O`ZBEKISTON RESPUBLIKASI

OLIY VA O`RTA MAXSUS TA'LIM VAZIRLIGI

NIZOMIY NOMIDAGI

TOSHKENT DAVLAT PEDAGOGIKA UNIVERSITETI

FIZIKA – MATEMATIKA FAKULTETI

"Himoyaga ruxsat etilsin"

Fakultet dekani p.f.d.,dotsent

_____ D.I.Yunusova

"____" __ _____ 2013 yil

5140200 – "Fizika va astronomiya" ta`limyo`nalishi
IV – kurs talabasi
ASHIRKULOV Abdunazar Abduvoyidovichning

Mass–spektrometr yordamida qattiq jism yuzasini o'rganish

mavsusidagi

B I T I R U V M A L A K A V I Y I SH I

Talaba:_____ A.A.Ashirkulov
Ilmiy rahbar : "Fizika va uni o`qitish metodikasi" kafedrasi o`qituvchisi t.f.n_____A.K.Sobirov
Taqrizchilar: "Fizika va uni o`qitish metodikasi kafederasi" dotsenti f-m.f.n._____ B.Ibragimov
O`zDJTU qoshidagi Uchtepa akademik litseyi o`qituvchisi _____ G.N.Tulebayeva

"Himoyaga tavsiya etilsin"
"Fizika va uni o`qitish metodikasi" kafederasi mudiri,p.f.n.,dotsent
_____ X.M.Maxmudova
"____" _____ 2013 yil

Toshkent – 2013 yil

MUNDARIJA:

KIRISH

Yoshlarga milliy vatanparvarlik
ruhida tarbiya berish bugungikunning
eng muhimvazifalaridan hisoblanadi.
I.A.Karimov

Mavzuning dolrzarbligi.O`zbekiston Respublikasida mustaqil xuquqiy demokratik davlat, erkin fuqorolik jamyat qurish yo`lida ulkan ishlar olib borilib, inson mohiyatining yangidan ochishga,uni o`zini anglashga imkonyatlarini ro`yobga chiqarishga va ma`naviy intelektual, aqliy–amaliy rivojlanishga ega shart–sharoyitlar yaratib berildi.

“Rivojlangan mamlakatlarning tajribasi fan uchun xech narsani olmayotgan mamlakat gullab – yashnayotganligini va bunday davlatda hamma yaxshi narsalarni odamlarning kuch – g`ayratlarni ro`yobga chiqarish uchun barcha sharoitlarni yaratish ilmiy jarayonni jadallashtirishning asosiy omilidir”.“Fan sohasidagi kadrlarni jadal ko`paytirish va yoshartirish uchun O`zbekiston intelektual imkonyatlarni keskin darajada oshirish uchun Respublika rahbaryati mablag` yaratishga, tegishli tashkiliy masalalarni xal qilishga tayyor” [1].

Ushbu fikr – mulohazalar bundan 22 yil avval Prezidentimiz I.A.Karimov tomanidan aytilganbo`lib, bugungi kunga kelib esa yuqoridagi fikr – mulohazalar qay darajada teranligini, aytilgan gaplarning amaldagi amaliy natijasini ko`rib turibmiz. Mustaqillik yillarida mamlakatimizda sog`lom va barkomol avlodni tarbiyalash, yoshlarning o`z ijodiy va intelektual salohiyatini ro`yobga chiqarish, mamlakatimiz yigit – qizlarini XXI asr talblariga to`liq javob beradigan har tomonlama yetuk shaxslar etib voyaga yetkazish uchun zarur shart – sharoyitlar va imkonyatlarni yaratish bo`yicha keng ko`lamli chora – tadbirlari amalga oshirilmoqda. Birgina ta`lim sohasini oladigan bo`lsak mamlakatimizda o`z mazmun va mohiyatiga ko`ra noyob bo`lgan “Kadrlar tayyorlash milliy dasturi” va “Ta`lim to`g`risida”gi Qonun muvaffaqiyatli amalga oshirildi. Ushbu dastur o`n ikki yillik yahlit majburiy uzluksiz ta`lim tizimiga o`tish hamda ta`lim jarayonlarining sifatini tubdan va tizimli oshirishga, kadrlarning yuksak darajadagi

umumiy va kasbiy madaniyatga ega yangi avlodni tarbiyalashga qaratilgan maxsus chora – tadbirlarni ko`rish imkonini beradi [2].

2013 yilning “Obod turmush yili” deb e`lon qilinganligi munosabati bilan mamlakatimizda xalqning turmush darajasi oshirish, farovonlik, tinchlik va totuvlikni ta`minlash vazifalarini amalga oshirishga resurslar va imkonyatlarni safarbar qilish davlat va nodavlat jamoat tashkilotlarini keng jalb etish bo`yicha aniq maqsadga yo`naltirilgan chora – tadbirlar kompleksini amalga oshirish maqsadida jismoniy va ma`naviy sog`lom, uyg`un holda kamol topib, o`sib kelayotgan yosh avlodni, professional zamonaviy darajada tayyorlash kadrlarni tarbiyalash borasida olib borilayotgan ishlarning samaradorligini har tomonlama oshirish, ta`lim saviyasini yanada takomillashtirish va sifatini yuksaltirish, ta`lim muassasalarining moddiy – texnik bazasini mustahkamlash vazifasi belgilandi [3].

Bundan ko`rinadiki,erkin demokratik fuqorolik jamyatni barpo etish, yuksak iqtisodiy taraqiyyotga erishish va aholi farovonligini ta`minlash kabi pirovard maqsadlarga ta`lim sohasini tubdan o`zgartirmasdan va zamonaviy asosda qayta qurmasdan turib erishib bo`lmaydi. Ma`naviyatni shakillantirishda be`vosita ta`sir qiladigan yana bir muhim hayotiy omil – bu ta`lim – tarbiya tizimi bilan chambarchas bog`liqdir. Ma`lumkiota – bobolarimiz qadimdan beboho boylik bo`lmish ilmuma`rifat, ta`lim va tarbiya inson kamolati va millat ravnaqining eng asosiy sharti va garovi deb bilganlar. Albatta ta`lim – tarbiya ong mahsuli, lekin ayni vaqtda ong darajasi va uning rivojini ham belgilaydigan, ya`ni xalq ma`navyatini shakllantiradigan va boyitadigan eng muhim omilidir. Binobarin ta`lim – tarbiya tizimini va shu asosda ongini o`zgartirmasdan turib ma`navyatni rivojlantirib bo`lmaydi. Buning uchun har qaysi ota – ona, ustoz va murabbiy har bir bola timsolida avvalo shaxsni ko`rishi zarur. Ana shu oddiy xaqiqatdan kelib chiqqan holda, farzandlarimizni mustaqil va keng fikrlash qobilyatiga ega bo`lgan, ongli yashaydigan komil insonlar etib voyaga yetkazish, ta`lim – tarbiya sohasining asosiy maqsadi va vazifasi bo`lishi lozim, deb qabul qilishimiz kerak.Bu esa ta`lim – tarbiyani uyg`unholda olib borishni talab etadi.

Ta`lim tarbiyadan, tarbiyani esa ta`limdan ajraqlib bo`lmaydi.Bu sharqona qarash, sharqona xayot falsafasi.Bu xaqda fikr yuritganda, men Abdulla Avloniyning“Tarbiya biz uchun yo xayot – yo mamot, yo najot – yo halokat, yo saodat – yo falokat masalasidir” deganchuqur ma`noli so`zlarni eslayman. Buyuk ma`rifatparvar, yurtparvar bobomizning bu so`zlari o`tgan asr boshida millatimiz uchun qanchalar muhim va dolzarb ahamiyat kasb etadi. Mustaqillikning dastlabki yillaridayoq butun mamlakat miqiyosida ta`lim va tarbiya, ilm – fan, kasb – xunarni o`rgatish tizimlarini tubdan isloh qilishga nihoyatda katta zaruryat sezila boshlandi.Kadrlar tayyorlashmilliy dasturini ishlab chiqish bilan bog`liq jarayon uzoq yillar moboynida bu sohada talay muommolar yig`ilib qolganini ko`rsatadi. Kadrlar tayyorlash milliy dasturini amalga oshirish jaroyonida maktab ta`limini, ayniqsaumumta`lim maktablarining moddiy – texnik bazasini mustaxkamlashga e`tiborni kuchaytirish biz uchun kun tartibdagi eng muxim va jiddiy masalaga aylanadi[4].

PrezidentimizI.A.Karimov mustaqillik yillarida amalga oshirgan o`zgarishlaribiz yoshlarga yaritib berayotgan shart – sharoyitlarni qancha gapirsak ozdir.Biz yoshlarxukumatimizning bunday e`tiboriga munosib javob berishlikni eng oily vazifamiz va burchimiz deb bilmog`imiz lozim. Shu maqsadda, yozayotgan Bitiruv Malakaviy ishimVatanimizning ilm – fan sohasidagi yutuqlariga ozgina bo`lsada o`z hissamni qo`shishga va albatta ilm – fan nuqtayi nazaridan yuqori saviyadagi ish bo`lishiga ishonaman. So`nggi so`z o`rnida shuni ayta olamanki, xukumatimiz Prezidentining biz yoshlarga bildirgan yuksak ishonchini o`z bilim salohiyatimiz orqali oqlashga, qolaversa davlatimizning buyuk kelajagi yo`lida o`zimizning munosib hissamizni qo`sha olishimizga ishonaman.

Ta`limni isloh qilish, yangi mazmundagi va zamon talabiga javob beradigan o`quv adabiyotlar, qo`llanmalarni yaratish va ilg`or pedagogik texnalogoyalarni joriy etishni taqqozo etadi. Ta`lim tizimidagi kamchiliklar, shu jumladan, fizika fanini ham o`qitish uslubiyotini xech chetlab o`tmaydi.

Bugungi kunda fizika fani bo`yicha yaratilgan o`quv dasturlari,darsliklari va qo`llanmalarining tahlili shuni ko`rsatdiki, ta`lim tizmining turli bosqichlarida

ta`lim olayotgan talabalarda Mass – spektrometr qurilmasi haqida tushunchalar yetarli darajada emasdir.

Bitiruv malakaviy ishining maqsadi: Mass – spektrometr yordamida qattiq jism elementlari tarkibini o`rganish.

**Bitiruv malakaviy ishining ob`ekti:** Qattiq jism, qattiq jism yuzasini o`rganish.Niobiy – Sirkoniy qotishmasi.

Bitiruv malakaviy ishining predmeti: Mass – spektrometrning tuzulishi, turlari va ishlash prinsipi, qattiq jism yuzasini o`rganish.

Bitiruv malakaviy ishining vazifalari:

- Mass – spektrometrning tuzilishini o`rganish.
- Mass – spektrometrlarning turlari.
- Mass – spektrometrning ishlash prinsipini o`rganish.
- Mass – spektrometr yordamida qattiq jism yuza tarkibini o’rganish.

I BOB. MASS–SPEKTROMETRTURLARI

1.1. Mass–spektrometr haqidatushuncha

Mass–spektrometrModdaning ionlashgan zarralarini massalari bo`yicha aniqlaydigan asbobdir.Ishi magnit va elektr maydonlarning bo`shliq (vakuum)dagi ionlar dastasiga ko`rsatadigan ta`siriga asoslangan bo`ladi.

Mass–spektrometrlar statistik va dinamik Mass–spektrometrlarga bo`linadi.

Statistk Mass–spektrometrning ishi o`zgarmas$\frac{m}{e}$magnit va elektr maydondagi ionlarning traektoriyasi nisbatiga bog`liq,bunda **m** – ion massasi,**e** – elektr zaryadi.

DinamikMass–spektrometrning ishi esa, asosan ionlarning manbadan kollektorgacha bo`lgan masofani o`tish vaqtiga yoki o`zgaruvchan elektr va magnit maydondagi tebranishdavriga asoslangan bo`ladi.

Qayd qilish uslubiga ko`ra Mass–spektrometr ionlar dastasini fotografik qayd qiluvchi va ion tokini elektr asboblar bilan qayd qiluvchi hillarga bo`linadi.

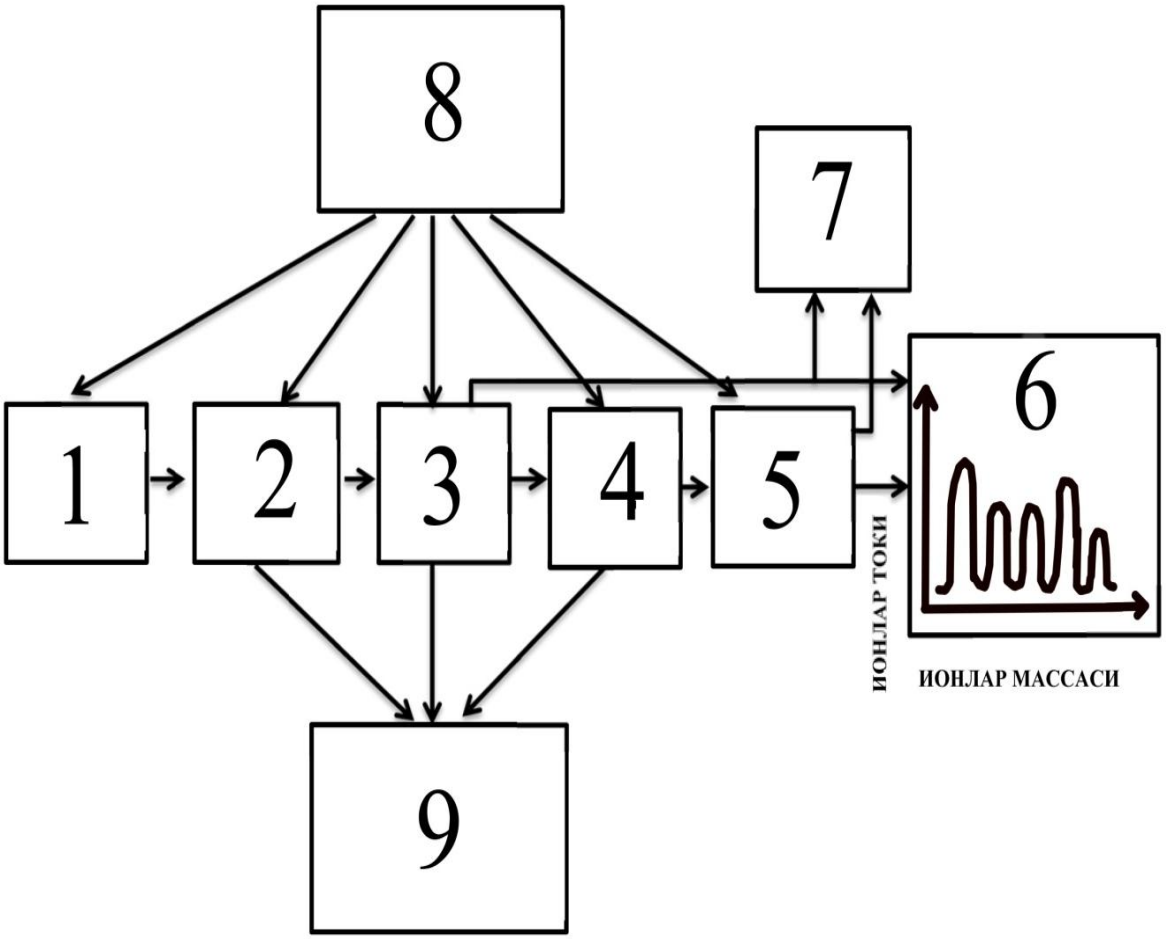
Mass–spektrometrning asosiy qismlariga:ion manbalari (tekshirilayotgan modda ionlashib,ma`lum yo`nalishda ion dastasi hosil qilinadi);

Analizator (asosan,ion manbaidan chiqayotgan ion dastasini ionlarning massasi,zaryadiga qarab bir necha ion dastasiga ajraladi);

Qabul qilish qurilmasi(bir yoki birnechamahsus elektrodlar – ion kollektordan iborat).Ion kollektorlari ion toki kuchaytirgichlari va hisoblash asboblariga ulanadi. Mass–spektrometrda,shuningdektekshirilayotgangazsimon moddani ion manbayiga o`tkazuvchi,qurulmavakuum manometrlar sistemasi, ion tutqichlar, ion manbayi va $10^{-7}$ – $10^{-5}$ mm.simob ustunibosimini vujudga keltiruvchi vakuumnasoslardan iborat bo`ladi.Mass–spektrometrning ion manbayi analizator va ion tok manbayiga ulanadi[4].

Mass–spektrometr tuzilishi.

Mass– spektrometr quyidagilardan iborat:



1–rasm

1–rasmda Mass – spektrometrning blok sxemasi ko`rsatilgan.

1 –Tekshiriluvchi jism. 6 – Qayd etuvchi qurulma
2 – Ionlar 7 – EXM
3 –Massalarga taqsimlangan ionlar 8 – Elektr manbayi
4 – 5 – Ionlar toki xaqida ma`lumot 9 – Vakuum qurulma
3 → 6 – Ionlar massasi haqida ma`lumot.

