

**O‘zbekiston Respublikasi Sog‘liqni saqlash vazirligi
TOSHKENT FARMATSEVTIKA INSTITUTI
NOORGANIK, FIZIK VA KOLLOID KIMYO KAFEDRASI**

2-MA’RUZA:

**DAVRIY JADVALNING 11-13 GURUH
ELEMENTLARI, BIRIKMALARI VA
XOSSALARI.**

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ASOSIY ADABIYOTLAR:

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2. Shriver and Atkins, Inorganic Chemisrty, Fifth Edition, 2010/ P.W.Atkins, T.L.Owerton, J.P. Rourke, M.T. Weller and F.A. Armstrong, W.H. Freeman and Company, New York. 2010. P. 825.
3. Э.Т.Оганесян, В.А.Попков, Л.И.Щербакова, А. К. Брель; под ред. Э. Т. Оганесяна. — М. : Юрайт, 2019. — 447 с. — Серия: Специалист.
4. Общая и неорганическая химия для фармацевтов: учебник и и практикум для СПО/ под общ.ред. В.В.Негребецкого, И.Ю.Белавина, В.П.Сергеевой.- Издательство Юрайт, 2019.-357 с.-Серия: профессиональное образование.
5. Шрайвер Д., Эткинс П. Неорганическая химия. В 2-х т. Т 1/ Перевод с англ. М.Г.Розовой, С.Я. Истомина, М.Е.Тамм-Мир, 2004.-679 с.
6. Шрайвер Д., Эткинс П.. Неорганическая химия. В 2-х т. Т 2/ Перевод с англ. А.И.Жирова, Д.О.Чаркина, С.Я. Истомина, М.Е.Тамм-Мир, 2004.-486 с.
7. Thomas R. Gilbert - Chemistry_ The Science in Context-Norton (2017)

REJA:

Mavzuning ma'ruza davomida yoritiladigan qismlari:

1. 11-13 guruh elementlarining umumiy xossalari;
2. 11-guruh elementlari (mis, kumush va oltin) ning umumiy kimyoviy xossalari;
3. 12-guruh elementlari (rux, kadmiy va simob) ning umumiy kimyoviy xossalari;
4. 13-guruh elementlari (bor va alyuminiy) ning umumiy kimyoviy xossalari;
5. Ga, In va Tl birikmalari.

Mavzuning talaba mustaqil o'zlashtirishi lozim bo'lgan qismlari:

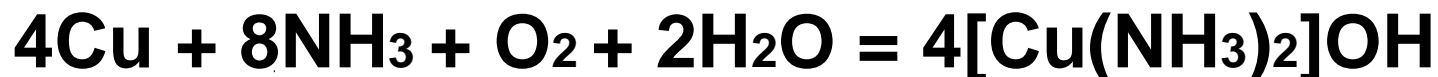
1. 11-13 guruh elementlarining olinishi;
2. Mis, kumush, oltin, rux, kadmiy, simob, bor va alyuminiy birikmalari;
3. 11-13 guruh elementlarining farmatsiyadagi ahamiyati.

11-guruh elementlarining asosiy kattaliklari

Asosiy kattaliklar	Mis	Kumush	Oltin
Atom massa	63,62	107,87	196,97
Elektron formula	$3d^{10}4s^1$	$4d^{10}5s^1$	$5d^{10}6s^1$
Atom radiusi, nm	0,128	0,144	0,144
Ion radiusi, nm	0,098	0,126	0,137
Suyuql.harorati, °C	1083	960,5	1455
Ionlanish energiyasi $M \rightarrow M^+$	7,726	7,576	9,226
Zichligi, g/sm³	8,96	10,5	19,3
Yer po'stlog'ida tarqalishi, %	$3 \cdot 10^{-3}$	$6 \cdot 10^{-6}$	$4 \cdot 10^{-10}$

11-guruh elementlarining umumiy xossalari (Cu, Ag, Au)

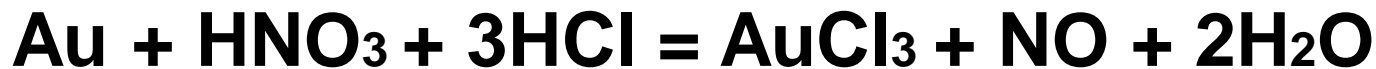
Cu va Ag kons. HNO₃ va H₂SO₄:



Cu, Ag va Au sianidlarda eriydi:

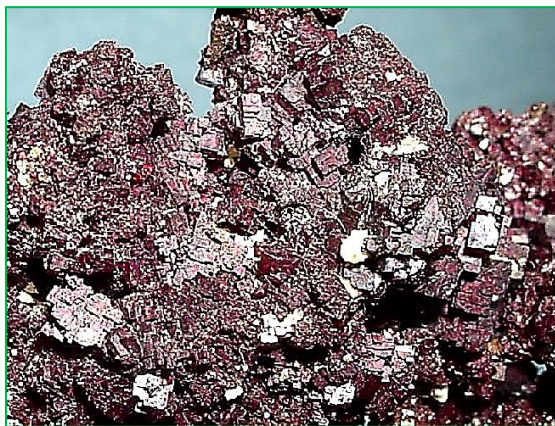


Au – zar suvi taʼsirida:



Fosfor bilan: Cu₃P, CuP Cu₂P₃ AgP₂, Ag₃P₁₁, AuP₃, Au₂P₃

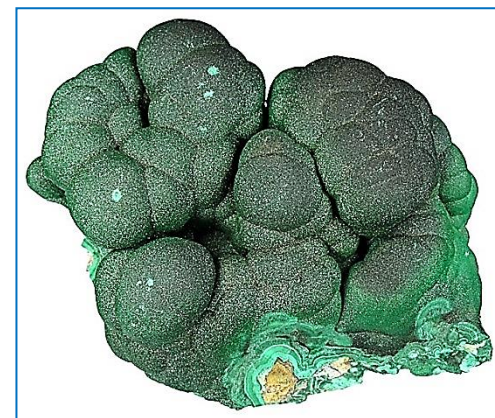
Misning tabiatda tarqalgan birikmalari



Kuprit
 Cu_2O



**Misli kolchedan yoki
xalkopirit – CuFeS_2**

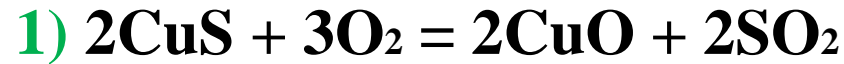


Malaxit (CuOH) $_2\text{CO}_3$

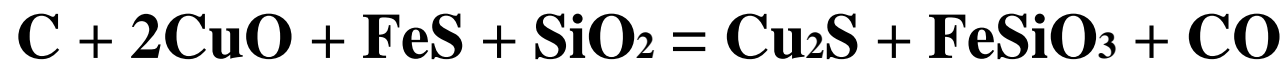


Azurit
 $\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2$

Cu olinishi:



Koks yordamida qizdirilib:

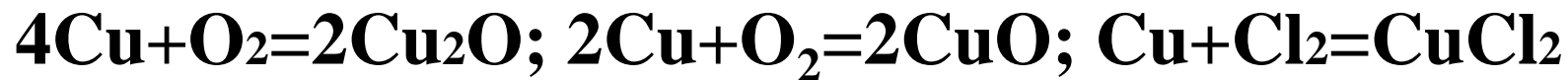


2) Toza mis, misli anodni elektroliz qilish orqali olinadi. (99,99 %).

Qo'llanilishi. Korabl korpuslari Cu qoplanadi.

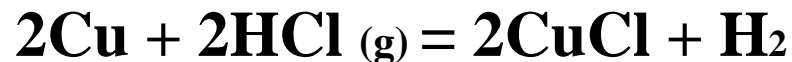
Bronza – Cu 90%, Sn – 10%; **Latun** – Cu 60%, Zn – 40%;

Tangalar – Cu 95%, Al – 5%.



Cu–N₂ va C bilan ta'sirlashmaydi. $2\text{Cu} + \text{O}_2 + \text{H}_2\text{O} + \text{CO}_2 = (\text{CuOH})_2\text{CO}_3$

Yuqori haroratda Cu – HCl bug'lari bilan:

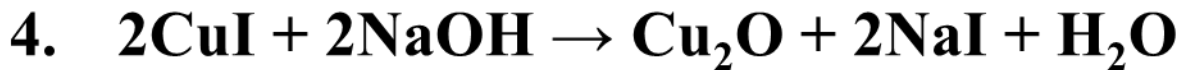
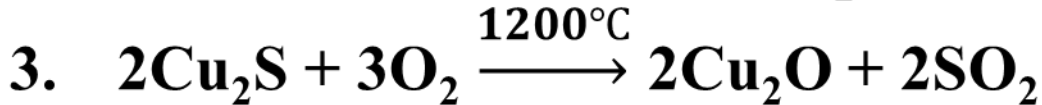
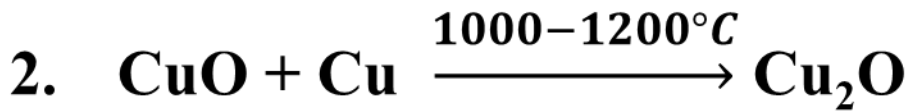


Xona haroratida muvozanat o'ngga siljiydi.

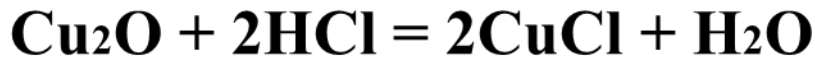
Mis (I) birikmalari

Cu_2O – qizil kristall modda (kuprit).

Olinishi:



Kimyoviy xossalari: Amfoter oksid, NaOH da qiyin eriydi.



CuOH (sariq) beqaror:



$[\text{Cu}(\text{NH}_3)_2]^+$ ammiakatlar .



Mis (II) birikmalari

CuO – qora rangli kukun. Amfoter oksid.

Olinishi: 1). $2\text{Cu} + \text{O}_2 = 2\text{CuO}$; 2). $\text{CuCO}_3 = \text{CuO} + \text{CO}_2$; 3) $\text{Cu}(\text{OH})_2 = \text{CuO} + \text{H}_2\text{O}$

Parchalanganda: $4\text{CuO} = 2\text{Cu}_2\text{O} + \text{O}_2$; $\text{H}_2 + \text{CuO} = \text{Cu} + \text{H}_2\text{O}$

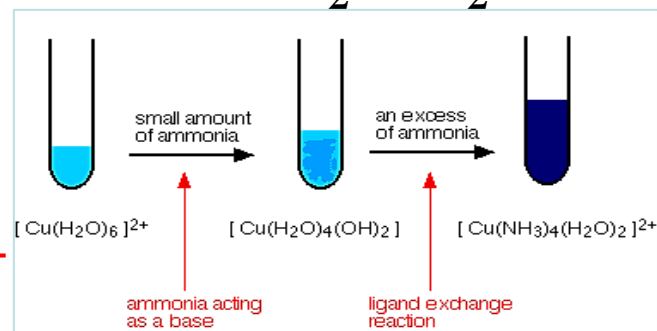
CuO – kons. NaOH da va kislotalarda eriydi:

$\text{CuO} + 2\text{NaOH} = \text{Na}_2\text{CuO}_2 + \text{H}_2\text{O}$; $\text{CuO} + 2\text{HCl} = \text{CuCl}_2 + \text{H}_2\text{O}$

$\text{CuSO}_4 + 2\text{NaOH} = \text{Cu}(\text{OH})_2 \downarrow + \text{Na}_2\text{SO}_4$

$\text{Cu}(\text{OH})_2 + 4\text{NH}_4\text{OH} = [\text{Cu}(\text{NH}_3)_4](\text{OH})_2 + 4\text{H}_2\text{O}$

$\text{Cu}(\text{H}_2\text{O})_4(\text{OH})_2 + 4\text{NH}_3 \rightarrow [\text{Cu}(\text{H}_2\text{O})_2(\text{NH}_3)_4]^{2+} + 2\text{H}_2\text{O} + 2\text{OH}^-$



Yangi tayyorlangan **Cu(OH)₂** kons. NaOH gidroksokupratlar:

$\text{Cu}(\text{OH})_2 + 2\text{NaOH} = \text{Na}_2[\text{Cu}(\text{OH})_4]$; $\text{CuCl}_2 + \text{HCl} = \text{H}[\text{CuCl}_3]$

$\text{CuCl}_2 + 2\text{HCl} = \text{H}_2[\text{CuCl}_4]$ Suvsiz **CuSO₄** oq kukun modda.

Eritmada ko'kish-havo rang $[\text{Cu}(\text{H}_2\text{O})_4]\text{SO}_4 \cdot \text{H}_2\text{O}$ (**CuSO₄ · 5H₂O**)

$\text{Cu}(\text{CH}_3\text{COO})_2 \cdot \text{H}_2\text{O}$; $2\text{Cu}(\text{NO}_3)_2 = 2\text{CuO} + 4\text{NO}_2 + \text{O}_2$



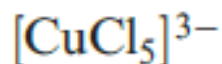
Linear

sp



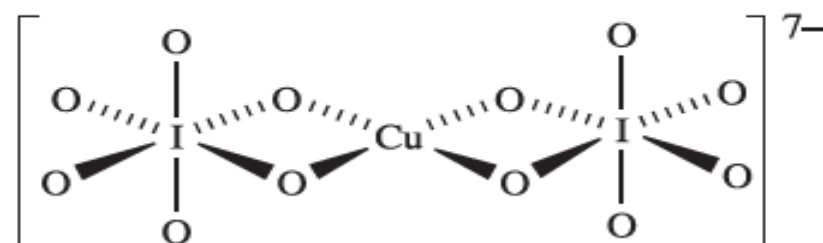
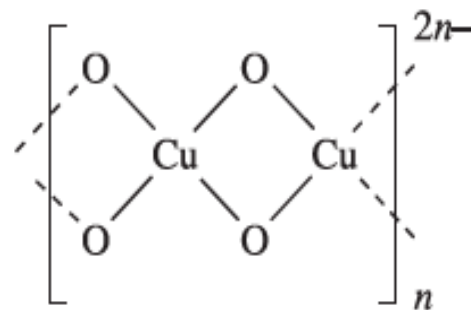
Trigonal planar

sp^2



Trigonal bipyramidal

sp^3d



octahedral structure.



желтый

гексацианоферрат (II) калия

коричнево-красный

гексацианоферрат (II)

меди (II)



гексацианоферрат (III) калия

зелено-желтый

гексацианоферрат (III)

меди (II)

Mis (III) birikmalari

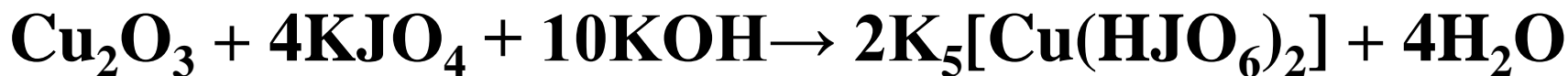
Cu₂O₃ – suvda erimaydigan qizil kristall modda.

Olinishi: - 23⁰C da:



75⁰C da parchalanadi: $\text{Cu}_2\text{O}_3 \rightarrow \text{CuO} + \text{O}_2$

Kuchli oksidlovchi:



Ftor bilan: K₃[CuF₆]. NaCuO₂ ning olinishi:

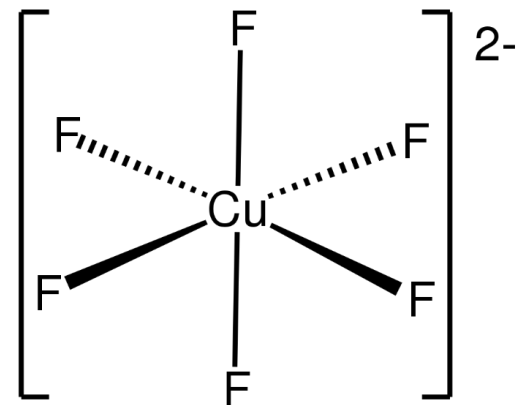


K₂S₂O₈ – kaliy peroksodisulfat;

Mis (IV) birikmalari



(Cs⁺)₂



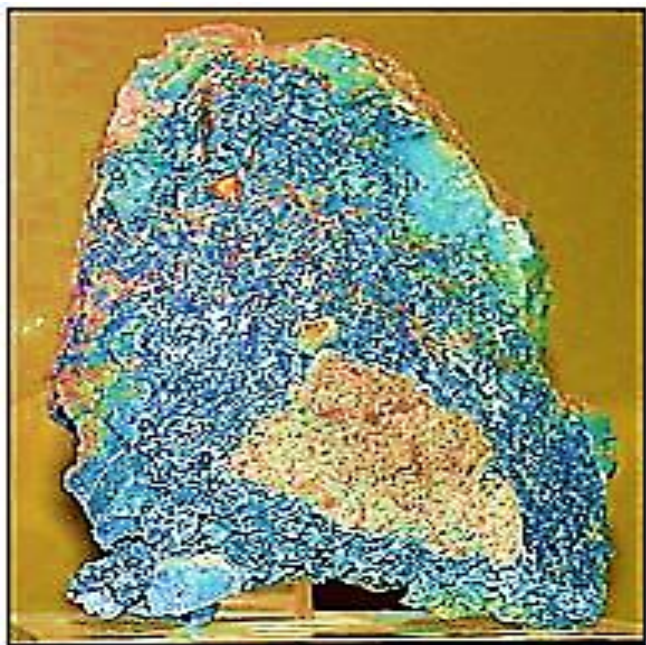
Ag ning tabiatda tarqalishi:

Kumush tiosurmanit – Ag_3SbS_3 .

Ag_3AsS_3 – kumush tioarsenit.

