

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

4-MA’RUZA:

**15-GURUH ELEMENTLARI. PNIKTOGENLAR.
DAVRIY JADVALDAGI p-BLOK METALLARI**

Ma’ruza mualliflari:

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ASOSIY ADABIYOTLAR:

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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.
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REJA:

Mavzuning ma'ruza davomida yoritiladigan qismlari:

- 1. Guruh elementlarining umumiy tavsifi;**
- 2. Azot va uning birikmalari;**
- 3. Fosfor va uning birikmalari;**
- 4. As, Sb va Bi birikmalari.**

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

- 1. 15-guruh elementlarining olinishi va xossalari;**
- 2. N₂, P, As, Sb, Bi birikmalari va xossalari;**
- 3. 15-guruh elementlarining farmatsiyadagi ahamiyati.**

15-guruh elementlarining asosiy kattaliklari

Asosiy kattaliklar	N	P	As	Sb	Bi
Atom massasi	14,006	30,97	74,82	121,75	208,98
El.formulasi	$2s^2 2p^3$	$3s^2 3p^3$	$4s^2 4p^3$	$5s^2 5p^3$	$6s^2 6p^3$
Atom radius, nm	0,071	0,13	0,148	0,161	0,182
Suyuq.h, °C	-210	44,1*	**	630,5	271,3
Qayn.h, °C	-195,8	257	**	1634	1550
Zichligi, g/sm ³	0,81***	1,83*	5,72****	6,68	9,80
Yer qo'stlog'ida tarqalishi, %	$1 \cdot 10^{-2}$	$8 \cdot 10^{-2}$	$5 \cdot 10^{-4}$	$4 \cdot 10^{-5}$	$2 \cdot 10^{-5}$

* oq fosfor;

** 615°C sublimatsiyalanadi;

*** suyuq azot uchun;

**** kulrang mishyak uchun.

... $ns^2 np^3$

15-guruh elementlarining umumiy xossalari

- Birikmalardagi oksidlanish darajasi: **-3,+3,+5**
- Valentlik: **III, V**

(Azot uchun yuqori valentlik IV)



**Asoslik
kamayadi**

**Barqarorlik
kamayadi**

**Suvda
eruvchanlik
kamayadi**

15-guruh elementlarining umumiy xossalari

+3 o.d. kislorodli kislotalari

- HRO_2 - HNO_2 , HAsO_2 ,
- H_3RO_3 - H_3PO_3 , H_3AsO_3 , H_3SbO_3

+5 o.d. kislorodli kislotalari

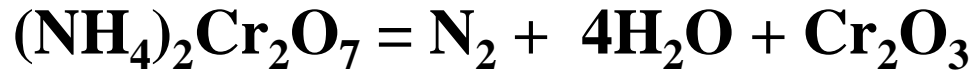
- HRO_3 - HNO_3 , HPO_3 , HAsO_3 , HSbO_3 , HBiO_3
- H_3RO_4 - H_3PO_4 , H_3AsO_4 , H_3SbO_4
- $\text{H}_4\text{R}_2\text{O}_7$ - $\text{H}_4\text{P}_2\text{O}_7$, $\text{H}_4\text{As}_2\text{O}_7$, $\text{H}_4\text{Sb}_2\text{O}_7$

Asosiy qonuniyatlar

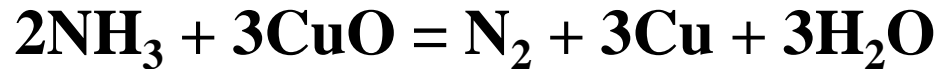
- Kislotalik va barqarorlik kamayadi
- +5 b-r oksidlovchilik kamayadi (HBiO_3 bundan mustasno, u bu qattorda eng kuchli oksidlovchi)

Azot

1772-yil Rezerford kashf qilgan, 1774-yil. A.Lavuaze “Azot” deb nomlagan.

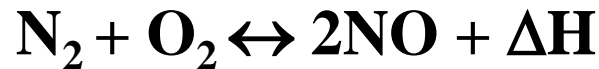


Laboratoriyada olinishi: $\text{NH}_4\text{NO}_2 = \text{N}_2 + 2\text{H}_2\text{O}$



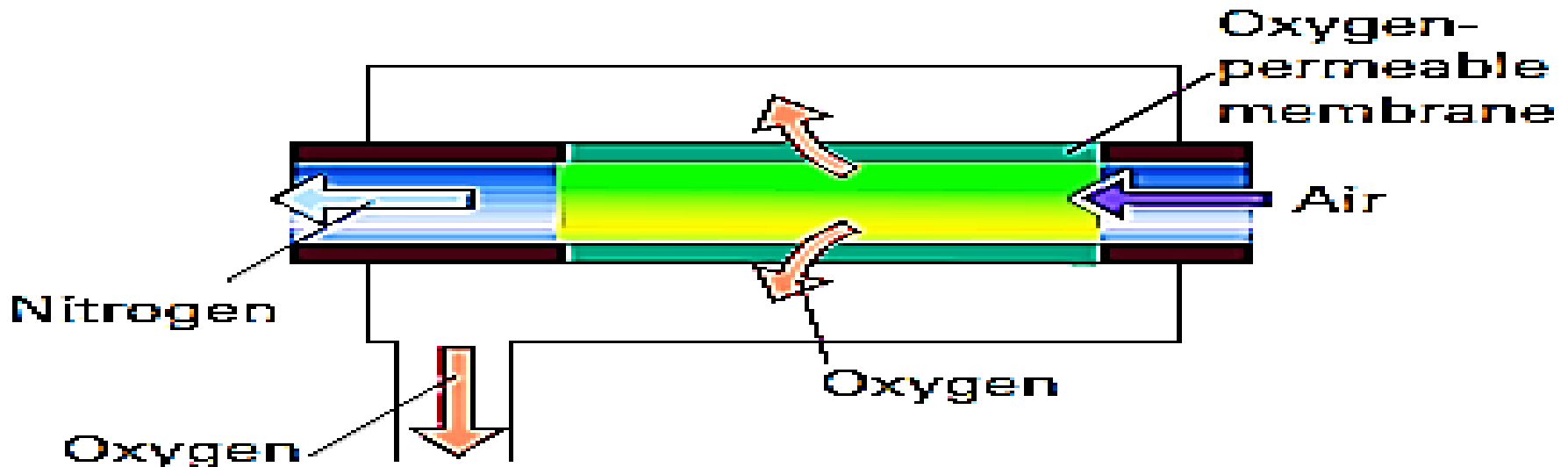
Чистый азот: $2\text{Na}_3\text{N} = 6\text{Na} + \text{N}_2$; $\text{NH}_2\text{-NH}_2 = 2\text{H}_2 + \text{N}_2$

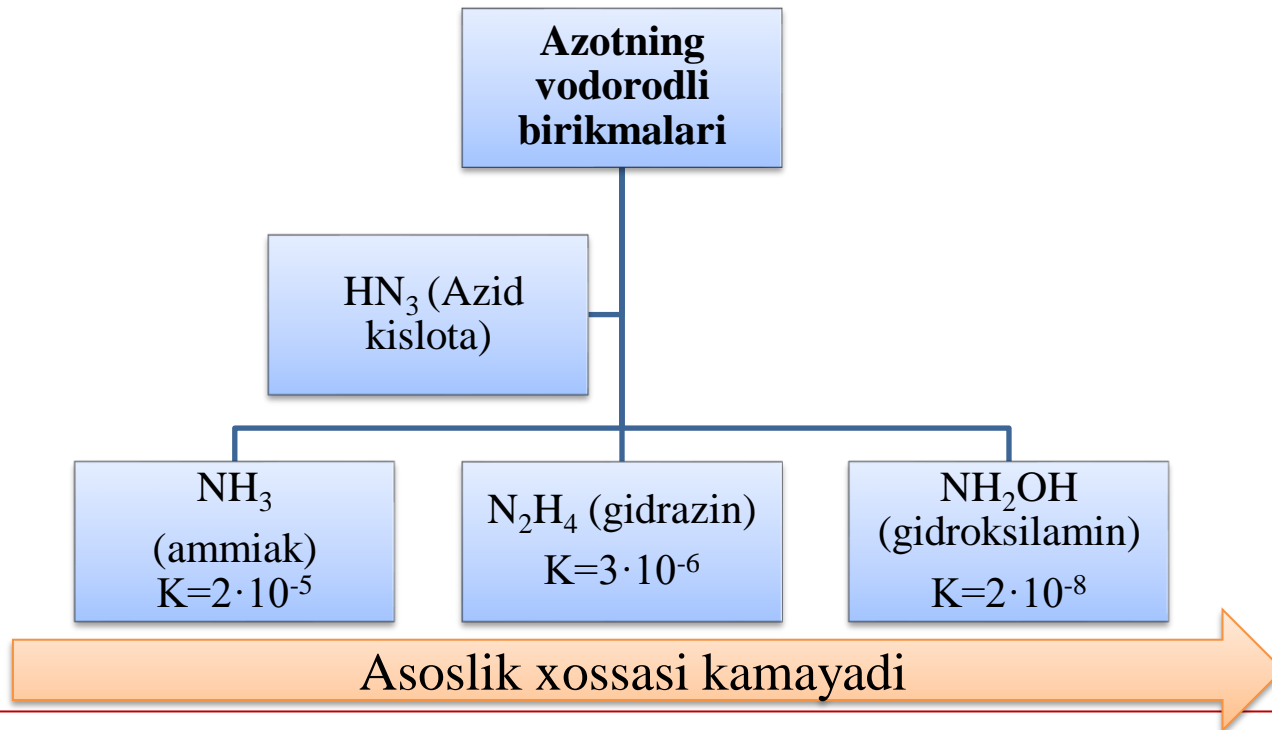
Kim. xossalari. $E_{\text{par.}} 940 \text{ kJ/mol}$. $\text{N}_2 + 6\text{Li} = 2\text{Li}_3\text{N}$; $6\text{Na} + \text{N}_2 = 2\text{Na}_3\text{N}$



