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

2-MA’RUZA:

ATOM TUZILISHI. ATOM YADROSINING TUZILISHI

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REJA:

Mavzuning ma’ruza davomida yoritiladigan qismlari:

1. Atom tushunchasi;
2. Tomson nazariyasi;
3. Yadro reaksiyalari;
4. Bor postulatlari;
5. Nurning kvant nazariyasi.

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

1. Qomusiy olimlarimiz atom borasida;
2. Dalton ta’limoti;
3. Radioaktivlik va sun’iy elementlar sintezi;
4. Shredinger tenglamasi.
5.

ASOSIY ADABIYOTLAR:

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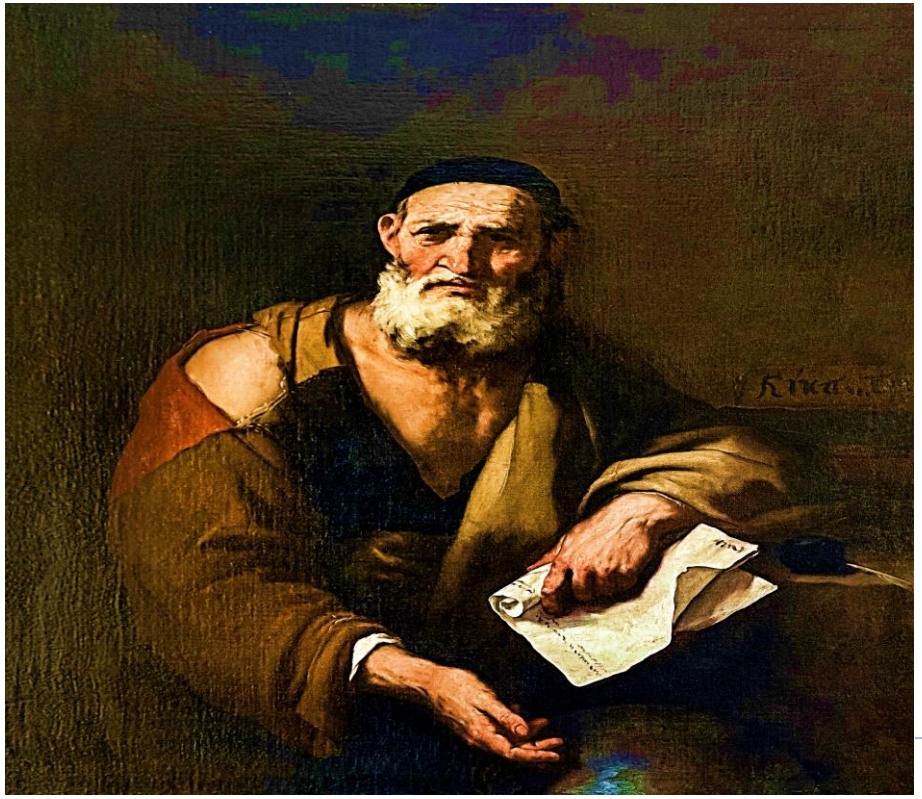
1. Atom tuzilishi

Atomistik ta'limotning asoschilari Levkipp va Demokritdir (tahminan miloddan avvalgi 460-370 yillar). Atomchilar ikkita asosiy qoidani ilgari surdilar:

1) cheksizlikka bo'linish mumkin emas, materiyaning bo'linish chegarasi bor va uni "atom" (yunoncha atomos - bo'linmas) so'zi deb atashgan, atomlar "haqiqiy". borliq, ular abadiy va doimiy mavjud;
2) "yo'qlik" ham bor - atomlar harakatlanadigan bo'shliq.



Atom tuzilishi

Atomic structure

Big Bang. 10^9 K.

J.Tomson - elektronni kashf etdi

$9{,}1095 \cdot 10^{-23}$

Elektronning massasi vodorod atom massasidan 1843 marta kichik, zaryadi -1 ga teng.