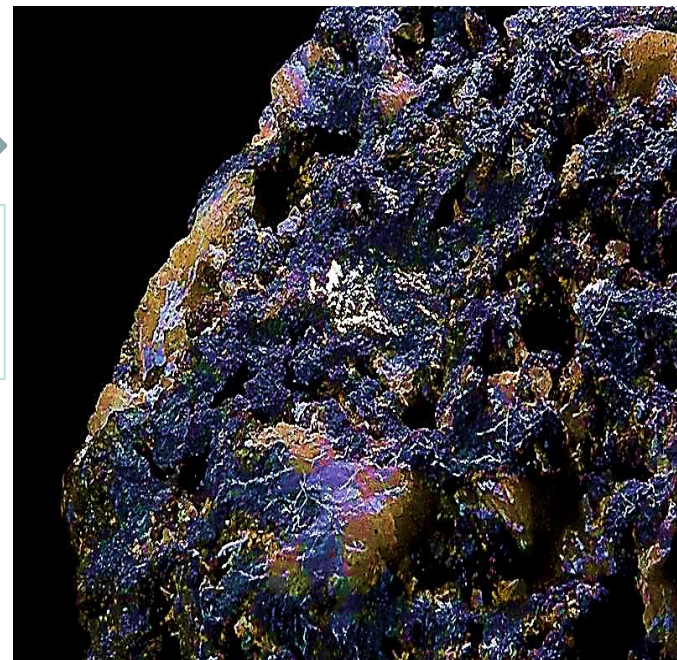
Kumush yaltirog'i – Ag_2S va AgCl , AgBr , AgI .

Amalgamalar: Ag_3Hg_3 , Ag_3Hg_2 , Ag_3Hg_4



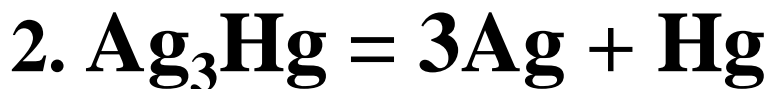
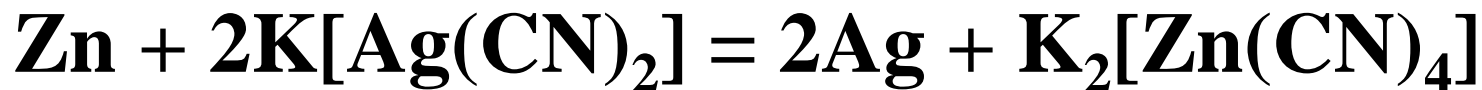
Sylvanite is silver-white or steel-gray and has a brilliant metallic luster and a yellowish gray streak. It is an isomorphous mixture of gold and silver tellurides in the ratio of about 1 to 1.

Sylvanit
 $(\text{Au}, \text{Ag})_2 \text{Te}_4$

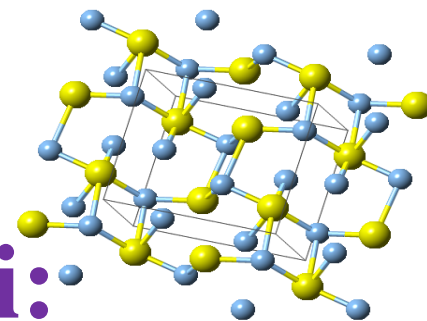


Kumushning yer po'stlog'idagi o'rtachaa tarqalishi (Vinogradov bo'yicha) – 70 mg/t. Uning qumdagi eng yuqori konsentratsiyasi 1 g/t. Dengiz suvida kumushning konsentratsiyasi – 0,04 mkg/l). Inson organizmidagi kumushning konsentratsiyasi – 0,02 mg/kg.

Ag olinishi:

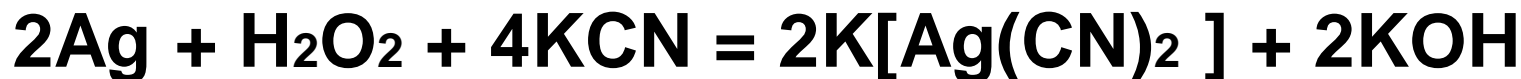


Tamg'a (proba). Ag 800-875.



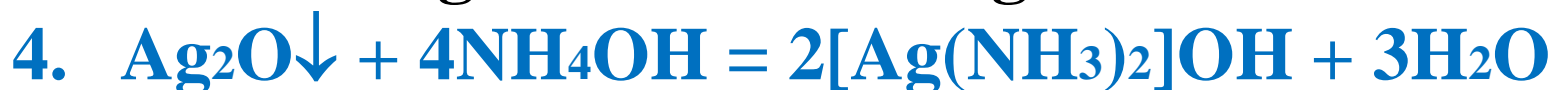
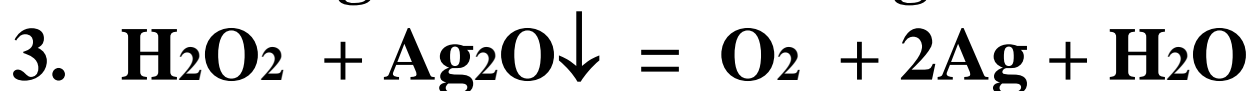
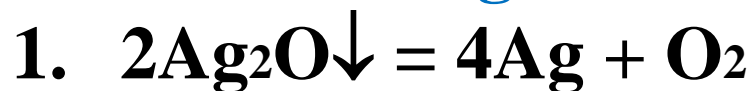
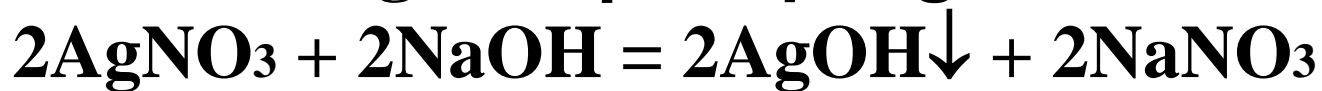
Ag ning kimyoviy xossalari:

Ag – O₂, H₂ va kislotalar bilan oksidlanmaydi. **Ag₂S**



Kumush (I) birikmalari

Ag⁺¹birikmalari. Ag₂O – qora qo'ng'ir kristall.



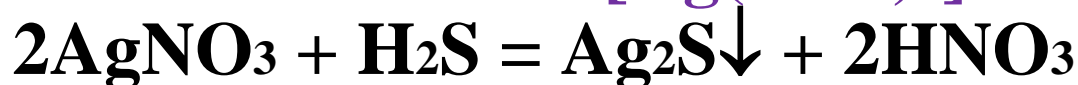
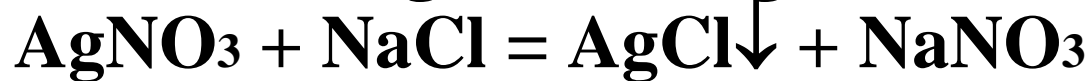
AgF*2H₂O yoki AgF*4H₂O rangsiz kristall.

AgCl komplekslari:



Kumush birikmalari

Ag⁺ oksidlovchi. $Zn + 2AgNO_3 = 2Ag + Zn(NO_3)_2$



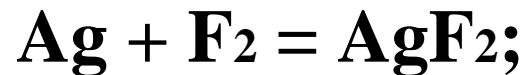
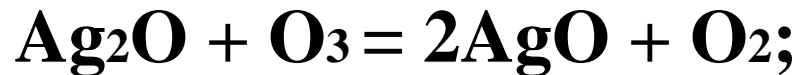
AgNO₃ – gidrolizga uchramaydi.



Ag⁺ - bakteriyalar o'sishini to'xtatadi.

AgNO₃ + KNO₃ (1:2 massa nisbat eritmalari) aralashmasi – **lyapis.**

Ag⁺² birikmalari. AgO va AgF₂.



Ag⁺³ birikmalari. K[AgF₄].

Lyapis – shilliq pardalar, yaralar, teri yoriqlari, kon'yunktivit va boshqa kasalliklarning shikastlanishini (eroziyasini) davolashda ishlatiladi. Past konsentratsiyalarda lyapis yallig'lanishga qarshi va biriktiruvchi ta'sirga ega va yuqori konsentratsiyalarda va kuydiradi.

Tabiatda oltinning tarqalishi



Klaverit
Au₂Te



Silvanit (Au, Ag)₂Te₄



Silvanite is silver-white or steel-gray and has a brilliant metallic luster and a yellowish gray streak. It is an isomorphous mixture of gold and silver tellurides in the ratio of about 1 to 1.

Au kvars
tarkibida



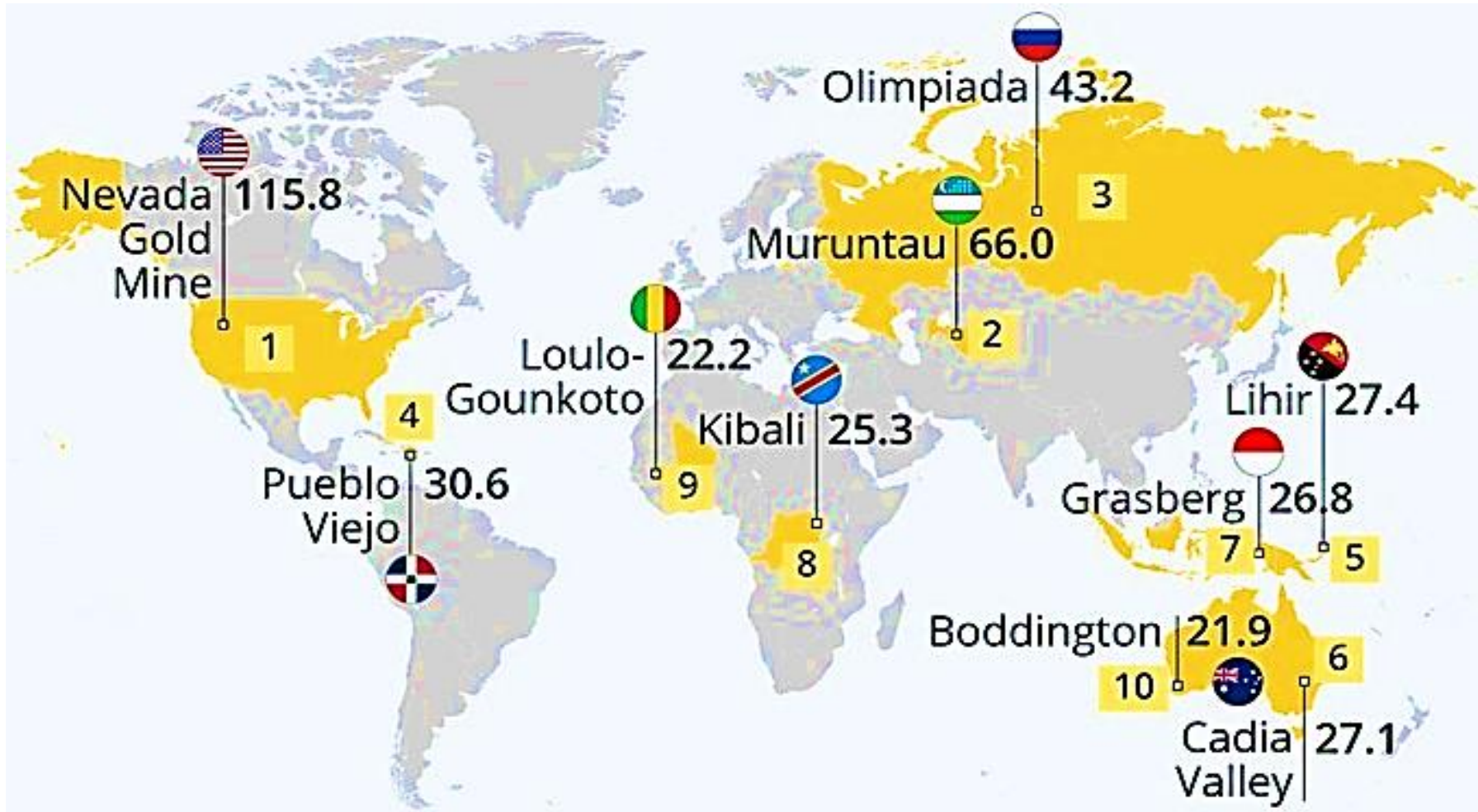
Олтин zahirasi bo'yicha yetakchilar (2014 yil holatiga ko'ra)

Лидеры добычи золота по состоянию на 2014 год^[33]:

1.  Китай — 450 т.;
2.  Австралия — 270 т.;
3.  Россия — 245 (272^[34]) т.;
4.  США — 211 т.;
5.  Канада — 160 т.;
6.  ЮАР — 150 т.;
7.  Перу — 150 т.;
8.  Узбекистан — 102 т.;
9.  Мексика — 92 т.;
10.  Гана — 90 т.;
11.  Бразилия — 70 т.;
12.  Индонезия — 65 т.;
13.  Папуа — Новая Гвинея — 60 т.;
14.  Чили — 50 т.

Manba: [Mineral commodity summaries 2015](#)

Dunyodagi eng yirik oltin konlari: Muruntov, O'zbekiston

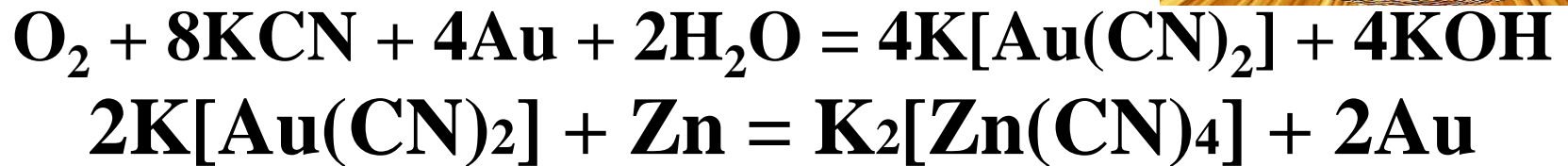
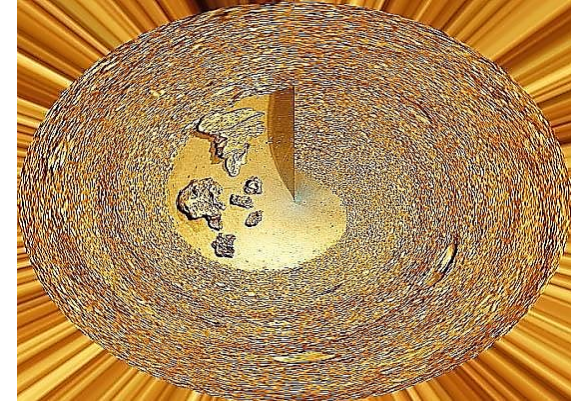


O'zbekistonning Qizilqum cho'lidagi Muruntov oltin koni dunyodagi eng yirik ochiq oltin koni bo'lib, yillik qazib chiqarish bo'yicha 66 tonna bilan ikkinchi o'rinda turadi.

<https://www.spot.uz/ru/2020/09/30/gold/>

Au olinishi:

1. Tog' minerallarini yuvib;
2. Hg amalgamalarini parchalab.



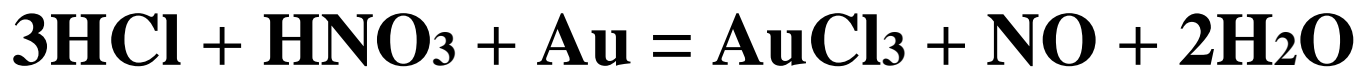
Au ning kimyoviy xossalari:

Au–suv, kislota O_2 , HNO_3 va H_2SO_4 lar b/n oksidlanmaydi.

Galogenlar, ftor bilan $300\text{-}400^\circ\text{C}$ da:



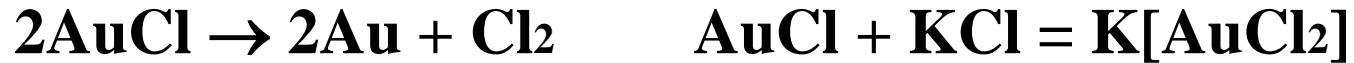
$\text{H}[\text{AuCl}_4]$ kompleksini hosil qiladi.



Au ning kimyoviy xossalari:

Au⁺. Au₂O, Au₂S erimaydi. Au va Cl₂ ta'sirlashuvi 150-300°C da boradi.

Au⁺³ barqaror.

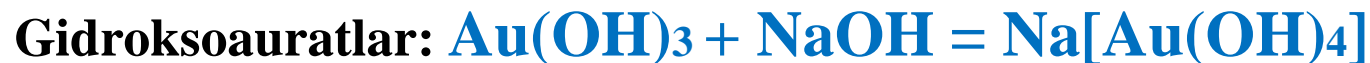


AuBr, AuJ, Au₂S – qora modda. AuCN – qo'ng'ir modda.



H[AuCl₄]* sariq “oltin tuz” - Na[AuCl₄]*2H₂O.

