KIMYO

Oliy o'quv yurtlariga kiruvchilar, akademik litsey va kasb-hunar kollejlari hamda umumiy o'rta ta'lim maktablari o'quvchilari uchun qisqacha ma'lumotnoma

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Ma'lumotnoma Respublika Ta'lim markazi, kimyo bo'yicha IMK tomonidan nashrga tavsiya etilgan.

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Ma'lumotnoma umumiy o'rta ta'lim maktablari, kimyo fani chuqur o'rganiladigan sinflar, akademik litsey va kasb-hunar kollejlari o'quvchilari, o'qituvchilari hamda kimyo fani bilan mustaqil ravishda shug'ullanuvchilar uchun mo'ljallangan. Ma'lumotnomada barcha ta'riflar, qoidalar, kimyoviy formulalar, reaksiyalar, moddalarning olinishi va ishlatilishiga doir nazariy hamda amaliy materiallar keltirilgan.

Ma'lumotnoma oraliq va bosqichli nazoratlarni, yakuniy attestatsiyani va oliy o'quv yurtlariga kirishdagi test savollarini yechishga muvaffaqiyatli tayyorlanishda katta yordam beradi.

К42 **Kimyo:** oliy o'quv yurtlariga kiruvchilar, akademik litsey va kasb-hunar kollejlari hamda umumiy o'rta ta'lim maktablari o'quvchilari uchun qisqacha ma'lumotnoma/ tuzuvchilar: O.Yu. Iskandarov, Yu. T. Toshpo'latov, G. Shoisayeva. — T.: «Niso poligraf», 2013. — 112 b.

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DAVRIY QONUN VA ATOM TUZILISHI HAQIDAGI TASAVVURLAR ASOSIDA D. I. MENDELEYEVNING KIMYOVIY ELEMENTLAR DAVRIY SISTEMASI

1869-yilda D. I. Mendeleyev quyidagi qonunni topadi: oddiy jismlarning xossalari hamda elementlarning birikish shakli va xossalari elementlarning atom og'irliklari kattaliklari bilan davriy ravishda bog'langan bo'ladi.

D. I. Mendeleyev o'sha davrda ma'lum bo'lgan barcha elementlarni atomlarning nisbiy massalari ortib borishi tartibida joylashtirganda ularning xossalari davriy ravishda o'zgarishini kuzatgan.

1911-yilda ingliz olimi E. Rezerford eksperimental ravishda, atom markazida musbat zaryadlangan yadro bo'lishini hamda yadroning zaryadi, elementning D. I. Mendeleyev davriy sistemasidagi tartib nomeri bilan mos tushishini isbotladi.

Keyingi tajribalar (radioaktivlikni o'rganish bo'yicha) atom yadrosida ikki turdagi zarra — proton (+1 zaryadga va massasi 1) va neytron (zaryadsiz va massasi 1) borligini ko'rsatdi. Atom elektr jihatidan neytral bo'lganligidan elektronlar (zaryadi — 1) soni, atom yadrosidagi protonlar soniga teng.

Bundan, kimyoviy element — bir xil zaryadga ega bo'lgan yadroli atom ekanligi kelib chiqadi. Elektronlarning yadrodan yaqin yoki uzoq joylashishiga qarab energiyalari va elektron bulut (orbitalari) shakli turlicha bo'ladi. Elektronlar energiyani bosh kvant soni bilan belgilangan miqdorda beradi yoki oladi. Bosh kvant soni butun sonlar — 1, 2, 3 va h.k. bilan ifodalanadi. Birinchi energetik sathda joylashgan elektronlar minimal energiyaga ega bo'ladi.

Berilgan energetik sathda bo'lgan elektronlarning maksimal soni $N=2n^2$ formula bilan aniqlanadi. Bunda, n — sath nomeri (bosh kvant soni).

Birinchi energetik sathda 2 ta, ikkinchisida 8 ta, uchinchisida 18 ta va h.k. sondagi elektronlar bo'ladi.

Elektron buluti sfera shaklida bo'lgan elektronlarni *S* elektronlar, gantel shaklidagi bulut bo'lsa, *p* elektronlar deyiladi. Har bira orbitalda ikkitadan ortiq elektron bo'lmaydi.

Birinchi energetik sathda faqat bitta *S* orbital, ikkinchi sathda bitta *S* orbital va uchta *p* orbital, uchinchi sathda bitta *S* orbital, uchta *p* orbital va beshta *d* orbital bo'ladi.

D. I. Mendeleyev davriy sistemasi yettita davrdan (gorizontal joylashgan elementlar qatori) va sakkizta guruhdan (vertikal joylashgan elementlar qatori) iborat.

1—3 davrlar kichik davr deyilib, u bitta qatordan tashkil topgan hamda unda ikkita element (H, He) bor. 2 va 3 da sakkizta element bor. 4—7 davrlar ikki qatordan iborat. Yettinchi davr tugamagan. Har bir guruhda elementlarni ikkita guruhchaga ajratiladi — asosiy va qo'shimcha.

Kichik davrlar — 2 va 3 da ayrim qonuniyatlar yaqqol ko'zga tashlanadi. Ular boshqa davrlarda ham bor.

Har bir davr ishqoriy metall bilan boshlanib, inert gaz bilan tugaydi.

Chapdan o'ngga qarab tartib nomeri ortishi bilan:

— elektromanfiyligi ortadi,
— atom radiusi kamayadi,
— metallik xossasi susayadi,
— metallmaslik xossasi kuchayadi.

Bosh guruhchalarda elementning tartib nomeri ortishi bilan qutidagi qonuniyatlar kuzatiladi:

— elektromanfiylik kamayadi,
— atom radiusi ortadi,

— metallik xossasi kuchayadi,

— metallmaslik xossasi susayadi.

D. I. Mendeleyev o'z jadvalini ishlash jarayonida hali topilmagan uchta elementning o'rnini va xossalarini ta'riflab o'tgan. Ularni keyingi 15 yil ichida Fransiya, Germaniya va Shvetsiyada topishadi.

№ 31 — galliy, 1875-yilda P. Lekok de Buabodron.

№ 21 — skandiy, 1880-yilda L. Nilson.

№ 32 — germaniy, 1886-yilda K. Vinkler.

Eng ko'p ishlatiladigan kimyoviy elementlar

Atom nomeri	Nomi	Simvoli	Atom massasi, At	Topilgan yil	Yer qobig'ida tarkibiy uchrashi, %
1	Vodorod	H	1,0079	1766	0,152
2	Geliy	He	4,0026	1895	$8\ 10^{-7}$
6	Uglerod	C	12,011	—	0,048
7	Azot	N	14,007	1772	0,0025
8	Kislorod	O	15,999	1775	47,1
11	Natriy	Na	22,99	1807	2,3
13	Aluminiy	Al	26,981	1825	8,2
14	Kremniy	Si	28,086	1823	27,7
15	Fosfor	P	30,974	1669	0,1
16	Oltingugurt	S	32,064	—	0,026
17	Xlor	Cl	35,453	1774	0,013

Davomi

19	Kaliy	K	39,098	1811	2,1
20	Kalsiy	Ca	40,08	1808	4,1
25	Marganes	Mn	54,938	1774	0,095
26	Temir	Fe	55,847	—	4,1
29	Mis	Cu	63,546	—	0,005
30	Rux	Zn	65,39	—	0,0075
31	Brom	Br	79,904	1826	$3{,}7 \cdot 10^{-5}$
47	Kumush	Ag	107,868	—	$7 \cdot 10^{-6}$
50	Qalay	Sn	118,69	—	$2{,}2 \cdot 10^{-5}$
53	Yod	I	126,904	1811	$1{,}4 \cdot 10^{-5}$
79	Oltin	Au	196,967	—	$1{,}1 \cdot 10^{-7}$
80	Simob	Hg	200,59	—	$5 \cdot 10^{-6}$
82	Qo'rg'oshin	Rb	207,19	—	0,0014
92	Uran	U	238,03	1840	$2{,}4 \cdot 10^{-4}$

Kimyoviy moddalarning tozaligi

Kimyoviy element deyilsada, tabiatda ular, asosan, birikmalar ko'rinishida uchraydi. Ularni sanoat miqyosida yoki laboratoriyalarda maxsus tozalanadi. Kimyoviy sanoatda ishlab chiqilgan moddalarga *kimyoviy reaktivlar* deyiladi. Ulardagi aralashmalar miqdoriga ko'ra bir qancha tasniflarga bo'linadi.

Kimyoviy reaktiv sifati

Tasnifi	Belgilanishi	Asosiy modda miqdori massa bo'yicha 1000 hissadan
Texnik	t	—
Toza	T	980 dan kam emas
Analiz uchun toza	a.u.t	990 dan kam emas
Kimyoviy toza	k.t.	990 dan ortiq
Maxsus toza	m.t	999 dan ortiq

Reaktivlar yorlig'ida unga tegishli ma'lumotlar keltiriladi. Unda, shuningdek, zaharliligi haqida ham ma'lumot beriladi. Toza suv va osh tuzidan boshqa barcha moddalar zaharli. Hatto 0,5 kg dan ortiq iste'mol qilingan shakar ham odamni zaharlaydi.

D. I. MENDELEYEVNING KIMYOVIY

DAVR-LAR	QATOR-LAR	E L E M E N T				
		I	II	III	IV	V
1	1	H 1 VODOROD 1,008				
2	2	Li 3 LITIY 6,941	Be 4 BERILLIY 9,012	B 5 BOR 10,811	C 6 UGLEROD 12,011	N 7 AZOT 14,00
3	3	Na 11 NATRIY 22,990	Mg	Al 13 ALYUMINIY 26,981	Si 14 KREMNIY 28,086	P 15 FOSFOR 30,974
4	4	K 19 KALIY 39,098	Ca	Sc 21 SKANDIY	Ti TITAN	V VANADIY
	5	Cu 29 MIS	Zn 30 RUX	Ga 31 GALLIY 69,72	Ge 32 GERMANIY 72,59	As 33 MISHYAK 74,922
5	6	Rb 37 RUBIDIY	Sr STRONSIY	Y	Zr	Nb
	7	Ag 47 KUMUSH	Cd KADMIY	In 49 INDIY 114,82	Sn 50 QALAY 118,69	Sb 51 SURMA 121,75
6	8	Cs 55 SEZIY	Ba BARIY	La LANTAN	Hf 72 GAFNIY	Ta TANTAL
	9	Au OLTIN	Hg 80 SIMOB	Tl 81 TALLIY 204,37	Pb 82 QO'RG'OSHIN 207,2	Bi 83 VISMUT 208,980
7	10	Fr 87 FRANSIY [223]	Ra 88 RADIY [226]	Ac AKTINIY [227]	Ku [261] KURCHATOVIY	(Ns) [260] NILSBORIY
YUQORI OKSIDLARI		R_2O	RO	R_2O_3	RO_2	R_2O_5
UCHUVCHAN VODORODLI BIRIKMALARI					RH_4	RH_3

* L A N T A N O I D L A R 58-71

Ce 58 SERIY 140,12	Pr 59 PRAZEODIM 140,908	Nd 60 NEODIM 144,24	Pm 61 PROMETIY [145]	Sm 62 SAMARIY 150,4	Eu 63 EVROPIY [151,96]	Gd 64 GADOLINIY 157,25

** A K T I N O I D L A R 90-103

Th 90 TORIY 232,038	Pa 91 PROTAKTINIY 231,036	U 92 URAN 238,029	Np 93 NEPTUNIY [237,048]	Pu 94 PLUTONIY [244]	Am 95 AMERITSIY [243]	Cm 96 KYURIY [247]

ELEMENTLAR DAVRIY JADVALI

G R U P P A L A R I						
VI	VII	VIII				
	(H)				He 2 GELIY 4,0026	K
O 8 KISLOROD 15,999	F 9 FTOR 18,998				Ne 10 NEON 20,179	L K
S 16 OLTINGU-GURT 32,064	Cl 17 XLOR 35,453				Ar 18 ARGON 39,948	M L K
Cr 24 XROM 51,996	Mn 25 MARGANES 54,938	Fe 26 TEMIR 55,847	Co 27 KOBALT 58,933	Ni 28 NIKEL 58,70		N M L K
Se 34 SELEN 78,96	Br 35 BROM 79,904				Kr 36 KRIPTON 83,80	N M L K
Mo 42 MOLIBDEN 95,94	Tc 43 TEXNETSIY 98,906	Ru 44 RUTENIY 101,07	Rh 45 RODIY 102,905	Pd 46 PALLADIY 106,4		O N M L K
Te 52 TELLUR 127,60	I 53 YOD 126,904				Xe 54 KSENON 131,30	O N M L K
W 74 VOLFRAM [illegible]	Re 75 RENIY 186,207	Os 76 OSMIY 190,2	Ir 77 IRIDIY 192,22	Pt 78 PLATINA 195,09		P O N M L K
Po 84 POLONIY [209]	At 85 ASTAT [210]				Rn 86 RADON [222]	P O N M L K
						Q P O N M L K
RO_3	R_2O_7	RO_4				
H_2R	HR					

Tb 65 TERBIY 158,925	Dy 66 DISPROZIY 162,50	Ho 67 GOLMIY 164,930	Er 68 ERBIY 167,26	Tm 69 TULIY 168,934	Yb 70 ITTERBIY 173,04	Lu 71 LYUTETSIY 174,967	P O N M L K

Bk 97 BERKLIY [247]	Cf 98 KALIFORNIY [251]	Es 99 EYNSHTEYNIY [254]	Fm 100 FERMIY [257]	Md 101 MENDELEVIY [258]	(No) 102 NOBELIY [255]	(Lr) 103 LOURENSIY [256]	Q P O N M L K

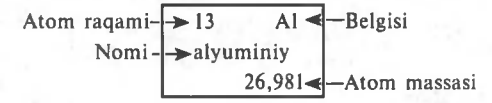
UMUMIY KIMYO

ASOSIY KIMYOVIY TUSHUNCHALAR

Atom — kimyoviy elementning oddiy va murakkab moddalar molekulasi tarkibiga kiruvchi eng kichik zarra. Atom — kimyoviy elementning xossasini saqlaydigan eng kichik zarra. **Atom** — musbat zaryadlangan yadro va manfiy zaryadlangan elektronlardan iborat elektroneytral zarra.

Molekula — muayyan moddaning kimyoviy xossalarini o'zida saqlab qoladigan eng kichik zarra.

Kimyoviy element — yadro zaryadi bir xil bo'lgan atomlar turi.



Oddiy modda — bitta elementning atomlaridan hosil bo'lgan moddalar.

Allotropiya — bir xil kimyoviy element atomlarining ikki yoki undan ortiq oddiy modda hosil qilish xususiyati.

KIMYOVIY FORMULALAR

Kimyoviy formula — modda tarkibini kimyoviy belgilar va indekslar bilan ifodalanishi. Modda molekulasida nechta atom borligini ko'rsatadigan songa, indeks deyiladi.

Shved kimyogari Y.Berselius taklijiga ko'ra kimyoviy elementlarni elementning lotin harflari bilan yozilgan nomining bosh harfu yoki undan keyin keluvchi harfi bilan birgalikda olingani bilan belgilash qabul qilingan. M.Vodorod — hydrogenium H, simob — hydrargyrum — Hg.

Kimyoviy formulalar emperik, molekular, grafik, elektron va molekular strukturalarga bo'linadi.

Emperik formulalar — moddaning tarkibida element atomlarining oddiy nisbati.

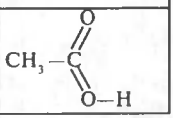
Molekular formula — molekuladagi atomlar sonini aks ettiradi, lekin uning atomlari orasidagi bog'lanishni aks ettirmaydi.

Grafik formula — molekuladagi atomlar orasida bog'lanish hosil qilishda qatnashgan elektron juftlarning har birini valent chiziqlar orqali ifodalash. Ular atomlar orasidagi bog'larni aks ettiradi, biroq molekulalarning geometrik shaklini, undagi atomlarning fazoviy holatlarini aks ettirmaydi.

Elektron formula — molekuladagi atomlar har birining tashqi valent pog'onachasidagi bog'lovchi va taqsimlanmagan elektronlari aks ettirgan tuzilish formulaga o'xshash ko'rinishga ega.

Molekular struktura formula — molekuladagi atomlar orasidagi masofalar, valent burchaklarning kattaligi haqidagi ma'lumotlarni aks ettiradi.

Kimyoviy formulalarga misollar

Moddaning nomlanishi	Molekular formulasi	Emperik formulasi	Grafik formulasi
oltingugurt (IV) oksidi	SO_2	SO_2	O=S=O
vodorod peroksid	H_2O_2	HO	H—O—O—H
sirka kislota	$C_2H_4O_2$	CH_2O	

KIMYOVIY TENGLAMALAR

$$aA + bB = cC + dD$$

bunda: a,b,c,d — stexiometrik koeffitsientlar; A, B, C, D — kimyoviy moddalar.

Kimyoviy reaksiyalar.

Bir moddadan ikkinchi modda hosil bo'ladigan hodisaga, kimyoviy reaksiya deyiladi. Ulan asosiy to'rt turda bo'ladi.

1. Parchalanish (Ajralish) reaksiyalari. Kimyoviy reaksiya davrida bir moddadan ikkita yoki birnechta boshqa moddalar hosil bo'lsa uni ajralish reaksiyasi deyiladi.

$$A \rightarrow B + C + ...$$

$$CaCO_3 \xrightarrow{t} CaO + CO_2$$

$$2H_2O \xrightarrow{el} 2H_2 + O_2$$

$$2KMnO_4 \xrightarrow{t} K_2MnO_4 + MnO_2 + O_2$$

2. Birikish reaksiyasi. Kimyoviy reaksiyada ikkita yoki birnechta moddalardan bitta yangi modda hosil bo'lsa unga birikish reaksiyasi deyiladi.

$$A + B + ... \rightarrow C$$

$$2H_2 + O_2 \rightarrow 2H_2O$$

$$CaO + CO_2 \rightarrow CaCO_3$$

$$4Fe + 6H_2O + 3O_2 \rightarrow 4Fe(OH)_3$$

3. O'rin olish reaksiyasi. Oddiy va murakkab modda orasida borayotgan kimyoviy reaksiyada, oddiy modda atomi, murakkab modda elementidagi atom o'rnini egallasa, unga o'rin olish reaksiyasi deyiladi.

$$A_{\text{oddiy modda}} + B_{\text{mur.modda}} \rightarrow C_{\text{oddiy modda}} + D_{\text{mur.modda}}$$

$$Fe + CuSO_4 \rightarrow Cu + FeSO_4$$

$$Zn + H_2SO_4 \rightarrow H_2 + ZnSO_4$$

4. Almashinish reaksiyasi. Kimyoviy reaksiyada, ikkita murakkab modda tarkibiy qismlarini almashtirsa, unga almashinish reaksiyasi deyiladi.

$$A_{\text{mur.modda}} + B_{\text{mur.modda}} \rightarrow C_{\text{mur.modda}} + D_{\text{mur.modda}}$$

$$AgNO_3 + NaCl \rightarrow \downarrow AgCl + NaNO_3$$

$$BaCl_2 + H_2SO_4 \rightarrow \downarrow BaSO_4 + 2HCl$$

Reaksiya unumini hisoblash formulasi:

$$\tau(A) = \frac{m_{amal}(A)}{m_{naz.}(A)} \cdot 100\%; \quad \tau(A) = \frac{V_{amal}(A)}{V_{naz.}(A)} \cdot 100\%$$

Jismlarning shakli yoki moddalarning agregat holati o'zgarib, tarkibi o'zgarmay qoladigan hodisaga ***gizik hodisa*** deyiladi.

NISBIY ATOM, MOLEKULAR MASSA. MOL. MOLAR MASSA

Atom massa birligi (a.m.b.) deyilganda, massa soni 12(^{12}C) ga teng bo'lgan uglerod izotopi massasining $\frac{1}{12}$ qismiga teng birlik tushuniladi.

1 a.m.b. = m (^{12}C)/12=1,66067·10^{-27}kg = 1,66067·10^{-24} g

Elementning nisbiy molar (yoki atom) massasi deyilganda, shu molekula (yoki atom) massasining uglerod atomi m_{oc} massasining $\frac{1}{12}$ qismiga nisbati tushuniladi:

$$M_r = \frac{m(mol.)}{1\,a.m.b.};\quad A_r = \frac{m(atom)}{1\,a.m.b.};\quad A_r(O) = \frac{m(O)}{1{,}66067\cdot 10^{-27}\,kg} = 16$$

Atomning absolut massasi deyilganda, atomining kilogrammlarda ifodalangan qiymati tushuniladi:

$$m(O) = Mr\cdot 1\ a.m.b. = 16\cdot 1{,}66067\cdot 10^{-27}kg = 26{,}57\cdot 10^{-27}kg$$

Birikmaning nisbiy molekular massasi:

$$M_r = \frac{m(molekula)}{1\,a.m.b.};\quad M_r(H_2O) = \frac{m(H_2O)}{1{,}66067\cdot 10^{-27}\,kg} = 18$$

Molekulaning absolut massasi deyilganda, molekulaning kilogrammlarda ifodalangan qiymati tushuniladi:

m(molekula) = $M_r\cdot 1$ m.a.b.; m(H_2O) = 18·1,66067·10^{-27}kg = 29,89206·10^{-27} kg.

Modda miqdori (mol):

$\nu = \frac{m}{M}$; bunda: m — modda massasi(g); M — molar massa (g/mol).

$N = \frac{m}{M} N_A$; bunda: N — m kg moddadagi zarralar soni (atom, molekula, ion)

N_A — 6,023·10^{23} mol^{-1} Avogadro doimiysi bo'lib, 1 mol moddadagi zarralar soni.

Moddaning molar massasi (g/mol) deyilganda, moddaning bir moliga to'g'ri kelgan massasini kilogrammlarda ifodalangan qiymati tushuniladi.

$M = m_0 N_A$; bunda: m_0 — bitta molekula massasi.

Biror modda tarkibidagi elementning massa ulushi:

$A_xB_yC_z$ $\qquad\qquad$ H_2SO_4

$$\omega(A) = X \cdot \frac{Ar(A)}{Mr(A_xB_yC_z)} \qquad \omega(H) = \frac{Ar(2H)}{Mr(H_2SO_4)} = \frac{2}{98} = 0{,}024$$

GAZ QONUNLARI

Mendeleyev — Klapeyron tenglamasi:

$$pV = \nu RT; \quad \nu = \frac{m}{M}; \quad pV = \frac{m}{M} RT$$

bunda: p — bosim; V — hajm; ν — modda miqdori; R — gazlarning universal doimiysi(R=8,314 J/mol·K); T — absolut temperatura; m — gaz massasi; M — gazning molekular massasi.

Boyl — Mariott qonuni — agar ma'lum bir massali gazning temperaturasi o'zgarmasa, gaz bosimi bilan hajmining ko'paytmasi o'zgarmaydi.

pV=const; yoki $p_1V_1 = p_2V_2$, bunda T=const.

Gey-Lyussak qonuni (1802-y) — agar ma'lum bir massali gazning bosimi o'zgarmasa, gaz hajmining temperaturasiga nisbati o'zgarmaydi:

$$p = \text{const.} \quad \boxed{\frac{V}{T} = \text{const}} \quad \text{yoki} \quad \frac{V_1}{T_1} = \frac{V_2}{T_2}.$$

Sharl qonuni (1787-y) — agar ma'lum bir massali gazning hajmi o'zgarmasa, gaz bosimining temperaturaga nisbati o'zgarmaydi:

V=const; $\frac{p}{T} = \text{const}$ yoki $\frac{p_1}{p_2} = \frac{T_1}{T_2}$.

Birlashgan gaz qonuni:

$$\frac{pV}{T} = \text{const} \quad \text{yoki} \quad \frac{p_1V_1}{T_1} = \frac{p_2V_2}{T_2}.$$

Avogadro qonuni (1811-y) — bir xil sharoitda, ya'ni bir xil temperatura va bir xil bosimda teng hajmda olingan gazlarda molekulalar soni teng bo'ladi:

Gazning molar hajmi: har qanday gazning bir moli normal sharoitda ($p = 101{,}325$ kPa, $t° = 0°C$) 22,4 l hajmni egallaydi:

$$V_m = \frac{V}{n} = \frac{RT}{p}.$$

Gazning zichligi:

$$\rho = \frac{M}{V_m}$$

Bunda: M — molar massa; V_m — molar hajm.

«A» gazning aralashmadagi hajmiy ulushi:

$$\varphi(A) = \frac{V(A)}{V(A)+V(B)+...}; \qquad \varphi = \frac{\upsilon(A)}{\upsilon(A)+\upsilon(B)+...}$$

Bunda: V — gaz hajmi; υ — gazning modda miqdori.

Gazlar aralashmasining o'rtacha molekular massasi:

$$M_{o\,r.} = \frac{\nu_1 \cdot M_1 + ... + \nu_n \cdot M_n}{\nu_1 + ... + \nu_n}; \qquad (1)$$

$$M_{o\,r.} = \frac{V_1 \cdot M_1 + ... + V_n \cdot M_n}{V_1 + ... + V_n}; \qquad (2)$$

$$M_{o'r.} = \varphi_1 \cdot M_1 + ... + \varphi_n \cdot M_n. \qquad (3)$$

Bunda: M — gazning molar massasi; ν — gazning modda miqdori; V — gazning hajmi; φ — gazning hajmiy ulushi.

ATOM TUZILISHI

Izotop — yadro zaryadlari bir xil, lekin atom massalari turlicha bo'lgan kimyoviy elementlar turkumi.

Masalan: $^{204}_{82}Pb$, $^{206}_{82}Pb$, $^{207}_{82}Pb$, $^{208}_{82}Pb$.

Izobarlar — elementlar massa sonlari o'zaro teng, lekin yadro zaryadlari har xil bo'lgan elementlar turkumi.

Masalan: $^{40}_{19}Ca - {}^{40}_{18}Ar$; $^{54}_{24}Cr - {}^{54}_{26}Fe$; $^{123}_{51}Sb - {}^{123}_{52}Te$.

Izotonlar — atomlar yadrosida neytronlar soni bir xil, ammo protonlar soni bilan farqlanadigan elementlar.

Masalan:

$^{136}_{54}Xe(54p+82n) - ^{138}_{56}Ba(56p+82n) - ^{139}_{57}La(57p+82n)$.