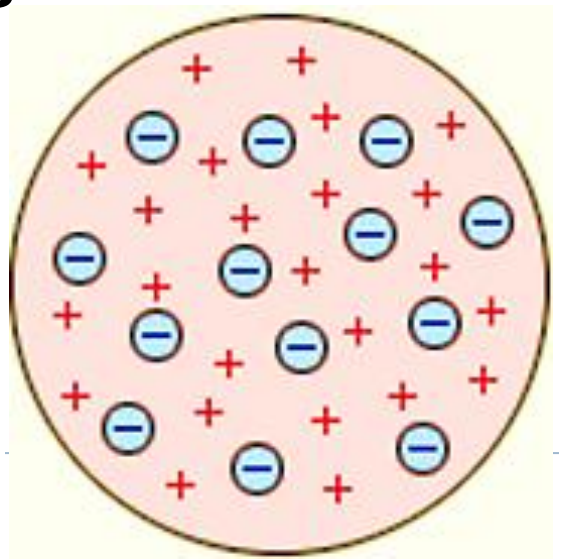
Table 1.1 Subatomic particles of relevance to chemistry

Practice	Symbol	Mass/m_u*	Mass number	Charge/e†	Spin
Electron	e^-	5.486×10^{-4}	0	−1	$\frac{1}{2}$
Proton	p	1.0073	1	+1	$\frac{1}{2}$
Neutron	n	1.0087	1	0	$\frac{1}{2}$
Photon	γ	0	0	0	1
Neutrino	ν	c. 0	0	0	$\frac{1}{2}$
Positron	e^+	5.486×10^{-4}	0	+1	$\frac{1}{2}$
α particle	α	[$^4_2He^{2+}$ nucleus]	4	+2	0
β particle	β	[e^- ejected from nucleus]	0	−1	$\frac{1}{2}$
γ photon	γ	[electromagnetic radiation from nucleus]	0	0	1

* Masses are expressed relative to the atomic mass constant, $m_u = 1.6605 \times 10^{-27}$ kg.
† The elementary charge is $e = 1.602 \times 10^{-19}$ C.

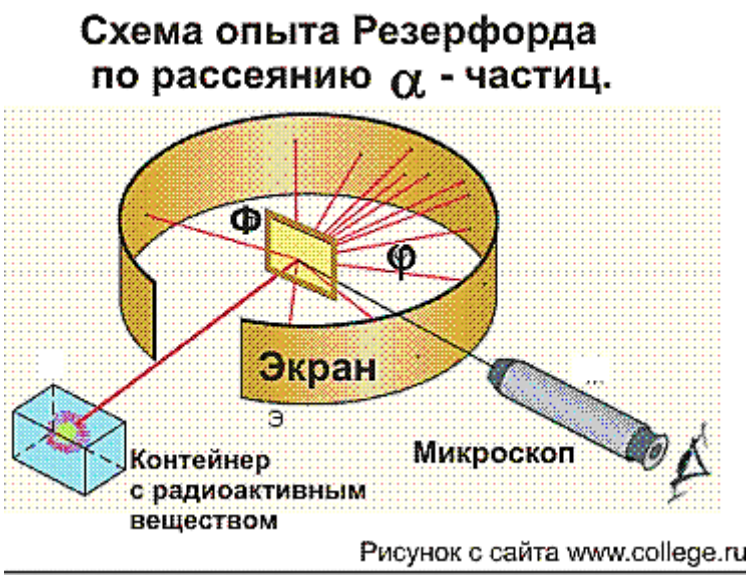
2. Atom yadrosining tuzilishi
2.1.Tomson nazariyasi

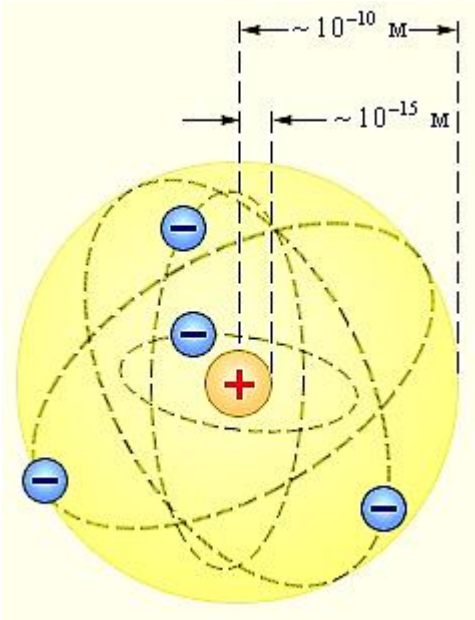
- **1903-yil J.Tomson atomning ion-elektron tuzilishini taklif etdi.**
- **Atom musbat zaryadlangan shar bo'lib, uning ichida elektronlar tebranib turadi.**
- **Atomning + (musbat) zaryadlangan qismiatomning butun hajmini egallab turadi.**