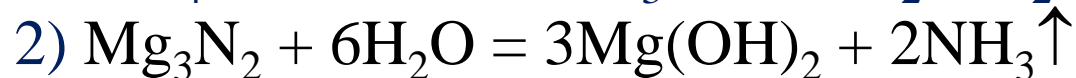
$\text{N}_2 - \text{Cl}_2, \text{O}_3$ va F_2 bilan ta'sirlashmaydi. $\text{N}_2 + 3\text{H}_2 \leftrightarrow 2\text{NH}_3$

Kalsiy sianamid: $\text{CaC}_2 + \text{N}_2 = \text{CaCN}_2 + \text{C}$;

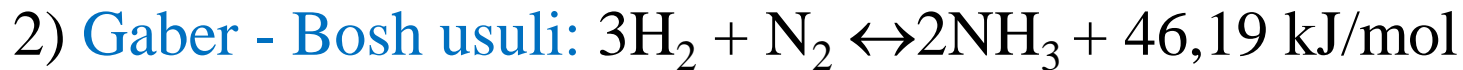




Ammiak. NH_3 – o'ziga xos hidli, rangsiz gaz.

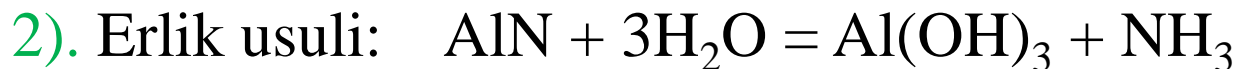
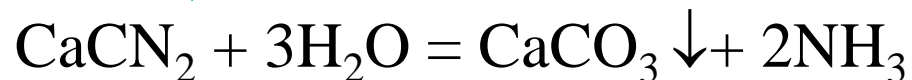


Sanoatda: 1) Toshko'mirdan koks olish jarayonida NH_3 olinadi.

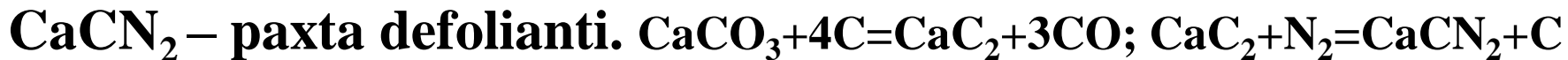
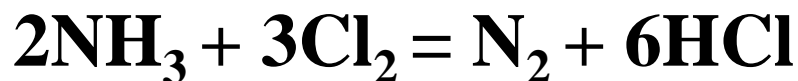
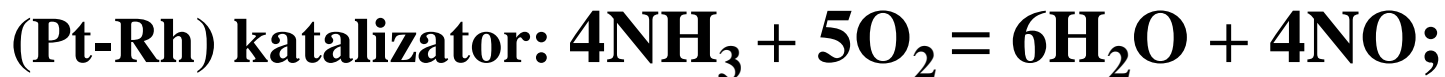


Gaber ammiak sintezi uchun 1918 y. **Nobel mukofotini** olgan.

1). Franko-Karlo usuli:



Ammiak

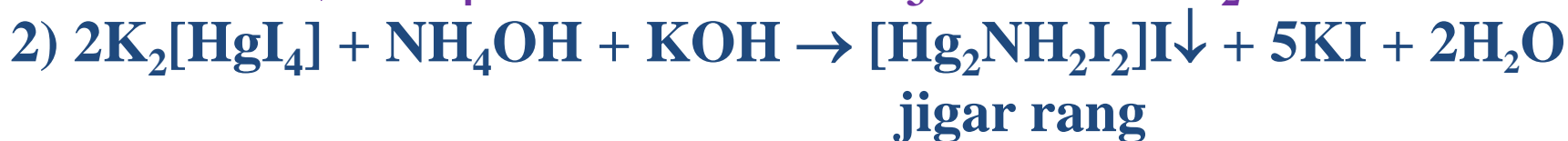


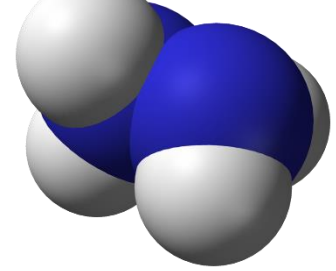
Qo'llanilishi: NH_3 – HNO_3 , $(\text{NH}_4)_2\text{SO}_4$, NH_4NO_3 uchun xom ashyo.

Soda olishda (Solvey usuli), karbamid $\text{CO}(\text{NH}_2)_2$.

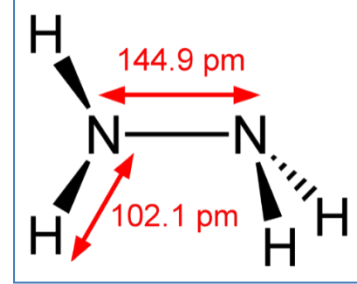


NH_4^+ uchun sifat reaksiya:

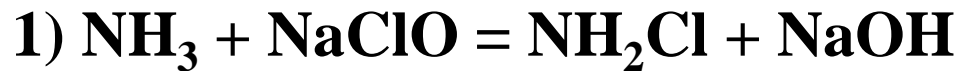
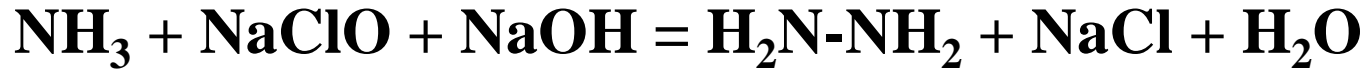




GIDRAZIN - $\text{H}_2\text{N}-\text{NH}_2$



Olinishi:



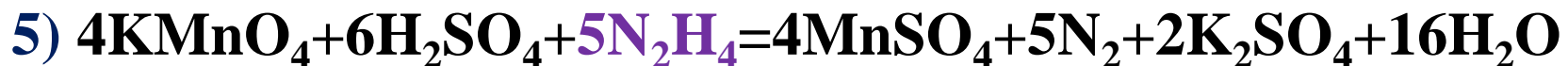
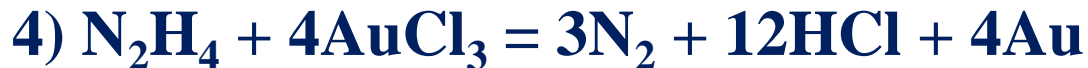
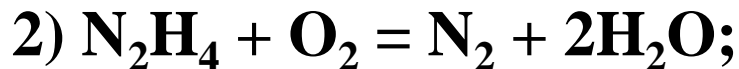
Xossalari:

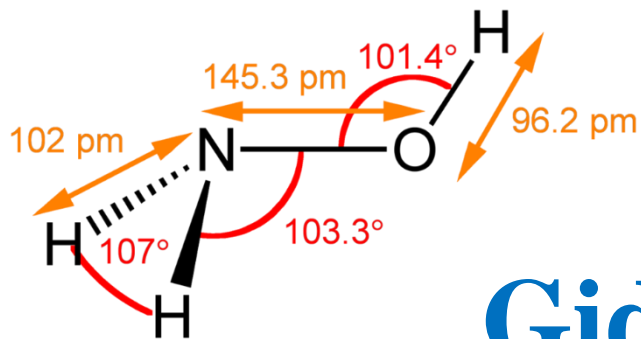
$\text{H}_2\text{N}-\text{NH}_2$ - rangsiz, havoda tutaydigan suyuqlik.



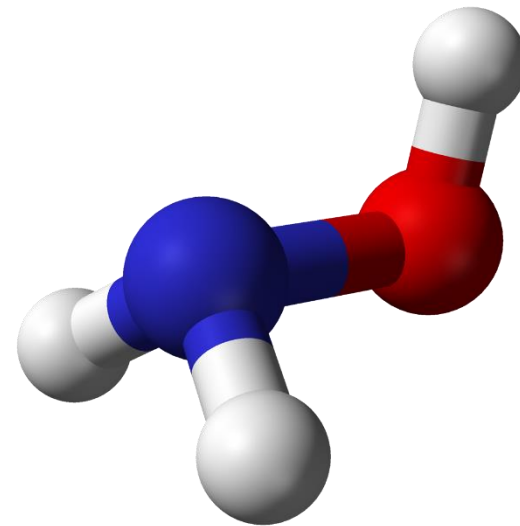
$[\text{N}_2\text{H}_4] \cdot 2\text{HCl}$ – dixlorgidrazin;

$[\text{N}_2\text{H}_4] \cdot \text{H}_2\text{SO}_4$ – gidrazin sulfat.