Mass–spektrometrning asosiy ko`rsatgichlari:

$\boldsymbol{D_m}$– massalar dispersiyasi, ya`ni $\boldsymbol{D_m = m\frac{\Delta x}{\Delta m}}$ $\boldsymbol{D_m}$– asosan,1 mm masofada ionlar dastasi massasining 1% o`zgarishi$\left(\frac{m}{\Delta m}\right)$ni aniqlaydi.

A–Mass–spektrometning ajrata olish kuchi. Bu kattalik massalari M_1vaM_2 deyarli teng (minimal massa farqi (ΔM) bo`lgan ionlar birdek qayd qilinmasligini bildiradi, ya`ni

$$\boldsymbol{A = \frac{M_0}{M_1 - M_2} = \frac{M_0}{\Delta M}} \quad (1)$$

(M_0– doimiy kattalik).Mass–spektrometrning sezish qobilyati,ya`ni Mass – spektrometrda qayd qilinadigan izotopning minimal miqdori ham muxim ko`rsatgich hisoblanadi.Atom yadrosi spektoskopiyasida maxsus spektrometrlar – alfa vabetta spektrometrlari mavjudir.Mass–spektrometrlar asosanfizikada, texnikada,biologiyada, tibbiyot, sanoat va boshqa sohalarda ishlatiladi [5].

Mass–spektroskopiya. Mass–spektrometriya – madda tarkibidagi atom va malekulalari spektri bo`yicha ularning massasini tekshirish usullari bilan shug`ullanadi.Atom va malekulalarni ionlashgan har bir moddada$\frac{\boldsymbol{m}}{\boldsymbol{e}}$nisbat bilan bir–biridan farq qiladi,bunday nisbat(bunda **m** – massa,**e** – ion zaryadi) Mass–spektrometrlar bilan o`lchanadi.Olingan spektiriga ko`ra,modda massasi va jism tarkibidagi boshqa moddalar miqdori topiladi. Mass–spektrometr tatbiqiy fizika,kimyo,biologiya, tibbiyot va texnikada analitik usullardan biri hisoblananib kelmoqda.Jism (yoki suyuqlik) tarkibidagi modda massasini aniqlashning har xil usulllari mavjud.

Masalan. Duplet usuli bilan dispersion chiziqlar orasidagi masofa aniqlanadi va shu masofa bo`yicha massalar farqi topiladi.Ionlar tokini o`lchash usuli bilan moddalar massasi aniqlanadi.

Gaz tarkibini aniqlash uchun ham Mass–spektrometrdan foydalaniladi.

Gazlarni to`liq bug`latish,izotopga ajratish,vakuumda uchqunlantish va ionlar bilan bombordimon qilish usullari orqali tekshiriladi.Ma`lum miqdordagi moddani

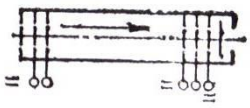
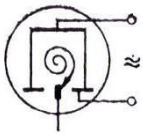
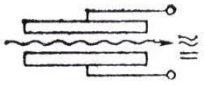
Mass–spektrometr bilan tekshirib,undagi elementlar miqdori nazorat qilinadi, aniqlanadi va izotoplar olinadi.

Kimyo sanoatida Mass–spektrometr bilan tehnalogik jarayonlar boshqariladi,atomning yuqori qatlamlari tarkibio`rganiladi,zaryadlizarralarning to`qnashishidagi jarayonlar kuzatiladi, ximyoviy reaksiyalar kinetikasi tekshiriladi. Mass–spektrometr yordamida Yer yuqori atmosferasining neytral va ion tarkibi o`lchanadi (boshqa sayyoralarning atmosferasi tarkibini ham shu usulda aniqlash mumkin).

Gazningporstiyal bosimini o`lchaydigan asboblar gazanalizator yoki Mass–spektrometrlar deyiladi.Deyarli barcha keng qo`llaniluvchi yuqori vakuumli Mass–spektrometrlarning harakat prinsiplari analiz qilinayotgan gazning ionlantirishga qaratilgan.Bu yerda hosil bo`lgan musbat ionlar har biriga xos ionmassasining uning zaryadiga nisbatan $\frac{m}{e}$ga bo`linadi, yana$\frac{m}{e}$ionlar massa soniham deyiladi.Sochilgan ionlar Mass–spektrometr kollektoriga tushadi va uning zanjirida bosimga proporsional bo’lgan to`k hosil bo`ladi. Shuning uchun Mass-spektrometrlar uchta asosiy qismdan iborat bo’ladi. Bularga ion manbai,analizator va ion qabul qilqichkiradi.

Zaryadli ionlar uchun ($e = 1$) to`plam sonlar ularning malekulyar massalari bilan(butun sonlarga) to`gri keladi va atom massasibirligi(a.m.b) C^{12} uglerodning$\frac{1}{12}$atom massasi izotopiga teng. Shuning uchun ko`pincha $\frac{m}{e} = m$ deb olinadi.

Yuqori vakuumli Mass – spektrometrli gazoanalizatorlarning asosiy tavsifi

Qurulma tipi.	Analizatornig prinsipial qurulmasi.	Ionlarnig ajralish metodi.	Ruxsat etilgn qobilyat $\frac{m}{\Delta m}$	Bosimning ish diyapozoni. Па	Analiz qilinayotgan massalarning diyapozoni	Asosi va qo`llanilishi.
Magnit razvetkali statistik Mass – spektrometr		Doimiy elektr va magnit maydonlar	30 va undan ortiq	10^{-2}-10^{9}	1 -200	Miqdoriy analiz. Mass – spektrometrli oqim qidiruvchi.
Vaqt o`tishidagi Mass – spektrometrlar (xranatron)		Uchish vaqtida tezliklar farqi xisobiga	100	10^{-2}-10^{-8}	1-600	Gaz kinetikasinig qidiruv.Kattavakuumli sistemalar
Partsial bosimning Omegatron o`lchagichi		Doimiy magnit va o`zgaruvchili elektr maydonda	40	10^{-8}-10^{-9}	1-250	Partsial bosimni o`lchash. So`rib olivchi va boshqa texnalogik qurilmalarnig vakuum sistemasi.
Kvadrupoli monopalyarniy Mass – spektrometr		O`zgaruvchili elektr maydonlarda	*M* dan katta yoki teng	10^{-2}-10^{-10}	1-300	Elektro vakuumli va boshqa vakuumli qurilmalar.

Harakat prinsipiga ko`ra barcha eng ko`p tarqalgan Mass–spektrometrlar quyidagicha taqsimlanadi.

1. Statik Mass – spektrometrlar.

Ionlarning taqsimlanishi doyimiy va sekin o`zgaruvchi magnit va elektr maydonlar statik Mass–spektrometrlaryordamida amalga oshiriladi. Bu yerda maydonlarning o`zgarish davri analizatordagi ionlar harakati vaqtidan ancha ko`pbo`ladi.

2. Vaqt o`tishdagi Mass – spektrometr (Xronotron).

IonlarningAnalizatordagi taqsimlanishi Elektr va magnit maydonidan xoli bo`lgan maydondagi fazoda uchib o`tish vaqtida sodir bo`ladi. Bu turdagi Mass – spektrometrlar Xronoronlar deb ham ataladi.

3. Radio chastotali Mass–spektrometrlar.

Radio chastotaliMass–spektrometrlardaionlar harakati, masalan tebranish chastotasiberilgan yuqori chastotali kuchlanishga mos keladi:

a) Partsial bosimnig Omegatronli o`lchagich.

b) Kvadrupol (massaning elektr filtiri) va Monopolyar Mass–spektrometrlar.

Bundan tashqari keng tarqalgan Mass–spektrometrli gazoanalizatordan tashqari,gazbosimini o`lchaydigan,temperatura ko`tarilishi bilan undan desorbsiyanlanuvchi va ya`na gaz aralashmasining faqat alohida kompanentlari uchun bosimning nazorati uchun desorbsion spektrometr ham ishlatiladi [6].

Endi qisqacha Mass–spektrometrlarning asosiy parametrlariniva tavsiflarini ko`rib chiqamiz.

Gazoanalizatorlarning asosiy parametrlariga Sezgirligi, Ajrata olish qobilyati, Tahlil qilanayotgan massalarning diapazoni kiradi.

Sezgirlik. Sezgirlik aniqlaniyotgan minimal gaz bosimining bo`lagini bildiradi.SezgirlikMass–spektrometrlarning tavsifiga bog`liq bo`lgan holda Mass–spektrometrlarning sezgirligi$\frac{1}{\text{Па}}$yoki$\frac{\text{A}}{\text{Па}}$da ifodalanishi mumkin.StatikMass –

spektrometrlarda sezgirlik ko`pincha foiz bo`laklarida ifodalanadi.Mass–spektrometrlarning sezgirligi har xil gazda turlicha bo`ladi.

Ajrata olish qobilyati. Ajrata olish qobilyati$\boldsymbol{m}$massa soniga nisbatan o`zidan kichik massasi$\Delta\boldsymbol{m}$ ga tomon o`zgaradi.Oddiy vakuum o`lchovlari uchun ajrata olish qobilyati 50 gacha olish mumkin.

Tahlil qilinayotgan massalar.

Vakuum o`lchagichlari uchun 2 dan50-100 gacha massa diapazoniyetarli.Mass–spektrometrlarning ishchi bosim diapozonlari bir hil sabablar bilan cheklangan.

Ishchi diapozoniningpastki chegarasi katta bo`lmagan gazlar spektori qiyinchilik bilan aniqlanadi.Ishchi diyapazon yuqori chegarasiionlar tokining chiziqli qonuniga asosan tekshirilayotgan bosim kompanenti tok ionlarining harakatlanishiga qarab aniqlanadi.

Massalar spektri:

2–rasmda Mass–spektrometrlarning spektrogrammasi chizilgan,undan gazoanalizatorning chiqish signalining $\mathbf{I}_{\Pi}$ayrim gazlarningmassalar soniga$\frac{\boldsymbol{m}}{\boldsymbol{e}}$bog`liqligi ko`rsatilgan.Mass–spektrogrammasi uzluksiz signallar asta sekin o`sishi asosida tuzilgan.

2–rasmda Ko`rsatilganidek, ionli to`klarning amplituda cho`qqisi,portsial bosimning alohida kompanentlariga, ionlashuvchi elektron toki va gazoanalizatorlarning mos kompanentlariga sezgirligiga proporsionaldir:

$$\boldsymbol{I_U = S_M A_G I_E P}(2)$$

Bu yerda$\boldsymbol{I_U}$ **–** Cho`qqi ampilitudasi, $\boldsymbol{S_M}$ – Azot bo`icha sezgirligi, $\boldsymbol{A_G}$– Nisbiy sezgirlik, $\boldsymbol{I_E}$–Ionlashuvchi elektron toki, $\boldsymbol{P}$ – Portsial bosimi.

OmegatronMass–spektrometrlarda umumiy sonlarda aniqlovchi ionlarcho`qqisi tok foni darajasidan ajralib turadi.Analizator kamerasida ionlarning sochilishi,yetarlibo`lmagan fokuslangan elektron vaion dastasi**,** manbayining bir xil bo`masligi va kuchayishi, Mass–spektrometrik gazoanalizatorlarning har xil

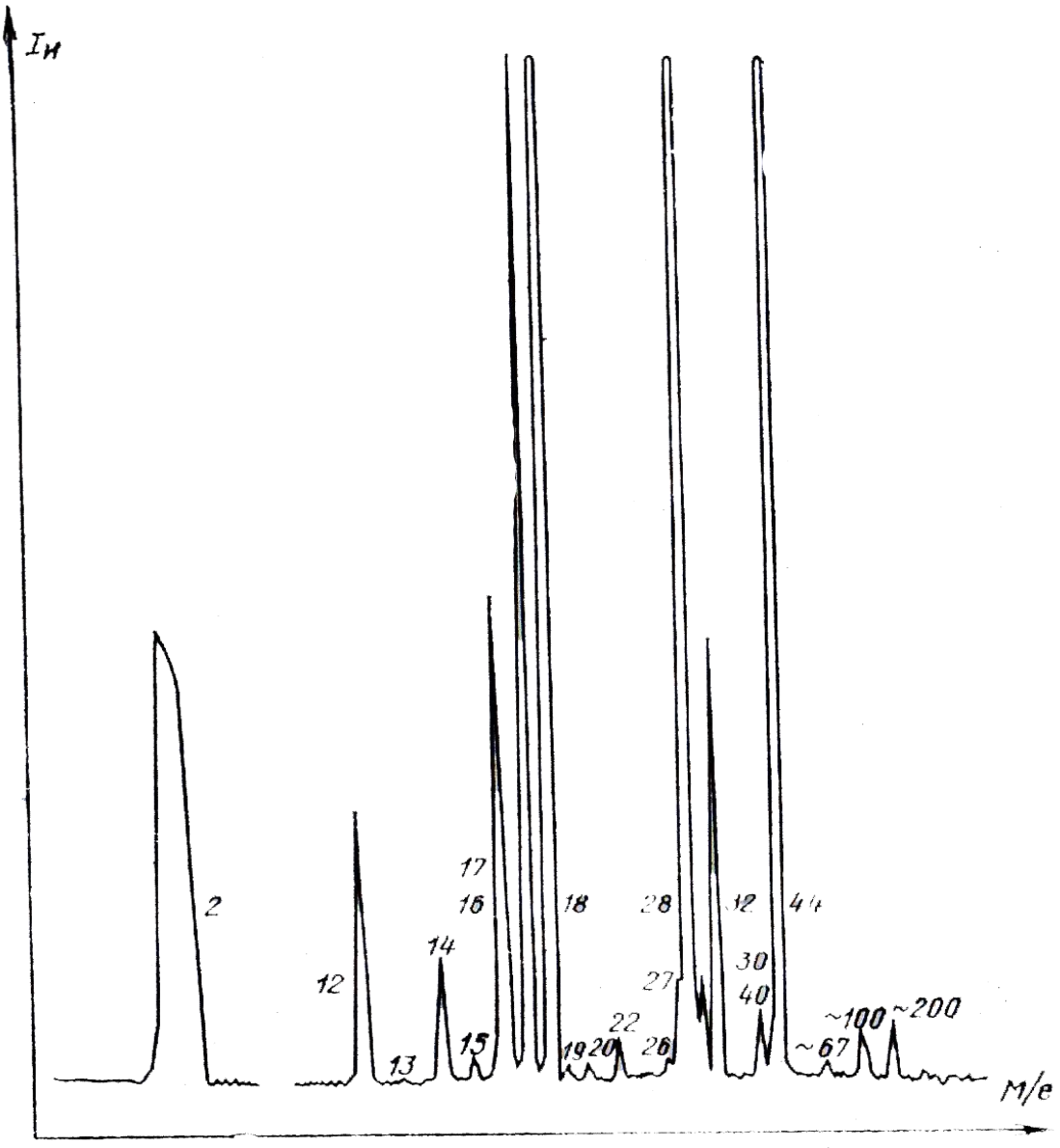
gazlarda nisbiy sezgirligi, gaz ionlashuvi ehtimolligiga to`g`ri proparsional va bir biriga o`xshash bo`ladi [15].

Gazoanalizatorlarga ta`sir etuvchi spektrometrlarni ko`rib chiqaylik.

Elektron nur va murakkab gaz malekulalarining ancha oson tuzuvchilari dissosilsilsini ishlab chiqadi.

Masalan CO_2 spektrida CO_2+,CO+,C+, O+,O_2+ cho`qqilarini kuzatiladi. Massa soni cho`qqisi turli jismlarga tegishli bo`lishi mumkin.

2–



rasm

Masalan:16 massa soni Metan CH_4+ ga tegishli bo`lganidek,u Kislorod atomi uchun ham O+, 28 massa soniga ega–Azot $N_2$ va CO+ Uglerod oksidlariga to`g`ri keladi.Ularni qo`shimcha kompanentlar birligi bilan aniqlasa bo`ladi.

Organik birikmalar ko`plab cho`qqilarni hosil qiladi.Murakkab organik aralashmadan so`ng yaxshi tozalanmasa, u etil spirti va dietil efiri 31 massa soni atrofida, asetonda esa 43 massa soni cho`qqini ko`rsatadi.

