

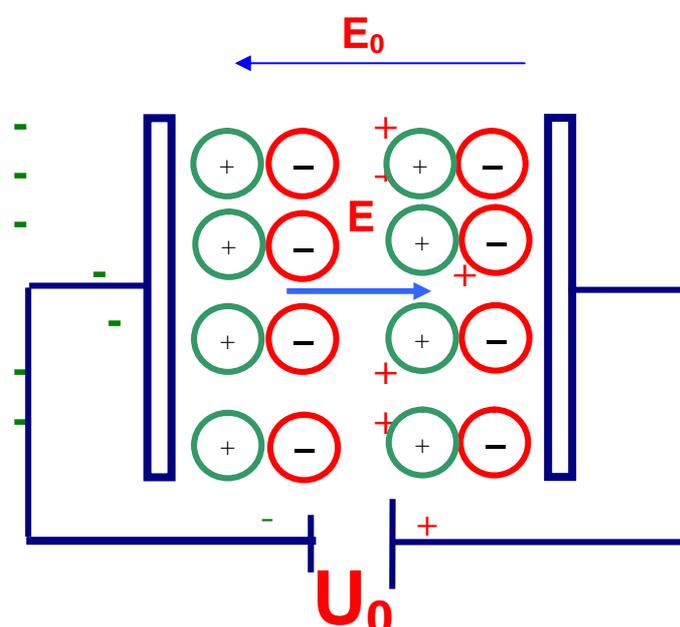
O‘ZBEKISTON RESPUBLIKASI OLIY VA O‘RTA MAXSUS TA‘LIM
VAZIRLIGI

O‘RTA MAXSUS, KASB-HUNAR TA‘LIMI MARKAZI

DO‘KUHTRI ning "Zamonaviy o‘qitish vositalari va axborot texnologialari" bo‘limi

FIZIKADAN

rangli o‘quv-uslubiy ko‘rgazmalar



$$e = \frac{E_0}{E}$$

*Akademik litsey va kasb-hunar kollejlari uchun
mo‘ljallangan*

Toshkent - 2002

Mualliflar:

Ilmiy rahbar:

O‘MKTRI ning “Zamonaviy o‘qitish vositalari va axborot texnologiyalari” bo‘limi boshlig‘i
f.m.f.n., dots. Xasanov E.G.

O‘MKTRI ning “Zamonaviy o‘qitish vositalari va axborot texnologiyalari” bo‘limi ilmiy xodimlari

f.m.f.n., dots. Yusupov R.A.

EHM operatori:

Nadjimova N.S.

Taqrizchilar:

Pedagogika fanlari doktori,

professor Mirzaxmedov B.

Pedagogika fanlari nomzodi,

dotsent Isyanov R.G.

MUNDARIJA

ELEKTROSTATIKA

1. Jismni elektrlash. Elektr zaryadning ikki turi-----	6
2. Elektr zaryadlarning o‘zaro ta’siri-----	7
3. Elektrostatikaning asosiy qonuni. Kulon qonuni-----	7
4. Muhitning dielektrik singdiruvchanligi-----	8
5. Elektr maydoni kuchlanganligi-----	9
6. Elektr maydon kuch chiziqlari-----	10
7. Ekvipotentsial sirtlar-----	11
8. Elektr maydon potentsiali-----	12
9. Elektr sig’imi. Sharning elektr sig’imi-----	12
10. Kondensatorlar, ularni ketma-ket va parallel ulash-----	13
11. Kondensator turlarni (yassi, sferik, silindrik)-----	14

O‘ZGARMAS TOK

12. Elektr toki. Tok kuchi-----	15
13. Zanjirning qismi uchun Om qonuni-----	16
14. Metall o‘tkazuvchining elektr qarshiligi-----	17
15. Metall o‘tkazgich qarshiligining haroratga bog‘liqligi-----	18
16. O‘tkazgichlarni ketma-ket va parallel ulash-----	19
17. O‘zgarmas tok manbayi-----	20
18. Berk zanjir uchun Om qonuni-----	20
19. Tok manbalarini ketma-ket va parallel ulash-----	21
20. Elektr zanjir uchun Kirxgof qonuni-----	22
21. Elektrolitlarda elektr tok-----	23
22. Gazlarda elektr toki. Elektr zaryadi-----	24
23. Vakuumda elektr toki. Elektron lampa-----	25
24. Yarimo‘tkazgichda elektr toki-----	25
25. Yarimo‘tkazgichning aralashmali o‘tkazuvchanligi-----	26
26. Elektron-teshikli o‘tkazuvchanlik-----	27

ELEKTROMAGNETIZM

27. Parallel toklarning ta’siri-----	28
28. Magnit maydonini grafikda ko‘rsatish-----	29
29. Magnit maydonida tokli o‘tkazgich. Amper kuchi-----	30
30. Magnit maydonida zaryadga ta’sir etuvchi kuch. Lorens kuchi-----	31
31. Elektromagnit induksiya qonuni-----	32
32. O‘zinduksiya elektr yaratuvchi kuch-----	33
33. Induksion magnit hususiyati-----	34
34. Jismning magnit hususiyati-----	34
35. Muhitning absolyut va nisbiy magnit singdiruvchanligi-----	35

36. Paramagnit va diamagnit hususiyati-----	36
37. Ferromagnitlar, jismning ferromagnitik va antiferromagnetik hususiyati. Gisterezis-----	37

OPTIKA

38. Yorug'likning to'g'ri chiziqli tarqalishi-----	38
39. Yorug'likning qaytish va sinish qonunlari-----	39
40. Jismning sindirish korsatkichi. to'la ichki qaytish-----	39
41. Yig'uvchi va sochuvchi ko'zgu, linzalar. Ko'zgu va linza ifodalari----	40
42. Yo'rug'lik interferentsiyasi-----	42
43. Yo'rug'lik difraktsiyasi-----	43
44. Yo'rug'lik dispersiyasi-----	44
45. Yo'rug'likning qutublanishi-----	44
46. Fotoelektrik effekt-----	45

ATOM VA YADRO FIZIKASI

47. Atom tuzilishi. Rezerford tajribasi. α , β , γ - parchalanish-----	47
48. Spontan va induksion nurlanish-----	48
49. Lazerning tuzilishi-----	49
50. Atom yadrosining tuzilishi-----	49
51. Yadro reaksiyasi. Radioaktivlik-----	50

Kirish soʻzi

Kadrlar tayyorlash milliy dasturining ikkinchi bosqichida oqitish samaradorligini va sifatini zamonaviy talab darajasiga koʻtarish maqsadida yangi oʻqitish vositalaridan keng foydalanish lozim.

Shu maqsadga erishish uchun oʻrta maxsus, kasb-hunar taʼlimini rivojlantirish institutining "Zamonaviy oʻqitish vositalari va axborot texnologiyalari" boʻlimi tomonidan eʼtiboringizga havola qilinayotgan elektron miniplakatlar yaratildi va maʼlumotlar kompakt diskga (SD) yozildi.

Ushbu oʻquv-elektron plakatlarga akademik litsey va kasb-hunar kollejlarda oʻqitiladigan fizika kursining **elektr, optika, atom va yadro fizikasi** qismlariga oid va oʻquv dasturlariga mos keluvchi mavzular kiritilgan.

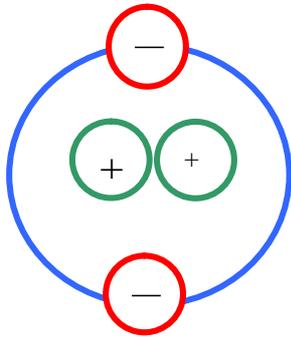
Undan tashqari bu oʻquv mahsulotlaridan kasb-hunar kollejlarning quyidagi maxsus kurslarida darslarni oʻtish jarayonida foydalanish tavsiya etiladi: **"Umumiy elektrotexnika asoslari"**, **"Elektrotexnika va elektronika asoslari"**, **"Elektr zanjirlar nazariyasi"**.

Kompakt diskdan foydalanish usullari:

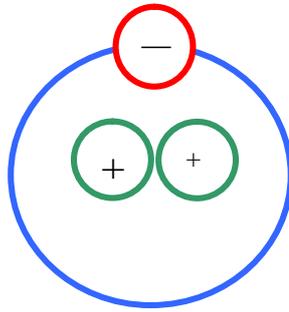
1. Dars oʻtish jarayonida oʻqituvchi kompakt-diskni kompyuterga oʻrnatib, multimedia-proektor orqali maʼlumotni ekranga tushirib, kerak miniplakatlarni tanlaydi va oʻquvchilarga tushuntiradi.
2. Kompyuter sinfida oʻquvchilar mustaqil ravishda miniplakatlarni oʻrganishlari mumkin.
3. Printer yordamida qogʻozga chiqarilgan miniplakatlar televizorga yoki multimedia-proektorga ulangan video-koʻz orqali tasviri ekranga tushirilib, oʻqituvchi tomonidan tushuntiriladi.
4. Printer yordamida slaydga chiqarilgan miniplakatlar kodoskop yordamida ekranga uzatiladi va tushuntiriladi.

ELEKTROSTATIKA

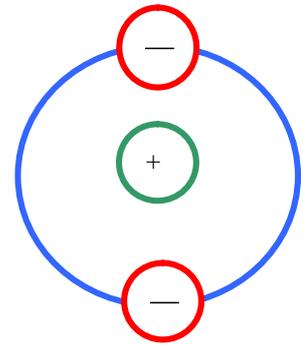
1. Jismni elektrlash. Elektr zaryadning ikki turi



elektr befarq holat

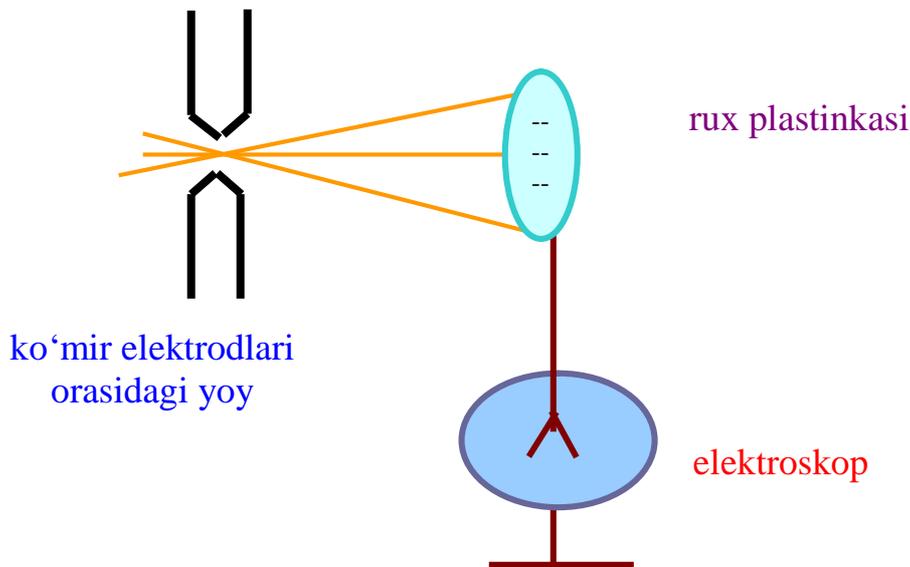


musbat zaryadlanish



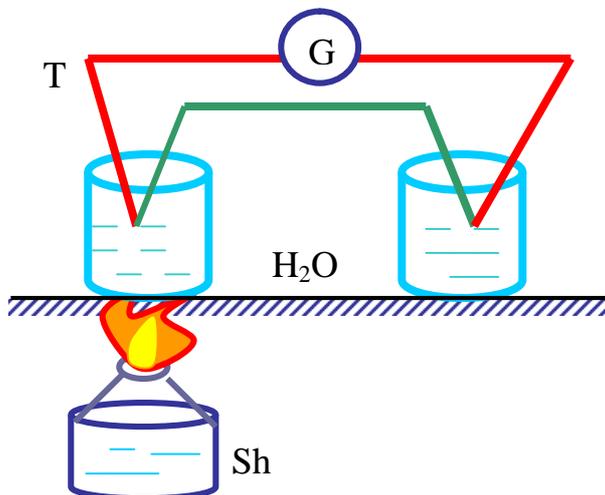
manfiy zaryadlanish

Yorug'lik ta'sirida zaryadlash



ko'mir elektrodleri orasidagi yoy

O'tkazgichlarni qizdirish tufayli zaryadlar hosil qilish



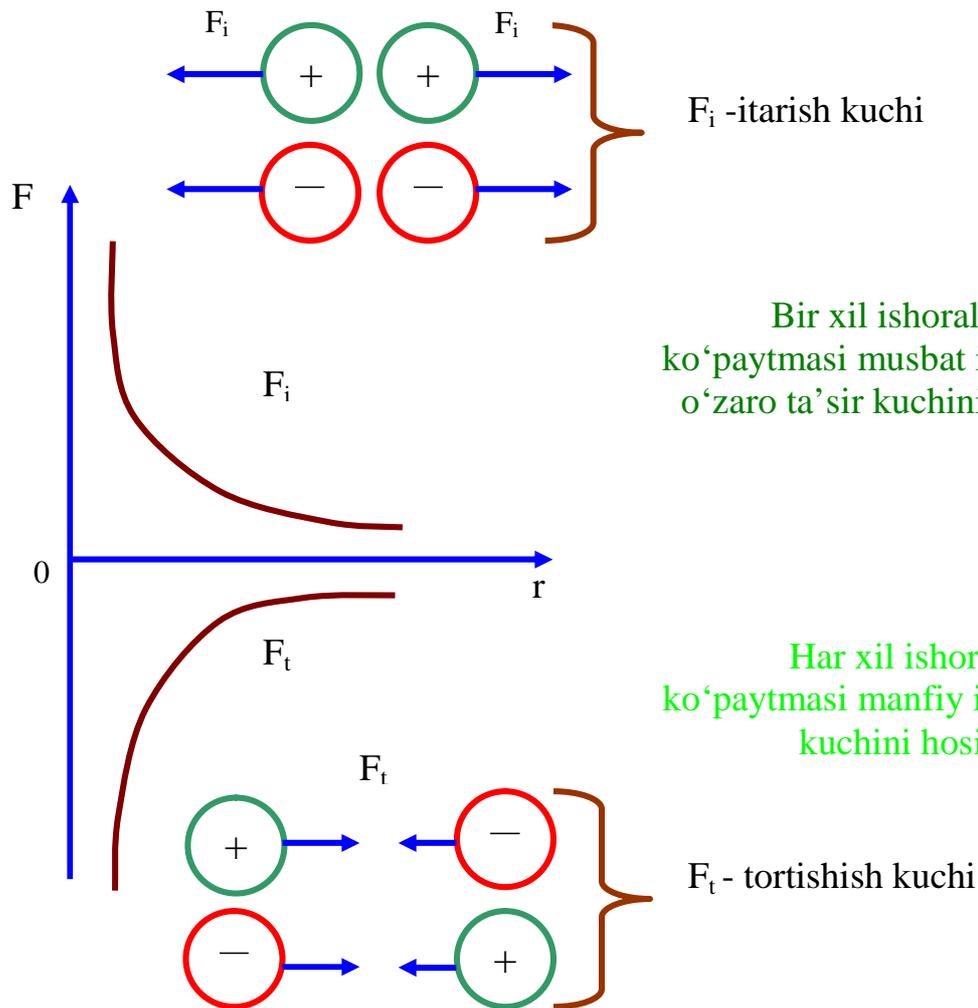
G - galvonometr;

T - termopara;

Sh - shamdon

G galvonometrik orqali kuchsiz tok o'tadi

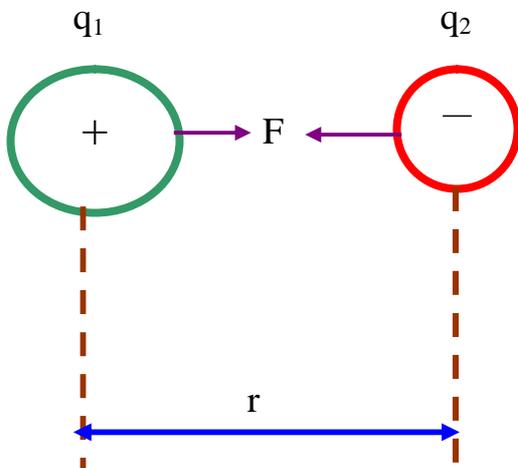
2. Elektr zaryadlarning o'zaro ta'siri



Bir xil ishorali zaryadlar ko'paytmasi musbat ishorali itarish o'zaro ta'sir kuchini hosil qiladi.

Har xil ishorali zaryadlar ko'paytmasi manfiy ishorali tortishish kuchini hosil qiladi.

3. Elektrostatika qonuni. Kulon qonuni



$$F_k = \frac{q_1 \cdot q_2}{4 \epsilon_0 p e r^2}$$

$$q_1 > q_2$$

q_1 ba q_2 -elektr zaryadlar;
 r -zaryad markazlarigacha masofa;

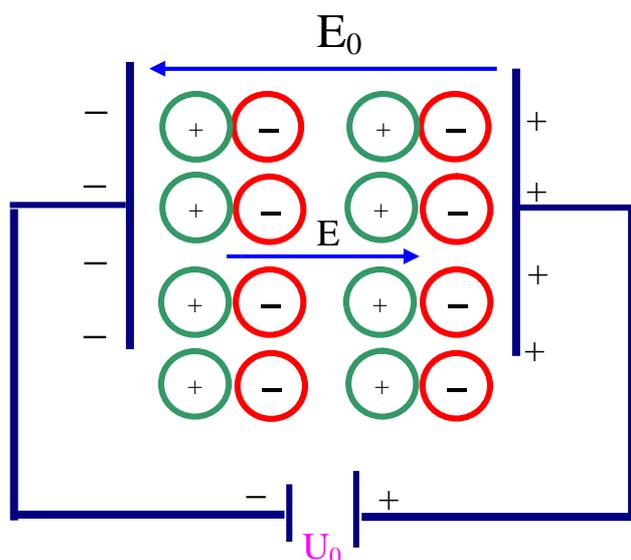
$\epsilon_0 = 8,85 \cdot 10^{-12} \frac{Kl^2}{H \cdot M^2}$ elektr

doimiysi;

ϵ - elektr singdiruvchanlik;

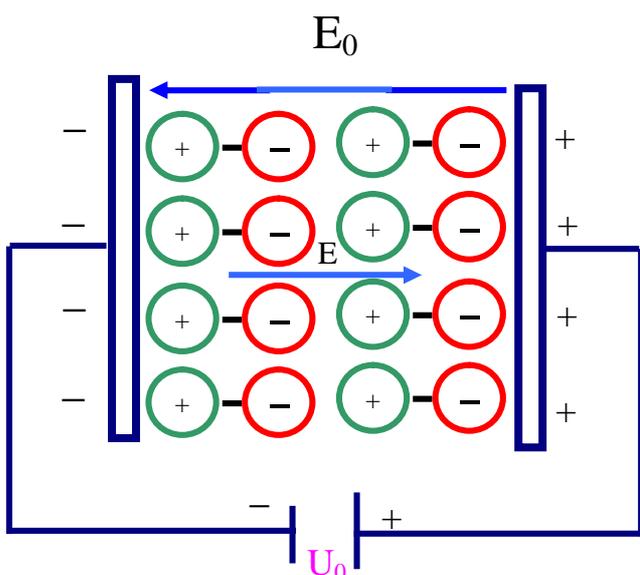
F - zaryadlarning o'zaro ta'sir etuvchi elektr kuchi- Kulon kuchi.

4. Muhitning dielektrik singdiruvchanligi



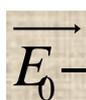
qutbsiz dielektriklar: inert gazlar, O_2 , H_2 , polietilen va t.b.

Musbat va manfiy zaryadlar taqsimotining markazlari ustma-ust tushadigan atom yoki molekulalar qutbsiz dielektriklar



qutbli dielektrik suv, spirt va t.b.

Musbat va manfiy zaryadlar taqsimotining markazlari ustma-ust tushmaydigan molekulalar qutbli dielektriklar



elektr maydonining vakuumdagi kuchlanganligi;



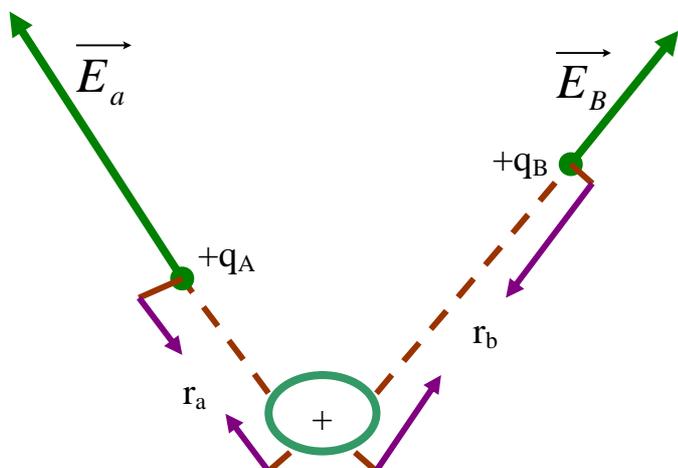
tashqi elektr maydonidagi dielektrik muhitning elektr maydoni;

ϵ - nisbiy dielektrik singdiruvchanlik;

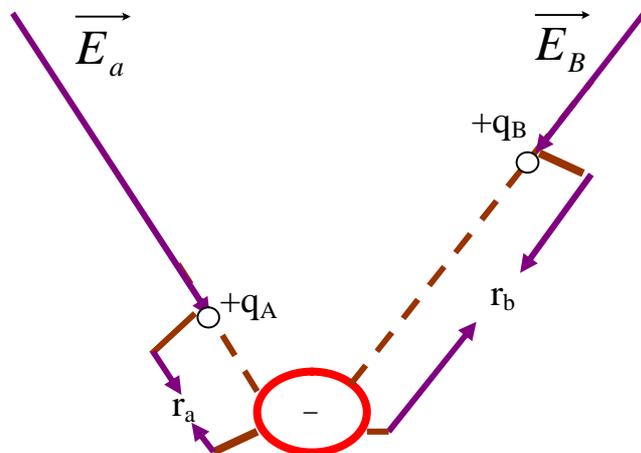
$$\epsilon = \frac{E_0}{E}$$

5. Elektr maydon kuchlanganligi

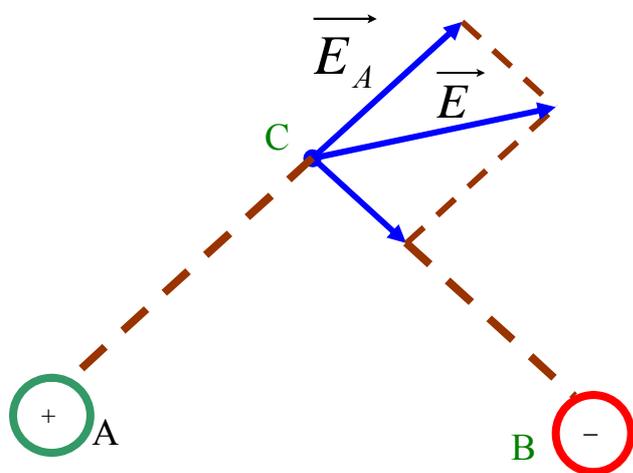
$+q_A$ va $+q_B$ birlik musbat zaryadlar



$$E_A = \frac{q}{4\pi\epsilon_0\epsilon_r r_a^2}$$



$$E_B = \frac{q}{4\pi\epsilon_0\epsilon_r r_b^2}$$



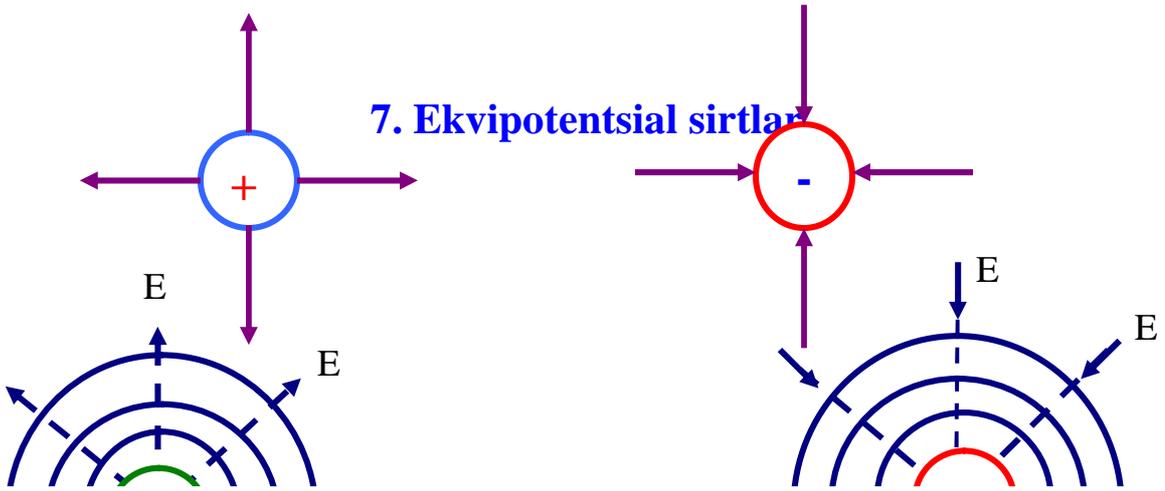
$+q$ - r_a va r_b masofada joylashgan nuqtaviy zaryadlar;
 E_A va E_B - elektr maydon kuchlanganligi vektorlari;
 ϵ_0 - elektr doymiy;
 ϵ - nisbiy elektr singdiruvchanligi;