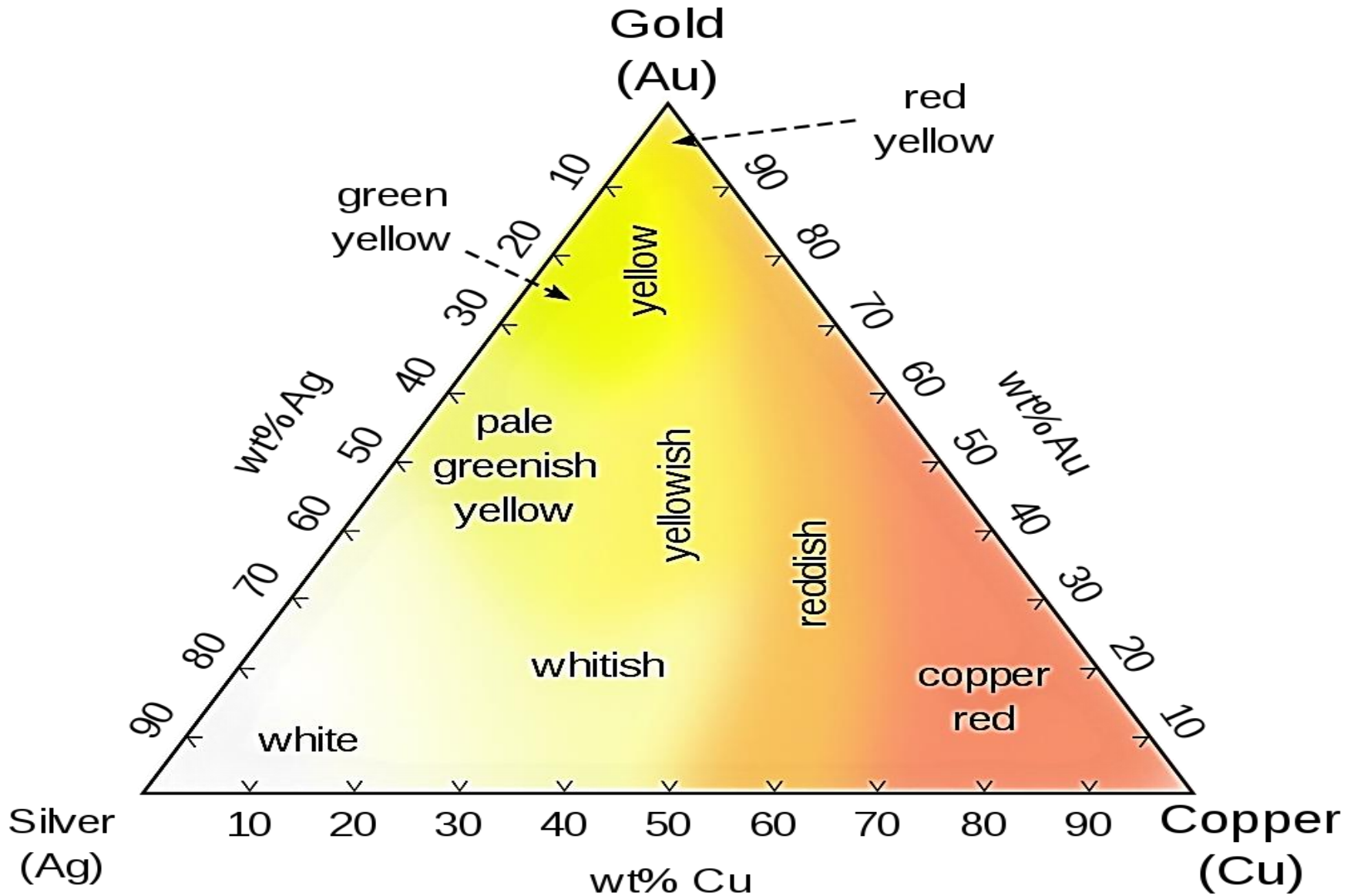
Au(OH)₃ – qizil-jigarrang.



Natriy tetragidroksoaurat (III)



11-guruh metallari o'zaro qotishmalarining ranglari



11-guruh elementlarining farmatsiyadagi ahamiyati

- Cu ko'payish, qonning quyilishi, pigmentatsiya, organizmning o'sishi va rivojlanishi, oksid-qayt.
- Cu yetishmasa gemogloblin hosil bo'lishi kamayib, anemiya kuzatiladi.
- $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ – antiseptik.
- Organizmning Ag ga 1 kunlik talabi 0,1 mg.
- Tuxum sarig'i 100 g ida 0,2 mg Ag bo'ladi.
- Au birikmalari sil kasalligi chqiruvchilariga faol.
- $\text{Na}[\text{AuS}_2\text{O}_3]$ qizilchada.
- Krizanol $[\text{Au-S-CH}_2\text{-CH}_2\text{-O-CH}_2\text{SO}_3]_2\text{Ca}$ qizilcha, sil, moxovda.
- Oltin-198 izotopi (yarim yemirilish davri 2,7 kun) yadro tibbiyotida, ayrim saraton va boshqa kasalliklarni davolashda ishlatiladi.

ToshFarmi olimlari tomonidan vitiligoni davolash uchun original dori vosita – “Kupir” ishlab chiqilgan.



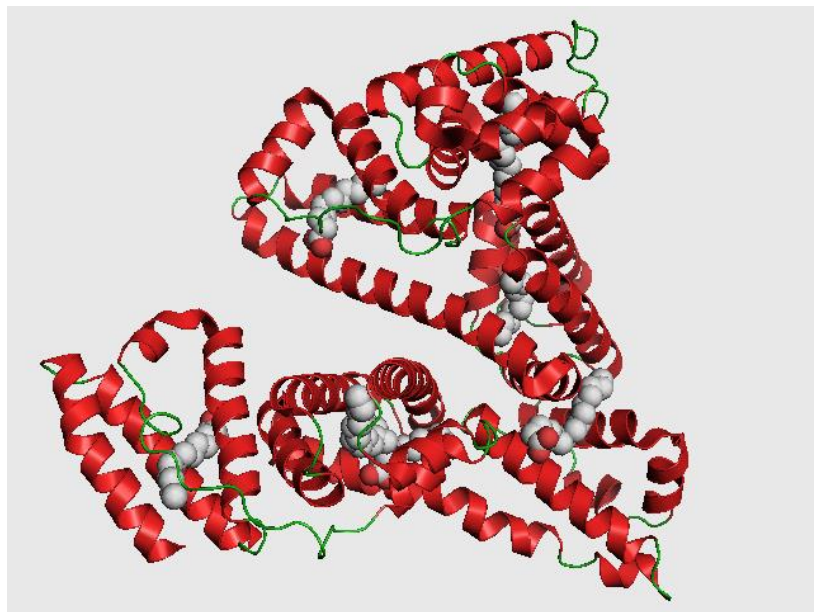
Misning kunlik qabul qilish me'yori:

Bolalarda yoshiga qarab – 200-100 mkg (0-13);

Kattalarda – 900 mkg;

Homilador ayollarda – 1000 mkg.

Kumush asosida “Protargol” va “Kollargol” dori vositalari olingan va tibbiyot amaliyotida keng qo’llanilib kelinmoqda.



Albumin M=65 kDa

**Kollargol (70% Ag);
Protargol - *Argentum proteinate*
(7,8-8,3% Ag)**

Lyapis – AgNO_3 , so’gallarni yo’qotishda qo’llaniladi.

Kumush bilan tozalangan suv tarkibida 0,05 mg/ml Ag saqlaydi.

Ag^+ bakteriyalarga qarshi faollikka ega.

$[\text{Ag}(\text{NH}_3)_2]\text{F}$ – kariesga qarshi

Oltinning turli ligandlar bilan ko'plab kompleks ionlari va birikmalari o'rganilgan [Letnikov, 1981]:

- 1. Xloridli** – $[\text{AuCl}_2]^-$, $[\text{AuCl}_4]^-$; trixlorid oltin gidratlangan holda eritmalarda mavjud $\text{H}_2[\text{OAuCl}_3]$.
- 2. Hidroksoxloridli** – $[\text{AuCl}_3(\text{OH})]^-$, $[\text{AuCl}_2(\text{OH})_2]^-$; $[\text{AuCl}(\text{OH})]^-$.
- 3. Hidroksokomplekslar** – $\text{Au}(\text{OH})$, $[\text{Au}(\text{OH})_2]^-$, $[\text{Au}(\text{OH})_4]^-$, $[\text{Au}(\text{OH})_5]^-$.
- 4. Bromli** – $[\text{AuBr}_2]^-$, $[\text{AuBr}_4]^-$.
- 5. Yodli** – $[\text{AuI}_2]^-$, $[\text{AuI}_4]^-$.
- 6. fluorli** – $[\text{AuF}_4]^-$, $[\text{AuF}_6]^-$.
- 7. Oltinugurtli** (sulfid va gidrosulfid) – $\text{Au}(\text{HS})$, $[\text{Au}(\text{HS})_2]^{2-}$, $[\text{Au}(\text{HS})_2\text{S}]^{2-}$, $[\text{AuS}]^-$.
- 8. Tiosulfat** – $[\text{Au}(\text{S}_2\text{O}_3)_2]^{3-}$.
- 9. Sianidli** – $[\text{Au}(\text{CN})_2]^-$.
- 10. Tarkibida oltin saqlovchi organik birikmalar.**

Oltinni eritmalarga o'tkazishda uning xlor, oltinugurt va uglerod bilan hosil qilgan va suvda eruvchan birikmalari muhim ahamiyatga ega.

Продукты питания богатые медью (Cu)

Печень



Медь: 3000 (мкг) свин.,
3800 (мкг) гов., 390 (мкг)
птицы.

Арахис



Медь: 1144 (мкг)

Фундук



Медь: 1125 (мкг)

Креветка



Медь: 850 (мкг)

Горох



Медь: 750 (мкг)

**Макаронные
изделия**



Медь: 700 (мкг)

Чечевица



Медь: 660 (мкг)

Гречка



Медь: 660 (мкг)

Рис



Медь: 560 (мкг)

Пшеница



Медь: 470 - 530 (мкг)

Грецкий орех



Медь: 527 (мкг)

Фисташки



Медь: 500 (мкг)

Овсянка



Медь: 500 (мкг)

Фасоль



Медь: 480 (мкг)

Осьминог



Медь: 435 (мкг)

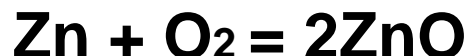
12-guruh elementlarining asosiy kattaliklari

Asosiy kattaliklar	Rux	Kadmiy	Simob
Atom massasi	65,37	112,4	200,69
Elektron formulasi	$3d^{10}4s^2$	$4d^{10}5s^2$	$5d^{10}6s^2$
Atom radiusi, nm	0,139	0,156	0,160
Ion radiusi, nm	0,085	0,099	0,112
Qaynash harorati, °C	419,53	321,1	-38,83
Ionlanish energiyasi $M \rightarrow Me^+$	17,96	17,90	18,75
Zichligi, g/sm³	7,1	8,7	13,55
Yer po'stlog'ida tarqalishi, %	$8 \cdot 10^{-3}$	$1,3 \cdot 10^{-5}$	$7 \cdot 10^{-6}$

12-guruh elementlari

Zn - Cd - Hg qatorida faollik kamayadi.

Zn va Cd sirti yupqa oksid parda bilan qoplangan.



Cd va Hg – ishqorlar b/n, Hg – suyuq. kislotalar b/n ta'sirlashmaydi.

Zn, Cd, Hg – galogenlar, xalkogenlar bilan ta'sirlashadi, azot, uglerod va vodorod bilan ta'sirlashmaydi.

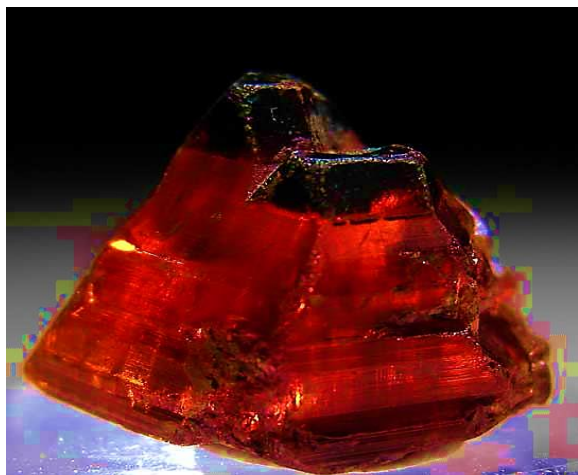


Zn, Cd – fosfor bilan reaksiyaga kirishadi:

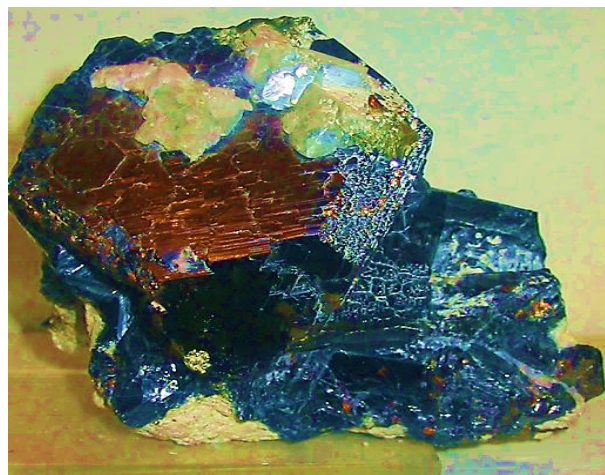


Ag va Sn – tish amalgamalari (plombalar). Zn va Cd – yumshoq va kumushsimon metallar. Ular geksoqanal zich joylashuvga ega. Cd – ruxdan yumshoq.

12-guruh elementlarining tabiatda tarqalishi



Vyuritsit - (α -ZnS)



Sfalerit - (β -ZnS)



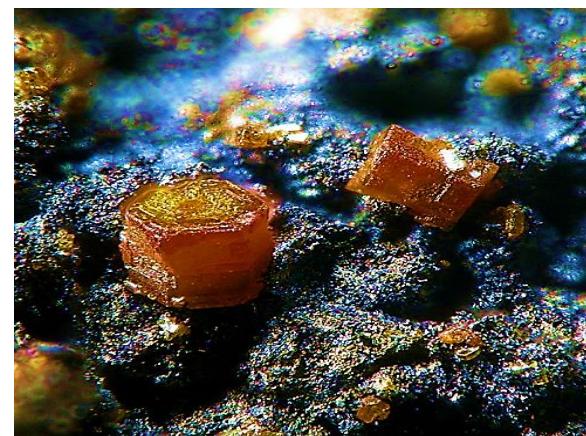
Galmey - $ZnCO_3$



Gemimorfit
 $Zn_4Si_2O_7(OH)_2 \cdot H_2O$

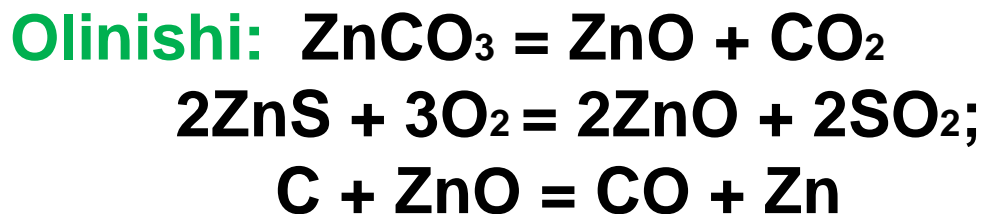


Kinovar - HgS



Grinokit - CdS

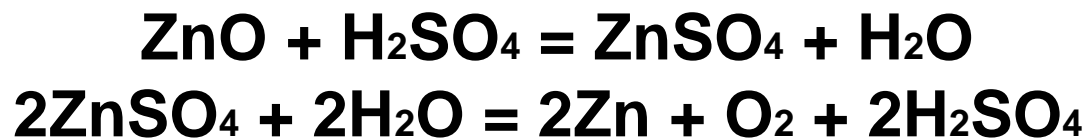
Ruxning olinishi



Koks bilan qaytarish:



Gidrometallurgiya:



Xossalari. Ko'k-kumushsimon metall.
Yupqa oksid pardaga ega,
suyuqlanish harorati $419,5^\circ\text{C}$.

Qo'llanilishi:

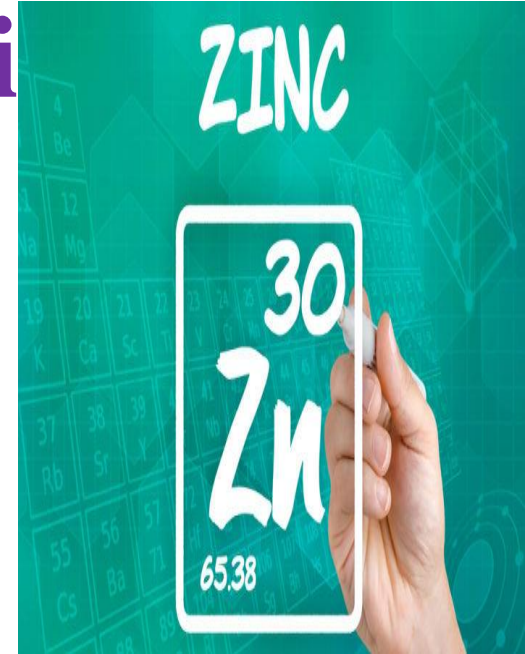
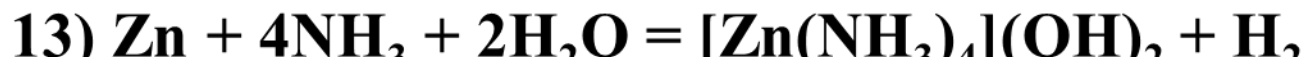
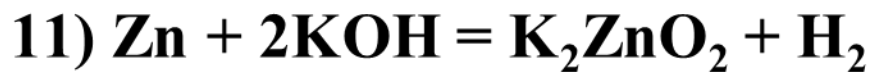
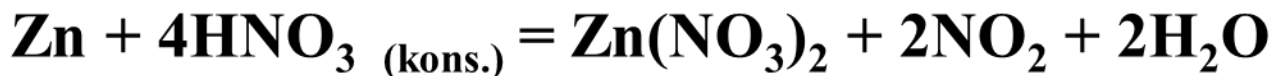
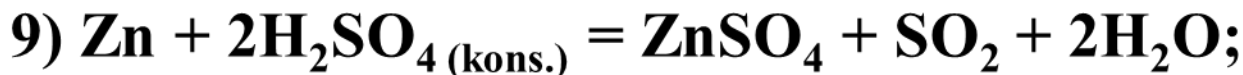
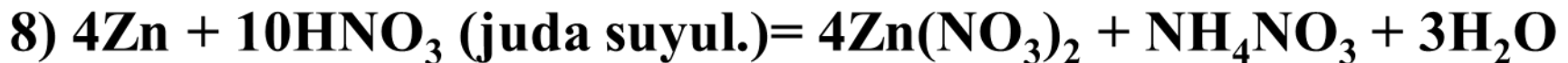
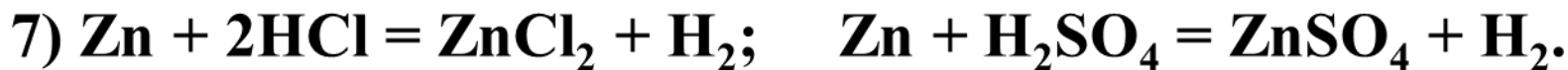
- ✓ Sirti rux bilan qoplangan temir korroziyaga uchramaydi.
- ✓ Latun – 60% Cu va 40% Zn.
- ✓ Laboratoriya sharoitida H_2 olish uchun.
- ✓ Rangli metallurgiyada Au va Ag olish uchun.