Eynshteyn formulasi: zarraning massasini uning energiyasi bilan bog'laydi.

$E=mc^2$; m — zarra massasi; c — $3\cdot10^8$ m/s yorug'lik tezligi.

Atom yadrosi tarkibi: A — massa soni.

$$A = Z + N,$$

bunda: Z — protonlar soni; N — neytronlar soni.

Massa deffekti:

$$\Delta m = Z\cdot M_p + (A-Z)\ M_n - M,$$

bunda: Z — protonlar soni; M_p va M_n — jami protonlar va neytronlar massasi; A — massa soni; M — yadroning tajriba asosida olingan massasi.

Radioaktiv α — yemirilish: α — zarra (^4_2He)

$$^A_zX \rightarrow {}^{A-4}_{z-2}Y + {}^4_2He.$$

Radioaktiv β — yemirilish:

$^A_zX \rightarrow {}^A_{z+1}Y + {}^0_{-1}e + \overline{\upsilon}$; $\overline{\upsilon}$ — antineytrino.

QONUNLAR

Mozli qonuni. Elementlarning rentgen spektrlaridagi xarakterli chiziqlariga to'g'ri keladigan tebranishning kvadrat ildizidan olingan qiymat elementning D. I. Mendeleyev sistemasidagi tartib raqamiga bog'liq bo'ladi:

$$\sqrt{\upsilon} = a(z-b)$$

a va b lar doimiy kattaliklar bo'lib, $a-2{,}48\cdot10^{15}$; $b-1$; z — elementning tartib raqami.

N. Borning I postulati: *atom sistemasi faqat maxsus statsionar holatda bo'lishi mumkin. Bu holatning har biriga aniq bir E_n energiya mos keladi. Atom statsionar holatda nur chiqarmaydi va yutmaydi.*

$$m\vartheta r = n\left(\frac{h}{2\pi}\right);$$

bunda: m — erkin elektron massasi; ϑ — elektron tezligi, r — orbita radiusi; h — Plank doimiysi.

N. Borning II postulati: *atom bir statsionar holatdan ikkinchisiga o'tganda elektromagnit energiya kvantini yutadi yoki chiqaradi.*

$$E_n - E_m = h\nu$$

E_n, E_m lar n va m orbitadagi elektronlar energiyalari.

ν — yorug'lik chastotasi.

$E_n = -\frac{2\pi^2 \cdot me^4}{h^2} \cdot \frac{1}{n^2} = -\frac{13{,}6\,eV}{n^2}$ bunda, $e = 1{,}6 \cdot 10^{-19}$C;

de Broyl formulasi: $\lambda = \frac{h}{m\vartheta}$

Elementar zarralar ham zarra, ham to'lqin tabiatiga ega.

Geyzenbergning noaniqlik prinsipi:

$$\Delta x \cdot \Delta(m\vartheta) > \frac{h}{4\pi}.$$

Elektronning impulsi yoki tezligi qanchalik aniqlik bilan topilsa, uning koordinatalari shunchalik noaniqlik bilan o'lchanadi.

KVANT SONLAR

Bosh kvant son — n ma'lum tartibda joylashgan energetik pog'onalarning tartib raqamini ifodalovchi va uning qabul qiladigan qiymatlari butun ratsional ketma-ketligidan iborat:

n — 1, 2, 3, 4, 5, 6.....∞

Energetik pog'onalardagi elektronlar soni $2n^2$ formula yordamida aniqlanadi.

Orbital kvant son — l

$l = 0, 1, ...n - 1$

$l = 0$ bo'lsa, s

$l = 1$ bo'lsa, p

$l = 2$ bo'lsa, d

$l = 3$ bo'lsa, f bilan ifodalanadi. Yana u pog'onacha tarkibiga kiruvchi orbitallar shaklini ham ifodalaydi.

Magnit kvant son — m elektron orbitallarning fazoviy holatini ifodalaydi. $m = 2l + 1$.

Spin kvant son — s elektronning o'z o'qi atrofida aylanishini ifodalaydi. Elektronning o'z harakat momenti miqdorining tanlangan o'qqa bo'lgan proyeksiyasiga spin kvant son deviladi.

$+\frac{1}{2}$ yoki $-\frac{1}{2}$; ↑↓

Atomdagi kvant sonlar *(jadval)*

n	l	m_e	m_s	Qavatchalardagi elektron	Maksimal
1	2	3	4	5	6
1	0	0	$+\frac{1}{2}; -\frac{1}{2}$	2(s)	2
2	0	0	$+\frac{1}{2}; -\frac{1}{2}$	2(s)	8
	1	+1; 0; −1	$+\frac{1}{2}; -\frac{1}{2}; +\frac{1}{2}; -\frac{1}{2}; +\frac{1}{2};$	6(p)	
3	0	0	$+\frac{1}{2}; -\frac{1}{2}$	2(s)	18
	1		$+\frac{1}{2}; -\frac{1}{2}; +\frac{1}{2}; -\frac{1}{2}; +\frac{1}{2};$	6(p)	
	2	+2; +1; 0; −1; 2	$+\frac{1}{2}; -\frac{1}{2}; +\frac{1}{2}; -\frac{1}{2}; +\frac{1}{2}; -\frac{1}{2}; +\frac{1}{2}; -\frac{1}{2}; +\frac{1}{2}; -\frac{1}{2}$	10(d)	18
4	0	0	$+\frac{1}{2}; -\frac{1}{2}$	2(s)	32
	1	+1; 0; −1	$+\frac{1}{2}; -\frac{1}{2}; +\frac{1}{2}; -\frac{1}{2}; +\frac{1}{2};$	6(p)	
4	2	+2; +1; 0; −1; 2	$+\frac{1}{2}; -\frac{1}{2}; +\frac{1}{2}; -\frac{1}{2}; +\frac{1}{2}; -\frac{1}{2}; +\frac{1}{2}; -\frac{1}{2}; +\frac{1}{2}; -\frac{1}{2}$	10(d)	

1	2	3	4	5	6
	3	+3; +2; +1; 0; −1; −2; −3	$+\frac{1}{2};\ -\frac{1}{2};\ +\frac{1}{2};\ -\frac{1}{2};\ +\frac{1}{2};\ -\frac{1}{2};\ +\frac{1}{2};\ -\frac{1}{2};\ +\frac{1}{2};\ -\frac{1}{2};$ $-\frac{1}{2};\ +\frac{1}{2};\ -\frac{1}{2};\ +\frac{1}{2};\ -\frac{1}{2}$	14(f)	

Atom orbitallarning elektron bilan to'lish tartibi:

$1s\,2s\,2p\,3s\,3p\,4s\,3d\,4p\,5s\,4d\,5p\,6s\,4f\,5d\,6p\,7s\,6d$

Pauli prinsipi: atomda to'rtta kvant soni bir xil bo'lgan ikkita elektron bo'lishi mumkin emas.

n^2 — pog'onadagi orbitallar soni.

$N_e = 2n^2$ pog'onalardagi elektronlar soni.

$2(2l+1)$ — pog'onachalardagi elektronlar soni.

$2l+1$ — pog'onachalar soni.

Klichkovskiy qoidasi:

1. Elektron pog'onachalarining elektronlar bilan to'lib borish ketma-ketligi ularning bosh va orbital kvant sonlar yig'indisi $(n+l)$ qiymati ortib borish tartibida bo'ladi.

2. Agar bir necha pog'onacha uchun n va l qiymatlari yig'indisi bir xil bo'lsa, bunday pog'onachalar chegarasida elektronlar joylashishi bosh kvant sonining ortib borishi tartibida bo'ladi.

Gund qoidasi. Atomda elektron spinlar yig'indisi maksimal qiymatga ega bo'lgan holatda atom energetik afzallikka ega bo'ladi.

Ionlanish energiyasi (I) atomlarning elektronlarini tortib olish uchun kerak bo'lgan minimal energiya miqdoridir:

$$X + I \rightarrow X^+ + E.$$

Elektromanfiylik (EM) — molekula tarkibidagi atomning o'ziga bog'lovchi elektronni tortishi:

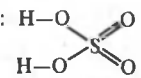
$$EM = \frac{I + E}{2}.$$

Bunda: I — atomning ionlanish energiyasi; E — atomning elektronga moyillik energiyasi.

Gibridlanish: sp; sp^2; sp^3; sp^3d; sp^3d^2;

H_2SO_4 molekulasida gibridlanish:

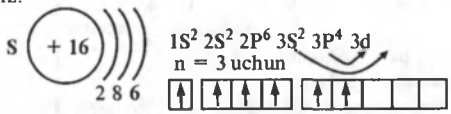
a) grafik formula yozamiz:



b) molekulada ikkita π bog' mavjud bo'lib, u π bog'ni hosil qilgan elektronlar gibridlanishda ishtirok etmaydi;

d) markaziy atomning valentligi VI ga teng;

e) uning VI valentli holati uchun elektron konfiguratsiyasini yozamiz:



f) oxirgi ikkita (d orbitaldagi) elektronlarni hisobga olmasa, demak, gibridlanish sp^3 holat kelib chiqadi.

Boshqa molekulalar gibridlanish turi ham xuddi shunday hisoblanadi.

KIMYOVIY REAKSIYALAR TERMODINAMIKASI

G.I. Gess qonuni (1840-y): reaksiyaning issiqlik effekti jarayonining qanday usullarda olib borilishiga bog'liq emas, balki reaksiyada ishtirok etayotgan moddalarning dastlabki va oxirgi holatiga bog'liq.

Termodinamikaning 1-qonuni: sistemaga berilgan issiqlik miqdori uning ichki energiyasining o'zgarishi (ΔU) va sistemaning tashqi kuchlar ustidan bajargan ishi (A) ga sarf bo'ladi:

$$\Delta U = U_2 - U_1 = Q - A.$$

Entalpiya — yunoncha «qizdiraman» so'zidan olingan.

$H = U + pV$

Bunda: p = bosim;

V = hajm;

U = ichki energiya.

Termodinamikaning 2-qonuni: muvozanat holatdagi har qanday sistema «Entropiya» nomli o'ziga xos holat funksiyasiga egaki, entropiyaning qaytar jarayonlarda o'zgarishi quyidagi $\Delta S = S_2 - S_1 = \frac{Q}{T}$ tenglama yordamida hisoblanadi.

Entropiya — moddada yuz berishi mumkin bo'lgan va uzluksiz o'zgarib turadigan holatlarni xarakterlovchi juda muhim funksiya.

Termodinamikaning 3-qonuni: barcha toza kristall moddalar entropiyalarining absolut qiymati 0 K (ya'ni — 273,15°C) ga yaqinlashganida nolga teng bo'ladi.

Gibbs energiyasi: G = H — TS bunda: H — entalpiya; S — entropiya.

KIMYOVIY REAKSIYA TEZLIGI

Vaqt birligi ichida konsentratsiya o'zgarishiga reaksiya tezligi deyiladi.

$\Delta C = C_2 - C_1$ (konsentratsiya farqi)

$\Delta t = t_2 - t_1$ (vaqtdagi farq)

$$\vartheta = \frac{\Delta C}{\Delta t} = -\frac{C_2 - C_1}{t_2 - t_1}; \qquad \vartheta = \frac{n}{V \cdot \Delta t}$$

Reaksiya tezligiga konsentratsiyaning ta'siri: kimyoviy reaksiya tezligi reaksiyaga kirishayotgan moddalarning konsentratsiyalari ko'paytmasiga to'g'ri proporsionaldir.

$A \rightarrow B + C$ — tipdagi reaksiyalar uchun $\vartheta = K \cdot C_A$

$A + B \rightarrow C + D$ — tipdagi reaksiyalar uchun $\vartheta = K \cdot C_A \cdot C_B$

$2A + B \rightarrow C + D$ — tipdagi reaksiyalar uchun $\vartheta = K \cdot C_A^2 \cdot C_B$

ϑ — reaksiya tezligi; K — tezlik konstantasi(temperaturaga bog'liq); C_A, C_B — reaksiyaga kirishuvchi moddalar konsentratsiyasi.

Vant-Goff qoidasi: har 10°C ga reaksiya temperaturasi oshirilsa, ushbu reaksiya tezligi 2—4 marta ortadi.

$$\vartheta t_2 = \vartheta t_1 \cdot \gamma^{\frac{t_2 - t_1}{10}}$$

$$\frac{\vartheta t_2}{\vartheta t_1} = \gamma^{\frac{t_2 - t_1}{10}}$$

Bunda: γ — reaksiya tezligining temperatura koeffitsiyenti;

t_2, t_1 — keyingi va dastlabki temperatura;

ϑt_2 = keyingi reaksiya tezligi;

ϑt_1 = oldingi reaksiya tezligi.

Katalizator — reaksiya tezligini o'zgartiradigan, lekin reaksiya natijasida kimyoviy jihatdan o'zgarmaydigan moddaga *katalizator* deyiladi.

Ingibitorlar — reaksiya tezligini pasaytiradigan moddalar manfiy katalizator yoki ingibitorlar deyiladi.

Promotorlar — katalizator kuchini oshiruvchi moddalar.

KIMYOVIY MUVOZANAT

$H_2 + J_2 \leftrightarrow 2HJ$

$\vartheta_1 = K_1 [H_2] \cdot [J_2]$; $\vartheta_2 = K_2 [HJ]^2$;

$\frac{K_1}{K_2} = K_M$ — muvozanat konstantasi

$$K_M = \frac{[HJ]^2}{[H_2][J_2]};$$

yoki

$aA + bB \leftrightarrow cC + dD$ reaksiya uchun

$$K_M = \frac{[C]^c \cdot [D]^d}{[A]^a \cdot [B]^b}$$

K_M — qiymati reaksiyaga kirishuvchi moddalarning tabiati va temperaturasiga bog'liq, lekin aralashmadagi moddalarning konsentratsiyasi, bosimi, begona qo'shimchalar ishtirok etish — etmasligiga bog'liq emas.

Le-Shatele (1884-y) prinsipi: kimyoviy muvozanatda turgan sistemada tashqi sharoitlardan biri (temperatura,

bosim, konsentratsiya) o'zgartirilsa, muvozanat tashqi o'zgarish ta'sirini kamaytiruvchi reaksiya tomonga boradi.

Konsentratsiya o'zgarishining ta'siri. Kimyoviy muvozanat holatida turgan sistemada moddalardan birining konsentratsiyasi orttirilsa, sistemada mumkin bo'lgan reaksiyalardan shunday reaksiya kuchayadiki, natijada konsentratsiyasi orttirilgan modda sarf bo'ladi.

Temperaturaning ta'siri. Muvozanatda turgan sistemaning temperaturasi o'zgarsa, temperatura ko'tarilganda sistemaning muvozanati issiqlik yutiladigan, temperatura pasaytirilganda esa issiqlik chiqadigan jarayon tomonga siljiydi.

Bosimning ta'siri. Muvozanatda turgan sistemaga bosim ta'sir qilinsa, muvozanat bosimni kamaytiradigan tomonga siljiydi, ya'ni hajm katta tomondan hajm kichik tomonga siljiydi.

Masalan: $N_2+3H_2 \rightleftarrows 2NH_3$ (P oshsa →, P kamaysa ←)

Katalizatorning ta'siri: muvozanatda turgan sistemaga katalizator ta'sir qilinsa, u muvozanat hosil bo'lishini tezlashtiradi, biroq muvozanatni siljitmaydi.

ERITMALAR VA ULARNING KONSENTRATSIYALARI

Erituvchi molekulalaridan va erigan modda zarralaridan tashkil topgan va ular orasida fizik va kimyoviy o'zaro ta'sir beradigan birjinsli sistemaga *eritma* deyiladi.

Berilgan temperaturada, berilgan moddaning erishi to'xtagan eritmani *to'yingan eritma*, qo'shimcha berilgan modda qo'shilganda erish davom etadigan eritma-*to'yinmagan eritma* deyiladi.

Erigan modda massasining eritma umumiy massasiga nisbati erigan moddaning *massa ulushi* deyiladi.

1. Foiz (%) konsentratsiya. 100 g eritmada erigan moddaning massasini (%)foizlarda ifodalanishi.

$$\omega\% = \frac{m(\text{er.modda})}{m(\text{eritma})} \cdot 100\% \quad \text{yoki} \quad \omega = \frac{m(\text{er.modda})}{m(\text{eritma})}$$

2. Molar konsentratsiya. 1 *l* (1000 ml) eritmada erigan moddaning mollar sonini bildiradi.

$C_M = \frac{n}{V_{(l)}}$ bunda: n — erigan modda miqdori; V_{ω} — eritma hajmi (litrda).

3. Normal konsentratsiya. 1 *l* (1000 ml) eritmada erigan moddaning ekvivalentlar sonini bildiradi.

$C_N = \frac{m \cdot 1000}{E \cdot V}$; bunda: E — erigan moddaning ekvivalent miqdori.

4. Molar konsentratsiya (mol/kg). 1 kg erituvchida erigan modda miqdorini bildiradi:

$$C_{\text{molar}} = \frac{n_{(\text{modda})}}{m_{(\text{erituvchi})}}.$$

5. Eritma titri. Eritmaning 1 millilitridagi erigan moddaning miqdori **titr** deb ataladi:

$$T = \frac{E \cdot N}{1000}.$$

6. Eruvchanlik. Ma'lum temperaturada ayni moddaning 100 g suvda erishi mumkin bo'lgan massasi, shu moddaning ayni temperaturadagi eruvchanligi deyiladi.

7. Foiz konsentratsiya va molar konsentratsiyaning bog'liqligi:

$$C_M = \frac{1000\,\omega \cdot \rho_{(\text{eritma})}}{M_{(\text{modda})}} \quad \text{yoki} \quad C_M = \frac{\omega\% \cdot \rho \cdot 10}{M}.$$

Bunda: ρ — eritma zichligi(g/ml); M — erigan modda molar massasi; ω — massa ulush; $\omega\%$ — foiz konsentratsiya.

ELEKTROLITIK DISSOTSILANISH, DISSOTSILANISH DARAJASI ELEKTROLITLAR. NOELEKTROIONLAR

Eritmalari elektr tokini o'tkazuvchi moddalar, elektrolitlar deyiladi. Elektrolitlarning ionlarga ajralish jarayoniga elektrolitik dissosiasiya deyiladi.

Eritmalari yoki suyuqlanmalari elektr tokini o'tkazmaydigan moddalar elektrolitlar (elektrolitmaslar deyiladi).

$AV \leftrightarrow A^+ + V^-$ (*kislota qoldig'i*

$K = \frac{[A^+][B^-]}{AB}$;

$AOH \leftrightarrow A^+ + OH^-$

A^+ — asos qoldig'i.

dissotsilanish konstantasi: $K = \frac{[A^+][OH^-]}{[AOH]}$

dissotsilanish darajasi: $\alpha = \frac{N'}{N}$

bunda: N' — dissotsilangan molekulalar soni;

N — umumiy molekulalar soni.

VODOROD KO'RSATKICH (pH)

Atomlarning bergan yoki olgan elektronlar soni shu atomning oksidlanish darajasi deyiladi.

$H_2O \leftrightarrow H^+ + OH^-$

$K = [H^+] \cdot [OH^-] = 1 \cdot 10^{-14}$; $t = 25°C$.

$[H^+] \cdot [OH^-] = 1 \cdot 10^{-14}$;

$[H^+] = \frac{1 \cdot 10^{-14}}{[OH^-]}$

$pH = -\lg[H^+]$;

$pH < 7$ — kislotali muhit; $pH = 7$ — neytral muhit;

$pH > 7$ — ishqoriy muhit.

OKSIDLANISH-QAYTARILISH REAKSIYALARI

Oksidlanish darajasi o'zgarishi bilan boradigan reaksiyalarga oksidlanish-qaytarilish reaksiyalari deyiladi.

oksidlanish (qaytaruvchi)

-5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8

qaytarilish (oksidlovchi)

$2H_2 + O_2 \leftrightarrow 2H_2O$

$H_2^0 - 2\bar{e} = 2H^+$ oksidlanish (qaytaruvchi)

$O_2^0 + 4\bar{e} = 2O^{-2}$ qaytarilish (oksidlovchi)

OKSIDLANISH-QAYTARILISH REAKSIYALARI TURLARI

Oksidlanish qaytarilish reaksiyalari 4 sinfga bo'linadi.

1. Atomlararo yoki molekulalararo oksidlanish-qaytarilish reaksiyalari:

$$2H_2^0 + O_2^0 \rightarrow 2H_2^{+1}O^{-2}$$

$$S^0 + O_2^0 \rightarrow S^{+4}O_2^{-2}$$

$$Cu^0 + 4HN^{+5}O_3 \rightarrow Cu^{+2}(NO_3)_2 + 2N^{+4}O_2 + 2H_2O$$

$$2KMn^{+7}O_4 + 10Fe^{+2}SO_4 + 8H_2SO_4 \rightarrow$$

$$\rightarrow K_2SO_4 + 2Mn^{+2}SO_4 + 5Fe_2^{+3}(SO_4)_3 + 8H_2O$$

2. Ichki molekular oksidlanish-qaytarilish reaksiyalari.

$$2KCl^{+5}O_3^{-2} \xrightarrow{t} 2KCl^{-1} + 3O_2^0$$

$$2KMn^{+7}O_4^{-2} \xrightarrow{t} K_2Mn^{+6}O_4^{-2} + Mn^{+4}O_2 + O_2^0$$

3. Disproporsiyalanish reaksiyalari.

$$3S^0 + 6KOH = 2K_2S^{-2} + K_2\overset{+4}{S}O_3 + 3H_2O$$

$$3K_2Mn^{+6}O_4 + 2H_2O = 2KMn^{+7}O_4 + Mn^{+4}O_2 + 4KOH$$

$$Hg_2^{+1}O \xrightarrow{t} Hg^0 + Hg^{+2}O$$

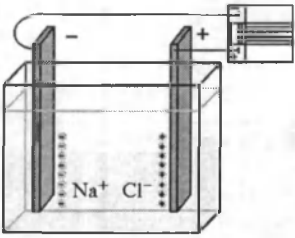
$$3HN^{+3}O_2 = HN^{+5}O_3 + 2N^{+2}O + H_2O$$

4. Sinproporsiyalanish reaksiyalari.

$$N^{-3}H_4N^{+3}O_2 \xrightarrow{t} N_2^0 + 2H_2O$$

$$N^{-3}H_4N^{+5}O_3 \xrightarrow{t} N_2^{+1}O + 2H_2O$$

ELEKTROLIZ



Elektr toki ta'sirida boradigan oksidlanish-qaytarilish reaksiyalariga **elektroliz** deyiladi.

(−) katod, unda qaytarilish jarayoni boradi.

(+) anod, unda oksidlanish jarayoni boradi:

$$2NaCl \xrightarrow{el} 2Na^0 + Cl_2^0$$

(−) katod: $Na^+ + 1e^- = Na^0$

(+) anod: $2Cl^- - 2e^- = Cl_2$

Eritma elektrolizida katod (−) va anodda (+) ajraladigan moddalar quyidagi ikkita ketma-ketlikda keltirilgan.

Metallarning aktivlik qatori standart elektrod potensialini ortib borish tartibidan kelib chiqadi.

1) Metallarning aktivlik qatori:

Li, K, Ba, Sr, Ca, Na, Mg, Al, Mn, Zn, Cr, Fe, Cd, Co, Ni, Sn, Pb, H, Cu, Hg, Ag, Pt, Au ←

2) Kislota qoldiqlarining (+) anodda oksidlanish ketma-ketligi: J^-, Br^-, S^{-2}, Cl^- $[OH^-]$, CO_3^{-2}, PO_4^{-3}, NO_3^-. →

Elektroliz qonunlari.

1. **Faradeyning 1-qonuni:** elektroliz jarayonida elektrodda ajralib chiqadigan moddaning massa miqdori eritmadan o'tgan zaryad miqdoriga to'g'ri proporsional bo'ladi:

$$m = k \cdot q = k \cdot I \cdot t.$$

Bunda: I — tok kuchi; t — vaqt; k — elektrokimyoviy ekvivalent (eritma orqali 1 Kulon zaryad miqdori o'tganda ajralib chiqadigan modda massasi), q — zaryad miqdori.

2. **Faradeyning 2-qonuni.** Agar bir necha ketma-ket ulangan elektrolizyordagi eritmasi orqali bir xil miqdordagi elektr toki o'tkazilsa, elektrodlarda ajralib chiqadigan moddalarning massa miqdorlari o'sha moddalarning kimyoviy ekvivalentlariga proporsional bo'ladi:

$$k = \frac{1}{96500} \cdot E.$$

E — modda ekvivalenti.

Faradey soni F elektron zaryadini Avogadro soniga ko'paytmasiga teng: $F = N_A \cdot e^-$.

1- va 2-qonunlardan:

$m = \frac{E \cdot I \cdot t}{96500}$ ifoda kelib chiqadi, $I \cdot t = q$ bo'lsa, u holda $m = \frac{E \cdot q}{96500}$ bo'ladi.

Elektroliz jarayoni unumi:

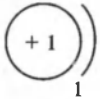
$$\eta = \frac{m \cdot 96500}{E \cdot I \cdot t} \cdot 100\%$$

ANORGANIK KIMYO

VODOROD

Vodorod XVI asr boshlaridan ma'lum bo'lib, uning reaksiya natijasida ajralishini Paratsels, Van-Gelmont, Boyl, Mentou, Lemeri, Pristley va boshqalar kuzatganlar. 1766-yilda Kavendish uni kimyoviy element sifatida kashf etdi. Unga "Hydrogenium" nomini Lavuazye berdi, u grekchadan *xyudor* — suv va *gennao* — tug'diraman; suv tug'duruvchi degan ma'noni beradi.

Atom tuzilishi:



suyuq. tem.= −259°C
qay. tem. = −252,8°C

Izotoplari: Protiy — H_1^1, Deyteriy — D_1^2, Tritiy — T_1^3.