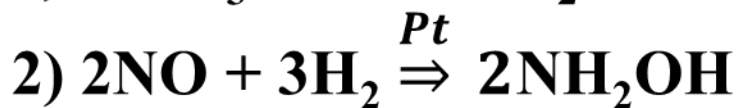
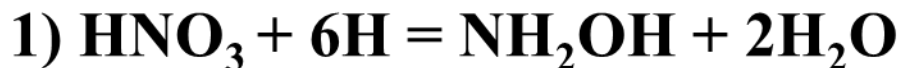




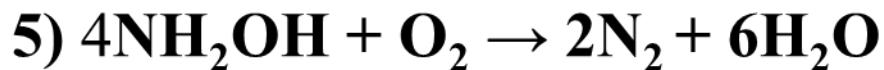
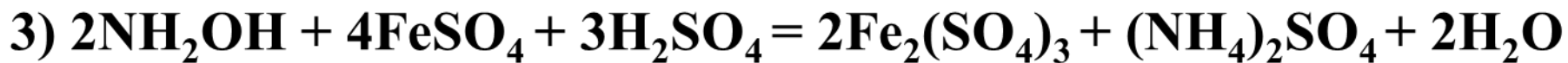
Gidroksilamin

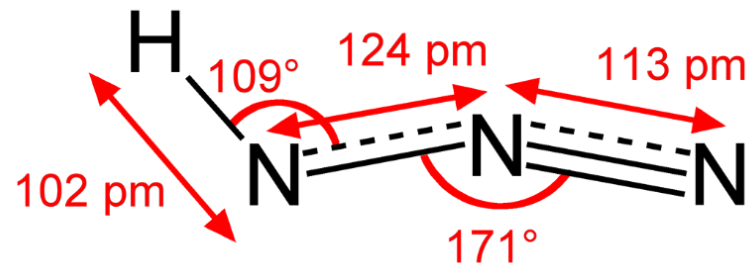
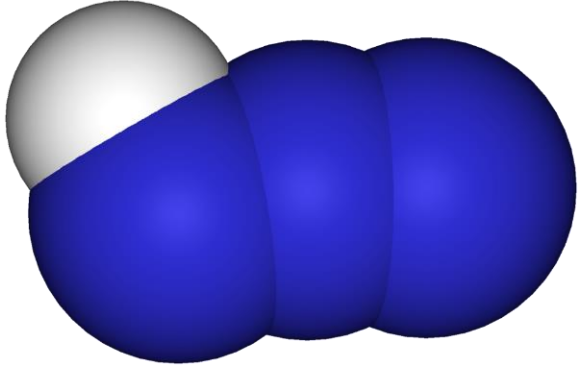


Sanoatda:



Xossalari: NH_2OH — Rangsiz kristall, suvda yaxshi eriydi va $\text{NH}_2\text{OH} \cdot \text{H}_2\text{O}$ tarkibli gidratga aylanadi.



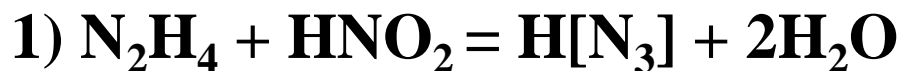


Azid kislota - $\text{H}[\text{N}_3]$

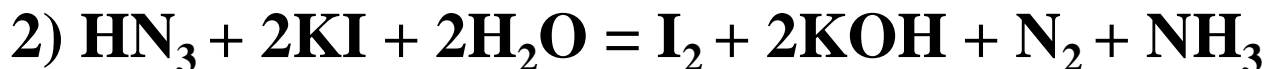
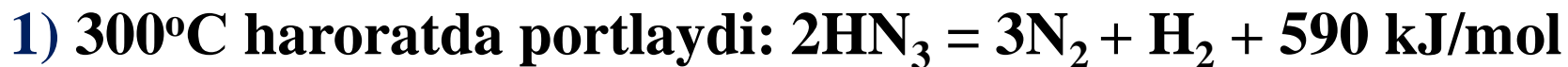
Azid kislota yoki triazid.

O'tkir hidli suyuqlik. Kuchli zahar.

Olinishi:



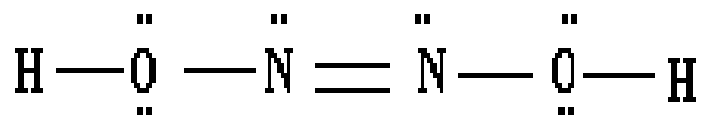
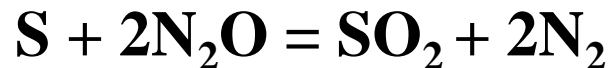
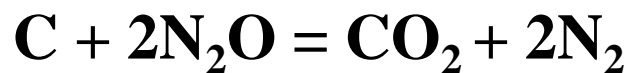
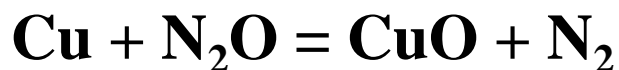
Xossalari: $\text{H}[\text{N}_3] \leftrightarrow \text{H}^+ + \text{N}_3^- \quad K=3 \cdot 10^{-3}$.



AZOTNING KISLORODLI BIRIKMALARI

N_2O , NO , N_2O_3 , NO_2 , N_2O_4 va N_2O_5 .

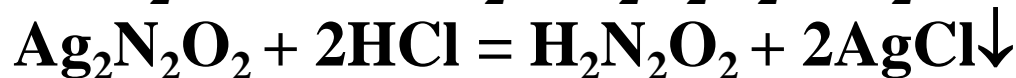
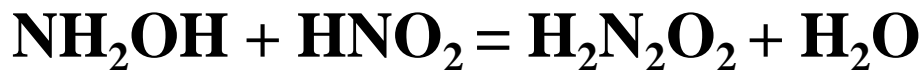
Azot (I) oksidi. Rangsiz gaz, kuchsiz hidli. N_2O “kuldiruvchi gaz” odam hidlaganda kuladi. Hirurgiyada - narkoz.



(700°C) N_2O parchalanadi: $2\text{N}_2\text{O} = 2\text{N}_2 + \text{O}_2$

N_2O ga giponitrit kislotasi mos keladi ($\text{H}_2\text{N}_2\text{O}_2$).

Indifferent oksid.



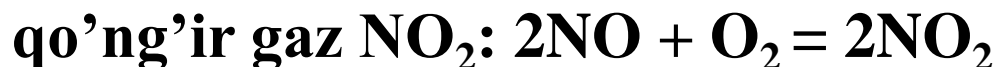
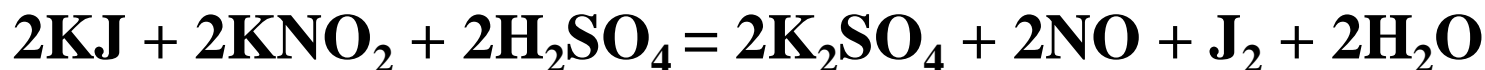
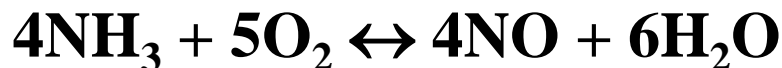
$\text{H}_2\text{N}_2\text{O}_2$ erkin holda uchramaydi.

$K_1=10^{-8}$, $K_2=10^{-12}$. Соли - $\text{Ag}_2\text{N}_2\text{O}_2$; PbN_2O_2 .

AZOTNING KISLORODLI BIRIKMALARI

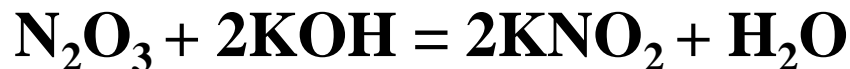
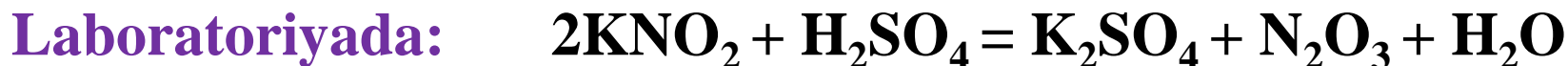
Azot (II) oksidi. Rangsiz, kuchli hidli, zaharli gaz.

Indefferent oksid bog' tartibi – 2,5.



NO ligand sifatida - $[\text{Fe}(\text{NO})_4]$, $[\text{Co}(\text{NO})_4]$.

Azot (III) oksidi. Kislotali oksid. Past haroratda barqaror, $3,5^\circ\text{C}$ da parchalanadi. NO_2 ga NO ta'sir ettirilib: $\text{NO}_2 + \text{NO} = \text{N}_2\text{O}_3$

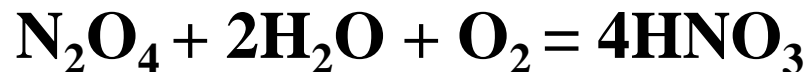


AZOTNING KISLORODLI BIRIKMALARI

Azot (IV) oksidi. $\text{NO}_2 + \text{H}_2\text{O} = \text{HNO}_3 + \text{HNO}_2$