Ruxning kimyoviy xossalari

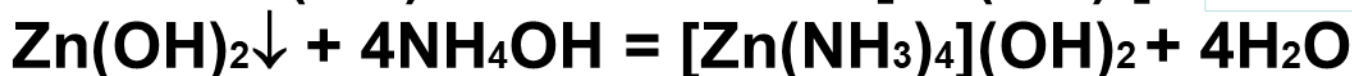
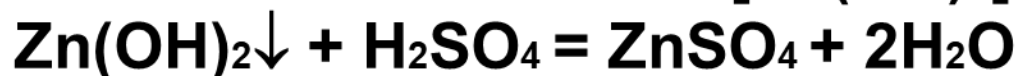
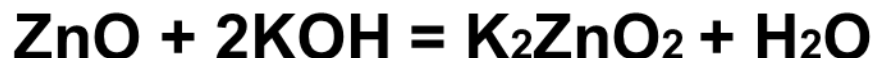
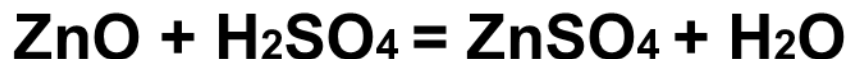


5) Rux H_2 , N_2 , Br_2 , Si va C b-n ta'sirlashmaydi.



Ruxning birikmalari

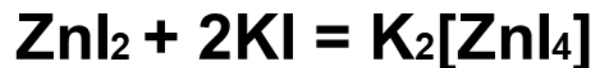
ZnO – amfoter oksid. Oq rangli, 1950°C da parchalanadi.



Akva komplekslar - $[\text{Zn}(\text{H}_2\text{O})_4]^{2+}$.



Anion komplekslar:



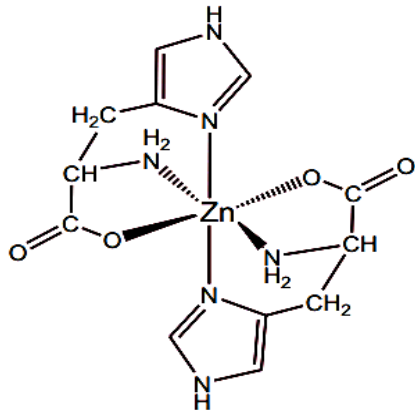
ZnS – lyuminofor modda.



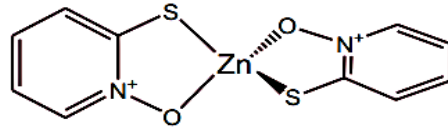
ZnSO₄ – tibbiyotda, elektrolit sifatida.



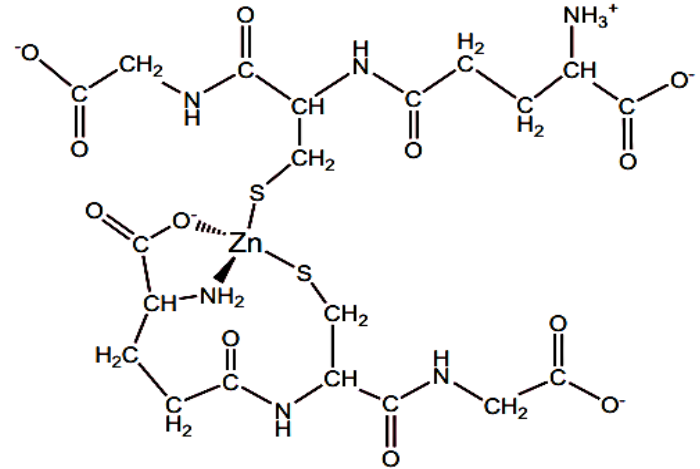
Zn (II) ning kompleks birikmalari



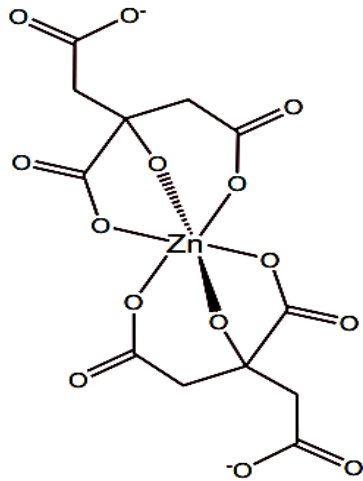
Zn(His)₂



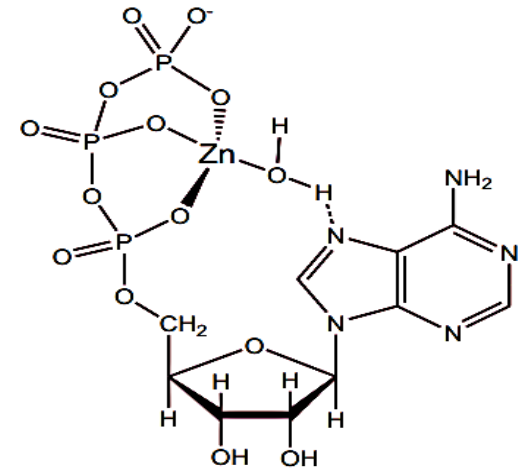
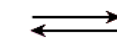
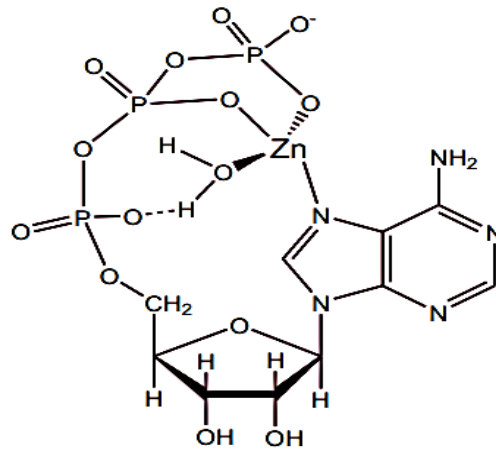
Zn(pyritione)₂



Zn(GSH)₂



Zn(citrate)₂



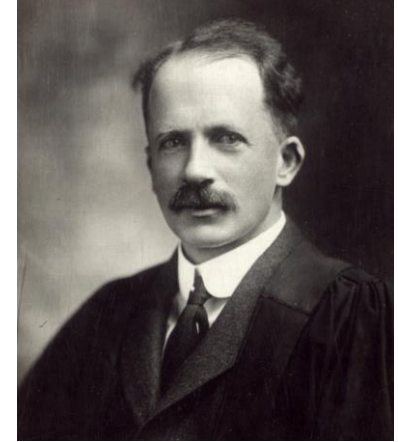
Zn-ATP

Insulin – hayot garmoni!

**Ular 1923 yilda
insulin gormonini
kashf etganlari
uchun Nobel
mukofotiga sazovor
bo'lishdi.**



Frederik Grant Banting
[14 noyabr 1891](#), Alliston^[en] —
[21 fevral 1941](#), Nyufaundlend)



Jon Jeyms Rikard Makleod
[6 sentabr 1876](#), Kluni^[en] —
[16 mart 1935](#), Aberdin

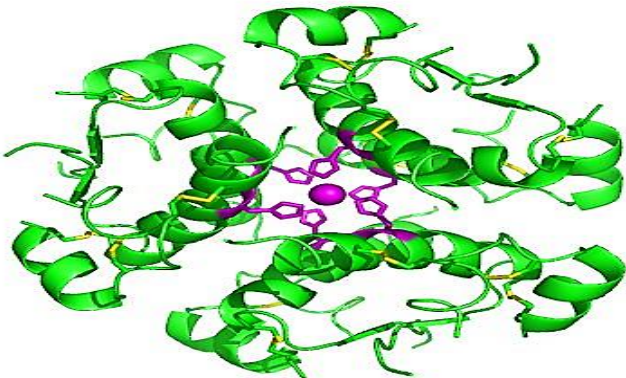
Best, Charlz Gerbert
(1899-1978)



1919

Insulin

Dag'al endoplazmatik to'ring ribosomalarida prekursor-peptid sintezlanadi - bu preproinsulindir. U 110 ta aminokislota qoldig'idan tuzilgan polipeptid zanjiri bo'lib, ketma-ket joylashgan: L-peptid, B-peptid, C-peptid va A-peptidni o'z ichiga oladi.



INSULIN ZINC INJECTABLE SUSPENSION (INSULIN-RUX SUSPENSIYASI IN'EKSIYA UCHUN)

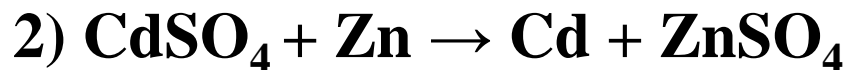
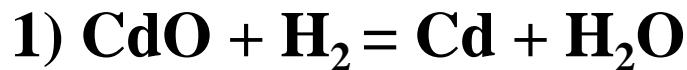
- Farmakologik ta'sir

Inson insulini (30% amorf va 70% kristalli insulin o'z ichiga olgan aralash rux-suspenziyasi) o'rtacha ta'sir qilish muddati. Qonda glyukoza darajasini pasaytiradi, uning to'qimalar tomonidan so'rilishini kuchaytiradi, lipogenezni, glikogenogenezni, oqsil sintezini kuchaytiradi va jigar tomonidan glyukoza ishlab chiqarish tezligini pasaytiradi. Ushbu insulinning ta'siri tomir ichiga yuborilganidan keyin 2,5 soat o'tgach boshlanadi. Maksimal ta'sir 7 dan 15 soatgacha rivojlanadi. Ta'sir qilish muddati 24 soat. Ushbu insulinning profili preparatning dozasi bog'liq bo'lib, sezilarli interpersonal va intrapersonal o'zgarishlarni aks ettiradi.

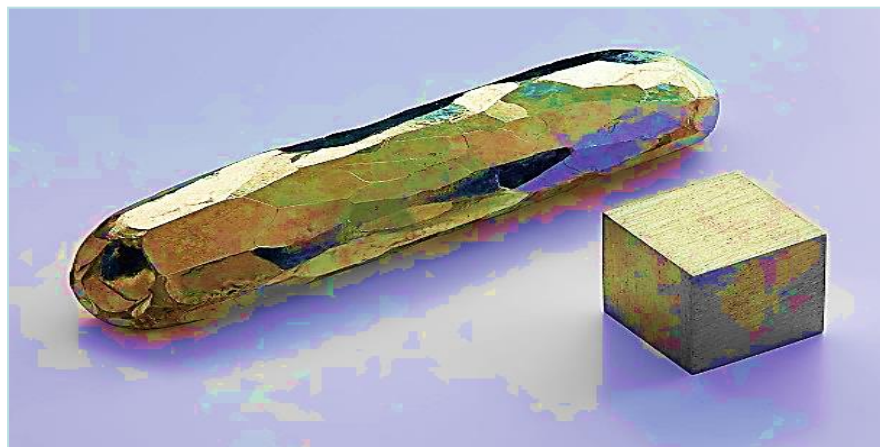
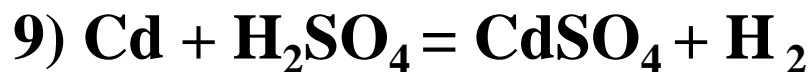
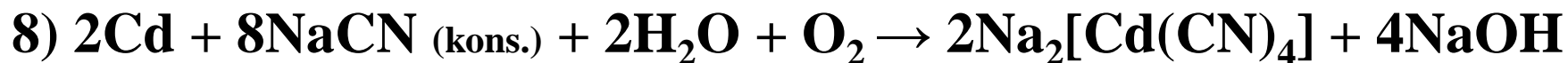


Kadmiy va uning xossalari

Olinishi: Agar vodorod atmosferasida CdO qizdirilsa, metal kadmiy hosil bo'ladi:



Xossalari:

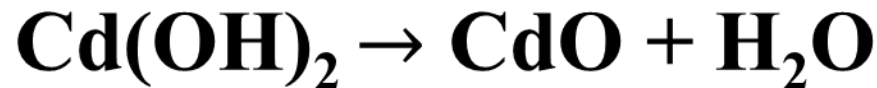


Kadmiy va uning birikmalari

CdO qo'ng'ir jigar rangli, lekin havoda CO_2 ni yutib oqarib qoladi.



Cd(OH)_2 -kadmiy gidroksid, oq kristall modda, qizdirilsa suvini yo'qotib CdO ga aylanadi. Rux gidroksidga o'xshash ammiak eritmasida eriydi.



Zn, Cd, Hg (II) birikmalari

1. Galogenli birikmalarining olinishi:



Qolgan galogenidlari to'g'ridan to'g'ri sintez qilib olinadi.

2. ZnF_2 , CdF_2 , HgI_2 suvda erimaydi, HgF_2 gidrolizlanadi:



3. Kompleks galogenidlari:



Sulfidlar

Zn,

Cd,

Hg (II)

ZnS

CdS

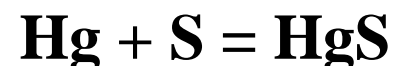
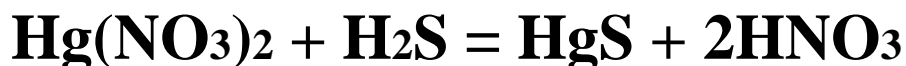
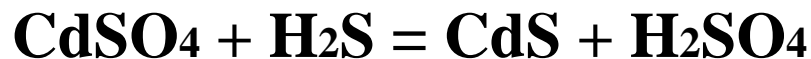
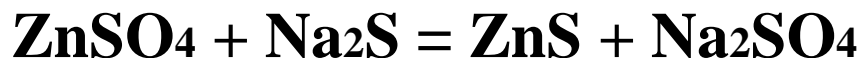
HgS

oq

sariq

qizil, qora

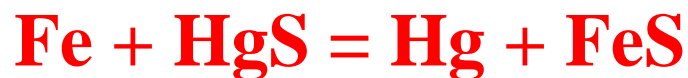
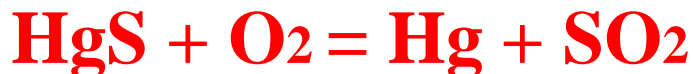
Olinishi:



Simob va uning birikmalari

Kinovar – HgS , kalomel – Hg_2Cl_2 , sulema – HgCl_2 ,
livingstonid – HgSb_4S_7 , korderoit – $\text{Hg}_3\text{S}_2\text{C}_{12}$.

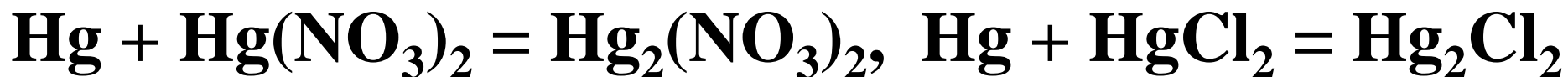
Olinishi: HgS ni $700\text{-}800^\circ\text{C}$ havoda oksidlab, Hg olinadi:



Qo'llanilishi: Hg – barometr va monometrlar ishlab chiqarishda, kvarsli lampalar va amalgamalar, Au, Ag ajratib olishda.

Свойства. Hg – bug'lari juda zaharli.

Hg metallar amalgamalari K, Na, Ag (45%), Au (16,7%), Zn, Cd, Pb, Fe, Ni, Mn va Sn – amalgamalar hosil qilmaydi.



Simob va uning birikmalari

Hg⁺¹. Hg₂O – qora rangli. Hg₂(NO₃)₂*2H₂O



Hg₂²⁺ - ham oksidlovchi, ham qaytaruvchi modda:

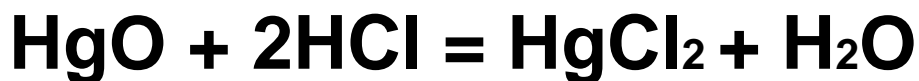


Hg₂²⁺ Hg-Hg – bog'lari kovalent. NO₃⁻ ionlarida bog' eng qisqa.

Hg₂Cl₂ – kalomel, yomon eruvchan oq modda.



HgO – ishqorlarda erimaydi, kislotalarda eriydi:



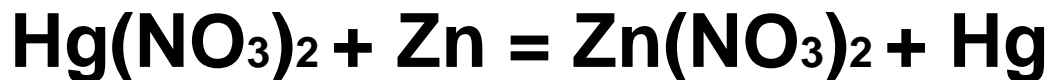
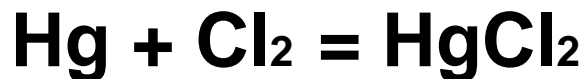
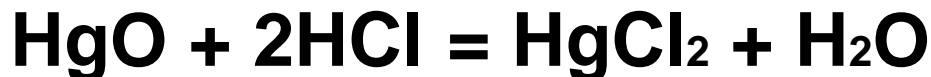
Sulema: HgCl₂

Simob (II) birikmalari

HgO olinishi: 1 yilda 8-9 ming tonna simob olinadi termometrlar, monometrlar, barometrlar va uskunalar.



Qizdirilganda: $2\text{Hg} + \text{O}_2 = 2\text{HgO}$



HgCl₂—zaharli modda, eritmaları tashqi dezinfeksiya uchun qo'llaniladi.

20°C da 100 g suvda 7,4 g Sulema eriydi.

0,2 g HgCl₂ inson uchun letal doza hisoblanadi.