Olinishi:

1) $Zn + 2HCl = ZnCl_2 + H_2\uparrow$

2) $Zn + H_2SO_4 = ZnSO_4 + H_2\uparrow$

3) $Fe + H_2SO_4 = FeSO_4 + H_2\uparrow$

4) $2Al + 2NaOH + 6H_2O = 2N\,a[Al(OH)_4] + 3H_2\uparrow$

5) $2NaCl + 2H_2O \xrightarrow{\text{elektroliz}} H_2 + Cl_2 + 2NaOH$

Sanoatda olinishi:

1) $C + H_2O \xrightarrow{1000°C} CO + H_2\uparrow$

2) $CO + H_2O \xrightarrow{t} CO_2 + H_2 - 40\ kDj$

3) $3Fe + 4H_2O \xleftarrow{650\ \ 800°C} Fe_3O_4 + 4H_2$

Kimyoviy xossalari:

1) Galogenlar bilan reaksiyaga kirishib, vodorod galogenidlar hosil qiladi.

$H_2 + Cl_2 = 2HCl$ (J, Br, F). F bilan xona temperaturasidayoq birikadi.

2) Kislorodda yonib suv hosil qiladi.

$2H_2 + O_2 = 2H_2O$

3) $H_2 + S \xrightarrow{t,\ P,\ kat} H_2S$

4) $3H_2 + N_2 \xrightarrow{t,\ P,\ kat} 2NH_3$

5) Ishqoriy metallar bilan birikadi.

$H_2 + 2Na = 2NaH$ (Li; K)

6) $CuO + H_2 \rightarrow Cu + H_2O$

GIDRIDLAR

Metallarning vodorod bilan hosil qilgan birikmalariga **gidridlar** deyiladi.

Olinishi: 1) $2K + H_2 = 2KH$ (kaliy gidrid)

2) $Ca + H_2 = CaH_2$ (kalsiy gidrid)

Kimyoviy xossalari:

1. Gidridlar suv bilan birikib vodorod hosil qiladi.

1) $KH + H_2O = KOH + H_2\uparrow$

2) $CaH_2 + 2H_2O = Ca(OH)_2 + 2H_2\uparrow$

Suv — H_2O; molekulasi sp^3 — gibridlanish, 104,3° burchakka ega. H_2O — 1000°C dan yuqori temperaturada H_2 va O_2 ga parchalanadi: $2H_2O \overset{1000^\circ}{=} 2H_2 + O_2$.

Kimyoviy xossalari.

1) Ishqoriy metallar bilan: Li, Na, K, Rb, Cs, Fr.

$$2Na + 2H_2O = 2NaOH + H_2$$

2) Ishqoriy metallarning oksidlari bilan: Li_2O, Na_2O, K_2O, Rb_2O.

$$Na_2O + H_2O = 2NaOH$$

3) Kislotali oksidlar bilan: CO_2, P_2O_5, SO_2, SO_3.

$$N_2O_5 + H_2O = 2HNO_3$$

4) Tuzlar bilan: NaCl, Al_2S_3, KNO_3, $CuSO_4$.

$$Al_2S_3 + 6H_2O = 2Al(OH)_3 + 3H_2S$$

Vodorod peroksid. H_2O_2 H—O—O—H

Olinishi. Laboratoriyada bariy peroksidga sulfat kislota ta'sir ettirib olinadi:

$$BaO_2 + H_2SO_4 = H_2O_2 + BaSO_4$$

Kimyoviy xossalari:

1) Oltingugurt (IV) oksidini oksidlaydi:

$$SO_2+H_2O_2=H_2SO_4$$

2) MnO_2 ta'sirida parchalanadi:

$$2H_2O_2 \xrightarrow{MnO_2} 2H_2O + O_2\uparrow$$

3) KJ ni oksidlaydi:

$$2KJ + H_2O_2 + H_2SO_4 \rightarrow J_2 + K_2SO_4 + 2H_2O$$

4) $KMnO_4$ ni qaytaradi:

$$5H_2O_2 + 2KMnO_4 + 3H_2SO_4 \rightarrow 5O_2\uparrow + K_2SO_4 + 2MnSO_4 + 8H_2O$$

VII GURUH ASOSIY GURUHCHA ELEMENTLARI

VII guruh asosiy guruhcha elementlariga **galogen** (tuz hosil qiluvchi)**lar** deyiladi. Ularga F(ftor), Cl(xlor), Br(brom), J(jod) kiradi.

Tashqi qavatdagi elektron taqsimlanishi: n^2n^5sp

F—1886-yil, Muassam

Cl—1774-yil, Sheele

Br—1826-yil, Balar

J—1811-yil, Kurtua

Ftorning olinishi:

$2HF=H_2+F_2$. Buning uchun oson suyuqlanuvchan $KF\cdot 2HF$ dan foydalaniladi. U 100°C po'lat katod va grafit anoddan foydalaniladi, bunda anodda quyidagi reaksiya boradi:

$$A+: = 2\overline{F} - 2\bar{e} + F_2\uparrow$$

Xlorning olinishi. Uni osh tuzi eritmasini elektroliz qilib olinadi:

$$2NaCl + 2H_2O \xrightarrow{El.(Eritma)} H_2 + Cl_2 + 2NaO$$

Oksidlovchilar ta'sirida olinishi:

$MnO_2 + 4HCl \rightarrow MnCl_2 + Cl_2\uparrow + 2H_2O$

3. $2KMnO_4 + 16HCl \rightarrow 2MnCl_2 + 5Cl_2\uparrow + 2KCl + 8H_2O$

4. $K_2Cr_2O_7 + 14HCl \rightarrow 3Cl_2\uparrow + 2CrCl_3 + 2KCl + 7H_2O$

5. $KClO_3 + 6HCl \rightarrow 3Cl_2\uparrow + KCl + 3H_2O$

Bromning olinishi:

1. $Cl_2 + 2HBr \rightarrow Br_2 + 2HCl$

2. $MnO_2 + 4HBr \rightarrow MnBr_2 + Br_2 + 2H_2O$

3. $MnO_2 + 2KJ + 2H_2SO_4 \rightarrow J_2 + K_2SO_4 + MnSO_4 + 2H_2O$

Kimyoviy xossalari:

Ftor kuchli oksidlovchi hisoblanadi:

$2F_2 + 2H_2O \rightarrow 4HF + O_2$

$5F_2 + 2P \rightarrow 2PF_5\uparrow$

$3F_2 + S \rightarrow SF_6\uparrow$

Ftor azot va kislorod bilan bevosita birikmaydi.

Xlor bilan suvning o'zaro ta'siri:

$$Cl_2 + H_2O \leftrightarrow HCl + HClO\ ;$$

$$2Cl_2 + 2H_2O \xrightarrow{h\nu} 4HCl + O_2\uparrow$$

Ishqorlar bilan ta'siri:

$$Cl_2 + 2KOH \rightarrow KClO + H_2O + KCl$$

qaynoq eritmasi bilan:

$$3Cl_2 + 6KOH \xrightarrow{t^\circ} 5KCl + KClO_3 + 3H_2O$$

Xlorli ohak hosil bo'lishi:

$$Cl_2 + Ca(OH)_2 \rightarrow CaOCl_2 + H_2O$$

Calogenlarning metallar va metallmaslar bilan ta'siri:

$$2Na + Cl_2 = 2NaCl$$

$$2Fe + 3Cl_2 = 2FeCl_3$$

$2Al + 3J_2 = 2AlJ_3$

$2P + 3Cl_2 = 2PCl_3$

$2P + 5Br_2 = 2PBr_5$

$H_2S + Br_2 = S + 2HBr$

$HJ + Br_2 = J_2 + 2HBr$

$H_2S + J_2 = S + 2HJ$

$J_2 + SO_2 + 2H_2O = H_2SO_4 + 2HJ;$

Galogenlarning vodorodli hosilalari:

Olinishi:

1. HF-tuzlariga kuchli kislotalarning konsentrlangan eritmalari ta'sir ettirib olinadi:

$$CaF_2 + H_2SO_4 \xrightarrow{t^\circ} CaSO_4 + 2HF\uparrow$$

$$H_2 + F_2 = 2HF + Q$$

2. HCl tuzlariga kuchli kislotalarning konsentrlangan eritmalari ta'sir ettirib olinadi:

3. HBr — olinishi: $KBr_{(k)} + H_3PO_4 = HBr\uparrow + KH_2PO_4$

4. $PBr_3 + 3H_2O = H_3PO_3 + 3HBr\uparrow$

5. HJ — olinishi: $2P + 3J_2 + 6H_2O = 2H_3PO_3 + 6HJ\uparrow$

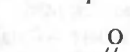
Galogenlarning kislorodli kislotalari va ularning olinishi:

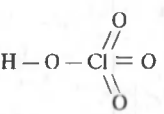
1. $HClO$ — gipoxlorit kislota — sp^3 — gibridlanish
2. $HClO_2$ — xlorit kislota — sp^3 — gibridlanish
3. $HClO_3$ — xlorat kislota — sp^3 — gibridlanish
4. $HClO_4$ — perxlorat kislota — sp^3 — gibridlanish

Geometrik formulasi:

1. H—O—Cl

3.



2. $H-O-Cl=O$ 4. 

Olinishi:

1. $Cl_2+H_2O \leftrightarrow HCl+HClO$
2. $Ba(ClO_3)_2 + H_2SO_4 = 2HClO_3 + BaSO_4\downarrow$
3. $J_2 + 5Cl_2 + 6H_2O = 2HJO_3 + 10HCl$
4. $KClO_4 + H_2SO_4 = KHSO_4 + HClO_4$

Kimyoviy xossalari:

1. $HClO + KOH = KClO + H_2O$
2. $HClO_2 + KOH = KClO_2 + H_2O$
3. $HClO_3 + KOH = KClO_3 + H_2O$
4. $HClO_4 + KOH = KClO_4 + H_2O$
5. Yorug'lik nurida: $2HClO = 2HCl+O_2$
6. $2HI + HClO = I_2 + HCl + H_2O$
7. $6P + 5KClO_3 = 3P_2O_5 + 5KCl$
8. Katalizatorsiz qizdirilganda

$4KClO_3 = KCl + 3KClO_4$

Katalizatorli (MnO_2) qizdirilganda

$2KClO_3 = 2KCl + 3O_2$

9. $2HClO_4 + P_2O_5 = Cl_2O_7 + 2HPO_3$
10. Kuchli qizdirilganda $KClO_4$ quyidagi tenglama bo'yicha parchalanadi: $KClO_4 = KCl + 2O_2$

VI GURUHCHA ELEMENTLARI

Kislorod

Atom tuzilishi:

$1S^2\ 2S^2\ 2P^4$

Kislorod molekulasi — O_2

Maksimal valentligi — 4

Yuqori oksidlanish darajasi — +2

Quyi oksidlanish darajasi — −2

Kislorod 1774-yilda Pristli va Sheele tomonidan bir vaqtda kashf etilgan. Lavuazye tomonidan unga «oxygenium» deb nom berilgan, ya'ni *okzeyn* — nordon, *geniko* — hosil qilaman degan so'zlardan olingan.

Suyuqlanish temperaturasi — −218,8°C;

Qaynash temperaturasi — −182,9°C.

Olinishi:

1. Laboratoriyada olinishi:

$$2KMnO_4 \xrightarrow{t^\circ} K_2MnO_4 + MnO_2 + O_2\uparrow$$

$$4K_2Cr_2O_7 \xrightarrow{t^\circ} 4K_2CrO_4 + 2Cr_2O_3 + 3O_2\uparrow$$

$$2KClO_3 \xrightarrow{t^\circ} 2KCl + 3O_2$$

$$2HgO \xrightarrow{t^\circ} 2Hg + O_2\uparrow$$

$$2H_2O_2 \xrightarrow{MnO_2} 2H_2O + O_2\uparrow$$

$$2NaNO_3 \longrightarrow 2NaNO_2 + O_2\uparrow$$

2. Sanoatda olinishi:

Suyuq havodan olinadi.

Suvni elektroliz qilishda hosil bo'ladi.

$$2H_2O \xrightarrow{el} 2H_2 + O_2$$

Kimyoviy xossalari. Kislorod oltin, kumush, platina va platina qatori elementlaridan tashqari deyarli barcha metallar, metalmaslar (VII guruh bosh guruhchasi elementlaridan tashqari), murakkab anorganik va organik moddalar bilan reaksiyaga kirishib oksidlarni hosil qiladi.

1. $4P + 5O_2 \rightarrow 2P_2O_5$
2. $S + O_2 \rightarrow SO_2$
3. $C + O_2 \rightarrow CO_2$
4. $2Na + O_2 \rightarrow Na_2O_2$
5. $4Li + O_2 \rightarrow 2Li_2O$
6. $4Al + 3O_2 \rightarrow 2Al_2O_3$
7. $N_2 + O_2 \rightarrow 2NO$
8. $4NH_3 + 3O_2 = 2N_2 + 6H_2O$
9. $2CuS + 3O_2 = 2CuO + 2SO_2$
10. $2NO + O_2 = 2NO_2$
11. $2SO_2 + O_2 = 2SO_3$
12. $2CO + O_2 = 2CO_2$

OZON

Ozon molekulasi — O_3
Geometrik formulasi —
Gibridlanishi — sp^2

1785 yilda Gollandiyalik Van-Marum tomonidan aniqlangan. Ozon sof holda faqat 1922 yilda nemis kimyogarlari Rezerford va Shvab tomonidan olingan.

Suyuq ozon to'q ko'k rangda, qattiq holatda, qora rangda bo'ladi.

Suyuqlanish temperaturasi — −192°C.

Olinishi:

1. Ozonatorda elektr toki yordamida kislorodni cho'glangan spiral orqali o'tkazib olinadi:

$$3O_2 \leftrightarrow 2O_3$$

Kimyoviy xossalari. Kislorodga qaraganda azon kimyoviy jihatdan birmuncha faol. U kuchli oksidlovchilik xossasiga ega.

1. $2KJ + O_3 + H_2O = J_2 + O_2 + 2KOH$
2. $3PbS + 4O_3 = 3PbSO_4$;

Oksidlar.

Ikkita elementdan iborat bo'lib, biri kislorod bo'lgan murakkab moddalarga *oksidlar* deyiladi.

Olinishi:

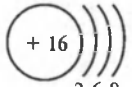
1. $Ca(OH)_2 \xrightarrow{t^\circ} CaO + H_2O$
2. $H_2SiO_3 \xrightarrow{t^\circ} SiO_2 + H_2O$
3. $2Pb(NO_3)_2 \xrightarrow{t^\circ} 2PbO + 4NO_2 + O_2$
4. $(NH_4)_2Cr_2O_7 \xrightarrow{t^\circ} Cr_2O_3 + N_2 + 4H_2O$ («vulqon» reaksiyasi)

Kimyoviy xossalari. Oksidlar ishqorlar, ishqoriy-yer metallarining gidridlari, ba'zi metalmaslarning oksidlari, kislotalar, asoslar bilan reaksiyaga kirishadi.

1. $CaO + H_2O = Ca(OH)_2$
2. $P_2O_5 + 3H_2O = 2H_3PO_4$
3. $4NO_2 + O_2 + 2H_2O = 4HNO_3$
4. $BaO + SiO_2 = BaSiO_3$
5. $Al_2O_3 + 3SO_3 = Al_2(SO_4)_3$
6. $MgO + H_2SO_4 = MgSO_4 + H_2O$
7. $CO_2 + Ca(OH)_2 = CaCO_3 + H_2O$
8. $3CuO + 2NH_3 \xrightarrow{t^\circ} 3Cu + N_2 + 3H_2O$
9. $P_2O_5 + 5C \xrightarrow{t^\circ} 2P + 5CO$
10. $SO_3 + H_2O = H_2SO_4$
11. $FeO + CO = Fe + CO_2$
12. $2CO + O_2 = 2CO_2$
13. $CaO + CO_2 = CaCO_3$
14. $CaCO_3 + CO_2 + H_2O = Ca(HCO_3)_2$

OLTINGUGURT VA UNING BIRIKMALARI

Atom tuzilishi:



$1S^2\ 2S^2\ 2P^6\ 3S^2\ 3P^4$

Suyuqlanish temperaturasi — +112,8°C (rombik)
+119,3°C (monoklinik)

Qaynash temperaturasi — +444,6°C

Maksimal valentligi — 6

Yuqori oksidlanish darajasi — +6 (faqat oksidlovchi)

Quyi oksidlanish darajasi — −2 (faqat qaytaruvchi).

Oltingugurt qadimdan ma'lum bo'lgan.

Olinishi:

1. Tabiatda erkin holatda uchraydi.
2. Kislorod kam miqdorda bo'lsa: $2H_2S + O_2 = 2S\downarrow + 2H_2O$
3. Kislorod yetarli miqdorda bo'lsa: $2H_2S+3O_2=3SO_2+2H_2O$

Kimyoviy xossalari.

Metallmaslar bilan reaksiyasi:

1. $S + O_2 = SO_2$
2. $S + 3F_2 = SF_6$
3. $S + H_2 \leftrightarrow H_2S$
4. $3S + 2P = P_2S_3$

Metallar bilan reaksiyasi:

1. $2Al + 3S = Al_2S_3$
2. $Hg + S = HgS$
3. $2Li + S = Li_2S$
4. $Cu + S = CuS$
5. $Zn + S \xrightarrow{t^\circ} ZnS$
6. Pt reaksiyaga kirishmaydi.

Murakkab moddalar bilan reaksiyasi:

1. $S + 2H_2SO_{4(kons.)} = 3SO_2 + 2H_2O$
2. $S + 6HNO_{3(kons.)} = H_2SO_4 + 6NO_2 + 2H_2O$
3. $3S+6NaOH_{(kons.)}=Na_2SO_3+2Na_2S+3H_2O$
4. $S+Na_2SO_3=Na_2S_2O_3$

Vodorod sulfid. H—S—H

Suvda biroz eruvchan, palag'da tuxum hidi keluvchi gaz. Sulfid (S^{-2}) va gidrosulfid (HS^{-1}) hosil qiladi. −60°C da suyuqlanadi, −61,8°C da qaynaydi.

Vodorod sulfid — kuchli qaytaruvchi.

Olinishi:

1. $H_2 + S \xrightarrow{t^\circ} H_2S\uparrow$
2. $FeS + 2HCl = FeCl_2 + H_2S\uparrow$
3. $Al_2S_3 + 6H_2O = 2Al(OH)_3 + 3H_2S\uparrow$

Kimyoviy xossalari:

1. Ikki asosli kislota bo'lganligi uchun ikki xil tuz hosil qiladi:

1) $H_2S + NaOH = NaHS + H_2O$
2) $H_2S + 2NaOH = Na_2S + 2H_2O$

2. Qaytaruvchi sifatida reaksiyaga kirishadi:

1. $H_2S + J_2 = 2HJ + S$
2. $H_2S + Br_2 = 2HBr + S$
3. $H_2S + 2FeCl_3 = 2FeCl_2 + S + 2HCl$
4. $2H_2S + SO_2 = 3S\downarrow + 2H_2O$
5. $H_2S + 4Cl_2 + 4H_2O = H_2SO_4 + 8HCl$
6. $H_2S + H_2SO_{4(kons.)} = S + SO_2 + 2H_2O$
7. $3H_2S + 8HNO_{3(kons.)} = 3H_2SO_4 + 8NO\uparrow + 4H_2O$

3. Og'ir metall tuzlari bilan reaksiyaga kirishadi:

$CuCl_2 + H_2S = CuS + 2HCl$

$Pb(NO_3)_2 + H_2S = PbS + 2HNO_3$

4. Ayrim xossalari:

$ZnCl_2 + Na_2S = ZnS\downarrow + 2NaCl$

$2H_2S + 4Ag + O_2 = 2Ag_2S\downarrow + 2H_2O$

Oltingugurt (IV)-oksidi — SO_2

O'tkir hidli gaz. — 10°C da suyuq, −73°C da qattiq holga o'tadi.

Olinishi:

1. Laboratoriyada:

$S + O_2 \xrightarrow{t^\circ} SO_2$

$Na_2SO_3 + 2HCl = 2NaCl + SO_2\uparrow + H_2O$

$Cu + 2H_2SO_{4(kons.)} = CuSO_4 + SO_2\uparrow + 2H_2O$

2. Sanoatda:

$$4FeS_2 + 11O_2 = 2Fe_2O_3 + 8SO_2\uparrow$$

Kimyoviy xossalari:

1. $H_2O + SO_2 \leftrightarrow H_2SO_3$ (suvli eritmada mavjud bo'ladi).
2. $2NaOH + SO_2 = Na_2SO_3 + H_2O$
3. $NaOH + SO_2 = NaHSO_3$
4. $SO_2 + J_2 + 2H_2O = H_2SO_4 + 2HJ$
5. $H_2SO_3 + 2H_2S = 3S + 3H_2O$
6. $SO_2 + H_2O + CaSO_3 = Ca(HSO_3)_2$
7. $2SO_2 + O_2 = 2SO_3$

8. $SO_2 + Cl_2 = SO_2Cl_2$
9. $SO_2 + Br_2 + 2H_2O = H_2SO_4 + 2HBr$
10. $5SO_2 + 2KMnO_4 + 2H_2O = K_2SO_4 + 2MnSO_4 + 2H_2SO_4$
11. $SO_2 + 2CO \xrightarrow{t^\circ} S + 2CO_2$

Oltingugurt (VI) oksidi — SO_3

SO_3 — suyuqlik.

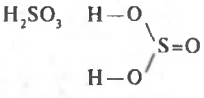
Olinishi:

1. $2SO_2 + O_2 = 2SO_3 + Q$

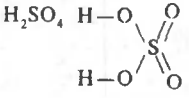
Kimyoviy xossalari:

1. $H_2O + SO_3 = H_2SO_4 + Q$
2. $SO_3 + Ca(OH)_2 = CaSO_4 + H_2O$
3. $SO_3 + Ba(OH)_2 = BaSO_4 + H_2O$

SULFIT VA SULFAT KISLOTALAR



Sulfit kislota



Sulfat kislota

Olinishi:

1. Sulfit kislota:

$$SO_2 + H_2O \leftrightarrow H_2SO_3$$

Kuchsiz kislota bo'lib, tuzlari barqaror.

2. Sulfat kislota:

$$SO_3 + H_2O = H_2SO_4$$

Sulfat kislota kuchli kislota.

Sanoatda 2 xil usulda — kontakt va nitroza usulida olinadi.

1. Kontakt usuli:

$$4FeS_2 + 11O_2 = 2Fe_2O_3 + 8SO_2\uparrow$$

$$2SO_2 + O_2 \xrightarrow{V_2O_5} 2SO_3$$

$$SO_3 + H_2SO_4 + H_2O \rightarrow H_2SO_4$$

2. *Nitroza usuli:*

$$SO_2 + NO_2 + H_2O = H_2SO_4 + NO$$
$$2NO + O_2 = 2NO_2 + Q$$

2-usul arzon hisoblanadi, chunki unda aralashgan katalizatordan tozalash (kontakt usulida) zarurati yo'q, biroq bunda konsentrlangan kislota olib bo'lmaydi. Taxminan 70% li kislota olinadi.

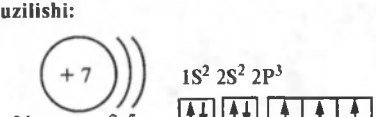
Kimyoviy xossalari:

1. $NaOH + H_2SO_4 = NaHSO_4 + H_2O$
2. $2NaOH + H_2SO_4 = Na_2SO_4 + 2H_2O$
3. $Zn + H_2SO_{4(suyul.)} = ZnSO_4 + H_2\uparrow$
4. $4Zn + 5H_2SO_{4(kons.)} \xrightarrow{t^\circ} 4ZnSO_4 + H_2S + 4H_2O$
5. $Zn + 2H_2SO_{4(kons.)} = ZnSO_4 + SO_2 + 2H_2O$
6. $3Zn + 4H_2SO_{4(kons.)} 3ZnSO_4 + S + 4H_2O$
7. $2Ag + 2H_2SO_{4(kons.)} = Ag_2SO_4 + SO_2\uparrow + 2H_2O$
8. $C + 2H_2SO_{4(kons.)} = CO_2\uparrow + 2\ SO_2\uparrow + 2H_2O$
9. $2P + 5H_2SO_4 = 2H_3PO_4 + 5\ SO_2\uparrow + 2H_2O$
10. $BaCl_2 + H_2SO_4 = BaSO_4\downarrow + 2HCl$
11. $2CuSO_4 \xrightarrow{t^\circ} 2CuO + 2SO_2\uparrow + O_2\uparrow$
12. $2Fe_2(SO_4)_3 \xrightarrow{1000} 2Fe_2O_3 + 6SO_2\uparrow + 3O_2\uparrow$
13. $Ag_2SO_4 = 2Ag + SO_2\uparrow + O_2\uparrow$
14. $2CaSO_4 \xrightarrow{1000} 2CaO + 2SO_2\uparrow + O_2\uparrow$

V GURUHNING ASOSIY GURUHCHA ELEMENTLARI

Azot va uning birikmalari

Atom tuzilishi:



Maksimal valentligi — 4
Yuqori oksidlanish darajasi — +5 (faqat oksidlovchi)
Quyi oksidlanish darajasi — −3 (faqat qaytaruvchi);
Kashf etilishi: 1772-yilda D.Rezerford tomonidan olingan va ta'riflangan.

Azot — hayot uchun yaroqsiz degan ma'noni beradi. «Zoe» grekchadan — hayot, «a» — inkor etuvchi.

Olinishi:

1. Laboratoriyada:

$NH_4Cl + NaNO_2 \xrightarrow{t^\circ} N_2\uparrow + NaCl + 2H_2O$

$(NH_4)_2Cr_2O_7 \xrightarrow{t^\circ} Cr_2O_3 + 4H_2O + N_2\uparrow$

$NH_4NO_2 \xrightarrow{t^\circ} N_2\uparrow + 2H_2O$

2. Sanoatda:

Sanoatda azot havodan olinadi. Buning uchun havo qattiq sovitiladi. Suyuq havo sekin bug'latiladi va bunda birinchi bo'lib azot uchib chiqadi. Buning sababi azotning qaynash harorati — 196°C.

Kimyoviy xossalari:

$6Li + N_2 = 2Li_3N$

$3Mg + N_2 = Mg_3N_2$

$N_2 + O_2 \xrightarrow{1800^\circ C} 2NO - Q$

$N_2 + 3H_2 \xrightarrow{t, p, kat} 2NH_3$

Ammiak — NH_3 $\quad H-\underset{\displaystyle H}{\underset{|}{N}}-H$

O'tkir hidli gaz, $t_{(qayn.)} = -33,4^\circ C$

$T_{(suyuq.)} = -77,7^\circ C$

1 *l* suvda 100 *l* ammiak eriydi.

