

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

6-MA’RUZA:

**17-GURUH ELEMENTLARI. GALOGENLAR VA
NODIR GAZLAR**

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TOSHKENT-2023

ASOSIY ADABIYOTLAR:

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REJA:

Mavzuning ma'ruza davomida yoritiladigan qismlari:

1. Guruh elementlarining umumiy tavsifi;
2. Ftor va uning birikmalari;
3. Xlor va uning birikmalari;
4. Brom va yod birikmalari;
5. 17-guruh elementlarining farmatsiyadagi ahamiyati.

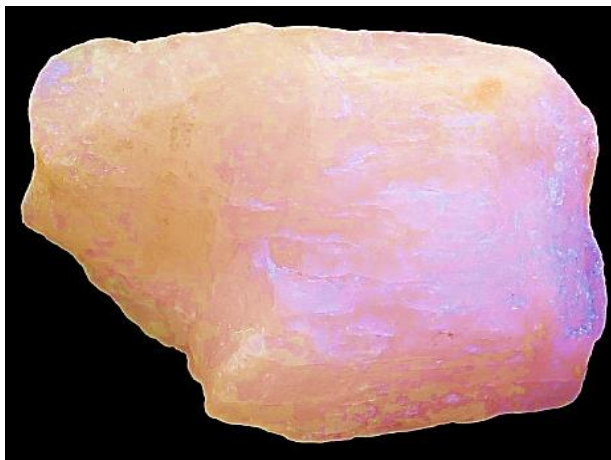
Mavzuning talaba mustaqil o'zlashtirishi lozim bo'lgan qismlari:

1. 17-guruh elementlarining olinishi va xossalari;
2. Galogenlarning o'zaro birikmalari va xossalari;
3. 17-guruh elementlari birikmalarining farmatsiyadagi ahamiyati;
4. 18-guruh elementlari.

17-GURUH ELEMENTLARINING UMUMIY TAVSIFI

Asosiy kattaliklar	Ftor	Xlor	Brom	Yod	Astat
Atom massasi	18,998	35,453	79,904	126,904	209,98
El. formulasi	$2s^2 2p^5$	$3s^2 3p^5$	$4s^2 4p^5$	$5s^2 5p^5$	$6s^2 6p^5$
Atom radiusi, nm	0,071	0,099	0,114	0,133	-
E ⁻ ion radiusi, nm	0,133	0,181	0,196	0,220	0,23
S. h, °S	-219,6	-101,0	-7,3	113,6	227
Qayn. h., °S	-188,1	-34,1	59,2	185,5	317
Odatdagi Sh.	Och-yashil gaz	Yashil-sariq gaz	Qizi-qo'ng'r suyuqlik	Qora-siyoh kristall	Qora ko'k kristall
Ionl. En. eV E → E ⁺	17,42	12,97	$1,6 \cdot 10^{-5}$	10,45	9,2
Yerda miqdori, %	$2,8 \cdot 10^{-2}$	$5 \cdot 10^{-2}$		$3 \cdot 10^{-3}$	Следы

Ftor



Kriolit – $\text{Na}_3[\text{AlF}_6]$



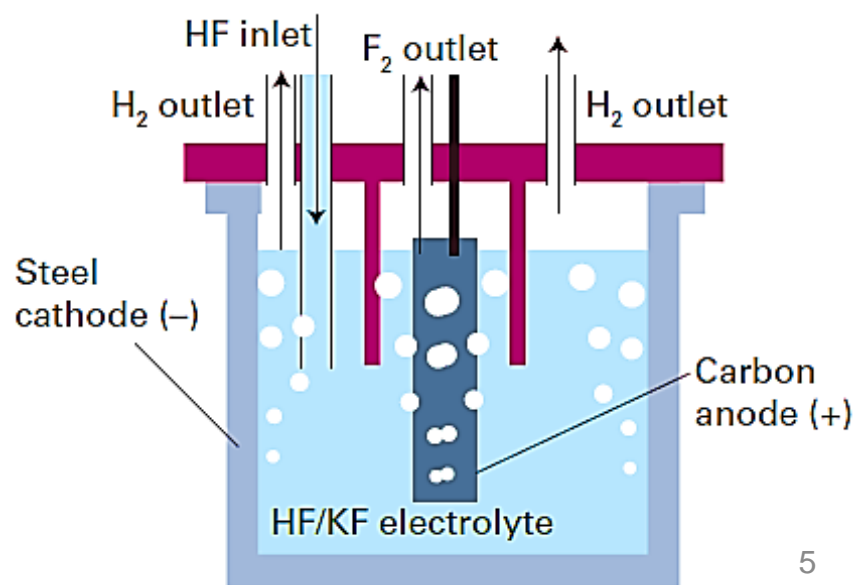
Flyuorit – CaF_2



Ftorappatit
 $3\text{Ca}_3(\text{PO}_4)_2 \cdot \text{CaF}_2$

• Fransuz kimyogari A. Muassan 1886-yilda kaliy ftorid qo‘shilgan suvsiz ftorid kislotani platina idishda — 55°C da elektrolizlab, ilk bor erkin Ftor olgan.

• Elektrolizyor Ni anod. Ko‘mir katod. F_2 – o‘tkirhidli, sarg‘ish-yashil gaz.



Ftorning kimyoviy xossalari

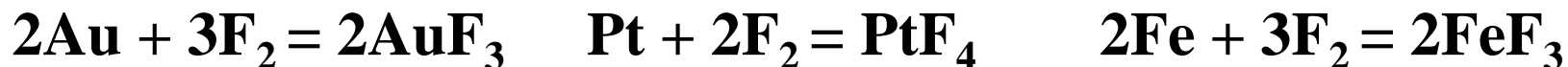
F_2 saqlash va tashish zanglamaydigan po'lat, Cu, Al, Ni.



O_2 va N_2 ftor bilan ta'sirlashmaydi. F_2 , H_2 hatto qorong'ida ($-250\text{ }^\circ\text{C}$):
 $H_2 + F_2 = 2HF$



Elektr zaryad ta'sirida $F_2 + O_2 = O_2F_2$ O_2F_2 – qizil rangli, qattiq modda. **Cho'g' holdagi Au va Pt bilan ftor:**



Ni, Pb va Cu ftoridlar qatlami bor metallni ftor ta'siridan saqlaydi. Inert gazlar: $Xe + 2F_2 = XeF_4$

Ksenon ftoridlari: Xe: XeF_2 , XeF_4 , XeF_6 .

$XeOF_2$, $XeOF_4$ va XeO_2F_2 olingan.

Ftor birikmalari

235 UF₆ va 238 UF₆ diffuzion usulda ajratiladi.

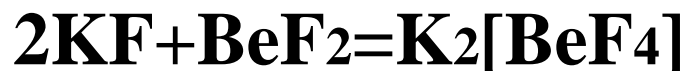
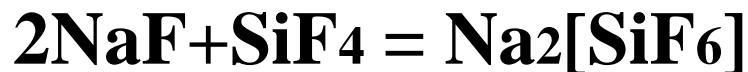
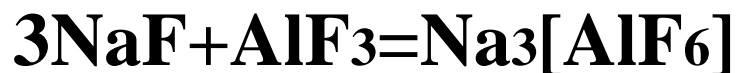
236 UF₆ - 56,7°C da qaynaydi.

