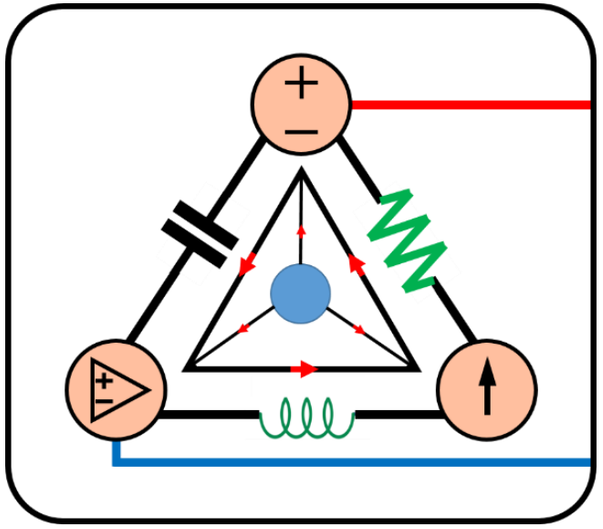
1-Mavzu: Kirish. O‘zgarmas tok zanjiri. Asosiy tushunchalar.

(Lecture-1: DC Circuits. Basic Concepts)

1-Mavzuning 3-qismi

(Part 3 of the Lecture-1)



Lecturer: Yusupov Sarvarbek

Toshkent Kimyo Xalqaro Universiteti
“Mashinasozlik texnologiyasi” kafedrasi
Toshkent shahri, Usmon Nosir, 156-uy.

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1-Mavzu: Kirish. O‘zgarmas tok zanjiri. Asosiy tushunchalar.

(Lecture-1: DC Circuits. Basic Concepts)

O‘quv rejasi:

1.1. Kirish.

1.2. Fanning maqsad va vazifalari.

1.3. Elektr zanjirlarida birliklar tizimi.

1.4. Elektr zanjirlarni tavsiflovchi asosiy kattaliklar va uning elementlari.

1.5. Elektr zaryad va tok kuchi.

1.6. Elektr kuchlanish.

1.7. Quvvat va energiya.

1.8. Elektr zanjiridagi manba elementlarining turlari.

1.9. Qo‘llanishishi.

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1.7. Quvvat va energiya.

Garchi tok kuchi va kuchlanish elektr zanjirida ikkita asosiy o‘zgaruvchi bo‘lsa-da, ular o‘z-o‘zidan yetarli emas. Amaliy maqsadlar uchun biz elektr qurilmasi qancha quvvatga ega bo‘lishini bilishimiz kerak. Biz hammamiz tajribamizdan bilamizki, 100 vattli lampochka 60 vattli lampochkadan ko‘ra ko‘proq yorug‘lik beradi. Bundan tashqari, biz ma’lum vaqt davomida iste’mol qilingan elektr energiyasi uchun elektr ta’minoti korxonalariga to‘lovlarni amalga oshirishimizda elektr va energiya hisob-kitoblari zanjir tahlilida muhim ahamiyatga ega.