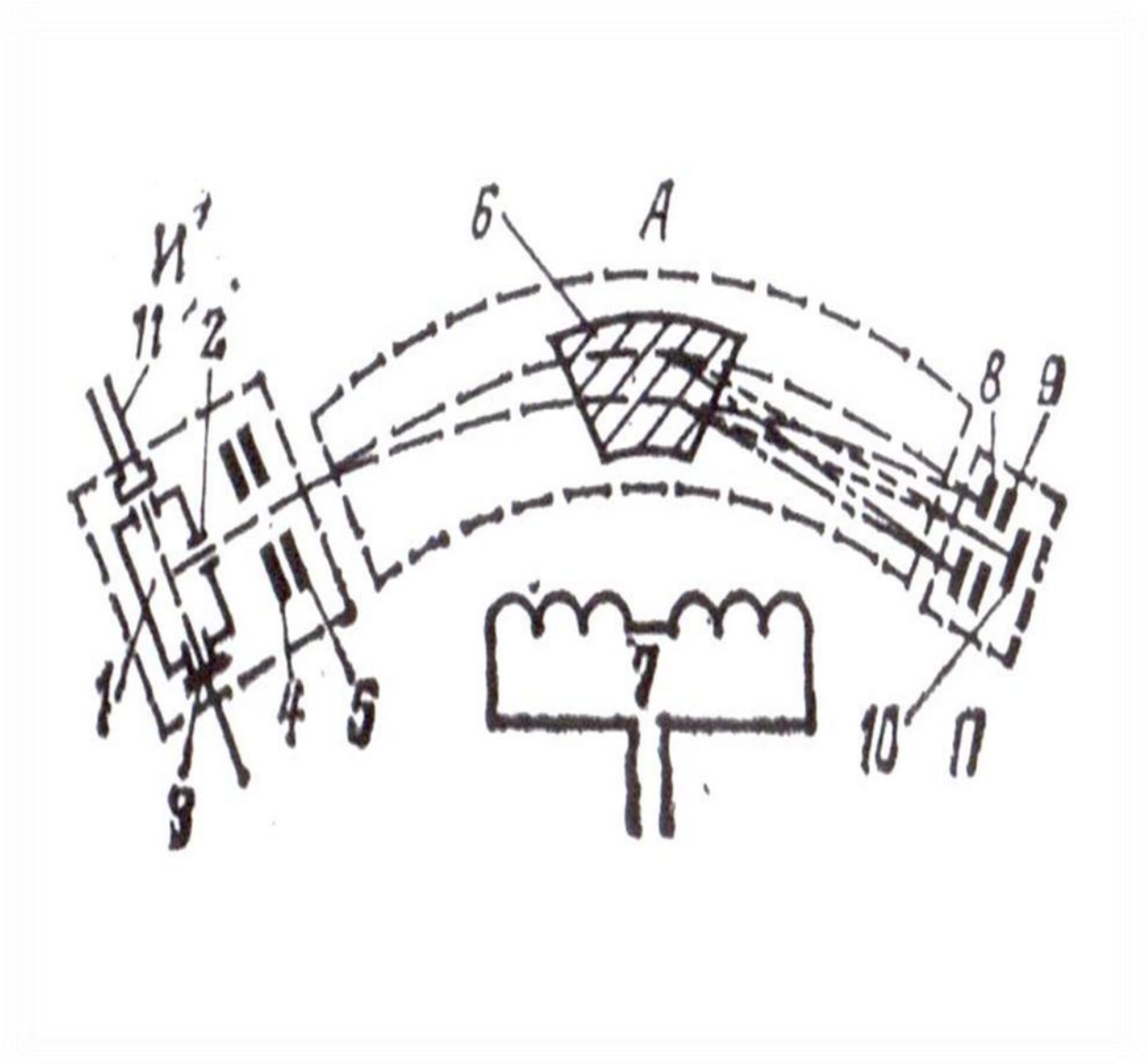
Yuqori vakuumli geometrik gaz qoldiqlari spektrda kislorod bo`lishi mumkin emas. Kislarod qurulmada qolib ketgan Uglerod cho`kindilariga nisbatan ustunlik qiladi.CO (massa soni 28)va CO_2 (massa soni 44). Havo (massa soni 32) va Argon (massa soni 40) cho`qqilarining o`sishiga olib keladi.

Gazoanalizatorni ishlatish rejimiga o`rnatgandan so`ng uni sozlash kerak. Shu bilan birga Mass–spektrometr (xranatron) berilgan gazning ishchi parametrlarini belgilash lozim:

Masalan Omegatron chostotasini olsak bo`ladi.Shunga qo`shimcha ion cho`qqilarini ham belgilasak bo`ladi.Qizdirilgan suv bug`larining (massa sonlari 18 va 17),Vodorodning (massa soni 2 ), Simobniki (massa soni 200) ga teng bo`ladi [7].

1.2. Ionning magnit maydonda bo`linishini o`rganuvchi statik Mass–spektrometr

Mass – spektrometrlarningionli magnitparchalaydigan turi kengtarqalganbo`lib ularga gaz,bug`, suyuqliklarni aniqlash, tahlil qilish uchun mo`ljallangan statsionar qurulmalar kiradi.



3–rasm

3 –rasmdaStatik Mass – spektrometrlar va ionning magnit maydonida parchalanish sxemasitasvirlangan.

И –Ion manbayi, A–Analizator,П –Ion qabul qilgich.

1. Ionizator qutisi.
2. Chiqish tirqishi
3. Elektron kollektor.
4. Plastinalar.
5. Plastinalar.
6. Magnit.
7. Magnit g`altagi.
8. Kirish tirqishi.
9. Supressor to`r.
10. Kollektor.
11. Katod.

MX seriadagi statistik Mass – spektrometrlar kimyoviy analizlar uchun mo`ljallangan bo`ladi, MI seriadagiMass – spektrometrlar – izatoplarni aniqlash uchun mo`ljallangan bo`ladi, MB serialiMass – spektrometrlar–yuqori ajrata olish qobilyati bilan boshqa Mass – spektrometrlardan farq qiladi.

3–rasmdaKomeraning statik Mass–spektrometri va ionning magnit maydonda parchalanishi pirinsipial sxemasi ko`rsatilgan.

Hamma ionlar bir xil energiya U_{usk} ga ega,lekin har–hil tezlikka U_u o`zlarining massasi$m$ va zaryadi $e$ ga ega bo`ladi.

$$\mathbf{U_u} = \frac{\overline{\mathbf{2U_{usk}}}}{\frac{\mathbf{m}}{\mathbf{e}}} \qquad (3)$$

Magnit harakati sohasiga tushgach, zarralarning harakatiga yo`nalishiga perpendikulyar bo`lgan maydonda ionlar Lorens kuchi ta`sirida o`z harakat yo`nalishini o`zgartiradi va B induksiyali bir toyifali magnit maydonda harakatlanuvchi ionlarning radiusi – traektoriyasi proportsonal bo`ladi.

$$\boldsymbol{r} = \frac{\boldsymbol{m}}{\boldsymbol{e}} \cdot \frac{\boldsymbol{U_u}}{\boldsymbol{B}} (4)$$

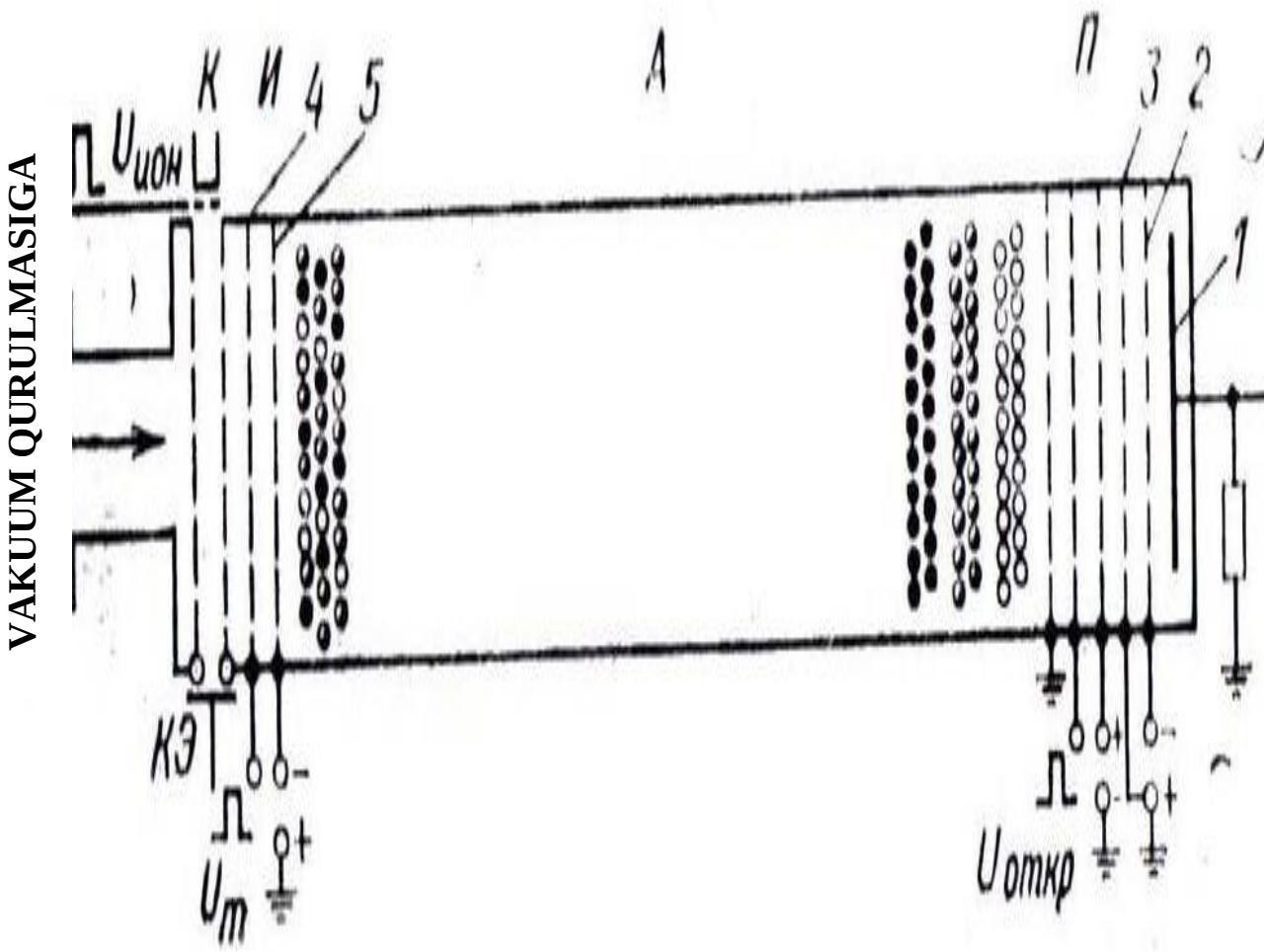
Yoki

$$\boldsymbol{r} = \frac{\mathbf{1}}{\boldsymbol{B}} \cdot \frac{\overline{\boldsymbol{2mU_{usk}}}}{\boldsymbol{e}} \qquad (5)$$

Tezlanuvchi kuchlanishyoki magnit maydonning induksiyasi *B* ni o`zgartirgan holda turli massali ion qabul qilgichning kirish tirqishiga ketma – ket yo`naltirish mumkindir [8].

1.3. Vaqt o`tishidagiMass–spektrometr

Vaqt o`tishidagi Mass–spektometrlarning ishi fazodagi elektr va magnit maydoni bo`lmagan joylarda ionlarning uchish vaqti bo`yicha ajrashiga asoslangan bo`ladi.Vaqt o`tishidagiMass–spektometrlarni impulsli spektrometr yoki xranatron deb ham atasa bo`ladi.



4 –rasm

4 –rasmdaVaqt o`tishidagiMass–spektometr komerasi.

⊖ – (M_1)ion massasi.I – Ionlar manbayi.

⊙ – (M_2) ion massasi. P – ion qabul qilgich. K – Katod.

⊛ – (M_3)ion massasi. A – analizator.

KE – elektronlar kollektori.U_m – kuchlanish.

U_{mtkr}– ochiluvchi kuchlanish.

1 – ion kolektori, 2 – antidinatron to`r, 3 – supressor to`r, 4 – tortish to`r,
5 – tezlatgich to`r.

4–rasmda Qurulmaning komera – tezlatuvchi prinsipial tuzilishi ko`rsatgan:

И – Ion manbayi M – analizatorga dreyf fazosini hosil qiladi.A – ion to`plami.Ion impulsini yuborish ionlar to`plamini 10^{-7} – 10^{-8}sekund davomida elektron oqimi impulsning ionlanishini qabul qilganidek,o`sha vaqt davomida doimiy elektron oqimi $\mathbf{U_m}$kuchlanishning itaruvchi elektrod yoki impulsning tortishuvchi diafragrammasini (4) uzatish orqali hamdeb olsa bo`ladi. (5) To`rga uzatiladigan $\mathbf{U_{usk}}$tezlatuvchi kuchlanishdan o`tib,ionlar inertsiya bo`yicha analizatorga *l*ion kollektori (1) tamon harakatlanadi.Ionlarning biridan И dan P ionlarni qabul qilgichgacha bo`lgan A dreyf fazosidagi*l* uzunligi quyidagi tenglama asosida aniqlanadi.

$$t = l \cdot \sqrt{\frac{m}{e}\frac{1}{2U_{usk}}} \qquad (6)$$

Analizatorda manbadan kollektorgacha harakat o`lchovi bo`yicha ionlar o`z massalar soniga raqamiga qarab bo`linadi.Birinchi bo`lib kollektorga yengil gazlar yetadi,undan keyin ketma – ket og`irroq gazlarning ionlariyetib keladi. Kollektorga (1) tushgach, ionlar guruhi o`z tok zanjiriga ionlar soniga ya`niy porsial bosimga proportsional bo`lgan tok xosil qiladi.Kuchaytirgich signal tekshiruv chastotasi ionlanivchi impulslarning takrorlanish chastotasi bilan sinxron bo`lgan osillografga tushadi.

Ion qabul qilgichga kollektordan oldin eng yaqin bo`lgan ta`sir sistemasi va antidinatronli to`r yaqinroq o`rnatiladi.(2 – To`r)

Qolgan to’rlar zarur bo`lganda ionlarni tanlab va faqat ma’lum massalar soni ionlarni kollektorga o`tkazish bilan shug`ullanadi.Bu vaqt davomida ionlanuvchi impulsning fazalanishi, ochiluvchi va yopiluvchi impulslarning to`rga uzatilishida amalga oshadi [9].

3 – Supressor to`ri enrgiyasi guruhidagi ion energiyasidan kichik bo`lgan sochilgan ionlarni kollektorga o`tkazmaydi.

Qurulmaning ajrata olish qobilyati

$$\frac{M}{\Delta M} = \frac{t}{2\Delta t} \quad (7)$$

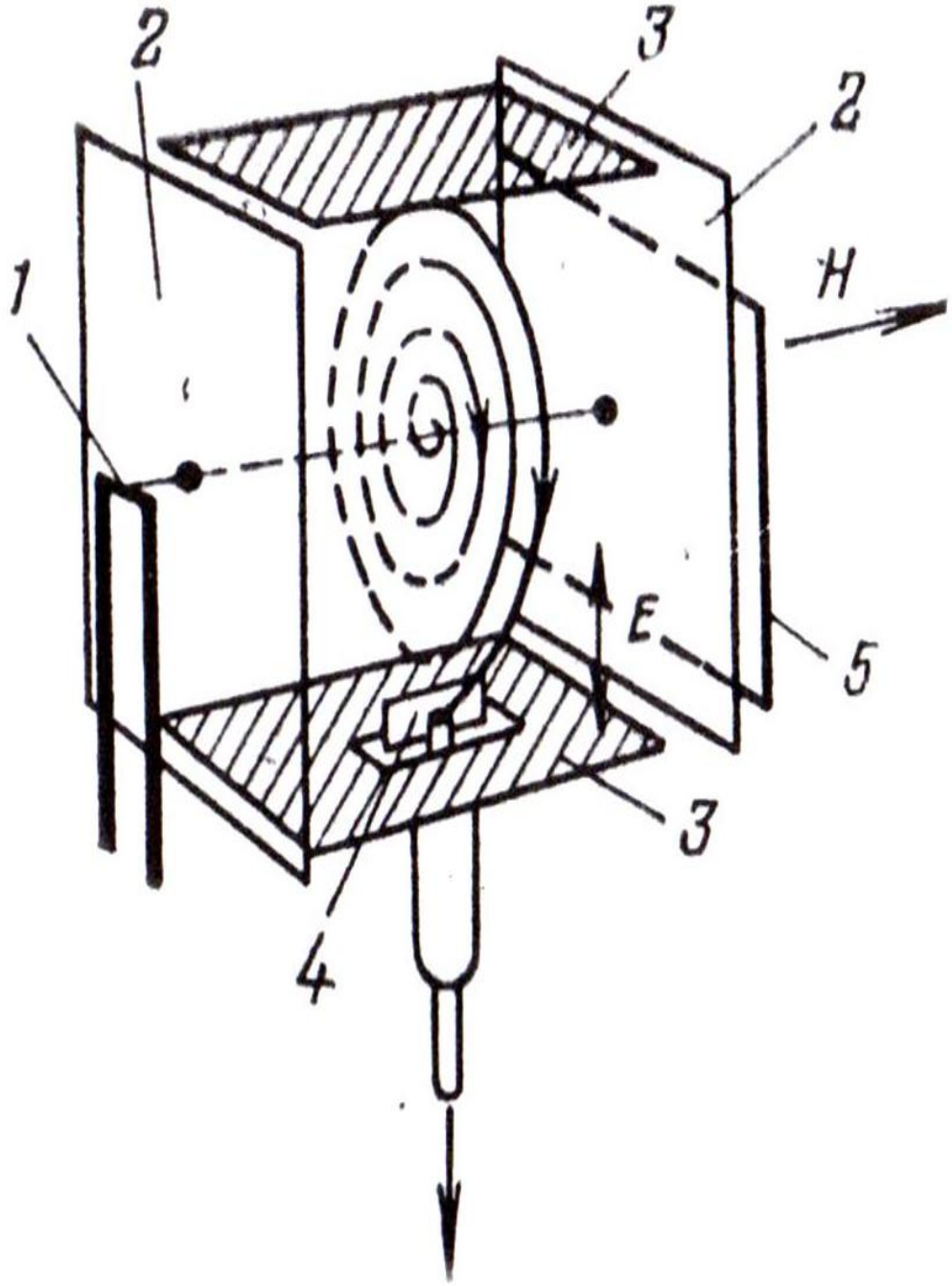
Bu yerda Δt – ionlarning qabullagichga o`tgan vaqti.Bu vaqt ionlarning kollektordagi ion guruhlarning qalinligiga to`g`ri proparsional.