Ftor sovityuchi agentlar va ftoroplastlar olishda.

F -1 birikmalari. Ftoridlar ion tuzilishli birikmalar.

Ishqariy MeF (Li dan tashqari), AgF, HgF₂, SnF₂ eruvchan birikmalardir.

Ftorid komplekslar:

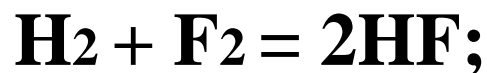
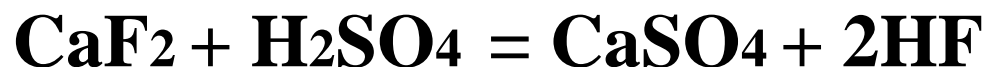


Ftorid kislota - HF

HF rangsiz, o'tkir hidli suyuqlik. Havoda tutaydi.
(suyuql.h.-83°C, qayn.h. 19,5°C).

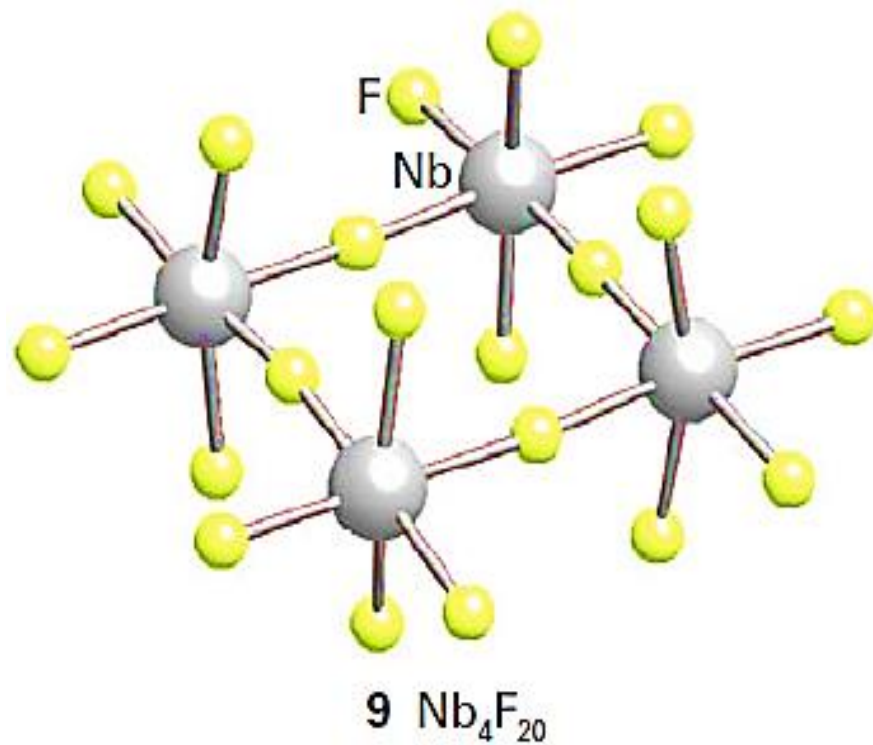
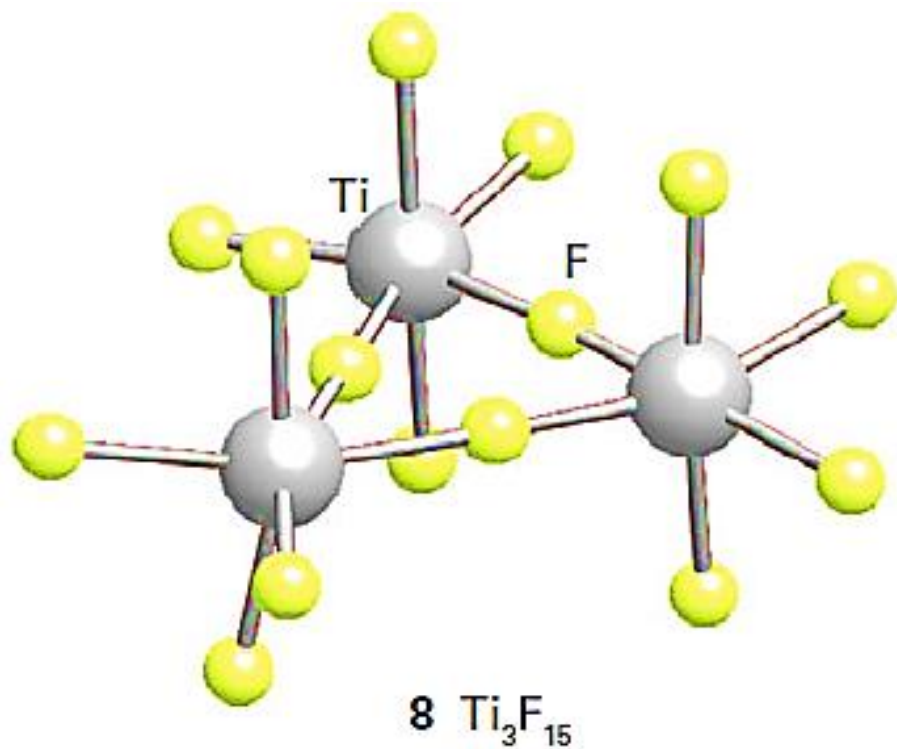
40% li HF – eritmasi plavik kislota.

Shisha idishlarda saqlab bo'lmaydi. Tashqi va ichki tomondan parafinlangan idishlarda yoki plastmassa va Pb li idishlarda saqlanadi.



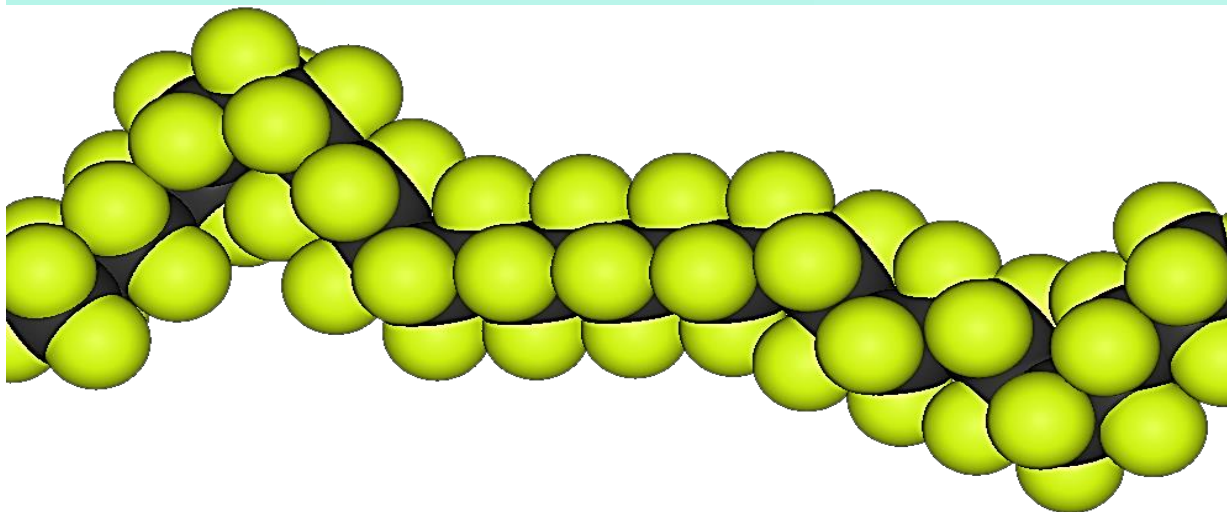
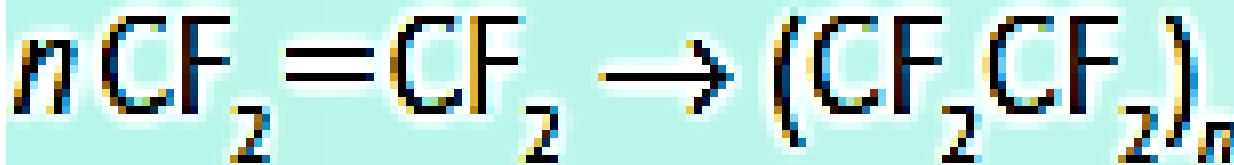
HF bug'lari zaharli; Kons. HF terini kuydirib, iz qoldiradi. Organik sintezda qo'llaniladi.