Olinishi:

1. Laboratoriyada:

1. $NH_4Cl + KOH \xrightarrow{t^\circ} NH_3\uparrow + KCl + H_2O$
2. $Mg_3N_2 + 6H_2O = 3Mg(OH)_2 + 2NH_3$

2. Sanoatda: $N_2 + 3H_2 \xrightleftharpoons{t, p, kat} 2NH_3$

Kimyoviy xossalari:

Ammiak suvda yaxshi eriydi, natijada ammoniy gidroksid hosil bo'ladi:

1. $NH_3 + H_2O \leftrightarrow NH_4OH$

Ammiak kislotalar bilan ham reaksiyaga kirishib tuz hosil qiladi.

2. $NH_3 + HCl = NH_4Cl$
3. $2NH_3 + H_2SO_4 = (NH_4)_2SO_4$
4. $NH_3 + H_2O + CO_2 = NH_4HCO_3$

Kislorodda yonadi va azot va suv hosil qiladi.

5. $4NH_3 + 4O_2 \xrightarrow{kat-siz} 2N_2 + 6H_2O$
6. $4NH_3 + 5O_2 \xrightarrow{t, p, kat} 4NO + 6H_2O$
7. $2NH_3 + 3CuO \xrightarrow{t^\circ} 3Cu + N_2 + 3H_2O$
8. $2NH_{3(suyuq.)} + 2Na = NaNH_2 + H_2\uparrow$

Ammoniy tuzlari olinishi:

Ammiakka kislotalar ta'sir etib olinadi.

1. $2NH_3 + H_2SO_4 \rightarrow (NH_4)_2SO_4$
2. $3NH_3 + H_3PO_4 \rightarrow (NH_4)_3PO_4$

Tuzlarining parchalanishi:

1. $(NH_4)_3PO_4 \xrightarrow{t^\circ} 3NH_3 + H_3PO_4$
2. $NH_4Cl \xrightarrow{t^\circ} NH_3\uparrow + HCl\uparrow$
3. $NH_4HCO_3 \xrightarrow{t^\circ} NH_3 + H_2O\uparrow + CO_2\uparrow$
4. $(NH_4)_2Cr_2O_7 \xrightarrow{t^\circ} N_2\uparrow + Cr_2O_3 + 4H_2O$
5. $NH_4NO_3 \xrightarrow{t^\circ} N_2O\uparrow + 2H_2O$

Azot oksidlari:

$N_2O \rightarrow NO \rightarrow N_2O_3 \rightarrow NO_2 \rightarrow N_2O_5$

Azot (I) oksid — N_2O — rangsiz, shirin mazali hidga ega, «kuldiruvchi gaz» ham deyiladi. N=N=O

Olinishi:

$NH_4NO_3 \xrightleftharpoons{t^\circ} N_2O + 2H_2O$

Kimyoviy xossalari:

1. $2N_2O \xrightarrow{t^\circ} 2N_2 + O_2$
2. $P_4 + 10N_2O \rightarrow P_4O_{10} + 10N_2$

Azot (II) oksid — NO — rangsiz gaz, suvda yomon eriydi. N=O

Olinishi:

1. $2NH_3 + O_2 \xrightarrow{Pt} 4NO + 6H_2O$
2. $3Cu + 8HNO_{3(suyul.)} = 3Cu(NO_3)_2 + 2NO\uparrow + 4H_2O$
3. $3SO_2 + 2HNO_3 + 2H_2O = 3H_2SO_4 + 2NO\uparrow$

Kimyoviy xossalari:

1. $2NO + O_2 = 2NO_2$
2. $2NO + Cl_2 = 2NOCl$
3. $2NO + 2SO_2 = 2SO_3 + N_2$

Azot (III) oksidi — N_2O_3 O=N—O—N=O

t — 102°C och ko'k tusli kristall
t — 30°C to'q ko'k tusli suyuqlik
t — 10°C parchalanadi.

$$N_2O_3 \underset{\text{sovutilganda}}{\overset{t^\circ}{\rightleftarrows}} NO + NO_2$$

Kimyoviy xossalari:

1. $N_2O_3 + 2NaOH = 2NaNO_2 + H_2O$
2. $N_2O_3 + H_2O = 2HNO_2$
3. $3HNO_2 \rightarrow HNO_3 + 2NO + H_2O$
4. $2HNO_2 \rightleftarrows NO + NO_2 + H_2O$
5. $2HNO_2 + O_2 \rightarrow 2HNO_3$

Azot(IV) oksid —NO_2— qizg'ish qo'ng'ir rangli gaz, qo'lansa hidli.

$$N_2O_3 \overset{t^\circ}{\rightleftarrows} NO + NO_2$$

Olinishi:

1) $2NO + O_2 = 2NO_2$

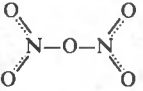
2) $Cu + 4HNO_3 = Cu(NO_3)_2 + 2NO_2\uparrow + 2H_2O$

3) $2Cu(NO_3)_2 \xrightarrow{t^\circ} 2CuO + 4NO_2 + O_2\uparrow$

Kimyoviy xossalari:

1. $2NO_2 \underset{t=-11^\circ C\rightarrow}{\rightleftarrows} N_2O_4$
2. $2NO_2 + H_2O = HNO_2 + HNO_3$
3. $3NO_2 + H_2O \xrightarrow{t^\circ} 2HNO_3 + NO\uparrow$
4. $4NO_2 + O_2 + 2H_2O = 4HNO_3$
5. $2NO_2 + 2NaOH = NaNO_2 + NaNO_3 + H_2O$
6. $SO_2 + NO_2 = SO_3 + NO$
7. $2C + 2NO_2 = 2CO_2 + N_2$
8. $2P + 5NO_2 = P_2O_5 + 5NO$
9. $2NO_2 + O_3 = N_2O_5 + O_2$.

Azot(V) oksid N_2O_5



rangsiz kristall modda, turg'un emas, uy temperaturasida parchalanadi:

$$2N_2O_5 \rightarrow 4NO_2 + O_2$$

Olinishi:

$2HNO_3 + P_2O_5 = 2HPO_3 + N_2O_5$.

Nitrit kislota —HNO_2 — kuchsiz kislota.

Olinishi:

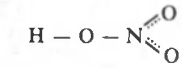
1. $AgNO_2 + HCl = HNO_2 + AgCl$
2. $KNO_2 + H_2SO_4(suyl) \xrightarrow{sovitilganda} KHSO_4 + HNO_2$
3. $N_2O_3 + H_2 \xrightarrow{0^\circ C\,da} 2HNO_2$

Kimyoviy xossalari:

1. $2HNO_2 + O_2 = 2HNO_3$.
2. $2KMnO_4+3H_2SO_4+5HNO_2=K_2SO_4+5HNO_3+2MnSO_4+3H_2O$.
3. $2HJ + 2HNO_2 = J_2 + 2NO + 2H_2O$.
4. $NaOH + HNO_2 = NaNO_2 + H_2O$.
5. $3HNO_2 \overset{t^\circ}{=} HNO_3 + H_2O + 2NO$.
6. $HNO_2 + Cl_2 + H_2O = HNO_3 + 2HCl$.

Nitrat kislota — HNO_3

Rangsiz, tutaydigan, o'tkir hidli suyuqlik.



Olinishi:

1) $4NO_2 + 2H_2O + O_2 = 4HNO_3$

2) $KNO_3(qat) + H_2SO_4(kons) \overset{t^\circ}{=} KHSO_4 + HNO_3$

Kimyoviy xossalari:

1) $KOH + HNO_3 = KNO_3 + H_2O$
2) $CaO + 2HNO_3 = Ca(NO_3)_2 + H_2O$
3) $3P + 5HNO_3 + 2H_2O = 3H_3PO_4 + 5NO\uparrow$
4) $S + 2HNO_3(kons) = H_2SO_4 + 2NO\uparrow$
5) $3C + 4HNO_3(kons) = 3CO_2 + 4NO\uparrow + 2H_2O$
6) $J_2 + 10HNO_3(kons) = 2HJO_3 + 10NO\uparrow + 4H_2O$

Metallar bilan ta'siri:

HNO_3 konsentratsiyasi	Qaytaruvchilar	Mahsulotlar
kons.	Vodoroddan o'ngda turgan Me	NO_2
suyul.	Vodoroddan o'ngdaturgan Me	NO
suyul.	Mg, Ca	N_2O
kuch.suyul.	Co	N_2
J.suyul	Fe, Zn, Al, Sn	

Masalan:

1. $Ag + 2HNO_3(kons) = AgNO_3 + \overset{\nearrow}{NO_2} + H_2O$
2. $3Ag + 4HNO_3(suyul) = 3AgNO_3 + \overset{\nearrow}{NO} + 2H_2O$
3. $4Mg + 10HNO_3(suyul) = 4Mg(NO_3)_2 + NH_4NO_3 + 3H_2O$
4. $FeS_2 + 8HNO_3 = Fe(NO_3)_3 + 2H_2SO_4 + 5NO\uparrow + 2H_2O$
5. $Au + HNO_3 + 4HCl = H[AuCl_4] + NO\uparrow + 2H_2O$
6. $3Pt + 4HNO_3 + 18HCl = 3H_2[PtCl_6] + 4NO\uparrow + 8H_2O$

Nitrat kislota tuzlari olinishi va parchalanishi:

Olinishi:

1. $NaOH + HNO_3 \rightarrow NaNO_3 + H_2O$.
2. $FeO + 2HNO_3 = Fe(NO_3)_2 + H_2O$.
3. $NH_4OH + HNO_3 = NH_4NO_3 + H_2O$.
4. $Cu + 4HNO_3(kons.) = Cu(NO_3)_2 + 2H_2O + 2NO_2$.

Parchalanishi:

$MeNO_3$ → (Li → Mg gacha) $MeNO_2 + O_2$

$MeNO_3$ → (Mg — Cu) $MeO + NO_2 + O_2$

$MeNO_3$ → (Ag — Pt) $Me + NO_2 + O_2$

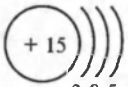
Masalan:

1. $2NaNO_3 \overset{t^\circ}{=} 2NaNO_2 + \overset{\nearrow}{O_2}$
2. $4Fe(NO_3)_2 \overset{t^\circ}{=} 2Fe_2O_3 + 8\overset{\nearrow}{NO_2} + \overset{\nearrow}{O_2}$
3. $2Pb(NO_3)_2 \overset{t^\circ}{=} 2PbO + 4\overset{\nearrow}{NO_2} + \overset{\nearrow}{O_2}$
4. $Hg(NO_3)_2 \overset{t^\circ}{=} Hg + 2\overset{\nearrow}{NO_2} + \overset{\nearrow}{O_2}$
5. $2AgNO_3 \overset{t^\circ}{=} 2Ag + 2\overset{\nearrow}{NO_2} + \overset{\nearrow}{O_2}$
6. . $NH_4NO_3 \overset{t^\circ}{=} \overset{\nearrow}{N_2O} + 2H_2O$
7. . $NH_4NO_3 \overset{t^\circ}{=} \overset{\nearrow}{N_2O} + 2H_2O$

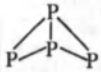
FOSFOR VA UNING BIRIKMALARI

Fosfor P_4

Atom tuzilishi:



$1S^2\ 2S^2\ 2P^6\ 3S^2\ 3P^3$



(tetraedr)

$t_{suyuq} = 44{,}1°C$
$t_{qay} = 282°C.$

Kashf etilishi — fosfor 1669-yilda gamburglik alkimyogar Brand tomonidan kashf etildi.

Fosfor — 3, 0, +3, +5 oksidlanish darajasini namoyon qiladi.

Olinishi:

$Ca_3(PO_4)_2 + 3SiO_2 + 5C \xrightarrow{t°} 3CaSiO_3 + 5CO\uparrow + 2P\uparrow$

Kimyoviy xossalari:

1. Yonishi:
$4P + 5O_2(mo'l) = 2P_2O_5$
$4P + 3O_2(kam) = 2P_2O_3$

2. Xlorlanishi:
$2P + 3Cl_2(kam) = 2PCl_3$
$2P + 5Cl_2(mo'l) = 2PCl_5$

3. Oltingugurt bilan:
$2P + 3S = P_2S_3$

4. Metallar bilan:
$3Mg + 2P = Mg_3P_2$

5. Kislota va ishqorlar bilan:
$3P + 5HNO_3 + 2H_2O = 3H_3PO_4 + 5NO\uparrow$
$4P + 3KOH + 3H_2O = PH_3 + 3KH_2PO_2$

Fosfin — PH_3

Fosfin beqaror birikma: $2P + 3H_2 = 2PH_3$

Olinishi:

1. $Ca_3P_2 + 6H_2O = 3Ca(OH)_2 + 2PH_3\uparrow$
2. $Ca_3P_2 + 6HCl = 3CaCl_2 + 2PH_3\uparrow$
3. $P_4 + 3KOH + 3H_2O = 3KH_2PO_2 + PH_3\uparrow$

Kimyoviy xossalari:

1. $PH_3 + 2J_2 + 2H_2O = H_3PO_2 + 4HJ$
2. $PH_3 + 2O_2 = H_3PO_4$

Fosfor (III) va fosfor (V) oksidlari

$P_2O_3(P_4O_6)$; $P_2O_5(P_4O_{10})$

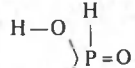
1) Olinishi:

$4P + 3O_2(kam) = 2P_2O_3$

P_2O_3 — oq kristall modda, u havoda oksidlanib P_2O_5 ga o'tadi.

$P_2O_3 + O_2 = P_2O_5$

$P_2O_3 + 3H_2O = 2H_3PO_3$



2) Olinishi:

$4P + 5O_2$ (ko'p) $= 2P_2O_5$;

P_2O_5 — oq kukun modda.

Kimyoviy xossalari:

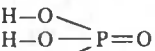
1) $P_2O_5 + H_2O = 2HPO_3$ metafosfat k-ta
2) $P_2O_5 + 3H_2O = 2H_3PO_4$ ortofosfat k-ta
3) $P_2O_5 + 2H_2O = H_4P_2O_7$ pirofosfat k-ta
4) $P_2O_5 + 3CaO = Ca_3(PO_4)_2$
5) $P_2O_5 + 6NaOH = 2Na_3PO_4 + 3H_2O$

$P_2O_5 + 4NaOH = 2Na_2HPO_4 + H_2O$

$P_2O_5 + 2NaOH + H_2O = 2NaH_2PO_4$

6) $P_2O_5 + 2HNO_3 = 2HPO_3 + N_2O_5$

Ortofosfat kislota — H_3PO_4



Olinishi:

1) $Ca_3(PO_4)_2 + 3H_2SO_4 = 3CaSO_4\downarrow + 2H_3PO_4$
2) $3P + 5HNO_3 + 2H_2O = 3H_3PO_4 + 5NO\uparrow$
3) $PCl_5 + 4H_2O = H_3PO_4 + 5HCl$.

Kimyoviy xossalari:

1) $3Ca(OH)_2 + 2H_3PO_4 = Ca_3(PO_4)_2 + 6H_2O$

$Ca(OH)_2 + H_3PO_4 = CaHPO_4 + 2H_2O$

$Ca(OH)_2 + 2H_3PO_4 = Ca(H_2PO_4)_2 + 2H_2O$

2) $3AgNO_3 + Na_3PO_4 = \downarrow Ag_3PO_4 + 3NaNO_3$

$3Ag^+ + PO_4^{3-} = Ag_3PO_4\downarrow$.

Fosfor sulfidlari:

$P_4S_7 + 62HNO_3 = 4H_3PO_4 + 7H_2SO_4 + 62NO_2 + 18H_2O$

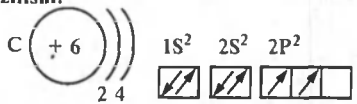
$3P_2S_3 + 28HNO_3 + 4H_2O = 6H_3PO_4 + 9H_2SO_4 + 28NO$

IV GURUHNING ASOSIY GURUHCHA ELEMENTLARI

Uglerod C

Uglerod erkin holda olmos va grafit shaklida uchraydi. Suyuqlanish harorati 3550°C (olmos) qaynashi 4830°C (sublimatlanadi).

Atom tuzilishi:



valentligi: II, III, IV;

oksidlanishda C^{-4}; C; C^{+2}; C^{+4};

Allotropik ko'rinishi: olmos, grafit, karbin.

Uglerod qadimdan insoniyatga ma'lum bo'lgan elementlar qatoriga kiradi.

Kimyoviy xossalari:

Metall va metallmaslar bilan reaksiyasi:

1) $C + O_2 = CO_2$ 2) $2C + O_2(kam) = 2CO$

3) $C + 2F_2 = CF_4$ 4) $Ca + 2C = CaC_2$

5) $4Al + 3C = Al_4C_3$

Murakkab moddalar bilan reaksiyasi.

1) $ZnO + C \overset{t^\circ}{=} Zn + CO$ 2) $2CuO + C \overset{t^\circ}{=} 2Cu + CO_2$

3) $SiO_2 + 2C \overset{t^\circ}{=} Si + 2CO$ 4) $CaO + 3C = CaC_2 + CO$

5) $SiO_2 + 3C(mo'l) = SiC + 2CO$

6) $C + 2H_2SO_4(kons) = CO_2 + 2SO_2 + 2H_2O$

7) $C + 4HNO_3(kons) = CO_2 + 4NO_2 + 2H_2O$

8) $BaSO_4 + 2C \xrightarrow{t^\circ} BaS + 2CO_2$

Uglerod(II) oksid — CO C≡O;
CO (is gazi) — zaharli gaz, rangsiz va hidsiz.
t_{suyuq} — −192°C
t_{qotish} — −205°C
Suvda kam eriydi.

Olinishi:
Laboratoriyada

1) $HCOOH \xrightarrow{H_2SO_4} CO\uparrow + H_2O$

2) $CO + Cl_2 \rightleftarrows COCl_2$

3) $CO_2 + C \overset{t}{\rightleftarrows} 2CO$

Kimyoviy xossalari:

1. $2CO + O_2 = 2CO_2$
2. $CO + Cl_2 \rightleftarrows COCl_2$
3. $CO + 2H_2 - \underset{|}{C} - CH_3OH$
4. $Fe_2O_3 + 3CO \xrightarrow{t^\circ} 2Fe + 3CO_2$
5. $CO + NaOH(suyuq) \xrightarrow{t^\circ} HCOONa$
6. $Ni + 4CO = Ni(CO)_4$
7. $CO + NH_3 = HCN + H_2O$

Uglerod(IV) oksid — CO_2; O = C = O

CO_2 — rangsiz, nafas olish uchun yaroqsiz, havodan 1,5 marta og'ir, idishdan idishga quyiladigan gaz.

Olinishi:
Laboratoriyada

1. $CaCO_3 + 2HCl = CaCl_2 + H_2O + CO_2\uparrow$
2. $NaHCO_3 + HNO_3 = NaNO_3 + H_2O + CO_2\uparrow$

Tuzlarni parchalab olish:

1. $2NaHCO_3 \xrightarrow{t^\circ} Na_2CO_3 + H_2O + CO_2$
2. $CaCO_3 \xrightarrow{t^\circ} CaO + CO_2$

Kimyoviy xossalari:

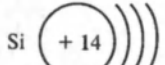
1. $2Mg + CO_2 = 2MgO + C$
2. $CO_2 + H_2O = CH_2O + O$
3. $Na_2O + CO_2 + Na_2CO_3$
4. $Ca(OH)_2 + CO_2 = \downarrow CaCO_3 + H_2O$
5. $Ca(OH)_2 + 2CO_2 = Ca(HCO_3)_2$.
6. $6nCH_2O = (C_6H_{10}O_5)n + nH_2O$
7. $6CO_2 + 6H_2O = C_6H_{12}O_6 + 6O_2$

Karbonat kislota va uning tuzlari:

1. $CO_2 + H_2O \rightleftarrows H_2CO_3 \quad HCO_3^- \rightleftarrows H^+ + CO_3^{2-}$
2. $H_2CO_3 \rightleftarrows H^+ + HCO_3^-$
3. $H_2CO_3 + NaOH = NaHCO_3 + H_2O$
   natriy gidrokarbonat
4. $H_2CO_3 + 2NaOH = Na_2CO_3 + 2H_2O$
   natriy karbonat
5. $Na_2CO_3 + 2HCl = 2NaCl + H_2CO_3(CO_2 + H_2O)$
6. $NaHCO_3$ — sanoatda ammiak usulda olish reaksiyasi:
   $NaCl + NH_3 + CO_2 + H_2O = NaHCO_3 + NH_4Cl$
7. $NH_4HCO_3 = NH_3 + CO_2 + H_2O$
8. $Na_2CO_3 + CO_2 + H_2O = 2NaHCO_3$.

KREMNIY VA UNING BIRIKMALARI

Atom tuzilishi:



$1S^2\ 2S^2\ 2P^6\ 3S^2\ 3P^2$

Valentlik: II; IV.

Oksid. dar.: −4; 0; +4.

Kashf etilishi: kremniy birikmalari avvaldan ma'lum bo'lsa ham, uni 1811-yilda fransuz olimlari Gey-Lyussak va Tenar tomonidan erkin holatda ajratib olindi.

Kremniy — o'ziga xos yaltiroq qattiq modda.
Kris. kremniy suyuq. t° = 1420°C
qay t° = 2355°C.

Olinishi:

1. $SiO_2 + 2Mg = 2MgO + Si$
2. $3SiO_2 + 4Al = 2Al_2O_3 + 3Si$
3. $SiO_2 + 2C = 2CO + Si$
4. $SiH_4 \xrightarrow{t^\circ} Si + 2H_2\uparrow$

Kimyoviy xossalari:

1. $Si + O_2 = SiO_2$
2. $Si + 2Cl_2 = SiCl_4$
3. $Si + 2Br_2 = SiBr_4$
4. $Si + 2F_4 = SiF_4$ — oddiy sharoitda reaksiyaga kirishadi.
5. $SiCl_4 + 2H_2O = SiO_2 + 4HCl$
6. $2Mg + Si = Mg_2Si$(magniy silitsid)
7. $Mg_2Si + 4HCl = 2MgCl_2 + SiH_4$(silan).
8. $SiH_4 + 2O_2 = SiO_2 + 2H_2O$ (havoda oson alangalanadi)
9. $Si + 2NaOH + H_2O = Na_2SiO_3 + 2H_2\uparrow$
10. $3Si + 4HNO_3 + 18HF = 3H_2[SiF_6] + 4NO\uparrow + 8H_2O$

Kremniy(IV) oksidi SiO_2 (atomli kr. panjara)

Olinishi:

Kuchli qizdirganda kremniy havoda yonadi va kremniy (IV) oksid hosil bo'ladi: $Si + O_2 = SiO_2$.
$Na_2SiO_3 + 2HCl = SiO_2 + 2NaCl + H_2O$.

Kimyoviy xossalari:

1. $SiO_2 + 2NaOH = Na_2SiO_3 + H_2O$
2. $SiO_2 + Na_2CO_3 = Na_2SiO_3 + CO_2$
3. $Na_2SiO_3 + CO_2 + H_2O = Na_2CO_3 + H_2SiO_3\downarrow$
4. $Na_2SiO_3 + 2CO_2 + 2H_2O = 2NaHCO_3 + H_2SiO_3$
5. $CaO + SiO_2 = CaSiO_3$
6. $Na_2CO_3 + CaCO_3 + 6SiO_2 = Na_2O \cdot CaO \cdot 6SiO_2 + 2CO_2\uparrow$
7. $SiO_2 + 4HF = SiF_4\uparrow + 2H_2O$.

Qalay va qo'rg'oshin

Olinishi:

1. $SnO_2 + 2C = Sn + 2CO$ $PbS + 2PbO = 3Pb + SO_2$.
2. $PbS + 3O_2 = 2PbO + 2SO_2$

Kimyoviy xossalari:

1. $Sn + O_2 = SnO_2$
2. $Sn + 2Cl_2 = SnCl_4$
3. $Sn + 2S = SnS_2$
4. $Sn + 2HCl = SnCl_2 + H_2\uparrow$
5. $Sn + 4HCl + O_2 = SnCl_4 + 2H_2O$
6. $Sn + 4HNO_3 = H_2SnO_3 + 4NO_2 + H_2O$
7. $Sn + 2KOH + 2H_2O = K_2[Sn(OH)_4] + H_2\uparrow$
8. $Sn + 2KOH + O_2 = K_2SnO_3 + H_2O$
9. $2Pb + O_2 = 2PbO$
10. $Pb + S = PbS$
11. $Pb + Cl_2 = PbCl_2$
12. $3Pb + 8HNO_3 = 3Pb(NO_3)_2 + 2NO + 4H_2O$
13. $Pb + H_2SO_4 + PbSO_4\downarrow + H_2$
14. $Pb + 2HCl = PbCl_2\downarrow + H_2$
15. $Pb + 2NaOH + NaNO_3 = Na_2PbO_2 + NaNO_2 + H_2O$.

I GURUHNING ASOSIY GURUHCHASI

Ishqoriy metallar

Li, Na, K, Rb, Cs — ishqoriy metallar.

Umumiy elekt. pog'onalarda taqsimlanishi:

$...n^1S$

Kashf etilishi: Na va K 1807-yilda ingliz kimyogari G. Devi tomonidan ajratib olindi.

Fizik xossalari: Na met. uchun

$t_{suyuq} = 97,8°C$

$t_{qay} = 883°C$

Simobda erib amalgama hosil qiladi.

Alangani Na^+ — sariq rangga; K^+ — binafsha rangga bo'yaydi.

