

выпуск 13 ⁰³ 13/10

МОСКОВСКИЙ ГОСУДАРСТВЕННЫЙ УНИВЕРСИТЕТ имени М.В.ЛОМОНОСОВА

Вариант 1

Место проведения Москва
город

ПИСЬМЕННАЯ РАБОТА

Олимпиада школьников по химии
наименование олимпиады

по химии
профиль олимпиады

Артюшкин Эмиль Артурович
фамилия, имя, отчество участника (в родительном падеже)

Дата
«12» марта 2023 года

Подпись участника
Эмиль

58-37-76-55
(63.2)

чистовик

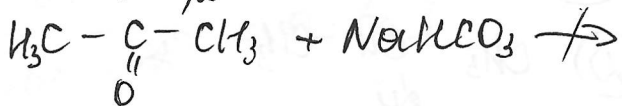
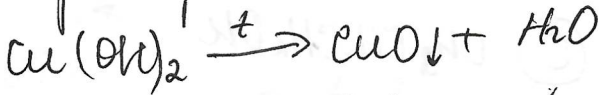
№ 2.6

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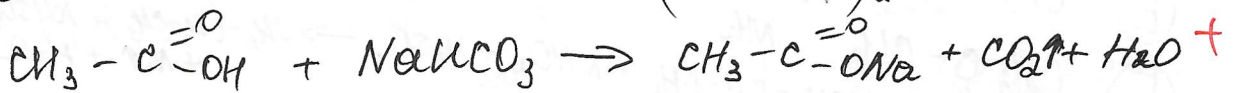
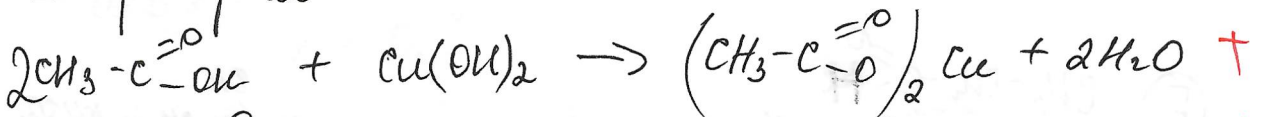
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III - альдегид (уксусной альдегид)

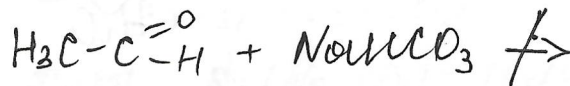
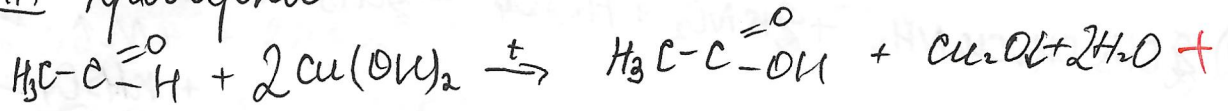
I пробирка



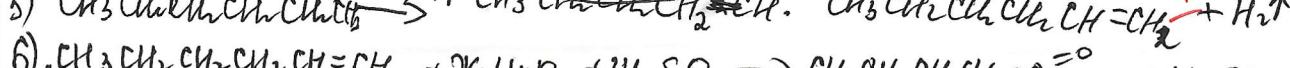
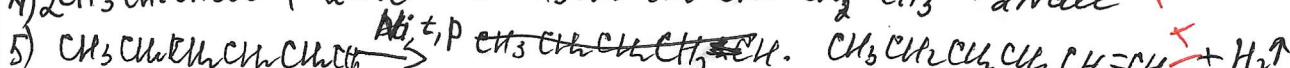
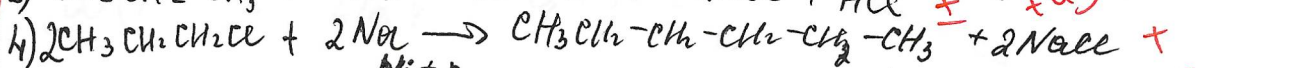
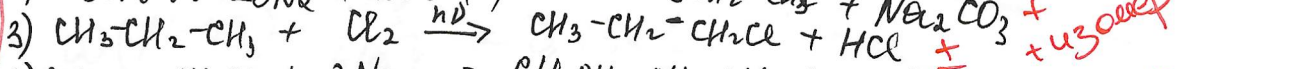
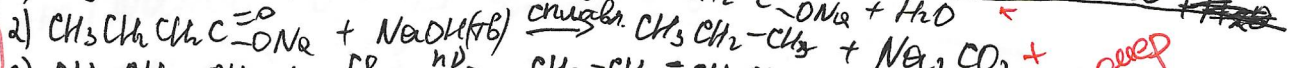
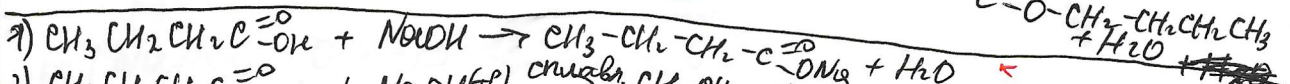
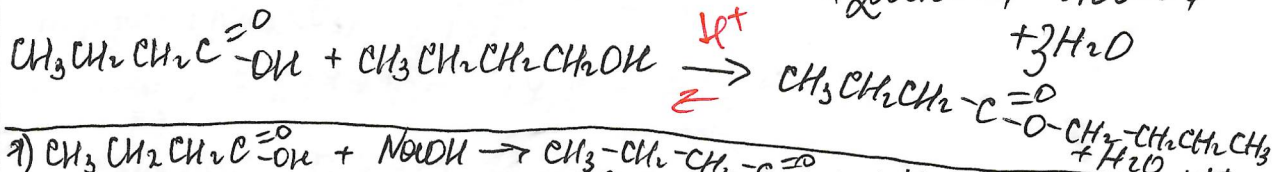
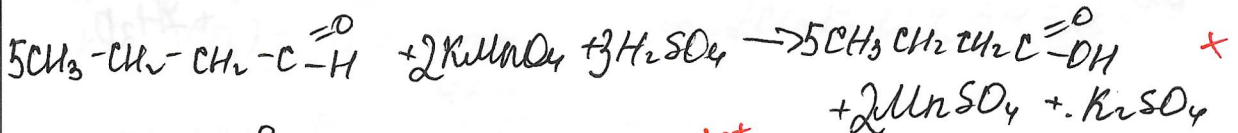
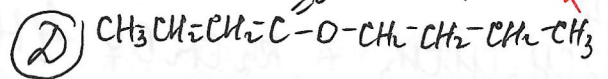
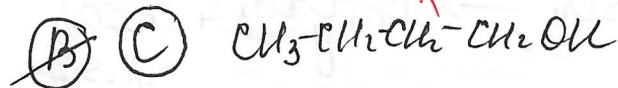
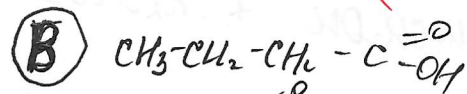
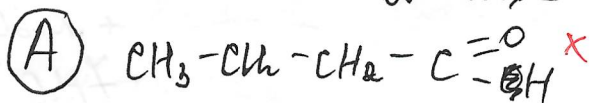
II пробирка