A va B nuqtadagi zaryadlarning C - nuqtada hosil qiluvchi E - elektr maydon kuchlanganligi.

$$E = \sqrt{E_A^2 + E_B^2 + 2E_A E_B \cos(\angle E_A E_B)}$$

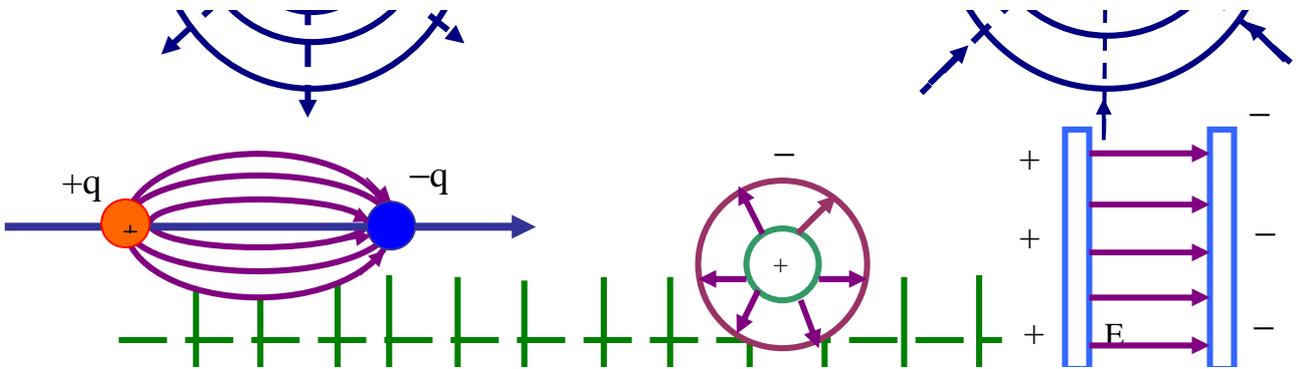
6. Elektr maydon kuch chiziqlari

7. Ekvipotensial sirtlar

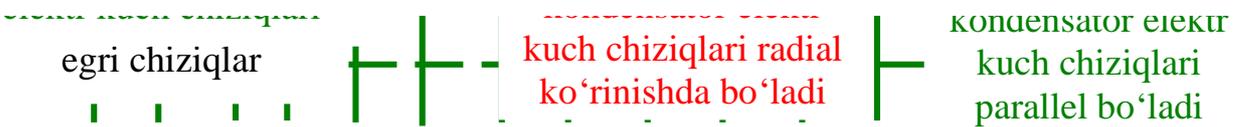


Nuqtaviy musbat va manfiy zaryadlarning ekvipotensial sirlari konsentrik aylanalardan iborat

E



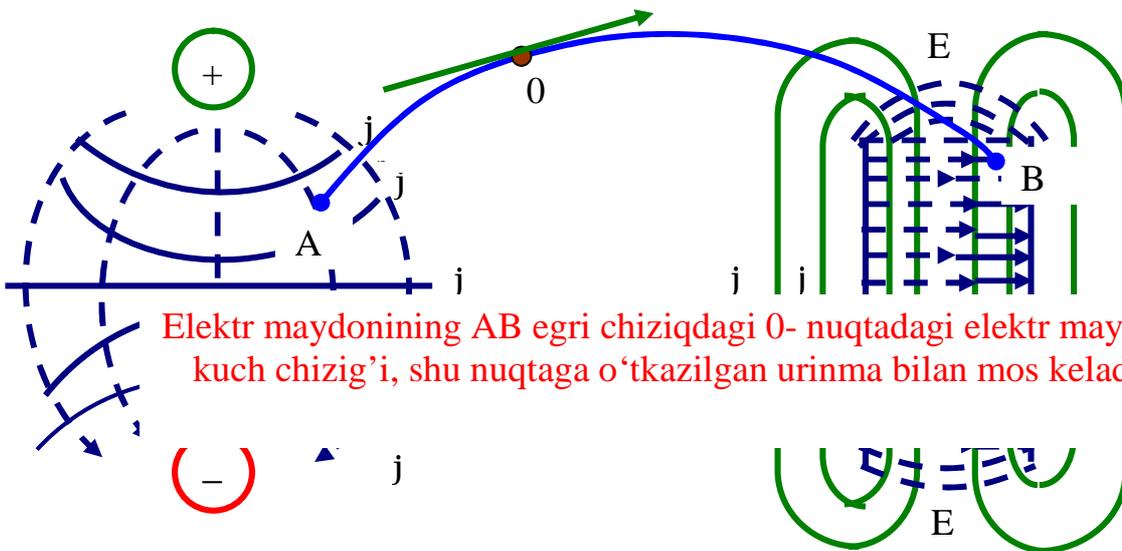
bir jinsli elektr maydonning ekvipotensial sirlari maydon kuch chiziqlariga tik



egri chiziqlar

kuch chiziqlari radial ko'rinishda bo'ladi

kondensator elektr kuch chiziqlari parallel bo'ladi



Elektr maydonning AB egri chiziqdagi 0- nuqtadagi elektr maydon kuch chizig'i, shu nuqtaga o'tkazilgan urinma bilan mos keladi.

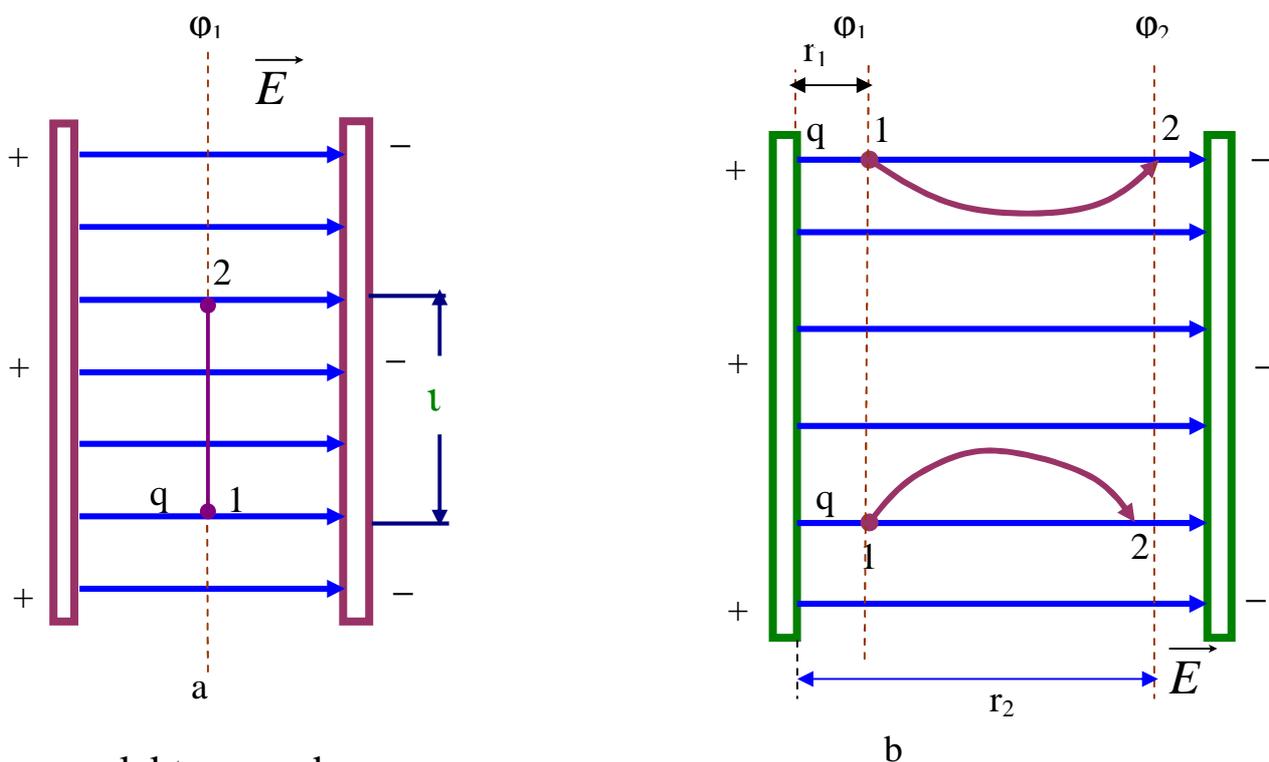
dipolning ekvipotensial sirti

kondensatorning ekvipotensial sirti

E - elektr maydon kuch chiziqlari.

o - ekvipotensial sirtlar

8. Elektr maydon potentsiali



q - elektr zaryad

1 va 2 - zaryadni ko'chirish nuqtalari;

$r_2 - r_1 = l$ - zaryadning ko'chish masofasi;

a - holda zaryad bajargan ish nulgga teng;

b - holda zaryad bajargan ish $A = qE(r_2 - r_1) = -(W_{p2} - W_{p1})$;

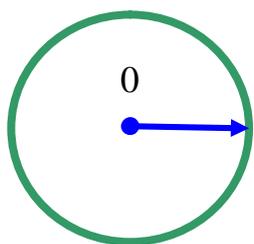
W_p - zaryadning potentsial energiyasi;

$j = \frac{W_p}{q}$ - berilgan zaryad potentsiali;

9. Elektr sig'imi. Sharning elektr sig'imi

$$C = \frac{q}{u}$$

birligi F- farada



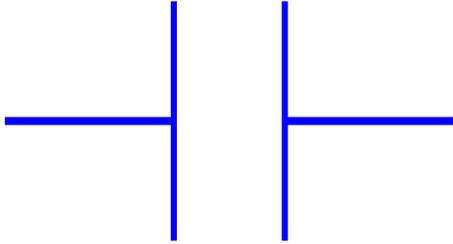
ϵ_0 - elektr doymiy;

ϵ - nisbiy dielektrik singdiruvchanlik;

r - shar radiusi;

$$C = 4\pi \epsilon_0 \epsilon r$$

10. Kondensatorlar, ularni ketma-ket va parallel ulash



yassi kondensator;

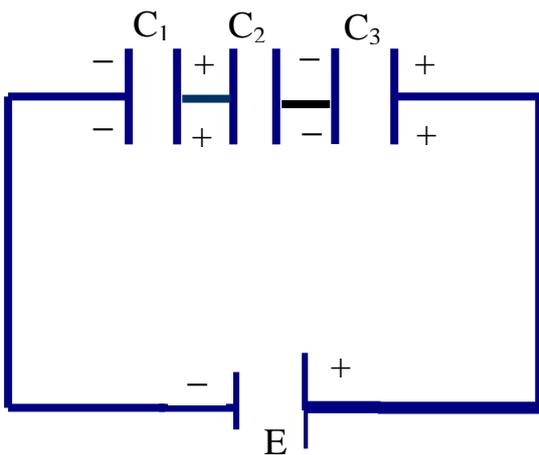
$$C = \frac{\epsilon \epsilon_0 S}{r}$$

S - kondensator qoplaminig yuzasi;

ϵ_0 - elektr doymiy;

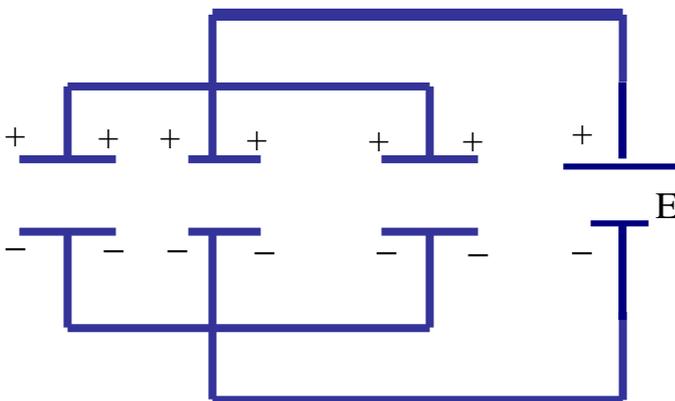
ϵ - nisbiy dielektrik singdiruvchanlik;

r - kondensator qoplamlari orasidagi masofa;



$$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$$

ketma-ket ulash



$$C = C_1 + C_2 + C_3$$

$C_1 C_2 C_3$ - kondensatorning sig'imi;

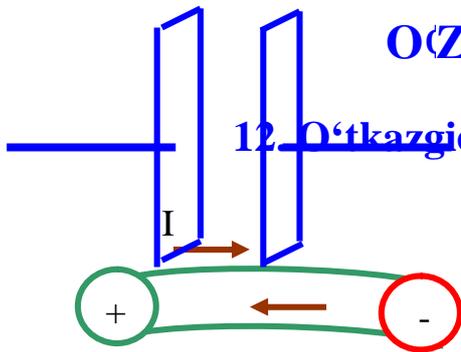
C - umumiy sig'im;

E - doymiy elektr manbayi;

parallel ulash

11. Kondensator turlarni (yassi, sferik, silindrik)

O'ZGARMAS TOK

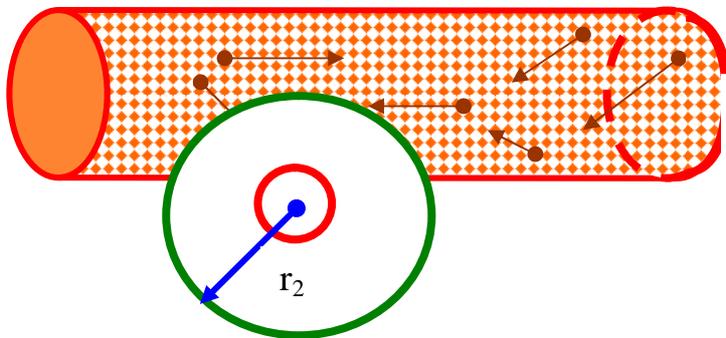


vassi parallel kondensator

12. O'tkazgichda elek

$$C = \frac{\epsilon_0 \epsilon S}{d}$$

har bir zaryadlangan o'tkazgichlarni sim bilan ulasak, tok o'tadi.



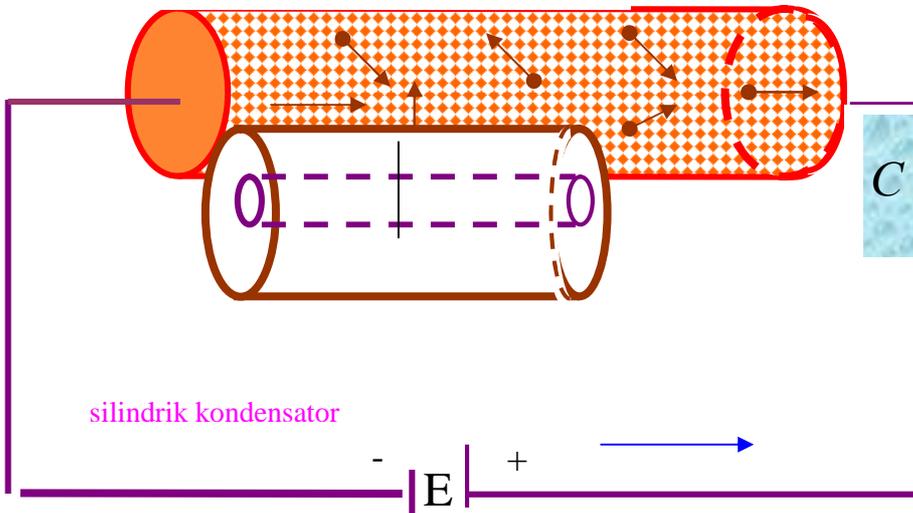
sferik kondensator

odatdagi holatda

$$C = 4\pi \epsilon_0 \epsilon \frac{r_1 r_2}{r_2 - r_1}$$

sonlar

tashqi elektr maydon ta'sirida elektronlarning o'rtacha tezligi taxminan tartibli bo'ladi.



silindrik kondensator

$$C = 2\pi \epsilon_0 \epsilon \frac{l}{\ln \left(\frac{r_2}{r_1} \right)}$$

irishi;
di;
cha tezligi;

s - vaqt birligi (sekund)
 Δt - vaqti o'zgarishi;
 $I(t)$ - tok kuchi;
 n- elektron konsentratsiyasi;
 E - tok manbayi;

ϵ_0 - elektr doyimiy;

ϵ - nisbiy dielektrik singdiruvchanlik;

$\Delta q =$ zarya

$\Delta q = I(t) \cdot$

vaqtdagi z

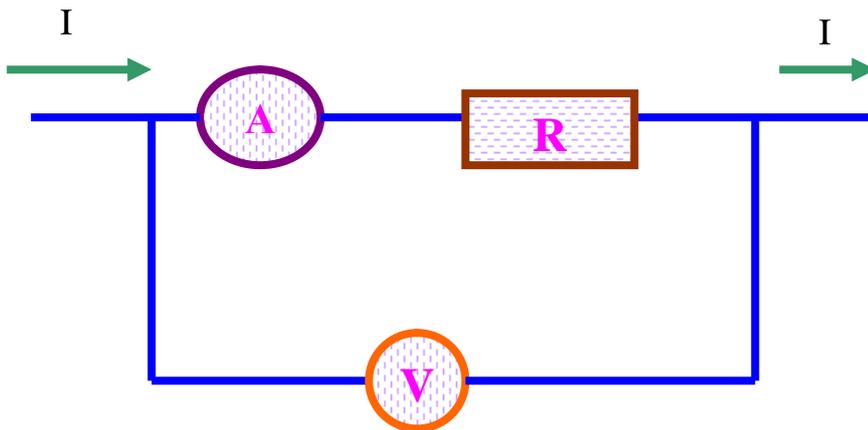
o'zgarishi.

$I = \Delta q / \Delta t$ Tok kuchi,

uning birligi

$$1 \text{ A} = \frac{\text{Kl}}{\text{S}}$$

13. Zanjirning qismi uchun Om qonuni

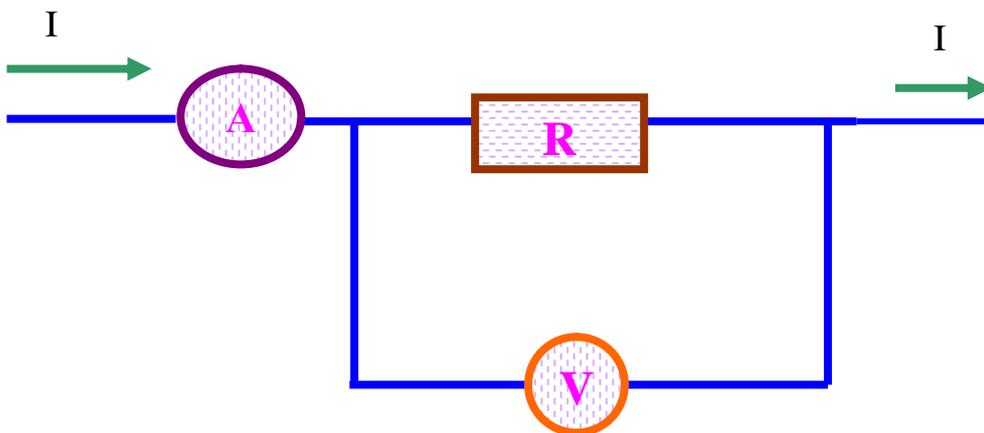


$$I = \frac{V}{R}$$

A - ampermetr;

R - qarshilik;

V - voltmetr;

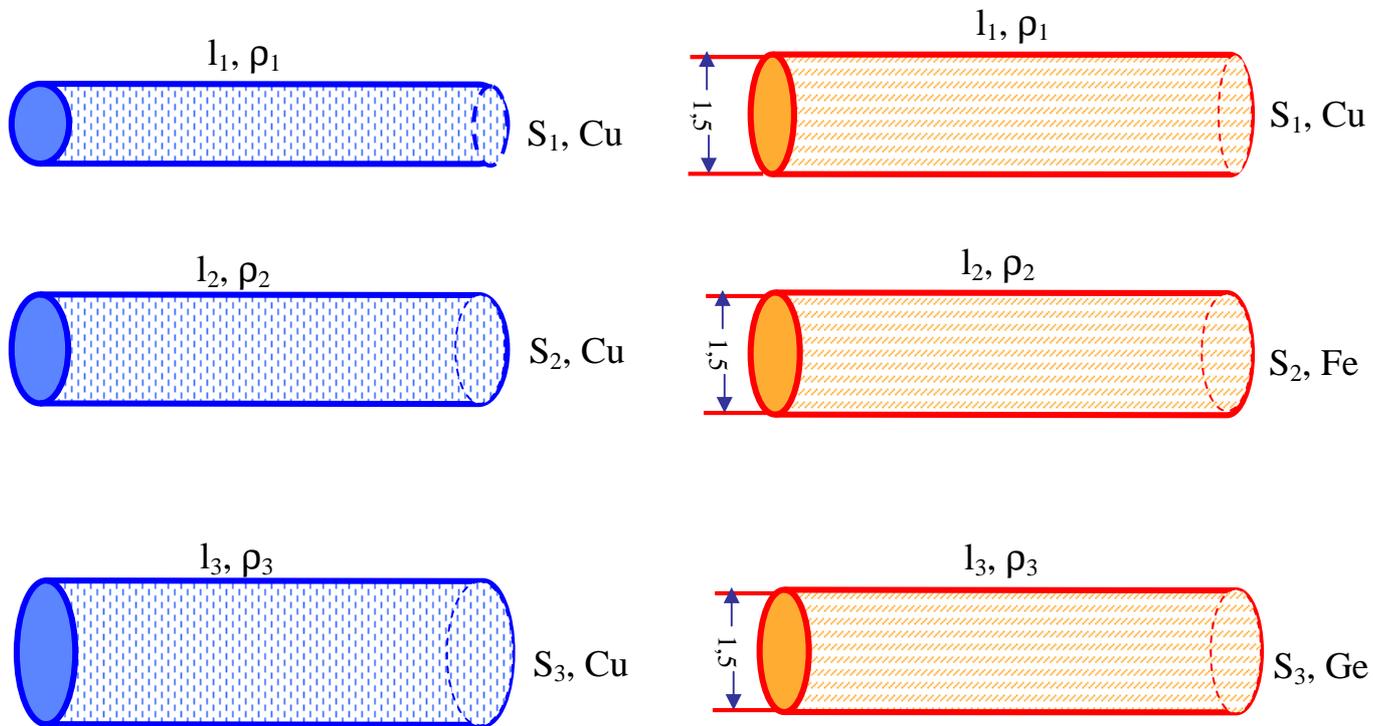


$$R = \frac{V}{I}$$

$$10\ m = 1\ \frac{B}{A}$$

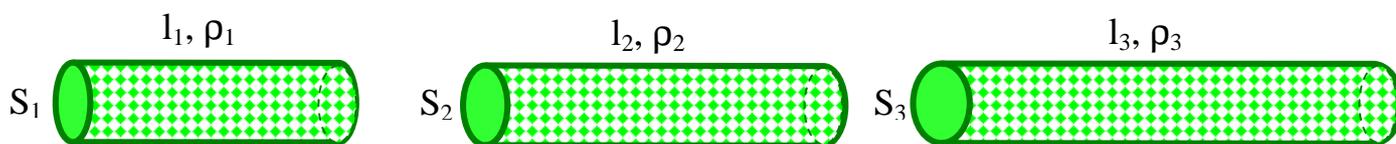
birligi

14. Metall o'tkazuvchining elektr qarshiligi



$l_1 = l_2 = l_3.$
 $\rho_1 = \rho_2 = \rho_3.$
 $S_1 < S_2 < S_3.$
 $R_1 > R_2 > R_3.$

