Fe}$

$$\begin{aligned} \nu(\text{CuSO}_4) &= \frac{64}{32+64+64} = \frac{64}{160} = 0,4 \text{ моль.} ; \nu(\text{CoSO}_4) = \frac{62}{59+32+64} = \frac{62}{155} = 0,4 \text{ моль.} \\ \nu(\text{FeSO}_4) &= \frac{60,8}{56+32+64} = \frac{60,8}{152} = 0,4 \text{ моль.} \end{aligned}$$

$$\nu(\text{Cu}) = \nu(\text{CuSO}_4) = 0,4 \text{ моль.} ; m_{\text{теор}}(\text{Cu}) = 0,4 \cdot 64 = 25,6 \text{ г.}$$

$$\nu(\text{Fe}) = \nu(\text{FeSO}_4) = 0,4 \text{ моль.} ; m_{\text{теор}}(\text{Fe}) = 0,4 \cdot 56 = 22,4 \text{ г.}$$

$$\nu(\text{Co}) = \nu(\text{CoSO}_4) = 0,4 \text{ моль.} ; m_{\text{теор}}(\text{Co}) = 0,4 \cdot 59 = 23,6 \text{ г.}$$

$$m = Ikt ; k = \frac{1}{F} \cdot \frac{M}{n}$$

$$\text{Cu: } n=2 \quad k = \frac{1}{96500} \cdot 32 = 3,316 \cdot 10^{-4} ; I=3 ; t = \frac{m_{\text{теор}}}{kI} = \frac{25,6}{3 \cdot 3,316 \cdot 10^{-4}} = 25733,8 \text{ с.}$$

$$t_{\text{обц}} = 10 \text{ ч } 43 \text{ мин.} = 38580 \text{ с.} \text{ Вся медь выпала.}$$

$$\text{т.к. } t_{\text{ост}} = 38580 - 25733,8 = 12846,2 \text{ с.}$$

$$\text{Co: } n=2 ; k = \frac{59}{96500 \cdot 2} = 3,057 \cdot 10^{-4} ; I=3.$$

$$m(\text{Co}) = 3,057 \cdot 10^{-4} \cdot 3 \cdot 10847 = 9,948 \text{ г.} ; m(\text{Co}) < (m)_{\text{теор}}(\text{Co}) \Rightarrow \text{в р-ре осталась } \text{CoSO}_4 \text{ и } \text{FeSO}_4$$

(3)