POLIFTORIDLAR

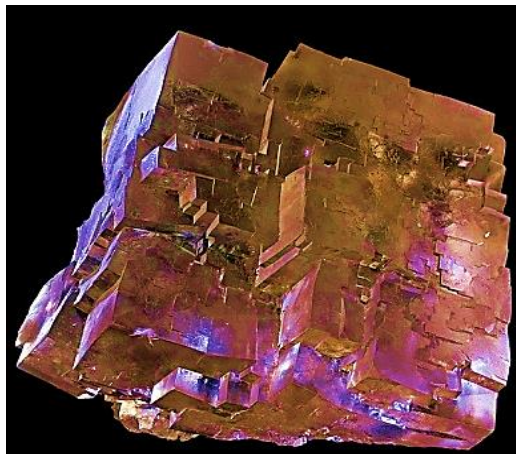


POLITETRAFTORETILEN

- $\text{CH}_4 + 3\text{Cl}_2 \rightarrow \text{CHCl}_3 + 3\text{HCl}$
- $\text{CHCl}_3 + 2\text{HF} \rightarrow \text{CHClF}_2 + 2\text{HCl}$
- $\text{CHClF}_2 \rightarrow \text{C}_2\text{F}_4 + 2\text{HCl}$



Xlor va uning birikmalari



Tosh tuzi yoki galit - NaCl



Silvin- KCl



Silvinit - KCl*NaCl



Kaunit
MgSO₄*KCl*3H₂O



Karnallit
KCl*MgCl₂*6H₂O

**1772-yil Sheele olgan.
1810-yil X.Devi yangi
element sifatida kashf
qildi. Xlor lotincha
“xloros” – sarg’ish-
yashil. Na, K va Mg li
tuzlari dengiz suvi
tarkibida uchraydi.**

Xlorning olinishi

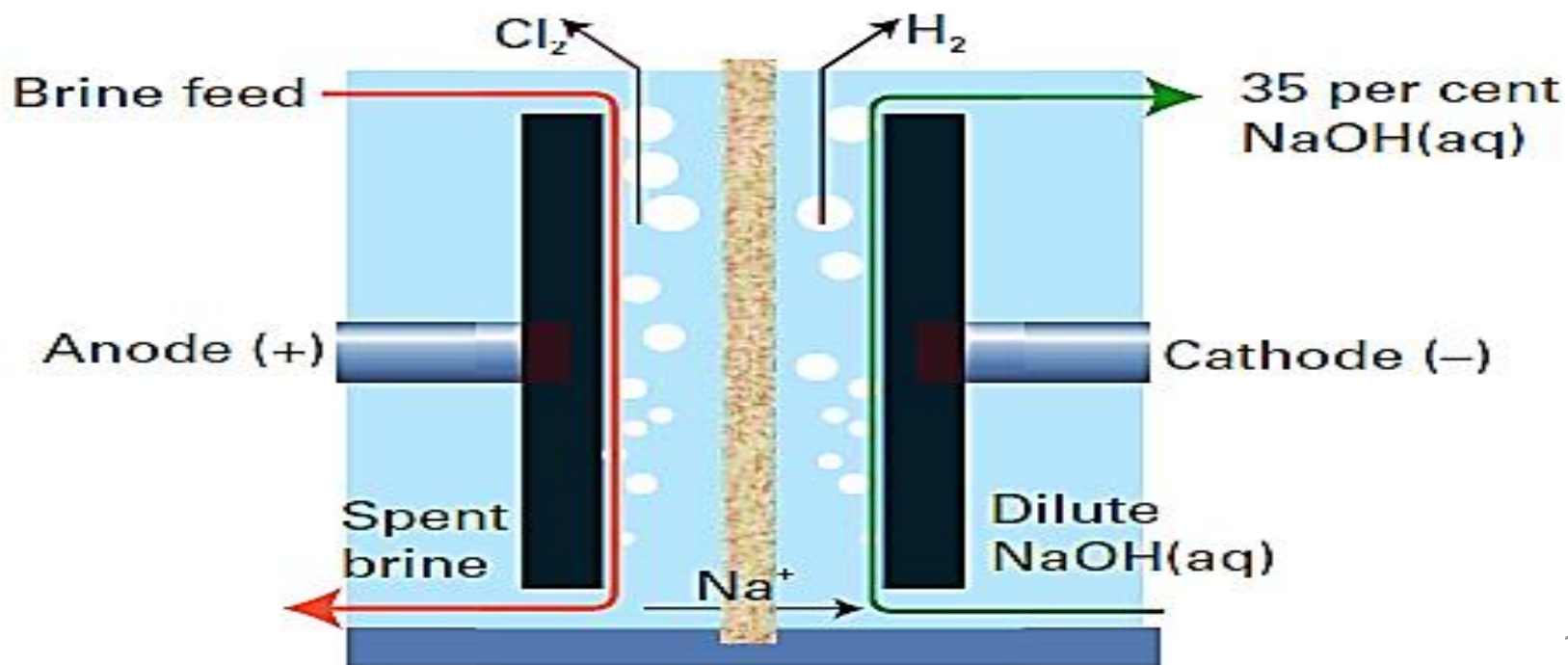
KCl yoki NaCl eritmasi elektroliz qilib olinadi.

Laboratoriyada:

Oksidlovchilar MnO_2 , KMnO_4 , PbO_2 , $\text{K}_2\text{Cr}_2\text{O}_7$, KClO_3 ta'sirida:



qattiq NaCl + H_2SO_4 kons. va MnO_2 :



Xlorning xossalari

Sarg'ish-yashil gaz, qay.h. -34°C , suyuql.h. -101°C .

Xlor suvda eriydi, 1 litr suvda 2,5 litr xlor eriydi.

0,6 MPa bosimda Cl_2 oson suyuq holatga o'tadi.

F_2 nisbatan biroz passiv.

Cl_2 – O_2 , N_2 va inert gazlar bilan ta'sirlashmaydi.