$l_1 = l_2 = l_3.$
 $\rho_1 < \rho_2 < \rho_3.$
 $S_1 = S_2 = S_3.$
 $R_1 < R_2 < R_3.$



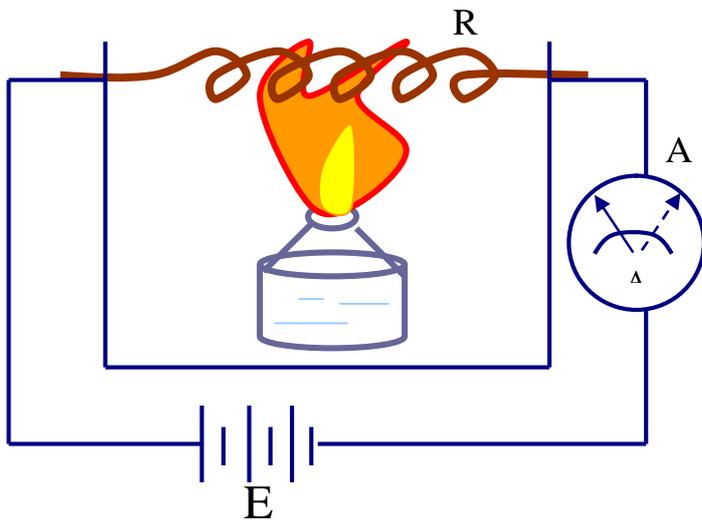
$l_1 < l_2 < l_3;$

$\rho_1 = \rho_2 = \rho_3;$

$S_1 = S_2 = S_3;$

$R_1 < R_2 < R_3.$

15. Metall o'tkazgich qarshiligining haroratga bog'liqligi.



$$R_t = R_0 (1 + \alpha t)$$

R- metall qarshilik;

c- shamdon;

A- Ampermetr;

E- tok manbayi;

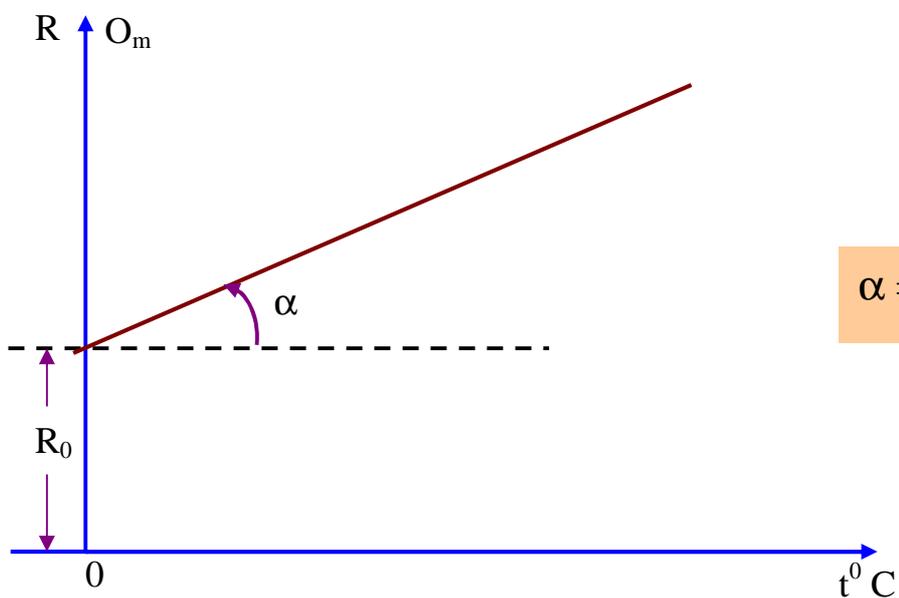
R₀- nol gradus Selsiydagi metall qarshilik;

α- qarshilikning harorat koeffitsienti;

t- Selsiy shkalasidagi harorat;

R_t- **t** haroratdagi qarshilik;

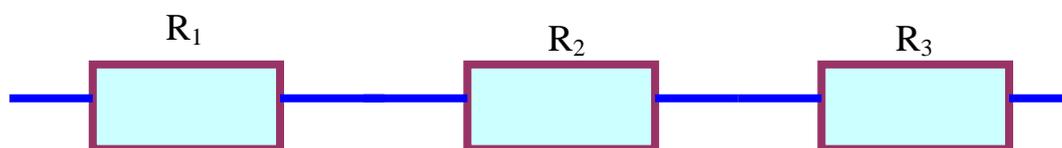
Qarshilikning haroratga bog'liqlik grafigi



$$\alpha = (R_t - R_0) / t$$

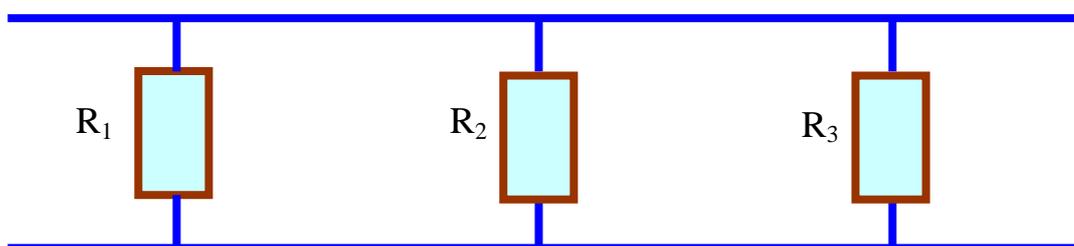
16. O'tkazgichlarni ketma-ket va parallel ulash.

O'TKAZGICHLARNI KETMA-



$$R = R_1 + R_2 + R_3$$

parallel ulash

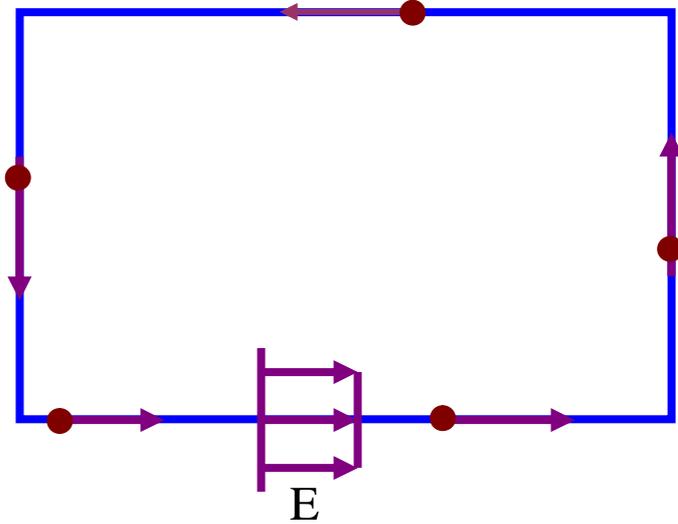


$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

R_1, R_2, R_3 - o'tkazgichlarning qarshiliklari;

R - umumiy qarshilik;

17. O'zgarmas tok manbayi

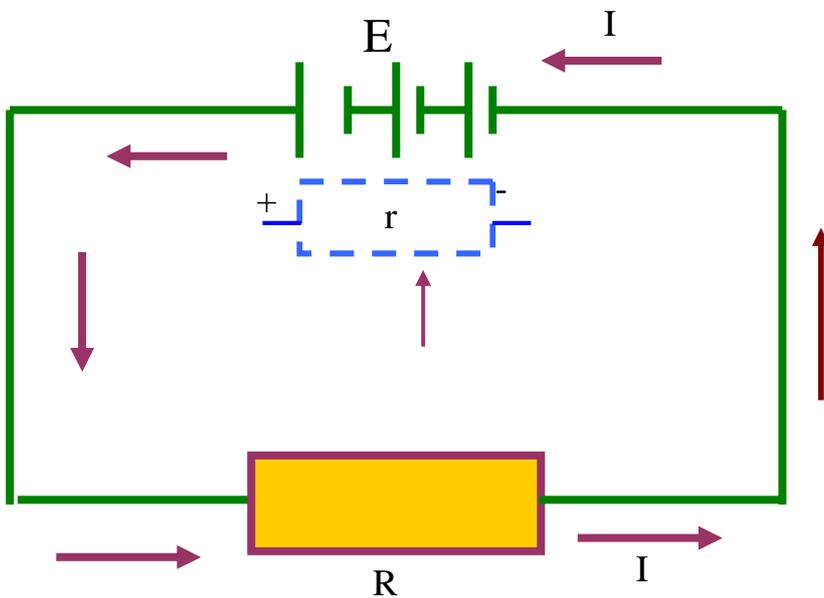


● → -elektron harakati

Galvanik elementda, akkumulyatorda, batareyada, kimyoviy reaksiya natijasida tok hosil bo'ladi.

Elektr tok manbasining bir qutbidan ikkinchi qutbiga o'tish uchun elektromagnit tabiyatga ega bo'lmagan ish bajarishi kerak.

18. Berk zanjir uchun Om qonuni



E - elektr tok manbayi;

r- manbaning ichki qarshiligi;

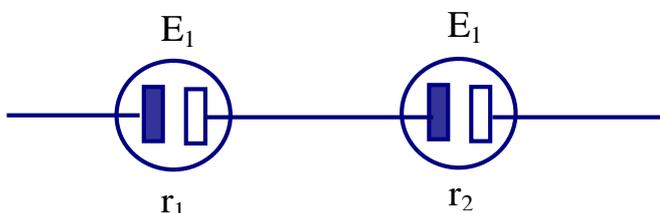
R- tashqi qarshilik;

I - zanjirdan o'tuvchi tok;

$$I = \frac{E}{R + r}$$

19. Tok manbalarini ketma-ket va parallel ulash.

TOK MANBALARI



$E = E_1 + E_2$ - umumiy elektr yurituvchi kuch;

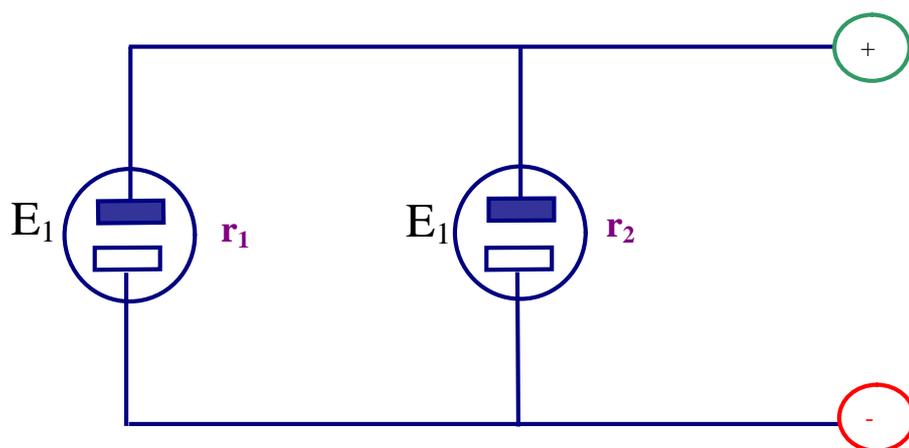
$r = r_1 + r_2$ - umumiy ichki qarshilik;

E_1 va E_2 - o'zgarmas tok manbalari;

r_1 va r_2 - tok manbalarining ichki qarshiligi;

I - tok kuchi;

TOK MANBALARINI KETMA-

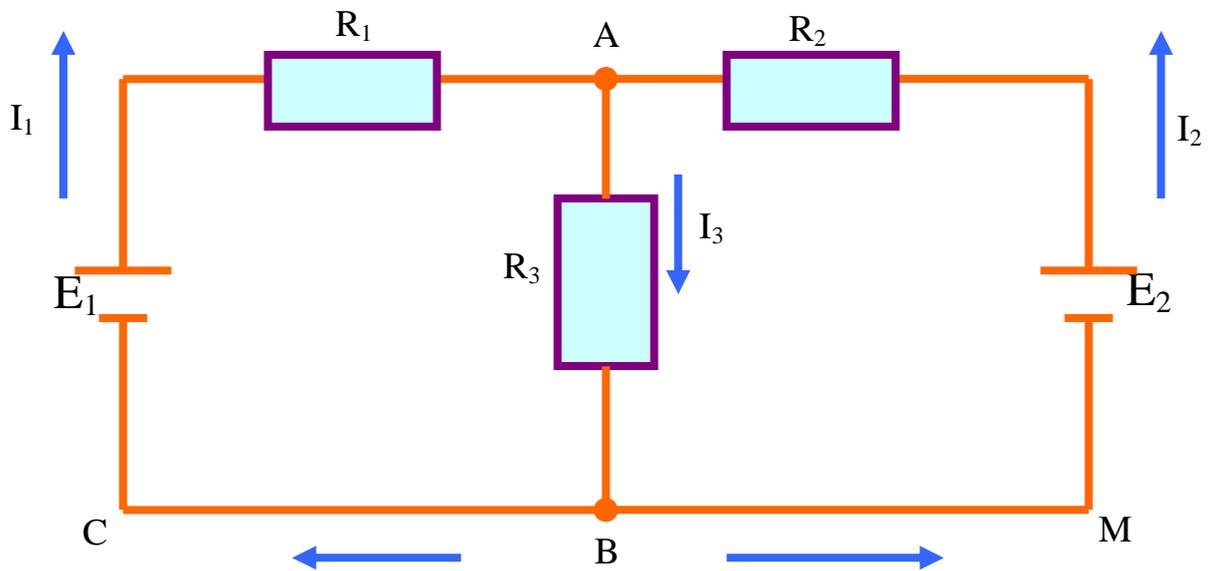


$$E_1 = E_2; \quad E = 0; \quad I = 0;$$

$$E_1 > E_2; \quad E = E_1 - E_2; \quad I \neq 0;$$

$$E_1 < E_2; \quad E = E_2 - E_1; \quad I \neq 0;$$

20. Elektr zanjir uchun Kirxgof qoidasi



E_1 va E_2 - tok manbalari;

R_1 , R_2 va R_3 - qarshiliklar;

Ikkita tugunlar A va B uchun Kirxgofning birinchi qoidasi;

$$I_1 + I_2 = I_3; I_1 + I_2 - I_3 = 0;$$

Kirxgofning birinchi qoidasi: tugunga kelgan toklar, undan ketuvchi toklarga teng.

Ucha kontur uchun Kirxgofning ikkinchi qoidasi;

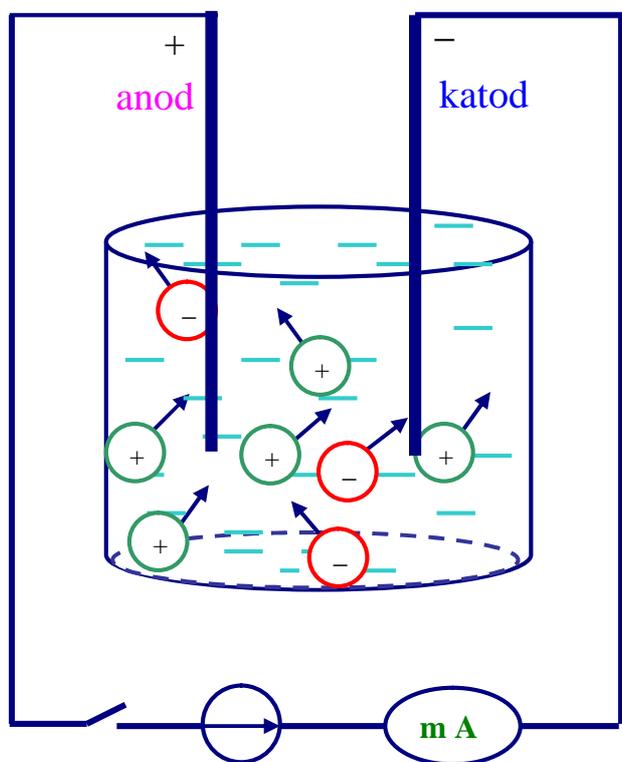
DABC - elektr kontur; $I_1 R_1 + (I_1 + I_2) R_3 = E_1$;

ANMB - elektr kontur; $I_2 R_2 + (I_1 + I_2) R_3 = E_2$;

DNMC - elektr kontur; $I_1 R_1 - I_2 R_2 = E_1 + E_2$;

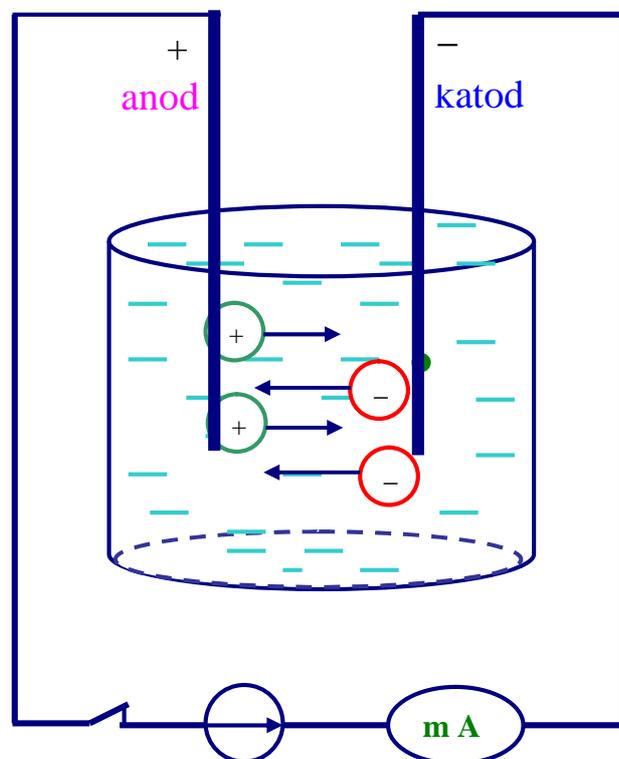
Kirxgofning ikkinchi qoidasi: berk zanjirdagi kuchlanish tushushlarning yig'indisi, zanjirdagi elektr yurituvchi kuchlarning yig'indisiga teng.

21. Elektrolitlarda elektr tok



ionlar betartib harakat qiladi

$$I = 0$$



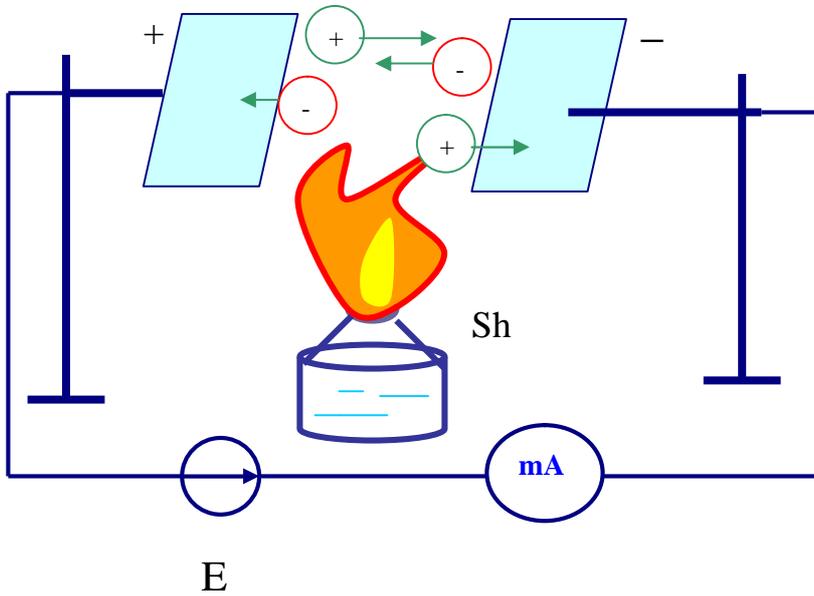
ionlar tartibli harakat qiladi

$$I \neq 0$$

$$i = \frac{I}{S} = aNe(v_+ + v_-)$$

- a** - dissosiyatsia koefitsienti;
- N** - umumiy molekularlar soni;
- e** - elektron zaryadi.
- v₊** - musbat ion tezligi;
- v₋** - manfiy ion tezligi;
- I** - elektrolitdan o'tuvchi elektr toki;
- S** - anod va katodlarning yuzasi;
- i** - tok zichligi

22. Gazlarda elektr toki. Elektr zaryadi



⊕ - musbat ion.

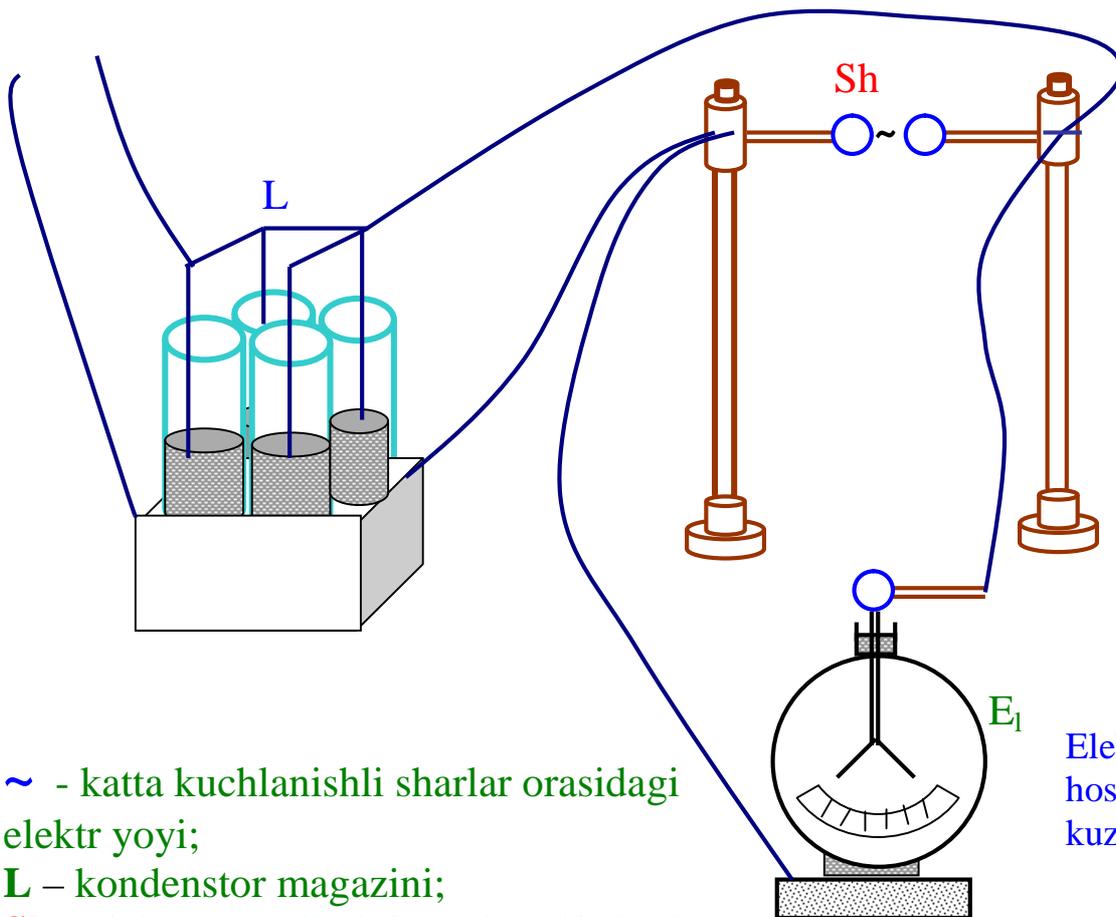
⊖ - manfiy ion.