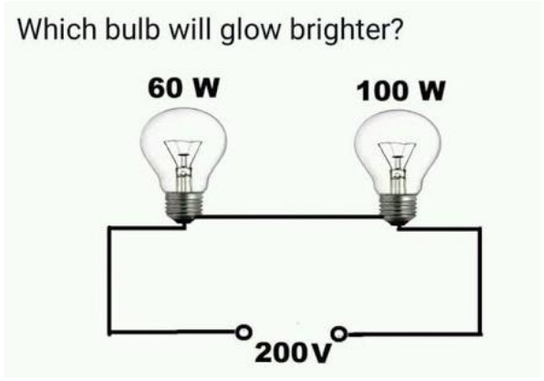

Photo source: [26] - https://www.youtube.com/watch?v=S9yX4Ws1q_U

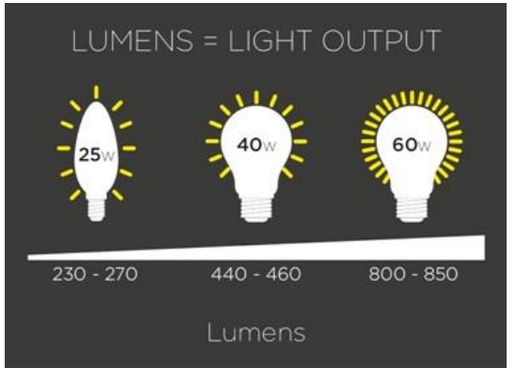

Photo source: [27] - https://integral-led.com/en/image/getthumbnail/7485

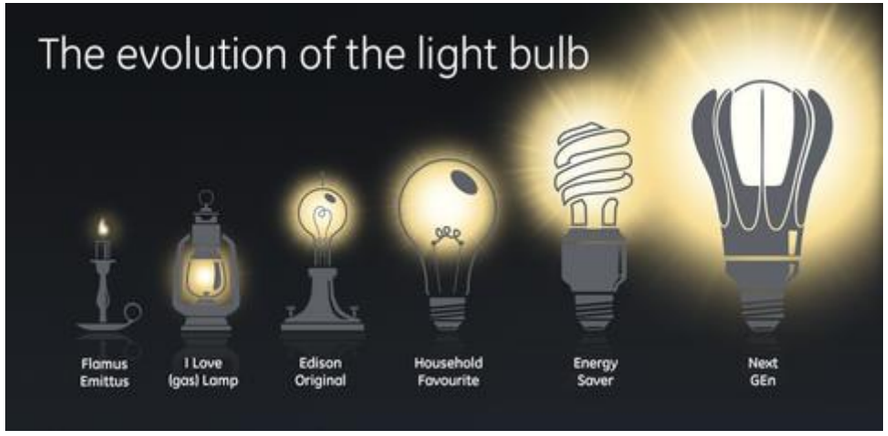

Photo source: [28] - https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcQfwNnxL0Y1uZSbnrqn9QKZ5SpEXpRjd8pE3Y8roOm891dzOkyxhK7g1F7e1OKNkdWbRTA&usqp=CAU

Quvvat - bu vattlarda (Vt yoki W) o‘lchanadigan energiyani sarflash yoki yutish vaqtidir. Biz bu munosabatni quyidagicha yozamiz:

$$p \triangleq \frac{dw}{dt}$$

bu yerda: p – quvvat vattda (Vt), w - energiya joulda (J), t - vaqt soniyada (s).

$$p = \frac{dw}{dt} = \frac{dw}{dq} \cdot \frac{dq}{dt} = ui$$

yoki,

$$p = ui$$

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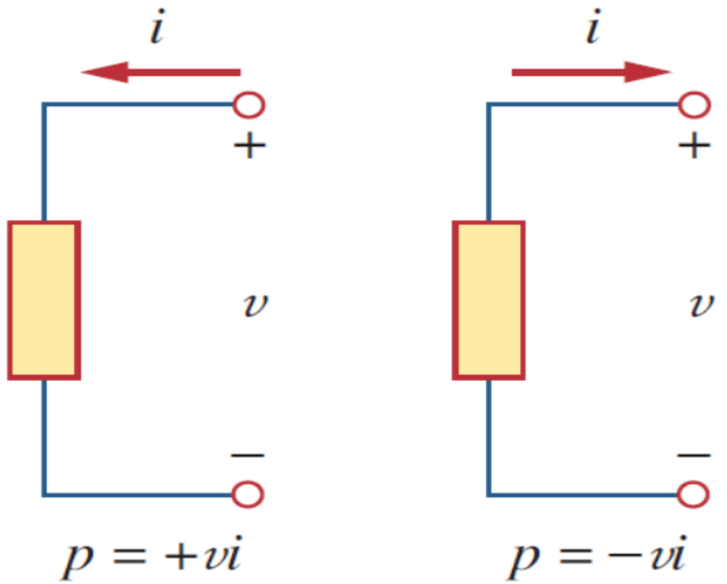
Passiv ishora konvensiyasi *(passive sign convention)* bo‘yicha $\boldsymbol{p = -ui}$.



a) b)

1.11-rasm. Passiv belgi konventsiyasidan foydalangan holda quvvat uchun mos qutblar:
a) quvvatni yutilishi; b) quvvatni ta’minlanishi.

Agar $\boldsymbol{p = -ui}$ yoki $ui < 0$, 1.11-rasm, b dagi kabi, element quvvatni hosil qiladi yoki quvvat bilan ta’minlaydi.

Passiv ishora konvensiyasiga ko‘ra, tok kuchi kuchlanishning musbat qutbi orqali kiradi. Bu holda $\boldsymbol{p = +ui}$ yoki $ui > 0$ elementning quvvat sarflashini bildiradi.

Faol ishora konvensiyasi *(active sign convention)* bo‘yicha $\boldsymbol{p = +ui}$.