Na bilan portlab: $2\text{Na} + \text{Cl}_2 = 2\text{NaCl}$

$\text{Ca} + \text{Cl}_2 = \text{CaCl}_2$

$2\text{Al} + 3\text{Cl}_2 = 2\text{AlCl}_3$

Nur ta'sirida: $\text{H}_2 + \text{Cl}_2 = 2\text{HCl}$

Metallmaslar bilan:

$2\text{P} + 5\text{Cl}_2 = 2\text{PCl}_5$

$2\text{P} + 3\text{Cl}_2 = 2\text{PCl}_3$

$\text{Si} + 2\text{Cl}_2 = \text{SiCl}_4$

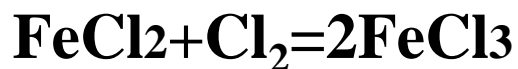
$2\text{Sb} + 3\text{Cl}_2 = 2\text{SbCl}_3$

Xlorning xossalari

Suv bilan: $\text{Cl}_2 + \text{H}_2\text{O} = \text{HCl} + \text{HClO}$

Uglerod bilan (CCl_4 , CHCl_3 , CH_2Cl_2 , CH_3Cl).

Oksidlovchi: $2\text{K}_2\text{MnO}_4 + \text{Cl}_2 = 2\text{KMnO}_4 + 2\text{KCl}$



Matolarni oqlashda hamda dizenfeksiyalash maqsadida.

Xlorid kislota va uning tuzlari.

1 litr suvda 450 litr HCl eriydi.

HCl kuchli kislota. Oshqozon shirasi tarkibiga kiradi.

Oshqozon shirasi (pH= 1-3) H^+ kationi va Cl^- anioni, H_2PO_4^- va HSO_4^- . Ko'proq xlorid ionlar.

HCl pepsinni faollashtiradi.

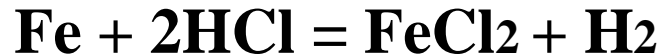
Xlorid kislota

Saonoatda: $\text{H}_2 + \text{Cl}_2 = 2\text{HCl}$; $\text{NaCl} + \text{H}_2\text{SO}_4 = \text{NaHSO}_4 + \text{HCl}$

Kons. HCl 37% bug'lanuvchan, kuchli elektrolit.

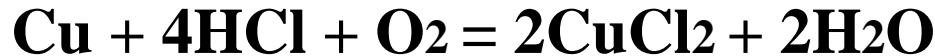
0,1 n li HCl ning $\alpha = 92\%$ ga teng.

HCl faol metatallar bilan (Mg, Ca, Zn, Fe, Al) H_2 ajratib reaksiyaga kirishadi:



HCl o'rtacha faol metallar bilan (Cu, Ag, Hg, Au, Pt) HCl ta'sirlashmaydi.

Kons. HCl passiv metallar bilan (Cu, Ag) havo kislorodi O_2 ishtirokida:

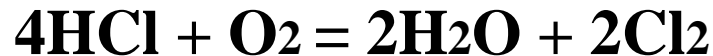


HCl tuzlari. AgCl, CuCl, Hg_2Cl_2 , PbCl_2 suvda oz eriydi.

Kons. HCl (MnO_2 , PbO_2 , KMnO_4) bilan qaytaruvchi:



CuCl₂ katalizator:



AlCl_3 , CrCl_3 , HgCl_2 , CuCl_2 tuzlari oson gidrolizlanadi.

Xlorning kislorodli birikmalari

Oxidation number	+1	+3	+4	+6	+7	
Formula	Cl ₂ O	Cl ₂ O ₃	ClO ₂	Cl ₂ O ₄	Cl ₂ O ₆	Cl ₂ O ₇
Colour	brown-yellow	dark brown	yellow	pale yellow	dark red	colourless
State	gas	solid	gas	liquid	liquid	liquid

Cl₂O, sarg'ish-qo'ng'ir gaz. Cl₂O – polyar molekula. Qizdirilganda portlaydi:



Cl₂O suv bilan: $\text{Cl}_2\text{O} + \text{H}_2\text{O} = 2\text{HClO}$

Kuchsiz kislota ($K=5 \cdot 10^{-8}$). $\text{HClO} = \text{HCl} + \text{O}$

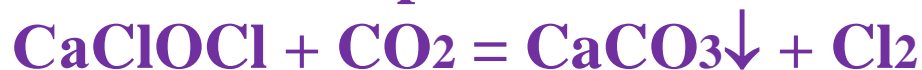
Gipoxloritlar: $2\text{NaOH} + \text{Cl}_2 = \text{NaCl} + \text{NaClO} + \text{H}_2\text{O}$

Katalizatorsiz: $3\text{KClO} = \text{KClO}_3 + 2\text{KCl}$

1792-yil Parijda (Javel suvi) Bertole gaz holatdagi xlorni:



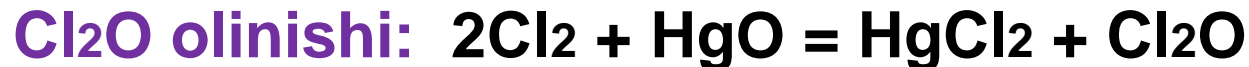
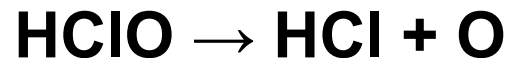
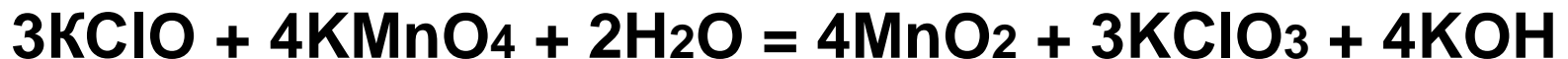
CaClOCl parchalanishi:



Xlorning kislородli birikmalari



HClO va tuzlari oksidlovchilar.



Xlor (IV) oksid – ClO₂.

Sarg'ish-yashil gaz, uzoq vaqt saqlanganda portlaydi.

(suyuql.h. 11°C).



ClO₂ ning olinishi:



Xlorning kislородli birikmalari

ClO₂ – kuchli oksidlovchi:



NaClO₂ – oqartiruvchi modda, kir yuvish kukunlariga qo'shiladi.

Xlor trioksidi – ClO₃,

Qoramtir-qizil rangli suyuqlik (qaynash.h. 203°C).

Bug' holatda – ClO₃, suyuq holatda bo'lsa Cl₂O₆.



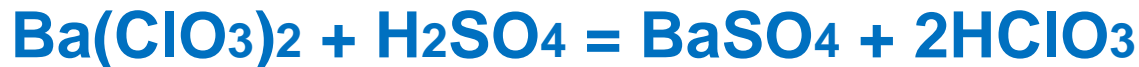
ClO₃ – portlaydi: 4ClO₃ = 2ClO₂ + Cl₂ + 4O₂

Xlorning kislородli birikmalari

Xlorat kislota 40 % gacha muvjud.

1 N eritmasi uchun $\alpha = 79\%$.

50% dan ortiq kons. HClO_3 o'z-o'zidan portlaydi:



Tuzlari rangsiz. Suvda eruvchan qattiq moddalardir.