Alangada parchalanganligi;

E - tok manbai;

mA - milli ampermetr;

Sh – shamdon;



~ - katta kuchlanishli sharlar orasidagi elektr yoyi;

L – kondensator magazini;

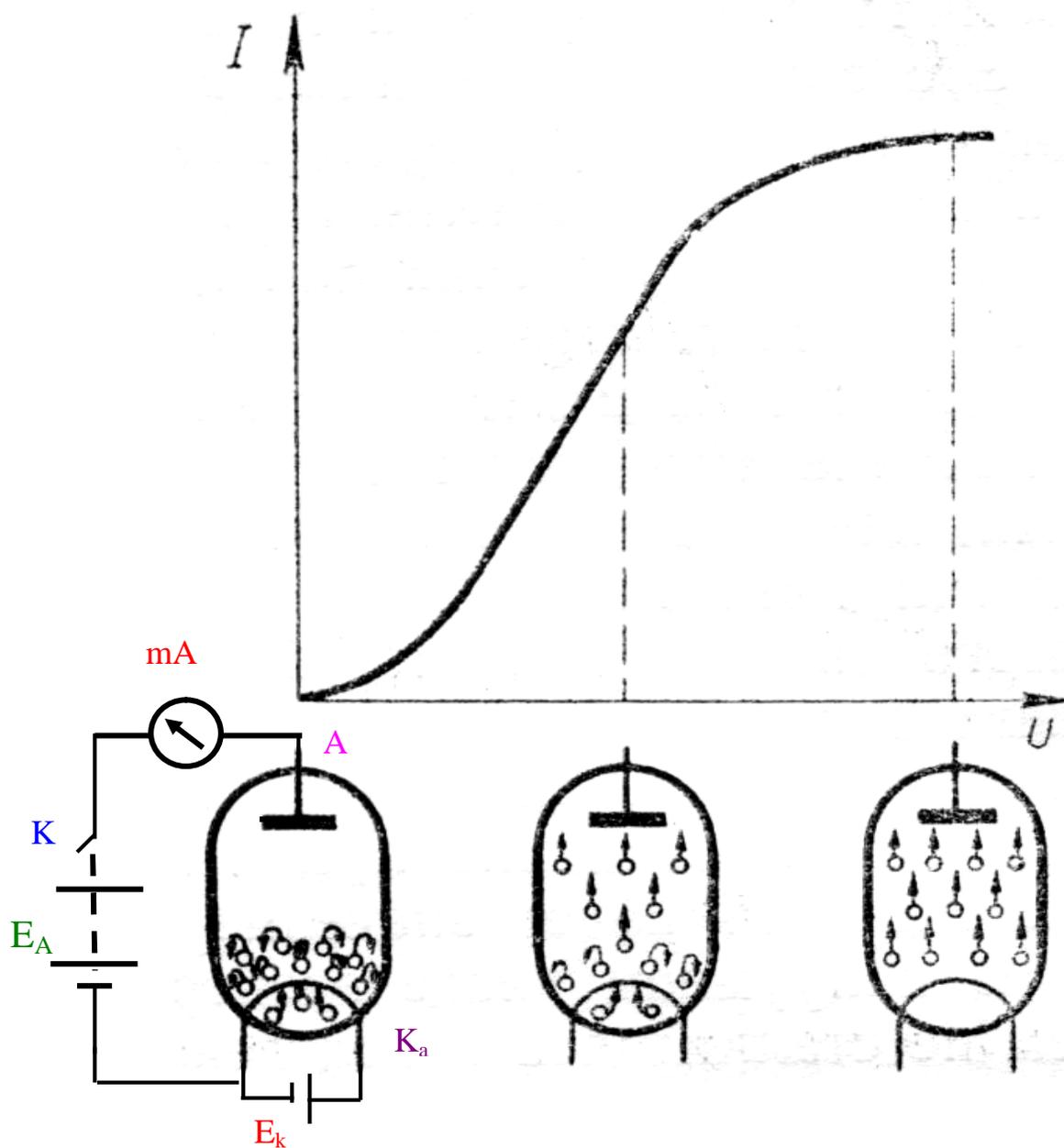
Sh - elektr zaryadlarini to'plovchi sharlar;

E₁ - elektrometr;

Elektr yoyni hosil qilish va kuzatish

23. Vakuumda elektr toki. Elektron lampa

24. Volt-amper xarakteristikasi



elektron lampaning ishlash tamoyili.

A - anod; E_A - anod tok manbayi;

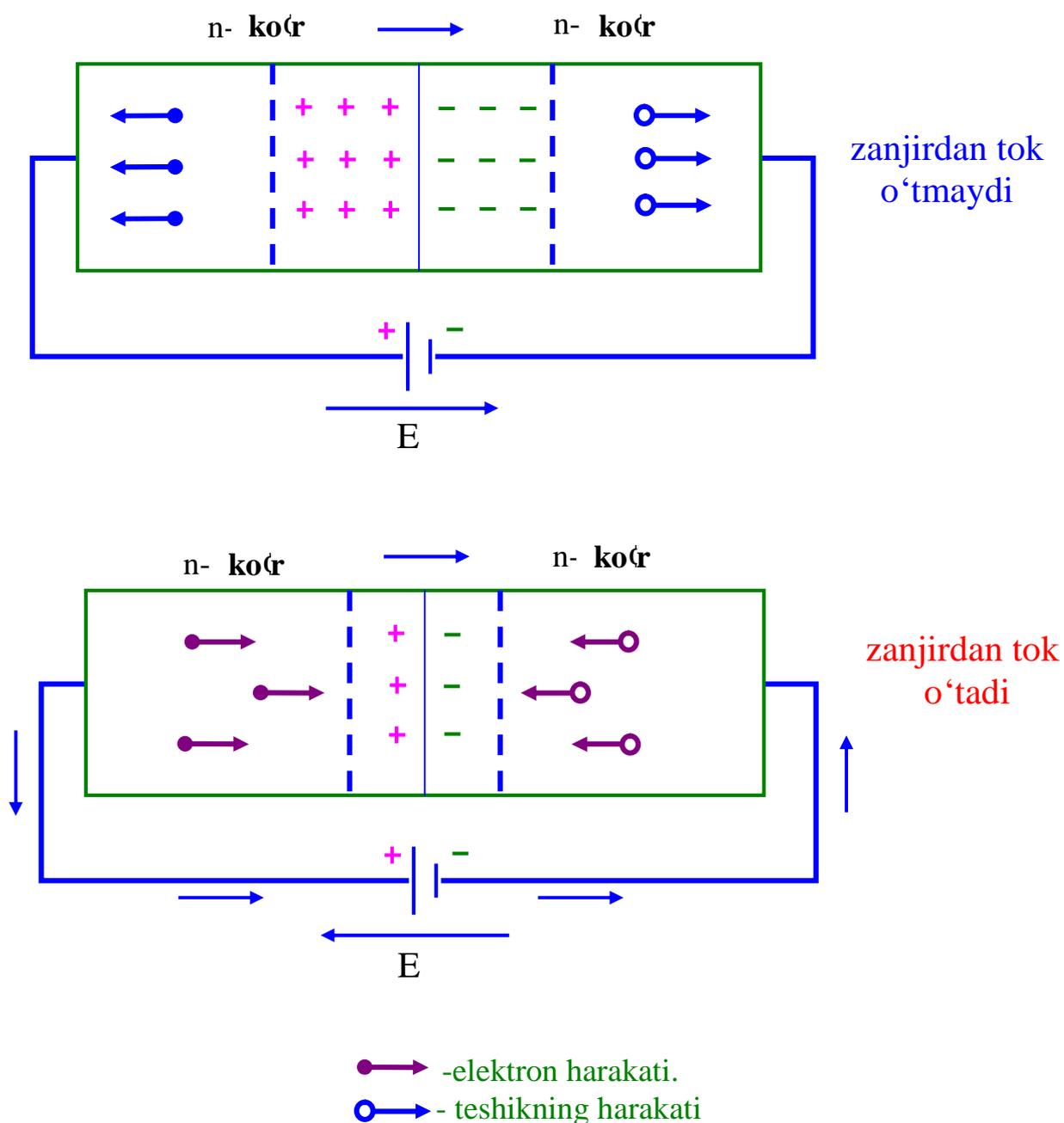
K - kalitd; E_K - katod tok manbayi;

mA - milliampermetr; K_a - katod;

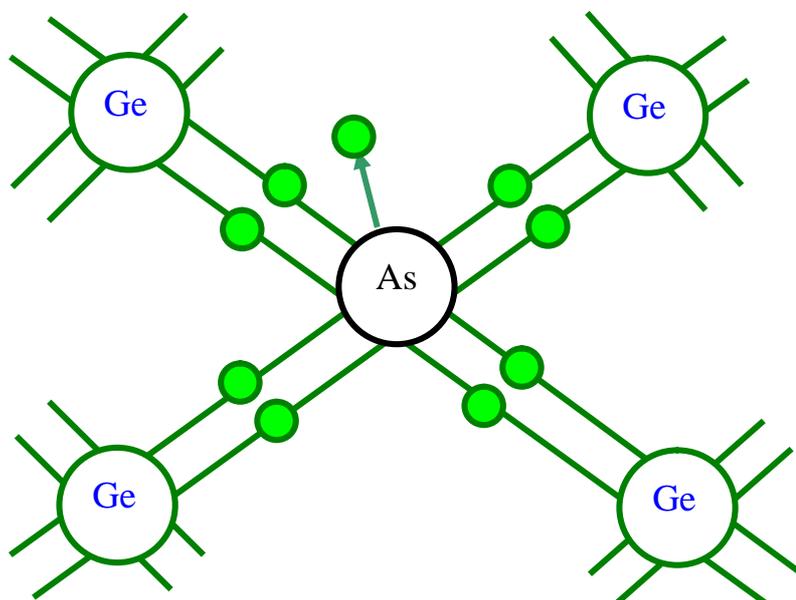
25. Yarimoʻtkazgichda elektr toki

E - tok manbayi;

E_k - n va p- koʻrinishdagi yarimoʻtkazgich chegarasidagi elektr maydon yoʻnalishi;



26. Yarim'otkazgichning aralashmali o'tkazuvchanligi



Ge - germaniy;

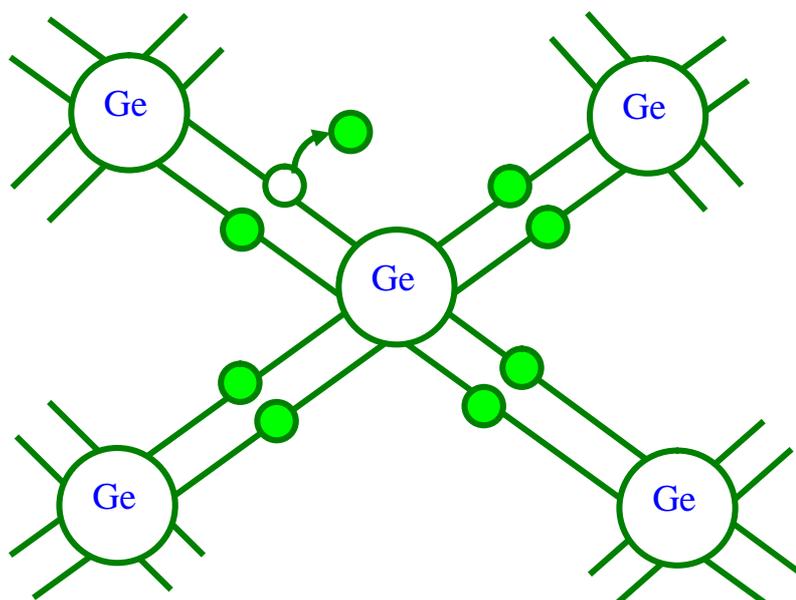
As - mishyak;

● - valent elektron;

Mishyakning tashqi elektron qobig'ida beshta elektronlar bor.

Germaniyning tashqi elektron qobig'ida to'rtta elektronlar bor.

Elektron-teshikli o'tkazuvchanlik



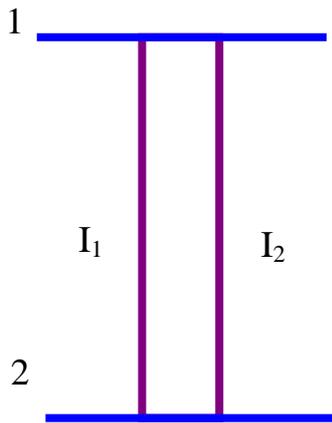
Ge - germaniy.

○ - teshik.

● - elektron.

ELEKTROMAGNETIZM

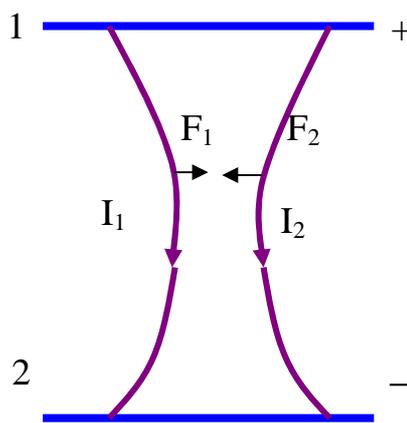
27. Parallel toklarning ta'siri



elektr toki yoq

I_1 va I_2 o'tkazgichlar

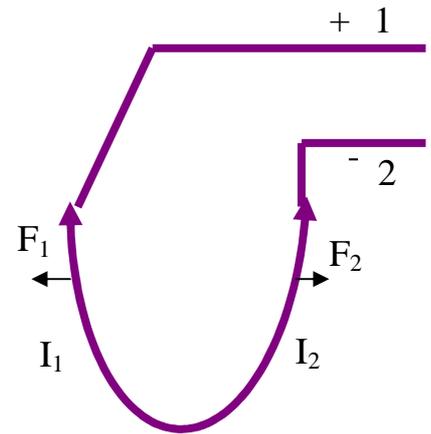
bir-biriga parallel



tok yo'nalishlari bir hil

I_1 va I_2 o'tkazgichlar

bir-biriga tortiladi



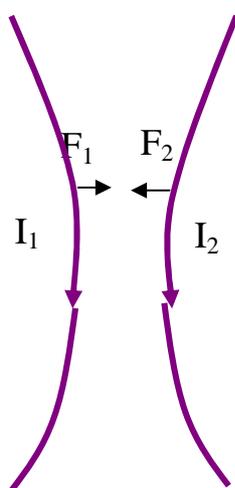
tok yo'nalishlari

qarama – qarshi

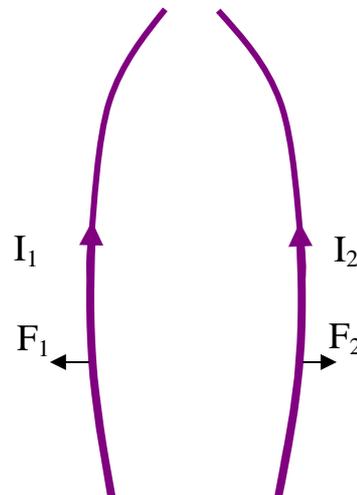
I_1 va I_2 o'tkazgichlar

bir-biridan uzoqlashadi

F_1 va F_2 - o'tkazgichlar orasidagi ta'sir etuvchi kuchlar

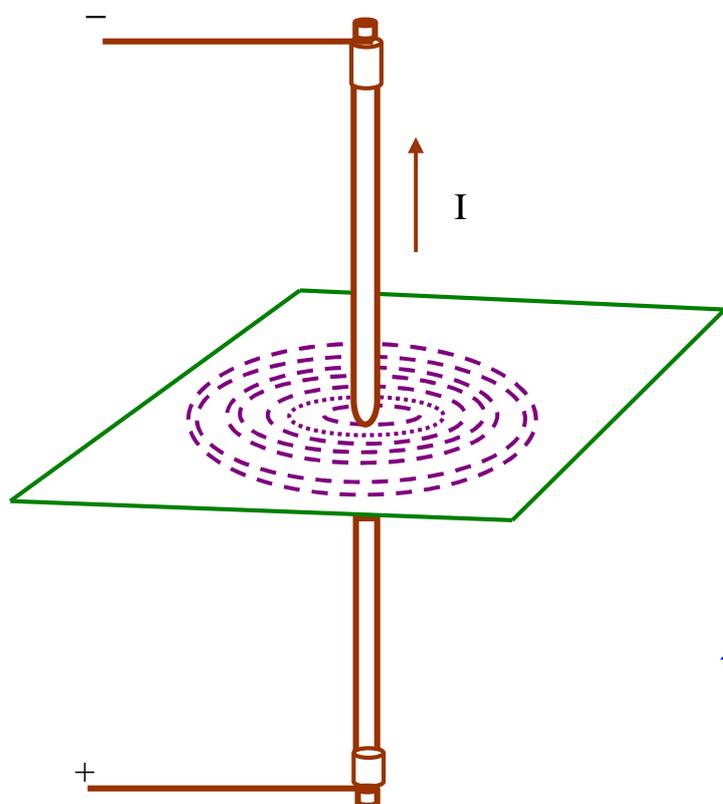


tok yo'nalishlari
bir hil

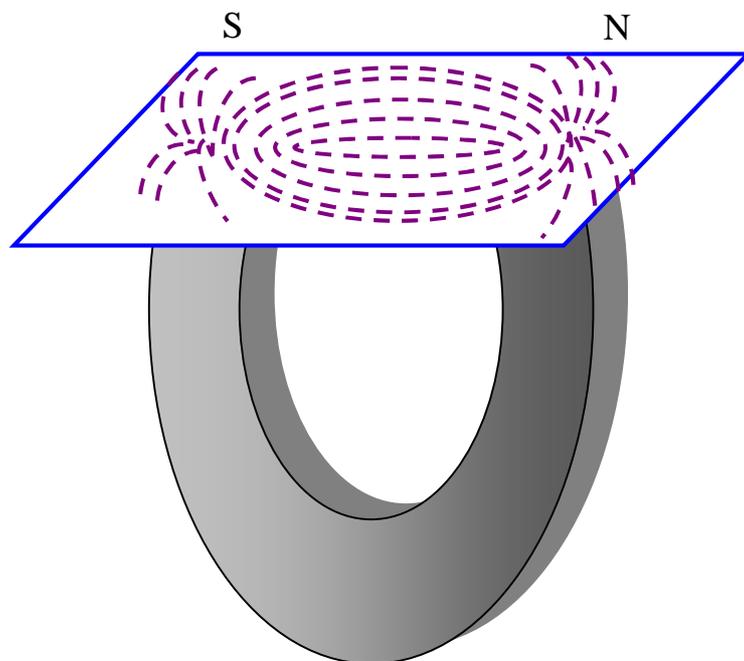


tok yo'nalishlari
qarama - qarshi

28. Magnit maydoninig kuch chiziqlarini namoyish etish



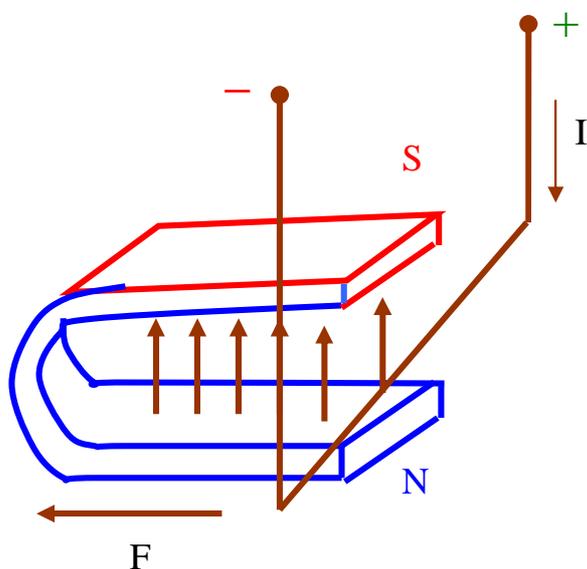
to'g'ri tok atrofida magnit maydon kuch chiziqlari



o'zgarmas magnit jismning magnit maydon kuch chiziqlari

Magnit maydonining tabiati qanday bo'lishidan qat'iy nazar, ularning kuch chiziqlari tutashgan ya'ni boshi va oxiri yoq. Bunday chiziqlarni uyurmaviy magnit maydon kuch chiziqlari deyiladi.