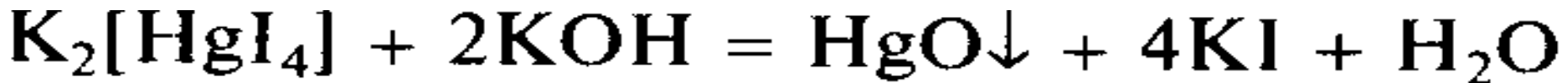
Sulema – spirt, efir va benzolda eriydi.

Simob (II) birikmalari

Sulema qo'sh va kompleks tuzlari:



Sulema gidrolizi: $\text{HgCl}_2 + \text{H}_2\text{O} = \text{HCl} + \text{HgOHCl}$



Qizg'ish-jigarrang - HgSO_4 ; $\text{Hg}(\text{NO}_3)_2$; $\text{Hg}(\text{CN})_2$ - simob (II) disian.



Nessler reaktivi ($\text{K}_2[\text{HgI}_4]$) dan – analitik kimyoda NH_4^+ ionlarini aniqlash maqsadida foydalaniladi

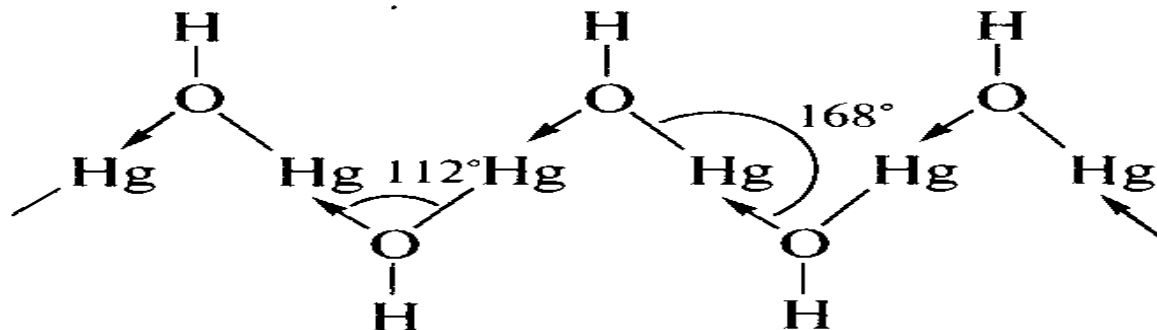


Simob (II) birikmlari

- ❖ Simob (II) asetatning benzolda erishidan olingan dibenzolmerkurat quyidagi formulaga ega: $[\text{Hg}(\text{C}_6\text{H}_6)_2]$. Simob (II) tuzlari degidratasiya reaksiyalarida katalizator sifatida ishlatiladi. Organik erituvchilarda (diethyl efiri) magniy organik birikmalar olingan:

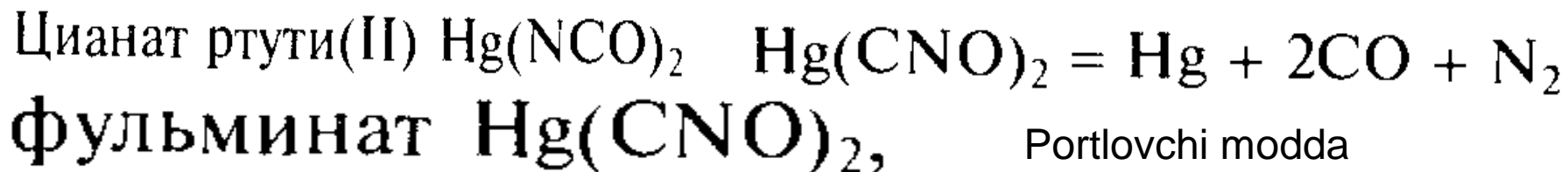


- Dietilsimob og'ir suyuqlik bo'lib havoda va suvda ancha barqaror. $\text{C}_2\text{H}_5\text{HgCl}$ birikmasi ham ma'lum. Metilsimob $[\text{CH}_3\text{Hg}]^+$ kationi simobning tirik organizmlarda mavjud bo'ladigan shakllaridan biridir.

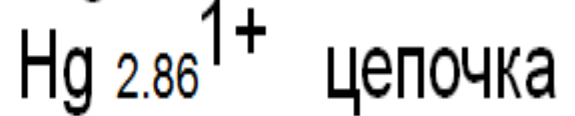
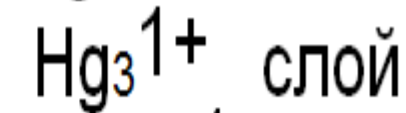
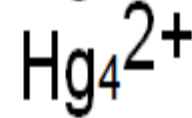
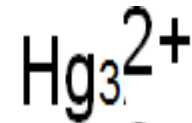
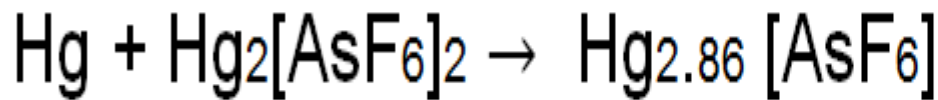
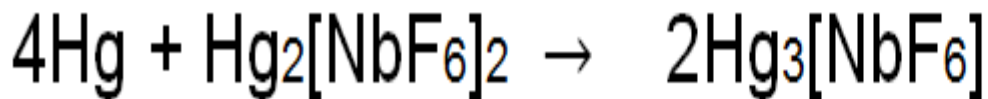
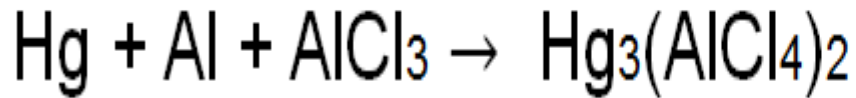


$\text{Hg}(\text{OH})_2$ – zig-zagsimon tuzilishli birikma.

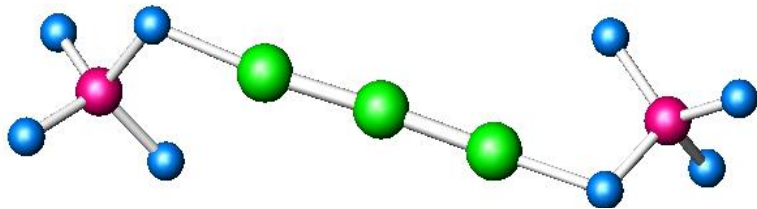
Simob oksalati $[\text{Hg}(\text{C}_2\text{O}_4)]$ – oq kukun, oson CO_2 va simobga parchalanadi.



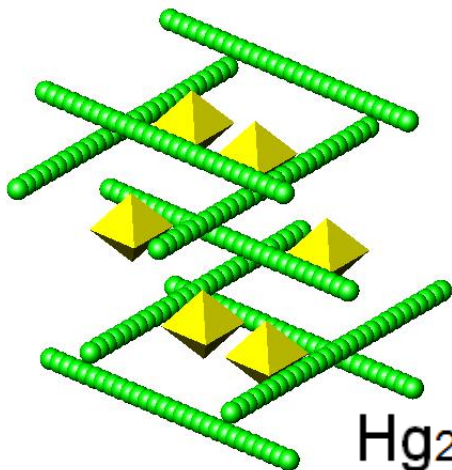
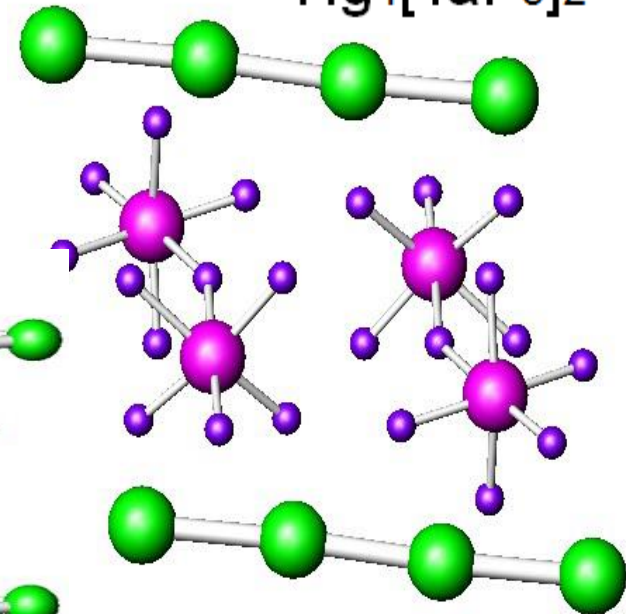
Simobning kompleks birikmalari



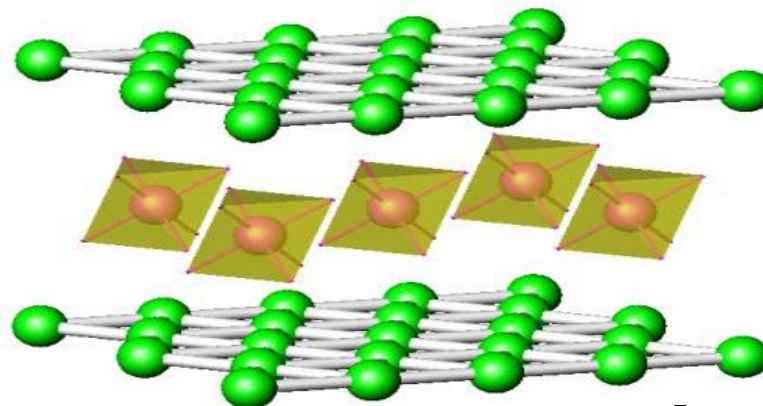
$\text{Hg}_3(\text{AlCl}_4)_2$



$\text{Hg}_4[\text{TaF}_6]_2$

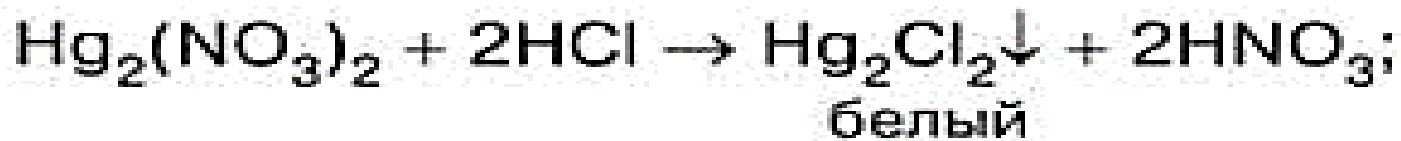


$\text{Hg}_{2.86}[\text{AsF}_6]$



$\text{Hg}_3[\text{NbF}_6]$

Simob va uning birikmalari



- ✓ Uzoq vaqt davomida nafas olganda, Hg bug'lari juda zaharli hisoblanadi.
- ✓ Hg dudbo'ronda, suv qatlami ostida, qalin devorli kolbalarda saqlanadi.
- ✓ **To'kilgan simob mis yoki latundan tayyorlangan qoshiqlar yordamida yig'iladi, simob metall yuzasiga yopishadi.**
- ✓ Bunday holda, siz supurgi ishlatilmaydi, chunki metall bo'laklarga bo'linadi.
- ✓ Hg tomchilarini bog'lash uchun S yoki FeCl₃ kukuni ishlatiladi:
$$2\text{FeCl}_3 + 2\text{Hg} = \text{Hg}_2\text{Cl}_2 + 2\text{FeCl}_2$$

Rux va uning birikmalarining farmatsiyadagi ahamiyati

- ✓ Zn teri epidermisida, soch, mushaklar, jigar va suyakda.
- ✓ Soch to'kilishi va tashqi yaralarda $ZnSO_4$ eritmasidan foydalanish buyuriladi.
- ✓ ZnO – yallig'lanishli teri kasalliklarida, terining qizarishida tashqi foydalanish uchun buyuriladi.
- ✓ Ruxning bir kunlik iste'mol me'yori – 10-15 mg.
- ✓ Zn – metallofermentlarda (20 dan ortiq). Bu qizil qon hujayralarining bir qismi bo'lib, karbongidraza, gidratatsiya va CO_2 degidratatsiyasiga ta'sir qiladi. Oshqozon osti bezida – karbongidraza mavjud.
- ✓ Peptidlarning gidrolizlanishiga ta'sir qiladi.
- ✓ Rux insulin, protamin-rux insulin, insulinnukleaza.

Продукты, богатые цинком (Zn)

Печень



Свинина 4 мг, говядина 5 мг,
курица 6.6 мг

Кедровые орехи Сыр плавленый



4.28 мг



3.5 мг

Арахис



3.27 мг

Говядина



3.24 мг

Фасоль



3.21

Горох



3.18

Баранина



3 мг

Свинина



3 мг

Пшеница



2.8 мг

Гречка



2.77 мг

Ячневая крупа



2.71 мг

Овсянка



2.68 мг

Утка



2.47 мг

Индейка



2.45 мг

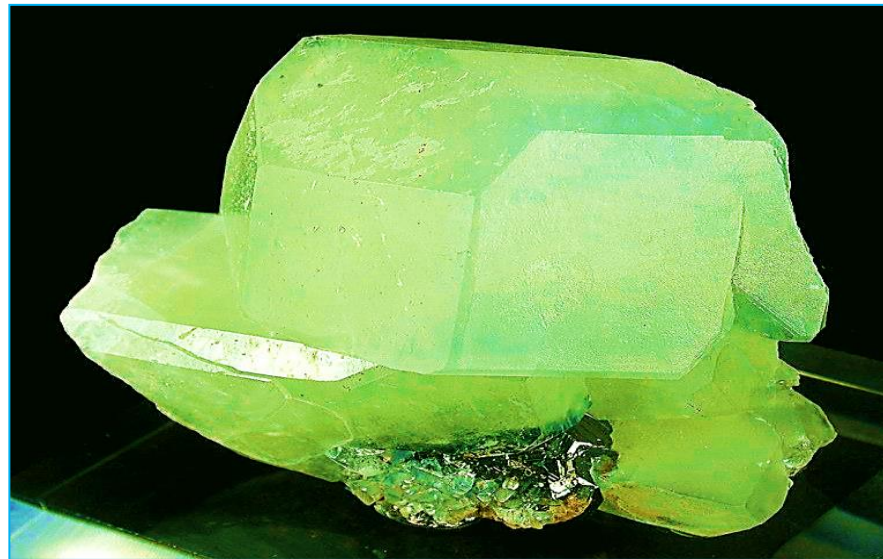
13-guruh elementlarining asosiy kattaliklari

Asosiy kattaliklar	Bor	Alyuminiy	Galliy	Indiy	Talliy
Atom massasi	10,81	26,98	69,72	114,82	204,37
Elektron formulasi	$2s^22p^1$	$3s^23p^1$	$4s^24p^1$	$5s^25p^1$	$6s^26p^1$
Atom radiusi, nm	0,091	0,143	0,139	0,166	0,171
Me³⁺ ion radiusi, nm	0,02	0,057	0,062	0,092	0,105
Qaynash harorati, °C	2075	660	29,8	156,4	304
Zichligi, g/sm³	2,34	2,70	5,90	7,31	11,85
Ionlanish energiyasi					
M→Me⁺	8,30	5,99	6,00	5,79	6,11
E⁺→E²⁺	25,15	18,8	20,5	18,9	20,4
E²⁺→E³⁺	37,90	28,4	30,7	28,0	29,8
Yer po'stlog'ida tarqishi					
%	$3 \cdot 10^{-4}$	8,8	$1,5 \cdot 10^{-3}$	$1,5 \cdot 10^{-3}$	$4,5 \cdot 10^{-5}$

Borning tabiatda tarqalishi



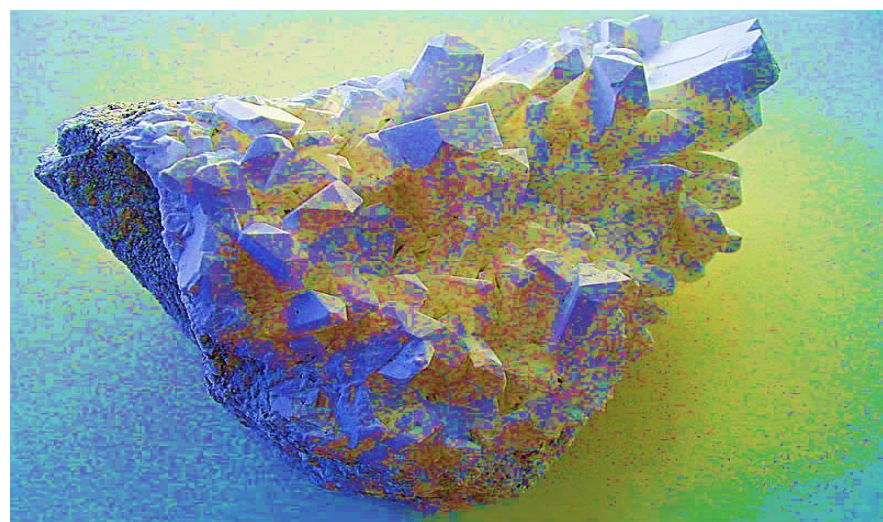
H_3BO_3 – sassolin



$\text{CaBSiO}_4(\text{OH})$ – datolit



$\text{Mg}_6\text{B}_{14}\text{O}_{26}\text{Cl}_2$ – boratsit



$\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$ – bura

Bor va uning xossalari

Gey-Lyussak tomonidan 1808-yil kashf qilingan.

Xossalari. Amorf B hidsiz, yuqori suyuql.h. ega.

Kristall B qora rangli (suyuql.h. 2300°C, tetragonal kristall panjaraga ega. Yarim o'tkazuvchanlik xossasiga ega.

B yadro reaksiyalarini sekinlashtiruvchi modda.