KClO_3 – katalizator (MnO_2):



Katalizatorsiz: $4\text{KClO}_3 = 3\text{KClO}_4 + \text{KCl}$

Olinishi: $3\text{Cl}_2 + 6\text{KOH} = \text{KClO}_3 + 5\text{KCl} + 3\text{H}_2\text{O}$

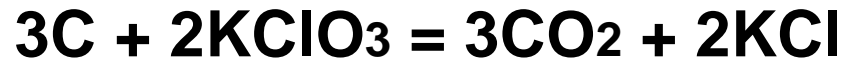
KClO_3 – gugurt ishlab chiqarish, Bengal olovi va portlovchi moddalar tayyorlashda qo'llaniladi.

Bertole tuziga S havonchada aralshtirilsa:



Xlorning kislородli birikmalari

Kuchsiz portlash: $6P + 5KClO_3 = 3P_2O_5 + 3KCl$



Shakarni $KClO_3$ bilan aralashtirib, bir tomchi kons. H_2SO_4 qo'shilsa:



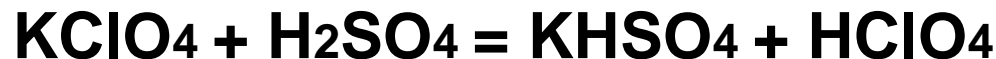
Bengal olovi

Cl_2O_7 – yog'simon suyuqlik (qayn.h. $83^\circ C$).

Chayqatilsa yoki $120^\circ C$ gacha qizdirilsa, portlaydi:

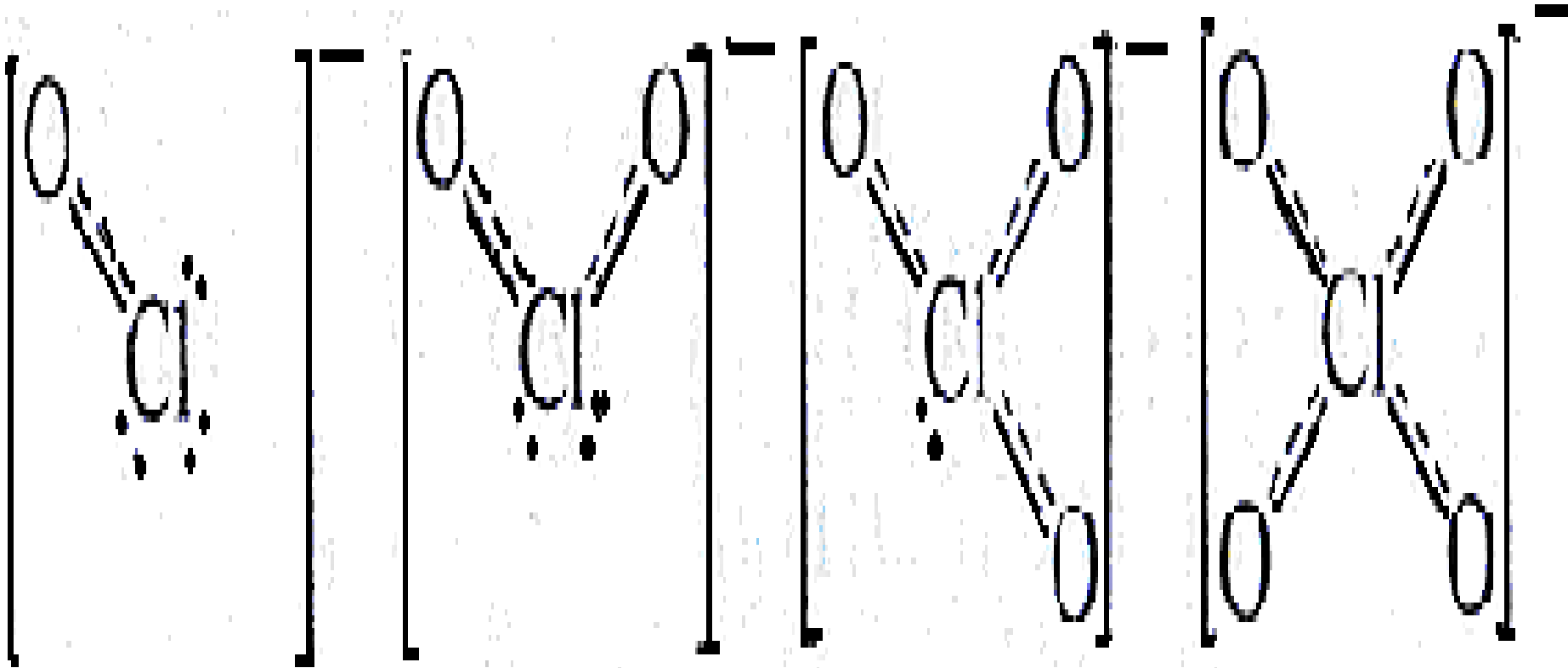


$HClO_4$ – rangsiz suyuqlik, o'z-o'zidan portlaydi.



Xlorning kislородli birikmalari

- Chapdan o'ngga kislота kuchi, barqarorlik va xlor atomlarining o. d. ortadi.
- Markaziy atom sp^3 gibridlangan:



Gipoxloritlar:



Xloritlar:



BROM

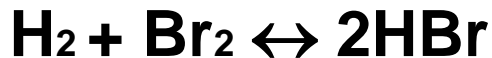


Brom - bromidlar elektrolizi orqali olinadi.

Laboratoriyada:



Qo'ngir rangli suyuqlik (qayn.h. - 7,3°C,) o'tkir hidli zahar.



Bromning kimyoviy xossalari



1 litr suvda 600 litr HBr eriydi.



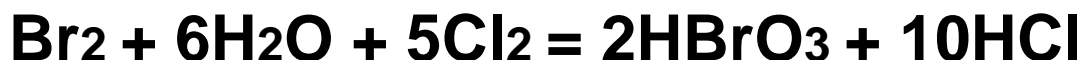
Ishqoriy hamda ishqoriy-yer metallari bromidlari ion bog' tabiatiga ega.

AgBr, PbBr₂ – bromidlar oz eriydi.



HBr qaytaruvchi: $2\text{HBr} + \text{H}_2\text{SO}_4 = \text{SO}_2 + \text{Br}_2 + 2\text{H}_2\text{O}$

Gipobromidlar parchalanishi:



HBrO₃ – barqaror. Kons. ni 50% yetkazish mumkin.

YOD

Olinishi: $2\text{KI} + \text{Cl}_2 = 2\text{KCl} + \text{I}_2$

$2\text{NaI} + \text{MnO}_2 + 3\text{H}_2\text{SO}_4 = \text{I}_2 + 2\text{NaHSO}_4 + \text{MnSO}_4 + 2\text{H}_2\text{O}$

Bug'lari zaharli, KI ishtirokida eruvchanlik ortadi.

$\text{KI} + \text{I}_2 = \text{K}[\text{I}_3]$ $\text{KI} + 2\text{I}_2 = \text{K}[\text{I}_5]$ $\text{KI} + 3\text{I}_2 = \text{K}[\text{I}_7]$ $\text{KI} + 4\text{I}_2 = \text{K}[\text{I}_9]$

Koordinatsion son 9 ga yetishi mumkin.