Olinishi:

1) $2NaCl \xrightarrow{suyuq.} 2Na + Cl_2\uparrow$ $\qquad 2KCl \xrightarrow{suyuq.} 2K + Cl_2\uparrow$

2) $4NaOH \xrightarrow{suyuq.} 4Na + 2H_2O + O_2\uparrow$

Kimyoviy xossalari:

1. $2Na + 2H_2O = 2NaOH + H_2$
2. $4Li + O_2 = 2Li_2O$
3. $2Na + O_2 = Na_2O_2$
4. $K + O_2 = KO_2$
5. $2Na + Cl_2 = 2NaCl$
6. $2Na + S = Na_2S$
7. $6Na + N_2 = 2Na_3N$
8. $2Na + H_2 = 2NaH$

Oksidlari

Olinishi:

1. $Na_2O_2 + 2Na = 2Na_2O$
2. $KO_2 + 3K = 2K_2O$

Kimyoviy xossalari:

1. $Na_2O + H_2O = 2NaOH$
2. $Na_2O + SO_3 = Na_2SO_4$
3. $Na_2O + 2HCl = 2NaCl + H_2O$

Peroksidlar

1. $Na_2O_2 + 2H_2O = 2NaOH + H_2O_2$
2. $2Na_2O_2 + 2CO_2 = 2Na_2CO_3 + O_2$
3. $2K_2O_4 + 2CO_2 = 2K_2CO_3 + 3O_2$;

Gidroksidlar

Olinishi:

1. $2NaCl + 2H_2O \xrightarrow{el.} 2NaOH + H_2\uparrow + Cl_2\uparrow$
2. $Na_2CO_3 + Ba(OH)_2 = BaCO_3\downarrow + 2NaOH$
3. $Na_2CO_3 + CaO + H_2O = CaCO_3 + 2NaOH$
4. $Na_2CO_3 + Ca(OH)_2 = CaCO_3\downarrow + 2NaOH$
5. $Na_2CO_3 + Fe_2O_3 = 2NaFeO_2 + CO_2$

$2NaFeO_2 + H_2O = Fe_2O_3 + 2NaOH$

Kimyoviy xossalari:

1. $2NaOH + CO_2 = Na_2CO_3 + H_2O$
2. $2NaOH + H_2SO_4 = Na_2SO_4 + 2H_2O$

II GURUHNING ASOSIY GURUHCHA ELEMENTLARI

Ishqoriy yer metallar: Be, Mg, Ca, Sr, Ba.

Umumiy elektron pog'anasida taqsimlanishi: ...nS^2

Kashf etilishi: 1808-yilda kalsiy, magniy, stronsiy, bariy Devi tomonidan kashf etildi.

Fizik xossalari: Mg — oq kumushrang metall.

$\rho = 1{,}744$ g/s^3;

Mg $t_{suyuq} = 651°C$ Ca $t_{suyuq} = 838°C$

$t_{qay} = 1080°C$ $t_{qay} = 1480°C$

Olinishi:

1. $MgO + CaC_2 \xrightarrow{1200°C} CaO + Mg + 2C$
2. $MgO + C \xrightarrow{2000°C} Mg + CO$
3. $2MgO + 2CaO + Si \xrightarrow{1200°C} Ca_2SiO_4 + 2Mg$
4. $BeF_2 + Mg \xrightarrow{t°} Be + MgF_2$
5. $3BaO + 2Al \xrightarrow{t°} Al_2O_3 + 3Ba$
6. $MgCl_2 \xrightarrow{suyuq.el} Mg + Cl_2\uparrow$

Kimyoviy xossalari:

1. $2Mg + O_2 = 2MgO$
2. $Mg + Cl_2 = MgCl_2$
3. $3Mg + N_2 = Mg_3N_2$
4. $3Mg + 2P = Mg_3P_2$
5. $2Mg + Si = Mg_2Si$
6. $Mg + H_2O \xrightarrow{t°} MgO + H_2$
7. $3Mg + MoO_3 = 3MgO + Mo$
8. $2Mg + ZrCl_4 = 2MgCl_2 + Zr$
9. $Mg + CO_2 = MgO + CO$
10. $2Mg + CO_2 = 2MgO + C$
11. $Mg + 2HCl = MgCl_2 + H_2$
12. $4Mg + 10HNO_3 = 4Mg(NO_3)_2 + N_2O + 5H_2O$

Umumiy ko'rinishda quyidagicha yozish mumkin:

1. $Me + 2H_2O = Me(OH)_2 + H_2\uparrow$ (berilliydan Be tashqari)
2. $2Me + O_2 = 2MeO$

3. $Ba + O_2 = BaO_2$
4. $Me + Cl_2 = MeCl_2$
5. $Me + S = MeS$
6. $3Me + N_2 = Me_3N_2$
7. $Me + H_2 = MeH_2$
8. $Me + H_2SO_4 = MeSO_4 + H_2\uparrow$
9. $Me + 2HCl = MeCl_2 + H_2$
10. $Be + 2NaOH + 2H_2O = Na_2[Be(OH)_4] + H_2\uparrow$

Oksidlari

Olinishi: 1. $MeCO_3 \xrightarrow{t^\circ} MeO + CO_2$

2. $2Me(NO_3)_2 \xrightarrow{t^\circ} 2MeO + 4NO_2 + O_2$

Kimyoviy xossalari:

1. $MeO + H_2O = Me(OH)_2$ (Me—Mg, Ca, Ba, Sr)
2. $MeO + SO_3 = MeSO_4$
3. $MeO + 2HNO_3 = Me(NO_3)_2 + H_2O$
4. $BeO + 2NaOH + H_2O = Na[Be(OH)_4]$

Gidroksidlari

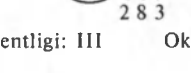
Olinishi: $MeO + H_2O = Me(OH)_2$

Kimyoviy xossalari:

1. $Me(OH)_2 + CO_2 = MeCO_3\downarrow + H_2O$
2. $Mg(OH)_2 + 2CH_3COOH = Mg(CH_3COO)_2 + 2H_2O$
3. $Ba(OH)_2 + Na_2SO_4 = BaSO_4\downarrow + 2NaOH$
4. $Be(OH)_2 + 2NaOH = Na_2[Be(OH)_4]$.

ALUMINIY VA UNING BIRIKMALARI

Atom tuzilishi:



$1S^2\ 2S^2\ 2P^6\ 3S^2\ 3P^1$

Valentligi: III Oksid. daraj: 0; +3;

Kashf etilishi: 1827-yilda nemis kimyogari F. Veler, 1856-yilda fransuz kimyogari Sen-Kler Devil tomonidan elektrokimyoviy usulda ajratib olindi.

Fizik xossalari: oq kumushrang yengil metall, $t_{suyuq} = 660°C$, plastik; elektr o'tkazuvchanligi yaxshi $t_{qaynash} = 2500°C$.

Olinishi:

1. $2Al_2O_3 \xrightarrow{el} 4Al + 3O_2$ (hozirgi vaqtda)
2. $AlCl_3 + 3Na = Al + 3NaCl$ (dastlabki olingan usullardan)

Kimyoviy xossalari:

1. $2Al + 6H_2O = 2Al(OH)_3 + 3H_2\uparrow$
2. $2Al + 6HCl = 2AlCl_3 + 3H_2\uparrow$
3. $2Al + 3H_2SO_4 = Al_2(SO_4)_3 + 3H_2\uparrow$
4. $8Al + 30HNO_3 = 8Al(NO_3)_3 + 3N_2O\uparrow + 15H_2O$
5. $Al + 4HNO_3 = Al(NO_3)_3 + NO\uparrow + 2H_2O$
6. $2Al + 2NaOH + 6H_2O = 2Na[Al(OH)_4] + 3H_2\uparrow$
7. $2Al + 3Br_2 = 2AlBr_3$
8. $4Al + 3O_2 = 2Al_2O_3$
9. $2Al + 3S = Al_2S_3$
10. $2Al + N_2 = 2AlN$
11. $4Al + 3C = Al_4C_3$
12. $8Al + 3Fe_3O_4 = 9Fe + 4Al_2O_3$
13. $2Al + 3Cl_2 = 2AlCl_3$

Oksid Al_2O_3

Olinishi:

1. $4Al + 3O_2 = 2Al_2O_3$
2. $2Al(OH)_3 \xrightarrow{t°} Al_2O_3 + 3H_2O$
3. $4Al(NO_3)_2 \xrightarrow{t°} 2Al_2O_3 + 8NO_2\uparrow + O_2\uparrow$

Kimyoviy xossalari:

1. $Al_2O_3 + 2NaOH = 2NaAlO_2 + H_2O$
2. $Al_2O_3 + 3K_2S_2O_7 = Al_2(SO_4)_3 + 3K_2SO_4$
3. $Al_2O_3 + Na_2CO_3 = 2NaAlO_2 + CO_2$
4. $Al_2O_3 + 6HCl = 2AlCl_3 + 3H_2O$
5. $Al_2O_3 + 2NaOH + 3H_2O = 2Na[Al(OH)_4]$

Gidroksid $Al(OH)_3$

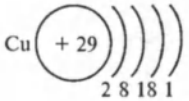
Olinishi:

1. $AlCl_3 + 3NaOH = Al(OH)_3\downarrow + NaCl$
2. $Al_2(SO_4)_3 + 6NH_3 + 6H_2O = 2Al(OH)_3\uparrow + 3(NH_4)_2SO_4$
3. $2Al(NO_3)_3 + 3Na_2CO_3 + 3H_2O = 2Al(OH)_3 + 6NaNO_3 + 3CO_2\uparrow$
4. $Na[Al(OH)_4] + CO_2 = Al(OH)_3 + NaHCO_3$
5. $Al_2S_3 + 6H_2O = 2Al(OH)_3\downarrow + 3H_2S\uparrow$

Kimyoviy xossalari:

1. $Al(OH)_3 + KOH = K[Al(OH)_4]$
2. $Al(OH)_3 + 3HCl = AlCl_3 + 3H_2O$

QO'SHIMCHA GURUHCHA METALLARI MIS VA UNING BIRIKMALARI



$1S^2\ 2S^2\ 2P^6\ 3S^2\ 3P^6\ 3d^{10}\ 4S^1$

Valentligi: I, II

Oksid. dar: 0; +1; +2;

Kashf etilishi: mis insoniyatga qadimdan ma'lum bo'lgan metallardan.

Fizik xossasi: Cu — qizil rangli metall.

$t_{suyuq} = 1083°C$

$t_{qay} = 2877°C.$

Olinishi:

1. $CuSO_4 + Fe = FeSO_4 + Cu$
2. $CuO + H_2 \xrightarrow{t°} Cu + H_2O$
3. $CuO + CO \xrightarrow{t°} Cu + CO_2$

Sanoatda Cu olish reaksiya tenglamalari:

4. $4CuFeS_2 + 13O_2 = 4CuO + 2Fe_2O_3 + 8SO_2$

$2Cu_2S + 3O_2 = 2Cu_2O + 2SO_2$

$2Cu_2O + Cu_2S = 6Cu + SO_2$

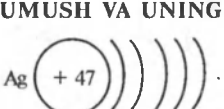
Kimyoviy xossalari:

1. $Cu + 2H_2SO_4(kons) = CuSO_4 + SO_2\uparrow + 2H_2O$
2. $Cu + 4HNO_3(kons) = Cu(NO_3)_2 + 2NO_2\uparrow + 2H_2O$
3. $3Cu + 8HNO_3(suyul) = 3Cu(NO_3)_2) + 2NO\uparrow + 4H_2O$
4. $2Cu + O_2 = 2CuO$
5. $Cu + Cl_2 = CuCl_2$
6. $CuCl_2 + Cu = 2CuCl$
7. $Cu + S = CuS$

Birikmalari:

1. $CuCl_2 + 2NH_3 = [Cu(NH_3)_2]Cl_2$
2. $CuSO_4 + 2NaOH = Cu(OH)_2\uparrow + Na_2SO_4$
3. $Cu(OH)_2 \overset{t^\circ}{=} CuO + H_2O$
4. $Cu(OH)_2 + H_2SO_4 = CuSO_4 + 2H_2O$
5. $Cu(OH)_2 + 4NH_3 = [Cu(NH_3)_4](OH)_2$
6. $CuO + H_2SO_4 = CuSO_4 + H_2O$
7. $CuO + SO_3 = CuSO_4$
8. $CuSO_4 + 2NaOH = Cu(OH)_2\downarrow + Na_2SO_4$
9. $Cu(OH)_2 + 2NaOH = Na_2[Cu(OH)_4]$
10. $Cu_2O + H_2SO_4 = CuSO_4 + Cu + H_2O$
11. $Cu_2O + 2HCl = 2CuCl + H_2O$
12. $2CuSO_4 + 4KJ = 2K_2SO_4 + Cu_2J_2 + J_2$
13. $CH \equiv CH + 2CuCl = Cu_2C_2 + 2HCl$

KUMUSH VA UNING BIRIKMALARI



$\ldots\ldots 4d^{10}\ 5S^1$;

Valentligi: I

Oksid. daraj: 0; +1;

Kashf etilishi: Ag ham qadimdan ma'lum bo'lgan metallardan.

Fizik xossalari: Ag — o'ziga xos yaltiroq metall.

$t_{suyul.} = 960{,}8^\circ C$; $t_{qay} = 2163^\circ C$; $\rho = 10{,}5\,g/sm^3$;

Olinishi: $2AgNO_3 + Cu = 2Ag + Cu(NO_3)_2$

Kimyoviy xossalari:

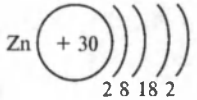
1. $Ag + 2HNO_3 = AgNO_3 + NO_2\uparrow + H_2O$
2. $2Ag + 2H_2SO_4 = Ag_2SO_4 + SO_2\uparrow + 2H_2O$
3. $3Ag + 4HNO_3(suyul) = 3AgNO_3 + NO\uparrow + 2H_2O$

Birikmalari:

1. $Ag_2O + 4NH_4OH = 2[Ag(NH_3)_2]OH + 3H_2O$
2. $2AgNO_3 \overset{t^\circ}{=} 2Ag + 2NO_2 + O_2$
3. $2AgNO_3 + 2NaOH = Ag_2O + 2NaNO_3 + H_2O$
4. $2Ag_2O \overset{t^\circ}{=} 4Ag + O_2$
5. $AgCl + 2NH_3 = [Ag(NH_3)_2]Cl$
6. $Ag^+ + Hal^-$ — AgF — suvda eriydi.
   AgCl — oq cho'kma (ammiak va natriy tiosulfatda eriydi)
   AgBr — och sariq cho'kma
   AgJ — sariq cho'kma

7. $AgNO_3$ ning ammiakdagi eritmasi asetilen bilan reaksiyaga kirishadi: $2AgNO_3 + CH \equiv CH \rightarrow Ag_2C_2 + 2HNO_3$.

RUX — Zn



$\underline{\ldots\ldots 3d^{10}\ 4S^2;}$

Valentligi: II

Oksid. daraj: 0; +2;

Kashf etilishi: qotishmalari qadimdan ma'lum edi. XVIII asrga kelib toza holatda ajratib olingan.

Fizik xossalari: Zn — ko'k tusli oq metall, metall yaltiroqligiga ega. Havoda oksid parda hosil qiladi.

t_{suyuq} — +419,5°C; t_{qay} — +913°C. $\rho = 7{,}13$ g/sm^3.

Olinishi: $2ZnO + C \overset{t^\circ}{=} 2Zn + CO_2$

Kimyoviy xossalari:

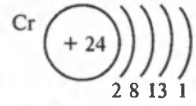
1. $Zn + 2HCl = ZnCl_2 + H_2\uparrow$
2. $Zn + 2NaOH + 2H_2O = Na_2[Zn(OH)_4] + H_2\uparrow$
3. $2Zn + O_2 = 2ZnO$
4. $Zn + CuSO_4 = ZnSO_4 + Cu$
5. $Zn + CdSO_4 = ZnSO_4 + Cd$
6. $Zn + 4NH_4OH = [Zn(NH_3)_4](OH)_2 + H_2 + 2H_2O$
7. $8Zn + 11H_2SO_4 = 8ZnSO_4 + H_2S + SO_2 + S + 10H_2O$

Birikmalari:

1. $ZnO + H_2SO_4 = ZnSO_4 + H_2O$
2. $ZnO + 2NaOH + H_2O = Na_2[Zn(OH)_4]$
3. $Zn(OH)_2 + 2HNO_3 = Zn(NO_3)_2 + 2H_2O$
4. $Zn(OH)_2 + 2NaOH = Na_2[Zn(OH)_4]$
5. $ZnO + CaO = CaZnO_2$
6. $ZnO + SiO_2 = ZnSiO_3$
7. $ZnS + 2HCl = ZnCl_2 + H_2S$
8. $ZnSO_4 + BaS = BaSO_4 + ZnS$.

XROM VA UNING BIRIKMALARI

Atom tuzilishi:



$1S^2\ 2S^2\ 2P^6\ 3S^2\ 3P^6\ 3d^5\ 4S^1$

Valentligi: II, III, VI. Oksid. dar. 0; +2; +3; +6;

Kashf etilishi: 1797-yilda Vokelen tomonidan kashf etildi.

Fizik xossalari: Xrom — juda qattiq, oq yaltiroq metall. $\rho = 7{,}2\ g/sm^3$; $t_{suyuq} = 1903°C$, $t_{qay} = 2570°C$.

Havo yuzasida oksid parda hosil qiladi.

Olinishi:

$$Cr_2O_3 + 2Al \xrightleftharpoons{t^\circ} Al_2O_3 + 2Cr$$

Kimyoviy xossalari:

1. $Cr + 2HCl = CrCl_2 + H_2\uparrow$
2. $2Cr + 6H_2SO_4(kons) \xrightarrow{t^\circ} Cr_2(SO_4)_3 + 3SO_2\uparrow + 6H_2O$
3. $Cr + 6HNO_3(kons) \xrightarrow{t^\circ} Cr(NO_3)_3 + 3NO_2 + 3H_2O$
4. $4Cr + 12HCl + 3O_2 = 4CrCl_3 + 6H_2O$
5. $4Cr + 3O_2 = 2Cr_2O_3$
6. $2Cr + 3Cl_2 = 2CrCl_3$
7. $2Cr + 3S = Cr_2S_3$
8. $2Cr + N_2 = 2CrN$

Xrom birikmalarining xossalari

1. Asoslarining xossalari: $Cr(OH)_2$ — sarg'ish rangli, suvda yomon eriydi.

1. $Cr(OH)_2 + 2HCl = CrCl_2 + 2H_2O$
2. $2Cr(OH)_3 + 3H_2SO_4 = Cr_2(SO_4)_3 + 6H_2O$
3. $Cr(OH)_3 + KOH = K[Cr(OH)_4]$ $Cr(OH)_3$ — kulrang-yashil rangli modda.
4. $2Cr(OH)_3 = Cr_2O_3 + 3H_2O$
5. $2Cr(OH)_3 + 3Cl_2 + 10KOH = 2K_2CrO_4 + 6KCl + 8H_2O$

2. Oksidlarining xossalari: CrO — tiniq qizil rangli qattiq modda. Cr_2O_3 — to'q yashil rangli kukunsimon modda. CrO_2 — to'q qizil kristall modda.

1. $Cr_2O_3 + 6HCl = 2CrCl_3 + 3H_2O$
2. $Cr_2O_3 + 2NaOH = 2NaCrO_2 + H_2O\uparrow$
3. $CrO_3 + 2KOH = K_2CrO_4 + H_2O$
4. $Cr_2O_3 + Na_2CO_3 = 2NaCrO_2 + CO_2$
5. $4CrO_3 + C_2H_5OH + 6H_2SO_4 = 2Cr_2(SO_4)_3 + 2CO_2 + 9H_2O$

3. Oksidlarining olinishi:

1. $2K_2Cr_2O_7 + 3C = 2Cr_2O_3 + 2K_2CO_3 + CO_2$
2. $K_2Cr_2O_7 + S = Cr_2O_3 + K_2SO_4$
3. $(NH_4)_2Cr_2O_7 = Cr_2O_3 + N_2 + 4H_2O$

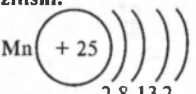
4. Tuzlarining xossalari:

1. $CrCl_2 + 2NaOH = Cr(OH)_2\downarrow + 2NaCl$
2. $Cr_2(SO_4)_3 + 6NaOH = 2Cr(OH)_3\downarrow + 3Na_2SO_4$
3. $CrCl_3 + 4NaOH = Na[Cr(OH)_4] + 3NaCl$
4. $2K_2CrO_4 + H_2SO_4 = K_2Cr_2O_7 + K_2SO_4 + H_2O$

5. $K_2CrO_4 + BaCl_2 = BaCrO_4\downarrow + 2KCl$
6. $K_2Cr_2O_7 + 2KOH = 2K_2CrO_4 + H_2O$
7. $K_2Cr_2O_7 + 14HCl = 3Cl_2 + 2KCl + 2CrCl_3 + 7H_2O$

MARGANES VA UNING BIRIKMALARI

Atom tuzilishi:



$\ldots\ldots 3d^5 4S^2$;

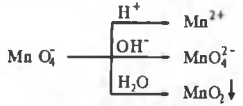
Valentligi: II, III, IV, VI, VII.
Oksid. dar: 0; +2; +3; +4; +6; +7.
Kashf etilishi: 1774-yilda Sheele va Ganlar olishgan.
Fizik xossalari: marganes — qattiq, oq-kumushrang metall.
$\rho = 7{,}2$ g/sm^3; $t_{suyul} = 1260°C$; $t_{qay} = 2120°C$
Olinishi:
1. $2MnO + C = 2Mn + CO_2$
2. $3MnO_2 = M_3O_4 + O_2$
   $3Mn_3O_4 + 8Al = 9Mn + 4Al_2O_3$
3. $Fe_2O_3 + MnO_2 + 5C = 2Fe + Mn + 5CO$.

Kimyoviy xossalari:
1. $Mn + H_2SO_4(suyul) = MnSO_4 + H_2\uparrow$
2. $Mn + 2H_2SO_4(kons) = MnSO_4 + SO_2 + 2H_2O$
3. $Mn + 4HNO_3(kons) = Mn(NO_3)_2 + 2NO_2 + 2H_2O$
4. $3Mn + 8HNO_3(suyul) = 3Mn(NO_3)_2 + 2NO + 4H_2O$
5. $3Mn + Fe_2O_3 = 3MnO + 2Fe$.

Marganesning kislorodli birikmalari:
1. $MnSO_4 + Ba(NO_3)_2 = BaSO_4\downarrow + Mn(NO_3)_2$
2. $Mn(NO_3)_2 \xrightarrow{t°} MnO_2 + 2NO_2$
3. $MnO_2 + 4HCl = MnCl_2 + Cl_2\uparrow + 2H_2O$
4. $H_2SO_3 + 2KMnO_4 + 4KOH = 2K_2MnO_4 + K_2SO_4 + 3H_2O$
5. $Mn_2O_7 + 2KOH = 2KMnO_4 + H_2O$
6. $MnO + SO_3 = MnSO_4$
7. $MnO + H_2SO_4 = MnSO_4 + H_2O$
8. $MnCl_2 + 2NaOH = Mn(OH)_2 + 2NaCl$
9. $Mn(OH)_2 + SO_3 = MnSO_4 + H_2O$

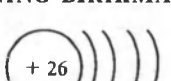
10. $Mn(OH)_2 + H_2SO_4 = MnSO_4 + 2H_2O$
11. $2Mn(OH)_2 + O_2 + 2H_2O = 2Mn(OH)_4$
12. $Mn(NO_3)_2 + PbO_2 = MnO_2 + Pb(NO_3)_2$
13. $2MnO_2 + 2H_2SO_4 = 2MnSO_4 + O_2 + 2H_2O$
14. $2KMnO_4 \xrightarrow{t^\circ} K_2MnO_4 + MnO_2 + O_2\uparrow$

MnO_4^- — permanganat ionining muhit ta'sirida o'zgarishi:



TEMIR VA UNING BIRIKMALARI

Atom tuzilishi:
Valentligi: II, III.
Oksid. daraj.: +2; +3; +6;



..... $3d^6\ 4s^2$;

Kashf etilishi: Temir insoniyatga qadimdan ma'lum bo'lgan metallardan hisoblanadi.

Fizik xossalari: Toza temir — kumushrang oq metall.
t_{suyuq} — +1534,8°C, $t_{qayn.}$ — −2770°C

Olinishi: temir tabiatda erkin holatda meteorit shaklida uchraydi, boshqa holatda birikma holda bo'ladi.

1. $FeO + C \xrightarrow{t^\circ} Fe + CO$ 2. $Fe_2O_3 + 3CO \xrightarrow{t^\circ} 2Fe + 3CO_2$

Kimyoviy xossalari:

1. Oddiy moddalar bilan:

1. $2Fe + 3Cl_2 = 2FeCl_3$	temir(III) xlorid
2. $3Fe + 2O_2 = Fe_3O_4$	temir kuyundisi
3. $3Fe + C = Fe_3C$	temir karbid
4. $Fe + S = FeS$	temir(II) sulfid
5. $2Fe + N_2 = 2FeN$	temir(III) nitridi.