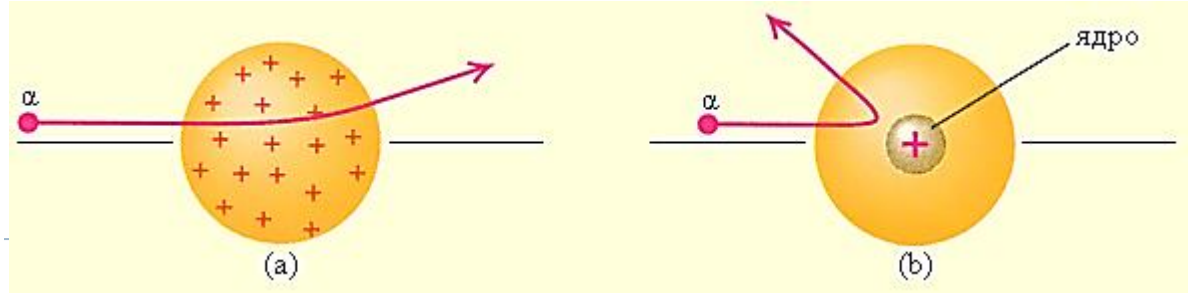


2.2. Rezerford nazariyasi α-zarrachaning yupqa metal plastinkadan o'tishi

1911-yil angliyalik fizik Ernest Rezerford atomning dinamik yoki yadroviy tuzilishini ilgari surdi.







1913-yil Rezerfordning shogirdi Mozli atom rentgen spektrlarini o’rganib:

$$\nu = A(z-b)$$

z elementning tartib raqami;

A, b doimiy sonlar;

ν- rentgen nurlanishi to’lqin chastotasi;

$$\nu = 1/\lambda$$

λ rentgen nurlarining to'lqin uzunligi.

$$_1{}^1P = 1 \quad u.b.$$

Yadroning zaryadi elementning tartib raqamiga teng

1932-yil D.I.Ivanenko hamda Geyzenberg birgalikda atomning proton-neytron nazariyasini yaratdilar:

$$N = A - Z$$

N-atomdagi neytronlar soni;

A-elementning atom massasi;

Z-elementning tartib raqami.

1932-yil Angliyalik fizik J.Chedvik zaryadsiz zarrachani kashf etdi hamda uni neytron deb nomladi.

Neytron ${}_0^1n$

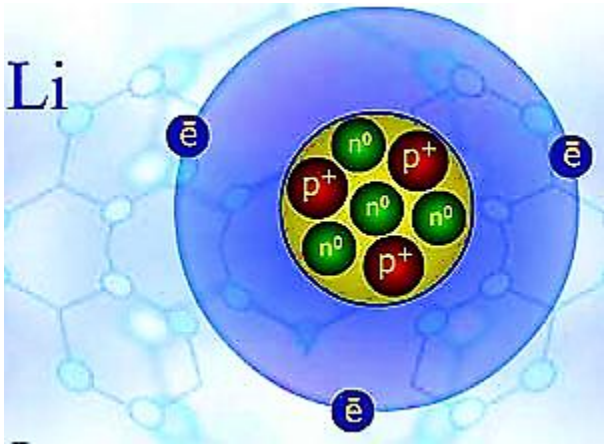
Yadroda neytronlar protonga aylanadi (o'tadi):