III пробирка



№ 5.8.1



Антонина
Анна

12/28/88
1/2/3/4/5/6/7/8/12/14/18/18/88
6/8/10/12/14/18/18/88

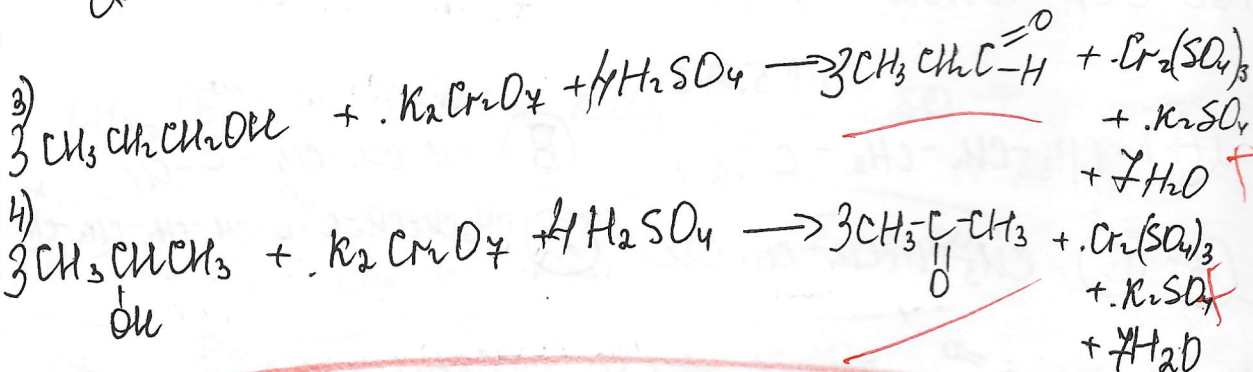
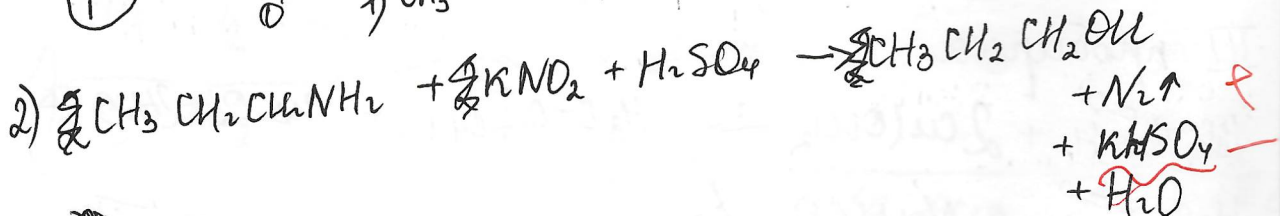
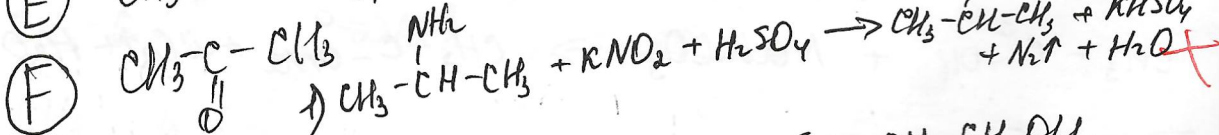
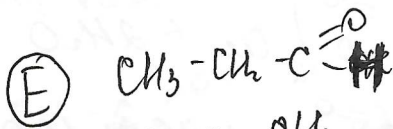
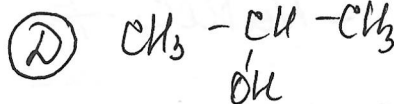
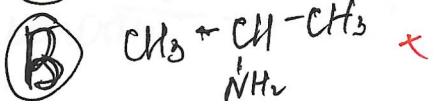
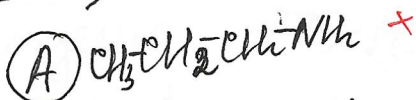
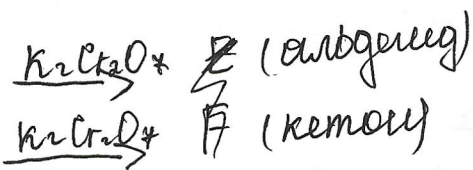
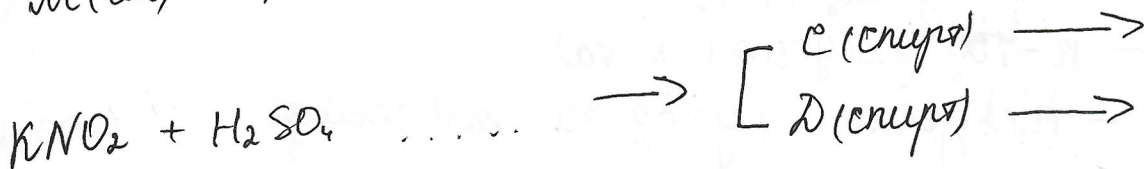
88