B ning tabiatda kam uchrashi quyidagi reakasiyaga bog'liq:



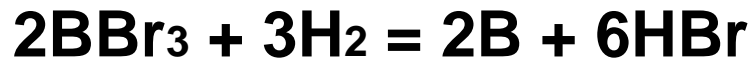
Olinishi:

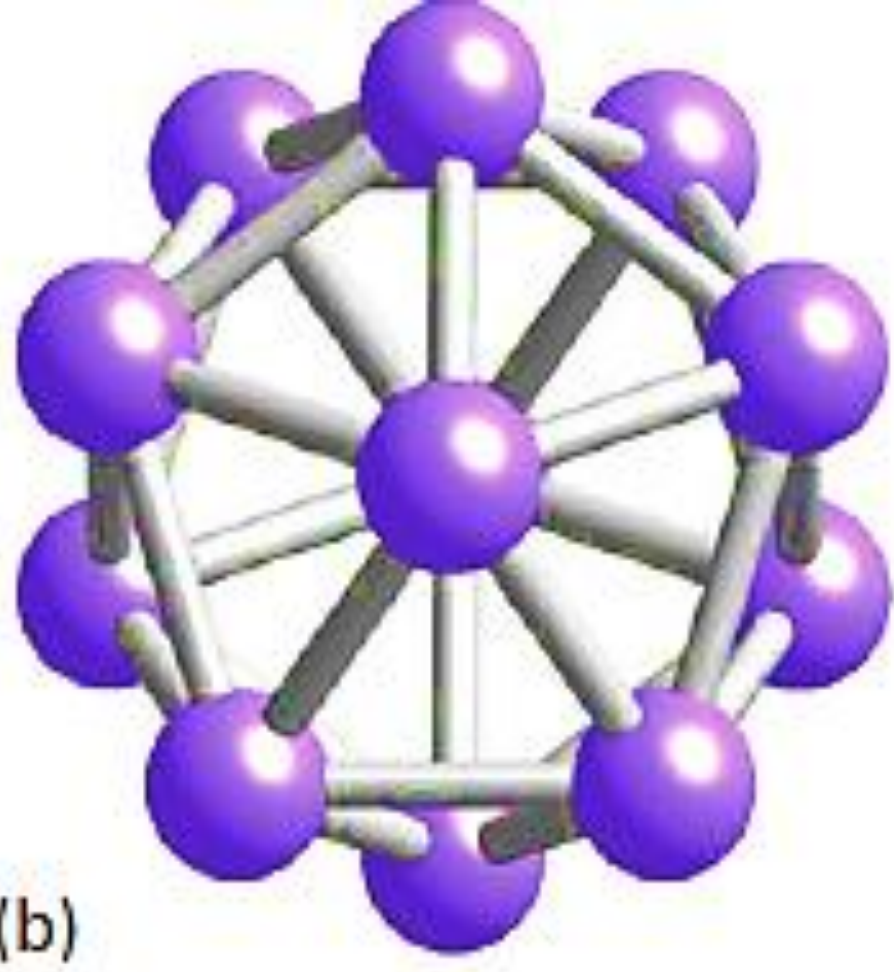
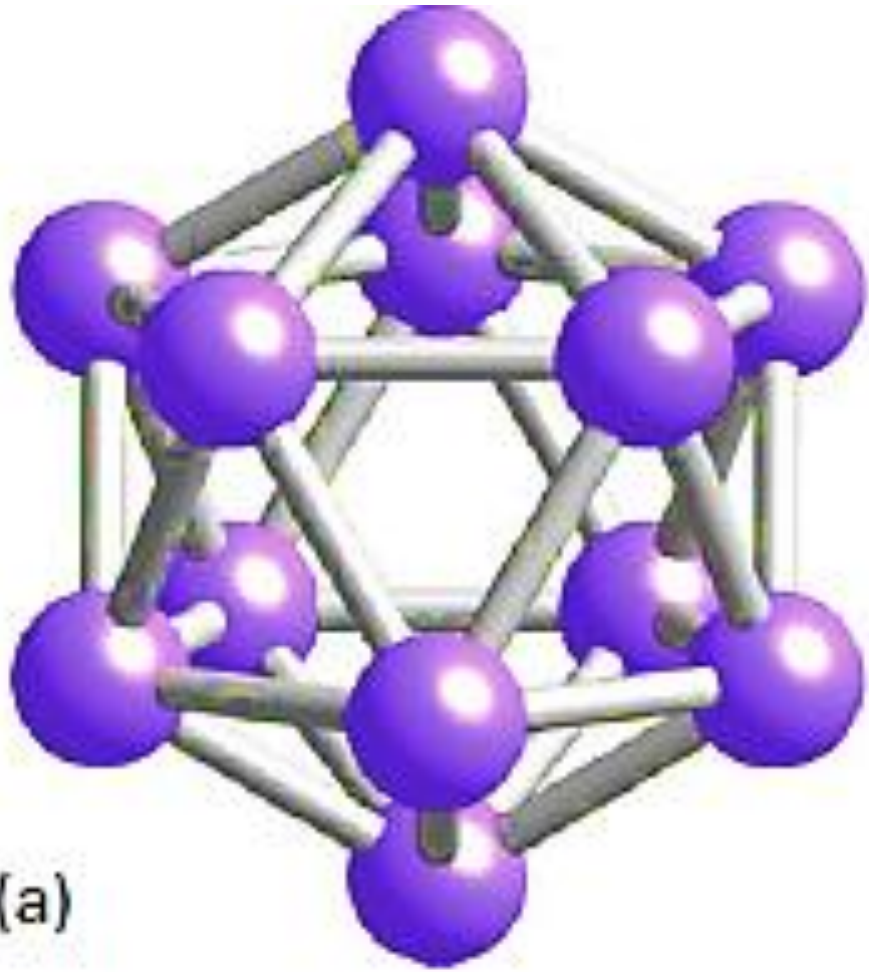


BF_3 – suyuqlanmasi elektrolizi. (99,5%).



Eng toza B (termik 1000-2000°C da):





Qattiq bor bir necha xil allotropik modifikatsiyalarga ega. Borning B₁₂ ikosaedrini romboedrik shakl o'zgarishiga ega holatini kristaldagi uchunchi tartibli o'qqa nisbatan to'g'ridan (a) va perpendikulyar (b) tuzilishi.

Borning kimyoviy xossalari

B 700 °C da: $4B + 3O_2 = 2B_2O_3 + 1171,1 \text{ kJ/mol}$

F₂ bilan xona haroratida: $2B + 3F_2 = 2BF_3$

400°C da: Cl₂, Br₂ va S: $2B + 3Cl_2 = 2BCl_3$

Nitridlar: $N_2 + 2B = 2BN$

NH₃ taʼsirida: $2B + 2NH_3 = 3H_2 + 2BN$

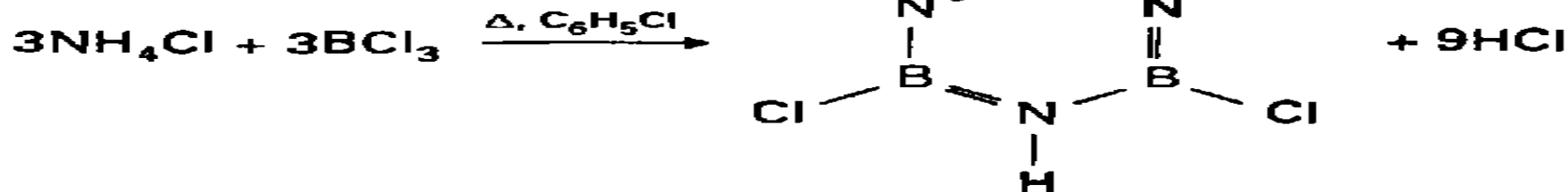
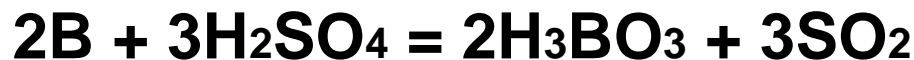
SiO₂, P₂O₅ bilan qaytaruvchi: $3SiO_2 + 4B = 2B_2O_3 + 3Si$

Suv bilan (harorat): $2B + 3H_2O = B_2O_3 + 3H_2$

Metaboratlar:



Kons., issiq HNO₃, H₂SO₄ va zar suvi:



Bor birikmalari va ularning xossalari

Boridlar: M_4B , M_2B , MB , M_3B_4 , MB_2 , MB_6 .

d-element boridlari qattiq va qiyin suyuqlanuvchi barqaror moddalardir (2000-3000°C):

Zr (Zr_4B , ZrB , ZrB_2); Cr (Cr_4B , Cr_2B , CrB , Cr_3B_4 , CrB_2)

Ti, Nb va Ta – ning B bilan qotishmalari gaz trubinalari ishlab chiqishda. ZrB_2 – 3040°C suyuql.

Gidrobokratlar. $Na[BH_4]$ – suvda yaxshi eruvchi, oq kritall modda.

Olinishi: $B(OCH_3)_3 + 4NaH = Na[BH_4] + 3CH_3ONa$

Alyuminiy tetragidrobokrat - Al $[Al(BH_4)_3]$ kovalent.

Bor gidridlari. Boretan (gaz):

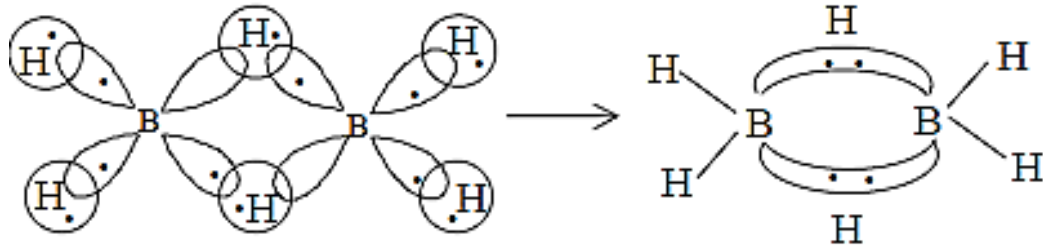
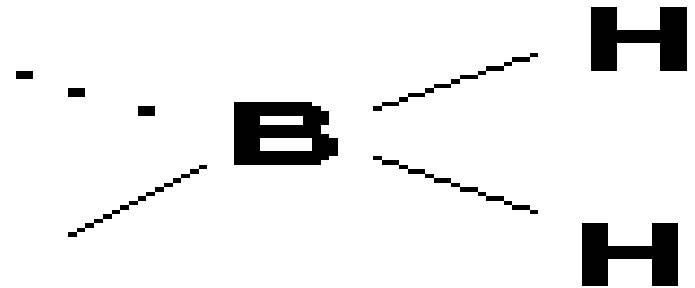
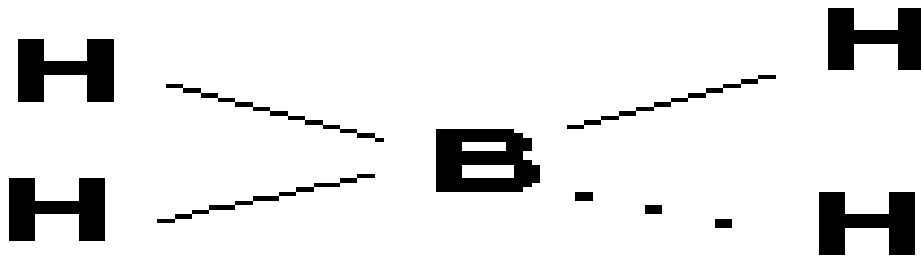
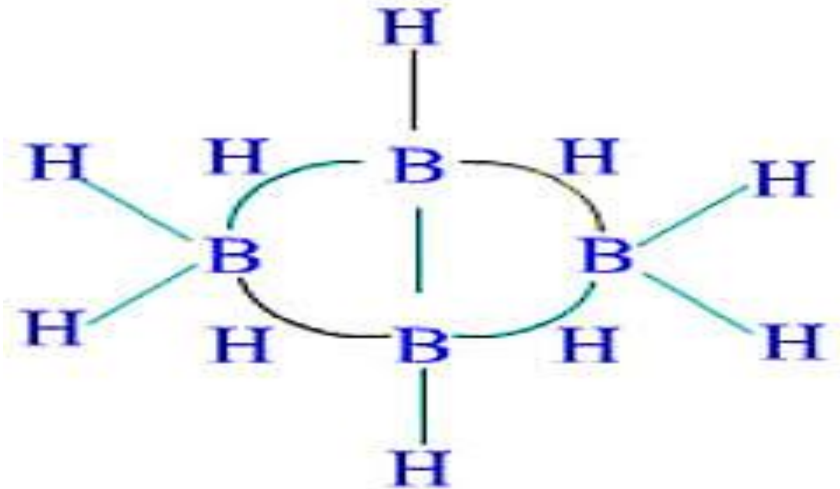
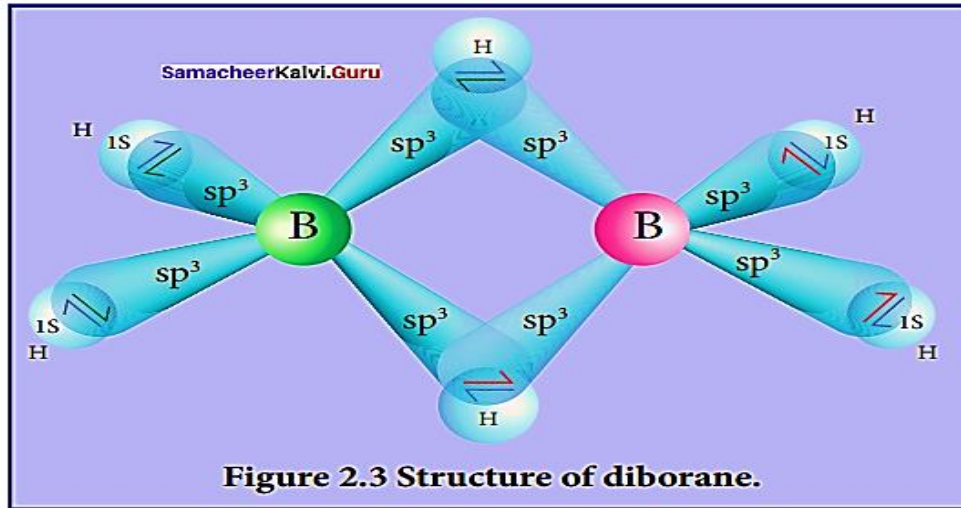


Boridlar: $6MgB_2 + 12HCl = H_2 + B_4H_{10} + 6MgCl_2 + 8B$

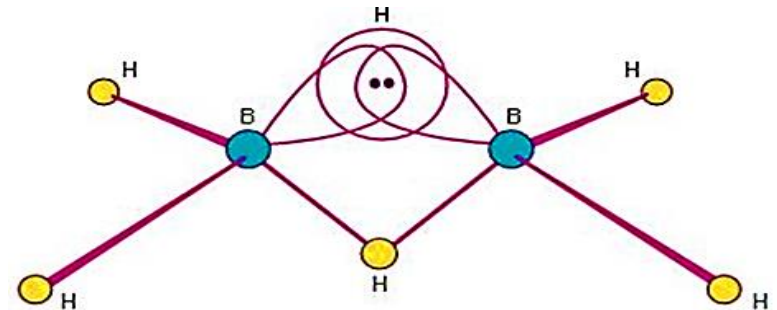
B₂H₆ – ikki yadroli gaz (suyuql.h. -92,5°C):

B₄H₁₀ – (BH₃* B₂H₄* BH₃) dan iborat.

Borbutan 18°C da qaynaydi.

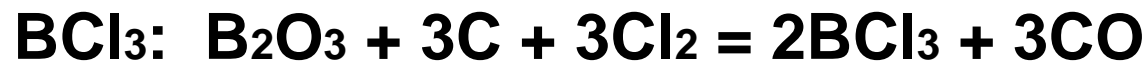


Structure of diborane



Borning galogenli birikmlari

BF_3 – gaz, BCl_3 – (suyuql.h.-12,5°C), BBr_3 – suyuqlik (suyuql. h. 90°C) va BI_3 – qattiq modda (suyuql.h. 43°C).



BF_3 va BCl_3 - katalizator. BCl_3 gidrolizi:

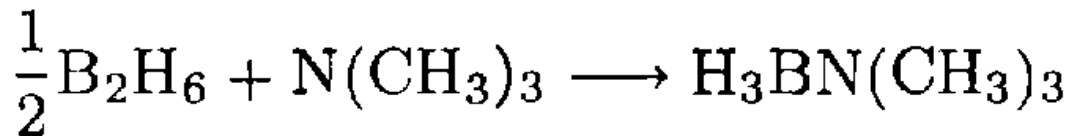


Anion komplekslari. **$\text{Na}[\text{BF}_4]$** – natriy tetraftorborat,

$\text{K}[\text{BF}_3\text{OH}]$ – kaliy ftorogidroksoborat,

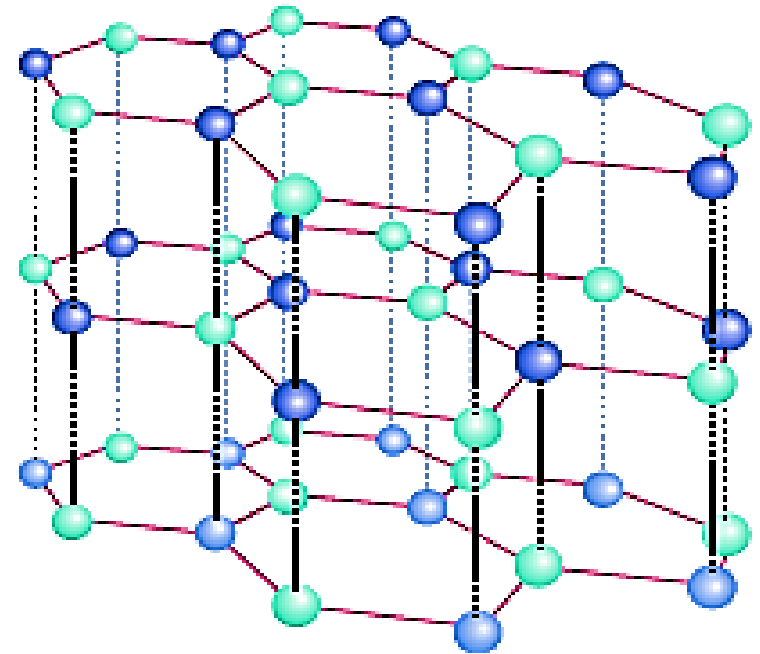
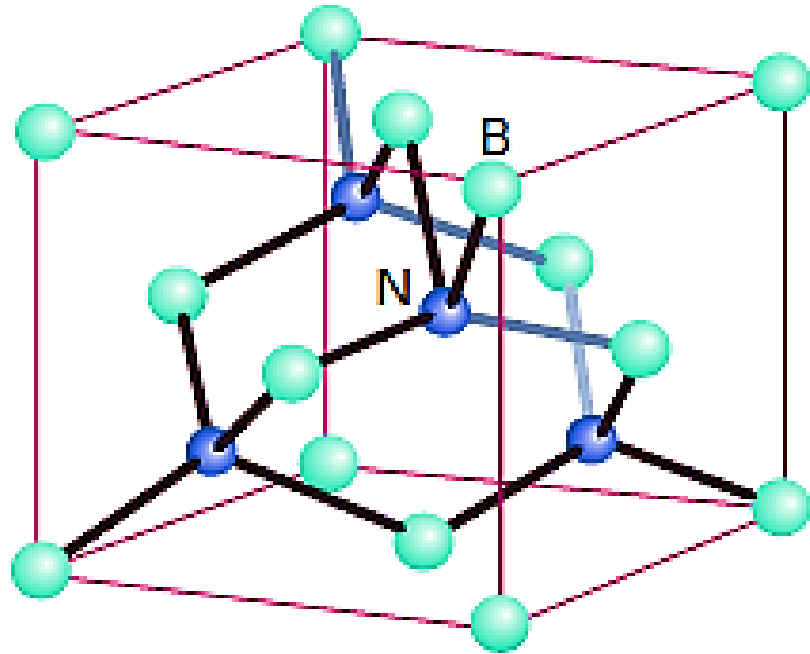
$\text{K}[\text{BH}_4]$ – kaliy tetragidroftoroborat,

$\text{K}[\text{BF}_3\text{H}]$ – kaliy triftorogidroborat.