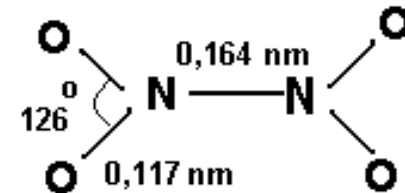
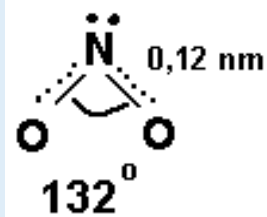
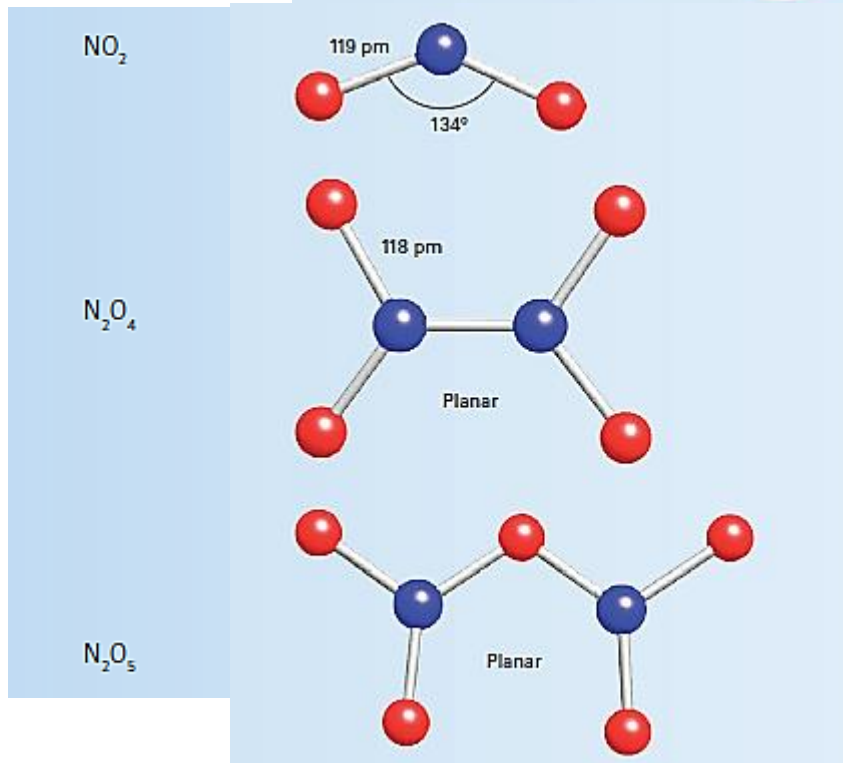
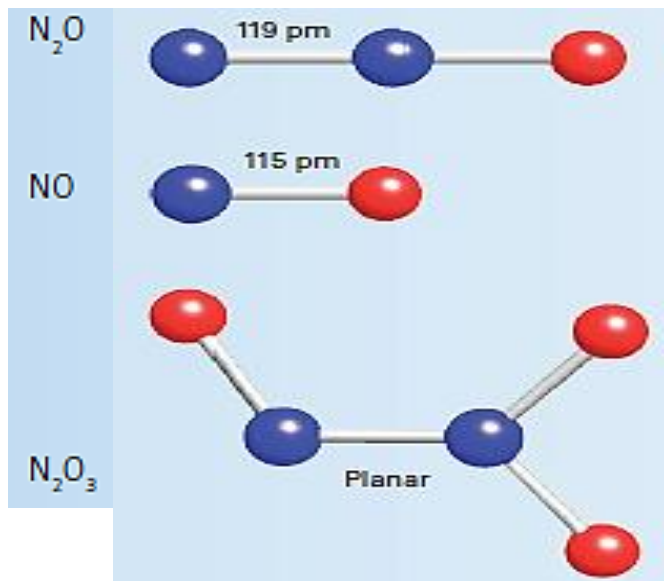
Получение NO_2 : $2\text{NO} + \text{O}_2 = 2\text{NO}_2$



N_2O_4 – rangsiz, gigroskopik krtistall.

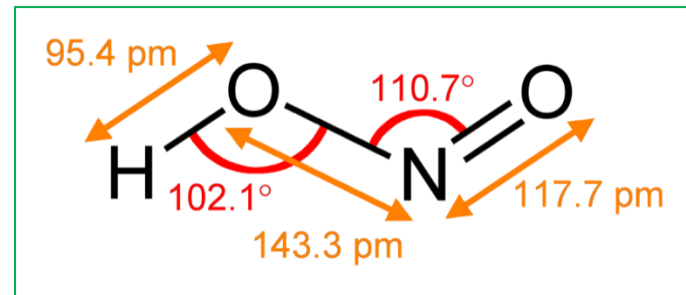
Azot (V) oksidi. $2\text{HNO}_3 + \text{P}_2\text{O}_5 = 2\text{HPO}_3 + \text{N}_2\text{O}_5$



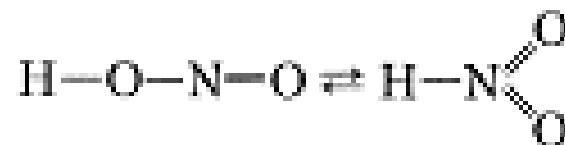
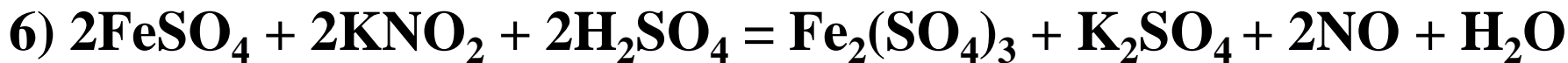
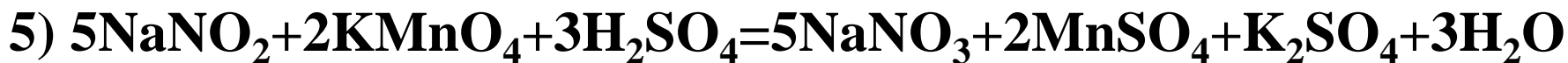
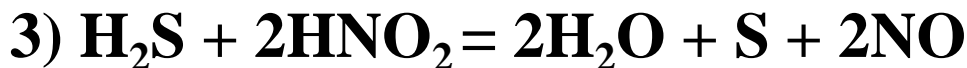


Colourless, ionic solid $[NO_2][NO_3]$
(m.p. $32^\circ C$); unstable

NITRIT KISLOTA



Xossalari: kuchsiz elektrolit $K=7 \cdot 10^{-4}$.



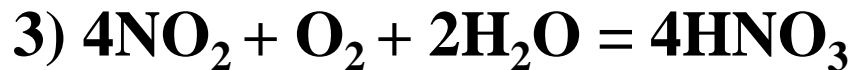
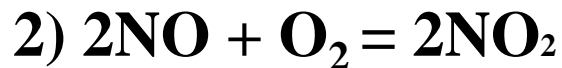
NaNO_2 – stenokardiyada, NO_2 – sovutilganda rangsiz.

-11,2°C da rangsiz kristall.

HNO₃ olinishi va uning xossalari

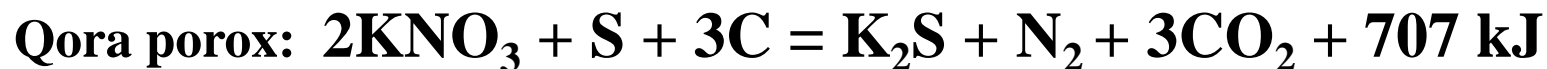
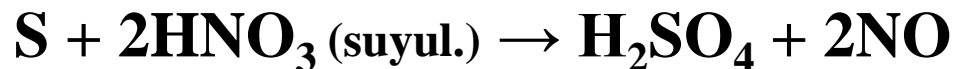
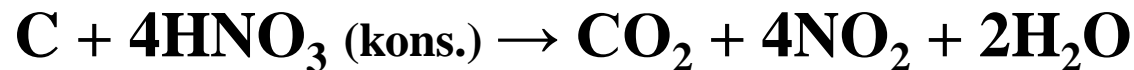
Laboratoriyada olinishi: $2\text{NaNO}_3 + \text{H}_2\text{SO}_4 = \text{Na}_2\text{SO}_4 + 2\text{HNO}_3$

Sanoatda olinishi: 1) $4\text{NH}_3 + 5\text{O}_2 = 4\text{NO} + 6\text{H}_2\text{O}$ 900°C Pt-Rh katalizator.



Xossalari: 1) $4\text{HNO}_3 = 2\text{H}_2\text{O} + 4\text{NO}_2 + \text{O}_2$

2) Metalmaslar bilan ta'sirlashadi.

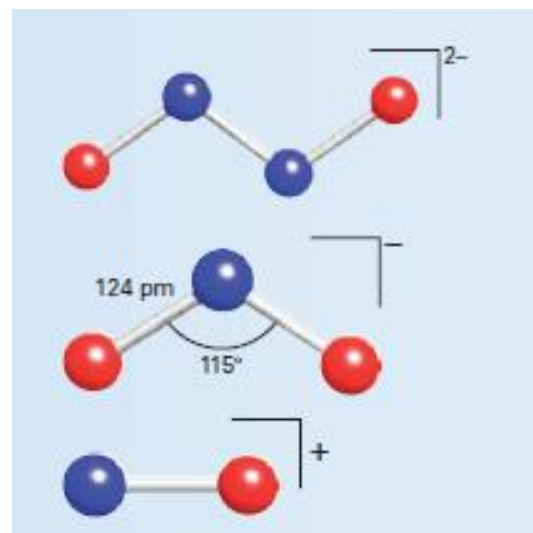


Nitrat kislalani metallar bilan ta'sirlashuvi

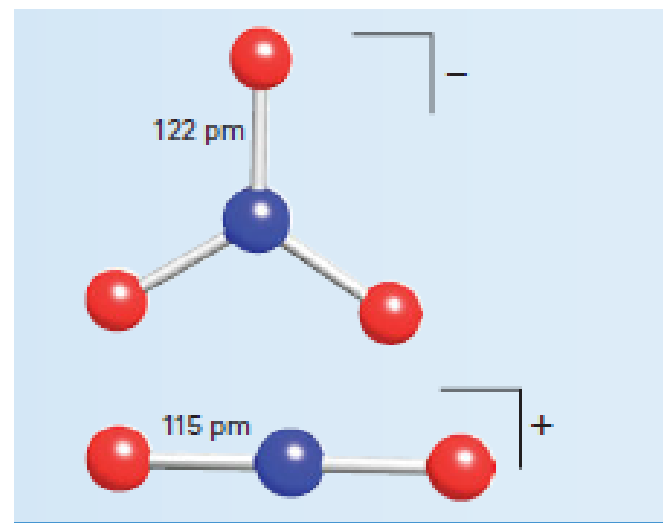


Metallar C(HNO ₃), %	Aktiv Li, Cs, Rb, K, Ba, Sr, Ca, Na, Mg, Al	O'rtacha aktiv Mn, Zn, Cr, Fe, Cd, Co, Ni, Sn, Pb	Passiv Bi, Cu, Ru, Hg, Ag, Rh, Pd	Nodir metallar Ir, Pt, Au
>80%	NO ₂	NO ₂	NO ₂	-
45-75%	N ₂ O	NO	NO ₂	-
10-45%	N ₂	N ₂ O	NO	-
<5%	NH ₄ NO ₃	N ₂	-	-