Kimyoviy xossalari. Faolligi kam.

$2\text{Na} + \text{I}_2 = 2\text{NaI}$ $\text{Ca} + \text{I}_2 = \text{CaI}_2$ $2\text{Al} + 3\text{I}_2 = 2\text{AlI}_3$

Metallmaslar: $2\text{P} + 5\text{I}_2 = 2\text{PI}_5$ $\text{Si} + 2\text{I}_2 = \text{SiI}_4$

Gipoyodit kislota (HIO): $\text{I}_2 + \text{H}_2\text{O} = \text{HI} + \text{HIO}$

$\text{I}_2 + 5\text{H}_2\text{SO}_4 = 2\text{HIO}_3 + 5\text{SO}_2 + 4\text{H}_2\text{O}$

Yodat kislota (HIO₃):

$3\text{I}_2 + 10\text{HNO}_3 = 6\text{HIO}_3 + 10\text{NO} + 2\text{H}_2\text{O}$

POLYIODIDLAR

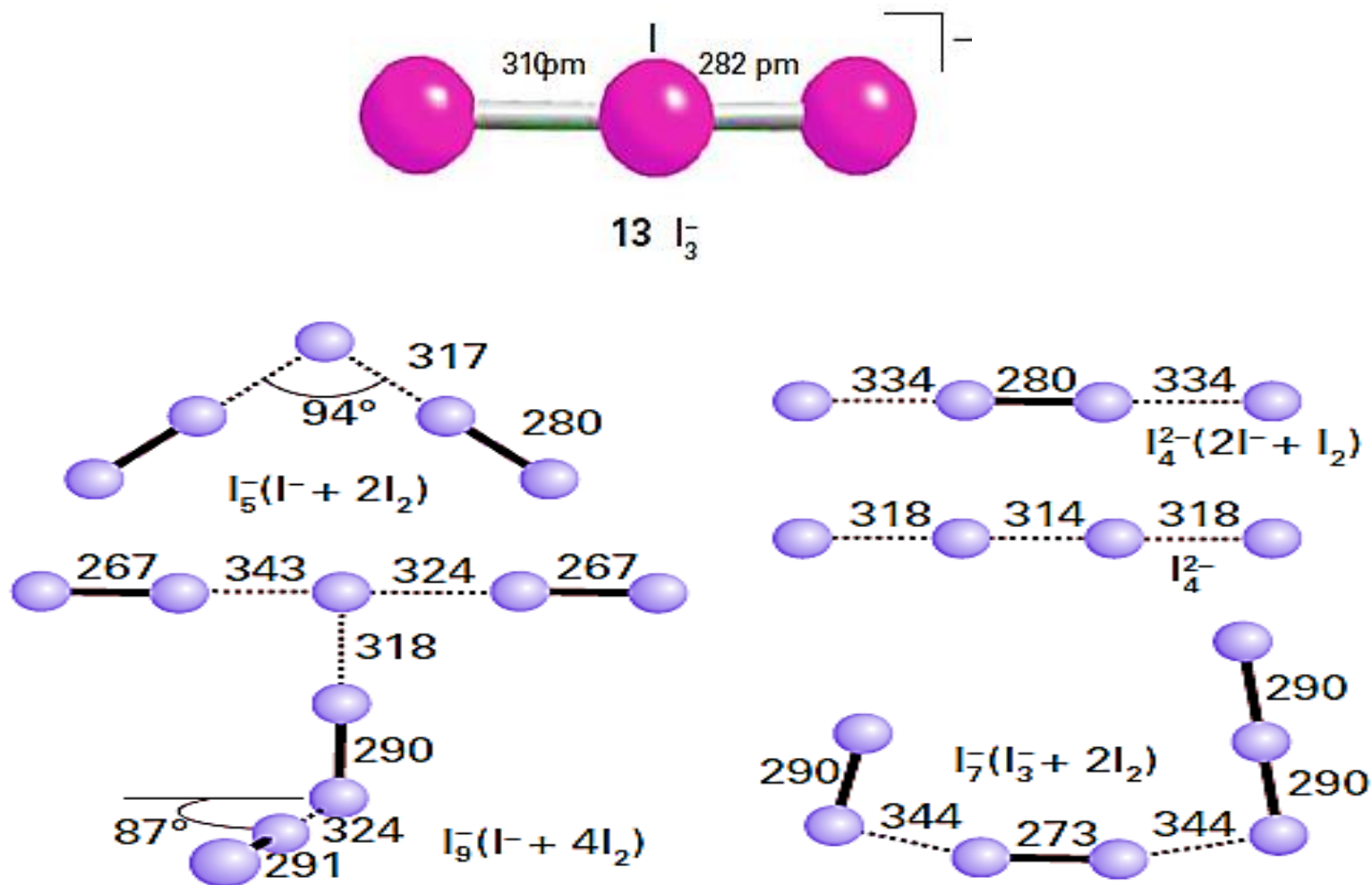


Figure 17.12 Some representative polyiodide structures and their approximate description in terms of I^- , I_3^- , and I_2 building blocks. Bond lengths and angles vary with the identity of the cation.

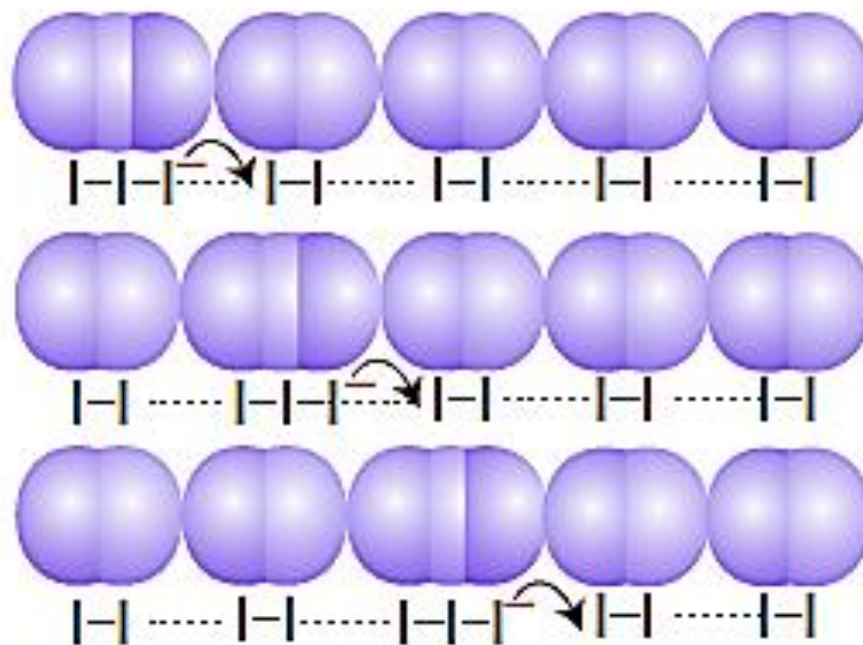


Figure 17.13 One possible mode of charge transport along a polyiodide chain is the shift of long and short bonds, resulting in the effective migration of an I^- ion along a chain. Three successive stages in the migration are shown. Note that the iodide ion from the I_3^- on the left is not the same one emerging on the right.