+ Quvvat sarflanadi = - Quvvat ta’minlanadi

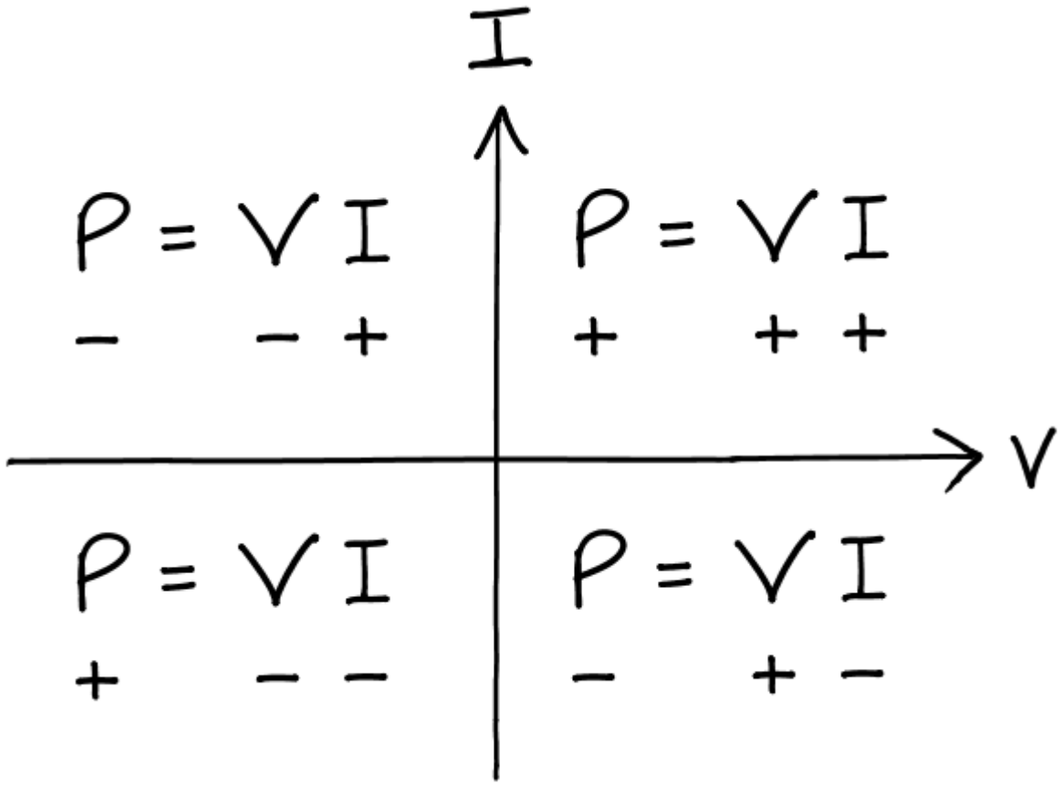


Photo source: [29] - https://faculty.math.illinois.edu/~dpv/ECE110Notes/content/course_notes/course_notes_files/images/power/IVPower.png

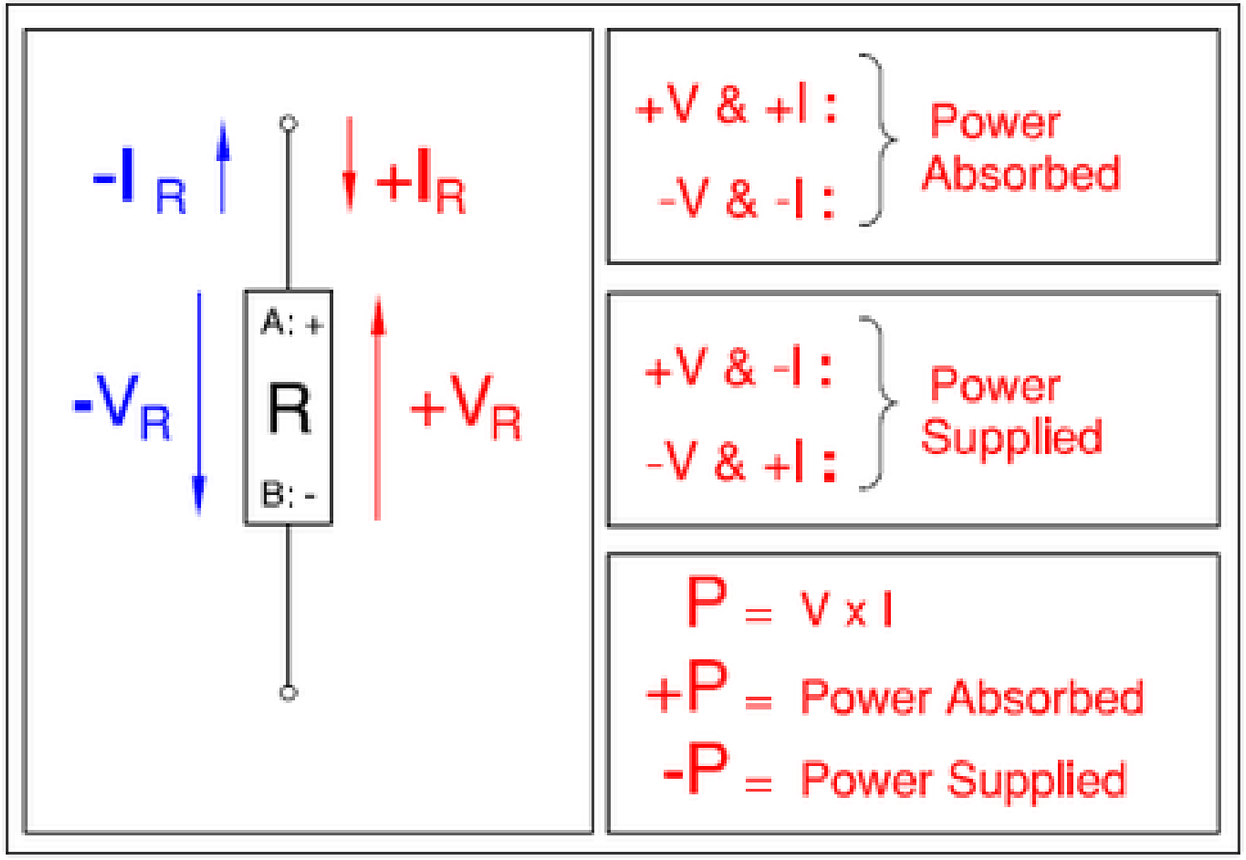
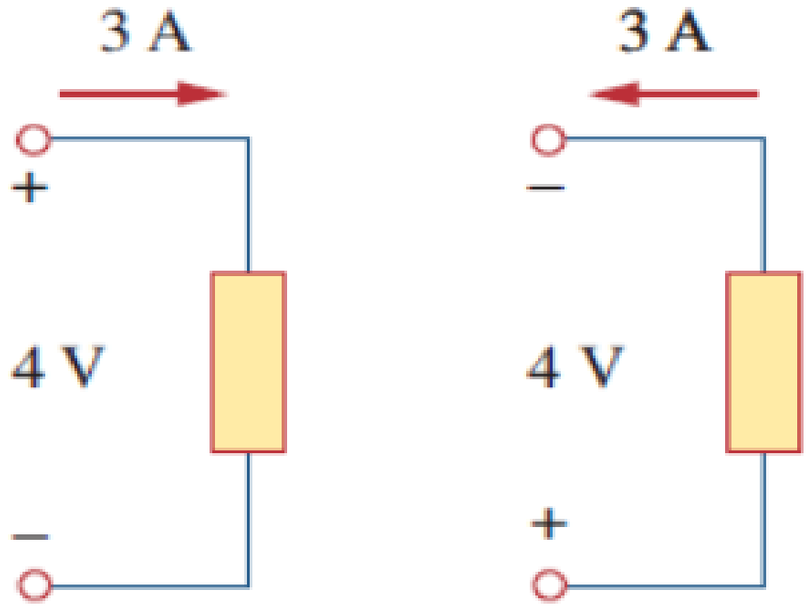