во все альдегиды
во все к-ты

Штабовик

№ 3.2

$$M(CM) = 2,107 \cdot 58,996 \text{ Число} \approx 59 \text{ Число}$$



Чистовик

№ 6.1

$$\omega_{\text{H}_2\text{O}} = \frac{21,8}{21,8 + 100}$$

$$= 0,1789$$

в массов. р-ре

Пусть: $\nu(\text{Na}_2\text{CO}_3) = x$ (моль), $\Rightarrow m(\text{Na}_2\text{CO}_3) = 106x$ (г),

$$m(\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}) = 286x$$

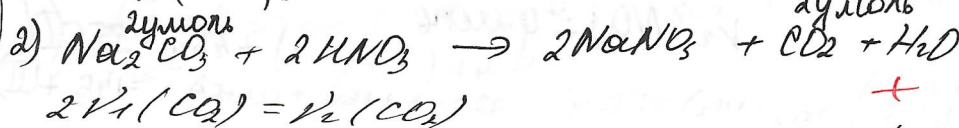
$$\frac{106x}{286x + 183,7} = 0,1789$$

$$106x = 51,1654x + 32,864$$

$$x = 0,6$$

$$\nu(\text{Na}_2\text{CO}_3) = 0,6 \text{ моль}$$

и моль



$$2\nu_1(\text{CO}_2) = \nu_2(\text{CO}_2)$$

Пусть $\nu_1(\text{Na}_2\text{CO}_3) = y$ моль, тогда $\nu_1(\text{CO}_2) = y$ моль

$$\nu_2(\text{CO}_2) = 2y \text{ моль}$$

$$y + 2y = 0,6$$

$$y = 0,2$$

$$\nu_2(\text{Na}_2\text{CO}_3) = 0,4 \text{ моль}$$

$$m_2(\text{Na}_2\text{CO}_3) = 0,4 \cdot 106 = 42,4 \text{ г}$$

$$\nu_2(\text{CO}_2) = 0,4 \text{ моль}$$

$$m_2(\text{CO}_2) = 0,4 \cdot 44 = 17,6 \text{ г}$$

$$m_{\text{р-ра}}(\text{Na}_2\text{CO}_3) = \frac{42,4}{0,1789} = 237,2$$

$$m_{\text{кач. 2}} = 237 + 200 - 17,6 = 419,4$$

$$m(\text{NaNO}_3) = 0,8 \cdot 85 \text{ г/моль} = 68 \text{ г}$$

$$\omega(\text{NaNO}_3) = \frac{68}{419,4} = 0,1621$$

Чистовик

№ 6.1

$$\omega_{\text{Na}_2\text{CO}_3} = \frac{21,8}{21,8 + 100}$$

$$= 0,1789$$

в массов. р-ре

Пусть: $\nu(\text{Na}_2\text{CO}_3) = x$ (моль), $\Rightarrow m(\text{Na}_2\text{CO}_3) = 106x$ (г),

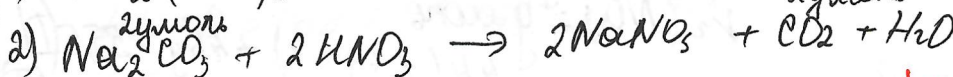
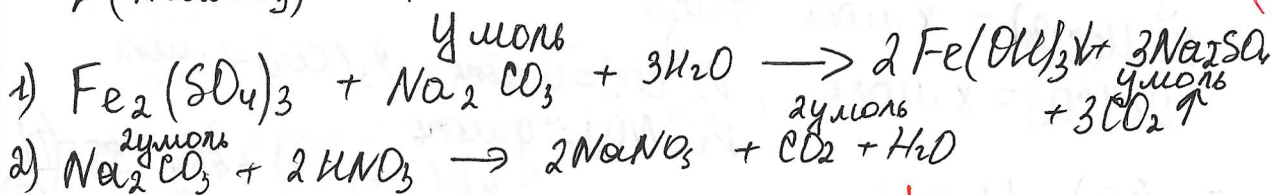
$$m(\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}) = 286x$$

$$\frac{106x}{286x + 183,7} = 0,1789$$

$$106x = 51,1654x + 32,864$$

$$x = 0,6$$

$$\nu(\text{Na}_2\text{CO}_3) = 0,6 \text{ моль}$$



$$2\nu_1(\text{CO}_2) = \nu_2(\text{CO}_2)$$

Пусть $\nu_1(\text{Na}_2\text{CO}_3) = y$ моль, тогда $\nu_1(\text{CO}_2) = y$ (моль)

$$\nu_2(\text{CO}_2) = \cancel{y} \cdot 2 = 2y \text{ (моль)}$$

$$y + 2y = 0,6$$

$$y = 0,2$$

$$\nu_2(\text{Na}_2\text{CO}_3) = 0,4 \text{ моль} \quad m_2(\text{Na}_2\text{CO}_3) = 0,4 \cdot 106 = 42,4 \text{ г}$$

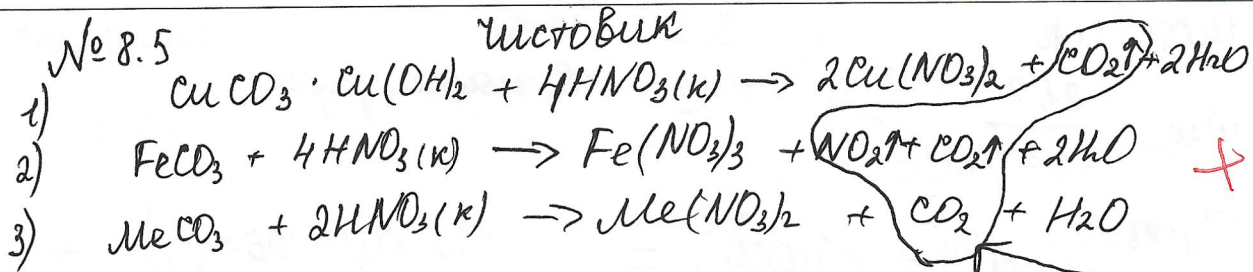
$$\nu_2(\text{CO}_2) = 0,4 \text{ моль} \quad m_2(\text{CO}_2) = 0,4 \cdot 44 = 17,6 \text{ г}$$