Vaqt o`tishidagi Mass – spektrometrlarda ajrata olish qobilyatini 100 gacha alohida qurulmalarda esa 200 gacha yetkazish mumkin.Elektron ko`paytgichning ion tokida impulsning kuchayishida ishlatilishi bosimni 10^{-7} Pa gacha o`lchashni ta`minlaydi.Vaqt o`tishidagi Mass – spektrometrlarning yuqori vakuum sistemalarida sezgirligi gaz tarkiblarini aniqlashda kang qo`llanilmoqda. Bu qurulmaning o`ziga hos xususyati unda magnit maydonning yo`qligidir [14].

1.4. Portsial bosimli Omegatron o`lchagich

Portsial bosimning omegatron o`lchagichi yoki Omegatron eng keng tarqalgan gazoanalizatorlarning biri bo`lib hisoblanadi.

5 – rasm



5 – rasmda Portsial bosimli Omegatron o`lchagich tasvirlangan.

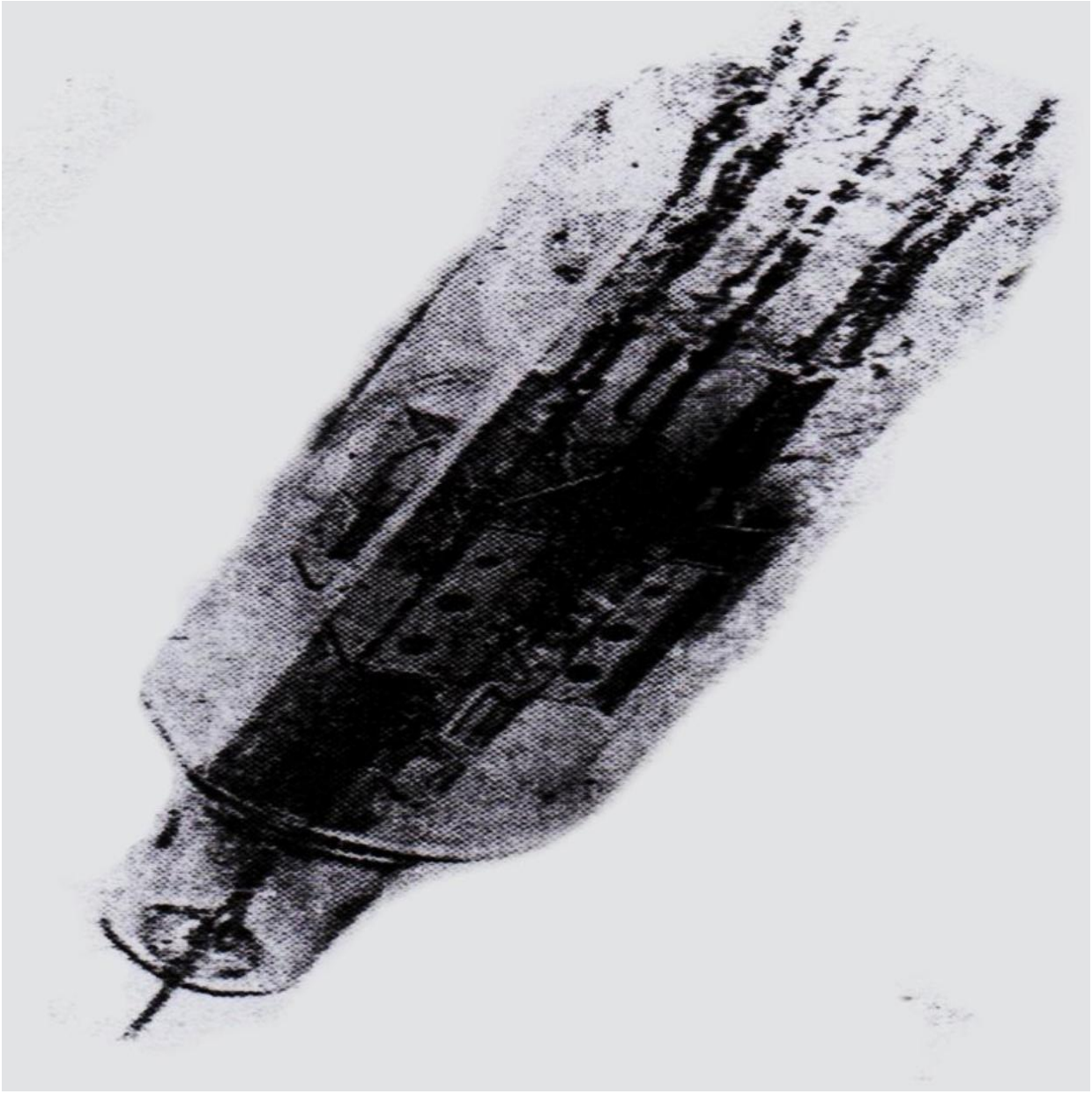
Omegatron (1) termakatoddan, ikki to`siqli plastinalar, (2) yuqori chastotaliplastinalar, (3) ionlar kollektori (4) elektronlar kollektori (5).

Katoddan chiqayotgan elektronlar (2) plastinadagi ingichka tirqishdan o`tib, musbat zaryadlangar (5) elektron kollektoriga tushadi.Ionizatsiya natijasida hosil bo`lgan turli massa sonli musbat ionlar bir vaqtdagi o`zoro perpendikulyar maydonlar ta'siri – plastinkalar orasiga qo'yilgan yuqori chastotali elektr maydon kuchlanganligi va tashqi magnitdagi *B* doimiy magnit maydoni induksiyasi qo`yilgan.Yuqori chastotali maydon ionlarni plastinkalar orasidagi tebranma harakat qilishiga majburlaydi. Ionlarnig aylanish chastotasi

$$\boldsymbol{\omega} = \frac{\boldsymbol{B}}{\frac{\boldsymbol{m}}{\boldsymbol{e}}}$$(8)ga teng.

$\frac{m}{e}$ionlarning belgilangan massa soni yuqori chastotali maydonning fazoda almashinishi,ikki maydonning bir vaqtdagi *f*va *B* orasidagi munosabat tuzilishi mumkin, ya`ni ionlarning hususiy chastotada va elektron maydonda aylaninshi orasida rezonans shartining amalga oshishidir [10].

Ayrim ionlar bo`laklarining aylanish hususiy chastotasi(3) yuqori chastotali plastinalar elektr maydonning chastotalari bilan mos keladi va yuqori chastotali maydonda aylanganda qo'shimcha energiya oladi va bularning hisobiga ular harakati traektoriyasining radius ortadi. Natijada ionlar spiral bo`ylab aylanadi.



6 – rasm

6 – rasmda Shishali Omegatron .

Bu harakat, ionlar (4) – ko’ndalang joylashgan ionlar kollektori plastinalariga tushguncha davom etadi. Yuqori chastotali kuchlanish chastotasini o`zgartirib turib, gaz qorishmasining partsial tarkibi haqida ma`lumot olinadi.Tahlil qilinayotgan$\frac{m}{e}$gazning ajrata olish qobilyati va massalar soni orasidagi bog`liqlik mavjud.

$$\frac{M}{\Delta M} = \frac{1}{M \cdot \frac{m'}{c}} \cdot \frac{rB^2}{2E} \qquad (9)$$

Yoki $\frac{M^2}{\Delta M} = const$ (10)

Bu erda ***r***–qurulma o`qidan (elektron nur) ionlar kollektorigacha bo`lgan masofa.

m' -Vodorod atomi massasi;

E – Yuqori chastotali elektr maydonning kuchlanishligi.

Demak $\frac{m}{e}$ning massalar soni qancha kichik bo`lsa, Omegatronning ajrata olish qobilyati shunchalik oshadi va aksincha ajrata olish qobilyati shunchalik kamayadi.

Masalan. Omegatronning ajrata olish qobilyatitopilsin deylik. Massalar soni (CO_2) 44 ga teng. M=20 va qurulmaning ajrata olish qobilyati 20 bo`lsa, Omegatronning ajrata olish qobilyati nimaga teng bo`ladi.

(8) va (9) tenglamalar asosida topilsin

$$\frac{M}{\Delta M} \cdot M = 20^2 = const \qquad \Delta M = \frac{44}{20^2} \approx 4{,}8 \qquad (11)$$

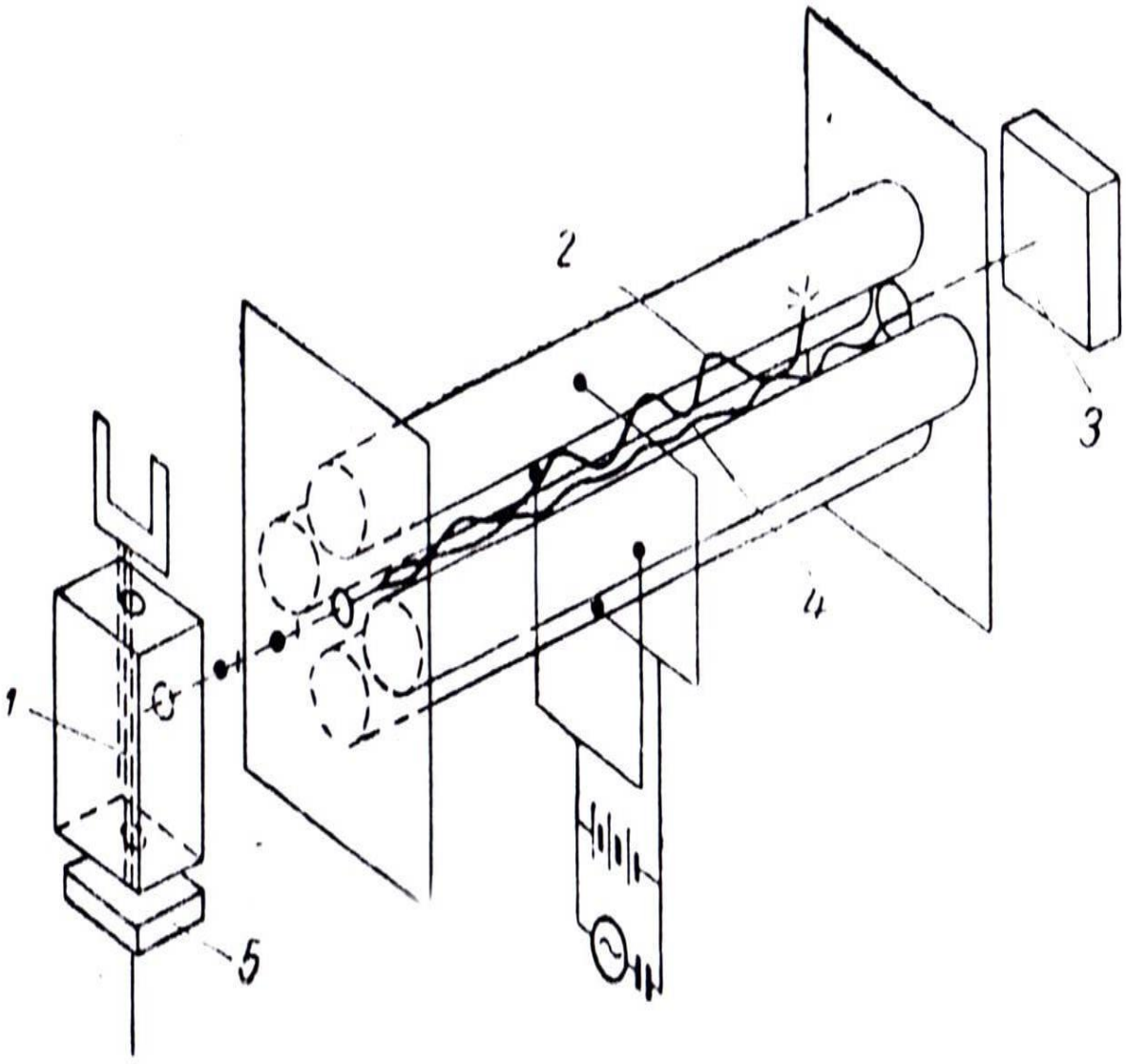
deb yozishimiz mumkin.

Massa soni 40 ga teng bo`lgan Argon,Karbanat angidirid gazi mavjud bo`lsa (M=44) qiyinchilik bilan aniqlanadi. Omegatrondagi ionizatsiya kamerasi ionlar analizatori bo`lib hisoblanadi va bu ionlarni keng qo`llashimizda imkoniyat yaratadi va Omegatronning sezgirligi yuqori bo`ladi.Qurulmaning yuqori vakuumda ishlatish uchun elektrodlarning ustki qavatini nihoyatda toza tutish talab etiladi. Agar bunga amal qilinmasa, qurulmaning ishchi harakteristikasida chetlashish kiritiladi. Shuning uchun Omegatronni issiq distirlangan qaynoq suvga va etil spirtiga yuvish lozim [11].

1.5. Kvadrupol va Monopalyar Mass–spektrometrlar

a) Kvadrupol Mass–spektrometr

Bu yuqorida qayd etilgan qurulmalarga qaraganda yuqori vakuumli sistemalardagi gazlar tarkibini aniqlashda qator avzalliklarga ega bo`lib,hozirda uni qo`llash keng tarqalgan. Qurulma portsial gaz tarkibi ***10***$^{-}$Pabosimgacha analiz qilish imkoniyatiga ega. Ajrata olish qobilyati (100 gacha va undan ortiq.)



7 –rasm

7–rasmda Kvadrupol Mass – spektrometrning sxemasi.

1 – Ionlashtiruvchi elektron dastasi ;

2 – Qozg`atuvchi ion; (Tebranuvchi ion)

3 – Ionlar kollektori;

4 – Qo`zg`almas ion; (Tebranmas ion)

5 –Elektronlar kollektori;

7–rasmda Kvadrupol Mass–spektrometrning partsial sxemasi keltirilgan. Tekshirilayotgan gaz ionlar manbayida avval ionlashadi va ionlar dastasito`plami ko`rinishida itarilib,analizator diafragmasi orqali chiqadi. Filtrlangan ma`lum massali ionlar analizator zanjirida (3), bosimga praportsional tok hosil qiladi.