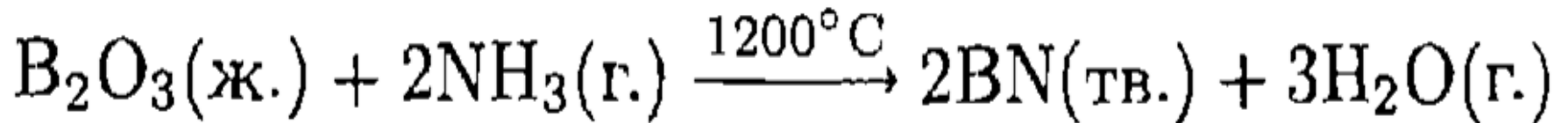


BN bor nitridi

Geksagonal tuzilishli, oq modda. Olmosdek qattiq, havoda 2000°C da oksidlanadi. Olmos 900°C da yonadi.



Tetragonal modifikatsiyasi, **qora rangli**, borazon yoki elbor – BN. BN – dielektrik modda.



Borovodorodlar o'z-o'zidan oksidlanib, energiya ajratib chiqaradi

(B_2H_6 -2025 kJ/mol; C_2H_6 1425 kJ/mol).



Qo'lansa hidli va zaharli:



Bor angidridi (B_2O_3). Kristall B_2O_3 (suyuql.h. $450^\circ C$).

Bor oksidi uvda erib: $B_2O_3 + 3H_2O = 2H_3BO_3$

H_3BO_3 – oq kristall modda. Suvda kam eriydi, harorat ortsa eruvchanligi ortadi.

Kuchsiz kislota:



$20^\circ C$ da $K_1=6 \cdot 10^{-10}$; $K_2=2 \cdot 10^{-13}$; $K_3=2 \cdot 10^{-14}$.

H_2CO_3 va H_2S dan ham kuchsiz.



Borning birikmalari va xossalari



Olinishi: Issiq $\text{Na}_2\text{B}_4\text{O}_7$ eritmasiga H_2SO_4 qo'shib:



H_3BO_3 ga mo'l miqdorda ishqor qo'shib:

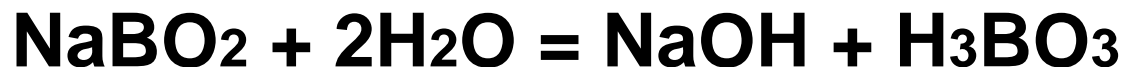
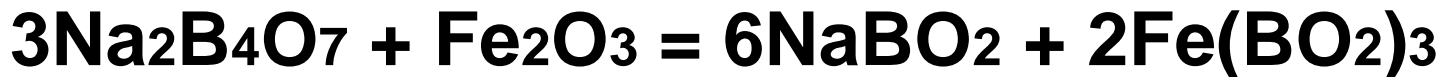
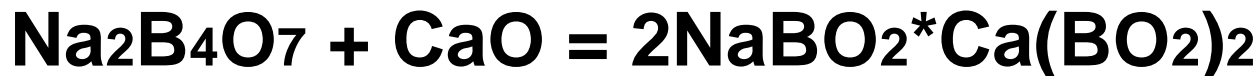


Bura kislotalar bilan: $\text{Na}_2\text{B}_4\text{O}_7 + \text{H}_2\text{SO}_4 = \text{Na}_2\text{SO}_4 + \text{H}_2\text{B}_4\text{O}_7$



Metaborat va ortoboratlar:

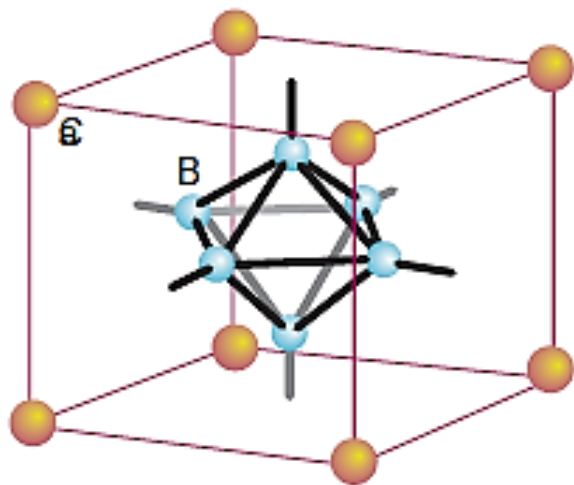
- 1) γ - HBO_2 (kubsimon, barqaror)
- 2) β - HBO_2 (monoklinik)
- 3) α - HBO_2 (rombik)



H_3BO_3 uchun sifat reaksiya:

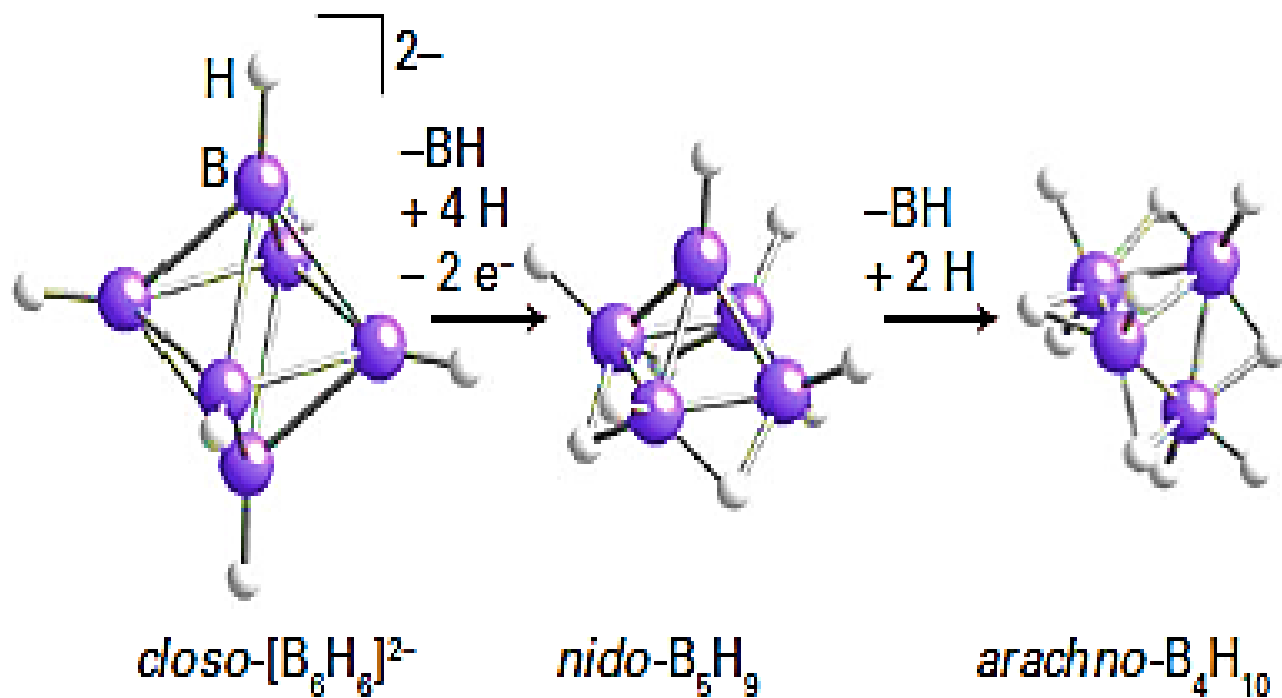


CaB_6 analogue of CsCl.



Metal borides

higher boranes and borohydrides

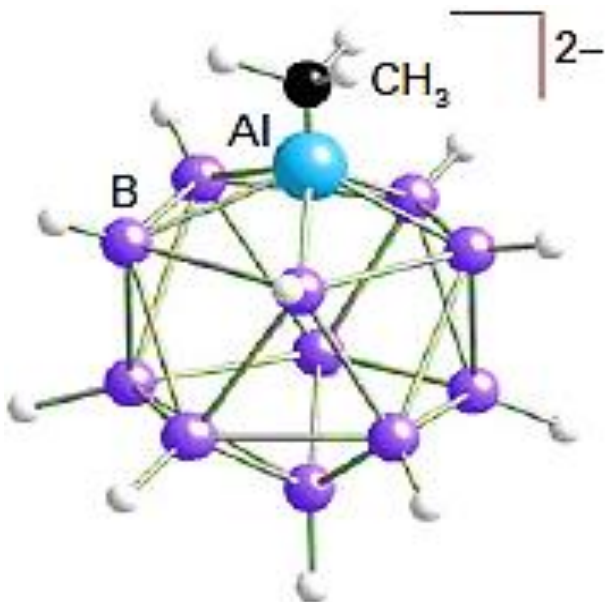


Closo – “qafas” ($\text{B}_n\text{H}_n^{2-}$);

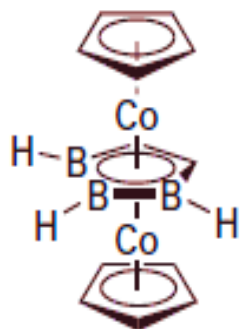
Nido – “uya” (B_nH_{n+4});

Arachno – “kapalak qanoti” (B_nH_{n+6}).

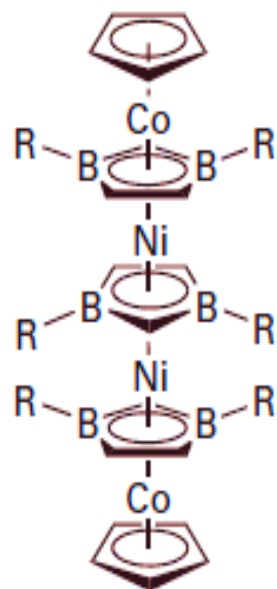
Metallaboranes and carboranes



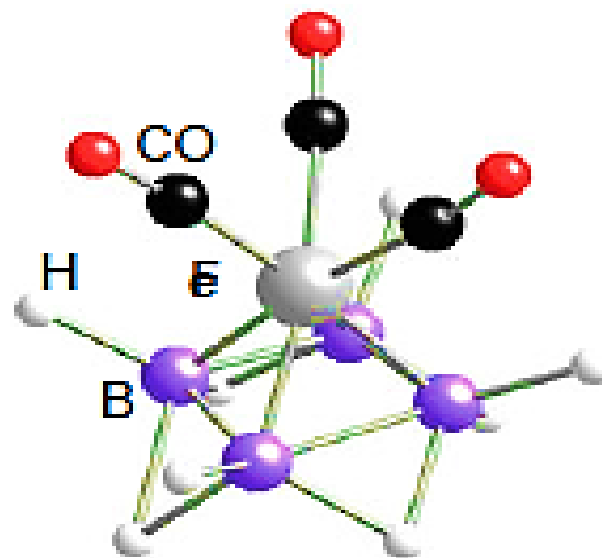
31 *closo*-[B₁₁H₁₁AlCH₃]²⁻



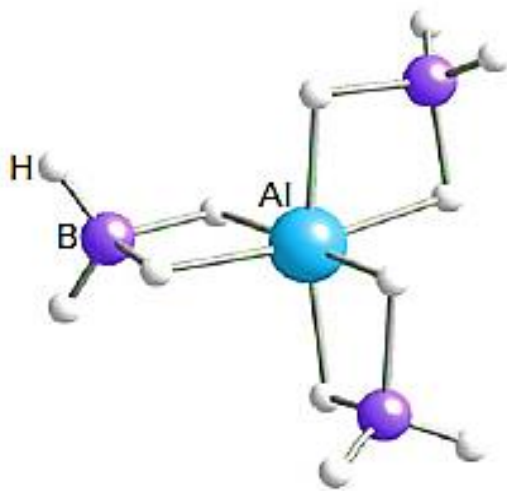
37



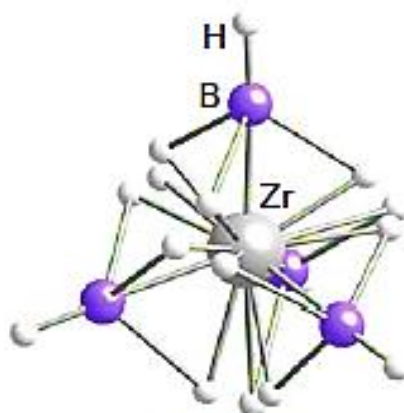
38



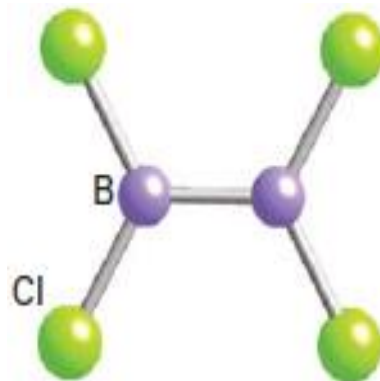
32 [Fe(CO)₂B₄H₈]



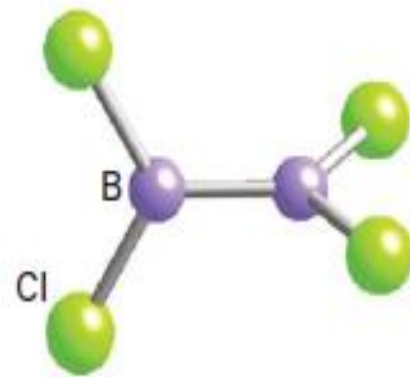
12 Al(BH₄)₃



13 Zr(BH₄)₄



14 B₂Cl₄, D_{2h}



15 B₂Cl₄, D_{2d}

ou

Bor organik birikmalar

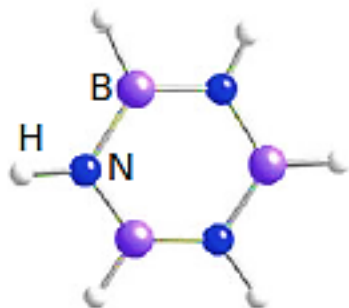
B-O-B, -B-N-B-, B-R-B, B-S-B kabi bog'lanishlar

$B_3N_3H_6$ – borazol, rangsiz suyuqlik.

(suyuql.h.-58°C, qayn.h. 55°C).

«Noorganik benzol».

Definil, Naftalin singari, bor azot bilan:



2 Borazine, $B_3N_3H_6$

CH_3-CH_3

H_3B-NH_3

borazan

$CH_2=CH_2$

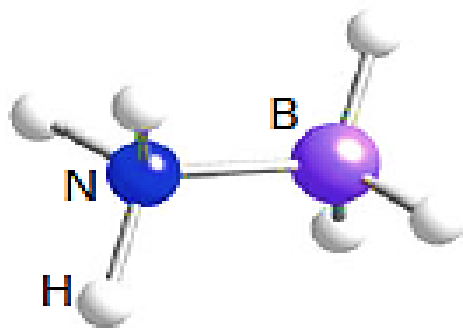
$H_2B=NH_2$

borazen

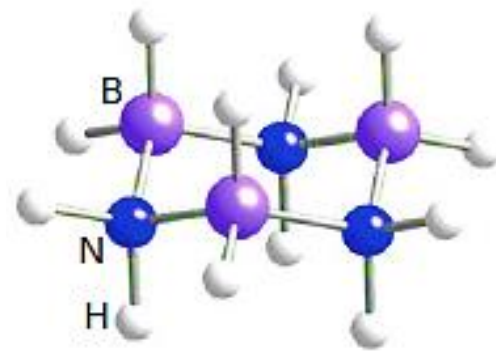
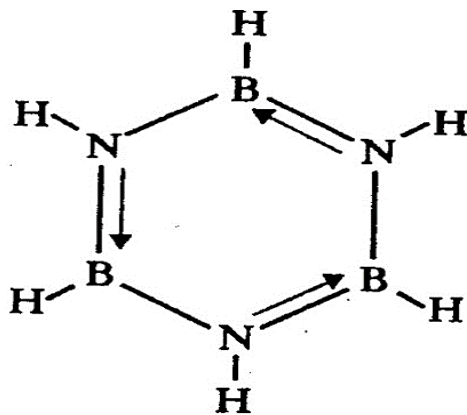
$CH\equiv CH$

$BH\equiv NH$

borazin



20 NH_3BH_3



21 $N_3B_3H_{12}$

Borning farmatsiyadagi ahamiyati

- Odam organizmida bor (10-5%).
- Bor asosan o'pkaga (0,34 mg), qalqonsimon bezda (0,30 mg), taloqda (0,26 mg), jigar va miyada (0,22 mg), buyrak va yurak muskullarida (0,21 mg) to'planadi.
- Borning ortib ketishi adrenalini faolligini kamaytiradi va amilaza va proteaza faolligini kamaytiradi.
- H_3BO_3 va bura antiseptik modda sifatida.
- H_3BO_3 – lipid membranalarida yaxshi eriydi va hujayralarga tez yetib boradi. Bunday holda, oqsillar denaturatsiyasi kuzatiladi, mikroorganizmlar o'ladi.
- Boraksning antiseptik xususiyatlari uning gidrolizi paytida H_3BO_3 hosil bo'lishiga asoslanadi.
- Bor muhim mikroelement hisoblanadi.
- Paxta, kanop, sabzavotlarga bor moddasi kerak. Bor yetishmasligi sabab bu o'simliklarning urug'lari shikastlanadi.