$$m_{\text{р-ра}}(\text{Na}_2\text{CO}_3) = \frac{42,4}{0,1789} = 237 \text{ г}$$

$$m_{\text{кач. 2}} = 237 + 200 - 17,6 = 419,4 \text{ г}$$

$$m(\text{NaNO}_3) = 0,8 \cdot 85 \text{ г/моль} = 68 \text{ г}$$

$$\omega(\text{NaNO}_3) = \frac{68}{419,4} = 0,1621$$



$$V_{\text{см}} = 1,816 \text{ чл}$$

$$V_{\text{см}} = 30,56 \text{ л} = 0,03056 \text{ м}^3$$

$$p = 101325 \text{ Па}$$

$$T = 273 + 25 = 298 \text{ К}$$

$$\left. \begin{array}{l} V_{\text{см}} \\ V_{\text{см}} \end{array} \right\} m_{\text{см}} = 1,816 \text{ чл} \cdot 30,56 \text{ л} = 55,5 \text{ г}$$

$$pV = \nu RT$$

$$\nu(\text{см}) = \frac{pV}{RT} = \frac{101325 \cdot 0,03056}{8,31 \cdot 298} = 1,25 \text{ моль}$$

Пусть $\nu(\text{CuCO}_3 \cdot \text{Cu(OH)}_2) = x \text{ моль}$, $\nu(\text{FeCO}_3) = y \text{ моль}$

$\nu(\text{MeCO}_3) = x \text{ моль}$, тогда

$\nu_1(\text{CO}_2) = x \text{ моль}$, $\nu_2(\text{CO}_2) = y \text{ моль}$, $\nu_3(\text{CO}_2) = 2 \text{ моль}$

$\nu_2(\text{NO}_2) = y \text{ моль}$

$$m_1(\text{CO}_2) = 44x \text{ (I)}$$

$$m_2(\text{CO}_2) = 44y; m_2(\text{NO}_2) = 46y$$

$$m_3(\text{CO}_2) = 44 \cdot 2$$

$$44(x+y+2) + 46y = 55,5 \text{ (I)}$$

$$222x + 116y + (11+60) \cdot 2 = 146,7 \text{ (II)}$$

$$m(\text{CuCO}_3 \cdot \text{Cu(OH)}_2) = 222x \text{ (I)}$$

$$m(\text{FeCO}_3) = 116y \text{ (I)}$$

$$m(\text{MeCO}_3) = (M+60)z \text{ (I)}; A_r(\text{Me}) = M$$

$$M(\text{Cu}_{\text{чистовик}}) = \frac{55,5}{1,25} = 44,4 \text{ г/моль}$$

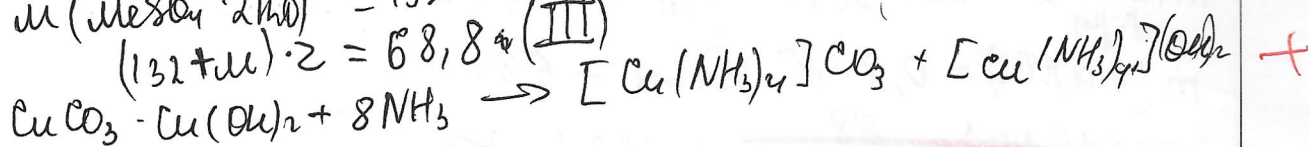
~~$M(\text{Cu}) + M(\text{NO}_2) \rightarrow \text{MeSO}_4 + 2\text{HNO}_3$~~



$$m(\text{MeSO}_4 \cdot 2\text{H}_2\text{O}) = 68,8 \text{ г}$$

$$M(\text{MeSO}_4 \cdot 2\text{H}_2\text{O}) = 132 + M \text{ чистовик}$$

$$(132 + M) \cdot z = 68,8 \text{ (III)}$$



$$\text{MeCO}_3 + \text{NH}_3 \rightarrow$$

$$\text{FeCO}_3 + \text{NH}_3 \rightarrow$$

$$m(\text{MeCO}_3) + m(\text{FeCO}_3) = 69 \text{ г}$$

$$z(M+60) + y \cdot 116 = 69 \text{ (IV)}$$

из III ур-ния

числовое

$$z = \frac{68,8}{132+m}$$

Подставим в IV

$$\frac{68,8(m+60)}{132+m} + y \cdot 116 = 69$$

$$116y = 69 - \frac{68,8(m+60)}{132+m} \quad \text{— подставим в II}$$

$$222x + 69 - \frac{68,8(m+60)}{132+m} + \frac{(m+60) \cdot 68,8}{132+m} = 146,7$$

$$222x + 69 = 146,7$$

$$222x = 77$$

$$x = 0,3468$$

Подставим в I

$$44(x+2) + 90y = 55,5$$

$$44 \cdot 0,3468 + 44 \cdot \frac{68,8}{132+m} + 90y = 55,5$$

$$\frac{3027,2}{132+m} + 90y = 40,2408$$

$$116y = \frac{9108 + 69m - 68,8m - 4128}{132+m} = \frac{4980 + 0,2m}{132+m}$$

$$y = \frac{42,931 + 0,001724m}{132+m}$$

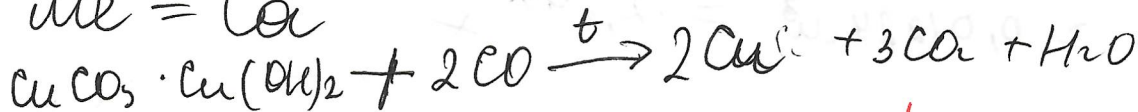
$$\frac{3027,2}{132+m} + \frac{9(42,931 + 0,001724m)}{132+m} = 40,2408$$