Zaryadlangan zarraqurulma (*r*) o`qi bo`ylab harakatlana boshlaydi. Bu yerda harakatlanish ampilitudasi sterjenlardagi kuchlanishga va ionlarning massa soniga bog`liq. Filtrdagi kuchlanishni ko`paytirishi oqibatida undan faqat ma`lum massali ionlarning bir turi o`tishiga erishsak bo`ladi.

$$\frac{U_{=}}{U_{\sim}} = \leq 0{,}167 \qquad (12)$$

Filtrdan chiqqan *M*ionlarning massa sonini quyidagicha aniqlanadi.

$$M = \frac{U_{\sim}}{\omega^2 r_0^2} const \qquad (13)$$

Bu yerda (r_0)giperbola cho`qqisidanzo`qi gacha bo`lgan masofa. Qabul qilgich otriga ya`na bir elektron ko`paytirgich o`rnatilishi qurulmaning sezgirligini yanada oshiradi.

b) Monopalyar Mass–spektrometr

Monopalyar Mass–spektrometr Kvadrupol Mass – spektrometrning to`rtdan bir qismini tashkil etadi.(7–rasm)

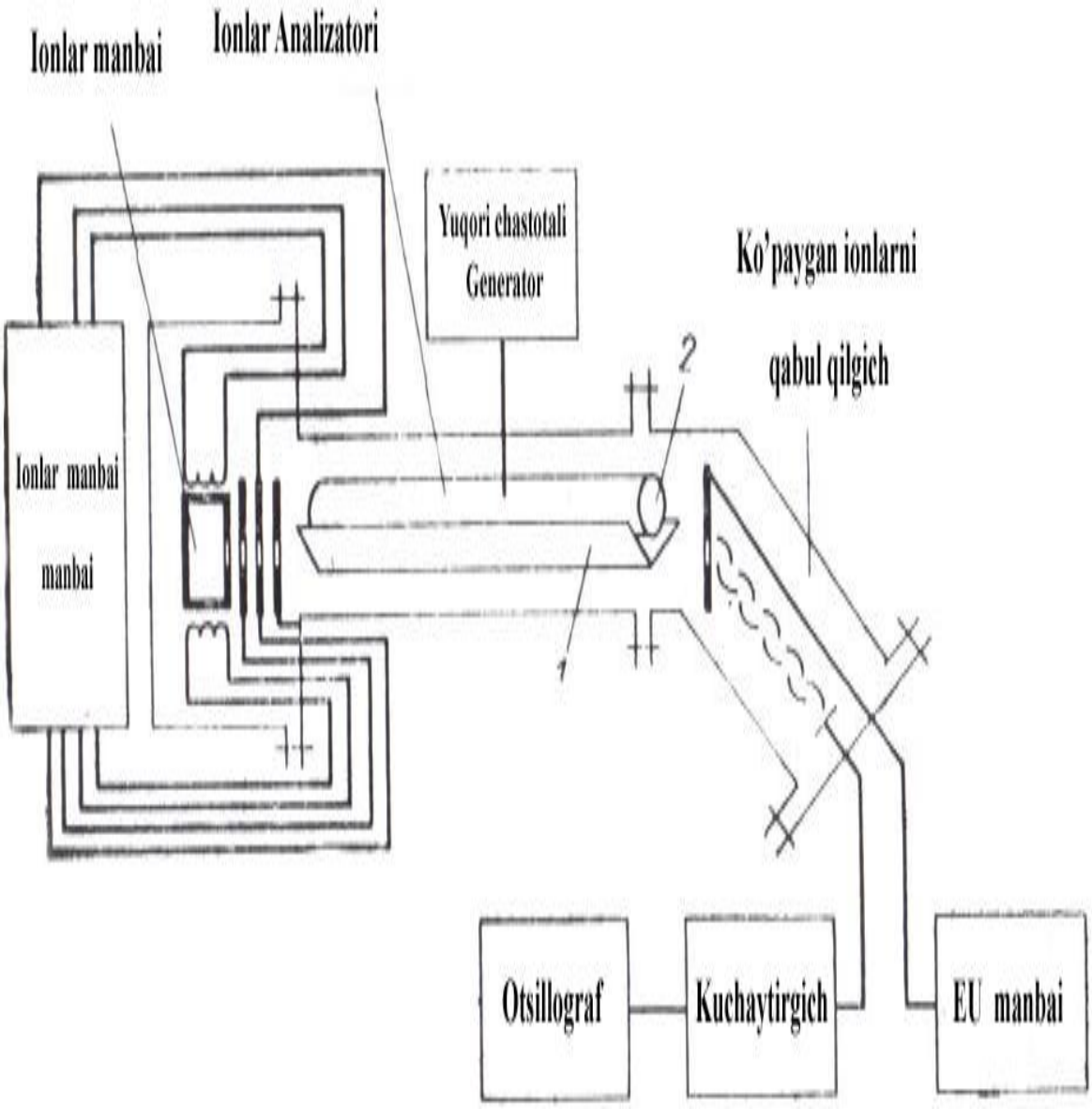
Monopalyar Mass–spektrometrlarning ionlar manbayi va qabul qilgichning tuzilishi Kvadrupol Mass – spektrometrdagiga o`xshash. Analizator datchigi (2) sterjn va burchaksimon plastinalardan tashkil topadi. Burchaksimon plastina va sterjnga quyidagi kuchlanish beriladi.

$$U_{=} + U_{\sim}\ const\ \omega t. \qquad (14)$$

analizatorni ishlatish jarayoni xuddi Kvadrupol Mass – spektrometrnikidek bo`ladi.

8 – rasmda MonopalyarMass – spektrometrning prinsipyal sxemasi keltirilgan.

Lekin bir xil ishlash sharoitidaMonopalyar Mass – spektrometr Kvadrupol Mass – spektrometrga yuqori ajrata olish qobilyati nisbatan kengroq diyapazonda analizatorga kuchlanish ishlatish imkoniga egadir [17].



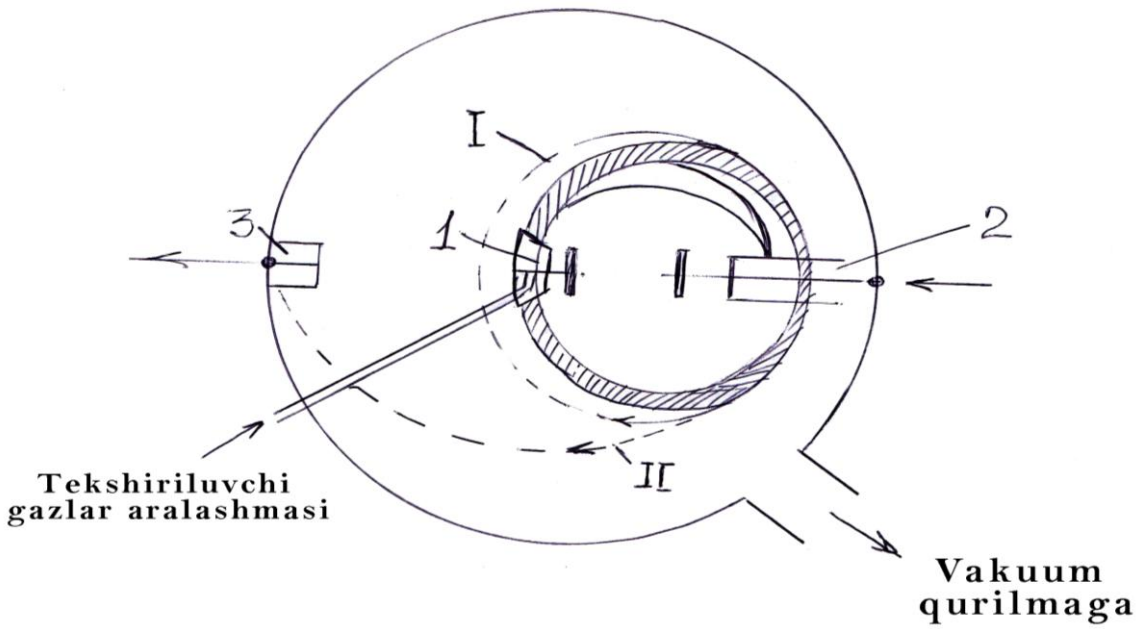
8–rasm

1.6 Magnit vaSiklotron rezonansli Mass – spektrometrlar

a) Magnit rezonansliMass – spektrometrlarda aylana trayektoriya bo`yicha biror massali ionlarning harakatlanishining vaqtga doyimiyligiga bog`liqligi ishlatiladi. Ionlar manbayidan (1) massalari bir xil bo`lgan ionlar ( ularningharakat yo`nalishiga shtrixlangan) bir jinsli magnit maydonda harakatlanib, modulyatorga (2) tushadi (9–rasm). Modulyatorga ingichka ionlar dastasi yuzaga keladi va ular modulyatordan olingan tezlanish hisobiga aylana bo`ylab harakatlanadi ( II ). Massalar bo`yicha taqsimlanish rezononsli ionlar tezlanishi natijasida yuzaga keladi va ularning doyiraviy chastotada $\omega_d$modulyator maydonidagi chastotasiga teng bo`ladi.

$$\omega = n\omega_d \quad (15)$$

(n – butun son).

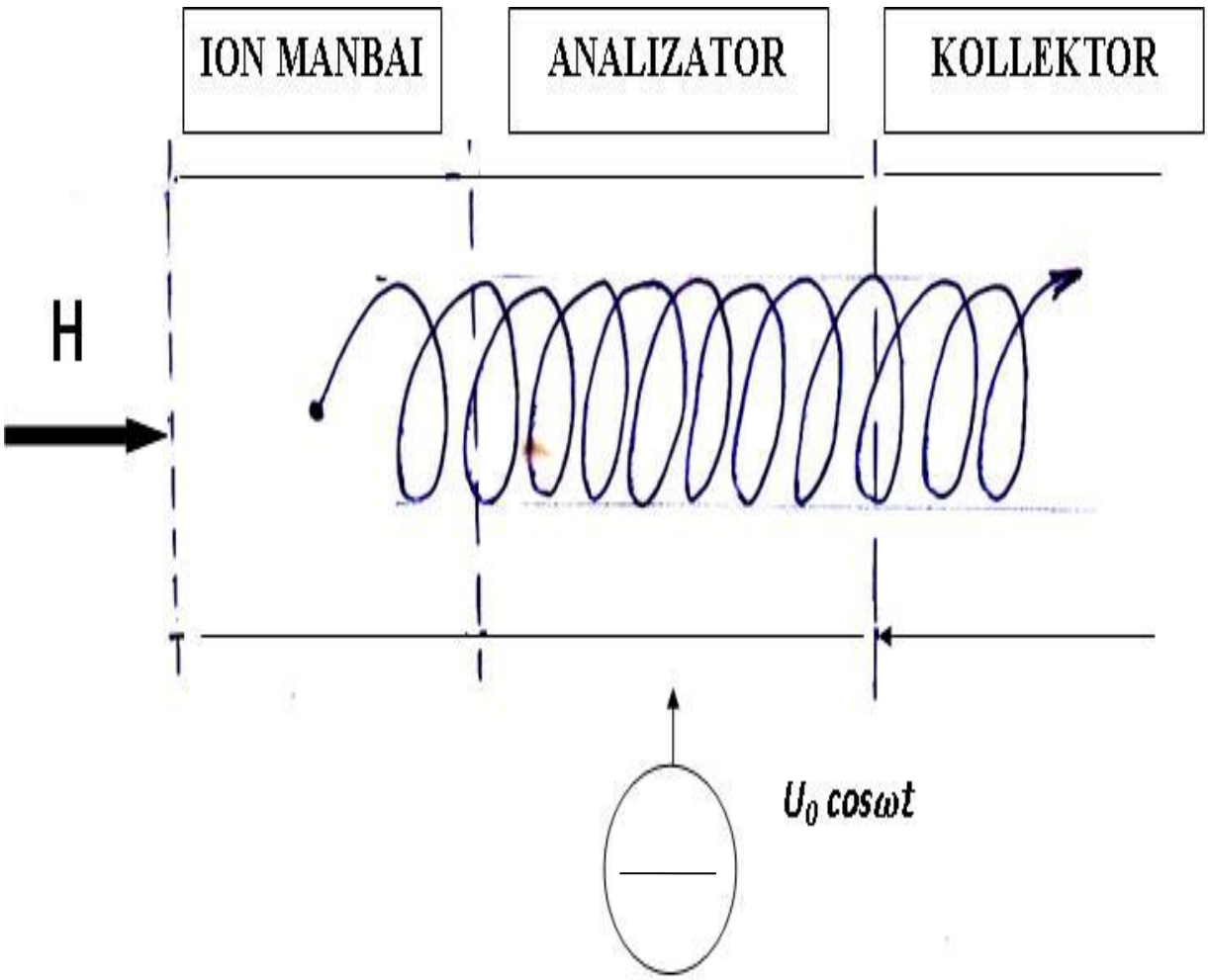


9–rasm

9–rasmda Magnit rezononsli Mass – spektrometr.

Bunday ionlar bir necha aylanishlar natijasida modulyator tomanidan tezlanishga ega bo`ladi va spiralsimon harakatlanib kollektorga (3) tushadi.

Siklatron rezonansli Mass – spektrometr



10 – rasm

10 – rasmdaSiklotron rezonansli Mass – spektrometr.

b) Siklotron rezonansli Mass – spektrometr elektromagnit energiyani ionlar tomonidan rezonans yutilishi, ionlarning Siklotron chastotasi analizatordagi o`zgaruvchan elektr maydon chastotasiga mos kelganda sodir bo`ladi. Ionlar bir jinsli magnit moydonda (H) Siklotron chastota bilan spiralsimon harakatlanadi va kollektorga tushadi: [13].

IIBOB.QATTIQ JISM YUZASINI TEKSHIRISHDA MASS – SPEKTROMETRDAN FOYDALANISH

2.1.Niobiy – Sirkoniy qotishmasi yuzasining elementar tarkibiniMass–spektrometr yordamida o`rganish

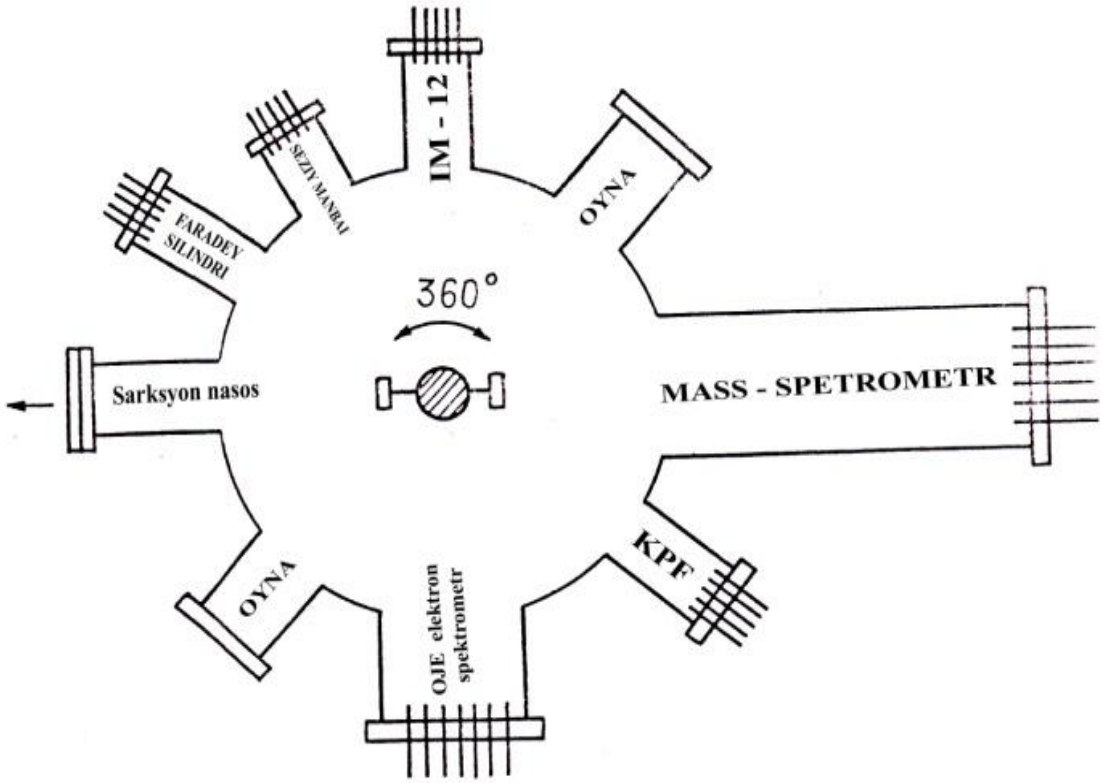
Tajribalar po`latdan yasalgan o`ta yuqori vakuumli qurulmada o`tkaziladi.Bu qurulmada metallar va qotishmaning emissionxossalari,turli usullar bilan yuza tarkibi o`rganishga mo`njallangan qurilma xisoblanadi.

Masalan OES– Oje elektron spektroskopiya usuli, to`la tok usuli yordamida emission xossalari o`rganishi mumkin bo`ladi.Hamda Mass – spektrometr yordamida qotishma yuzasining ximyaviy tarkibi o`rganiladi.Tajribalar $1 \cdot 10^{-9}$tor vakuumda o`tkazildi.Emission tokni o`lchash uchun kollektor sifatida Faradey silindiridan foydalanildi.Qotishma yuzasidagi chiqish ishi to`la tok usuli bilan aniqlanadi.

Tajriba o`tkaziluvchi metal ( Po`lat) kameradan iborat bo`lib qurulama NMD - 0,4 magnit razryad vakuum nasosi, SON – 1sorbsion vakuum nasosi va seolit nasoslaridan iborat bo`ladi.Qurulma markazida minipulyatorda tekshiriluvchi jism (namuna) joylashtirilgan bo`lib uo`q bo`yicha $180^0$ga burulishi ham mumkindir. Qurulmada ikkita oynalar mavjudbo`ladi bular namunani kuzatish maqsadida qo`yilgandir.