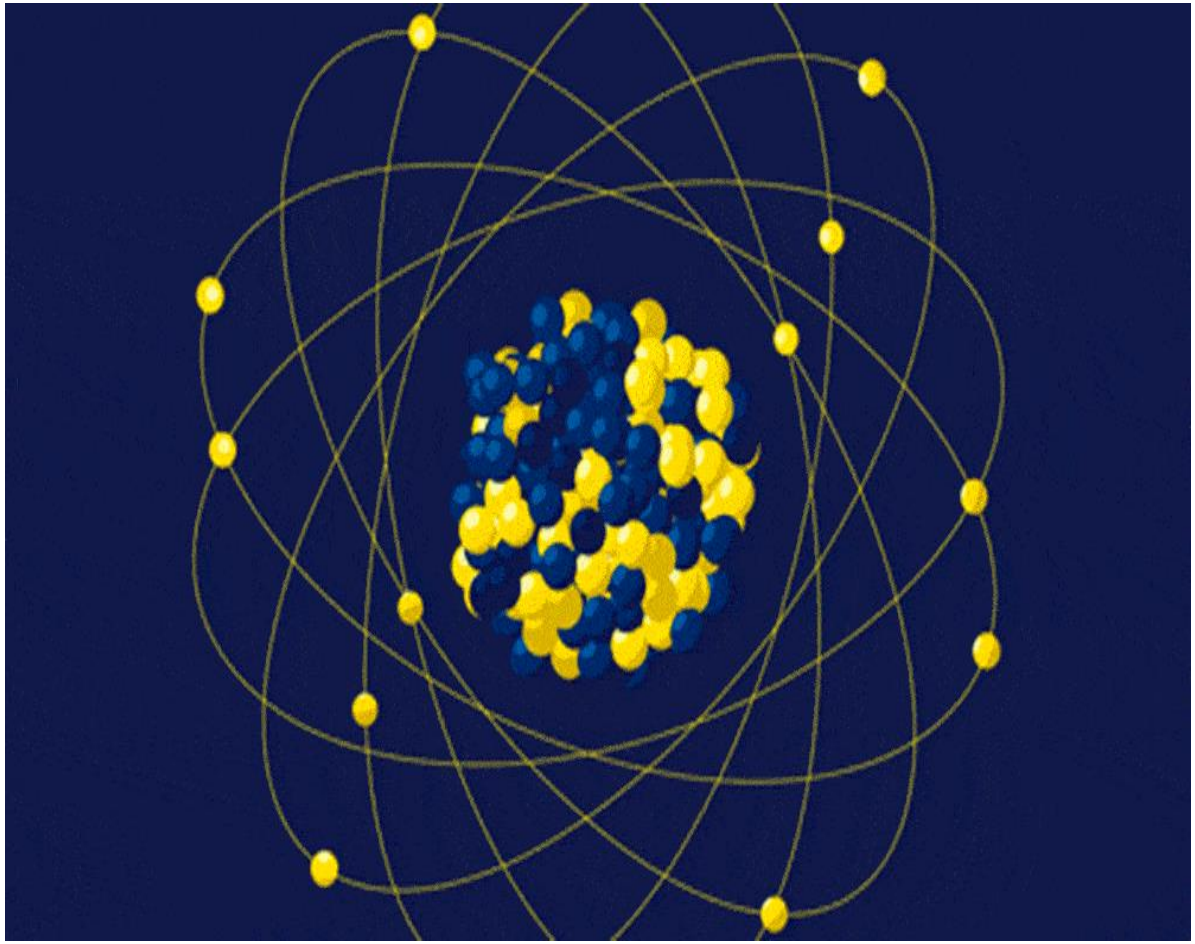
$$ {}_0^1n = {}_1^1p + {}_{-1}^{o}e $$

O'z navbatida protonlar neytronga aylanadi (o'tadi):

$$ {}_1^1p = {}_0^1n + {}_{+1}^{o}e $$

Atom modeli





Izotop, isobar va izotonlar

Изотопы: ${}_{17}^{35}Cl$ ${}_{17}^{37}Cl$; ${}_{12}^{24}Mg$; ${}_{12}^{25}Mg$; ${}_{12}^{26}Mg$

Изобары : ${}_{18}^{40}Ar$ ${}_{19}^{40}K$ ${}_{20}^{40}Ca$

Изотоны ${}_{54}^{136}Xe$ ${}_{55}^{137}Cs$ ${}_{56}^{138}Ba$

3. Yadro reaksiyalari

1919-yil E.Rezerford yadro reaksiyasini amalga oshirdi (10-7 sekund davomida)

$$_7{}^{14}N + _2{}^4\alpha \rightarrow _1{}^1H + _8{}^{17}O; \qquad _7{}^{14}N(\alpha, _1{}^1H)_8{}^{17}O$$

Uran yadrosining issiq neytronlar yordamida parchalanishi (1939-yil)

$$_{92}{}^{235}U + _o{}^1n \rightarrow _{36}{}^{92}Kr + _{56}{}^{141}Ba + 2_0{}^1n$$

Uran atomi parchalanishida 2 ta yadro hosil bo'ladi, ayni vaqtda 200 MVt energiya ajralib chiqadi.