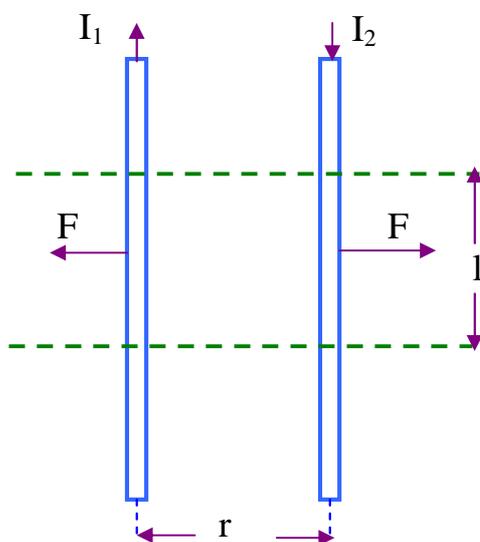
29. Magnit maydonida tokli o'tkazgich. Amper kuchi



N S - o'zgarmas magnetik jism;

I - elektr tok;

F – O'tkazgichga ta'sir etuvchi Amper kuchi;



$$F_A = m_o m H I \cdot l = m_o m \frac{I_1 I_2}{2pr} l$$

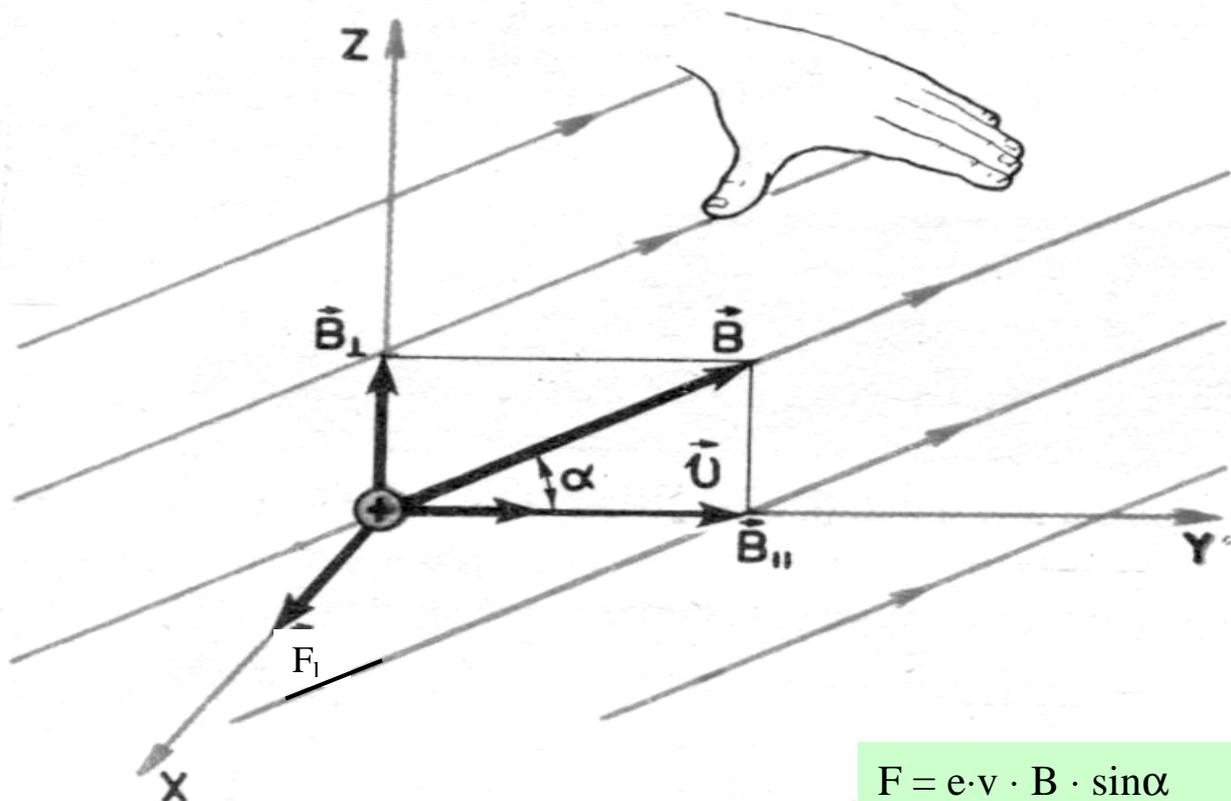
H – magnit maydon kuchlanganligi;

I - o'tkazgichdagi tok kuchi;

l - magnit maydonidagi o'tkazgich uzunligi;

r - o'tkagichlar orasidagi masofa;

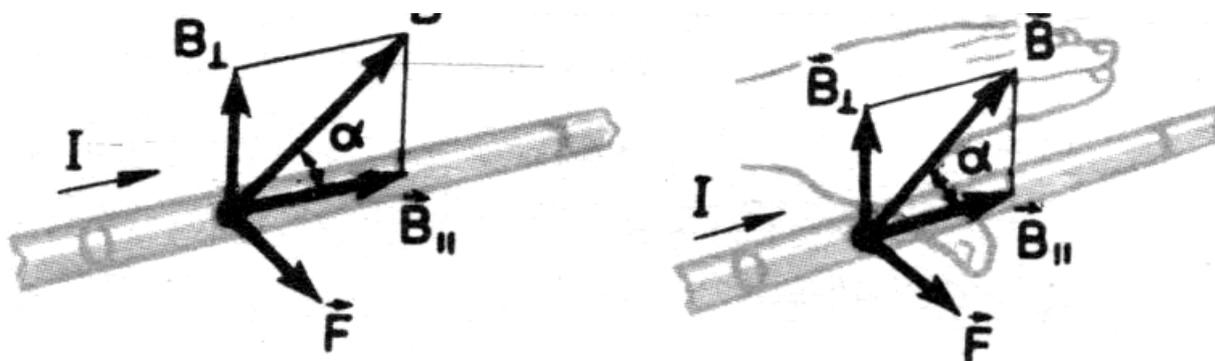
30. Magnit maydonida zaryadga ta'sir etuvchi kuch. Lorents kuchi



$$F = e \cdot v \cdot B \cdot \sin\alpha$$

X, Y, Z - koordinata o'qlari; \vec{B} - magnit induksiya vektori.

\vec{v} - manfiy zaryad tezligi; \vec{F}_l - Lorents kuchi.

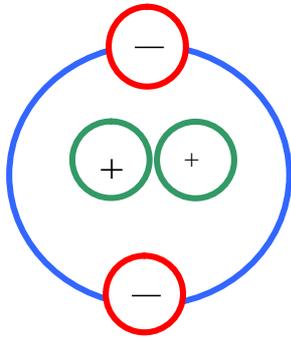


α - o'tkazgich va \vec{B} orasidagi burchak.

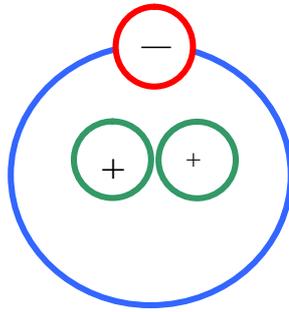
\vec{B}_{\parallel} va \vec{B}_{\perp} - magnit induksiya vektorining parallel va tik tashkil etuvchilari.

ELEKTROSTATIKA

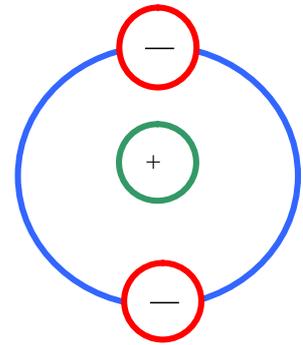
1. Jismni elektrlash. Elektr zaryadning ikki turi



elektr befarq holat

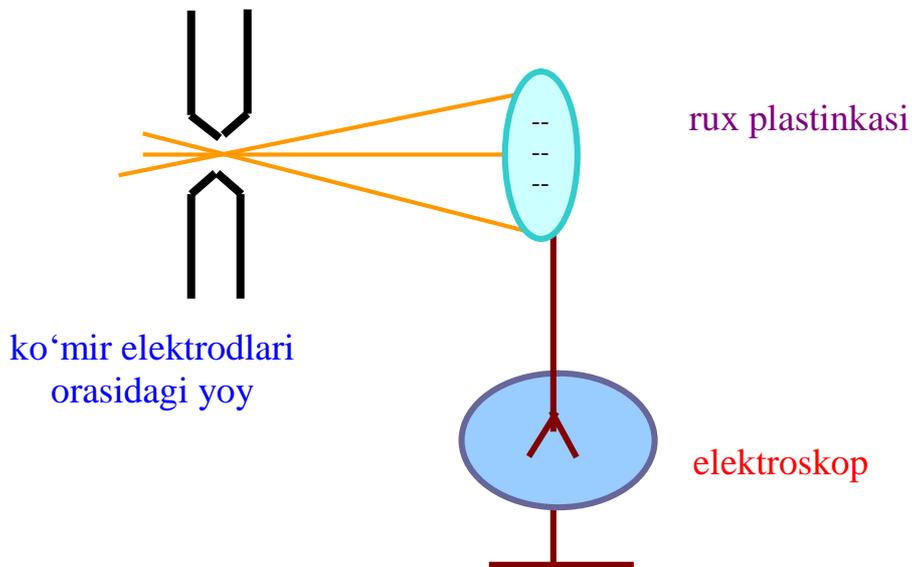


musbat zaryadlanish

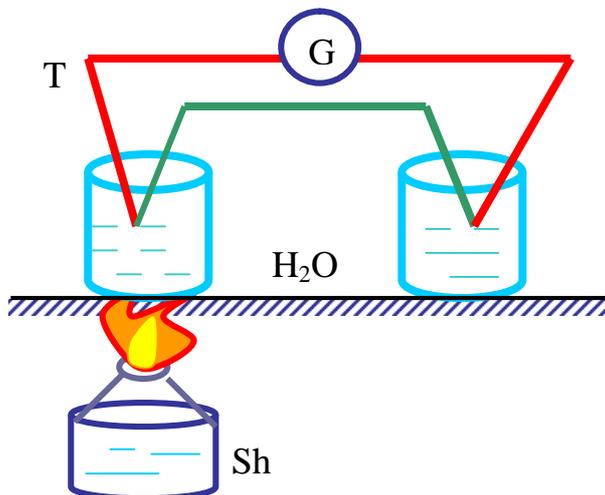


manfiy zaryadlanish

Yorug'lik ta'sirida zaryadlash



O'tkazgichlarni qizdirish tufayli zaryadlar hosil qilish



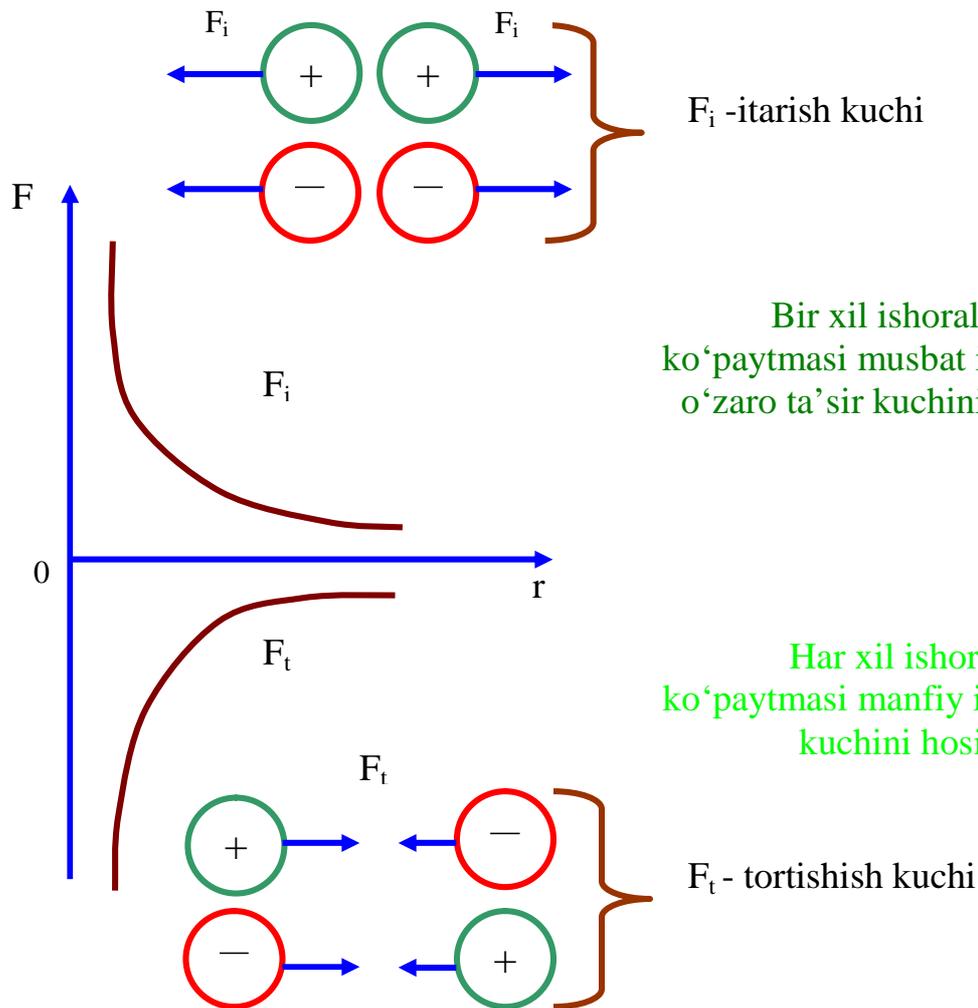
G - galvonometr;

T - termopara;

Sh - shamdon

G galvonometrik orqali
kuchsiz tok o'tadi

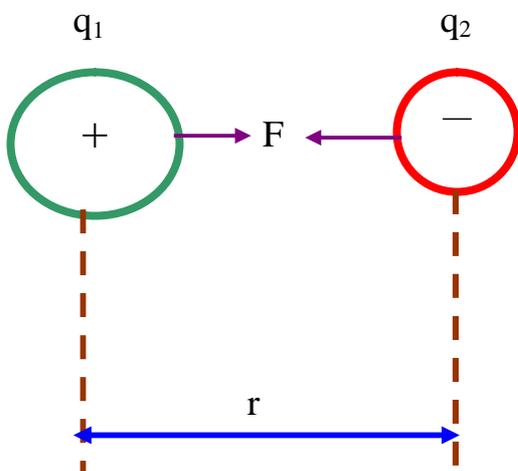
2. Elektr zaryadlarning o'zaro ta'siri



Bir xil ishorali zaryadlar ko'paytmasi musbat ishorali itarish o'zaro ta'sir kuchini hosil qiladi.

Har xil ishorali zaryadlar ko'paytmasi manfiy ishorali tortishish kuchini hosil qiladi.

3. Elektrostatika qonuni. Kulon qonuni



$$F_k = \frac{q_1 \cdot q_2}{4 \epsilon_0 p e r^2}$$

$$q_1 > q_2$$

q_1 ba q_2 -elektr zaryadlar;
 r -zaryad markazlarigacha masofa;

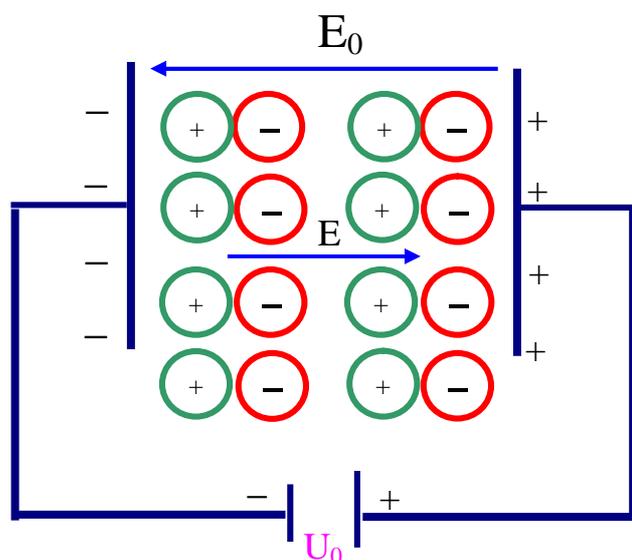
$\epsilon_0 = 8,85 \cdot 10^{-12} \frac{Kl^2}{H \cdot M^2}$ elektr

doimiysi;

ϵ - elektr singdiruvchanlik;

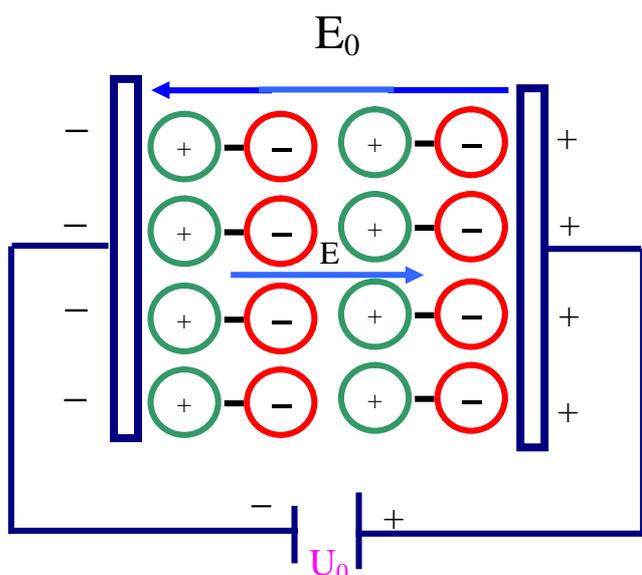
F - zaryadlarning o'zaro ta'sir etuvchi elektr kuchi- Kulon kuchi.

4. Muhitning dielektrik singdiruvchanligi



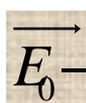
qutbsiz dielektriklar: inert gazlar, O_2 , H_2 , polietilen va t.b.

Musbat va manfiy zaryadlar taqsimotining markazlari ustma-ust tushadigan atom yoki molekulalar qutbsiz dielektriklar



qutbli dielektrik suv, spirt va t.b.

Musbat va manfiy zaryadlar taqsimotining markazlari ustma-ust tushmaydigan molekulalar qutbli dielektriklar



E_0 — elektr maydonining vakuumdagi kuchlanganligi;



E — tashqi elektr maydonidagi dielektrik muhitning elektr maydoni;

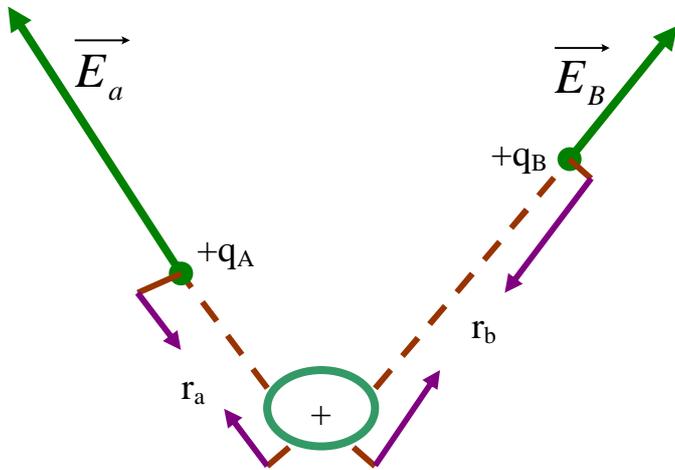


e — nisbiy dielektrik singdiruvchanlik;

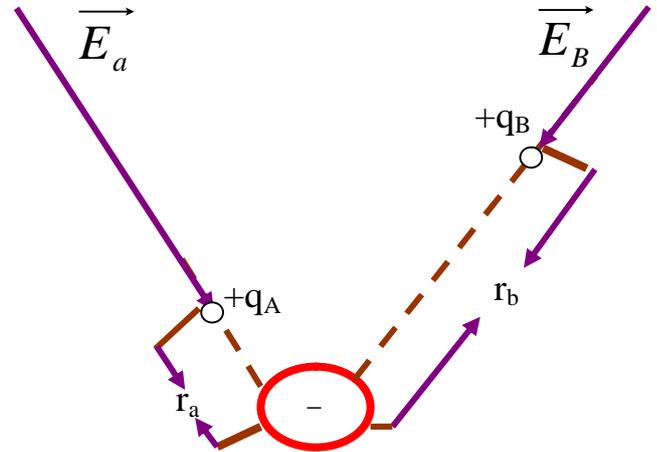
$$e = \frac{E_0}{E}$$

5. Elektr maydon kuchlanganligi

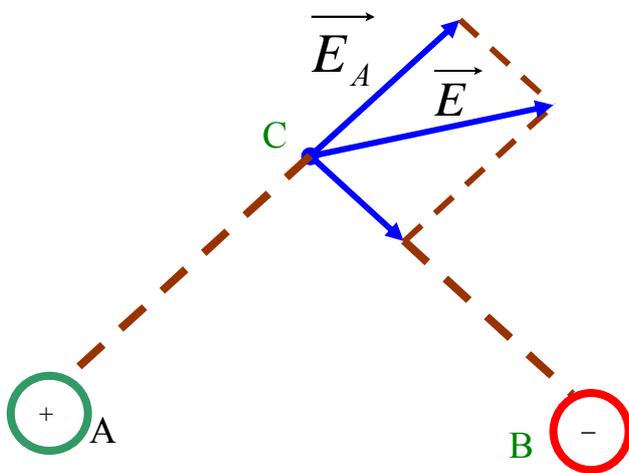
+q_A va +q_B birlik musbat zaryadlar



$$E_A = \frac{q}{4\pi\epsilon_0\epsilon r_a^2}$$



$$E_B = \frac{q}{4\pi\epsilon_0\epsilon r_b^2}$$



+q -r_a va r_b masofada joylashgan nuqtaviy zaryadlar;

E_A va E_B -elektr maydon kuchlanganligi vektorlari;

ε₀ - elektr doyimiy;

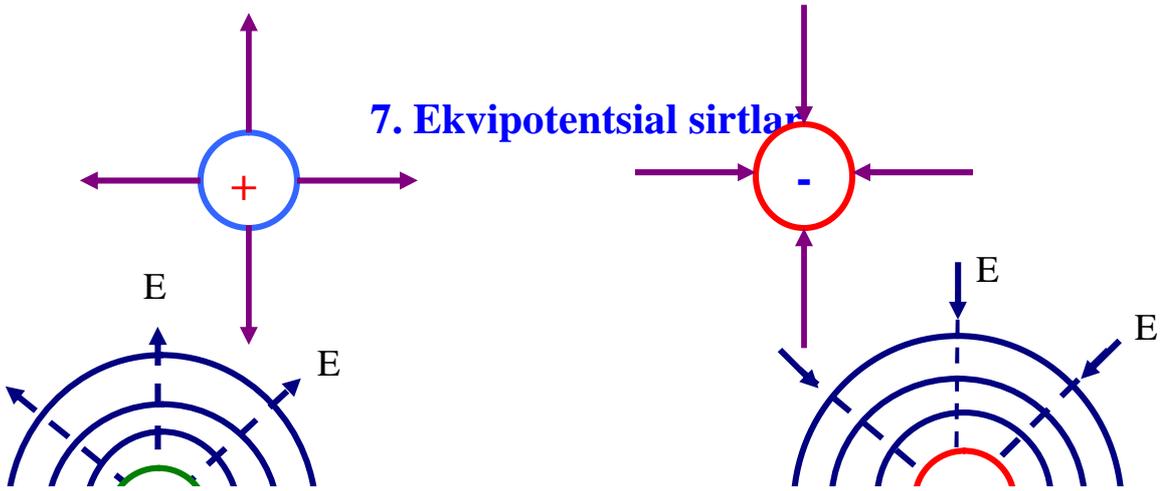
ε - nisbiy elektr singdiruvchanligi;

A va B nuqtadagi zaryadlarning C - nuqtada hosil qiluvchi E - elektr maydon kuchlanganligi.

$$E = \sqrt{E_A^2 + E_B^2 + 2E_A E_B \cos(\angle E_A E_B)}$$

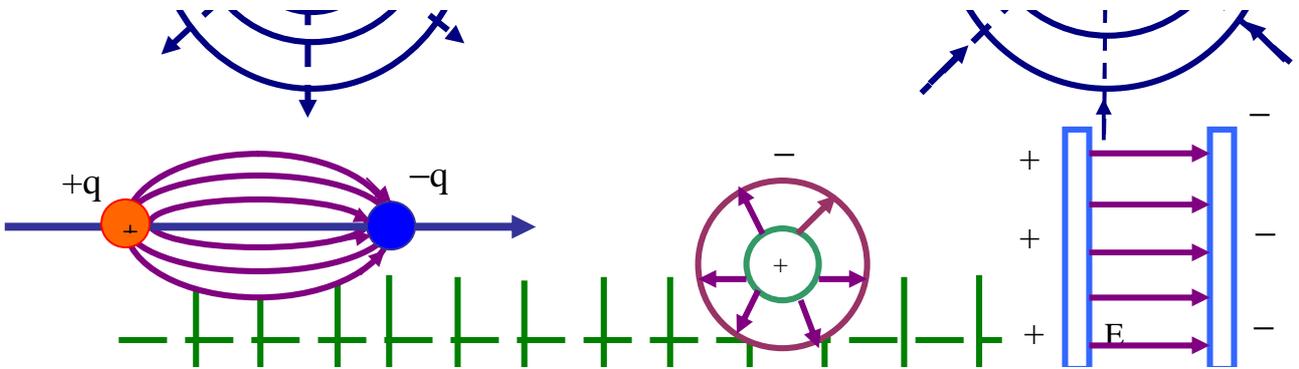
6. Elektr maydon kuch chiziqlari

7. Ekvipotensial sirtlar

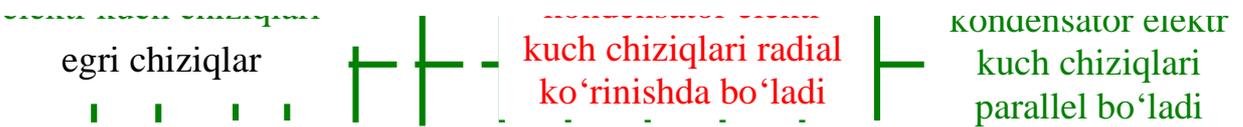


Nuqtaviy musbat va manfiy zaryadlarning ekvipotensial sirlari konsentrik aylanalardan iborat

E



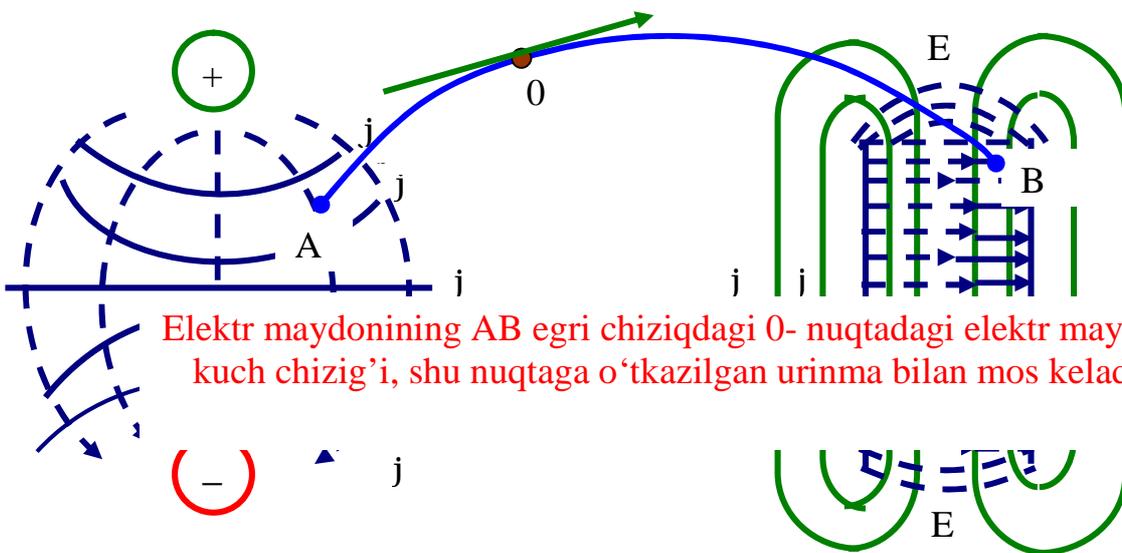
bir jinsli elektr maydonning ekvipotensial sirlari maydon kuch chiziqlariga tik



egri chiziqlar

kuch chiziqlari radial ko'rinishda bo'ladi

kondensator elektr kuch chiziqlari parallel bo'ladi



Elektr maydonning AB egri chiziqdagi 0- nuqtadagi elektr maydon kuch chizig'i, shu nuqtaga o'tkazilgan urinma bilan mos keladi.