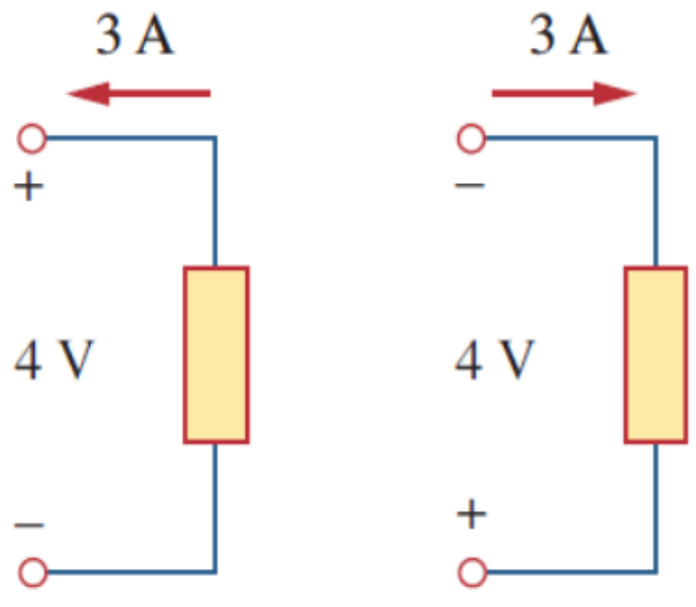
Photo source: [30] - https://upload.wikimedia.org/wikiversity/en/thumb/9/95/EE-102-L01-Fig1.4.png/400px-EE-102-L01-Fig1.4.png



1.12-rasm. Quvvat sarfi 12 Vt bo‘lgan elementning ikkita holati:

a) $p = +4 \cdot 3 = 12\ Vt;$

b) b) $p = +4 \cdot 3 = 12\ Vt.$



1.13-rasm. 12 Vt quvvat ta’minlanishiga ega bo‘lgan elementning ikkita holati:

a) $p = -4 \cdot 3 = -12\ Vt;$

b) b) $p = -4 \cdot 3 = -12\ Vt.$

Har qanday elektr zanjirida energiya saqlanish qonuni *(law of conservation of energy)*ga rioya qilish kerak. Shu sababli, elektr zanjiridagi quvvatning algebraik yig‘indisi vaqtning istalgan onida nolga teng bo‘lishi kerak:

$$\sum p = 0$$

Energiya - bu ishni bajarish qobiliyati bo‘lib, joul (J) bilan o‘lchanadigan.

Elektr ta’minoti kompaniyalari energiyani vatt-soatda (Wh) o‘lchaydilar.