Qurilmaga emission tokni o`lchash uchun Faradey silindiri va uch elektrodli to`p (KRP – kantakt patensiallar farqi metodi) o`rnatilgan.Hamda Oje – analizator, Mass – spektrometr MX – 7304,Seziy manbayi o`rnatilgan bo`ladi.

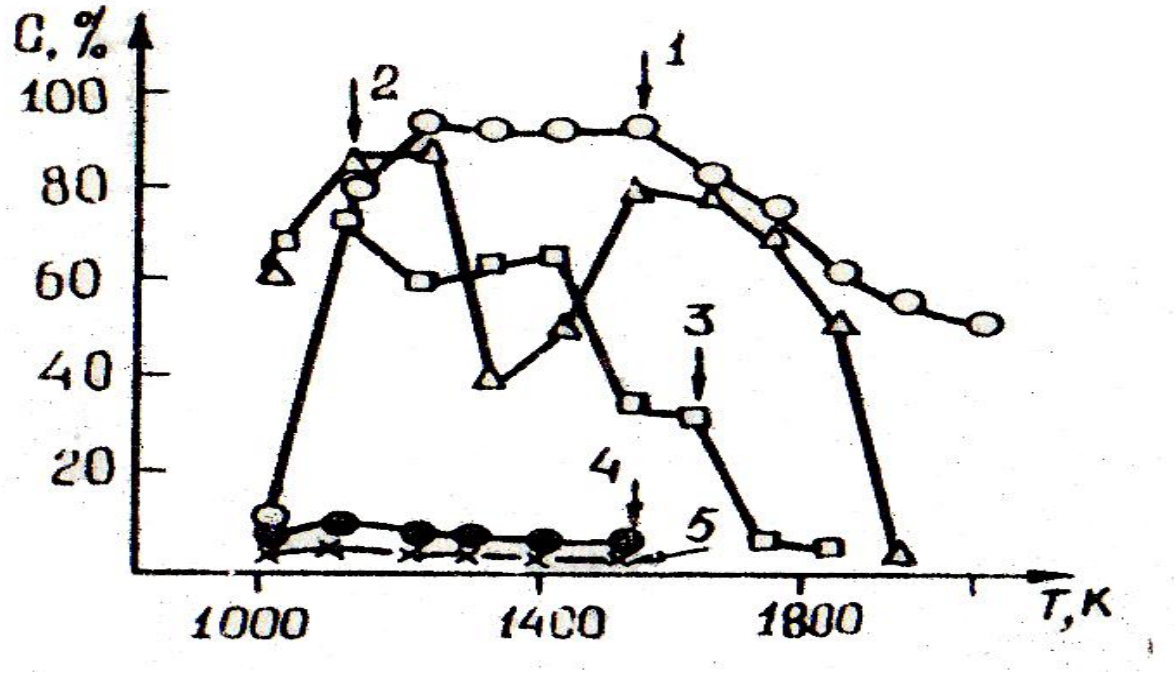
Qotishma yuqori temperaturada (T = 1800^0 Kga) qizdirib, emission tok o`lchanadi. So`ngra Mass – spektrometr yordamida har bir temperaturadagi qotishma yuzasidagi ximyaviy elementlar aniqlanadi.



11 – rasm

11– rasmda Tajriba qurulmasi keltirilgan.

Qotishma temperaturasini300^0 K dan 200^0 K gacha har100^0 K da emission tokning Mass – spektrometr yordamida qotishma yuza tarkibi o`rganiladi.



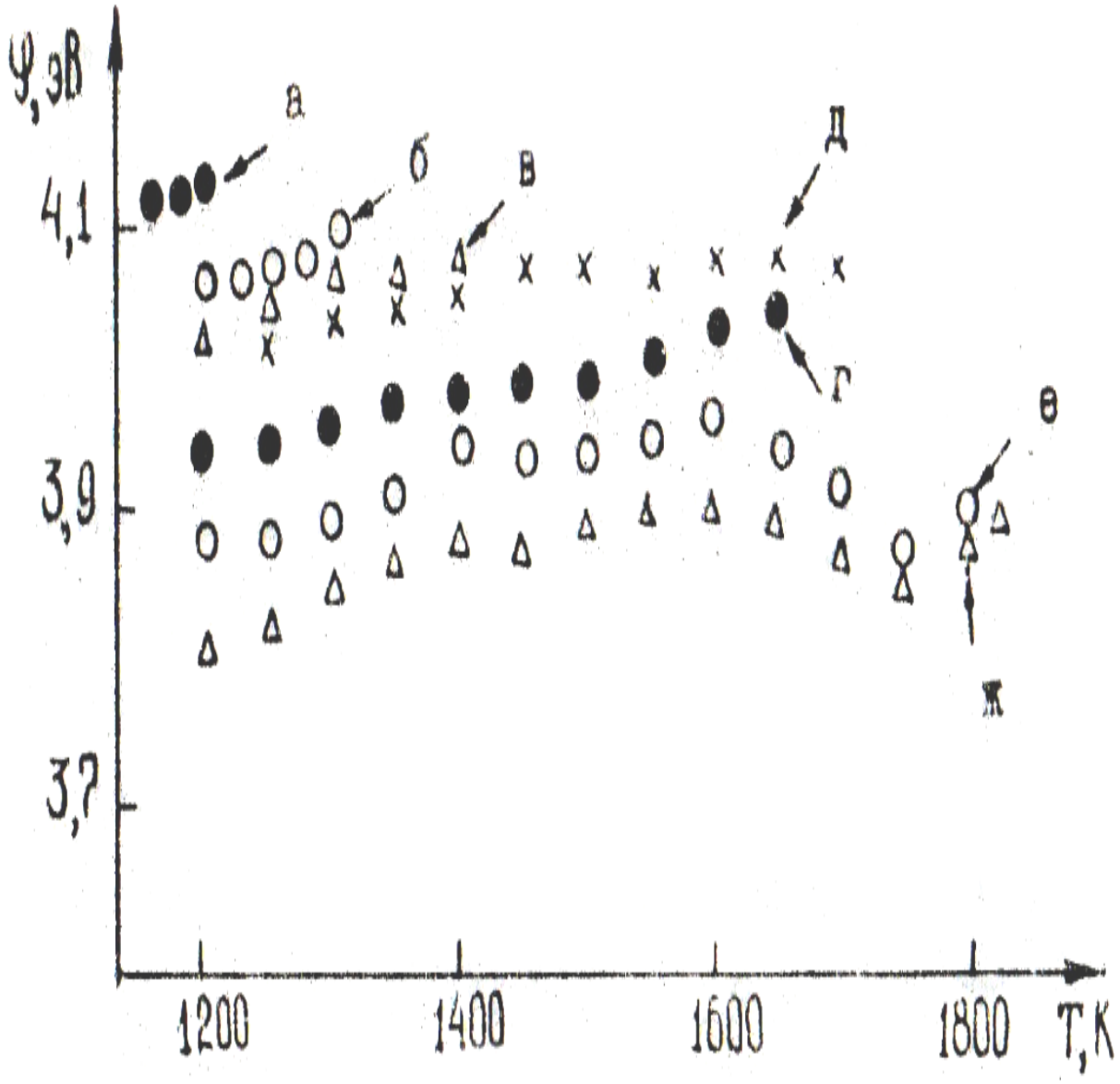
12 – rasm

12 – rasmda Turli temperaturalarda qizdirish natijasida tekshirilayotgan jism yuzasidagi Oltingugurt atomlarining konsentratsiyasining o`zgarish egri chizig`ini ko`rishimiz mumkin.

Nb – Zr qotishmasi yuzasidagi Oltingugurt atomi konsentratsiyasini turli temperaturalarda qizdirish natijasida olingan o`zgarish egri chizigi keltirilgandir. Qotishma temperaturasini T = $1000^0$ K dan boshlab to $2000^0$ K gacha qizdirilib, har$100^0$ Kda Oltingugurt atomining o`zgarish konsentratsiyasi kuztishimiz keltirilgan. Bu temperaturalarda qotishma yuzasida aniqlangan Uglerod, Kislorod va boshqa ximyaviy elementlar 5-10% ni tashkil etdi. Buni 12 – rasmdaximyaviy elementlarning konsentratsiyasi grafik orqali ko`rishimiz mumkindir [10].

Kislarod atomining konsentratsiyasi yuqori temperaturalardaT = 2000^0-2100^0 K da 30% gacha ortishini kuzatishimiz mumkin.Qotishmani T=2100^0 Kda 3 soat vaqt davomida qizdirish natijasida yuzada Oltingugurt va Uglerod atomining konsentratsiyasi 5% gachakamayadi. 12–rasmda ko`rinadiki, Nb – Zr qotishmasini qizdirishning boshlang`ich davrida yuzadagi Oltingugurt konsentratsiyasi 70 % ga yetadi

(1–egri chiziq). Qotishmani qizdirishnatijasida temperaturasining oshishishi Oltingugurt konsentratsiyasi 30 % gacha tushadi. Agar Nb – Zr qotishmasi yuzasida Oltingugurt atomlari tekis taqsimlangan deb oladigan bo`lsak, 3 – 4 manoqatlamga to`g`ri keladi, keyengi yuqori temperaturalarda qizdirish natijasida qotishmasi yuzada Oltingugurt atomi konsentratsiyasining turlitemperaturalarda o`zgarishi murakkab bog`lanishga ega bo`lishini kuzatishimiz mumkindir (2 va 3 – egri chiziqlar orqali).Tajribalar shuni ko`rsatdiki, qotishma yuzasidaOltingugurt va Uglerod konsentratsiyalari juda kam miqdorga qolganda, Qotishma yuzasida kislorod atomlari konsentratsiyasi orta boshlaydi [12].



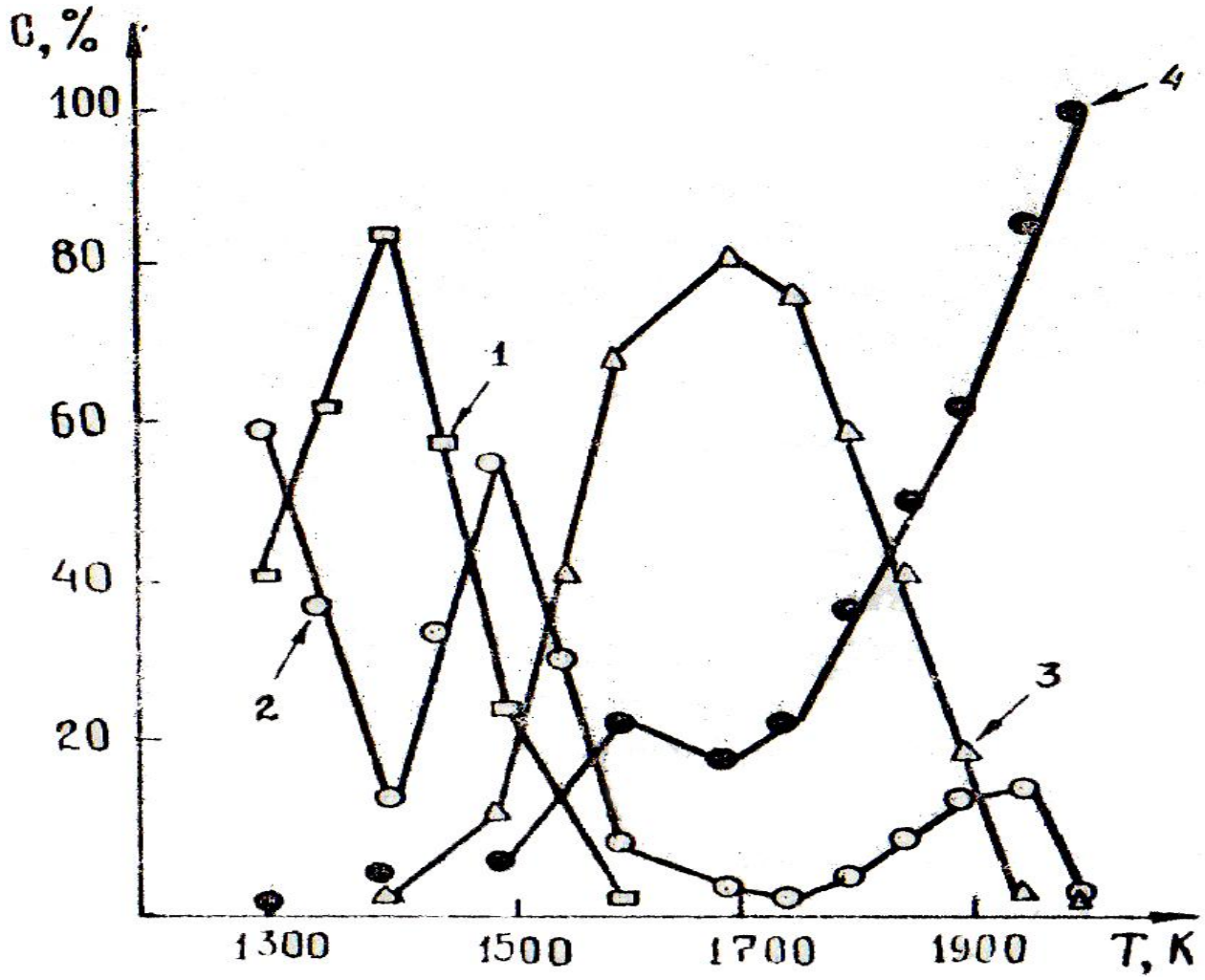
13 – rasm

13–rasmda Qotishma chiqish ishining temperaturaga bog`liq grafigi o`zgarishi keltirilgan.

Nb – Zr qotishmasini chiqish ishining temperaturasi bog`liq grafigi o`zgarishi keltirilganbo`lib$T = 1200^0 - 1400^0\ K$ temperaturalar orqalig`i Nb – Zr qotishmasining chiqish ishi 4,10 - 4,15eV ni tashkil etdi (a,b,v egri chiziqlar).

Qorishma temperatirasini T =1700^0 K gacha qizdirish natijasida, chiqish ishining ortishiga olib keladi. Qotishma temperaturasini yanada oshirish natijasida, chiqish ishini kamayishiga olib keladi(g,d,e – egri chiziqlar).

Nb – Zr qotishmasini yuza tarkibini Mass –spektrometr yordamida terkshirilayotgan paytda boshlang`ich qizdirishdanso`ng $T = 1000^0 - 1300^0\ K$ temperaturada qotishma yuzasida Uglerod va Oltingugurt borligi aniqlanadi.T = 1300 ^{0} K temperaturada qotishmani qizdirish vaqtini oshirsak, Uglerod atomi konsentratsiyasi kamayadi, qotishma yuzasidagi Oltingugurt esa o`zgarishsiz qoladi.T = 1400 $^0$ K va undan yuqori temperaturada qizdirilganda esa qotishma yuzasidaSirkoniy atomini kuzatish mumkin bo`ladi.QotishmaniT = 1600 ^{0} K va undan yuqori temperaturalarda qizdirilgandaSirkoniy atomi konsentratsiyasi ortadi[11].



14 – rasm

14 –rasmda qotishma yuzasidagi elementlar, atomlar konsentratsiyasining temperaturaga bog`liq grafig o`zgarishi ko`rsatilgan.

1 – C (Ugrerod), 2 – S (Oltingugurt),

3 –Zr(Sirkoniy),4 – Nb (Niobiy).

$T = 1300^0 \div 2000^0\ K$temperaturalar oralig`ida Nb–Zr qotishmasi yuzasida ximyaviy elementlar atom konsentratsiyasining o`zgarishi yuz bera boshlaydi.

T = 1500 ^{0} K temperaturada qotishmani qizdirganda yuzada Sirkoniy atomlari konsentratsiyasikeskin o`sa boshlaydi.$T = 1600^0 - 1800^0\ K$temperaturalar oralig`ida esa maksimal qiymat(70%)gacha erishadi.

Temperatura T = 1300^0Kgacha bo`lganda qotishma yuzasida Uglerod atomi konsentratsiyasi maksimal bo`ladi.Buning sababi,qotishma boshlang`ichqizdirish (tozalash) paytida yaxshi tozalanmaganligini ko`rsatadi. $T = 1500^0 - 1950^0\ K$temperaturalar oralig`ida esa qotishma yuzasida Oltingugurt atomi konsentratsiyasi maksimumlari kuzatiladi.Bunga sabab qotishmadagi xajmiy effekt natijasida yuz beradi. Niobiy atomi konsentratsiyasining temperaturaga bog`liqligi murakkab ko`rinishga ega,$T = 1400^0 - 1600^0\ K$temperaturalar orlig`ida qotishma yuzasidagi Niobiy atomi konsentratsiyasi orta boshlaydi.Bunga sabab, qotishma yuzasi Uglerod va Oltingugurtdan tozalanganligi tufaylidir.T=1700^0K temperaturada Niobiy atomi konsentratsiyasidagi minimum qotishma xajmidan yuzaga Sirkoniy atomlarining diffuzyasi hisobiga hosil bo`ladi.Qotishmani T = $1900^0$ K gacha va undan yuqori temperaturada qizdirishi narijasida qotishma yuzasida Sirkoniy atomlari konsentrasiyasi keskin kamayadi.ChunkiT = $1900^0$Kva undan yuqori temperaturalarda Sirkoniy atomlari bug`lanib ketadi.T = 1400^0 K gacha temperaturada qotishma chiqish ishining o`zgarishi Uglerod va Oltingugurt atomlari konsentrasiyalari o`zgarishiga bog`liq bo`ladi.T = 1500^0K temperaturadan boshlab qotishma yuzasi Sirkoniy atomlari bilan to`yinadi va shundan so`ng Sirkoniy atomlarining qotishma emission xossalarining ta`siriT = $1650^0$Ktemperaturadan boshlanadi.Uglerod atomi konsentratsiyasining temperaturaga bog`liqligida yaqqol maksimum kuzatiladi.