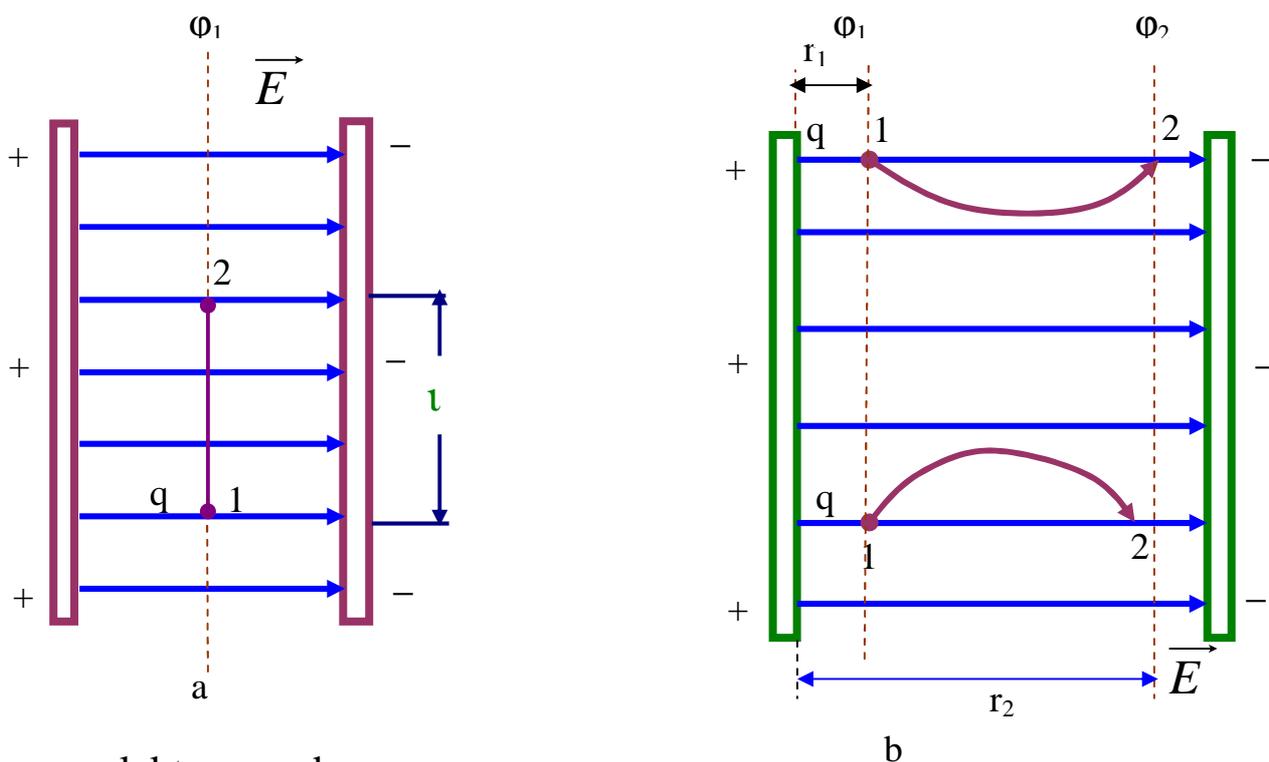
dipolning ekvipotensial sirti

kondensatorning ekvipotensial sirti

E - elektr maydon kuch chiziqlari.

o - ekvipotensial sirtlar

8. Elektr maydon potentsiali



q - elektr zaryad

1 va 2 - zaryadni ko'chirish nuqtalari;

$r_2 - r_1 = l$ - zaryadning ko'chish masofasi;

a - holda zaryad bajargan ish nulgga teng;

c - holda zaryad bajargan ish $A = qE (r_2 - r_1) = - (W_{p2} - W_{p1})$;

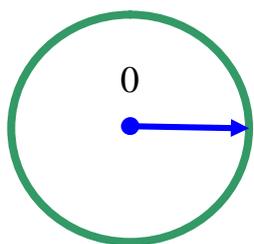
W_p - zaryadning potentsial energiyasi;

$j = \frac{W_p}{q}$ - berilgan zaryad potentsiali;

9. Elektr sig'imi. Sharning elektr sig'imi

$$C = \frac{q}{u}$$

birligi F- farada



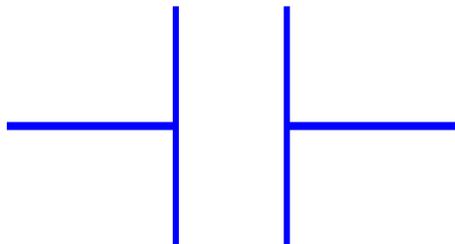
ϵ_0 - elektr doymiy;

ϵ - nisbiy dielektrik singdiruvchanlik;

r - shar radiusi;

$$C = 4\pi \epsilon_0 \epsilon r$$

10. Kondensatorlar, ularni ketma-ket va parallel ulash



yassi kondensator;

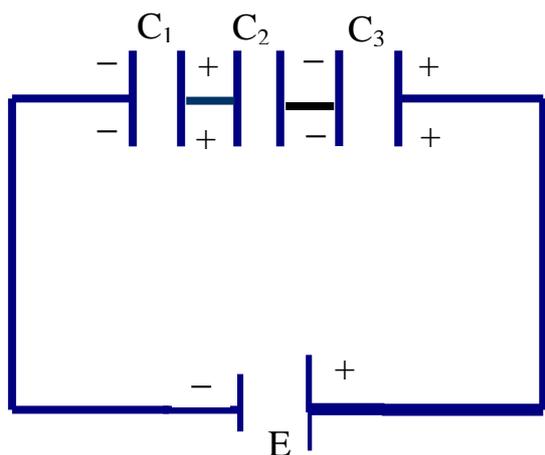
$$C = \frac{\epsilon \epsilon_0 S}{r}$$

S - kondensator qoplaming yuzasi;

ϵ_0 - elektr doymiy;

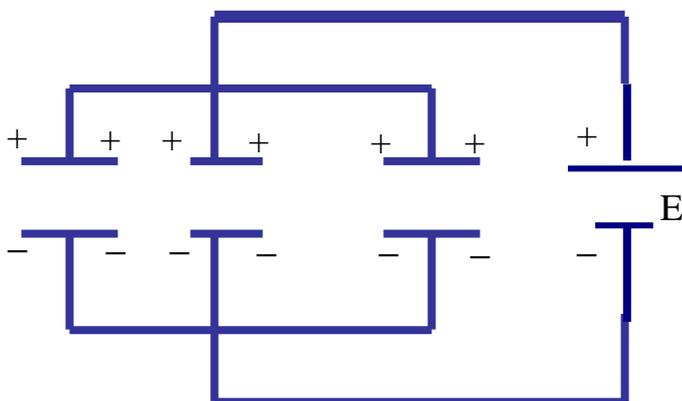
ϵ - nisbiy dielektrik singdiruvchanlik;

r - kondensator qoplamlari orasidagi masofa;



$$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$$

ketma-ket ulash



$$C = C_1 + C_2 + C_3$$

$C_1 C_2 C_3$ - kondensatorning sig'imi;

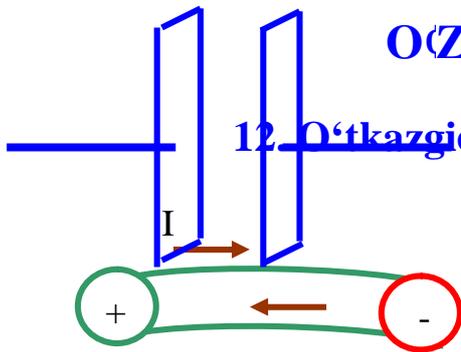
C - umumiy sig'im;

E - doymiy elektr manbayi;

parallel ulash

11. Kondensator turlarni (yassi, sferik, silindrik)

O'ZGARMAS TOK

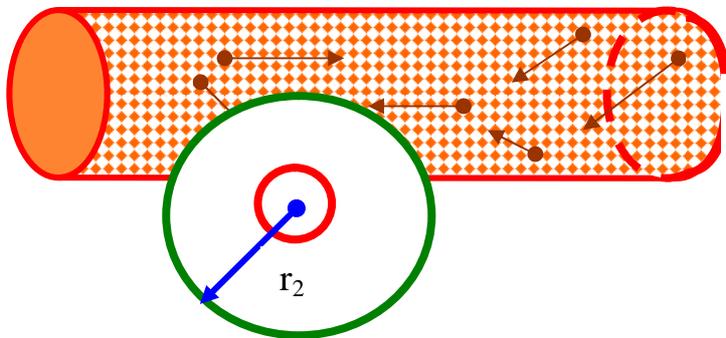


vassi parallel kondensator

12. O'tkazgichda elek

$$C = \frac{\epsilon_0 \epsilon S}{d}$$

har bir zaryadlangan o'tkazgichlarni sim bilan ulasak, tok o'tadi.



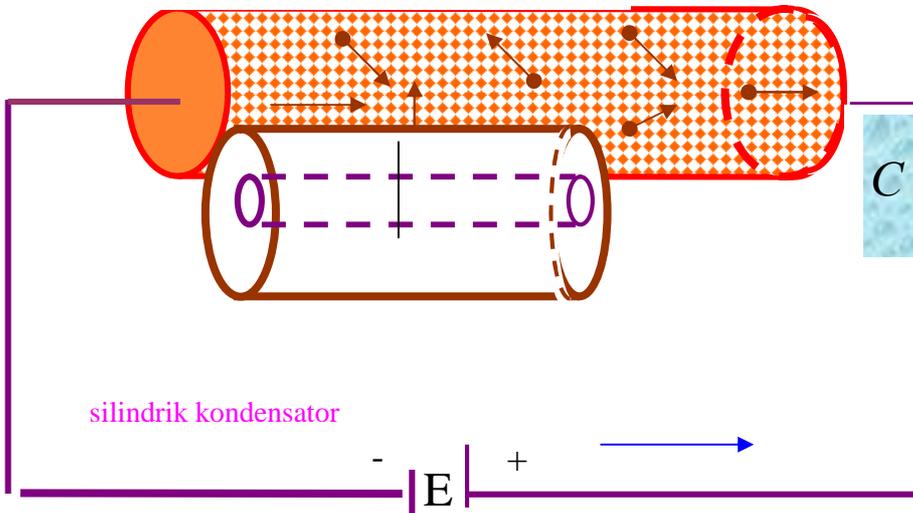
sferik kondensator

odatdagi holatda

$$C = 4\pi \epsilon_0 \epsilon \frac{r_1 r_2}{r_2 - r_1}$$

sonlar

tashqi elektr maydon ta'sirida elektronlarning o'rtacha tezligi taxminan tartibli bo'ladi.



silindrik kondensator

$$C = 2\pi \epsilon_0 \epsilon \frac{l}{\ln \left(\frac{r_2}{r_1} \right)}$$

irishi; di; cha tezligi;

S - vaqt birligi (sekund)
 Δt - vaqti o'zgarishi;
 I (t) - tok kuchi;
 n- elektron konsentratsiyasi;
 E - tok manbayi;

ϵ_0 - elektr doyimiy;

ϵ - nisbiy dielektrik singdiruvchanlik;

$\Delta q =$ zarya

$\Delta q = I(t) \cdot$

vaqtdagi z

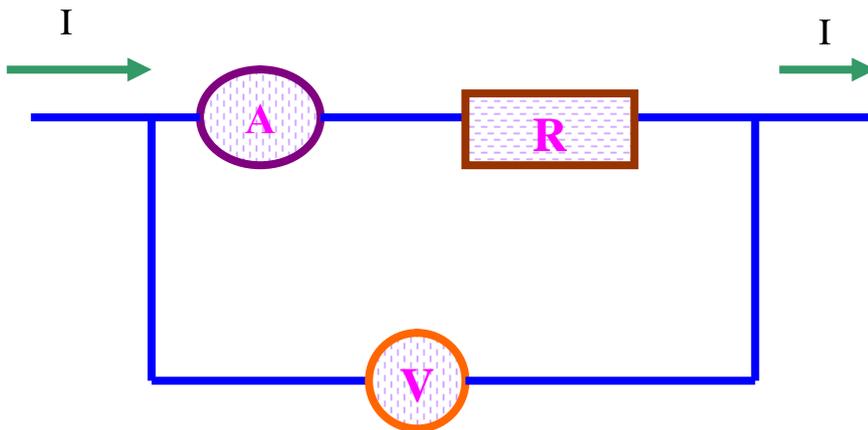
o'zgarishi.

$I = \Delta q / \Delta t$ Tok kuchi,

uning birligi

$$1 \text{ A} = \frac{\text{Kl}}{\text{S}}$$

13. Zanjirning qismi uchun Om qonuni

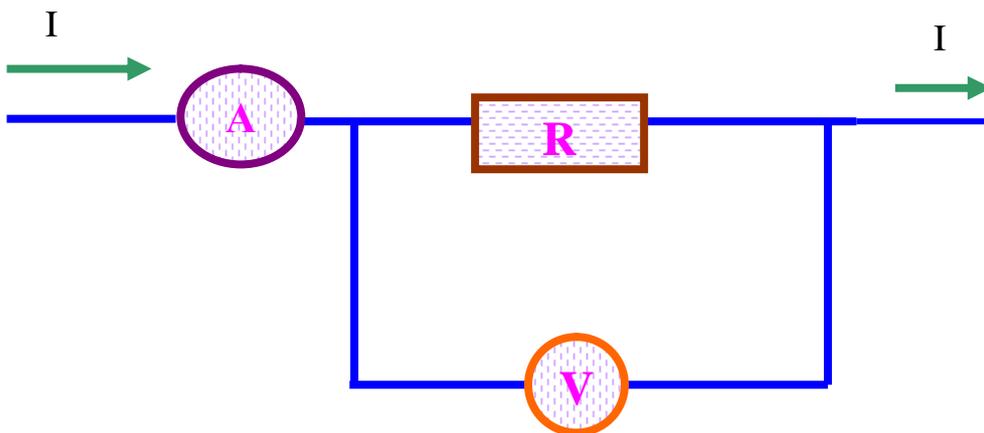


$$I = \frac{V}{R}$$

A - ampermetr;

R - qarshilik;

V - voltmetr;

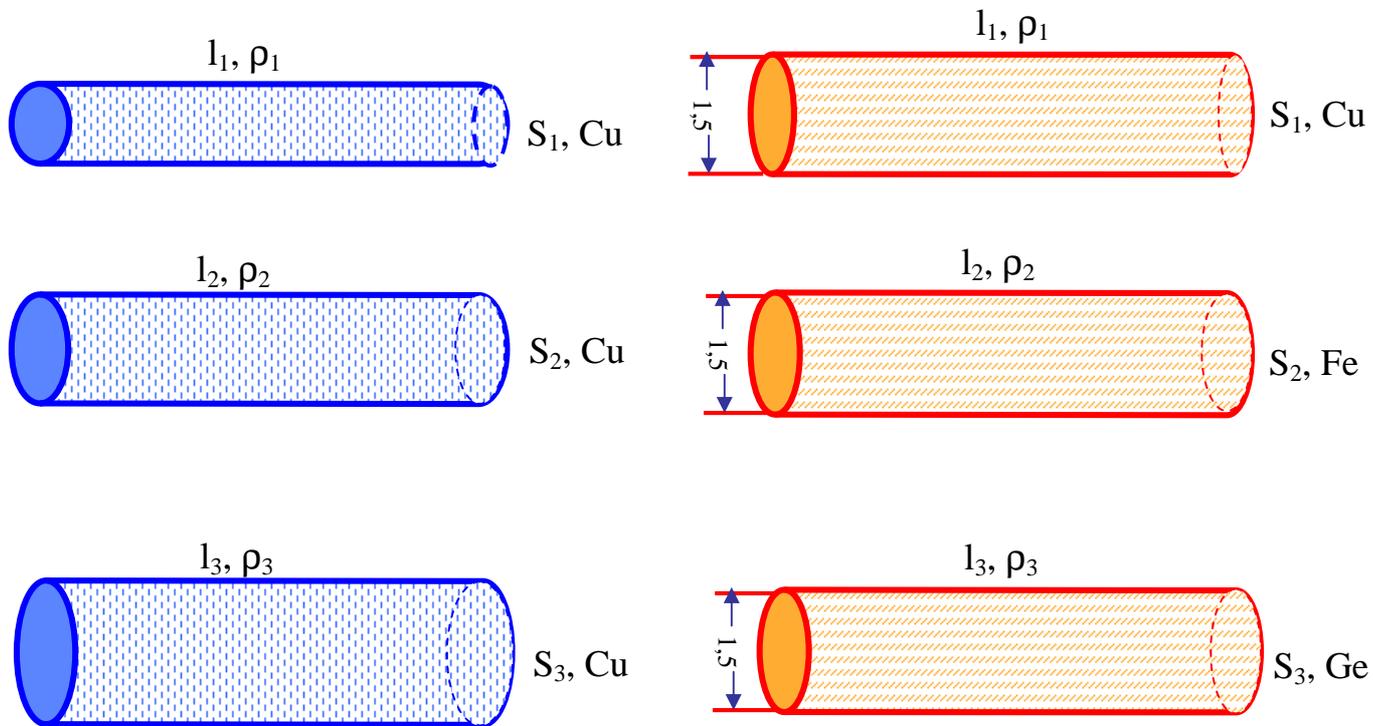


$$R = \frac{V}{I}$$

$$10\ m = 1\ \frac{B}{A}$$

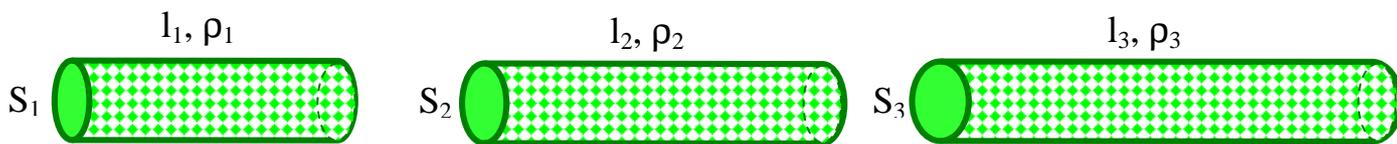
birligi

14. Metall o'tkazuvchining elektr qarshiligi



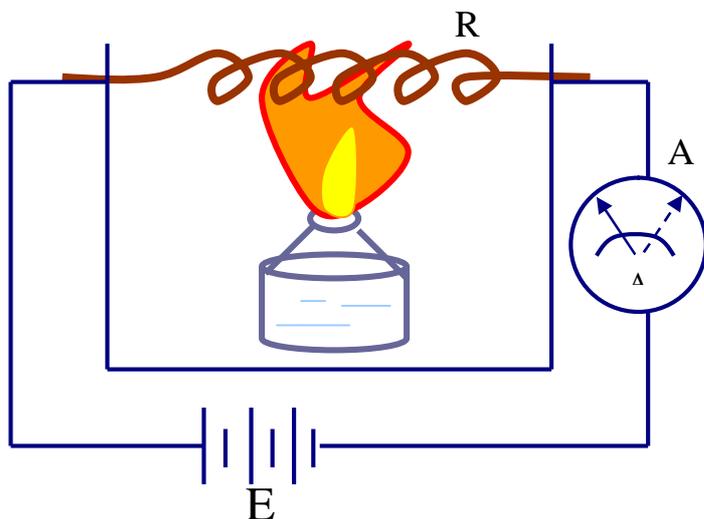
$l_1 = l_2 = l_3.$
 $\rho_1 = \rho_2 = \rho_3.$
 $S_1 < S_2 < S_3.$
 $R_1 > R_2 > R_3.$

$l_1 = l_2 = l_3.$
 $\rho_1 < \rho_2 < \rho_3.$
 $S_1 = S_2 = S_3.$
 $R_1 < R_2 < R_3.$



$l_1 < l_2 < l_3;$ $\rho_1 = \rho_2 = \rho_3;$ $S_1 = S_2 = S_3;$ $R_1 < R_2 < R_3.$

15. Metall o'tkazgich qarshiligining haroratga bog'liqligi.



$$R_t = R_0 (1 + \alpha t)$$

R- metall qarshilik;

c- shandon;

B- Ampermetr;

E- tok manbayi;

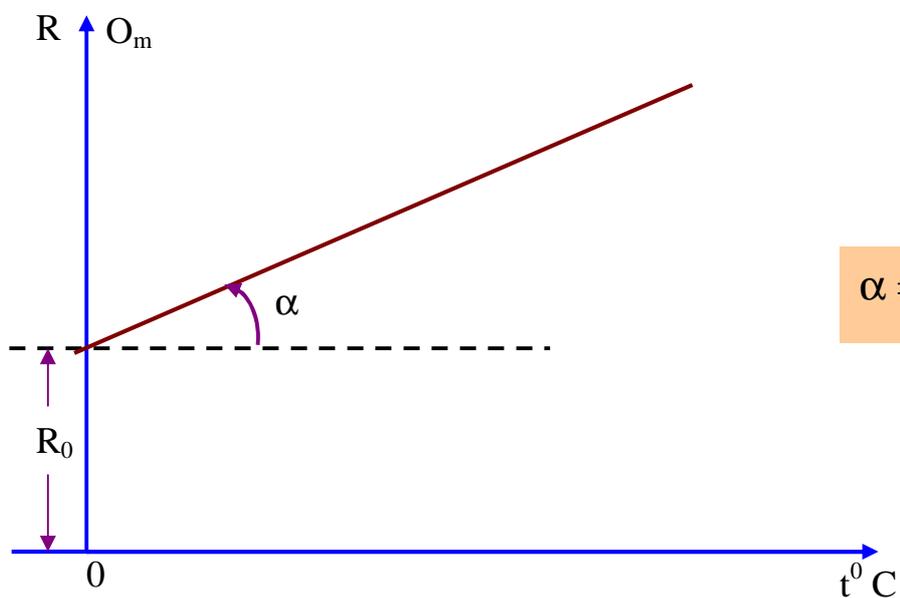
R₀- nol gradus Selsiydagi metall qarshilik;

α- qarshilikning harorat koeffitsienti;

t- Selsiy shkalasidagi harorat;

R_t- **t** haroratdagi qarshilik;

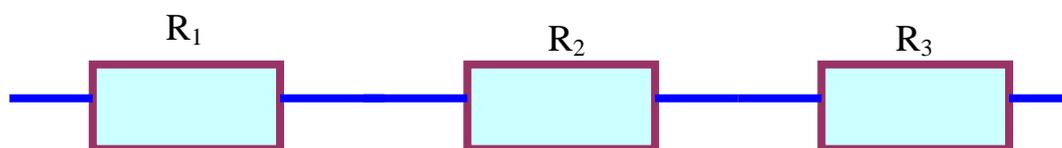
Qarshilikning haroratga bog'liqlik grafigi



$$\alpha = (R_t - R_0) / t$$

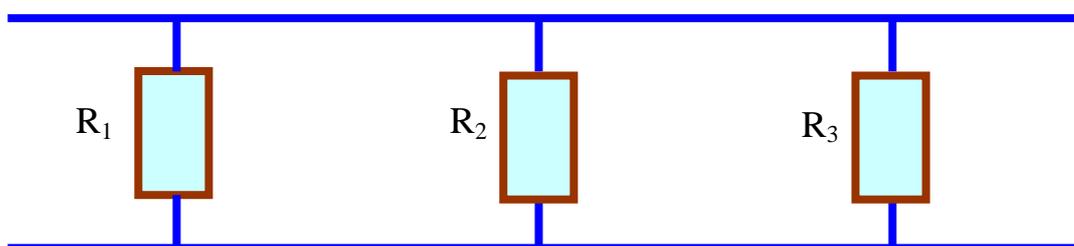
16. O'tkazgichlarni ketma-ket va parallel ulash.