Bu energiyaning qiymati $19{,}2 \cdot 10^9$ *кДж/моль* **ga teng yoki mazkur energiya 2 mln kg yuqori sifatli ko'mir yonishidan ajralib chiqadigan energiya miqdoriga teng.**

O’zbekiston atom elektrostansiyasi

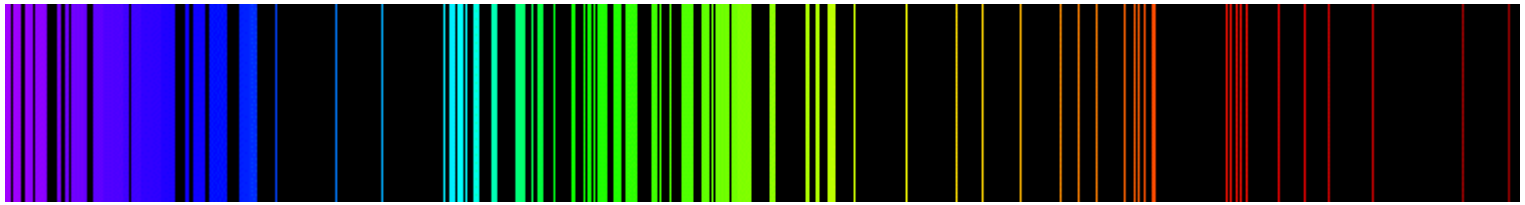
Forish tumani, quvvati 4800 MVt

МАГАТЭ

International Atomic Energy Agency

4. Atom spektrlari. Bor nazariyasi

- **Atomlarning barqarorligi.**
- **Atomlarning spektrlari bo'yicha noto'g'ri xulosalar.**
- **Kaliy spektrida 3 ta chiziq: 2 qizil va 1 binafsha.**
- **Fe va H atomlari spektrlari:**



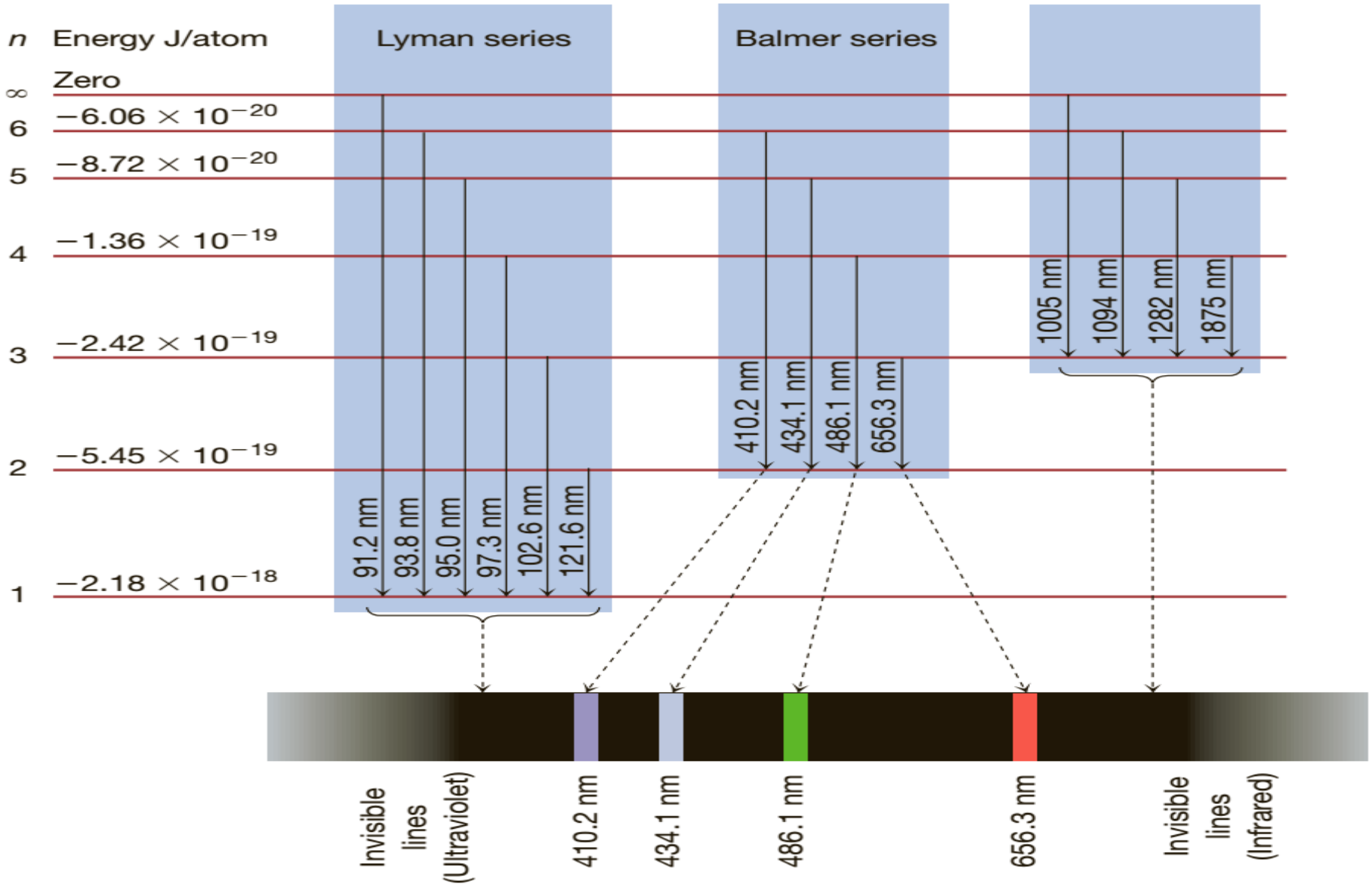
- **Bor postulotlariga ko’ra elektron qavatchalar tuzilishi:**
- Daniyalik fizik **Nils Bor** atomning yadroviy tuzilishi, nurning kvant tabiati hamda nurlanishning diskret tabiatini hisobga olgan holda o’zining atom tuzilish nazariyasi (postulotlarini) taklif etdi:
- **1. Atom yadrosida elektronlar har qanday orbitalarda emas, aksincha “statsionar orbitallar” ya‘ni “ruxsat etilgan” orbitallar bo‘ylab harakatlanadi;**
- **2. Elektron “Ruxsat etilgan” orbitallar bo’ylab harakatlanganda nur tarqatmaydi;**
- **3. Elektron bir “Ruxsat etilgan“ orbitaldan boshqa bir “Ruxsat etilgan“ orbitalga ko‘chganida nur tarqatadi. Bu elektromagnit kvanti energiyasi atomning oxirgi holatdan boshlang’ich holatga o’tgandagi energiyalari farqidan topiladi:**