2. Murakkab moddalar bilan:

1. $Fe + 3O_2 + 6H_2O = 4Fe(OH)_3$
2. $Fe + 2HCl = FeCl_2 + H_2$
3. $Fe + 6H_2SO_4(kons) = Fe_2(SO_4)_3 + 3SO_2\uparrow + 6H_2O$
4. $Fe + 4HNO_3(suyul) = Fe(NO_3)_3 + NO + 2H_2O$
5. $Fe + CuSO_4 = FeSO_4 + Cu$

3. Oksidlarining xossalari:

1. $FeO + H_2SO_4 = FeSO_4 + H_2O$
2. $3FeO + 10HNO_3 = 3Fe(NO_3)_3 + NO + 5H_2O$
3. $Fe_2O_3 + CO = 2FeO + CO_2$
4. $6Fe_2O_3 = 4Fe_3O_4 + O_2$
5. $Fe_2O_3 + Na_2CO_3 = 2NaFeO_2 + CO_2$
6. $Fe_2O_3 + 6HCl = 2FeCl_3 + 3H_2O$
7. $Fe_2O_3 + 3H_2 = 2Fe + 3H_2O$

Asoslarining xossalari:

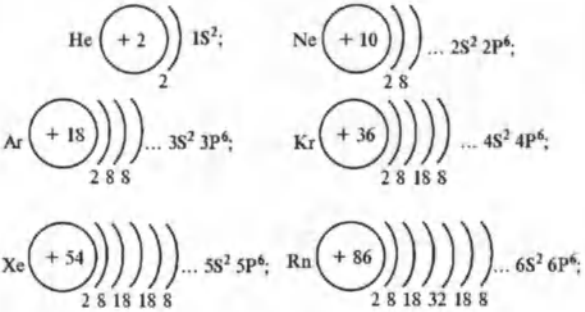
1. $4Fe(OH)_2 + O_2 + 2H_2O = 4Fe(OH)_3$
2. $Fe(OH)_2 + H_2SO_4 = FeSO_4 + 3H_2O$
3. $Fe(OH)_2 \xrightarrow{t^\circ} FeO + H_2O$
4. $Fe(OH)_3 + 3HCl = FeCl_3 + 3H_2O$
5. $2Fe(OH)_3 \xrightarrow{t^\circ} Fe_2O_3 + 3H_2O$

Tuzlarining xossalari:

1. $FeSO_4 + 2NaOH = Fe(OH)_2\downarrow + Na_2SO_4$
2. $3Fe(NO_3)_2 + 4HNO_3 = 3Fe(NO_3)_3 + NO + 2H_2O$
3. $FeCl_2 + 6KCN = K_4[Fe(CN)_6] + 2KCl$
4. $FeCl_2 + K_3[Fe(CN)_6] = KFe[Fe(CN)_6]\downarrow + 2KCl$
5. $4FeS_2 + 11O_2 = 2Fe_2O_3 + 8SO_2$
6. $FeCl_3 + 3NaOH = Fe(OH)_3\downarrow + 3NaCl$
7. $2FeCl_3 + H_2S = S + 2FeCl_2 + 2HCl$
8. $FeCl_3 + K_4[Fe(CN)_6] = KFe[Fe(CN)_6]\downarrow + 3KCl$
9. $2NaFeO_2 + H_2O = Fe_2O_3 + 2NaOH$
10. $2FeCl_3 + 2KJ = 2FeCl_2 + J_2 + 2KCl$
11. $2FeCl_3 + Fe = 3FeCl_2$
12. $FeCl_3 + 3KSCN = Fe(SCN)_3 + 3KCl$
13. $FeCl_2 + H_2 = Fe + 2HCl$

NODIR GAZLAR

Atom tuzilishi: He, Ne, Ar, Kr, Xe, Rn.



Kashf etilishi:

He — fransuz astronomi Jansen tomonidan quyoshni spektr analizi vaqtida 1868-yilda Hindistonda kashf etildi.

Ar — 1894-yil Ramzay va Reele tomonidan atmosfera azotidan ajratib oldilar.

Ne — 1898-yilda Ramzay va Travers tomonidan havodan ajratib olindi, yangi degan ma'noni beradi.

Kr — 1898-yilda Ramzay va Travers tomonidan havodan ajratib olinadi («yashirin» degan ma'noni beradi).

Xe — 1898-yilda Ramzay va Travers havodan ajratib oldilar («begona» degan ma'noni beradi).

Rn — 1900-y. F. Dorn tomonidan kashf etildi, 1908-yilda Ramzay va Freyem tomonidan ajratib olindi (uning nomi Ra^{226} izotopining α parchalanishidan Rn^{222} izotopi hosil bo'lishi bilan bog'liq).

F. Xossalari: gazlar rangsiz bo'lib, molekulasi 1 ta atomdan iborat. 20°C da 1 *l* suvda 8,8 ml He, 10,4 ml Ne, 33,6 *l* Ar eriydi. Bu gazlar elektr o'tkazuvchanligi va elektr uchqunida har xil rangga kirishi bilan ajralib turadi: He — sariq,

Ne — qizil, Ar — ko'k, Kr — yashil, Xe — binafsha, Rn — oq-yaltiroq rang beradi.

	He	Ne	Ar	Kr	Xe	Rn
t_{qay}	-268,98	-246,03	-185,87	-152,9	-107,1	-65
	-272,1	-248,6	-189,4	-156,6	-111,5	-71

Olinishi: He tabiiy gazdan, He va Ne — havodan, bunda ularning suyuq havoning aktivlangan ko'mirga kam adsorblanish xossasidan foydalaniladi. Ar — havodan olinadi. Rn — Ra ning radioaktiv parchalanishidan olinadi.

Kimyoviy xossalari:

1. He, Ne, Ar ning kimyoviy birikmalari olingan emas.
2. 1962-yilda Bartlett $Xe[PtF_6]$ birikmasini oladi, shundan keyin ksenon kimyosi rivojlanadi:

1. $Xe + PtF_6 = Xe[PtF_6]$
2. $2Xe[PtF_6] + 6H_2O = 2Xe + O_2 + 2PtO_2 + 12HF$
3. $Xe + F_2 = XeF_2$
4. $2XeF_2 + 4KOH = 2Xe + 4KF + O_2 + 2H_2O$
5. $Xe + 2F_2 = XeF_4$
6. $XeF_4 + Pt = PtF_4 + Xe$
7. $XeF_4 + 2Hg = 2HgF_2 + Xe$
8. $6XeF_4 + 12H_2O = 2XeO_3 + 24HF + 4Xe + 3O_2$
9. $Xe + 3F_2 = XeF_6$
10. $SiO_2 + 2XeF_6 = 2XeOF_4 + SiF_4$
11. $XeF_6 + H_2O = XeOF_4 + 2HF$
12. $XeO_3 + H_2O \rightleftarrows H_2XeO_4$
13. $XeO_3 + O_3 + 4NaOH = Na_4XeO_6 + O_2 + 2H_2O$
14. $Ba_2XeO_6 + 2H_2SO_4 = 2BaSO_4 + XeO_4 + 2H_2O$
15. $XeF_6 + 3H_2O \xrightarrow{\text{sovuq holda}} XeO_3 + 6HF$
16. $3XeO_4 = 2XeO_3 + Xe + 3O_2$

ORGANIK KIMYO

Organik kimyo — uglerod birikmalari va ularning o'zgarishlarini o'rganadi.

M. Butlerovning organik moddalar tuzilish nazariyasi.

1. Organik moddalar molekulasini hosil qilgan hamma atomlar o'z valentliklariga muvofiq ravishda ma'lum izchillikda birikadi.

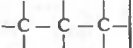
2. Moddalarning xossalari molekulalar tarkibiga qanday atomlar va qancha atom kirishigagina emas, balki molekula bu atomlarning qanday tartibda birikkanligiga ham bog'liq bo'ladi.

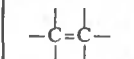
3. Berilgan moddalarning xossalariga ko'ra uning molekula tuzilishini aniqlash, molekulasining tuzilishidan esa uning xossalarini oldindan aytish mumkin.

4. Modda molekulasidagi atomlar va atomlar guruhi o'zaro bir-biriga ta'sir etadi.

Izomeriya — bir necha moddalarning tarkibi hamda molekula massasi bir xil bo'lib, lekin molekulalarining tuzilishi bilan farqlanadigan hodisadir.

UGLEVODORODLAR

№	Nomi	Umumiy formulasi	Tuzilishi	Burchak	Gibrid	Atom masofasi	Izomer
1	2	3	4	5	6	7	8
1	To'yingan uglevodorod	C_2H_{2n+2}		109°28'	sp^3	1,54°A	

1	2	3	4	5	6	7	8
2	Sikloparafin	C_nH_{2n}		109°28'	sp^3	1,54°A	izomer
3	To'yinmagan uglevodorod a) etilen qatori b) diyen qatori c) asetilen qatori	C_nH_{2n} C_nH_{2n-2} C_nH_{2n-2}		120° 120° 180°	sp^2 sp^2 sp	1,33°A 1,34°A 1,2°A	izomer
4	Aromatik uglevodorod	C_6H_{2n-6}		120°	sp^2	1,39°A	

To'yingan uglevodorodlar (alkanlar, parafinlar)

1. Gomologik qatori, tuzilishi, nomlanishi:

Emperik formula	Nomi	Radikali	Nomi
CH_4	metan	CH_3—	metil
C_2H_6	etan	C_2H_5—	etil
C_3H_8	propan	C_3H_7—	propil
C_4H_{10}	butan	C_4H_9—	butil
C_5H_{12}	pentan	C_5H_{11}—	pentil
C_6H_{14}	geksan	C_6H_{13}—	geksil
C_7H_{16}	geptan	C_7H_{15}—	geptil
C_8H_{18}	oktan	C_8H_{17}—	oktil
C_9H_{20}	nonan	C_9H_{19}—	nonil
$C_{10}H_{22}$	dekan	$C_{10}H_{21}$—	desil

METAN

Fizik xossalari: rangsiz, hidsiz gaz, havodan yengil, suvda yomon eriydi. Tabiiy gazning 90—80%ni tashkil etadi, yo'ldosh gazlar tarkibiga kiradi. «Botqoqlik gazi» ham deyiladi.

Olinishi (laboratoriyada):

1) $CH_3COONa + NaOH \xrightarrow{t^\circ} CH_4 + Na_2CO_3$

2) $Al_4C_3 + 12H_2O \rightarrow 3CH_4 + 4Al(OH)_4$

Umumiy olinishi:

1) $CH_2 = CH_2 + H_2 \xrightarrow{Ni,\ t^\circ} CH_3 - CH_3$

2) Vyurs reaksiyasi: $2RBr + 2Na \rightarrow R - R + 2NaBr$

3) Orlov—Fisher—Tropsh sintezi:

$nCO + (2n + 1)H_2 \xrightarrow{Ni,\ t^\circ} C_nH_{2n+2} + nH_2O$

Kimyoviy xossalari:

1) $CH_4 + Cl_2 \xrightarrow{h\nu} CH_3Cl + HCl$

2) Konovalov reaksiyasi: $CH_4 + HNO_{3(suyul.)} \xrightarrow{t^\circ} CH_3 - NO_2 + H_2O$

3) $CH_3 - CH_2 - CH_2 - CH_3 \xrightarrow{AlCl_3} CH_3 - \underset{\displaystyle CH_3}{\underset{|}{C}}H_2 - CH_3$

4) Kreking:

$C_8H_{18} \xrightarrow{t^\circ} C_4H_{10} + C_4H_8$

5) $2CH_4 \xrightarrow{t^\circ} C_2H_2 + 3H_2$

6) $2C_4H_{10} + 5O_2 \xrightarrow{t^\circ} 4CH_3COOH + 2H_2O$

7) *Umumiy yonish tenglamasi:*

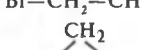
$C_nH_{2n+2} + \frac{3n+1}{2}O_2 \rightarrow nCO_2 + (n+1)H_2O$

8) $CH_4 \xrightarrow{O_2} CH_3OH \xrightarrow[-H_2O]{O_2} H\ \ CHO$

SIKLOPARAFINLAR

Olinishi: Sukloparafinlar — yopiq zanjirli to'yingan uglevodorodlar.

1) $Br-CH_2-CH_2-CH_2-Br + Zn \rightarrow$

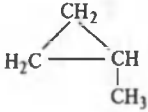


$+ZnBr_2$

2) $Br-(CH_2)_n-Br + Mg \xrightarrow{t^\circ} C_nH_{2n} + MgBr_2$

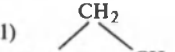
3) $C_6H_6 + 3H_2 \xrightarrow{Pt} C_6H_{12}$

4) $CH_3-\underset{\displaystyle Br}{\underset{|}{CH}}-CH_2-CH_2-Br + Zn \rightarrow$

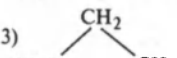


$+ZnBr_2$

Kimyoviy xossalari:

1)  $+Br_2 \rightarrow Br-CH_2-CH_2-CH_2-Br$

2)  $+H_2 \xrightarrow{50\ 70^\circ C,\ Pt} CH_3-CH_2-CH_3$

3)  $+HBr \rightarrow CH_3-CH_2-CH_2Br$

4) $C_5H_{10} + H_2 \xrightarrow{350^\circ C,\ Pt} C_5H_{12}$

siklopentan — pentan

5) $C_6H_{12} \xrightarrow{Ni,\ t} C_6H_6 + 3H_2$

6) $C_6H_{12} + Cl_2 \xrightarrow{h\nu} C_6H_{11}Cl + HCl$

Sintez — gaz — $CO + 2H_2$; (suv gazi)

Xloroform — $CHCl_3$

Yodoform — CHJ_3 (tibbiyotda ishlatiladi)

To'yinmagan uglevodorodlar (alkenlar, alkadiyenlar va alkenlar)

Molekulalarida uglerod atomlari qo'shbog' yoki uchbog' orqali bog'langan uglevodorodlar — to'yingan uglevodorodlardir.

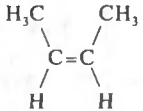
Alkenlar

C_2H_4 $CH_2=CH_2$ etilen(eten)

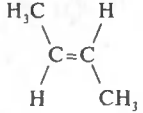
C_3H_6 $CH_3-CH=CH_2$ propilen (propen)

C_4H_8 $CH_3-CH_2-CH=CH_2$ buten — 1.

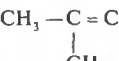
$CH_3-CH=CH-CH_3$ buten — 2.



buten-2 (sis)



buten-2 (trans.)



2-metil propen

Fizik xossalari. Etilen — rangsiz gaz, deyarli hidsiz, havodan biroz yengil, suvda yomon eriydi. Propilen va butenlar ham normal sharoitlarda gaz holatida, penten C_5H_{10} dan boshlab $C_{18}H_{36}$ oktadesengacha suyuqliklar, $C_{19}H_{38}$ — nonodesendan esa qattiq moddalardir.

Olinishi:

1. $C_2H_5OH \xrightarrow{t>140°C,\ H_2SO_4(kons)} H_2C=CH_2+H_2O$
2. $2CH_4 \xrightarrow{550\ \ 650°C,\ (kons)} C_2H_4+2H_2$
3. $CH_3-CH_3 \rightarrow CH_2=CH_2+H_2$
4. $CH_2Br-CHBr-CH_3+Zn \rightarrow H_2C=CH-CH_3+ZnBr_2$
5. $CH_3-\underset{\boxed{OH}}{CH}-\underset{\boxed{H}}{CH_2}+KOH_{(spirt)} \xrightarrow{t} H_2C=$

$=CH-CH_3+KCl+H_2O$

6. Etilen sanoatda tabiiy gazdan hamda neftning krekingi va pirolizi jarayonlaridan olinadi.

Kimyoviy xossalari:

1. $H_2C = CH_2 + Br_2 \rightarrow CH_2Br-CH_2Br$
2. $H_2C = CH_2 + H_2 \xrightarrow{t,\ kam.} H_3C-CH_3$
3. $H_2C = CH_2 + H_2O \xrightarrow{H_2SO_4 \text{ yoki } H_3PO_4} H_3C-CH_2OH$
4. $H_2C = CH_2 + HBr \rightarrow CH_3-CH_2Br$

5. Marovnikov qoidasi: vodorod ko'p gidrogenlangan, galogen atomi esa kam gidrogenlangan uglerod atomiga birikadi:

$H_2C = CH-CH_3 + HBr \rightarrow CH_3-CHBr-CH_3$

6. $3CH_2 = CH_2 + 4H_2O \xrightarrow{2KMnO_4} 3HO-CH_2-CH_2-OH + 2MnO_2 + 2KOH$
7. $2CH_2 = CH_2 + O_2 \xrightarrow{150\ \ 350°C,\ kat} 2CH_2-CH_2$ (O)
8. $nCH_2 = CH_2 \xrightarrow{kat} (-CH_2-CH_2-)n$

Diyen uglevodorodlar(alkadiyenlar)

Alkadienlar (dien uglevodorodlar) — tarkibida ikkita qo'shbog' tutgan to'yinmagan uglevodorodlar.

1. C_4H_6 $H_2C = CH-CH = CH_2$ butadiyen — 1,3.
2. C_5H_8 $H_2C = \underset{\displaystyle CH_3}{\underset{|}{C}}H-CH = CH_2$ 2 metil butadiyen — 1,3.

Fizik xossalari. 1,3 butadiyen n.sh. da gaz, −4,5°C da suyuqlanadi. 2-metil 1,3 butadiyen uchuvchan suyuqlik, 34,1°C temperaturada qaynaydi.

Olinishi:

1) $2CH_3-CH_2-OH \xrightarrow{425°C,\ Al_2O_3ZnO} CH_2 = CH-CH = CH_2 + 2H_2O + H_2$

2) $C_4H_8 \xrightarrow{500\ \ 600°C,\ MgO} CH_2 = CH-CH = CH_2 + H_2$

3) $CH_3-\underset{\displaystyle CH_3}{\underset{|}{C}}H-CH_2-CH_3 \xrightarrow{t,\ Cr_2O_3,\ Al_2O_3} CH_2-\underset{\displaystyle CH_3}{\underset{|}{C}}-CH=CH_3 + 2H_2$

$= CH_3 + 2H_2$

Kimyoviy xossalari:

1. $CH_2=CH-CH=CH_2 + Br_2 \rightarrow CH_2Br-CH=CH-CH_2Br$
2. $CH_2Br-CH=CH-CH_2Br + Br_2 \rightarrow CH_2Br-CHBr-CHBr-CH_2Br$
3. $nCH_2=CH-CH=CH_2 \xrightarrow{H^+} (-CH_2-CH=CH-CH_2-)_n$
4. $CH_2=\underset{\displaystyle CH_3}{\overset{\displaystyle |}{C}}-CH=CH_2 \xrightarrow{H^+} \left(-CH_2-\underset{\displaystyle CH_3}{\overset{\displaystyle |}{C}}-CH-CH_2-\right)_n$

Asetilen qatori uglevodorodlar (alkinlar)

Molekulasida bitta ugbog' tutgan uglevodorodlar alkiplar deyiladi.

1. C_2H_2 $H-C\equiv C-H$ asetilen (etin)
2. C_3H_4 $CH_3-C\equiv C-H$ propin
3. C_4H_6 $CH_3-CH_2-C\equiv CH$ butin-1
4. C_4H_6 $CH_3-C\equiv C-CH_3$ butin-2

Fizik xossalari: asetilen havodan yengil gaz, suvda kam eriydi, toza holda deyarli hidsiz.

Olinishi:

1. $CaC_2 + 2H_2O \rightarrow \downarrow Ca(OH)_2 + C_2H_2$
2. $2CH_4 \xrightarrow{1500^\circ C} C_2H_2 + 3H_2$
3. $R-CH_2-CBr_2-R' + 2KOH \xrightarrow{C_2H_5OH} R-C\equiv C-R' + 2KBr + 2H_2O$
4. $R-C\equiv C-Na + Br-R' \rightarrow R-C\equiv C-R' + NaBr$

Kimyoviy xossalari:

1. $HC\equiv CH + H_2 \xrightarrow{t,\,kat} H_2C=CH_2$

$H_2C=CH_2 + H_2 \xrightarrow{t,\,kat} H_3C-CH_3$

2. Kucherov reaksiyasi: $HC\equiv CH + H-OH \xrightarrow{HgSO_4} CH_3-CHO$
3. $HC\equiv CH + HCl \rightarrow CH_2=CHCl$
4. $CH_2=\underset{\displaystyle Cl}{\overset{\displaystyle |}{C}}H + CH_2=\underset{\displaystyle Cl}{\overset{\displaystyle |}{C}}H \ldots \rightarrow (-CH_2-\underset{\displaystyle Cl}{\overset{\displaystyle |}{C}}H-)_n$

5. $2C_2H_2 + 5O_2 \rightarrow 4CO_2 + 2H_2O$

6. $HC \equiv CH \xrightarrow{Br_2} CHBr = CHBr \xrightarrow{Br_2} CHBr_2 - CHBr_2$

7. $CH_3 - C \equiv CH \xrightarrow{HCl} CH_3 - CCl = CH_2 \xrightarrow{HCl} CH_3 - CCl_2 - CH_3$

8. $CH_3 - C \equiv CH + H_2O \xrightarrow{Hg^{+2}, H^+} CH_3 - CO - CH_3$

9. $HC \equiv CH + 2[Ag(NH_3)_2]OH \rightarrow Ag - C \equiv C - Ag\downarrow + 4NH_3 + 2H_2O$

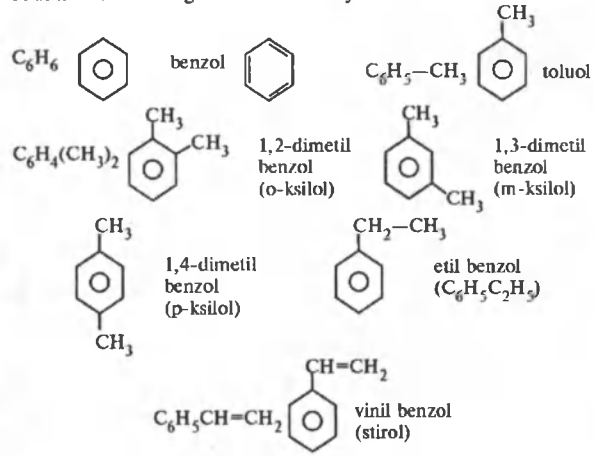
10. $RC \equiv CH + [Ag(NH_3)_2]OH \rightarrow RC \equiv CAg\downarrow + 2NH_3 + H_2O$

11. $HC \equiv CH + HC \equiv CH \rightarrow HC \equiv C - C = CH_2$

12. $3HC \equiv CH \xrightarrow{C,\ 600°C} C_6H_6$

Aromatik uglevodorodlar (arenlar)

Molekulasida benzol yadrosi tutgan karbosiklik uglevodorodlar aromatik uglevodorodlar deyiladi.



Fizik xossalari: benzol — rangsiz, suvda erimaydigan, o'ziga xos hidli suyuqlik. Qaynash temperaturasi 80,1°C. Sovitilganda oson qotib, oq kristall moddaga aylanadi. Suyuqlanish temperaturasi 5,5°C.

Olinishi:

1. $C_6H_{14} \xrightarrow{t, p, Cr_2O_3} C_6H_6 + 4H_2$
2. $C_6H_{12} \xrightarrow{t, Pd} C_6H_6 + 3H_2$
3. $3HC \equiv CH \xrightarrow{C, 600°C} C_6H_6$ (N. D. Zelenskiy, 1927-y.)
4. $C_6H_5COONa + NaOH \xrightarrow{t} C_6H_6 + Na_2CO_3$
5. $C_6H_{11}CH_3 \xrightarrow{Pt, 300°C} C_6H_5CH_3 + 3H_2$

Kimyoviy xossalari:

1. $C_6H_6 + Br_2 \xrightarrow{FeCl_3, t} \underset{\text{brom benzol}}{C_6H_5Br} + HBr$
2. $C_6H_6 + HONO_2 \xrightarrow{H_2SO_4, t} \underset{\text{nitrobenzol}}{C_6H_5NO_2} + H_2O$
3. $C_6H_5CH_3 + HNO_3 \rightarrow C_6H_2(NO_2)_3CH_3 + 3H_2O$
4. $C_6H_5CH_3 + 3O \rightarrow C_6H_5COOH + H_2O$
5. $2C_6H_6 + 15O_2 \rightarrow 12CO_2 + 6H_2O$
6. $C_6H_6 + 3Cl_2 \xrightarrow{h\nu} C_6H_6Cl_6$ (geksaxlorsiklogeksan) geksaxloran.
7. $C_6H_6 + 3H_2 \rightarrow C_6H_{12}$ siklogeksan
8. $nCH_2 = \underset{\displaystyle C_6H_5}{\underset{|}{CH}} \rightarrow \left(-CH_2- \underset{\displaystyle C_6H_5}{\underset{|}{CH}}- \right)_n$
9. $C_6H_6 + Cl_2 \xrightarrow{AlCl_3} \underset{\text{xlorbenzol}}{C_6H_5Cl} + HCl$
10. $C_6H_6 + CH_3Cl \xrightarrow{AlCl_3} \underset{\text{toluol}}{C_6H_5CH_3} + HCl$
11. $C_6H_6 + CH_3-CH=CH_2 \xrightarrow{AlCl_3} \underset{\text{izopropilbenzol}}{C_6H_5-CH(CH_3)_2}$

12. $C_6H_5CH_3 + Cl_2 \xrightarrow{AlCl_3} C_6H_4(Cl)CH_3 + HCl$

13. $C_6H_5CH_3 + Cl_2 \xrightarrow{h\nu} C_6H_5CH_2Cl + HCl$

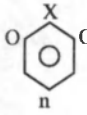
14. $5C_6H_5CH_3 + 6KMnO_4 + 9H_2SO_4 \rightarrow 5C_6H_5COOH + 6MnSO_4 + 3K_2SO_4 + 14H_2O$

15. $C_6H_5C_2H_5 \xrightarrow{t, ZnO} C_6H_5CH=CH_2 + H_2$

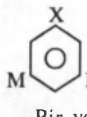
16. $C_6H_5CH=CH_2 + Br_2 \rightarrow C_6H_5CHBr-CH_2Br$

17. $3C_6H_5CH=CH_2 + 2KMnO_4 + 4H_2O \rightarrow$
$\rightarrow 3C_6H_5-CH(OH)-CH_2OH + 2MnO_2 + 2KOH$

BENZOL HALQASIDAGI ORIYENTATSIYA QOIDALARI



1-guruh oriyentantlar orto va para — holatlarga yo'naltiradi. Ularga —OH, NH_2, —Hal, $-C_nH_{2n+1}$ kiradi.



2-guruh oriyentantlar: meta — holatga yo'naltiradi.

Ular: $-NO_2$, —CHO, —COOH, —COOR.

SPIRTLAR

Bir yoki bir necha vodorodni —OH gidroksid funksional guruhiga almashtirgan uglevodorod hosilalari spirtlar deyiladi.

Umumiy formulasi: $C_nH_{2n+1}OH$.

CH_3OH metanol yoki metil spirti

C_2H_5OH etanol yoki etil spirti

C_3H_7OH $CH_3-CH_2-CH_2-OH$ propanol-1 (birlamchi spirt)

$CH_3-CH(OH)-CH_3$ propanol-2 (ikkilamchi spirt)

C_4H_9OH $H_3C-CH_2-CH_2-CH_2-OH$ butanol-1 (birlamchi spirt)

$CH_3-CH_2-CH(OH)-CH_3$ butanol-2 (ikkilamchi spirt

$CH_3-CH(CH_3)-CH_2-OH$ 2-metil-propanol (birlamchi)

$CH_3-C(OH)(CH_3)-CH_3$ 2-metil 2-propanol (uchlamchi)

Fizik xossalari. Dastlabki spirtlar suyuqliklar, $C_{15}H_{31}OH$ dan boshlab qattiq moddalar. Spirtlarda vodorod bog' mavjud. Suvda yaxshi eriydi. Yuqori spirtlar $C_{11}H_{23}OH$ dan boshlab suvda amalda erimaydi. Quyi spirtlar o'ziga xos alkogol hidga ega. Ulardan keyin keladigan gomologlar o'tkir hidli, ba'zilari qo'lansa hidli. Yuqori spirtlar hidsiz bo'ladi. Metanol CH_3OH juda zaharli.