O'TKAZGICHLARNI KETMA-



$$R = R_1 + R_2 + R_3$$

parallel ulash

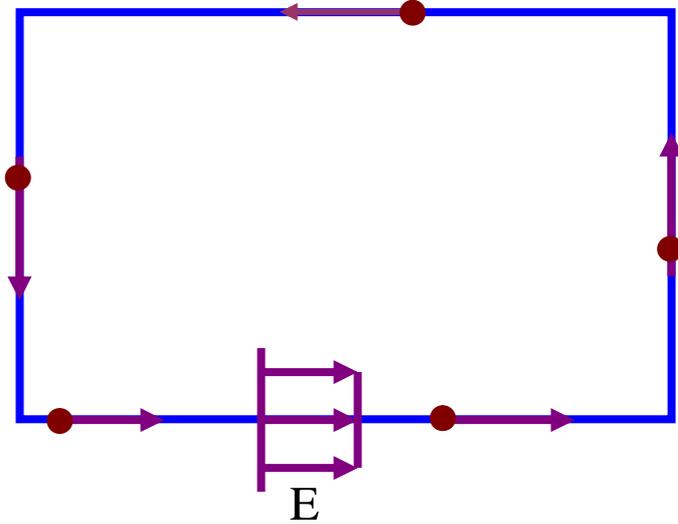


$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

R_1, R_2, R_3 - o'tkazgichlarning qarshiliklari;

R - umumiy qarshilik;

17. O'zgarmas tok manbayi

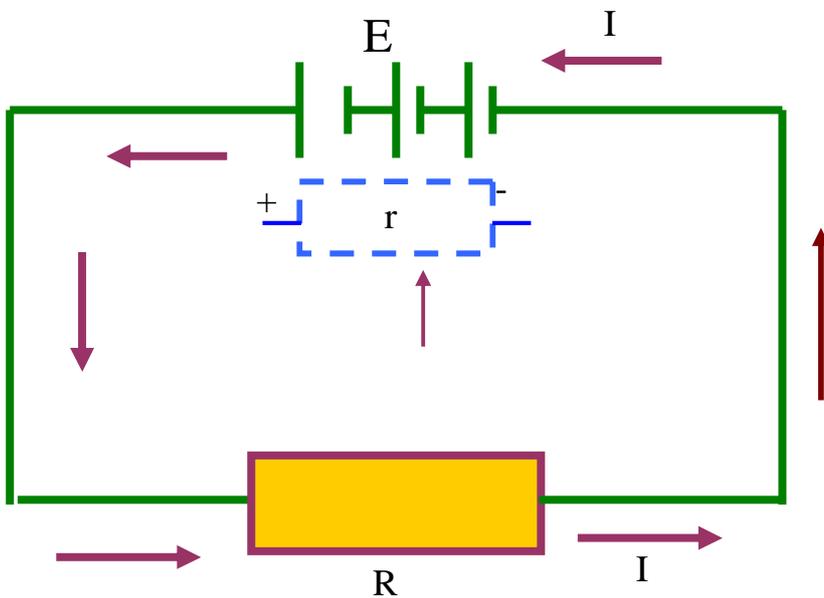


→ -elektron harakati

Galvanik elementda, akkumulyatorda, batareyada, kimyoviy reaksiya natijasida tok hosil bo'ladi.

Elektr tok manbasining bir qutbidan ikkinchi qutbiga o'tish uchun elektromagnit tabiyatga ega bo'lmagan ish bajarishi kerak.

18. Berk zanjir uchun Om qonuni



E - elektr tok manbayi;

r - manbaning ichki qarshiligi;

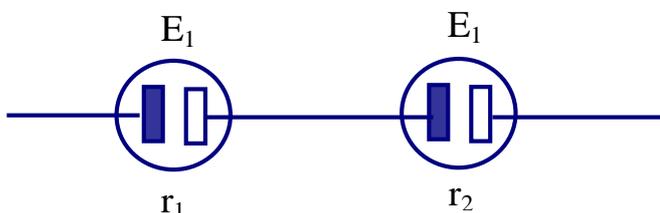
R - tashqi qarshilik;

I - zanjirdan o'tuvchi tok;

$$I = \frac{E}{R + r}$$

19. Tok manbalarini ketma-ket va parallel ulash.

TOK MANBALARI



$E = E_1 + E_2$ - umumiy elektr yurituvchi kuch;

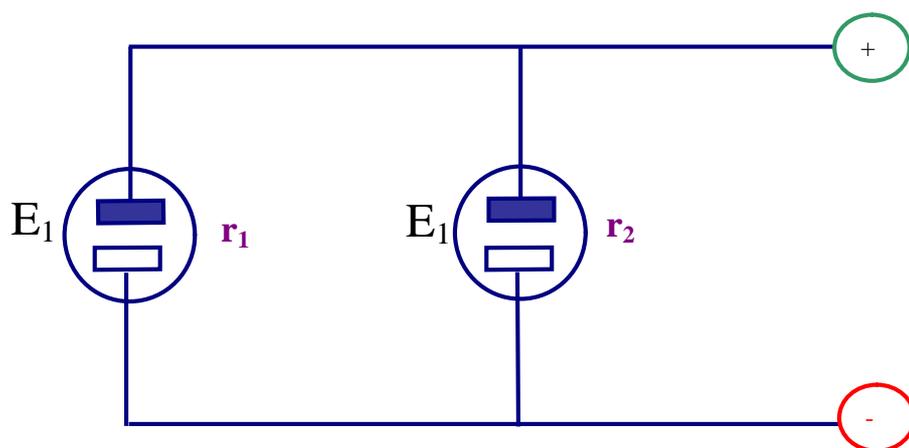
$r = r_1 + r_2$ - umumiy ichki qarshilik;

E_1 va E_2 - o'zgarmas tok manbalari;

r_1 va r_2 - tok manbalarining ichki qarshiligi;

I - tok kuchi;

TOK MANBALARINI KETMA-

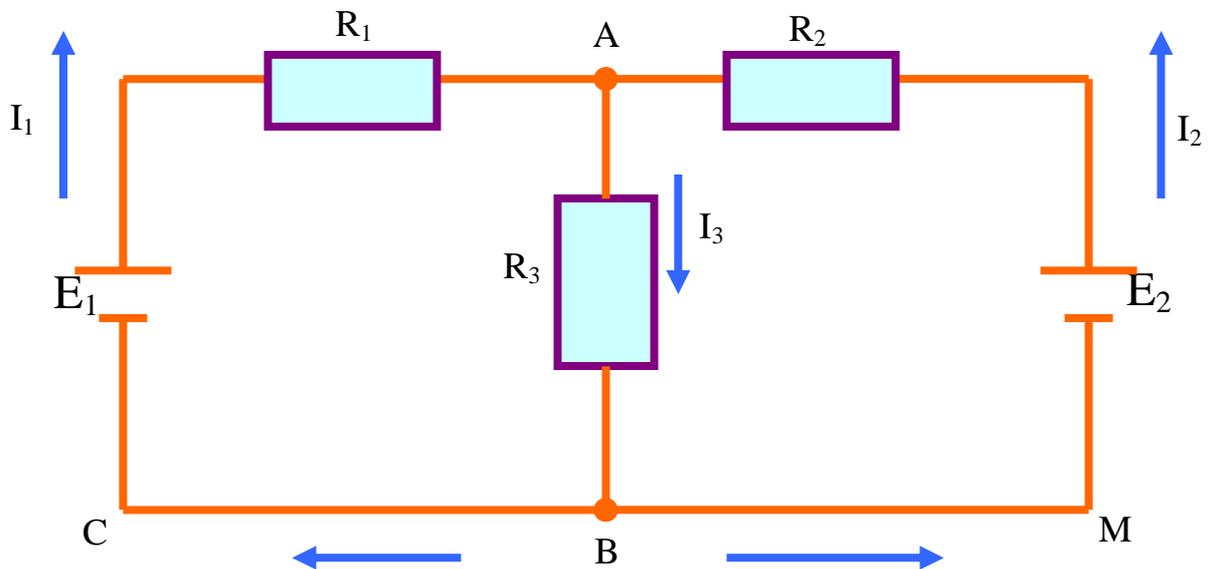


$$E_1 = E_2; \quad E = 0; \quad I = 0;$$

$$E_1 > E_2; \quad E = E_1 - E_2; \quad I \neq 0;$$

$$E_1 < E_2; \quad E = E_2 - E_1; \quad I \neq 0;$$

20. Elektr zanjir uchun Kirxgof qoidasi



E_1 va E_2 - tok manbalari;

R_1 , R_2 va R_3 - qarshiliklar;

Ikkita tugunlar A va B uchun Kirxgofning birinchi qoidasi;

$$I_1 + I_2 = I_3; I_1 + I_2 - I_3 = 0;$$

Kirxgofning birinchi qoidasi: tugunga kelgan toklar, undan ketuvchi toklarga teng.

Ucha kontur uchun Kirxgofning ikkinchi qoidasi;

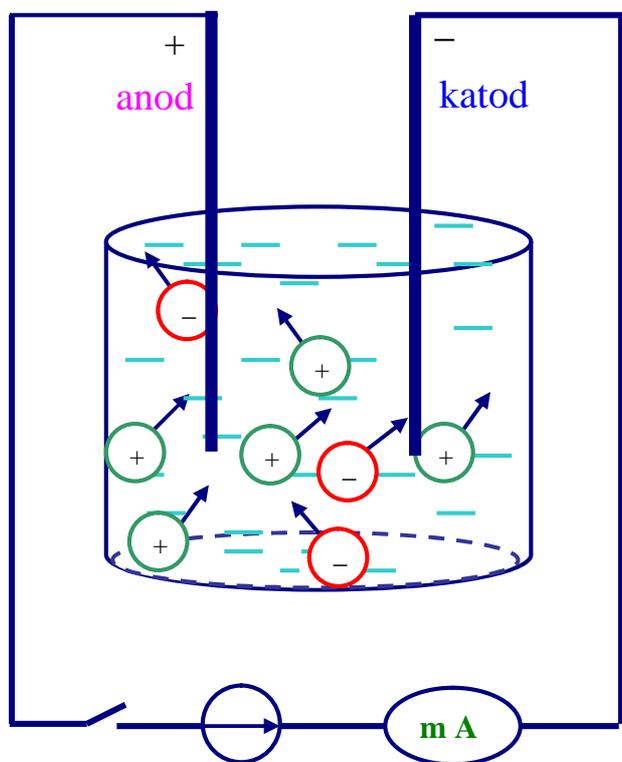
DABC - elektr kontur; $I_1 R_1 + (I_1 + I_2) R_3 = E_1$;

ANMB - elektr kontur; $I_2 R_2 + (I_1 + I_2) R_3 = E_2$;

DNMC - elektr kontur; $I_1 R_1 - I_2 R_2 = E_1 + E_2$;

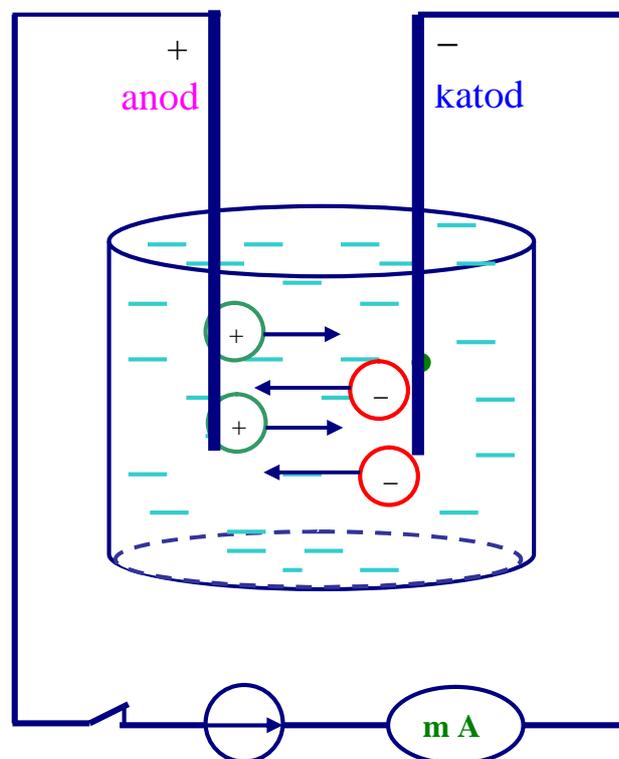
Kirxgofning ikkinchi qoidasi: berk zanjirdagi kuchlanish tushushlarning yig'indisi, zanjirdagi elektr yurituvchi kuchlarning yig'indisiga teng.

21. Elektrolitlarda elektr tok



ionlar betartib harakat qiladi

$$I = 0$$



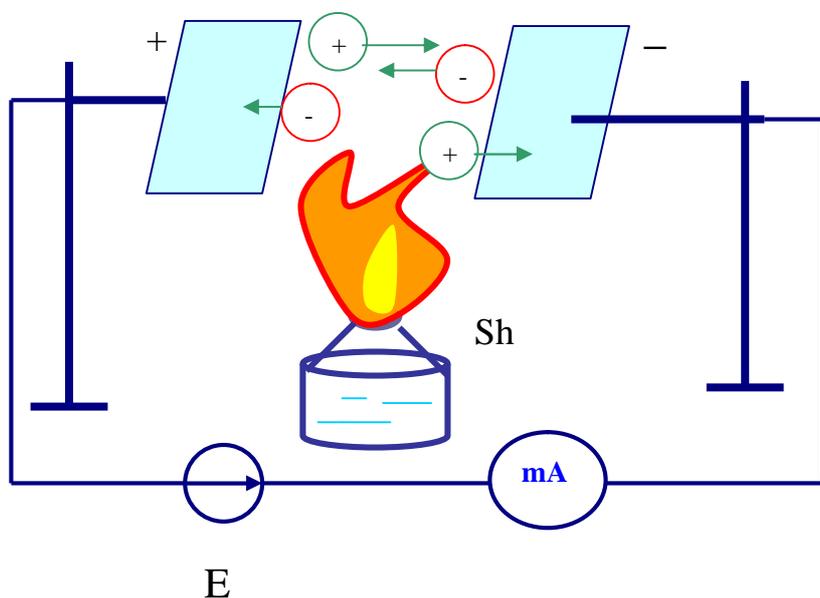
ionlar tartibli harakat qiladi

$$I \neq 0$$

$$i = \frac{I}{S} = aNe(v_+ + v_-)$$

- a** - dissosiyatsia koefitsienti;
- N** - umumiy molekularlar soni;
- e** - elektron zaryadi.
- v₊** - musbat ion tezligi;
- v₋** - manfiy ion tezligi;
- I** - elektrolitdan o'tuvchi elektr toki;
- S** - anod va katodlarning yuzasi;
- i** - tok zichligi

22. Gazlarda elektr toki. Elektr zaryadi



⊕ - musbat ion.

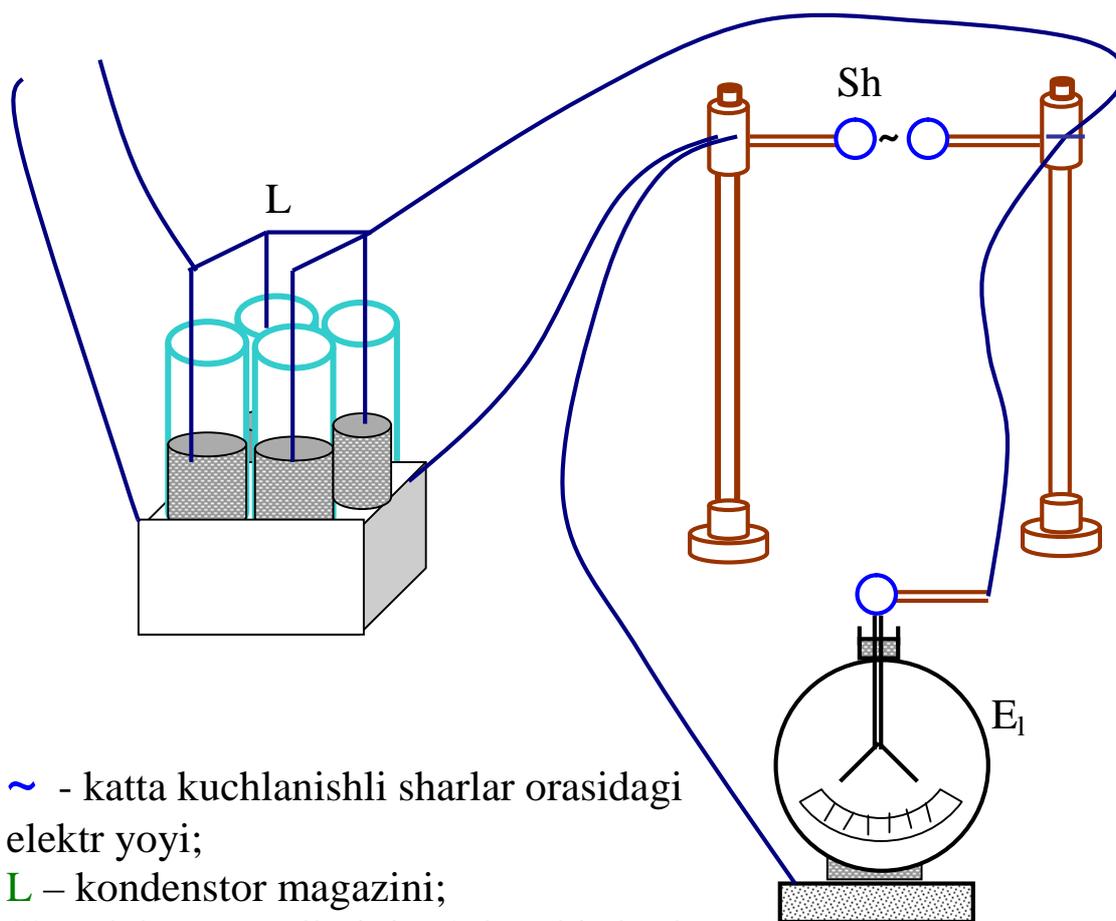
⊖ - manfiy ion.

Alangada parchalanganligi;

E - tok manbayi;

mA - milli ampermetr;

Sh – shamdon;



~ - katta kuchlanishli sharlar orasidagi elektr yoyi;

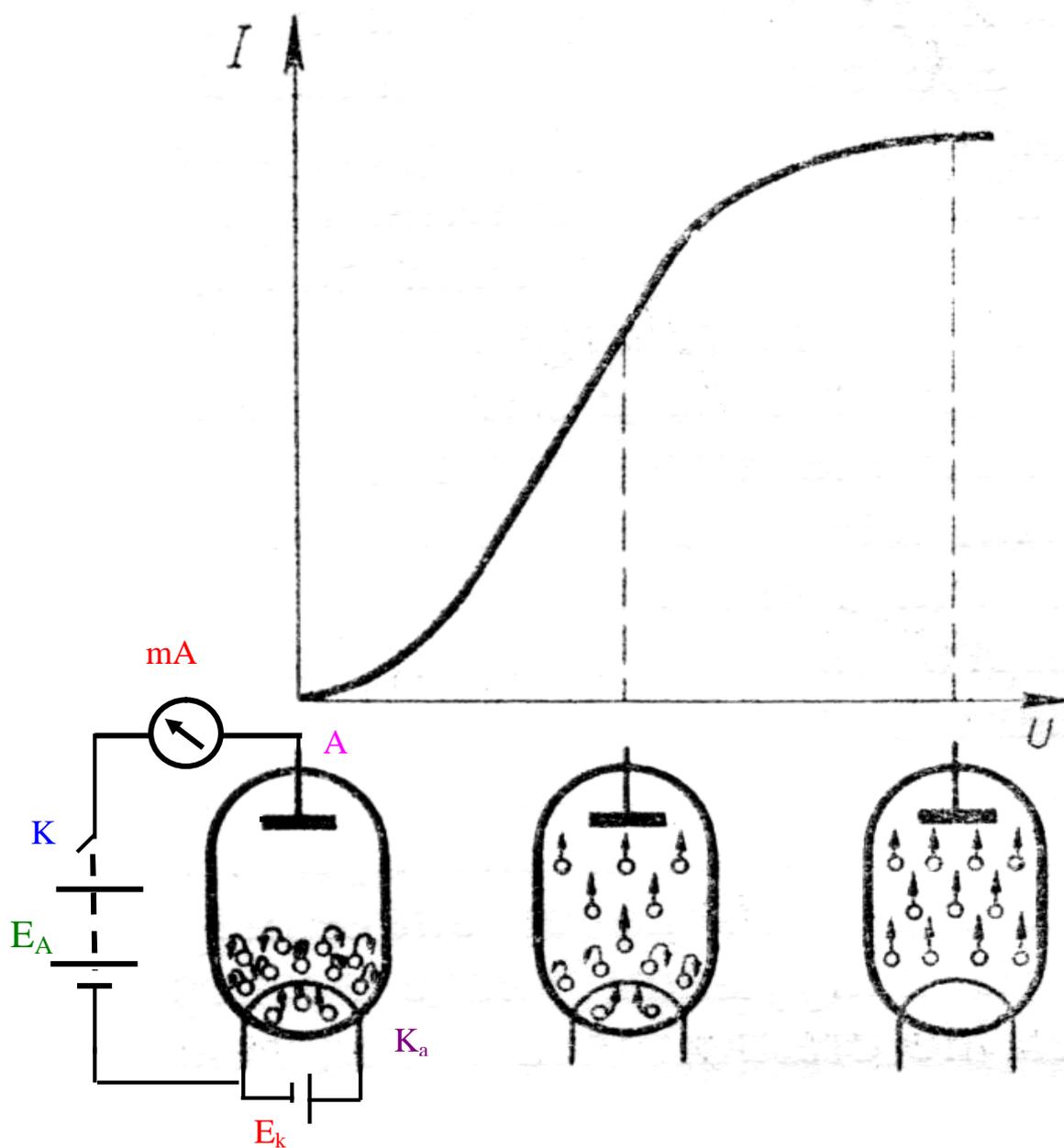
L – kondensator magazini;

Sh - elektr zaryadlarini to'plovchi sharlar;

E₁ - elektrometr;

23. Vakuumda elektr toki. Elektron lampa

24. Volt-amper xarakteristikasi



elektron lampaning ishlash tamoyili.