Bu yerda:

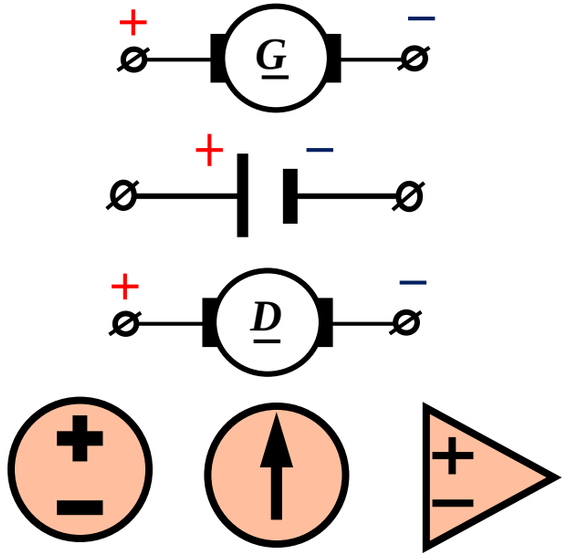
$$1\ Vt \cdot soat\ (Wh) = 3{,}600\ J$$

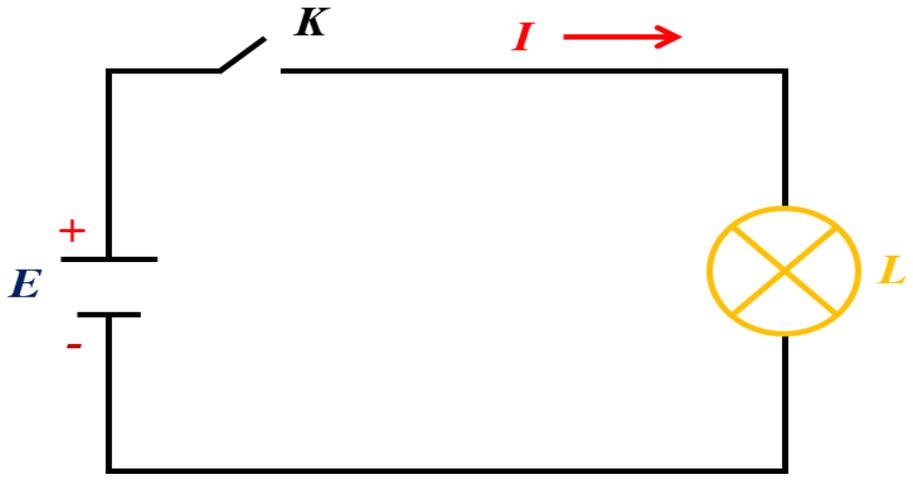
1.8. Elektr zanjiridagi manba elementlarining turlari.

Elementlar zanjirni asosiy hosil qiluvchi qismlari hisoblanadi. Elektr zanjiri oddiygina elementlarning o‘zaro bog‘lanishidir. Zanjir tahlili - zanjir elementlari bo‘ylab kuchlanishlarni (yoki tok kuchlarni) aniqlash jarayonidir.

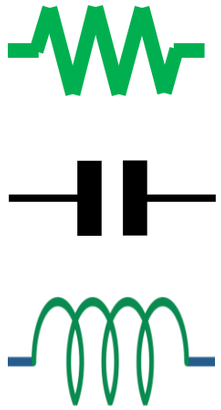
Elektr zanjirlarida ikkita turdagi

Faol (aktiv) elementlar

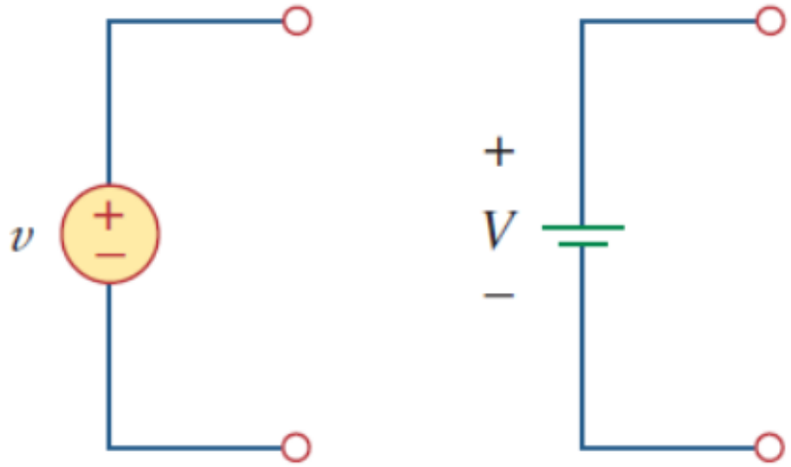




Passiv elementlar

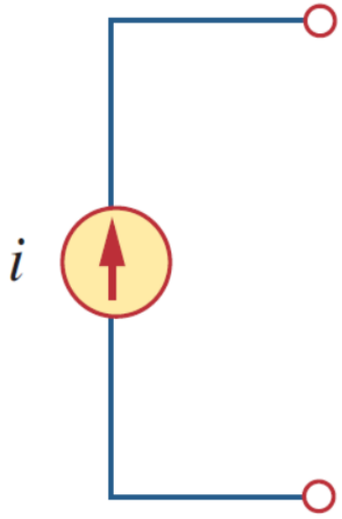


Ideal mustaqil manba - boshqa elektron elementlardan butunlay mustaqil bo‘lgan belgilangan kuchlanish yoki tok kuchini ta’minlaydigan faol elementdir (1.17-1.18-rasm).