Olinishi:

1. $C_5H_{11}Cl + KOH \rightarrow KCl + C_5H_{11}OH$ — pentanol.
2. $CO + 2H_2 \xrightarrow{220\ 300°C, P, Cu, ZnO} CH_3OH$ — metanol
3. $CH_2=CH_2 + HOH \xrightarrow{280\ 300°C, 7\ 8mPa, H_3PO_4} CH_3-CH_2OH$
4. $C_6H_{12}O_6 \xrightarrow{\text{bijg ish}} 2C_2H_5OH + 2CO_2$
5. $RCH=O + H_2 \rightarrow R-CH_2OH$ — spirtlar (birlamchi).
   aldegidlar
6. $R-CO-R' + H_2 \rightarrow R-CH(OH)-R'$ (ikkilamchi spirtlar)
   ketonlar

Kimyoviy xossalari:

1. $2CH_3-CH_2-OH + 2Na \rightarrow 2CH_3-CH_2-ONa + H_2$
   etanol natriy etilat
2. $CH_3-CH_2-ONa + HOH \leftrightarrow CH_3-CH_2-OH + NaOH$
3. $CH_3OH + HCl \xrightarrow{H_2SO_4} H_2O + CH_3Cl$ — xlormetan.
4. $H_3C-CH_2OH \xrightarrow{t>140°C, H_2SO_4(kons)} H_2C=CH_2 + H_2O$

5. $H_3C-CH_2O\boxed{H+HO}-CH_2-CH_3 \xrightarrow{t<140^\circ C,\ H_2SO_4(kons)}$

$CH_3-CH_2-O-CH_2-CH_3+HOH$

6. $H_3C-CH_2OH + CuO \xrightarrow{t} CH_3CHO + Cu + H_2O$

7. $H_3C-CH_2OH + O_2 \rightarrow 2CO_2 + 3H_2O$

8. $CH_3C(=O)-\boxed{OH+H}O-CH_2-CH_3 \underset{}{\overset{t,H_2SO_4}{\rightleftharpoons}} CH_3C(=O)-O-CH_2-CH_3 + HOH$

9. $C_2H_5OH + HO-NO_2 \leftrightarrow C_2H_5ONO_2 + H_2O$

10. $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-OH \xleftarrow{[O]} CH_3-\underset{\displaystyle CH_3}{\underset{|}{C}}=O + H_2$

ikkilamchi propil spirt; (propanol-2) — aseton(dimetilketon)

KO'P ATOMLI SPIRTLAR

$\underset{\displaystyle OH}{\underset{|}{CH_2}}-\underset{\displaystyle OH}{\underset{|}{CH_2}}$ etilenglikol

$\underset{\displaystyle OH}{\underset{|}{CH_2}}-\underset{\displaystyle OH}{\underset{|}{CH}}-\underset{\displaystyle OH}{\underset{|}{CH_2}}$ glitserin

Fizik xossalari. Ular shirin ta'mli, qiyomsimon, rangsiz suyuqliklar, suvda va etanolda yaxshi eriydi. Etilenglikol 197,6°C da, glitserin 290°C da qaynaydi. Etilenglikol juda zaharli. Ulardan antifrizlar tayyorlanadi.

Kimyoviy xossalari:

1) $HOCH_2-CH_2OH + 2Na \rightarrow NaO-CH_2-CH_2-ONa + H_2\uparrow$

2) $HOCH_2-CH_2OH + HCl \rightarrow HOCH_2-CH_2Cl + H_2O$

3) $2\begin{vmatrix}CH_2-OH\\CH_2-OH\end{vmatrix} + Cu(OH)_2 \rightarrow \begin{vmatrix}CH_2-O\\CH_2-O\end{vmatrix}\!\!>\!Cu\!<\!\!\begin{vmatrix}H-O-CH_2\\O-CH_2\end{vmatrix} + 2H_2O$

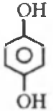
4) CH_2-OH / $CH-OH + 3HNO_3 \xrightarrow{H_2SO_4}$ / CH_2-OH → CH_2-ONO_2 / $CH-ONO_2 + 3H_2O$ / CH_2-ONO_2

1,2,3-trinitroglitserin

FENOLLAR C_6H_5OH — FENOL

Benzol yadrosidagi uglerod atomi bilan gidroksil guruh bevosita bog'langan aromatik uglevodorodlar fenollar deyiladi.

fenol



gidroxinon
1, 4 benzoldiol

pirokatexin
1, 2 benzoldiol

piragallol
1, 2, 3 benzoltriol

o-krezol
(metilfenol)

Fizik xossalari: C_6H_5OH

O'ziga xos hidli, rangsiz kristall modda.

Suyuq. temp. 40,9°C, sovuq suvda oz eriydi, 70°C da har qanday nisbatda eriydi.

FENOL ZAHARLI! Organik erituvchilarda eriydi.

Olinishi:

1. $C_6H_5-Cl + NaOH \xrightarrow{t,p} C_6H_5OH + NaCl$
2. $C_6H_5-CH(CH_3)_2 + O_2 \rightarrow C_6H_5-OH + (CH_3)_2CO$

kumol izopropil benzol — fenol — aseton

Kimyoviy xossalari:

1) $2C_6H_5OH + 2Na \rightarrow 2C_6H_5ONa + H_2\uparrow$

2) $C_6H_5OH + NaOH \rightarrow C_6H_5ONa + H_2O$

3) $C_6H_5OH + 3Br_2 \rightarrow C_6H_2Br_3OH + 3HBr$

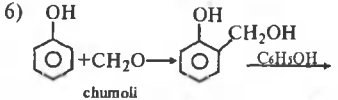
2, 4, 6 tribrom fenol

4) $C_6H_5OH + 3HNO_3 \rightarrow C_6H_2(NO_2)_3OH + 3H_2O$

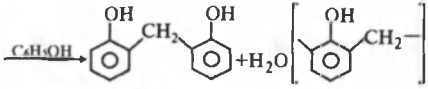
2, 4, 6 trinitrofenol (pikrin kislota)

5) $C_6H_5OH + CH_3-\overset{\overset{O}{\parallel}}{C}-Cl \rightarrow CH_2-\overset{\overset{O}{\parallel}}{C}-O-C_6H_5 + HCl$

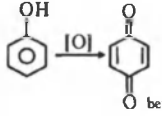
fenol — fenilasetat

6) 

chumoli aldegidi



fenolformaldegid — polifenolformaldegid n

7) 

benzoxinon

8) $C_6H_5OH + 3H_2 \xrightarrow[Ni]{t,p} C_6H_{11}OH$

siklogeksanol

ALDEGIDLAR

Molekulalarida uglevodorod radikali bilan karbonil funksional churuhi tutgan birikmalarga aldegidlar deyildi.

$C_nH_{2n}O$ yoki $R-\overset{\overset{O}{\parallel}}{C}-H$; $-\overset{\overset{O}{\parallel}}{C}-H$ funksional guruhi (aldegid guruh) bo'lgan organik birikmalar.

1. H—CHO metanal yoki formaldegid (chumoli aldegid).
2. CH_3—CHO etanol yoki asetaldegid (sirka aldegid).
3. CH_3—CH_2—CHO propanal
4. CH_3—CH_2—CH_2—CHO butanal
5. $CH_3-CH(CH_3)-CHO$ 2-metil propanal
6. CH_3—CH_2—CH_2—CH_2—CHO — pentanal
7. CH_3—CH_2—CH_2—CH_2—CH_2—CHO — geksanal

Fizik xossalari: metanal — o'tkir hidli, rangsiz gaz. 35—40% li eritmasi formalin deyiladi. So'ngilari suyuq, yuqorilari qattiq moddalar.

Olinishi:

1) Laboratoriyada:

$$R-CH_2-O-H+[O]\xrightarrow{CuO\ yoki\ H_2O_2}R-CHO+H_2O$$

2) Sanoatda:

$$CH_4+O_2\xrightarrow{500^\circ C,\ kat}H-CHO+H_2O$$

$$2CH_3OH+O_2\xrightarrow{CuO\ yoki\ Ag}2H-CHO+2H_2O$$

Kucherov reaksiyasi:

$$H-C\equiv C-H+H_2O\xrightarrow{HgSO_4}CH_3-\overset{\overset{O}{\parallel}}{C}-H$$

$$CH_2=CH_2+[O]\xrightarrow{Cu^{+2},Fe^{+2},Pd^{+2}}CH_3-CHO$$

$$CH_3CHCl_2+2NaOH\longrightarrow CH_3-CHO+2NaCl+H_2O$$

Kimyoviy xossalari.

1. $R-CHO+Ag_2O\xrightarrow{t,NH_3}R-COOH+2Ag\downarrow$ «Kumush ko'zgu» reaksiyasi

2. $R-CHO+2Cu(OH)_2\xrightarrow{t^\circ}R-COOH+2CuOH+H_2O$
(havorang → sariq)

$$2CuOH\xrightarrow{t^\circ}Cu_2O+H_2O$$
(qizil)

3. $\underset{\text{metanal}}{H-CHO} + H_2 \xrightarrow{t,\ kat} \underset{\text{metanol}}{CH_3-OH}$

4. $R-\overset{\overset{O}{\|}}{C}-H + HCN \rightarrow R-\overset{\overset{OH}{|}}{CH}-CN$

5. $R-\overset{\overset{O}{\|}}{\underset{H}{\underset{|}{C}}}+:\overset{\overset{O}{\|}}{\underset{OH}{\underset{|}{S}}}-ONa \rightarrow R-\overset{\overset{HO}{|}}{\underset{H}{\underset{|}{C}}}-\overset{\overset{O}{\|}}{\underset{O}{\underset{\|}{S}}}-ONa$

6. $HCOH + 2Ag_2O \xrightarrow{NH_3} CO_2 + 4Ag\downarrow + H_2O$

7. $HCOH + 4Cu(OH)_2 \rightarrow CO_2 + 2Cu_2O + 5H_2O$

8. $5R\ CHO + 2KMnO_4 + 3H_2SO_4 \rightarrow$
$\rightarrow 5R\ COOH + 2MnSO_4 + K_2SO_4 + 3H_2O$

9. $RCOH + 2[Ag(NH_3)_2]OH \rightarrow RCOONH_4 +$
$+2Ag + 3NH_3 + 4H_2O$

KETONLAR

Molekulasidagi korbonil guruh ikkita uglevodorod radikali bilan bog'langan organik birikma ketonlar deyiladi.

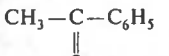
$C_nH_{2n}O$ yoki $R-\overset{\overset{O}{\|}}{C}-R'$

$CH_3-\overset{\overset{O}{\|}}{C}-CH_3$ aseton, dimetil keton, propanon — 2;

$CH_3-\overset{\overset{O}{\|}}{C}-CH_2-CH_3$ butanon — 2.

$C_6H_{10}O$ yoki  siklogeksanon

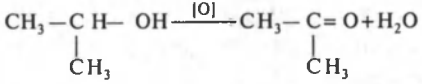
$C_6H_5-\overset{\overset{O}{\|}}{C}-C_6H_5$ difenilketon

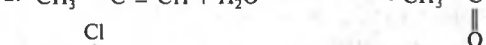

asetofenon

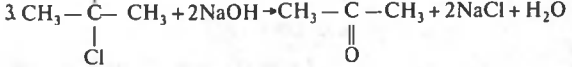
Fizik xossalari: aseton suyuq modda bo'lib, 56°C da qaynaydi. Yuqori ketonlar qattiq moddalar. O'ziga xos kuchsiz hidga ega, ayrim ketonlar hatto yoqimli hidga ega. Quyi ketonlar suvda yaxshi eriydi, biroq uglerod soni oshishi bilan eruvchanlik keskin kamayadi.

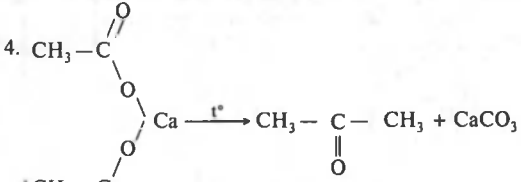
Olinishi:

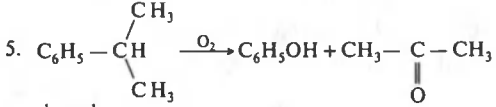
1. Ikkilamchi spirtlar oksidlab olinadi:



2. 

3. 

4. 

5. 
kumol

Kimyoviy xossalari:

1. $CH_3-\underset{\underset{O}{\|}}{C}-CH_3 + 2[H] \rightarrow CH_3-\underset{\underset{OH}{|}}{CH}-CH_3$

aseton — propanol – 2

2. Ketonlar «kumush ko'zgu» reaksiyasini bermaydi.

KARBON KISLOTALAR

Molekulasida uglevodorod radikali bilan tutashgan bir yoki bir necha karboksil —COOH guruh tutgan murakkab, organik birikmalarga karbon kislotalar deyiladi.

$C_nH_{2n+1}COOH$ yoki $R-\underset{\backslash}{\overset{\overset{O}{//}}{C}}OH$

Karbon kislotalar — molekulalarida uglevodorod radikali yoki vodorod atomi bilan birikkan bir yoki bir necha karboksil guruh bo'lgan organik moddalardir.

$HCOOH$ — metan yoki chumoli kislota.

CH_3COOH — etan yoki sirka kislota.

C_2H_5COOH — propan yoki propion kislota.

$CH_3CH_2CH_2COOH$ — butan yoki moy kislota.

$CH_3-(CH_2)_3-COOH$ — valerian yoki pentan kislota.

$CH_3-(CH_2)_4-COOH$ — kapron yoki geksan kislota.

$CH_3-(CH_2)_5-COOH$ — enant yoki geptan kislota.

$CH_3-(CH_2)_{14}COOH$ — palmitin yoki geksadekan kislota.

$CH_3-(CH_2)_{15}COOH$ — oktodekan yoki stearin kislota.

Fizik xossalari: dastlabki karbon kislotalar o'tkir hidli, suvda yaxshi eriydigan suyuqliklar. Nisbiy molekular massasining ortishi bilan kislotalarning suvda eruvchanligi kamayadi, qaynash temperaturasi esa ortib boradi. $C_8H_{17}COOH$ dan boshlab hidsiz, suvda erimaydigan qattiq moddalar.

Olinishi:

1) $2CH_3-COONa + H_2SO_4 \xrightarrow{t} Na_2SO_4 + \underset{\text{sirka kislota}}{2CH_3-COOH}$

2) $2CH_3-(CH_2)_{16}-COONa + H_2SO_4 \xrightarrow{t}$
natriy stearat
$\xrightarrow{t} Na_2SO_4 + 2CH_3-(CH_2)_{16}-COOH$
stearin kislota

3) $5CH_3CH_2OH + 4KMnO_4 + 6H_2SO_4 \rightarrow 5CH_3COOH + 2K_2SO_4 + 4MnSO_4 + 11H_2O$;

4) $CH_3-CHO + 2Cu(OH)_2 \rightarrow CH_3COOH + Cu_2O + 2H_2O$;

5) $CH_3-CCl_3 + 2H_2O \rightarrow CH_3-COOH + 3HCl$;

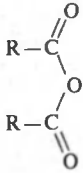
6) $CH_3-CN + 2H_2O + HCl \rightarrow CH_3COOH + NH_4Cl$;

7) $2C_4H_{10} + 5O_2 \rightarrow 4CH_3COOH + 2H_2O$;

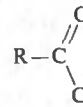
8) $CH_3OH + CO \xrightarrow{kat,\ bosim} CH_3-COOH$;

9) $CO + NaOH \xrightarrow{t} HCOONa$;
$HCOONa + H_2SO_4 \rightarrow 2HCOOH + Na_2SO_4$.

Karbon kislotalarda quyidagi funksional hosilalari mavjud:

1. Angidridlar: 

$2CH_3-COOH \xrightarrow{P_2O_5} (CH_3CO)_2O + H_2O$
sirka angidrid

2. Xlorangidridlar: 

$CH_3COOH + PCl_5 \rightarrow CH_3-COCl + POCl_3 + HCl$
$RCOCl + H_2O \rightarrow RCOOH + HCl$

3. Murakkab efirlar: $R-\overset{\overset{O}{\parallel}}{C}-O-R'$

$$CH_3COOH + HOCH_3 \rightarrow \underset{\substack{\text{sirka metil efiri}\\ \text{metil asetat}}}{CH_3COOCH_3} + H_2O$$

$$CH_3COOCH_3 + NaOH \rightarrow CH_3COONa + CH_3OH$$

4. Amidlar: $R-\overset{\overset{O}{\parallel}}{C}-NH_2 + CH_3COONH_4 \xrightarrow{t} CH_3-CONH_2 + H_2O$

YOG'LAR

Yog'lar — uch atomli spirt glitserin va yuqori molekular karbon kislotalarning murakkab efirlari.

$$\begin{array}{l} CH_2-O-CO-R \\ | \\ CH-O-CO-R' \\ | \\ CH_2-O-CO-R'' \end{array}$$

Kimyoviy xossalari:

1. $$\begin{array}{l} CH_2-O-CO-R \\ | \\ CH-O-CO-R \\ | \\ CH_2-O-CO-R \end{array} + 3NaOH \rightarrow \begin{array}{l} CH_2-OH \\ | \\ CH-OH \\ | \\ CH_2-OH \end{array} + 3RCOONa$$

2. $$\begin{array}{l} CH_2-O-CO-C_{17}H_{33} \\ | \\ CH-O-CO-C_{17}H_{33} \\ | \\ CH_2-O-CO-C_{17}H_{33} \end{array} + 3H_2 \xrightarrow{t,p} \begin{array}{l} CH_2-O-CO-C_{17}H_{35} \\ | \\ CH-O-CO-C_{17}H_{35} \\ | \\ CH_2-O-CO-C_{17}H_{35} \end{array}$$

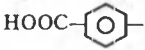
glitserin trioleati (suyuq yog') — glitserin tristearati (qattiq yog')

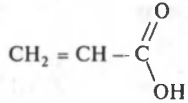
3. To'yinmagan yuqori molekular karbonkislota qoldiqlari suyuq yog'larda, to'yinganlari esa qattiq yog'larda bo'ladi.

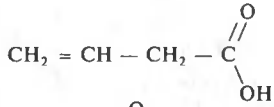
AYRIM KARBON KISLOTALAR

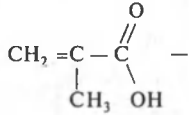
1. C_6H_5COOH — benzoy kislota.

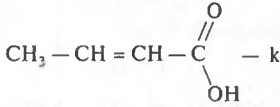
2.  — ortoftal kislota.

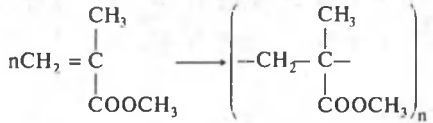
3.  — tereftal kislota.

4.  — akril kislota.

5.  — vinilsirka kislota

6.  — metakril kislota

7.  — kraton kislota.

8. 

metilmetakrilat — polimetilmetakrilat (organik shisha)

Kimyoviy xossalari:

Karbonil guruhda elektron zichlik kislorod atomi tomon siljiganligi uchun uglerod atomi qisman musbat zaryadlanadi. Natijada uglerod elektron zichlikni gidroksil guruhdan tortadi

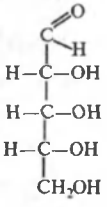
va vodorod atomi spirtlar molekulasidagiga nisbatan bir muncha aktivlashadi.

$$HCOOH \rightleftarrows HCOO^- + H^+$$

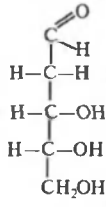
1. $2HCOOH + Ca \rightarrow Ca(HCOO)_2 + H_2\uparrow$
2. $HCOOH + NaOH \rightarrow HCOONa + H_2O$
3. $2CH_3COOH + Na_2CO_3 \rightarrow 2CH_3COONa + CO_2 + H_2O$
4. $2CH_3COOH \xrightarrow{P_2O_5} (CH_3CO)_2O + H_2O$
5. $CH_3CH_2{-}COOH + C_2H_5OH \xrightarrow{t,\,H_2SO_4} \xrightarrow{t,\,H_2SO_4} CH_3{-}CH_2{-}COOC_2H_5 + H_2O.$
6. $CH_3{-}CH_2{-}COH + Br_2 \xrightarrow{h\nu} \xrightarrow{h\nu} CH_3{-}CHBr{-}COOH + HBr$
7. $HCOOH \xrightarrow{H_2SO_4} CO\uparrow + H_2O$
8. $HCOOH + Cl_2 \longrightarrow CO_2 + 2HCl$
9. $HCOOH + Ag_2O \xrightarrow{NH_3} 2Ag + CO_2 + H_2O$

UGLEVODLAR

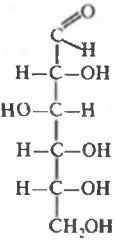
Uglerod, kislorod va vodoroddan tashkil topgan. Murakkab moddalarga uglevodorodlar deyildi.



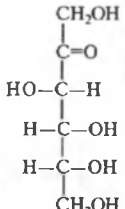
riboza (pentoza) $C_5H_{10}O_5$



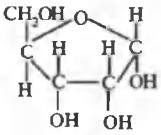
dezoksiriboza (pentoza) $C_5H_{10}O_4$

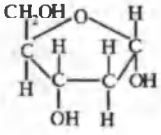


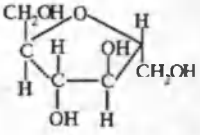
glukoza (geksoza) $C_6H_{10}O_6$

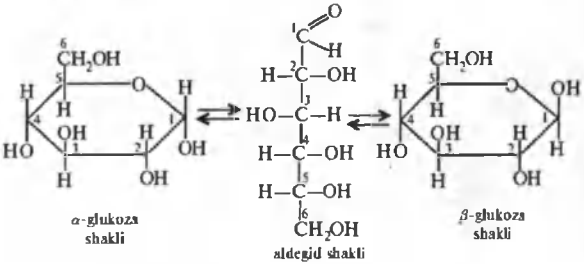


fruktoza (geksoza) $C_6H_{12}O_6$


riboza

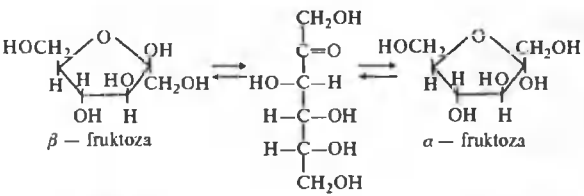

dezoksiriboza


fruktoza

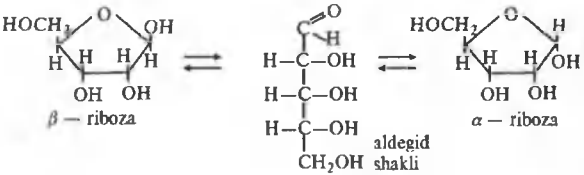

α-glukoza shakli

aldegid shakli

β-glukoza shakli

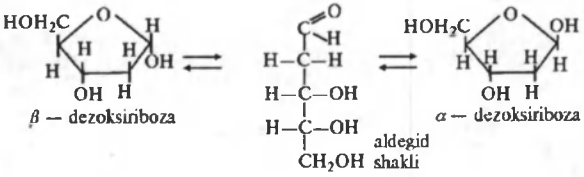

β — fruktoza

α — fruktoza


β — riboza

aldegid shakli

α — riboza



GLUKOZA

Glyukoza (uzum qandi) $C_6H_{12}O_6$.

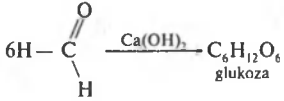
Fizik xossalari: glukoza shirin ta'mli, rangsiz kristall modda, suvda yaxshi eriydi.

Olinishi:

1. Fotosintez:

$$6CO_2 + 6H_2O \xrightarrow{h\nu} C_6H_{12}O_6 + 6O_2$$

2. A. Butlerov — 1861-y.



3. Sanoatda:

$$\underset{\text{kraxmal}}{(C_6H_{10}O_5)_n} + nH_2O \xrightarrow{H_2SO_4} \underset{\text{glukoza}}{nC_6H_{12}O_6}$$

4. $$\underset{\text{saxaroza}}{C_{12}H_{22}O_{11}} + H_2O \xrightarrow{H^+} \underset{\text{glukoza}}{C_6H_{12}O_6} + \underset{\text{fruktoza}}{C_6H_{12}O_6}$$

5. $$\underset{\text{kraxmal}}{(C_6H_{10}O_5)} \rightarrow \underset{\text{dekstrinlar}}{(C_6H_{10}O_5)} \rightarrow x\underset{\substack{\text{maltoza}\\(\text{saxaroza}\\\text{izomeri})}}{C_{12}H_{22}O_{11}} \rightarrow n\underset{\text{glukoza}}{C_6H_{12}O_6}$$

Kimyoviy xossalari:

1. Glukozada 5 ta gidroksil guruh borligini uning 5 ta sirka kislota qoldig'i birikishdan aniqlanadi.

Kumush ko'zgu reaksiyaga kirishadi:

2. $CH_2OH-(CHOH)_4-\underset{H}{\overset{\overset{O}{//}}{C}} + Ag_2O \xrightarrow{NH_3} CH_2OH-$

$(CHOH)_4 \quad COOH + 2Ag\downarrow$

glukon kislota

3. $CH_2OH-(CHOH)_4-\underset{H}{\overset{\overset{O}{//}}{C}} + 2Cu(OH)_2 \rightarrow CH_2OH-$

$-(CHOH)_4- \; COOH + Cu_2O\downarrow + 2H_2O$

4. $CH_2OH-(CHOH)_4-\underset{H}{\overset{\overset{O}{//}}{C}} + 2[H] \rightarrow CH_2OH-$

$-(CHOH)_4- \; CH_2OH$

sorbit – glukakol

5. Spirtli bijg'ishi:

$C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2\downarrow$

6. Sut kislotali bijg'ishi:

$C_6H_{12}O_6 \rightarrow 2CH_3-CH(OH)-COOH$

7. Moy kislotali bijg'ishi:

$C_6H_{12}O_6 \rightarrow CH_3-CH_2-CH_2-COOH + 2CO_2\nearrow + 2H_2\nearrow$

Saxaroza — $C_{12}P_{22}O_{11}$ — disaxarid.