HI VA YODIDLAR

HI rangsiz, havoda tutaydigan, suvda yaxshi eriydigan gaz. (suyuql.h. $-50,8^{\circ}\text{C}$).

1 litr suvda 400 litr HI eriydi.

0,1 n eritma $\alpha = 95\%$ ga teng. $\text{H}_2 + \text{I}_2 \leftrightarrow 2\text{HI}$

Olinishi: $2\text{P} + 3\text{I}_2 = 2\text{PI}_3$

$\text{PI}_3 + 3\text{H}_2\text{O} = \text{H}_3\text{PO}_3 + 3\text{HI}$

Yodidlariga kons. H_2SO_4 dan HI olinmaydi:

$2\text{KI} + \text{H}_2\text{SO}_4 = \text{K}_2\text{SO}_4 + 2\text{HI}$

$2\text{HI} + \text{H}_2\text{SO}_4 = \text{I}_2 + 2\text{H}_2\text{O} + \text{SO}_2$

NaI , KI , NH_4I – rangsiz kristallar.

AgI – suvda kam eruvchi, sariq kristall.

AgI kristallari HNO_3 eritmasida ham erimaydi.

Yodning kislородli birikmalari

Oksidlari I_2O , IO_2 va I_2O_5 . Eng barqarori I_2O_5 .

Gipoyodit kislota – HIO , yodat kislota – HIO_3 ,

Peryodat kislota – HIO_4 .

Tarkibida suv tutuvchi kislotalar:

Mezaperyodat kislota - H_3IO_5 ($HIO_4 \cdot H_2O$),

Ortoperyodat kislota - H_5IO_6 ($HIO_4 \cdot 2H_2O$).

Gipoyodit kislota HIO beqaror, faqatgina eritmada mavjud.



KJO parchalanganda:



Yodning kislородli birikmalari

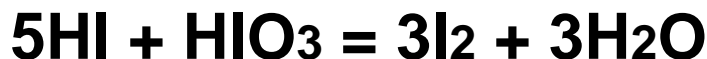


HJO_3 – barqaror.

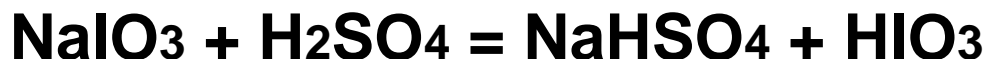
HIO_3 – molekulyar komplekslar hosil qiladi:



I_2O_5 – oq kukun modda. Oson parchalanadi.



Yodatlarga sulfat kislota ta'sirida:



Xlor ta'sirida oksidlashda:



KIO_3 – tuzi barqaror:



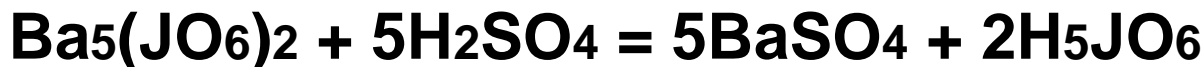
Yodning kislородli birikmalari

Peryodat kislota – HIO_4 . J_2O_7 angidridi olinmagan.

$\text{HIO}_4 \cdot 2\text{H}_2\text{O}$ (H_5IO_6) – ortoperyodat kislota.

Ag_5IO_6 – tuzi mavjud. H_5IO_6 – kuchli gigroskopik modda.

Ortoperyodat kislota bariy ortoperyodatdan olinadi:

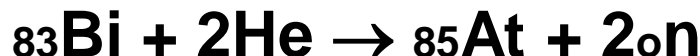


Peryodatlar tarkibida suv tutadi – $\text{HJO}_4 \cdot 4\text{H}_2\text{O}$ (H_9IO_8).

$\text{H}_2\text{O} \cdot \text{HJO}_4$ (H_5IO_4) birikma.

Tabiatda At. At – 1940-yil sun'iy ravishda olingan.

Bunda Bi atomiga α - zarrachalar ta'sir ettiriladi:



Astat so'zi yunoncha «beqaror» ma'nosini beradi. Yarim yemirilish davri ${}_{83}\text{At}$ 7,2 soat. At uning birikmalarini elektroliz qilib olinadi. At – C_6H_6 da eriydi. Kumush astatid – AgAt , suvda erimaydi. At_2S – cho'kma. At - birikmalarda -1, +1 va +5 o.d. ega. O.d. +7 bo'lgan birikmalari olinmagan.

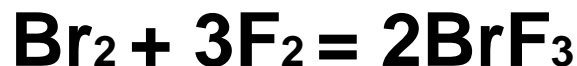
Galogenlarning o'zaro birikmalari

Xlor (III) ftorid ClF_3 – suyuqlik (suyuql.h. -83°C).



Xlor mo'l miqdorda bo'lganda - ClF monoftorid xlor (suyuql.h.- 154°C)

Brom va ftorning o'zaro ta'siri:



BrF_3 – qizil suyuqlik (suyuql.h. 9°C).

Brom ftorid – BrF_5 va IF_5 - rangsiz modda.

Ftorning +7 o.d. ega birikmasi olingan.

IF_7 , IO_3F , BrF_7 – yuqori faollikka ega moddalardir.

Geptaftorid yod suv bilan ta'sirlashganda (H_5IO_6):