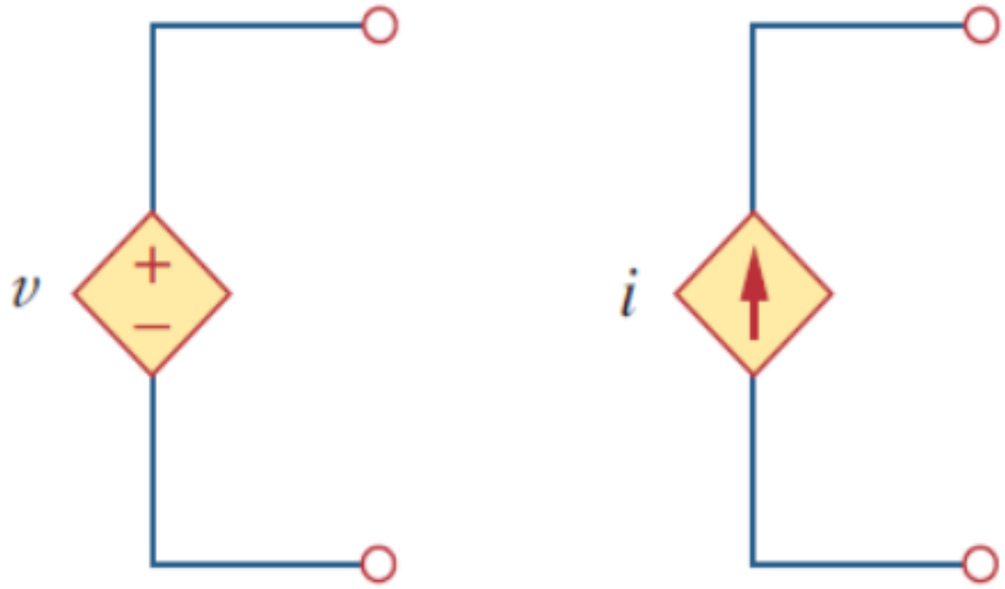
a) b)

1.17-rasm. Mustaqil kuchlanish manbalarining shartli belgilari:
a) o‘zgarmas yoki vaqt bo‘yicha o‘zgaruvchi kuchlanish uchun ishlatiladi; b) o‘zgarmas kuchlanish uchun ishlatiladi (DC).



1.18-rasm. Mustaqil tok kuchi manbai uchun shartli belgi.

Ideal bog‘liq bo‘lgan manba (yoki boshqariladigan) faol element bo‘lib, unda manba miqdori boshqa kuchlanish yoki tok kuchi bilan boshqariladi (1.19-rasm).



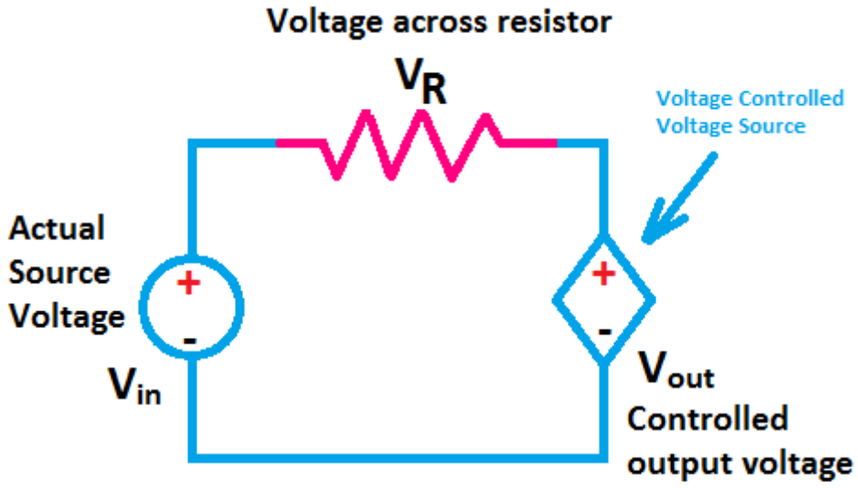
a) b)

1.19-rasm. Bog‘liq bo‘lgan manbalarining shartli belgilari:

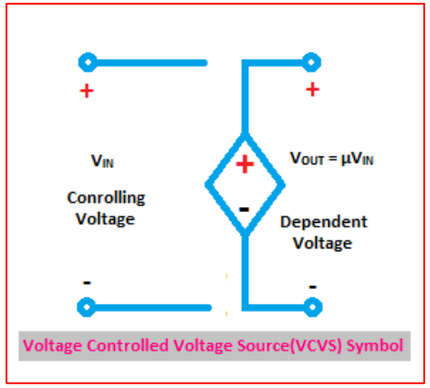
a) bog‘liq bo‘lgan kuchlanish manbai; b) bog‘liq bo‘lgan tok kuchi manbai.