$$3027,2 + 3888,79 + 0,15516m = 5311,786 + 40,2408m$$

$$1579,204 = 40,0856m$$

$$m \approx 40 \quad +$$

$$Me = Ca$$

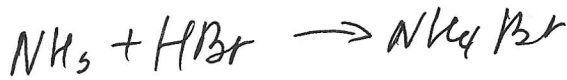


$$V(Cu) = 2 \cdot 0,3468 = 0,6936 \text{ моль} \quad +$$

$$m(Cu) = 44,392$$

+

№ 2 Чистовик



$$v(\text{HBr}) = 1,03 \cdot 0,3 = 0,309$$

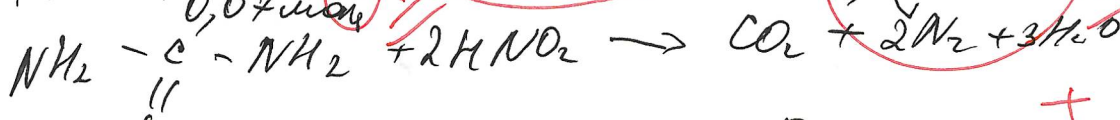
$$pK = 1,52 \quad pK = -\lg [H^+]$$

$$[H^+] = 0,03 \text{ моль/л}$$

$$v(\text{HBr})_{\text{нрр.}} = 0,309 - 0,03 = 0,279 \text{ моль}$$