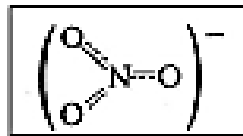
+1	$\text{N}_2\text{O}_2^{2-}$	Hyponitrite
+3	NO_2^-	Nitrite
+3	NO^+	Nitrosonium (nitrosyl cation)



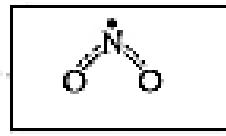
+5	NO_3^-	Nitrate
+5	NO_2^+	Nitronium (nitryl cation)



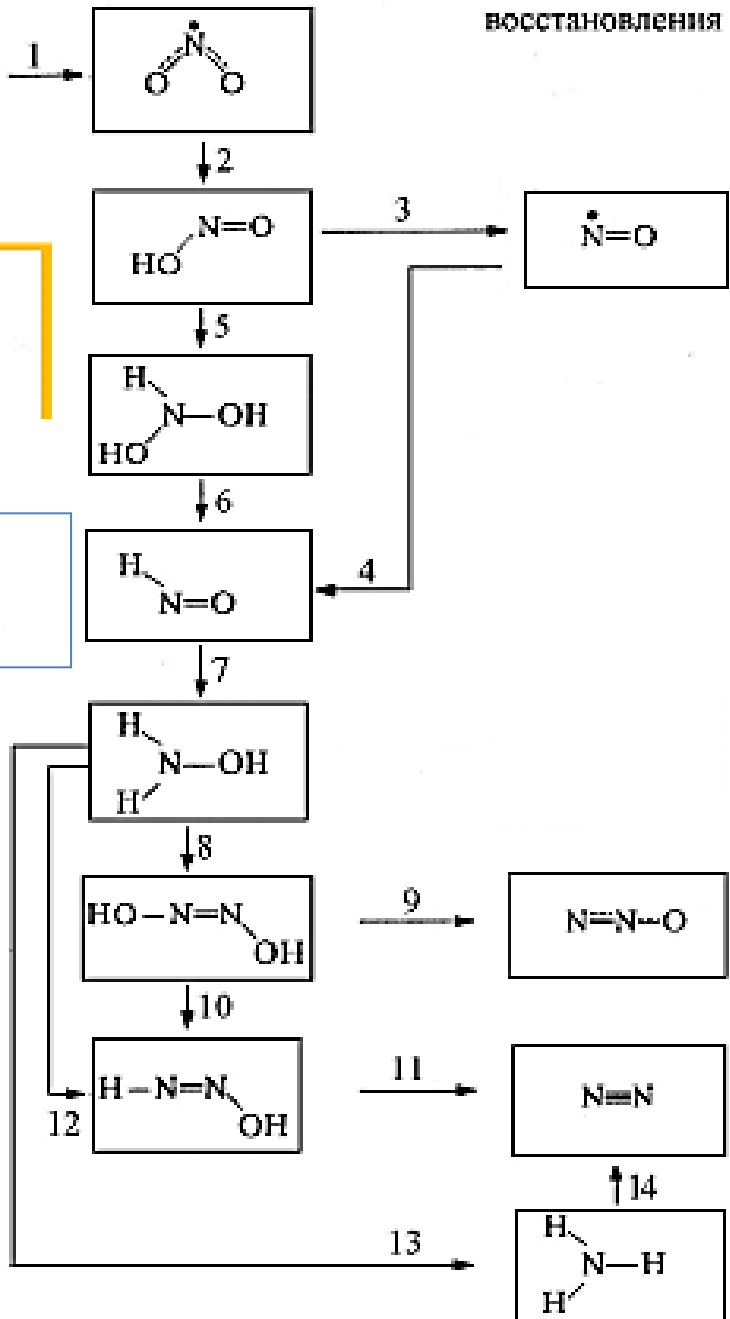
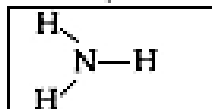
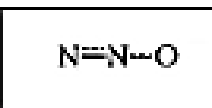
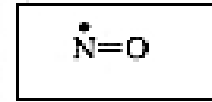
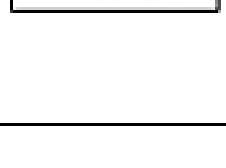
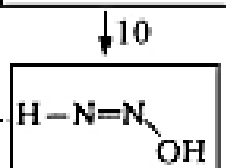
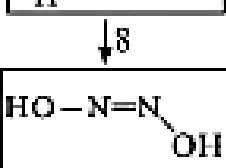
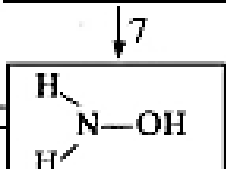
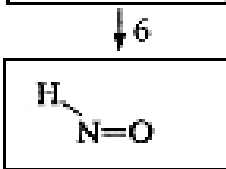
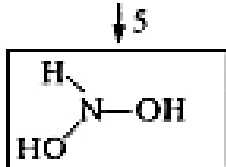
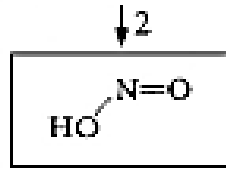
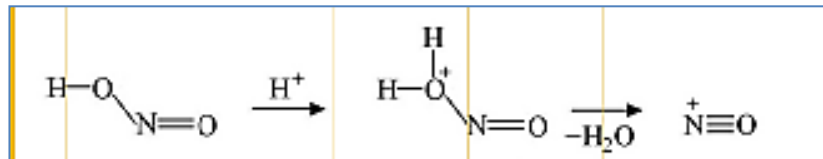
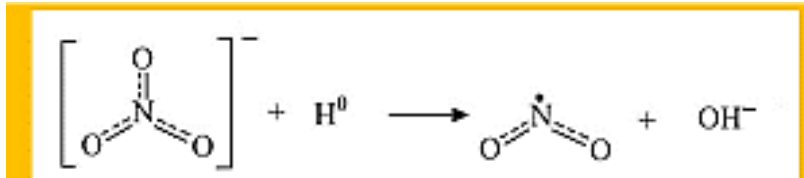
Исходный
нитрат-анион



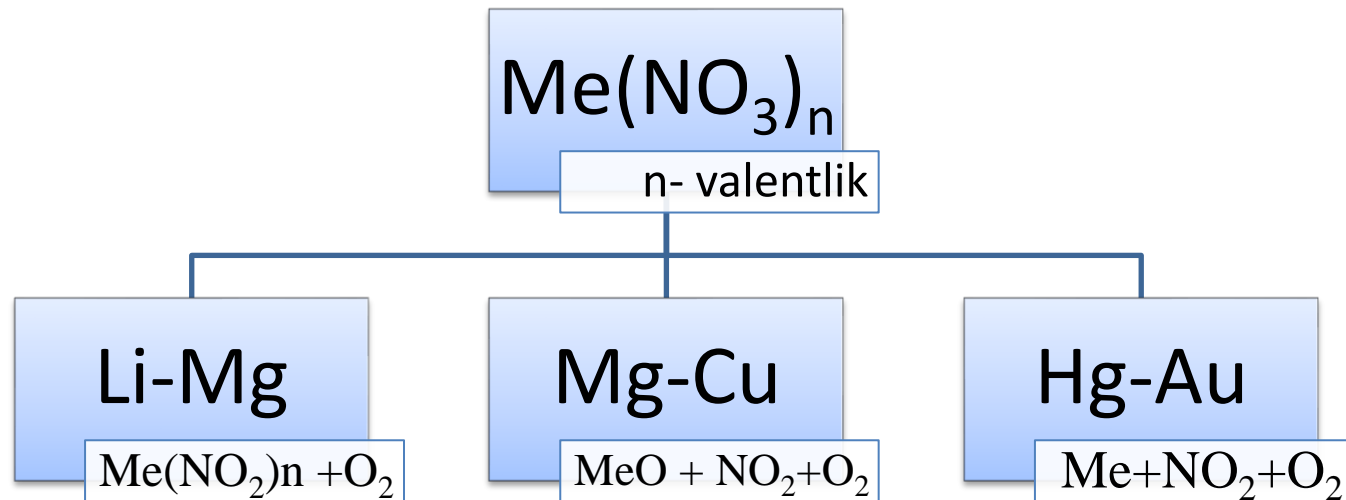
Интермедиаы



Конечные
продукты
восстановления



NITRATLARNI PARCHALANISHI



- **Misollar:** 1) $2\text{KNO}_3 = 2\text{KNO}_2 + \text{O}_2$
2) $2\text{AgNO}_3 = 2\text{Ag} + 2\text{NO}_2 + \text{O}_2$
3) $2\text{Cu(NO}_3)_2 = 2\text{CuO} + 4\text{NO}_2 + \text{O}_2$
 $4\text{LiNO}_3 \rightarrow 2\text{Li}_2\text{O} + 4\text{NO}_2 + \text{O}_2$

Nitridlar

Nitrid

```
graph TD; Nitrid --> Asosli; Nitrid --> Amfoter; Nitrid --> Kislotali;
```

Asosli



Amfoter



Kislotali



d – metallar nitridlari qattiq, qiyin suyuqlanadi.
 TiN (3220 °C), HfN (2982°C), TaN (3090°C).