$$h\nu = E_2 - E_1$$

E_2 и E_1 atomdagi turli energetik holatlardagi energiyalar farqi.

Vodorod atomining tuzilishi nazariyasi, keyin Zommerfeld ko'p elektronli atomlarning tuzilishini ishlab chiqdi.

Understand the Bohr model of the atom.



Hydrogen line spectrum and the Bohr model

Young, Susan M_Vining, William_Day, Roberta_Botch, Beatrice - General Chemistry_ Atoms First-Cengage Learning Custom P (2017)

5. Nurning kvant nazariyasi

- **1920-yil Maks Plank cho'g'lanma jismlarning nurlanishi, fotoeffekt va atom spektrlari energiyasi kvantlari diskret (uzuq-uzuq tabiatga ega) holda tarqaladi, yutiladi va chiqariladi degan xulosaga keldi.**
- **Shunga ko’ra nur energiyasi:**

$$E = h \cdot \nu$$

- **E-nur energiyasi, ν-nur chastotasi, h-proporsionallik koeffisienti yoki Plank doimiysi. h=6,626 ·10^{-34} J/sek**

6. Kvant mexanikasi asoslari

1924-yilda de Broyl (Fransiya) korpuskulyar-to'lqin tabiati nafaqat fotonlarga, balki boshqa moddiy zarrachalarga (elektron) ga ham xosdir, deb taklif qildi:

$$\lambda = \frac{h}{m \cdot V}$$

m – zarracha massasi (elektron);
v - zarracha tezligi (elektron).

Elektronografiya, elektron difraksiyasi.

Kvant mexanikasining asosiy qoidalaridan biri Geyzenberg tomonidan o'rnatilgan noaniqlik prinsipidir.

Ayni bir vaqtda zarracha koordinatalarni va uning chastotasini aniqlash mumkin emas.

(p=m•v) **$\Delta q \Delta v \geq h|m$**

$$\Delta P \cdot \Delta x \geq \frac{h}{4\pi}$$

E’tiboringiz uchun raxmat!