$$v(\text{NH}_3) = 0,279 \text{ моль}$$

$$v_1(\text{моль}) = \frac{0,279}{2} = 0,14 \text{ моль}$$

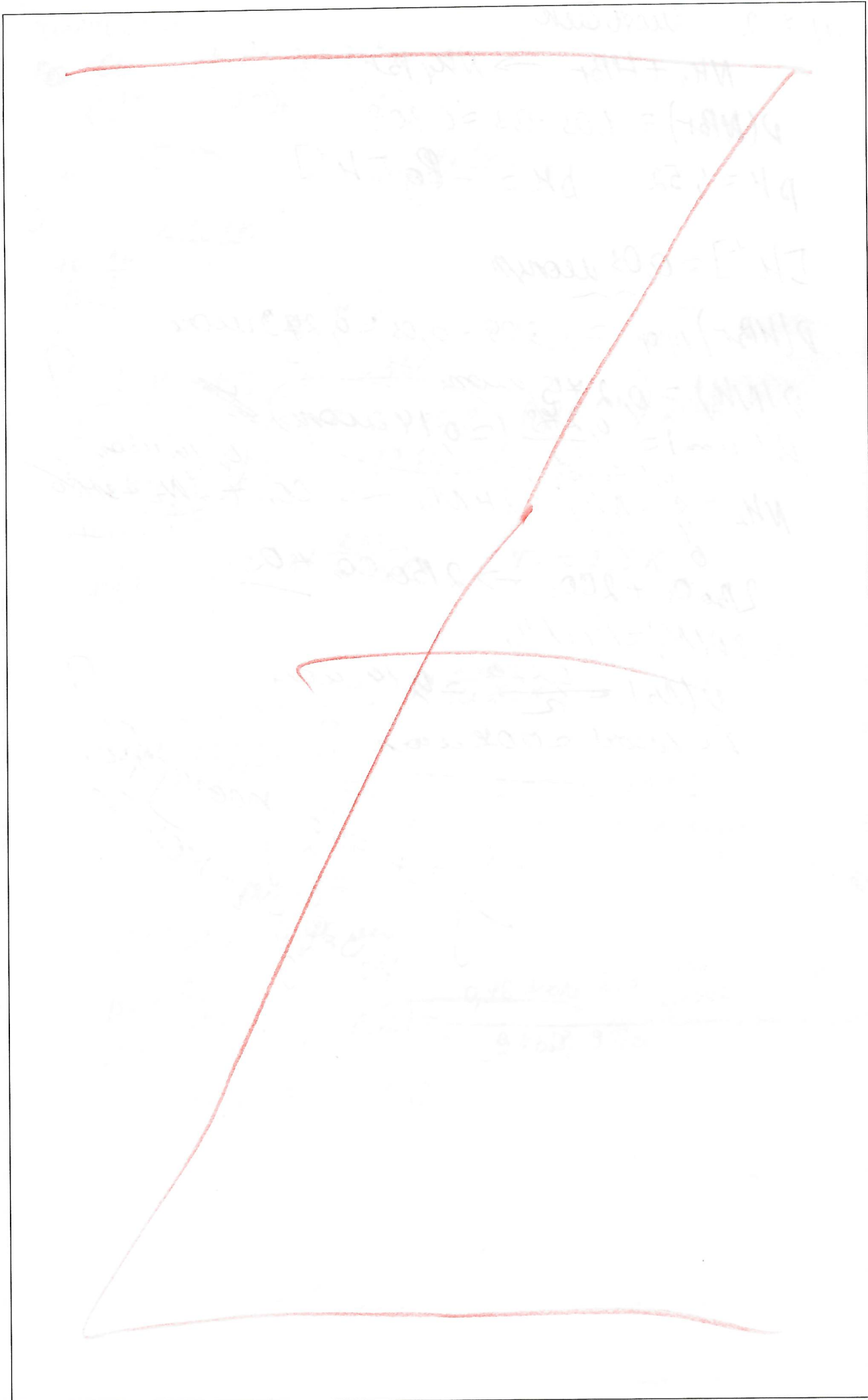


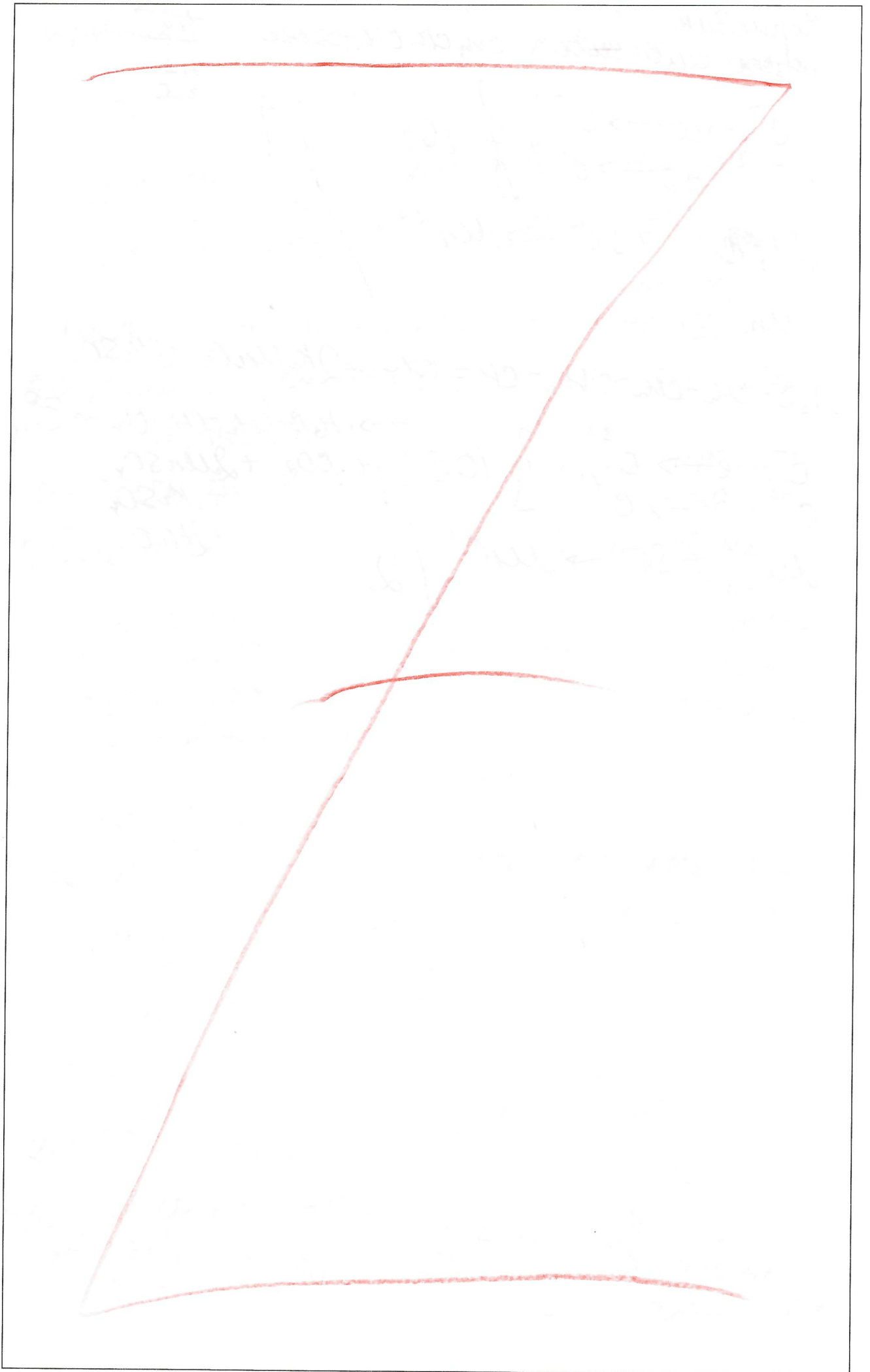
$$2v(\text{N}_2) = v_1(\text{NH}_3)$$

$$v(\text{N}_2) = \frac{0,279}{2} = 0,14 \text{ моль}$$

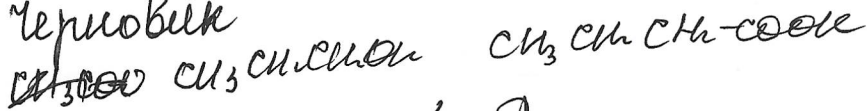
$$v_2(\text{моль}) = 0,04 \text{ моль ?}$$

Уравнение реакции
 $\text{H}_2\text{N}-\overset{\ominus}{\text{C}}-\text{NH}_2 + \text{KOH} \rightarrow$