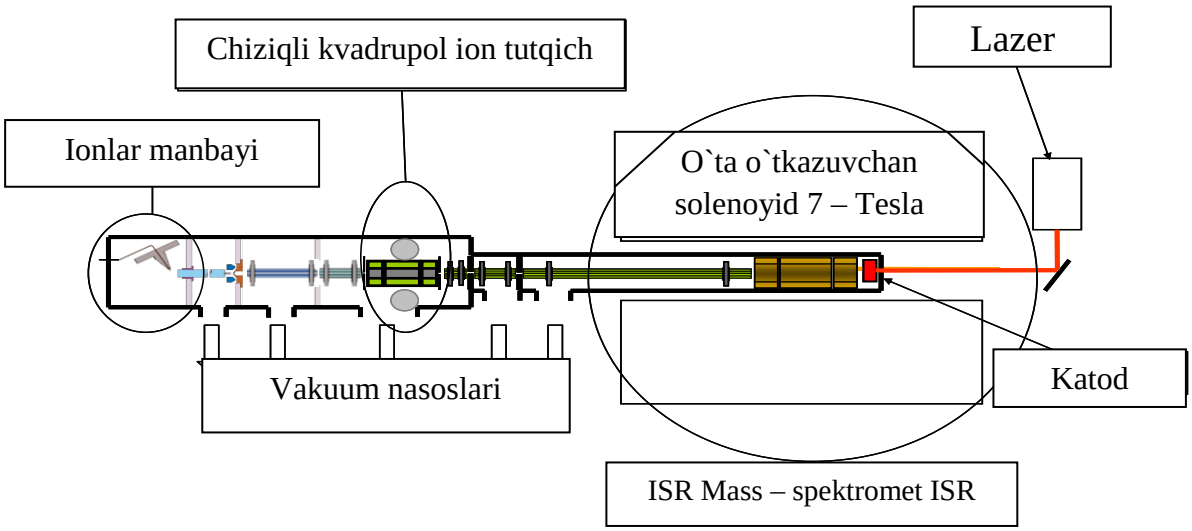
$T = 1500^0 - 1650^0\ K$ temperaturalar oralig`ida qotishma emission xossalariga Uglerod va Sirkoniy atomlari ta`sir qiladi. T = 1800^0 K temperaturada qotishmamani qizdirishda chiqish ishining temperaturaga bog`liqligiga keskin o`zgarishini ko`rishimiz mumkin bo`ladi.Nb – Zr qotishmasini $T = 1400^0$ Kva $T = 1600^0$ K temperaturalarda qizdirganda chiqish ishining temperaturaga bog`liqligida maksimumlarni kuzatmaymiz.T = $1750^0$ K temperaturada qizdirilganda esa chiqish ishining minimumlarini kuzatamiz. Bu temperaturada qotishma yuzasida Sirkoniy atomlarining konsentratsiyasimaksimumga erishadi.Ya`ni bu temperaturada qotishma xajmidan yuzasiga Sirkoniy atomlarining diffuzyasi maksimumga erishadi.Nb – Zr

qotishmasini dastlabki qizdirish davomida chiqish ishi 4,1 – 4,2 eV gacha ko`tariladi.

Qotishmani T = 1650^0 K temperaturagacha qizdirganda esa qotishma yuzasida Sirkoniy atomlarining konsentrasiyasi 30 – 40 % ni tashkil etadi. Qotishma temperaturasini,T = 1700^0 - 1800^0 K temperaturagacha qizdirilganda qotishma yuzasidagi Sirkoniy atomining konsentrasiyasi 50-70 % gacha oshadi. Bu temtemperaturalarda qotishmaning chiqish ishi 3,9– 4eV bo`ladi. Ko`p marta qizdirishlardan so`ng Nb – Zr qotishmasi chiqish ishining temperaturasiga bog`liqligini 14 – rasmda *e* va *j* egri chiziqlarorqali tahlil qilishimiz mumkindir[14].

2.2. FINNIGANMASS – SPEKTROMETRI YORDAMIDA ORGANIK BIRIKMALARINI ANIQLASH

Finning Mass – spektrometri (Bremen, Germaniya) o`ta o`tkazuvchan solenoid va yuqori sezgirlikka ega bo`lgan chiziqli kvadrupol ion tutqichdan iborat bo`ladi. Solenoyidning magnit maydon induksiyasi 7 – Teslaga teng bo`ladi.



15 – rasm

15 –rasmdaFinniganMass – spektrometrningtuzulishi keltirilgan.

1 – Ion manbayi.

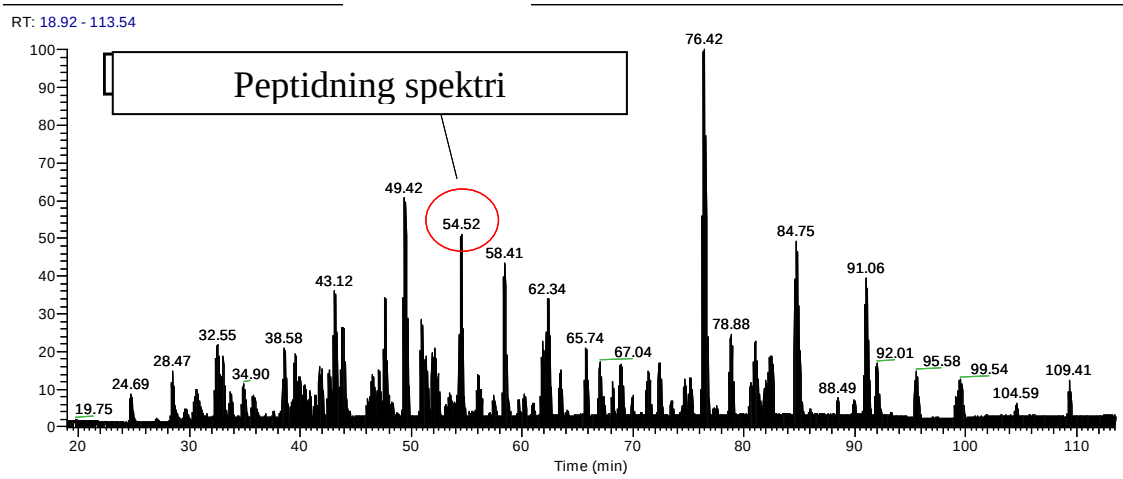
2 – Chiziqli kvadrupol ion tutqich.

3 – Vakuum nasoslari.

4 – O`ta o`tkazuvchanlik.

5 – Ion siklotron rezonansli Mass – spektrometr.

Bu Mass – spektrometrning ajrata olish qobilyati R = 50000 va massalar soni 400 gacha atom yoki molekulalarni aniqlab beradi. Ion Siklotronli rezonans Mass – spektrometrlarboshqa Mass – spektrometrlardan farqi shundaki jismni tashkil qilgan atom massalarini maksimal aniqlikda o`lchash imkoniga egadir.



16 – rasmda Finnigan Mass – spektrometri yordamida olingan natijalar grafigi keltirilgan.

XULOSA

Bitiruv malakaviy ishimning ilmiy predmetini yoritishda Prezidentimizning asarlaridagi nutqlarini yana qayta o`qish orqali Respublikamizda ijtimoiy iqtisodiy va siyosiy sohalardagi erishilayotgan yutuqlardan yanada kengroq bilimga ega bo`ldim. Shuning dek, mavzuni qamrab olgan o`quv qo`llanmalarni bevosita mavzuga tegishli bo`lgan ilmiy maqolalarni o`qib,internet ma`lumotlaridan kengroq foydalangan holda tahlil qilib xulosalar chiqardim.

Ushbu bitiruv malakaviy ishi“Mass –spektrometr yordamida qattiq jism yuza tarkibini o`rganish” mavzusi bo`yicha tayyorlangan bo`lib,u kirish, ikkitabob,xulosa,foydalangan adabiyotlar ro`yxati va izoxli lug`atdan iborat.

Biriruv malakaviy ishi Mass–spektrometr yordamida qattiq jism yuzasini tekshirishga bag`ishlangan. Mass–spektrometr vakuumda tekshirilayotgan jism (namuna) yuzasining elementar tarkibini aniqlashga yordam beradi.Mass – spektrometr yordamida faqat qattiq jismlarni emas, gazlar tarkibini aniqlash ham mumkin. Ximyaviy elementlarni massa soni orqali aniqlash mumkin.

Ushbu bitiruv malakaviy ishni bajarish natijasida quyidagilar amalga oshirildi:

- Mass – spektrometr yordamida qattiq jism yuza tarkibini o`rganishi xaqidagi ma`lumotlar o`rganildi va tahlil qilindi.
- Mass – spektrometr yordamida qattiq jism yuza tarkibini o`rganildi va boshqa fanlar bilan bog`liqligi o`rganilib chiqildi.
- Ushbu ishdaNiobiy – Sirkoniy qotishmasidan foydalanib tajriba – sinov ishlari o`tkazildi va uning ijobiy natijalari taxlil qilindi xamda kerakli tavsiyalr ishlab chiqildi.

Masalan Uglerod – 12, Azot – 14, Kislorod – 16, Suv bug`i – 18 va boshqalar.Mass–spektrometr yordamida qattiq jismning faqat yuzadagi elementlar to`g`risida ma`lumotlarni olish mumkin bo`ladi.

Qattiq jismning ichki tarkibi to`g`risida ma`lumotlarni olish uchun boshqa metodlardan foydalanish kerak bo`ladi

Foydalangan adabiyotlar ro`yxati

1.I. Karimov A. O`zbekiston mustaqillikka erishish ostonasida. Toshkent “O`qituvchi ”, 2011yil 439 b.

2. O`zbekiston Respublikasi Prezidentining «Obod turmush yili » Davlat dasturi to`g`risidagi 2013–yil 14 – fevraldagi PQ – 1920 – sonli qarori.

3. Karimov I.A. Yuksak ma`naviyat – yengilmas kuch.Toshkent.:“Ma`naviyat” 2009 yil, 173 b.

4. Yosh fiziklar ensiklapedik lug`ati. Toshkent.: “ Pedagogika”,1989 yil, 145b.

5. Pipko A.I. va boshqalar.Osnovni vakuumniy texniki. Moskva.:“Energoizdat” 1997 yil 245 b.

6. Djeyram R. Mass – spektrometriya. Moskva.: “Mir” 1996 yil 213b

7. Korolev B.I.va boshqalar. Osnovnoy vakuumniy texnika. Moskva “Energiya ” 1995 yil 242 b.

8. Rafilson A.E.,A.M.Sherishevskiy Mass – spektrometrichiski pribori.Moskva. “O`quvchi” 1992 yil 245 b.

9. Slobodenyuk G.I. Kvadrupolniy Mass – spektrometr.Moskva.: “Nauka”.1994 yil 338 b.

10. Metod analiza poverxnosti. Pod redaksii A.Zaderna.Moskva.: “Nauka”.1994 yil 302 b.

11. Famenko V.S.Emissioniye svoyvstva materialov. Sparovochnik K.:“Mir”.1992 yil 215 b.

12. Dobrosov M.N., Gomoyunova M.B.Emissionoya elektronika. Moskva.: “Nauka”.1992 yil 246 b.

13. Platnik P.S., N.N. Papirov Epitaksionalniy plyonki. Moskva.: “Nauka”.1993 yil 265 b.

14. Balshov A. va boshqalar. Submonosloyniye plyonki na poverxnosti metallov. Moskva.: “Nauka”.1993 yil 206 b.

15. Zaidberg H., Ionov A. Poverxnostiya ionizatsiya.Moskva.: “Nauka”.1992 yil 288 b.

16. http://old.gov.uz/uz/press/society/11752

17. http://www.google.com.physics.ru

18. https://uz.wikipedia.org/wiki/Fizika

19. https://en.wikipedia.org/wiki/Physics

20. http://www.press-service.uz/uz/news/archive/dokladi/

21. http://www.Qisloq qurulish bank.uz/ uz/ news/ php? Page= id=210 21.02.2013 yil.

Izoxli lug`at

1.	**Mass – spektrometr – Mass – spectrometry** (**MS**) is the science of displaying the *spectra* (singular *spectrum*) of the masses of the molecules comprising a sample of material. It is used for determining the elemental composition of a sample, the masses of particles and of molecules, and for elucidating the chemical structures of molecules, such as peptides and other chemical compounds. Mass spectrometry works by ionizing chemical compounds to generate charged molecules or molecule fragments and measuring their mass-to-charge ratios.[1] In a typical MS procedure a sample, which may be solid, liquid, or gas, is ionized.
2.	**Ta`lim–Education**in its broadest, general sense is the means through which the aims and habits of a group of people lives on from one generation to the next. Generally, it occurs through any experience that has a formative effect on the way one thinks, feels, or acts.
3.	**Hodisa – Event** (particle physics).An event in particle physics describes one set of particle interactions occurring in a brief span of time, typically recorded together. At modern particle accelerators this refers to the interactions that occur as a result of one beam crossing inside a detector.
4.	**Fizik kattaliklar – Physical quantity**physical quantity is a physical property of a phenomenon, body, or substance that can be quantified by measurement.
5.	**Harorat** – **Temperature** is a physical quantity that is a measure of hotness and coldness on a numerical scale.[1] It is a measure of the thermal energy per particle of matter or radiation; it is measured by a thermometer, which may be calibrated in any of various temperature scales, Celsius, Fahrenheit, Kelvin, etc.Temperature is an intensive property, which means it is independent of the amount of material present; in contrast to energy, an extensive property, which is proportional to the amount of material in the system. For example a spark may well be (very briefly!) as hot as the Sun.
6.	**Mantiqiy ehtimollik - Logical possibility** is usually considered the broadest

	sort of possibility; a proposition is said to be logically possible if there is no logical contradiction involved in its being true. "Dick Cheney is a bachelor" is logically possible, though in fact false; most philosophers have thought that statements like "If I flap my arms very hard, I will fly" are logically possible, although they are homologically impossible. "Dick Cheney is a married bachelor," on the other hand, is logically impossible; anyone who is a bachelor is therefore not married, so the sentence involves a logical contradiction.
7.	**Ta`lim tizimi–Systems of schooling.**School children line, in Kerala, India. Systems of schooling involve institutionalized teaching and learning in relation to a curriculum, which itself is established according to a predetermined purpose of the schools in the system.
8.	**Ion-Ion** is an atom or molecule in which the total number of electrons is not equal to the total number of protons, giving the atom a net positive or negative electrical charge.Ions can be created by both chemical and physical means. In chemical terms, if a neutral atom loses one or more electrons, it has a net positive charge and is known as a cation. If an atom gains electrons, it has a net negative charge and is known as an anion. An ion consisting of a single atom is an atomic or monatomic ion; if it consists of two or more atoms, it is a molecular or polyatomic ion.In the case of physical ionization of a medium, such as a gas, what are known as "ion pairs" are created by ion impact, and each pair consists of a free electron and a positive ion.
9.	**Emission – Emission** of a chemical element or chemical compound is the spectrum of frequencies of electromagnetic radiation emitted due to an atom's electrons making a transition from a high energy state to a lower energy state. The energy of the emitted photon is equal to the energy difference between the two states. There are many possible electron transitions for each atom, and each transition has a specific energy difference. This collection of different transitions, leading to different

	radiated wavelengths, make up an emission spectrum. Each element's emission spectrum is unique. Therefore, spectroscopy can be used to identify the elements in matter of unknown composition. Similarly, the emission spectra of molecules can be used in chemical analysis of substances.
10.	**Bosim - Pressure** (the symbol: *p*) is the ratio of force to the area over which that force is distributed.Pressure is force per unit area applied in a direction perpendicular to the surface of an object. Gauge pressure (also spelled *gage* pressure)[a] is the pressure relative to the local atmospheric or ambient pressure. While pressure may be measured in any unit of force divided by any unit of area, the SI unit of pressure (the newton per square metre) is called the *pascal* (Pa) after the seventeenth-century philosopher and scientist Blaise Pascal. A pressure of 1 Pa is small; it approximately equals the pressure exerted by a dollar bill resting flat on a table. Everyday pressures are often stated in kilopascals (1 kPa = 1000 Pa).
11.	**Tehnalogiya– Technology**is the making, usage, and knowledge of tools, machines, techniques, crafts, systems or methods of organization in order to solve a problem or perform a specific function. It can also refer to the collection of such tools, machinery, and procedures. Technologies significantly affect human as well as other animal species' ability to control and adapt to their natural environments.
12.	**Experemental –Experiment.**An experiment is a methodical trial and error procedure carried out with the goal of verifying, falsifying, or establishing the validity of a hypothesis. Experiments vary greatly in their goal and scale, but always rely on repeatable procedure and logical analysis of the results. A child may carry out basic experiments to understand the nature of gravity, while teams of scientists may take years of systematic investigation to advance the understanding of a phenomenon.
13.	**Analitik tahlil –Alciphron.** Alciphron was widely read and caused a bit of a stir. But it was an offhand comment mocking Berkeley's arguments by the

	'free-thinking' royal astronomer Sir Edmund Halley that prompted Berkeley to pick up his pen again and try a new tack. The result was The Analyst, conceived as a satire attacking the foundations of.
14.	**Masala** – **Problem** is an obstacle, impediment, difficulty or challenge, or any situation that invites resolution; the resolution of which is recognized as a solution or contribution toward a known purpose or goal. A problem implies **a** desired outcome coupled with an apparent deficiency, doubt or inconsistency that prevents the outcome from taking place.
15.	**Modda –Chemistry,**a chemical substance is a form of matter that has constant chemical composition and characteristic properties. It cannot be separated into components by physical separation methods, i.e. without breaking chemical bonds. They can be solids, liquids or gases.Chemical substances are often called 'pure' to set them apart from mixtures. A common ehample of a chemical substance is pure water; it has the same properties and the same ratio of hydrogen to oxygen whether it is isolated from a river or made in a laboratory.
16.	**Fizik jism**–**Physical body** or physical object (sometimes simply called **a** body or object) is a collection of masses, taken to be one. For ehample, **a** football can be considered an object but the ball also consists of many particles (pieces of matter).The common conception of physical objects includes that they have extension in the physical world, although there do exist theories of quantum physics and cosmology which may challenge this.
17.	**Formula–Formula**One, also known as Formula 1 or Fl and referred to officially as the FIA Formula One World Championship,is the highest class of single sealer auto racing sanctioned by the FederationInternationals de Automobile (FIA). The "formula", designated in the name, refers to a set of rules with which all participants' cars must comply. The Fl season consists of a series of races, known as Grand's Prix (in English, Grand Prizes), held on purpose-built circuits and public roads.