Farmatsiyagi ahamiyati

- ✓ **10% ammiak eritmasi novshadil spirti deb ataladi va asab tizimini qo'zg'atuvchi vosita sifatida ishlatiladi.**
- ✓ **NH₄Cl peshob haydovchi va balg'am ko'chiruvchi vosita.**
- ✓ **Gidrazin sulfati – saratonga qarshi vosita.**
- ✓ **Qon tomirini kengaytirish : natriy nitrit, erinit, kardiket, monosan, izoket va b.**

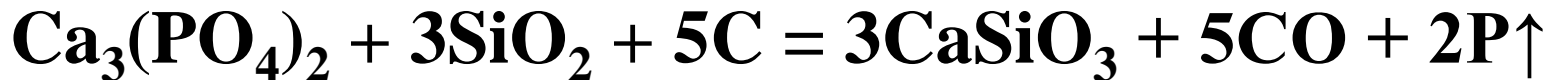
Fosfor

$3\text{Ca}_3(\text{PO}_4)_2 \cdot \text{CaF}_2$ yoki CaCl_2 ; fosforitlar $\text{Ca}_3(\text{PO}_4)_2$.

$3\text{Ca}_3(\text{PO}_4)_2 \cdot \text{CaCl}_2$ – xlor apatitlar.

$\text{Ca}_3(\text{PO}_4)_2$ – suyak tarkibida. Organizmda P - 4,0 %.

Fosfor 1669-yil gamburglik kimyogar Brand tomonidan olingan:

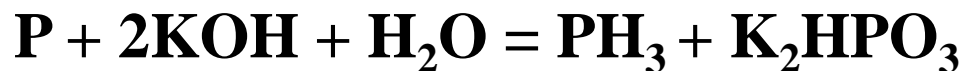
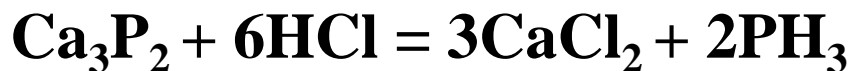


Fizik xossalari: P ning k.s. 6. 11 ta modifikatsiyasi bor. 1000°C dan yuqori haroratda P_2 . Oq fosfor 1000°C dan past haroratda P_4 barqaror tetraedrik tuzilishga ega. Oq P – amorf modda, suyuql.h. 44°C , qayn.h. 275°C . Oq fosfor zaharli (o'lim dozasi 0,1 g). Polimer modifikatsiyalari qizil va qora P. Qora P ($\rho=2,7 \text{ g/sm}^3$) garfitga o'xshash. 200°C da va 1200 atm da qizdirib olinadi. Grafitdan. $\text{P}_{\text{oq}} \rightarrow \text{P}_{\text{qora}} + 16,7 \text{ kJ/mol}$.

Oq fosforni qizdirib qizil fosfor olinadi.

Qora fosfor oq fosforni 400°C da qizdirib yuqori bosim ostida olinadi. Qora fosfor CS_2 da erimaydi. Tok o'tkazadi. Oq fosfor 50°C , qizil fosfor 250°C , qora fosfor 400°C yonuvchan moddalardir.

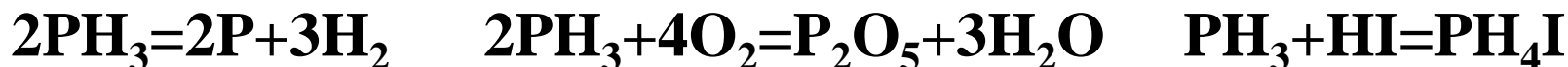
Oq fosfor



$3\text{Mg} + 2\text{P} = \text{Mg}_3\text{P}_2$; Na_3P , K_3P va Na_3P oson gidrolizlanadi.

MeP , Me_2P , Me_3P (d-elementlar). Metallga o'xshash moddalar.

PH_3 – sarimsoq hidli gaz. PH_4ClO_4 , PH_4Cl .



Saqlanganda sariq rangda P_2H_6 (qattiq) va keyin PH_3 .

Sulfidlar. Tarkibi P_xS_y ($x=3,4$ va $y=3,5,7,10$).

P_4S_3 sariq rangli. P_4S_5 , P_4S_7 , P_4S_{10} ham mavjud. PCl_3 – o'tkir hidli, rangsiz gaz. PCl_5 – qattiq modda. PF_5 va PF_3 – gazlar. PBr_3 – suyuqlik,

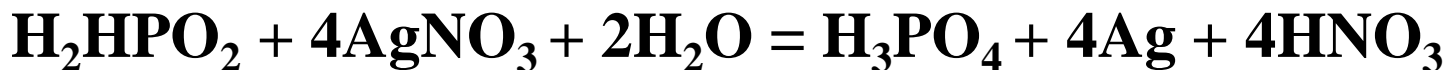
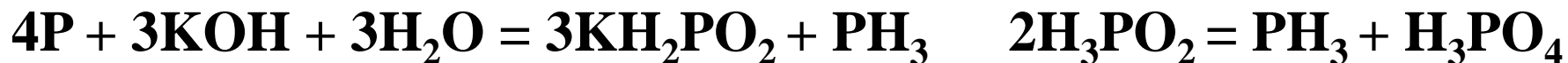
PBr_5 – sariq qattiq modda. PCl_3 va PCl_5 organik sintezda.



Fosfor birikmalari

P (I) birikmalari. H_3PO_2 rangsiz. kristall. (suyuql.h. $26,5^\circ\text{C}$), suvda eriydi. Bir asosli ($K=7,9*10^{-2}$).

Gipofosfor kislotasi tuzlari (KH_2PO_2).



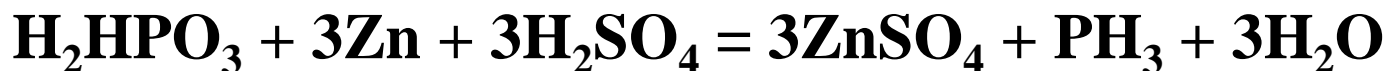
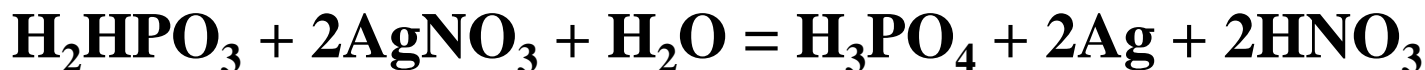
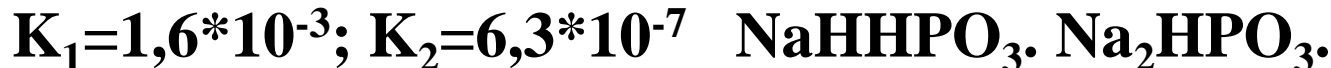
P (III) birikmalari. Fosfit anhidrid:

P_4O_6 – oq kristall modda, $23,8^\circ\text{C}$ da suyuqlanadi;

P_4O_6 – molekulyar kristall panjarali uchuvchan modda.



Fosfit kislotasi. H_3PO_3 kristall modda (suyuql.h. $73,6^\circ\text{C}$):



P (V) birikmlari.

Sovuq suv: $P_4O_{10} + 2H_2O = (HPO_3)_4$

Issiq suv: $P_4O_{10} + 4H_2O = 2H_4P_2O_7$

Qaynoq suv: $P_4O_{10} + 6H_2O = 4H_3PO_4$

$6 NaOH + P_2O_5 = 2Na_3PO_4 + 3H_2O$

$3BaO + P_2O_5 = Ba_3(PO_4)_2$

$P_4 + 5O_2 = 2P_2O_5$

$-H_2O \qquad \qquad -H_2O$

$2 H_3PO_4 \xrightarrow{-H_2O} H_4P_2O_7 \xrightarrow{-H_2O} 2 HPO_3$

$HPO_3 - Ag^+$ - bilan oq cho'kma hosil qiladi.

$(HPO_3)_x$ $x=2,3,6 \dots$ polimer. Oqsilni cho'ktiradi.

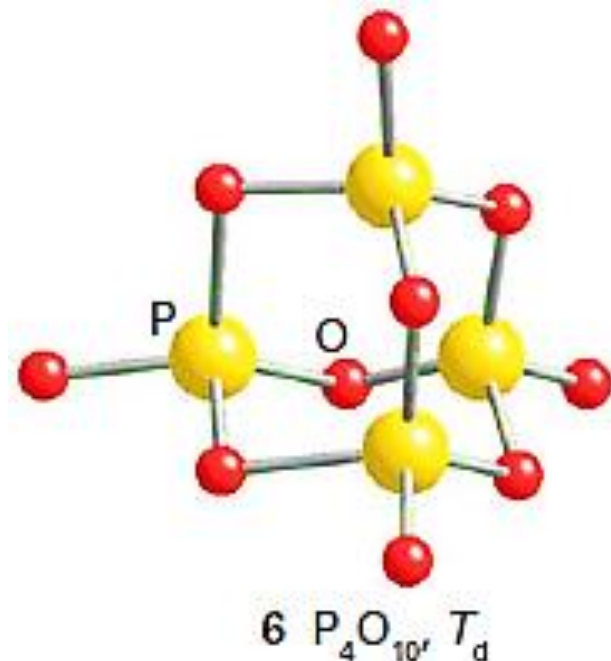
$H_4P_2O_7 - Ag^+$ - bilan oq cho'kma $Ag_4P_2O_7$ hosil qiladi.