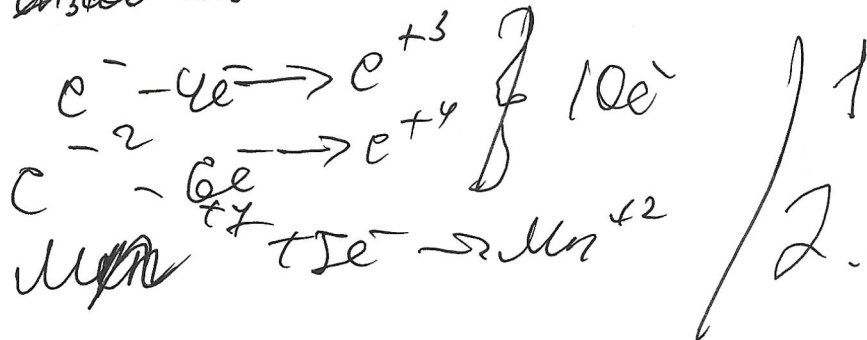




Черновик

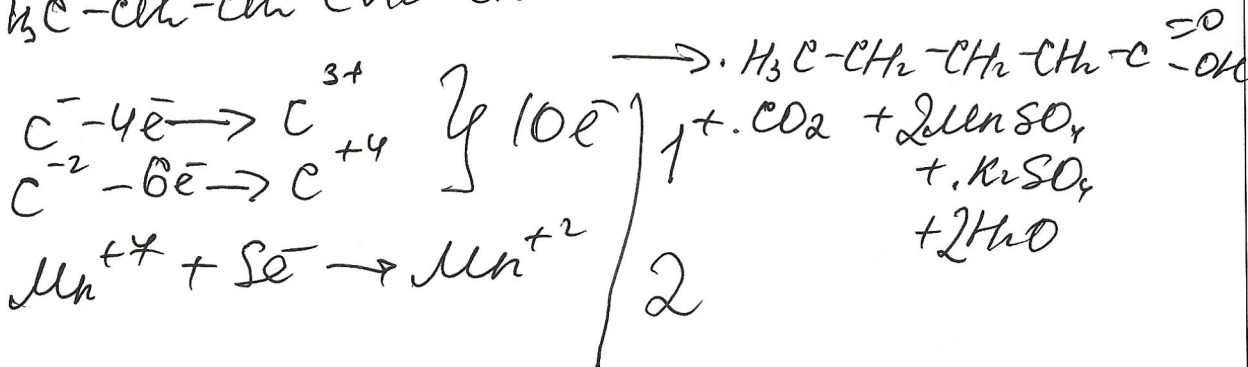
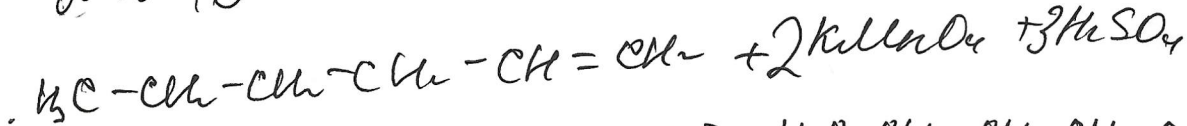


~~1,6~~
~~4,5~~
7,2
~~8,5~~



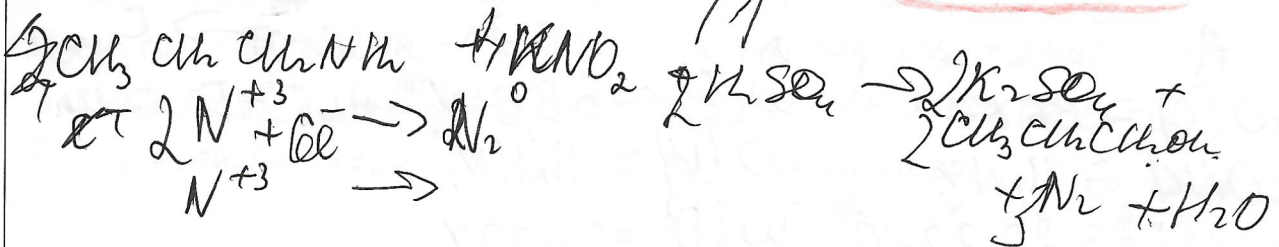
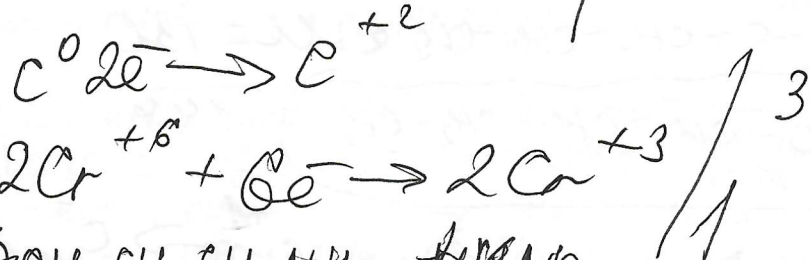
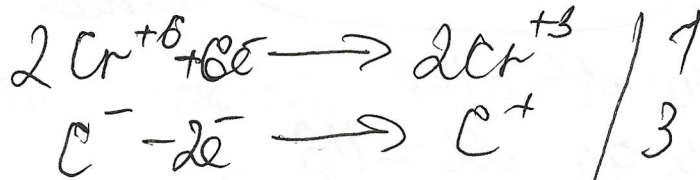
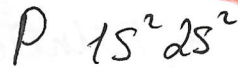
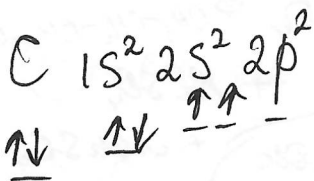
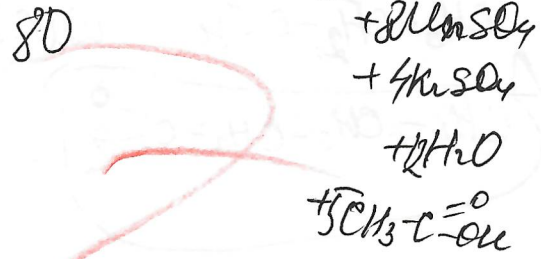
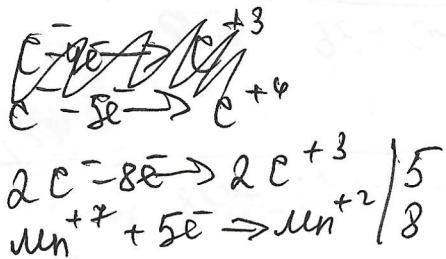
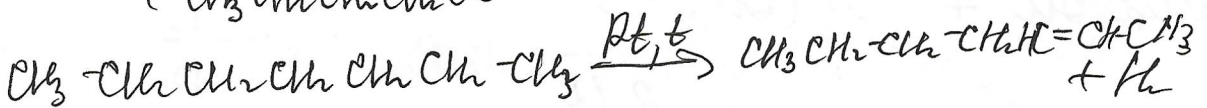
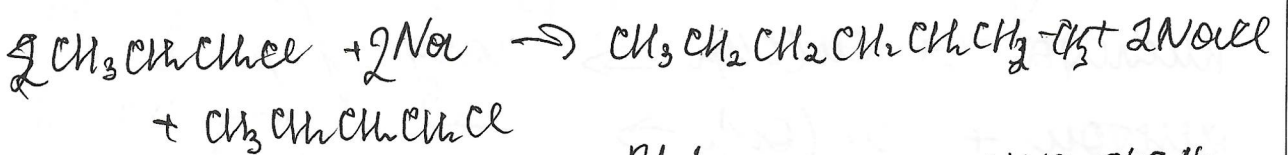
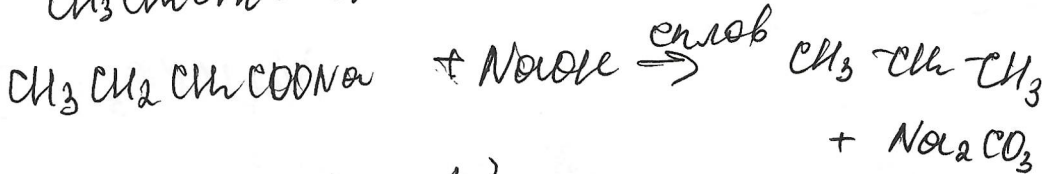
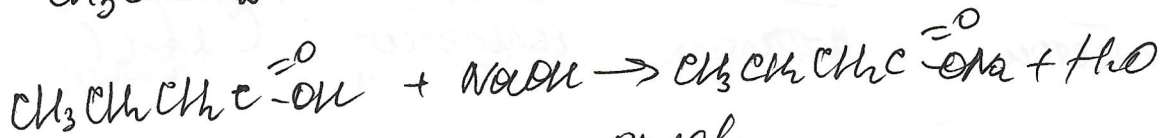
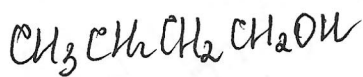
~~2~~