A - anod; E_A - anod tok manbayi;

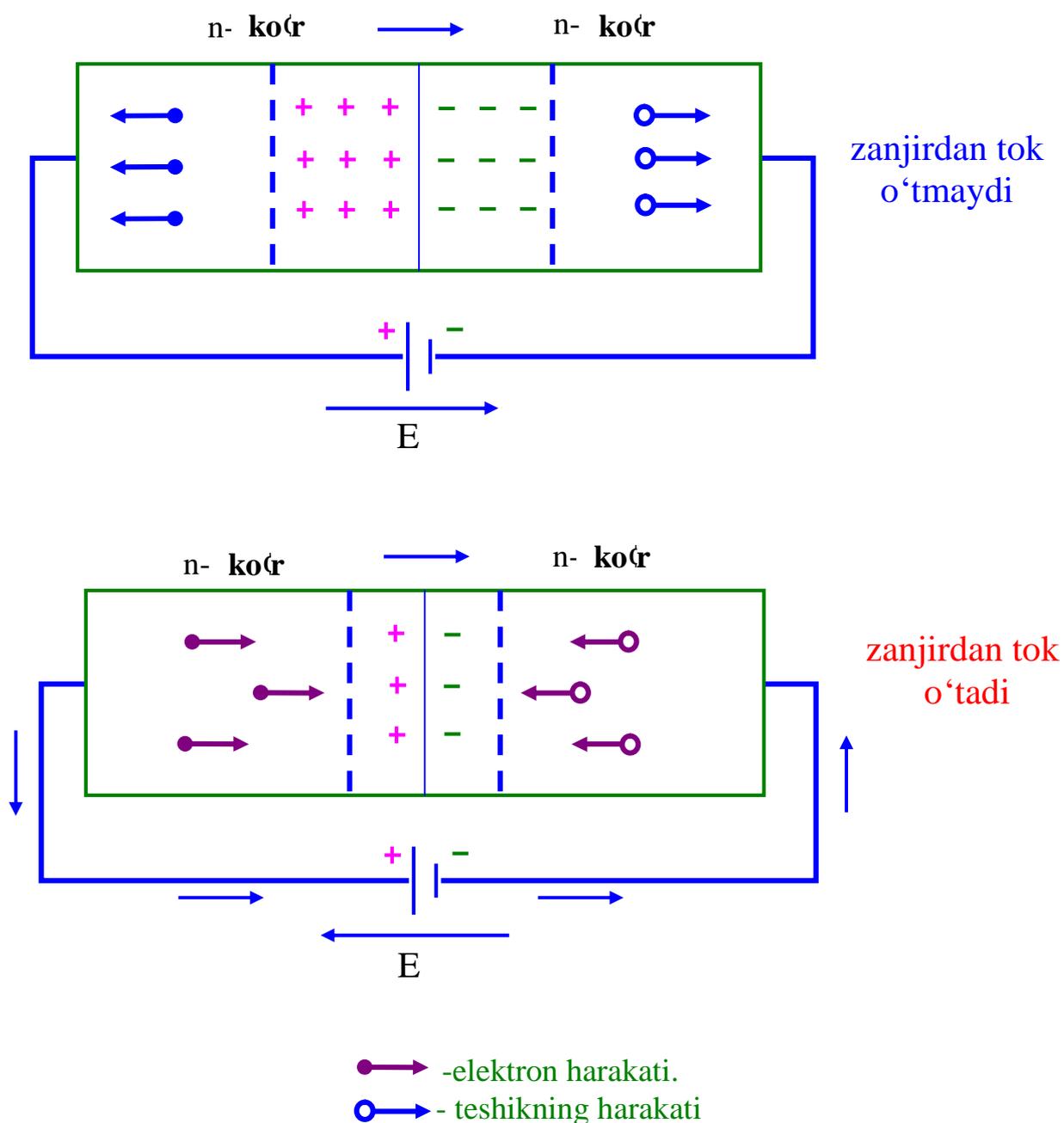
K - kalitd; E_K - katod tok manbayi;

mA - milliampermetr; K_a - katod;

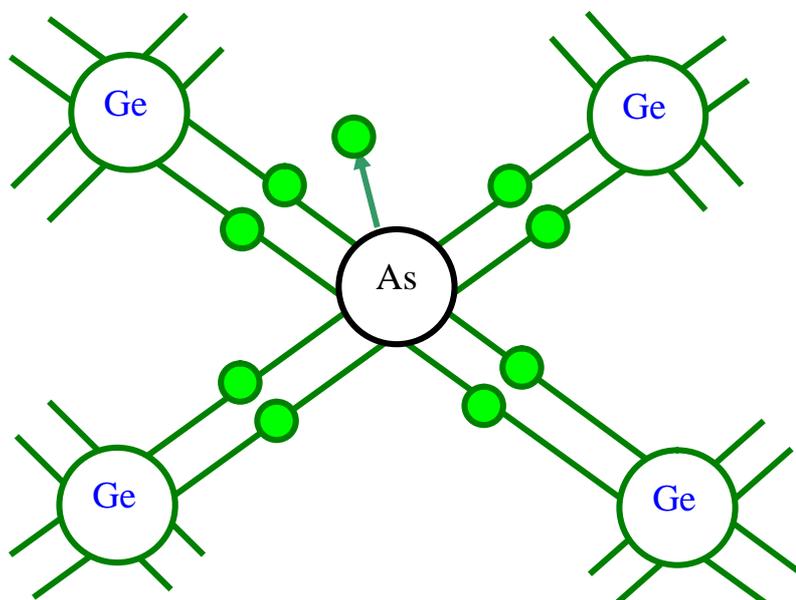
25. Yarimoʻtkazgichda elektr toki

E - tok manbayi;

E_k - n va p- koʻrinishdagi yarimoʻtkazgich chegarasidagi elektr maydon yoʻnalishi;



26. Yarim'otkazgichning aralashmali o'tkazuvchanligi



Ge - germaniy;

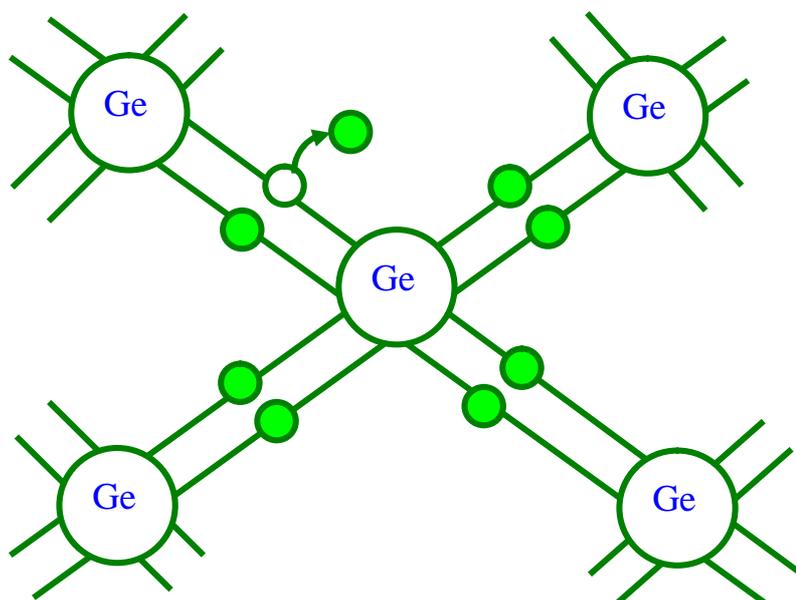
As - mishyak;

● - valent elektron;

Mishyakning tashqi elektron qobig'ida beshta elektronlar bor.

Germaniyning tashqi elektron qobig'ida to'rtta elektronlar bor.

Elektron-teshikli o'tkazuvchanlik



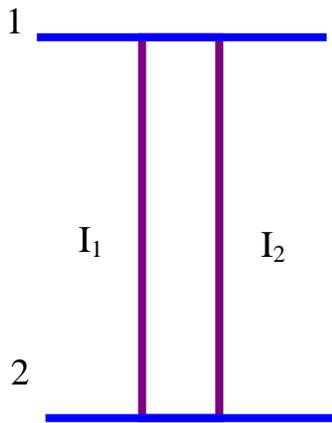
Ge - germaniy.

○ - teshik.

● - elektron.

ELEKTROMAGNETIZM

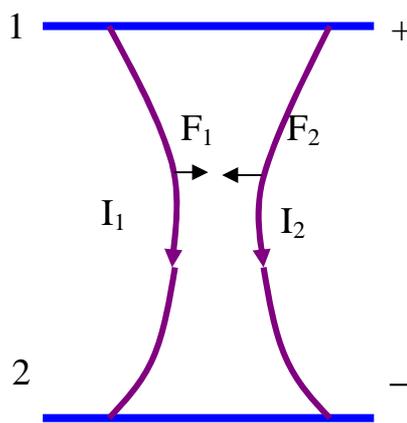
27. Parallel toklarning ta'siri



elektr toki yoq

I_1 va I_2 o'tkazgichlar

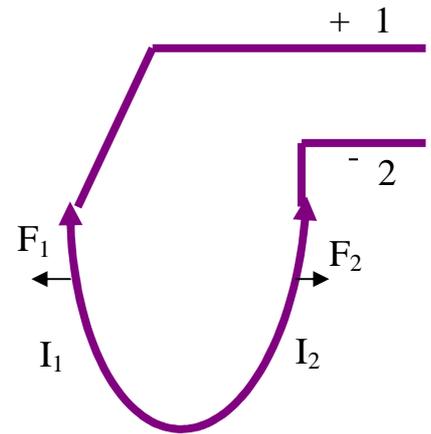
bir-biriga parallel



tok yo'nalishlari bir hil

I_1 va I_2 o'tkazgichlar

bir-biriga tortiladi



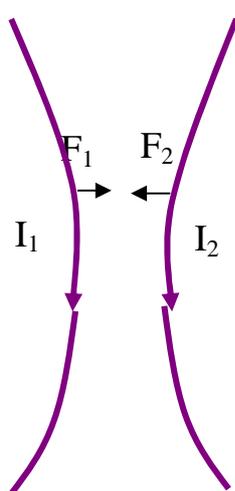
tok yo'nalishlari

qarama – qarshi

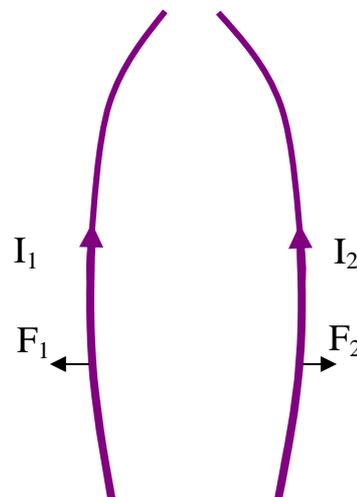
I_1 va I_2 o'tkazgichlar

bir-biridan uzoqlashadi

F_1 va F_2 - o'tkazgichlar orasidagi ta'sir etuvchi kuchlar

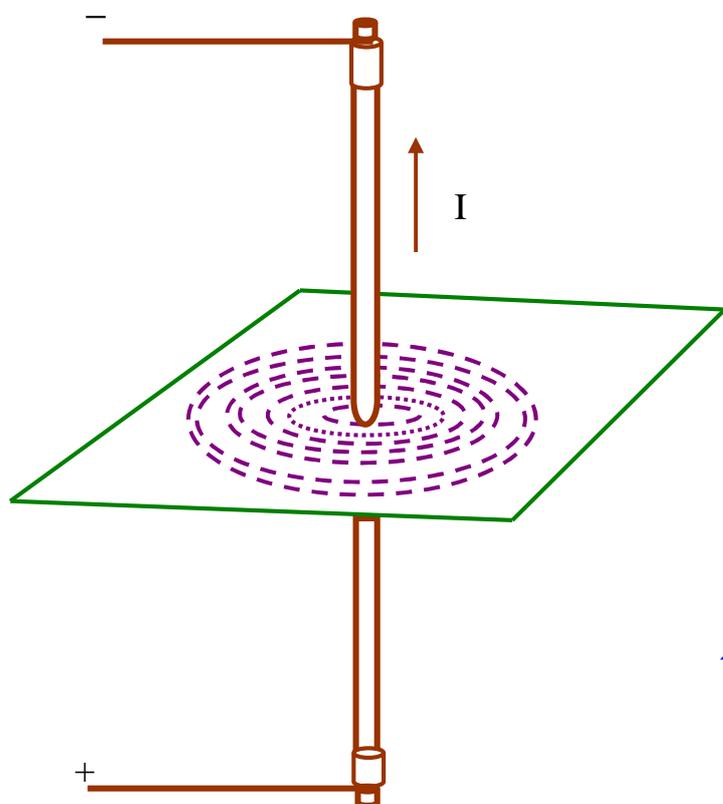


tok yo'nalishlari
bir hil

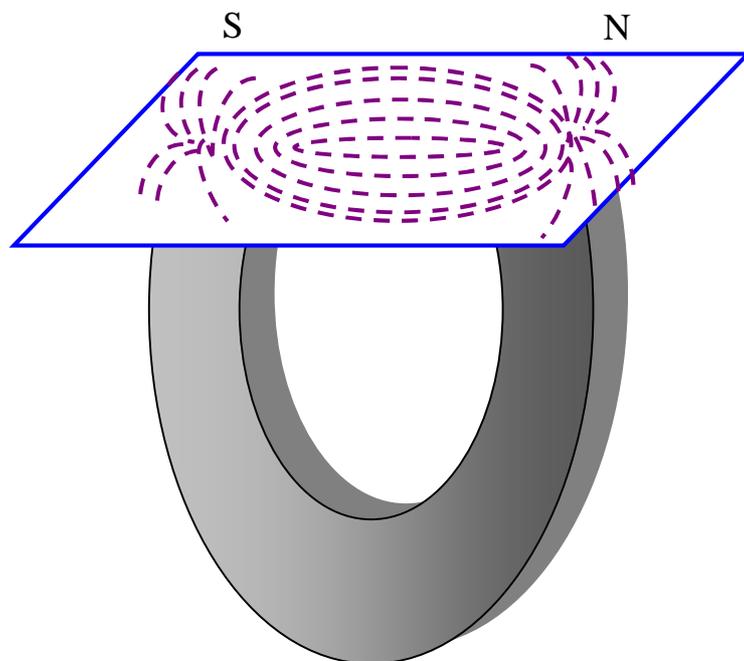


tok yo'nalishlari
qarama - qarshi

28. Magnit maydoninig kuch chiziqlarini namoyish etish



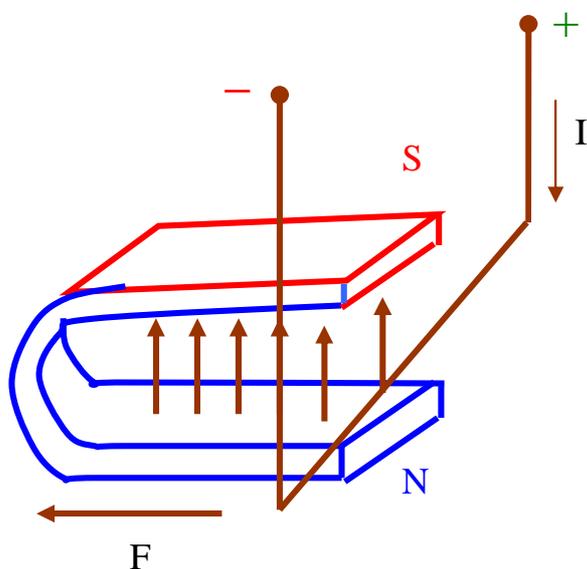
to'g'ri tok atrofida magnit maydon kuch chiziqlari



o'zgarmas magnit jismning magnit maydon kuch chiziqlari

Magnit maydonining tabiati qanday bo'lishidan qat'iy nazar, ularning kuch chiziqlari tutashgan ya'ni boshi va oxiri yoq. Bunday chiziqlarni uyurmaviy magnit maydon kuch chiziqlari deyiladi.

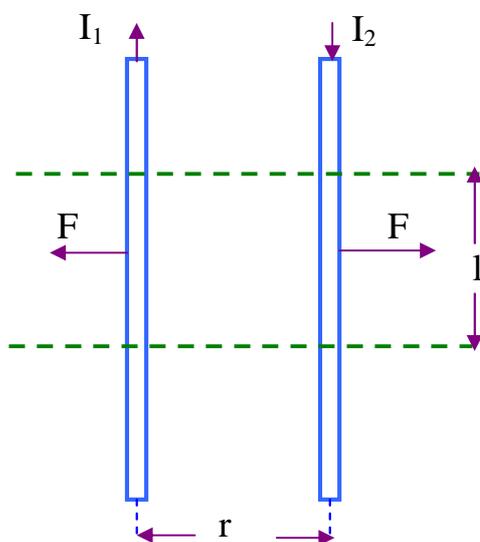
29. Magnit maydonida tokli o'tkazgich. Amper kuchi



N S - o'zgarmas magnetik jism;

I - elektr tok;

F – O'tkazgichga ta'sir etuvchi Amper kuchi;



$$F_A = m_o m H I \cdot l = m_o m \frac{I_1 I_2}{2pr} l$$

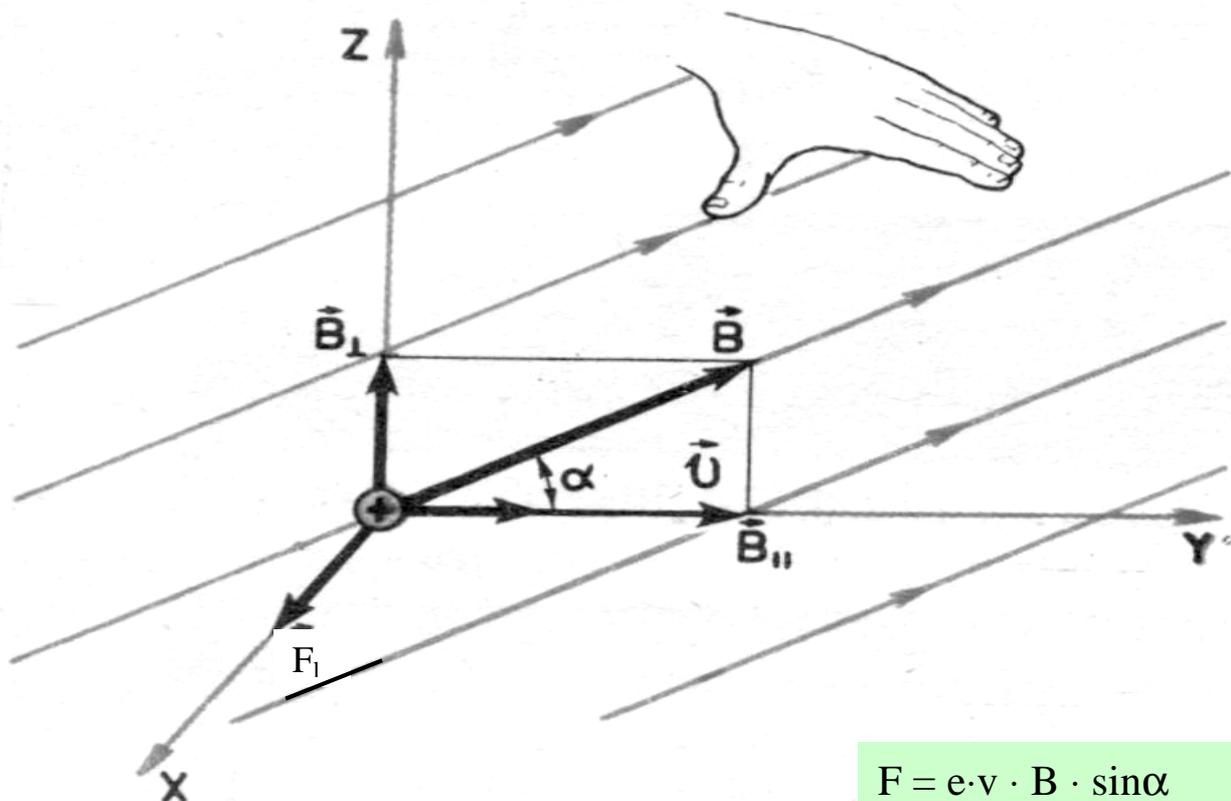
H – magnit maydon kuchlanganligi;

I - o'tkazgichdagi tok kuchi;

l - magnit maydonidagi o'tkazgich uzunligi;

r - o'tkagichlar orasidagi masofa;

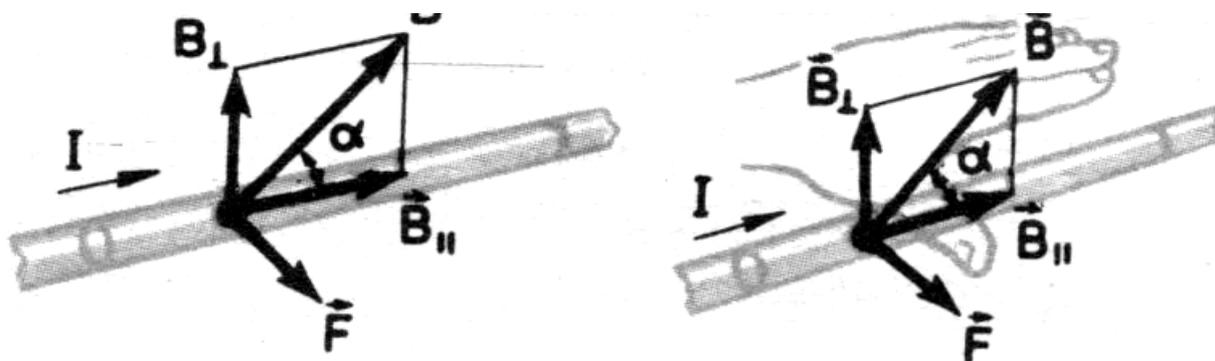
30. Magnit maydonida zaryadga ta'sir etuvchi kuch. Lorents kuchi



$$F = e \cdot v \cdot B \cdot \sin\alpha$$

X, Y, Z - koordinata o'qlari; \vec{B} - magnit induksiya vektori.

\vec{v} - manfiy zaryad tezligi; \vec{F}_l - Lorents kuchi.



α - o'tkazgich va \vec{B} orasidagi burchak.

\vec{B}_{\parallel} va \vec{B}_{\perp} - magnit induksiya vektorining parallel va tik tashkil etuvchilari.