Biroq tuxum oqi cho'kma hosil qilmaydi.

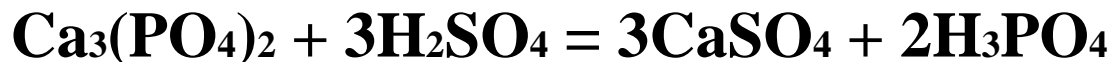
$H_3PO_4 - AgNO_3$ - bilan sariq cho'kma hosil qiladi.

O'rta kuchli elektrolit ($K_1=7,52 \cdot 10^{-3}$, $K_2=6,31 \cdot 10^{-8}$, $K_3=1,26 \cdot 10^{-12}$)

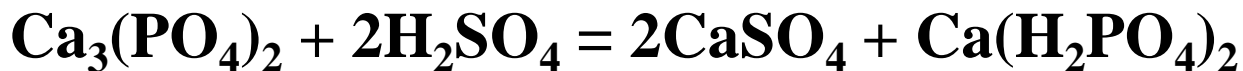
NaH_2PO_4 ; Na_2HPO_4 ; Na_3PO_4 .



P (V) birikmalari



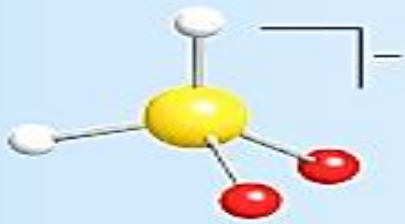
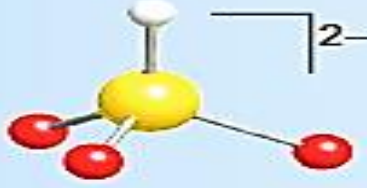
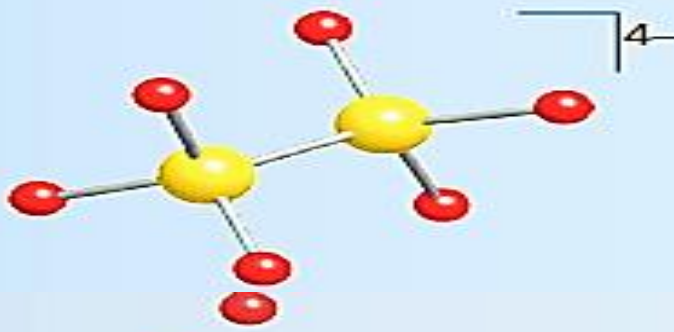
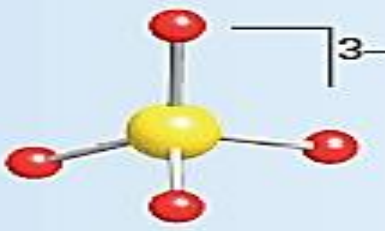
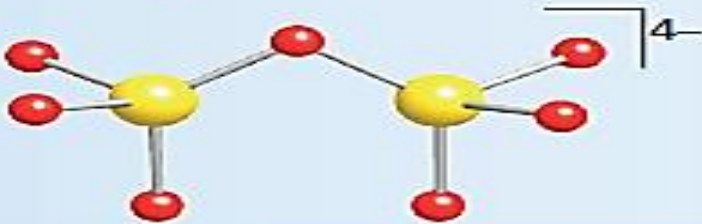
O'g'itlar ishlab chiqishda: $\text{Ca}_3(\text{PO}_4)_2$



oddiy superfosfot



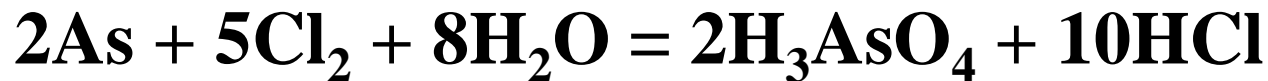
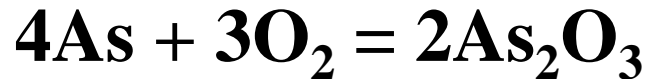
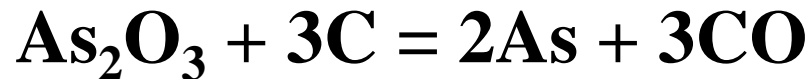
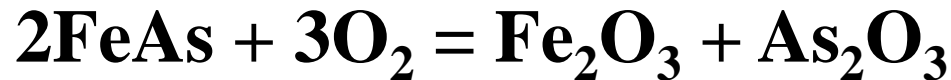
Fosfor kislotalari

+1	H_2PO_2^-	Hypophosphite (dihydrodioxophosphate)	
+3	HPO_3^{2-}	Phosphite	
+4	$\text{P}_2\text{O}_6^{4-}$	Hypophosphate	
+5	PO_4^{3-}	Phosphate	
+5	$\text{P}_2\text{O}_7^{4-}$	Diphosphate	

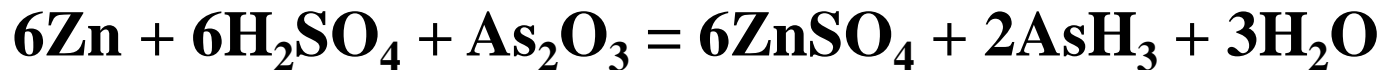
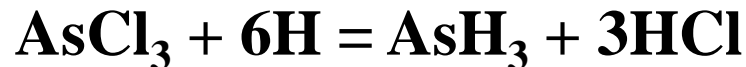
Mishyak, surma va vismut

Tabiatda: As_4S_4 – rvalger, As_2S_3 – surnigmat,
 FeAsS – mishyak kolchedani.

Olinishi: $\text{FeAsS} = \text{As} + \text{FeS}$



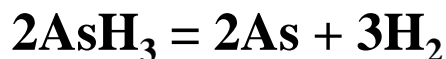
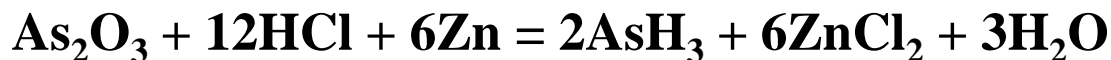
Mishyak gidridi, Arsin AsH_3 , rangsiz, zaharli gaz.



Mishyak, surma va vismut

Havoda AsH_3 10^{-6} g miqdori o'limga olib keladi.

1836-yil, Chexiyalik alkimyogar mishyakni sintez qilgan ($200-300^\circ\text{C}$) da:



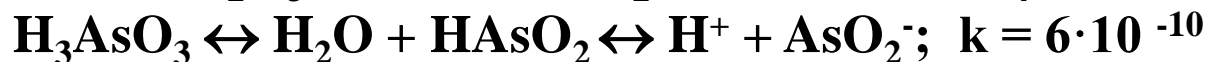
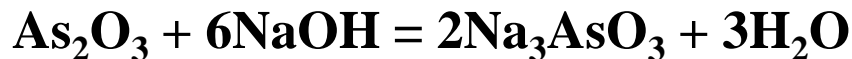
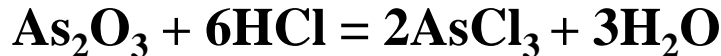
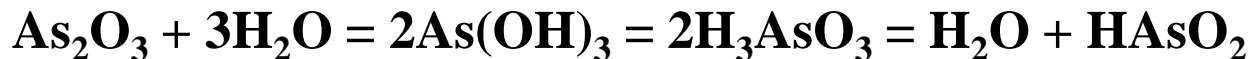
Qora qoplam

«Mishyakli qoplama» (aniqlik 10-8 g As).

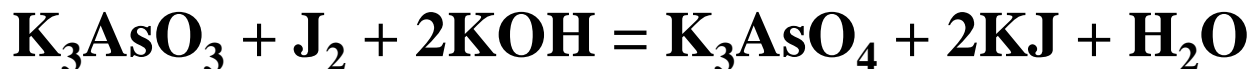
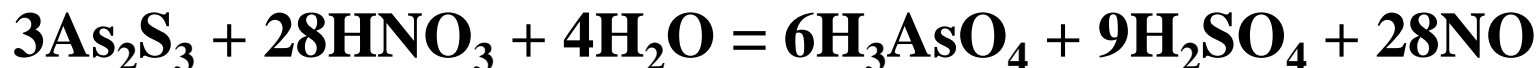
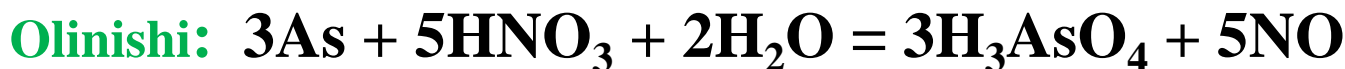
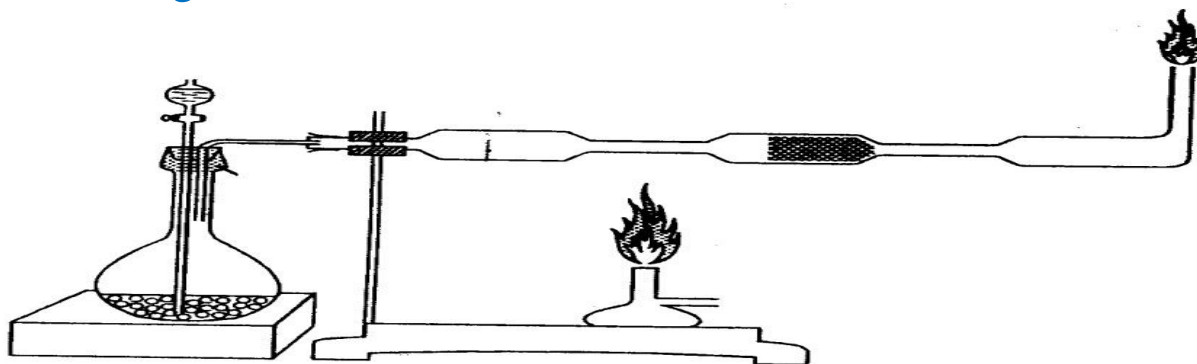


Arrenidlar (arsenidlar) Cu_3As , Ca_3As_2 .