17-guruh elementlari uchun Frost diagrammasi

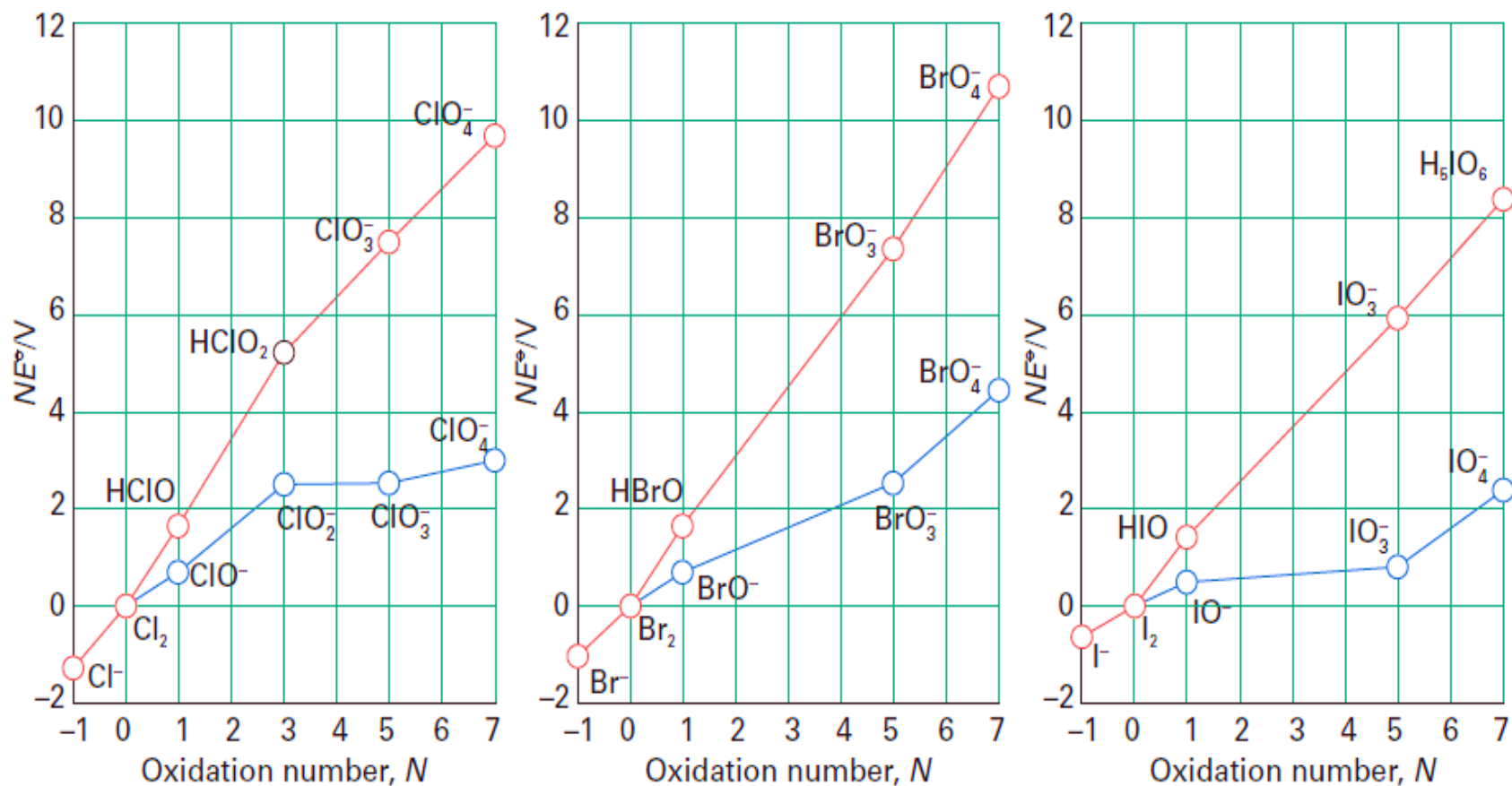


Figure 17.14 Frost diagrams for chlorine, bromine, and iodine in acidic solution (red line) and in basic solution (blue line).

Oxidation number

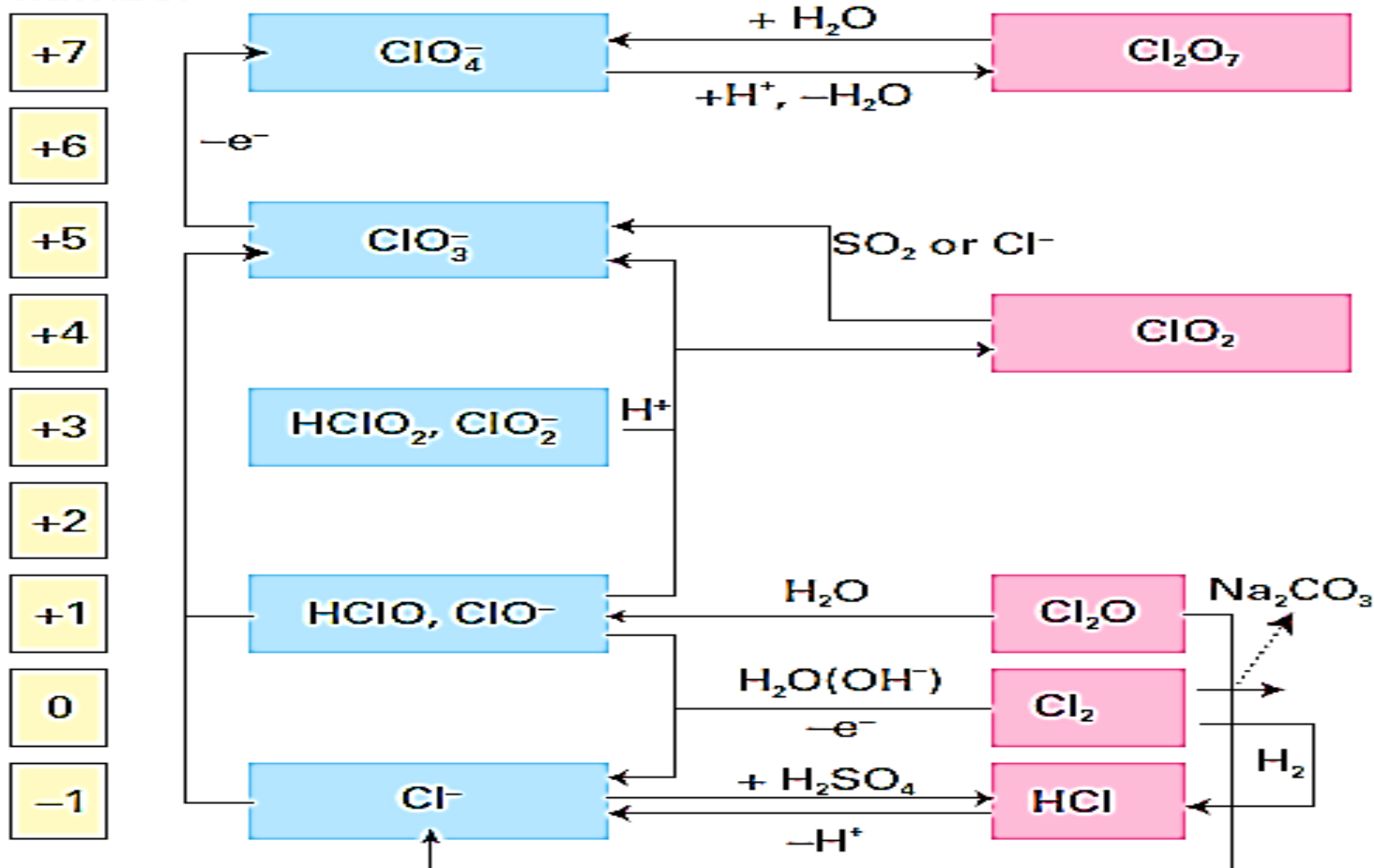


Figure 17.15 The interconversion of oxidation states of some important chlorine species.

FARMATSIYA VA TIBBIYOTDAGI AHAMIYATI

- ✓ Ftor – suyak va tish emalining tarkibiga kiradi.
- ✓ Organizmda 2,6 g gacha ftor bor. F ichimlik suvi bilan kiradi.
- ✓ Suvda 1-1,5 mg/ml ftor mavjud.
- ✓ Ftor etishmasligi yoki ortiqchaligi tish kasalligiga olib keladi.
- ✓ Xlorid ioni hujayralarida elektr o'tkazuvchanlikni ta'minlaydi.
- ✓ Me'da shirasi HCl, hazm qilish, fermentlar faoliyati.
- ✓ NaCl – organizmda qonning osmotik bosimini, eritrotsitlar faoliyatini me'yorida saqlaydi.
- ✓ Yodning spirtli eritmasi antiseptik xossaga ega.
- ✓ Yod teridagi bakteriyalarni o'ldirib, terining bitishini osonlatadi.
- ✓ Yodning radoaktiv izotoplari xavfli o'smalar, qalqonsimon bezi va arterioskleroz kasalliklarini davolashda qo'llaniladi.