Bog‘liq bo‘lgan manbani boshqarish zanjirdagi boshqa elementning kuchlanishi yoki tok kuchi bilan ta’minlanganligi va manba kuchlanish yoki tok kuchi bo‘lishi mumkinligi sababli, bog‘liq bo‘lgan manbalarning to‘rtta mumkin bo‘lgan turi mavjud, xususan:

1. Kuchlanish bilan boshqariladigan kuchlanish manbai (VCVS);



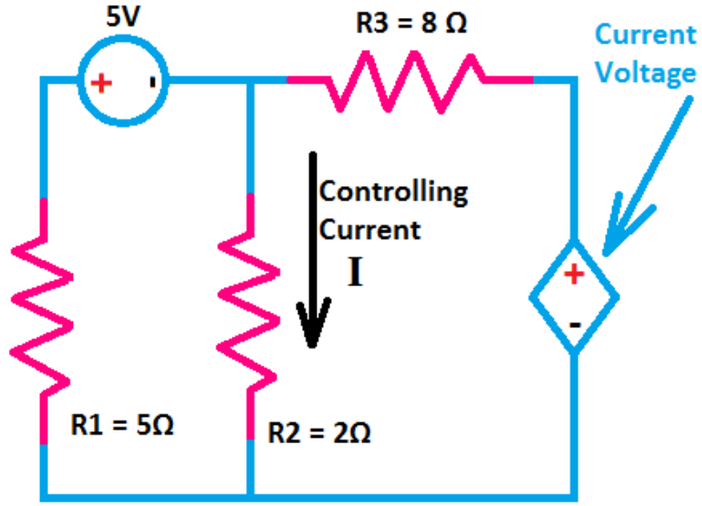
Voltage Controlled Voltage Source(VCVS) Circuit

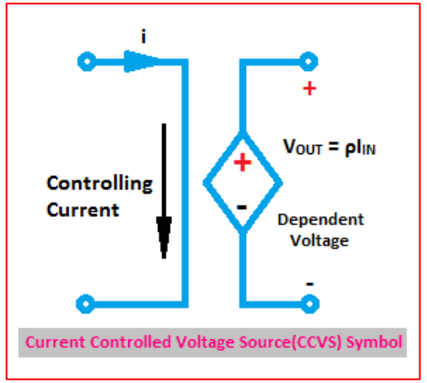


Voltage Controlled Voltage Source(VCVS) Symbol

Photo source: [31] - https://blogger.googleusercontent.com/img/b/R29vZ2xl/AVvXsEge1GHWPzKpBvNerWXygRtEpPzTPxDH-1C81uORWURt9s-bysF9AUF6tTrMtXDsx9tPGCvnDvFSN6ZevDjqNHOh3uJG8JcGIT5y6rsdA0jppBLgu7bCsyAb8kO0NX2M9lkOHSzAfvmNvqvu9HGvIp_Axmo4CftvYA_8kr-66HdF14TDfUlTEhiMPZXd/s482/Voltage%20Controlled%20Voltage%20Source%20or%20VCVS%20Circuit.png