18.	**Fizik qonun– Physical law**or scientific law is "a theoretical principle deduced from particular facts, applicable to a defined group or class of phenomena, and expressible by the statement that a particular phenomenon always occurs if certain conditions be present
19.	**Elementar zarra - Elementary particle -** In particle physics, an elementary particle or fundamental particle is a particle not known to have any substructure, thus it is not known to be made up of smaller particles. If an elementary particle truly has no substructure, then it is one of the basic building blocks of the universe from which all other particles are made. In the Standard Model of particle physics, the elementary particles include the fundamental fermions (including quarks, leptons, and their antiparticles), and the fundamental bosons (including gauge bosons and the Higgs boson). Although elementary particles are not made up of smaller particles, some of them may change to lighter particles (according to specific rules).
20.	**Jarayon –Processor** processing typically describes the act of taking something through an established and usually routine set of procedures or steps to convert it from one form to another, such as processing milk into cheese, or processing paperwork to grant a mortgage loan, or converting computer data from one form to another. A process involves steps and decisions in the way work is accomplished.The process that one follows is as important as the results that are produced by the process. Without understanding the underlying process, it is difficult to know how a certain set of results were achieved, or why they were good or bad. So If results are viewed as the "destination", then process can be viewed as the "vehicle" that gets you there (and ideally, you should be able to use the same "vehicle" for many trips...with a few modifications based on the desired destination!)
21.	**Vaqt – Time**is a part of the measuring system used to sequence events, to compare the durations of events and the intervals between them, and to quantify rates of change such as the motions of objects. The temporal

	position of events with respect to the transitory present is continually changing; future events become present, then pass further and I further into the past. Time has been a major **subject** of religion, philosophy, and science.
22.	**Fizik tajriba – experiment**is a methodical trial and error procedure carried out with the goal of verifying, falsifying, or establishing the validity of a hypothesis. Experiments vary greatly in their goal and scale, but always rely on repeatable procedure and logical analysis of the results.
23.	**Fizik hodisa– thephysicalphenomenon** a different change occurring in surrounding us world. For instance, mechanical, heat, electric, light phenomenos.
24.	**Fizik kattalik —Physical values** volume, the temperature, time, length, velocity, mass, and others.
25.	**Nazariya – Theory -** The three other known forces of nature are mediated by elementary particles: electromagnetism by the photon, the strong interaction by the gluons, and the weak interaction by the W and Z bosons. The hypothesis is that the gravitational interaction is likewise mediated by a – yet undiscovered – elementary particle, dubbed *the graviton*. In the classical limit, the theory would reduce to general relativity and conform to Newton's law of gravitation in the weak-field limit.
26.	**Fizik nazariya—**physical theory-theory referring and determined of the physical science.
27.	**Tajriba – sinov ishlari—**experienced–experimental workcheck result studies on pedagogical experiment.
28.	**Oltingugurt - Sulfur** or **sulphur** is a chemical element with symbol **S** and atomic number 16. It is an abundant, multivalentnon-metal. Under normal conditions, sulfur atoms form cyclic octatomic molecules with chemical formula S_8. Elemental sulfur is a bright yellow crystalline solid when at room temperature. Chemically, sulfur can react as either an oxidant or reducing agent. It oxidizes most metals and several nonmetals, including carbon,

	which leads to its negative charge in most organosulfur compounds, but it reduces several strong oxidants, such as oxygen and fluorine.Sulfur occurs naturally as the pure element (native sulfur) and as sulfide and sulfate minerals. Elemental sulfur crystals are commonly sought after by mineral collectors for their distinct, brightly colored polyhedron shapes.
29.	**Ehtimollik – Probability**(Possibility) densities corresponding to the wave functions of an electron in a hydrogen atom possessing definite energy levels (increasing from the top of the image to the bottom: n = 1, 2, 3, ...) and angular moments (increasing across from left to right: s, p, d, ...). Brighter areas correspond to higher probability density in a position measurement. Wave functions like these are directly comparable to Calando's figures of acoustic modes of vibration in classical physics, and are indeed modes of oscillation as well, possessing a sharp energy and, thus, a definite frequency. The angular momentum and energy are quantized, and take only discrete values like those shown (as is the case for resonant frequencies in acoustics).
30.	**Fizika–Physics**(from Greek: physis "nature") is a natural science that involves the study of matterand its motion through spacetime, along with related concepts such as energy and forceMore broadly, it is the general analysis of nature, conducted in order to understand how the universe behaves.Physics is one of the oldest academic disciplines, perhaps the oldest through its inclusion of astronomy.
31.	**Ehtimoliy hodisa - Epistemic possibility -** The contrast with epistemic possibility is especially important to draw, since in ordinary language the same phrases are often used to express either sort of possibility. But they are not the same. We do not know whether Holdback's conjecture is true or not (no-one has come up with a proof yet); so it is (epistemic ally) possible that it is true and it is (epistemically) possible that it is false. But if it is, in fact, provably true, then it would have to be (subjunctive) necessarily true; what being provable means is that it would not be (logically) possible for it to be

	false. Similarly, it might not be at all (epistemically) possible that it is raining outside – wemight know beyond a shadow of a doubt that it is not—but that would hardly mean that it is (subjunctive) impossible for it to rain outside. This point is also made by Norman Swartz and Raymond Bradley.
32.	**Vadorod - Hydrogen** is a chemical element with symbol **H** and atomic number 1. With an atomic weight of 1.00794 u (1.007825 u for hydrogen-1), hydrogen is the lightest element and its monatomic form (H_1) is the most abundant chemical substance, constituting roughly 75% of the Universe's baryonic mass.[7][note 1] Non-remnantstars are mainly composed of hydrogen in its plasma state.At standard temperature and pressure, hydrogen is a colorless, odorless, tasteless, non-toxic, nonmetallic, highly combustiblediatomicgas with the molecular formula H_2. Most of the hydrogen on Earth is in molecules such as water and organic compounds because hydrogen readily forms covalent compounds with most non-metallic elements.
33.	**Klassik fizika- Classical physics** - explains matter and energy at the macroscopic level of the scale familiar to human experience, including the behavior of astronomical bodies. It remains the key to measurement for much of modern science and technology. On the other hand, at the end of the 19th century scientists discovered phenomena in both the large (macro) and the small (micro) worlds that classical physics could not explain. Coming to terms with these limitations led to the development of quantum mechanics, a major revolution in physics. This article describes how physicists discovered the limitations of classical physics and developed the main concepts of the quantum theory that replaced them in the early decades of the 20th century. These concepts are described in roughly the order they were first discovered; for a more complete history of the subject, see History of quantum mechanics.
34.	**Foton - Photon -** A photon is an elementary particle, the quantum of light

	and all other forms of electromagnetic radiation, and the force carrier for the electromagnetic force, even when static via virtual photons. The effects of this force are easily observable at both the microscopic and macroscopic level, because the photon has no rest mass; this allows for interactions at long distances. Like all elementary particles, photons are currently best explained by quantum mechanics and exhibit wave–particle duality, exhibiting properties of both waves and particles. For ehample, a single photon may be refracted by a lens or exhibit wave interference with itself, but also act as a particle giving a definite result when its position is measured.
35.	**Kvantlash– Quantization**- In physics, quantization is the process of explaining a classical understanding of physical phenomena in terms of a newer understanding known as "quantum mechanics". It is a procedure for constructing a quantum field theory starting from a classical field theory. This is a generalization of the procedure for building quantum mechanics from classical mechanics. One also speaks of field quantization, as in the "quantization of the electromagnetic field", where one refers to photons as field "quanta". This procedure is basic to theories of particle physics, nuclear physics, condensed matter physics, and quantum optics.
36.	**Elektron –Electron.** The electron (symbol: e−) is a subatomic particle with a negative elementary electric charge. It has no known components or substructure; in other words, it is generally thought to be an elementary particle. An electron has a mass that is approximately 1/1836 that of the proton. The intrinsic angular momentum (spin) of the electron is a half-integer value in units of ħ, which means that it is a fermion.
37.	**Qotishma - An alloy** is a mixture or metallicsolid solution composed of two or more elements. An alloy will contain one or more of the three: a solid solution of the elements (a single phase); a mixture of metallic phases (two or more solutions); an intermetallic compound with no distinct boundary between the phases. Solid solution alloys give a single solid

	phasemicrostructure, while partial solutions give two or more phases that may or may not be homogeneous in distribution, depending on the thermal (heat treatment) history of the material. An intermetallic compound will have another alloy or pure metal embedded within another pure metal. Alloys are used as their properties are superior to those of the pure component elements.
38.	**Siklotron –** A **cyclotron.**is a type of particle accelerator in which charged particles accelerate outwards from the center along a spiral path. The particles are held to a spiral trajectory by a static magnetic field and accelerated by a rapidly varying (radio frequency) electric field.
39.	**Tadqiqot–Locations** .The *Half-Life* series of video games features many locations set in a dystopian future stemming from the events of the first game, *Half-Life*. These locations are used and referred to throughout the series. The locations, for the most part, are designed and modeled from real-world equivalent locations in Eastern Europe, but also include science fiction settings including the Black Mesa Research Facility, a labyrinthine subterranean research complex, and Xen, an alien dimension.
40.	**Matematika - Mathematics** - In probability theory, a stochastic process, or sometimes random process, is the counterpart to a deterministic process (or deterministic system). Instead of dealing with only one possible reality of how the process might evolve under time, in a stochastic or random process there is some indeterminacy in its future evolution described by probability distributions. This means that even if the initial condition (or starting point) is known, there are many possibilities the process might go to, but some paths may be more probable and others less so.
41.	**Statistika - Statistics** -A statistician is someone who works with theoretical or applied statistics. The profession exists in both the private and public sectors. It is common to combine statistical knowledge with expertise in other subjects.
42.	**Elektr toki - Electric current** -An electric current is a flow of electric

	charge. Electric charge flows when there is voltage present across a conductor. In electric circuits this charge is often carried by moving electrons in a wire. It can also be carried by ions in an electrolyte, or by both ions and electrons such as in plasma. The SI unit for measuring an electric current is the ampere, which is the flow of electric charges through a surface at the rate of one coulomb per second. Electric current can be measured using an ammeter. Electric currents cause many effects, notably heating, but also induce magnetic fields, which are widely used for motors, inductors and generators.
43.	**Egilish- Deflection (physics)** - In physics deflection is the event where an object collides and bounces against a plane surface. Magnetic deflection refers to Lorentz forces acting upon a charged particle moving in a magnetic field. An object's deflective efficiency can never equal or surpass 100%. For ehample, a mirror will never reflect exactly the same amount of light cast upon it. Also, a ball in free-fall (meaning no forces are acting on it other than gravity), upon hitting the ground, will never bounce back up to the spot where it first started to descend. This is due to the Laws of Thermodynamics, which state that, in every action, some energy being used in that action escapes into the environment.
44.	**Molekula - Molecule -** A molecule is an electrically neutral group of two or more atoms held together by covalentchemical bonds. Molecules are distinguished from ions by their lack of electrical charge. However, in quantum physics, organic chemistry, and biochemistry, the term molecule is often used less strictly, also being applied to polyatomic ions. In the kinetic theory of gases, the term molecule is often used for any gaseous particle regardless of its composition. According to this definition, noble gas atoms are considered molecules despite being composed of a single non-bonded atom.

45.	**Rezonons – Resonance.** In physics, resonance is the tendency of a system to oscillate with greater amplitude at some frequencies than at others. Frequencies at which the response amplitude is a relative maximum are known as the system's resonant frequencies, or resonance frequencies. At these frequencies, even small periodic driving forces can produce large amplitude oscillations, because the system stores vibrational energy.
46.	**Uglerod - Carbon** (from Latin: *carbo* "coal") is the chemical element with symbol **C** and atomic number 6. As a member of group 14 on the periodic table, it is nonmetallic and tetravalent—making four electrons available to form covalent chemical bonds. There are three naturally occurring isotopes, with ^{12}C and ^{13}C being stable, while ^{14}C is radioactive, decaying with a half-life of about 5,730 years.[11] Carbon is one of the few elements known since antiquity.
47.	**Sirkoniy - Zirconium** is a chemical element with the symbol **Zr**, atomic number 40 and atomic mass of 91.224. The name of zirconium is taken from the mineral *zircon*, the most important source of zirconium. It is a lustrous, grey-white, strong transition metal that resembles titanium. Zirconium is mainly used as a refractory and opacifier, although it is used in small amounts as an alloying agent for its strong resistance to corrosion. Zirconium forms a variety of inorganic and organometallic compounds such as zirconium dioxide and zirconocene dichloride, respectively. Five isotopes occur naturally, three of which are stable. Zirconium compounds have no known biological role.
48.	**Atom – Atom-** The atom is a basic unit of matter that consists of a dense central nucleus surrounded by a cloud of negatively chargedelectrons. The atomic nucleus contains a mix of positively charged protons and electrically neutral neutrons. The electrons of an atom are bound to the nucleus by the electromagnetic force. Likewise, a group of atoms can remain bound to each

	other by chemical bonds based on the same force, forming a molecule. An atom containing an equal number of protons and electrons is electrically neutral; otherwise it is positively or negatively charged and is known as an ion. An atom is classified according to the number of protons and neutrons in its nucleus: the number of protons determines the chemical element, and the number of neutrons determines the isotope of the element.
49.	**Kvant– Quant –** In physics, a quantum (plural: quanta) is the minimum amount of any physical entity involved in an interaction. Behind this, one finds the fundamental notion that a physical property may be "quantized," referred to as "the hypothesis of quantization". This means that the magnitude can take on only certain discrete values. There is a related term of quantum number. An ehample of an entity that is quantized is the energy transfer of elementary particles of matter (called fermions) through bosons and of photons. A photon is a single quantum of light, and is referred to as a "light quantum". The energy of an electron bound to an atomorbital (at rest) is said to be quantized, which results in the stability of atoms, and of matter in general. As incorporated into the theory of quantum mechanics, this is regarded by physicists as part of the fundamental framework for understanding and describing nature at the infinitesimal level. Normally quanta are considered to be discrete packets with energy stored in them.
50.	**Energiya - Energy** –In physics, energy (Ancient Greek: Evspyeiot energeia “activity, operation” is a j indirectly observed quantity. It is often understood as the ability a physical system has to do work on other physical systems. Since work is defined as a force acting t hip ugh a distance (a length of space), energy is always equivalent to the ability to exert pulls or!