Alyuminiyning tabiatda tarqalishi



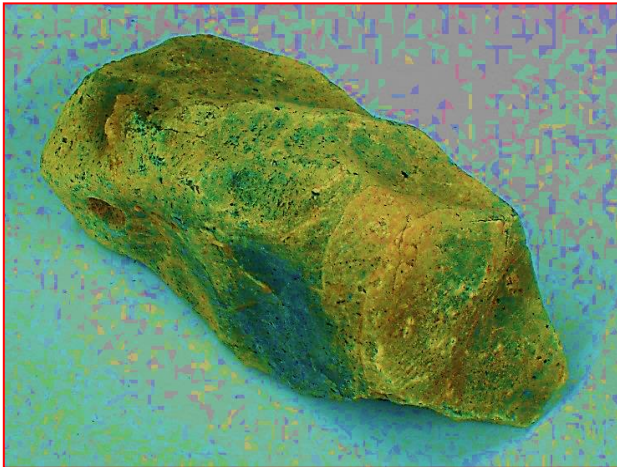
$\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2 \cdot 2\text{H}_2\text{O}$ – kaolin



Al_2O_3 – sapfir



KAlSi_3O_8 – ortoklaz



$\text{NaAlSi}_3\text{O}_8$ – nefelin



$\text{Al}_2\text{O}_3 \cdot n\text{H}_2\text{O}$ – boksit



Al_2O_3 – korund

Alyuminiy va uning birikmalari

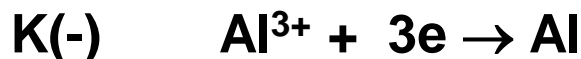
Fizik xosslari. Kumushsimon-oq metall (suyuql.h. 660°C), issiqli va elektrni yaxshi o'tkazadi. Undan yupqa qavatli metal sim tayyoqlanadi. Kukun va folga holda ham uchraydi.

Olinishi: 1887-yil Al ni Vyeller sintez qilgan:

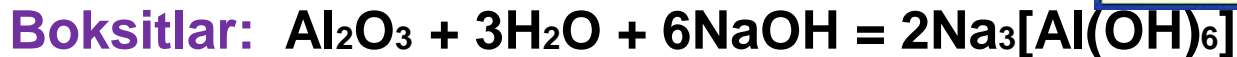


Texnikada Al Al_2O_3 (8%) suyuqlanmasi 950°C da elektroliz qilish orqali olinadi. Erituvchi - $\text{Na}_3[\text{AlF}_6]$ (92%) - kriolit. Elektrolizatorning katod va anod ko'mir.

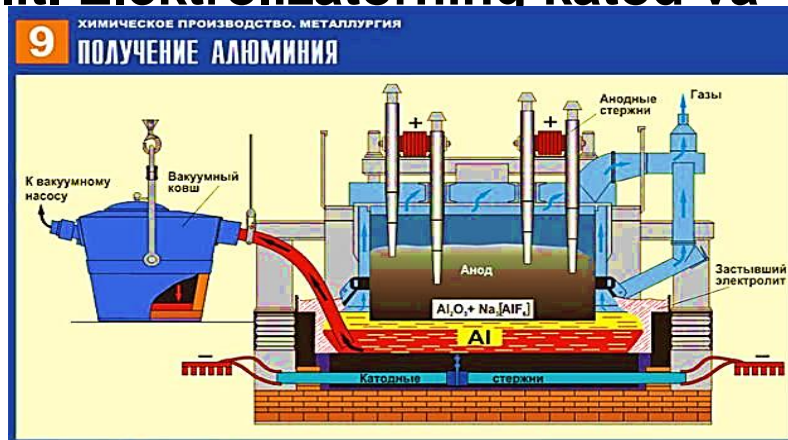
Al suyuqlanib, idish tubida yig'iladi:



Elektrolizda uglerod sarf bo'ladi.

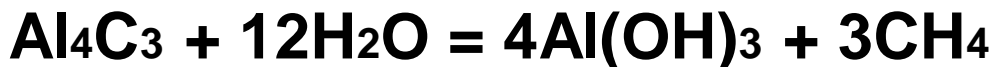


Tozalangan oksiddan:



Alyuminiy va uning birikmalari

Qizdirilganda:



Al_2O_3 qizil rangli. Amfoter oksid.



Ishqorlarda: $\text{Al}_2\text{O}_3 + 2\text{NaOH} = 2\text{NaAlO}_2 + \text{H}_2\text{O}$

Al_2O_3 ning asosli xossasi kislotali xossasidan ustun:

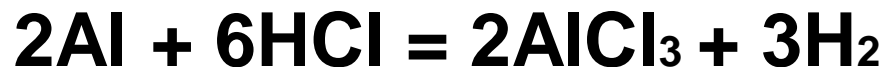


Agar $\text{Al}(\text{OH})_3$ suvsizlantirilsa- Al_2O_3 (alyumogel) hosil bo'ladi.
U adsorbent sifatida ishlatiladi.

Al tuzlari oson gidrolizlanadi. Kristallogidratlari:



Alyuminiy va uning birikmlari



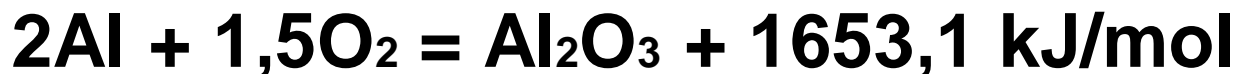
Kons. HNO_3 – Al ni passivlaydi.

Al - H_2SO_4 bilan asosli tuzlar hosil qiladi.

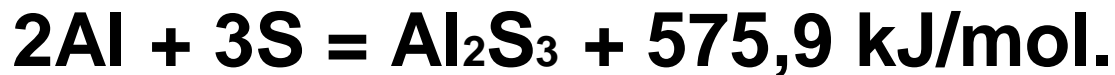
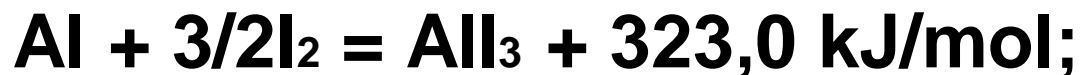
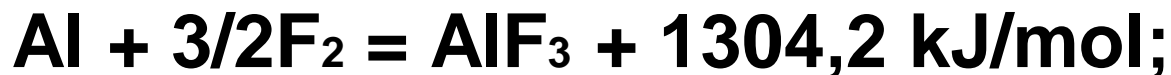
Al ishqorlarda:



Al kislorod ishtirokida:



3000-3500°C da Al galogenidlar:

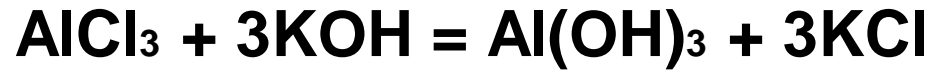


Alyuminiy galogenidlari

Kimyoviy inert, qiyin suyuqlanuvchan, suvda erimaydi:

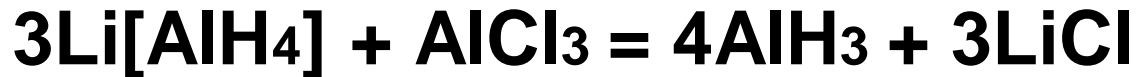


Suvsiz AlCl_3 havoda **tutaydi**, gidlozilanadi:



AlCl_3 , AlBr_3 , AlI_3 dimerlar hosil qiladi – Al_2Gal_6 .

$\text{Al}(\text{AlH}_3)$ – polimer tuzilishga ega modda.

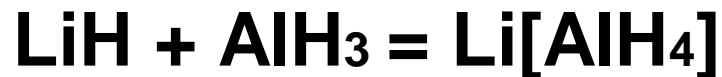


Akva komplekslar – $[\text{Al}(\text{H}_2\text{O})_6]^{3+}$

Komplekslari: $\text{Na}_3[\text{AlF}_6]$, $\text{Na}_2[\text{AlF}_5]$, $\text{Na}[\text{AlF}_4]$.

Eruvchan komplekslari: $\text{K}[\text{AlCl}_4]$, $\text{K}[\text{AlBr}_4]$, $\text{K}[\text{AlI}_4]$.

AlH_3 gidridlar bilan ta'sirlashib tetragidroalyuminatlar h.q.:



Mazkur modda kristallar, oq, organikda katalizator sifatida ishlatiladi.

Alyuminiy va uning birikmalari

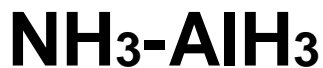
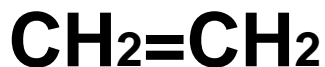
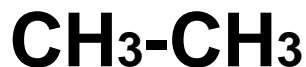
$\text{Al}(\text{OH})_3$ ning 4 xil kristall tuzilishi mavjud:

1. Monoklinnik (γ) gibbsit;
2. Triklinnik (γ') gibbsit (gidragillit);
3. Bayerit (γ);
4. Nordstrandit (β).

Al^{3+} ioni uchun sifat reaksiya:



Alyuminiyning organik birikmalari:



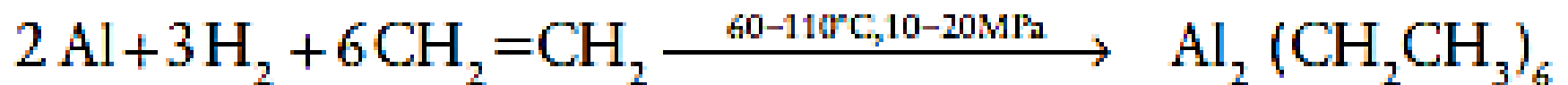
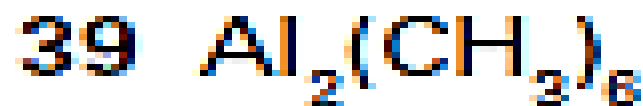
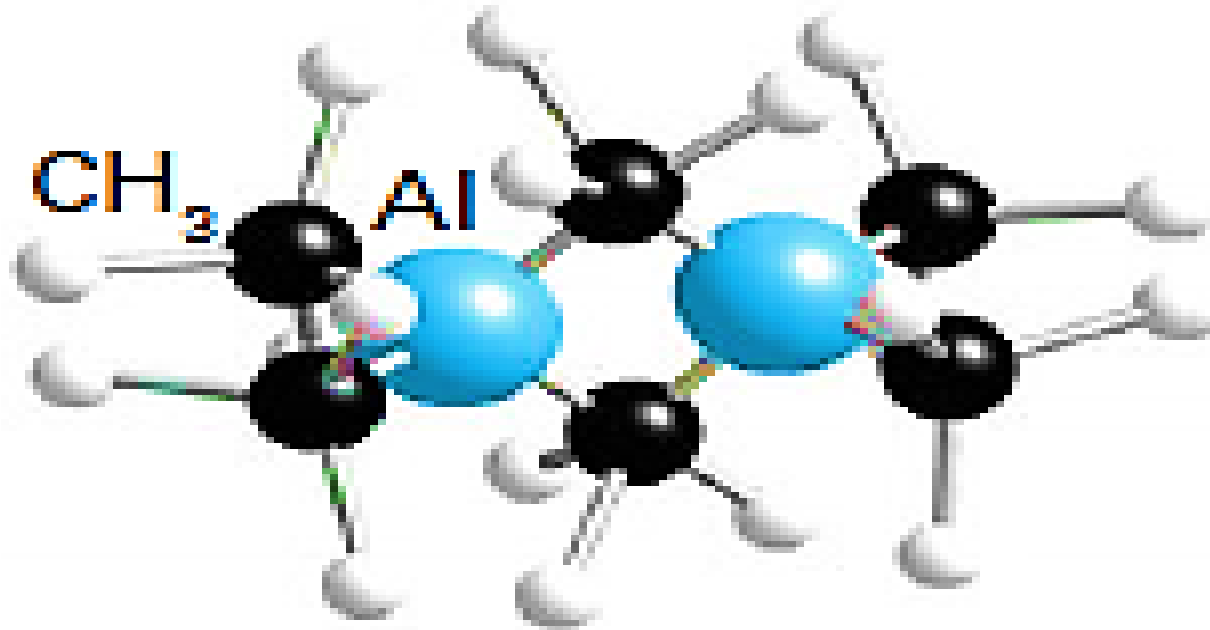
Allozan

Allozen

Allozin

Kompleks birikmalari: $\text{Al}_3\text{N}_3\text{Al}_3\text{H}_6$ – allazol.

Organometallic compounds



Ziegler–Natta polymerization catalyst

Alyuminiyning qo'llanilishi

- Toza Al o'tkazgichlar, yengil qotishmalar sifatida.
- Duralyuminiy (94%-Al, 4% Cu 0,5% Mg Mn, Fe va Si dan), silumin (85-90% Al, 10-14% Si, 0,1% Na).
- Al yuzasida $0,101 \cdot 10^{-4}$ sm ingichka pardaga ega.
- Al_2O_3 bir nechta allotropik modifikatsiyaga ega. Korund - yuqori suyuqlanish harorati ($2050^{\circ}C$) ega bo'lgan o'tga chidamli kristall. Qattiqligida olmosga yaqin. Kristalli Al_2O_3 suv va kislotalar bilan o'zaro ta'sir qilmaydi. Al yuzasiga ishlov berilganda (kons. HNO_3 , $K_2Cr_2O_7$) korroziyaga chidamliligi ortadi.
- Al idishlarda HNO_3 (kons) ni tashish va saqlash uchun.

Alyuminiyning farmatsiyadagi ahamiyati

- Oshqozonning kislotaliligi ortganda, kukun shaklida, oshqozonning surunkali yallig'lanishida ishlatiladi.
- Almagel – dori vositasi tarkibiga kiradi.
- Kaliy-alyuminiy kvars - $KAl(SO_4)_2 \cdot 12H_2O$ qon to'xtatuvchi.
- Farmakologik ta'sir Al^{3+} ionining oqsillar bilan o'zaro ta'sirida gellarning shakllanishiga asoslangan. Bu mikroblarning cho'kishi va yallig'lanishning pasayishiga olib keladi.
- $Al(CH_3COO)_3$ 8% li eritma shaklida "Burov suyuqligi".
- Al qon zardobida, o'pkada, jigarda, suyakda, buyrakda, tirnoqlarda va sochlarda to'planadi.
- Alyuminiyning kunlik dozasi 47 mg ni tashkil qiladi.
- U biriktiruvchi to'qimalarga, soch hujayralariga va fosfor almashinuviga ta'sir qiladi.

Galliy guruhchasi elementlari

Ga, In, Tl. Al dan Ga – ionlanish potentsiali ortadi.
Ga⁺³ va In⁺³, Tl⁺¹ da uchraydi.

Tabiatda. Al, Pb va Zn minerallari tarkibida uchraydi.

Olinishi. Ga va In oksidlar tarkibida yoki polimetall xlorid minerallari tarkibida uchraydi.

Xossalari. Kumushsimon-oq metallar.

Ga suyuql.h. (29,8°C). Ga va In oksid pardaga ega.

Tl oson oksidlanadi. Ayniqsa qizdirilganda.

Xona haroratida Cl₂, Br₂ va qizdirilganda I₂ bilan ta'sirlashadi.

Ga ishqorlarda erib, gidroksogallatlar hosil qiladi:



In va Tl ishqorlar ta'siriga barqror moddalardir.

Galliy guruhchasi elementlari

Ga_2O_3 – oq kristall modda. In_2O_3 – sariq rangli.

Tl_2O_3 – jigarrangli birikma.

Oksidlari suvda erimaydi. Ga, In va Tl gidroksidlari suvda erimaydi va $\text{Al}(\text{OH})_3$ ga o'xshash xossalarga ega.

Ga – In – Tl qatorida asoslik xossalari ortadi.

$[\text{Me}(\text{H}_2\text{O})_6]^{3+}$. Ga va In (III), Tl (III) – oq-sariq moddalardir.

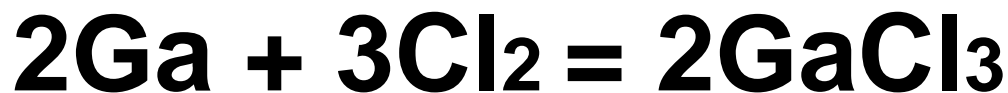
In va Ga gidroksokomplekslar hosil qiladi:



KInO_2 va KGaO_2 indatlar va gallatlar.

Tl_2O (suyuql.h. 300°C) suvda eruvchan, qora rangli modda.

TlOH – kuchli asos, 100°C suvsizlanadi.



Ga, In va Tl birikmalari zaharli.