Mn 10



Черновик

1 6 2 3 4 5 6 7 8
 ? ✓ ✓ ? ✓ ✓ - -



Черновик

№ 2.6.

I
ацетон

II
к-та

III
альдегид

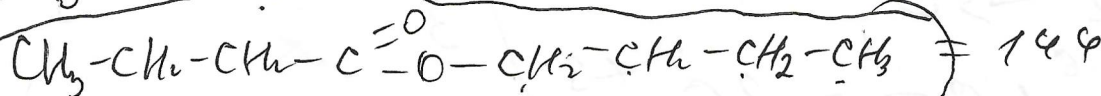
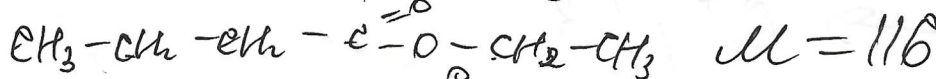
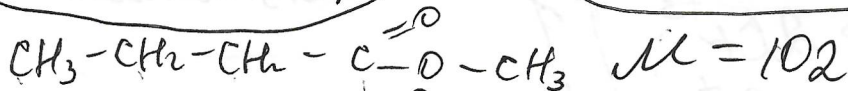
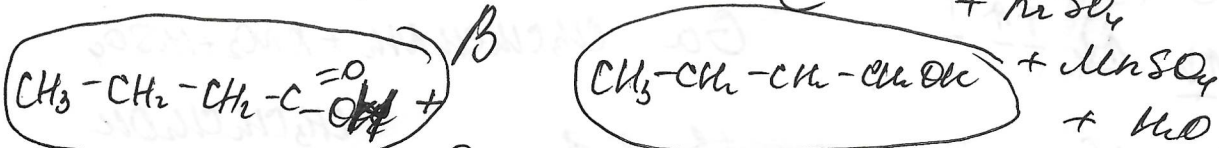
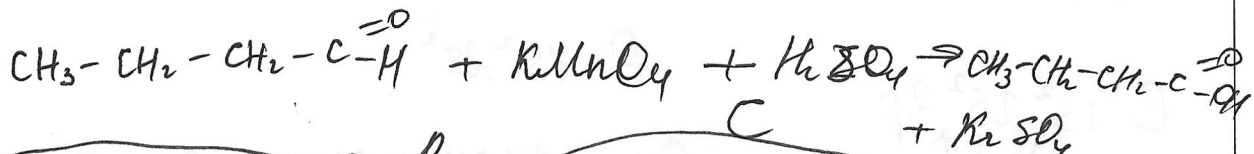
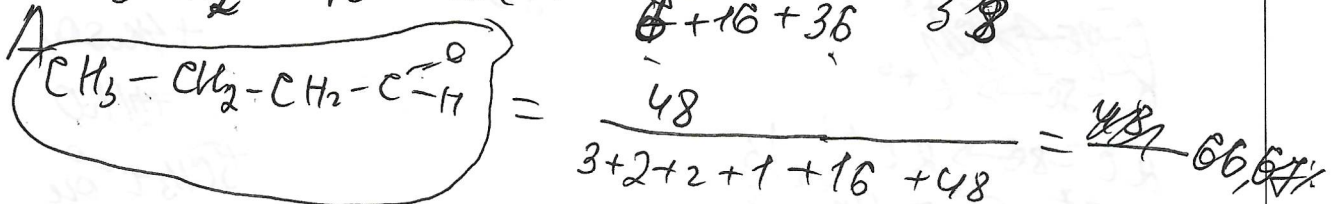
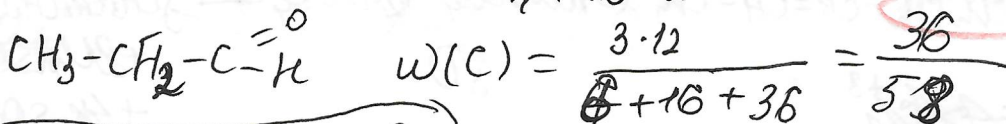
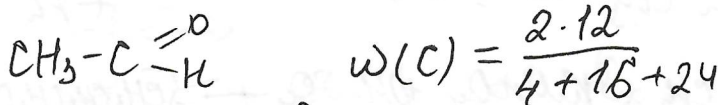
сульфид



альдегид + $\text{Cu(OH)}_2 \rightarrow$ ~~кислота~~ муравьиная кислота

кислота + $\text{Cu(OH)}_2 \rightarrow$ осадок.

ацетон + $\text{Cu(OH)}_2 \rightarrow$ —



A
 $\omega(\text{C}) = 66,67\%$
 $\omega(\text{H}) = 11,11\%$
 $\omega(\text{O}) = 22,22\%$

B
 $\omega(\text{C}) = 66,67\%$
 $\omega(\text{H}) = 11,11\%$
 $\omega(\text{O}) = 22,22\%$