Mishyakning kislorodli birikmalari: As_2O_3 , As_2O_5

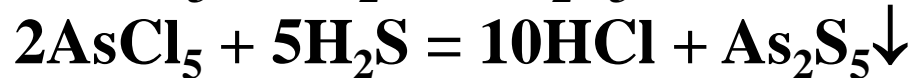
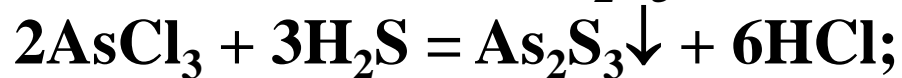
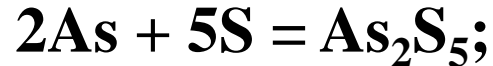


Mishyak, surma va vismut



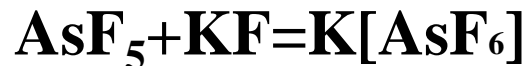
Mishyak, surma va vismut

Sulfidlar: $2\text{As} + 3\text{S} = \text{As}_2\text{S}_3$ (qora rangli);



As_2O_3 sichqonlar uchun zahar. AsF_5 gaz.

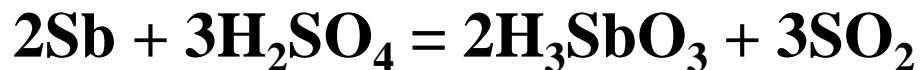
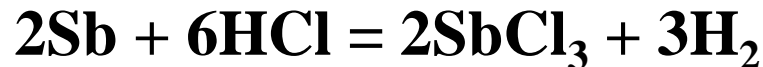
Kompleks birikma (kaliy geksaftorarsenat)



Sb. Tabiatda. Sb yaltirog'i, Sb_2S_3 – antimanit.



Sb (sariq); Sb (qora, $p=5.3$); Sb (kulrang $p=5.8$)

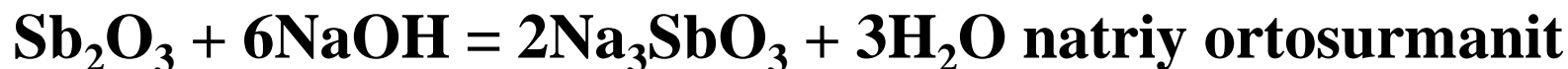
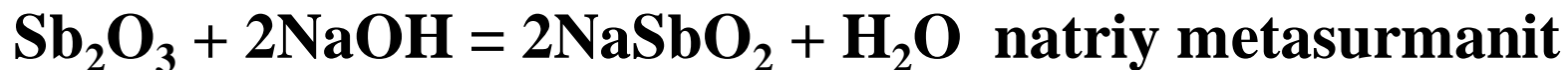
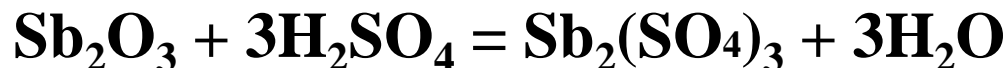
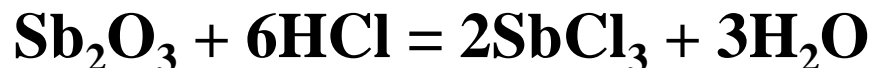


Mishyak, surma va vismut

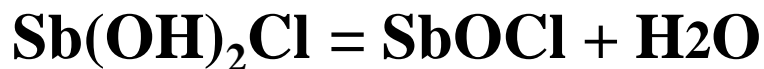
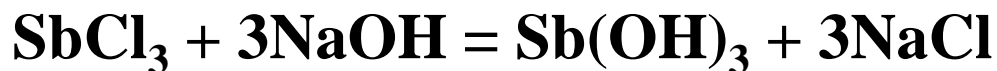
SbH₃ (stibin) – Sb gidridi zaharli gaz, H₂S hidiga o'xshash hidli.



Antimonidlar: AlSb, GeSb, ZnSb – elektronikada yarim o'tkazgich sifatida. Sb₃O₃ – amfoter modda:



Surmanit kislota, oq rangda Sb(OH)₃.



SbOCl – antimanil xlorid yoki antimon oksoxlorid.

Sb₂O₅ - sariq rangli, suvda eruvchan modda.



Mishyak, surma va vismut

HSbO_3 – m-surmanat kislota; $\text{H}_4\text{Sb}_2\text{O}_7$ – piro-surmanat kislota

H_3SbO_4 – o-surmanat kislota.

Sb_2O_5 ishqorlarda erib, kaliy geksagidroksostibatlar hosil qiladi:

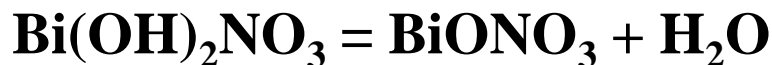
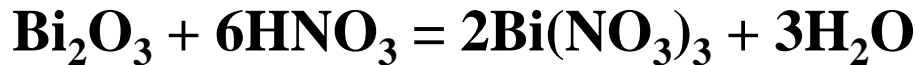
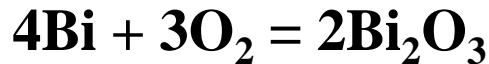


SbF_5 – suyuq modda. Oson stibatlar hosil qiladi: $\text{KF} + \text{SbF}_5 = \text{K}[\text{SbF}_6]$.

Vismut

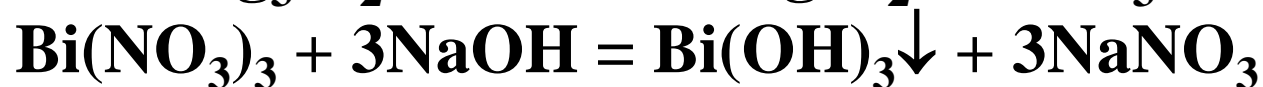
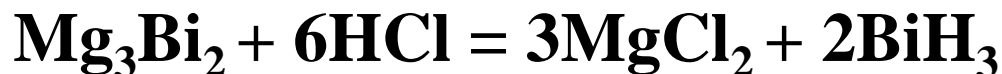
Qizil-binafsha rangli metal (suyuql.h. 271°C) .

Tabiatda: Vismut oxrasi – Bi_2O_3 . Vismut yaltirog'I – Bi_2S_3 .

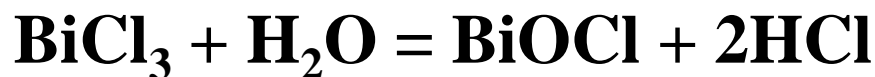


Mishyak, surma va vismut

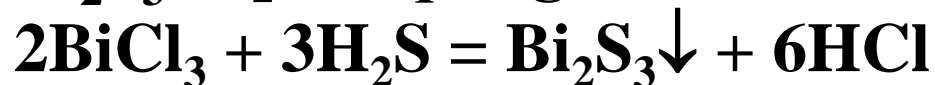
Vismutin (BiH_3) beqaror, tezda parchalanadi.



BiCl_3 – gigroskopik modda, gidrolizlanadi:

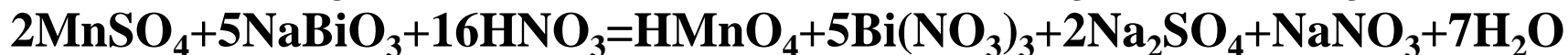


Bi_2S_3 – qora-qo'ng'ir cho'kma.



Bi_2O_5 – qizil-qora kukun. BiF_5 – qattiq modda.

HBiO_3 – vismutat kislota (NaBiO_3 va KBiO_3).



Mishyak, surma va vismut

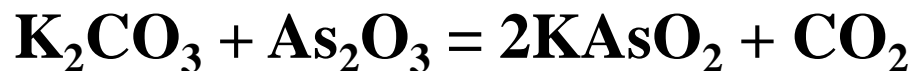
Organizmda ATF ning 0,95 % fosfor.

Suyak tarkibida (kalsiy ortofosfat), tishlarda (ftorapatit) ham fosfor mavjud.

Organizmning fosforga kunlik talabi - 1,3 g.

As organizmdagi miqdori $1 \cdot 10^{-6}$ %).

Mishyak – jigar, buyrak, taloq, o'pka, suyaklar va sochlarda keng tarqalgan. Soch va suyaklarda to'planadi. $KAsO_2$ olinadi:



$Bi(NO_3)_3$ – antiseptik, oshqozon yarasi uchun ishlatiladi. Bi tutgan organik moddalar (xreofom, dermatol va boshqalar).