Fizik xossasi: toza saxaroza — shirin ta'mli, rangsiz kristall modda suvda yaxshi eriydi.

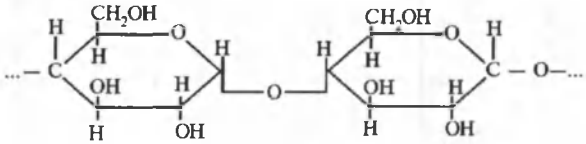
Olinishi: U, asosan, qand lavlagi va shakarqamishdan olinadi.

Kimyoviy xossalari:

$C_{12}H_{22}O_{11} + H_2O \xrightarrow{H_2SO_4;\, t^\circ C} C_6H_{12}O_6 + C_6H_{12}O_6$

glukoza fruktoza

Kraxmal — $(C_6H_{10}O_5)_n$



kraxmal α — glukoza qoldiqlaridan iborat.

Fizik xossalari: kraxmal oq kukun, sovuq suvda erimaydi, issiq suvda bo'kib kleyster hosil qiladi.

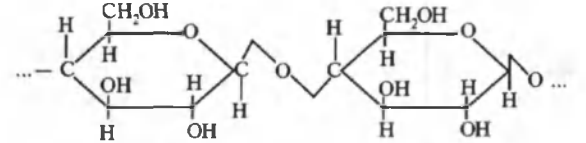
Olinishi: kraxmal ko'pincha kartoshkadan olinadi.

Kimyoviy xossalari:

1. $(C_6H_{10}O_5)_n + nH_2O \xrightarrow{H_2SO_4;\ t^\circ C} \underset{\text{glukoza}}{nC_6H_{12}O_6}$

2. $\underset{\text{kraxmal}}{(C_6H_{10}O_5)_n} \rightarrow \underset{\text{dekstrinlar}}{(C_6H_{10}O_5)_m} \rightarrow \underset{\text{maltoza}}{^xC_{12}H_{22}O_{11}} \rightarrow \underset{\text{glukoza}}{^nC_6H_{12}O_6}$

Selluloza — $(C_6H_{10}O_5)n$



Selluloza β — glukoza qoldiqlaridan iborat.

Fizik xossalari: selluloza — tolasimon modda, suvda ham, odatdagi organik erituvchilarda ham erimaydi. Uning erituvchisi «Shveyser reaktivi» — mis (II) gidroksidning ammiakli eritmasidir.

Olinishi: selluloza paxtadan, yog'ochdan ajratib olinadi.

Kimyoviy xossalari:

1. $(C_6H_{10}O_5)_n + nH_2O \xrightarrow{H_2SO_4,\ t} \underset{\text{glukoza}}{nC_6H_{12}O_6}.$

2. $[C_6H_7O_2(OH)_3]_n + 3nCH_3COOH \rightarrow$

$\rightarrow \underset{\text{selluloza triasetati}}{[C_6H_7O_2(OCOCH_3)_3]_n} + \ + 3nH_2O.$

3. $[C_6H_7O_2(OH)_3]_n + 3n\ HNO_3 \rightarrow$
$\rightarrow [C_6H_7O_2(ONO_2)_3]_n + \ + 3nH_2O.$
selluloza trinitrati
(piroksilin)

4. $[C_6H_7O_2(OH)_3]_n + 2nHNO_3 \rightarrow$
$\rightarrow [C_6H_7O_2(ONO_2)_2(OH)]_n + 2nH_2O.$
selluloza dinitrati
(kolloksilin)

AMINLAR

Ammiakdagi NH_3 bitta, ikkita yoki barcha vodorod atomlarining uglevodorod radikallariga almashingan murakkab moddalarga aminlar deyiladi.

$C_nH_{2n+3}N$ — to'yingan aminlar

1. $CH_3—NH_2$ — *metil amin*
2. $C_2H_5—NH_2$ — etil amin

Birlamchi aminlar: $R—NH_2$
Ikkilamchi aminlar: $R—NH—R'$
Uchlamchi aminlar: $R—N(—R')—R''$

Fizik xossalari: aminlar ammiakning hosilalari bo'lganligi sababli uning xossalarini takrorlaydi. Quyi aminlar odatdagi sharoitda ammiak hidli gazlar, o'rta a'zolari kuchsiz hidli suyuqliklar, yuqori aminlar hidsiz va qattiq moddalar.

Olinishi:

1. $2NH_3 + CH_3Cl \rightarrow \underset{\text{metilamin}}{CH_3NH_2} + NH_4Cl$
2. $RNO_2 + 3H_2 \rightarrow RNH_2 + 2H_2O$
3. $RNO_2 + 3Fe + 6HCl \rightarrow RNH_2 + 3FeCl_2 + 2H_2O$
4. $RNO_2 + 2Al + 2KOH + 4H_2O \rightarrow RNH_2 + 2K[Al(OH)_4]$
5. $[CH_3NH_3]Cl + NaOH \xrightarrow{t^\circ} CH_3NH_2\uparrow + NaCl + H_2O$

Kimyoviy xossalari:

1. $RNH_2 + H_2O \rightleftarrows [RNH_3]^+ + OH^-$
2. $CH_3NH_2 + HCl \rightarrow \underset{\text{metilammoniy xlorid}}{[CH_3NH_3]Cl}$

3. $RNH_2 + HNO_2 \rightarrow ROH + N_2\uparrow + H_2O$

4. $4CnH_{2n+3}N + (6n+3)O_2 = 4nCO_2 + 2N_2 + (4n+6)H_2O$

5. $4CH_3NH_2 + 9O_2 \rightarrow 4CO_2 + 2N_2 + 10H_2O$

Aminlarning asoslik xossasi:

$$(CH_3)_3N > (CH_3)_2NH > CH_3NH_2 > NH_3 > C_6H_5NH_2 > (C_6H_5)_2NH > (C_6H_5)_3N.$$

Anilin — $C_6H_5NH_2$

Fizik xossalari: anilin — o'ziga xos biroz hidli, rangsiz moysimon suyuqlik. U suvdan biroz og'ir va unda kam eriydi, lekin spirt, efir va benzolda yaxshi eriydi. Juda zaharli. Havoda oksidlanib qo'ng'ir tusga kiradi.

Olinishi: N. N. Zinin usuli:

1. $C_6H_5NO_2 + 3(NH_4)_2S \rightarrow \underset{\text{anilin}}{C_6H_5NH_2} + 3S + 6NH_3 + 2H_2O$

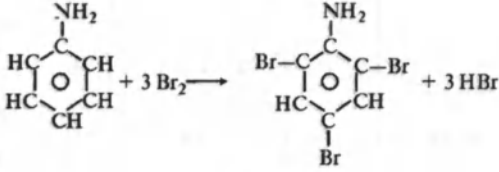
2. $4C_6H_5NO_2 + 9Fe + 4H_2O = 4C_6H_5NH_2 + 3Fe_3O_4$

3. $C_6H_5NO_2 + 3H_2 \rightarrow C_6H_5NH_2 + 2H_2O$

4. $C_6H_5NO_2 + 2Al + 2NaOH + 4H_2O \rightarrow$
$\rightarrow C_6H_5NH_2 + 2Na[Al(OH)_4]$

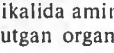
Kimyoviy xossalari:

1. $C_6H_5NH_2 + HCl \rightarrow [C_6H_5NH_3]Cl$

2. 

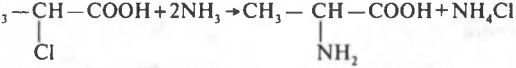
AMINOKISLOTALAR

Uglevodorod radikalida aminoguruh ($-NH_2$) va karboksil ($-COOH$) guruh tutgan organik kislotalar aminokislotalar deyiladi.

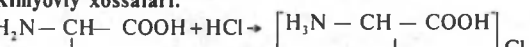


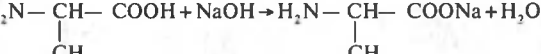
Fizik xossalari: aminokislotalar yuqori temperaturalarda (250°C dan yuqorida) suyuqlanadigan rangsiz kristall moddalardir. Suvda oson eriydi, efirda erimaydi.

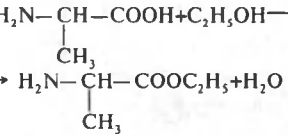
Olinishi:



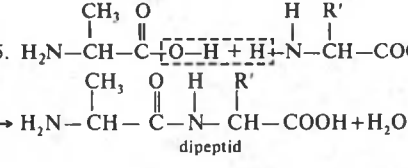
Kimyoviy xossalari:

1. 

2. 

3. 

4. 

5. 

dipeptid

6. $H_2N-\underset{\underset{CH_3}{|}}{CH}-\overset{\overset{O}{\|}}{C}-NH-\underset{\underset{CH_3}{|}}{CH}-COOH + 2\,KOH \rightarrow$

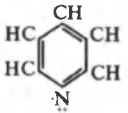
$\rightarrow [H_3N-CH(CH_3)COOH]Cl + [H_3N-CH(CH_3)COOH]Cl;$

7. $H_2N-\underset{\underset{CH_3}{|}}{CH}-\overset{\overset{O}{\|}}{C}-NH-\underset{\underset{CH_3}{|}}{CH}-COOH + 2\,KOH \rightarrow$

$H_2N-\underset{\underset{CH_3}{|}}{CH}-COOK + H_2N-\underset{\underset{CH_3}{|}}{CH}-COOK + H_2O$

AZOTLI GETEROTSIKLIK BIRIKMALAR

Piridin C_5H_5N

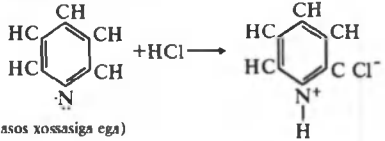


Fizik xossalari:
Piridin 115°C da qaynaydigan badbo'y rangsiz suyuqlik.
Olinishi:

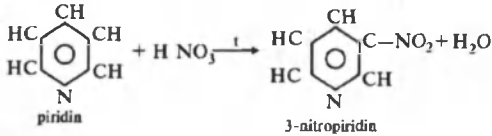
$2HC \equiv CH + HC \equiv N \rightarrow C_5H_5N$

asetilen sianid k-ta piridin

Kimyoviy xossalari:

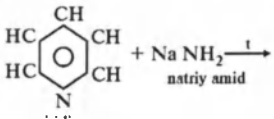
1. 

(asos xossasiga ega) piridin xlorid

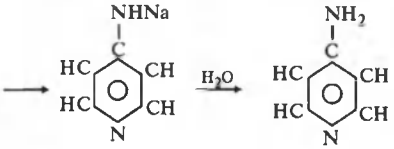
2. 

piridin 3-nitropiridin

3.

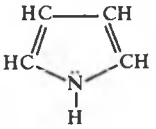


piridin



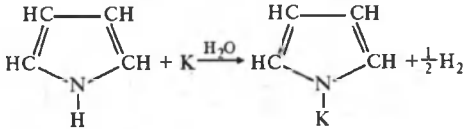
4-aminopiridin

PIRROL C_4H_4NH



Fizik xossalari: suvda kam eriydigan rangiz suyuqlik, uning qaynash temperaturasi 130°C.

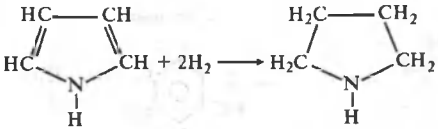
1.



(kislotali xossaga ega)

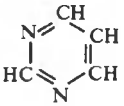
kaliy pirrol

2.

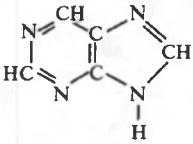


pirrolidin

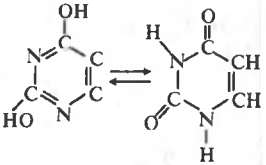
Pirimidin $C_4H_4N_2$



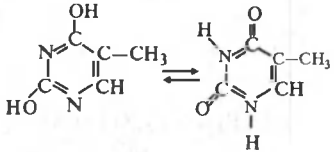
Purin $C_5H_4N_4$



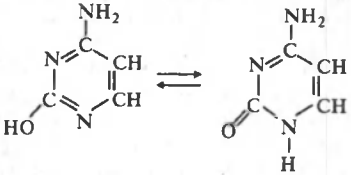
PIRIMIDIN ASOSLARI



uratsil (2, 4 — digidraksopirimidin)
$C_4H_4N_2O_2$

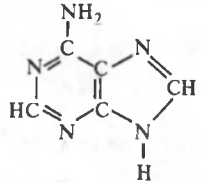


timin (2, 4 — digidpokso-5-metilpirimidin)
$C_5H_6N_2O_2$

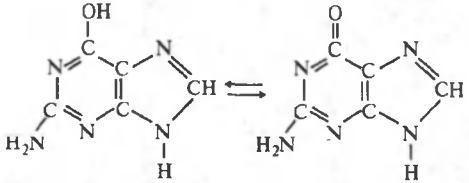


sitozin (4-amino-2-gidroksopirimidin) $C_4H_5N_3O$

PURIN ASOSLARI



adenin (6-aminopurin) $C_5H_5N_5$

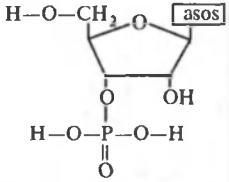


guanin (2-amino-6-gidroksapurin) $C_5H_5N_5O$

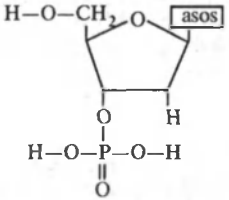
NUKLEIN KISLOTALAR

Barcha tirik hujayralarning eng muhim komponentlari nuklein kislotalardan tashkil topgan. Bu moddalar irsiyat xususiyatlarining avloddan-avlodga o'tishini boshqarib turadi.

Nuklein kislotalarning monomer bo'g'ini mononukleotidlar bo'lib, ular tarkibiga pirimidin yoki purin asoslarning qoldiqlari, uglevodlar komponenti — riboza yoki dezoksiribozalar va ortofosfat kislotalarning qoldiqlari kiradi. Ribonuklein kislotalar RNK — riboza qoldig'iga ega bo'lgan nukleotidlar



Dezoksiribozanuklein kislotalar DNK — dezoksiriboza qoldig'i bo'lgan nukleotidlar.



O'zaro vodorod bog'lanishlar orqali bir-biri bilan birikkan asoslar komplementar yoki bir-birini to'ldiruvchi asoslar deb ataladi.

Asoslarning biri albatta purin asos, ikkinchisi pirimidin asos bo'lishi kerak. Timin albatta adenin bilan, sitozin esa guanin bilan juft hosil qiladi.

OQSILLAR

Oqsillar molekulalari murakkab tarkib va tuzilishga ega bo'lgan azotli yuqori molekular organik moddalardir.

1888-yilda A. Ya. Danilevskiy $-\overset{\overset{O}{\|}}{C}-\overset{\overset{H}{|}}{N}-$ peptid bog'i mavjudligini ko'rsatdi.

1. Oqsillarda uzunasiga ketma-ket joylashgan amino-kislotalar bo'g'inlaridan iborat polipeptid zanjir oqsil molekulasining birlamchi strukturasi deyiladi.

2. *Oqsil molekulasining spiral shaklini eslatuvchi fazoviy* konfiguratsiyasi $-\overset{\overset{O}{\|}}{C}-$ va $-\overset{\overset{H}{|}}{N}-$ guruhlar orasida juda

ko'p vodorod bog'lar borligi tufayli oqsilning ikkilamchi strukturasi hosil bo'ladi.

3. *Fazoda spiral shaklida* buralgan polipeptid zanjir — oqsilning uchlamchi strukturasini hosil qiladi. Unda—disulfid (—S—S—), murakkab efir, tuz ko'priklar bo'ladi.

4. Oqsilning to'rtlamchi strukturasi—bunda ba'zi oqsil makromolekulalari bir-biri bilan birlashib yirik agregatlar hosil qiladi.

Rangli reaksiyalari:

1. Oqsil eritmasiga kamroq miqdorda natriy peroksid eritmasidan quyib, unga tomchilatib mis (II) sulfat eritmasi qo'shilsa qizil-gunafsha rang paydo bo'ladi.

2. Konsentrlangan HNO_3 bilan sariq rangga bo'yaladi.

3. Qo'rg'oshin (II) asetat eritmasidan solib, unga natriy gidroksid qo'shib qizdirilsa, qora rangli cho'kma tushadi. Bu S borligini bildiradi.

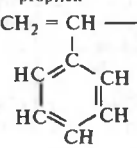
YUQORI MOLEKULAR BIRIKMALAR

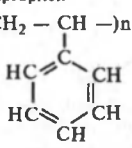
Olinishi:

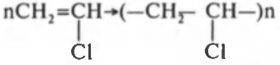
1. $nCH_2 = CH_2 \rightarrow (-CH_2-CH_2-)n$
   etilen — polietilen

2. $nCH_2=\underset{\underset{CH_3}{|}}{CH} \rightarrow (-CH_2-\underset{\underset{CH_3}{|}}{CH}-)n$
   propilen — polipropilen

3. $n\ CH_2 = CH \longrightarrow (-CH_2-CH-)n$


stirol

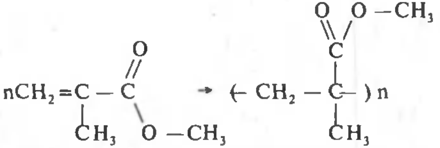

polistirol

4. 

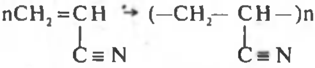
vinilxlorid — polivinil xlorid

5. $nCF_2 = CF_2 \rightarrow (-CF_2-CF_2-)n$

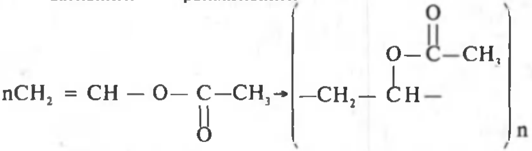
1,1 2,2 tetraftor etilen — politetraftoretelen (teflon)

6. 

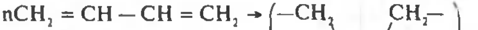
metil metakrilat — polimetilmetakrilat

7. 

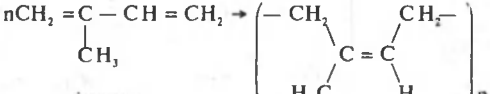
akrilonitril — poliakrilonitril

8. 

vinilasetat — polivinilasetat

9. 

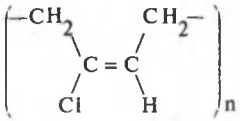
butadien – 1, 3
divinil

10. 

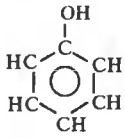
izopren — izopren kauchuk

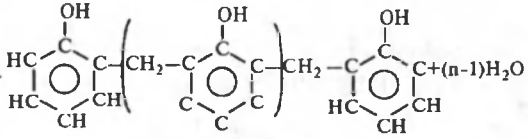
11. $nCH_2=C(Cl)-CH=CH_2 \rightarrow$

xlorpren

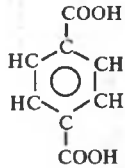
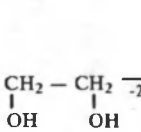


xlorpren kauchuk

12. n  + (n-1) $CH_2O \longrightarrow$

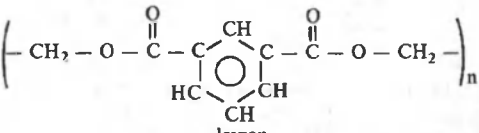


fenolformaldegid smola

13. n  + (n-1) 

tereftal k-ta

etilenglikol



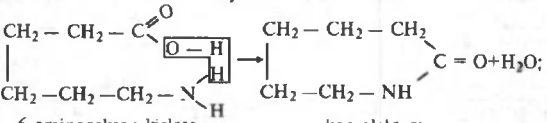
lavsan

14. $nH_2N(CH_2)_6NH_2 + nHOOC(CH_2)_4COOH \rightarrow$

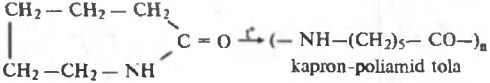
geksametilendiamin adipin kislota

$$\rightarrow (-NH-(CH_2)_6-NH-CO-(CH_2)_4-CO-)_n + 2nH_2O$$

neylon

15. 

6-aminogeksan kislota — kaprolaktam

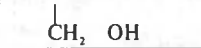
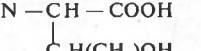
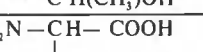
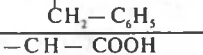
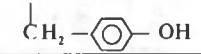
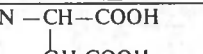
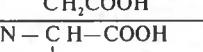
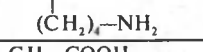
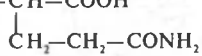
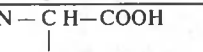


kapron-poliamid tola

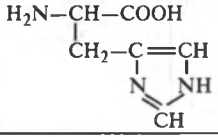
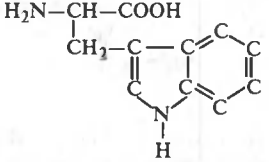
α-AMINOKISLOTALAR

Nomi	Formulasi
Glitsin	H_2N-CH_2-COOH
Alanin	$H_2N-\underset{\displaystyle CH_3}{\underset{\vert}{CH}}-COOH$
Valin	$H_2N-\underset{\displaystyle CH(CH_3)_2}{\underset{\vert}{CH}}-COOH$
Leysin	$H_2N-\underset{\displaystyle CH_2-\underset{\displaystyle CH_3}{\underset{\vert}{CH}}-CH_3}{\underset{\vert}{CH}}-COOH$
Izoleysin	$H_2N-\underset{\displaystyle CH(CH_3)C_2H_5}{\underset{\vert}{CH}}-COOH$
Sistein	$H_2N-\underset{\displaystyle CH_2SH}{\underset{\vert}{CH}}-COOH$
Metionin	$H_2N-\underset{\displaystyle CH_2-CH_2SCH_3}{\underset{\vert}{CH}}-COOH$

Jadvalning davomi

Nomi	Formulasi
Serin	
Treonim	
Fenilalanin	
Tirozim	
Asparagin kislota	
Glutamin kislota	
Glutamin	
Lizin	
Arginin	
Arginin	

Jadvalning davomi

Nomi	Formulasi
Gistidin	
Triptofan	

Ayrim muhim organik sintezlar:

1. **Vyoler.** 1828-yilda anorganik moddalardan mochevina sintezi.

$$NaOCN \xrightarrow{t,(NH_4)_2SO_4} NH_4OCN \xrightarrow{qay.\ gurh.} \underset{\text{mochevina}}{NH_2CONH_2}$$

2. **Zinin.** 1824-yil nitrobenzoldan anilan olish.

$$C_6H_5NO_2 + 3(NH_4)_2S \rightarrow C_6H_5NH_2 + 3S + 6NH_3 + 2H_2O$$

3. **Vyurs.** 1854-yil uglevodorodlar sintezi:

$$2RHal + 2Na \rightarrow R{-}R + 2NaHal(Hal{-}Cl,\ F,\ Br,\ J)$$

4. **Bertlo.** Noorganik moddalardan metan sintezi

$$CS_2 + 2H_2S + 8Cu \rightarrow CH_4 + 4Cu_2S$$

1854-yilda yog' sintezi:

$$\underset{\text{glitserin}}{C_3H_5(OH)_3} + 3\underset{\text{karbon k-ta}}{RCOOH} \rightarrow C_3H_5(OOCR)_3 + 3H_2O$$

1855-yilda etilendan etil spirt sintezi:

$$C_2H_4 + H_2O \xrightarrow{H_2SO_4} C_2H_5OH$$

1863-yilda metilen oddiy moddalardan sintezi:

$$2C + H_2 \xrightarrow{qizdirish} C_2H_2$$

1866-yilda asetilendan benzol sintezi:

$$3C_2H_2 \xrightarrow{qizdirish} C_6H_6$$

5. **Butlerov.** 1961-yilda formaldegiddan oddiy uglevodlar sintezi:

$$6CH_2O \xrightarrow{Ca(OH)_2} C_6H_{12}O_6$$

6. **Kucherov.** Asetilendan sirka aldegid sintezi, 1881-y.

$$HC \equiv CH + H_2O \xrightarrow{HgO} CH_3-\overset{\overset{O}{\parallel}}{C}-H$$

7. **Lebedev.** Butadien kauchugi sintezi, 1928-y.

$$2C_2H_5OH \xrightarrow{kat.} C_4H_6 + 2H_2O + H_2$$

$$xC_4H_6 \xrightarrow{Na} (C_4H_6)_x.$$

Organik kimyodan muhim qoidalar:

1. Markovnikov qoidasi:

$$CH_3-CH=CH_2 + HCl \rightarrow CH_3-\underset{\underset{Cl}{|}}{CH}-CH_3$$

2. Markovnikov qoidasiga teskari:

$$Cl-CH_2-CH=CH_2 + HCl \rightarrow Cl-CH_2-CH_2-CH_2-Cl$$

3. $$CH_3-C=CH + H_2O \rightarrow CH_3-\underset{\underset{}{|}}{\overset{OH}{C}}=CH_2 + H_2O$$

$$\rightarrow \left[CH_3-\underset{\underset{OH}{|}}{\overset{OH}{C}}-CH_3\right] \rightarrow CH_3-\underset{\underset{O}{\|}}{C}-CH_3 + H_2O$$

1 ta uglerod atomida bir vaqtda 2 ta —OH— gidroksil guruh mavjud bo'la olmaydi.

4. $$CH\equiv CH + H-OH \rightarrow [CH_2=CH-OH] \rightarrow CH_3-\overset{\overset{O}{\parallel}}{C}-H$$

qo'shbog' tutgan uglerod atomida —OH gidroksil guruh bo'la olmaydi.

MUNDARIJA

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ANORGANIK KIMYO

ORGANIK KIMYO

3400 сўм.

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G. Shoisayeva

KIMYO

Ma'lumotnoma

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Badiiy muharrir *J. Gurova*
Kompyuterda tayyorlovchi *B. Babaxodjayeva*

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