2. Tok kuchi bilan boshqariladigan kuchlanish manbai (CCVS);



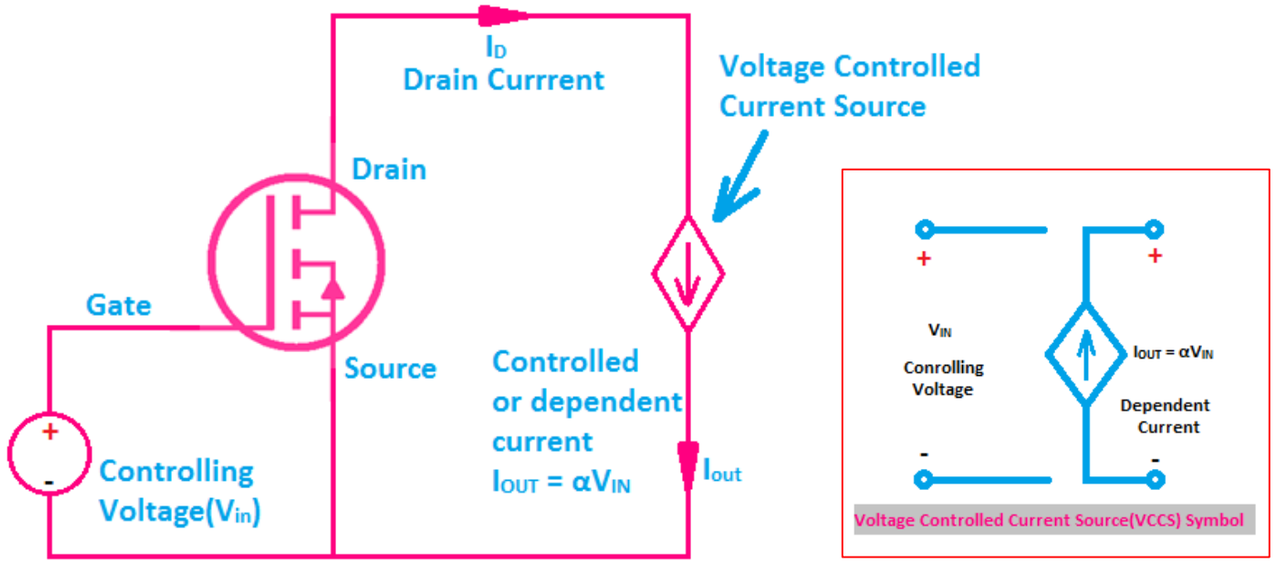


Current Controlled Voltage Source(CCVS) Symbol

Current Controlled Voltage Source(CCVS) Circuit Diagram

Photo source: [32] - https://blogger.googleusercontent.com/img/b/R29vZ2xl/AVvXsEhgfjMESNw-6lKErPPWlkHCHYSyVvrnyXiGv4mHNZrNrpGbcHLma0qxmB19WvKsZF4Y6r0NSBeTotnXJxrUL-aIHTsWlJRN_wMfAHQonFifqaXY52lUZe83cmOLHdc0SWItVGJdVjM-CCkF3yuLxkhhRHiG_JMDaktOI3TpeYrFATa34wFbK1YOvdBH/s541/Current%20Controlled%20Voltage%20Source%20or%20CCVS%20Circuit%20Diagram.png

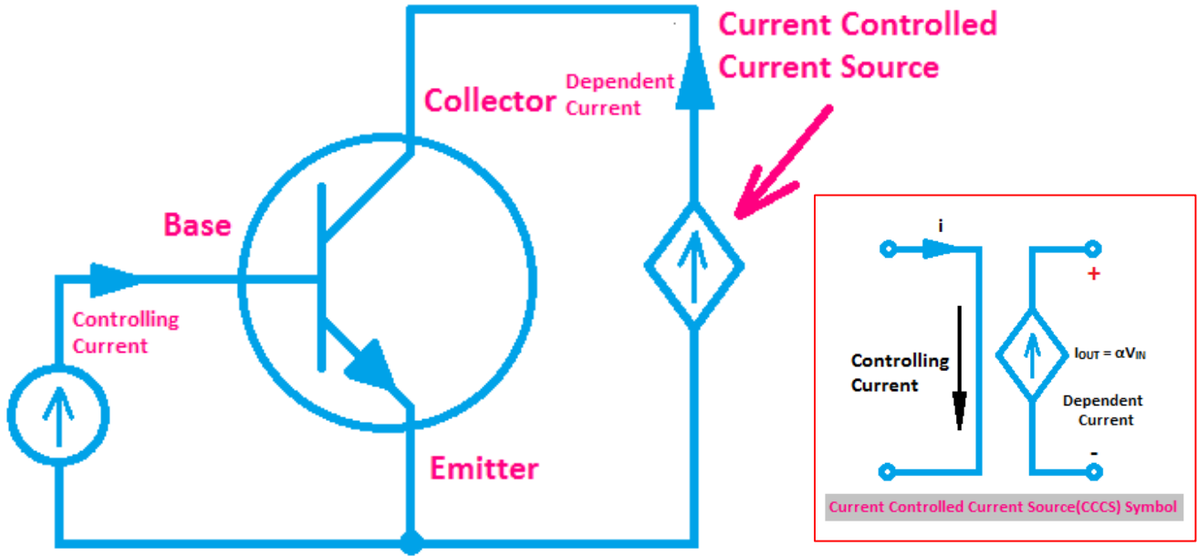
3. Kuchlanish bilan boshqariladigan tok kuchi manbai (VCCS);



Voltage Controlled Current Source(VCCS) Circuit

Photo source: [33] -
https://blogger.googleusercontent.com/img/b/R29vZ2xl/AVvXsEiCL_5vJjRr2jpesxGuuuB9qq_0iC_Kpc-rw787DhilYEkzhJOY3-weHOlFHpTFw739SOlHjKD9NHPNjIHYJwphL5CACBP6S8g2QJkRBvUNPbsBFhFzBjfr2_KPvYPwrPcATzy6hsvQwBUNPJrKRfp_aAC0y_gLpvrnID0bwZNOLbSMZBmIGaFcCeCc/s593/Voltage%20Controlled%20Current%20Source%20or%20VCCS%20Circuit%20Diagram.png

4. Tok kuchi bilan boshqariladigan tok kuchi manbai (CCCS).



Current Controlled Current Source(CCCS) Circuit Diagram

Photo source: [34] -
https://blogger.googleusercontent.com/img/b/R29vZ2xl/AVvXsEhenCf8EbSlmIZMnu5hQE2TE9DXDnlO19Nx3xdZu6OtPIMxkFka0Bjy7GDSwLS16JXRR74zOKlYIdKdYLNMLJOiUwfj8DEQTGWk_pxRwTLVuuSycP-xOK1stsn-p8F5PDcei7sLBmCt5Lz023sUxcsNLUqklqZK57re7HvlxZ_7dkcsogmrEYWCERGH/s570/Current%20Controlled%20Current%20Source%20CCCS%20Circuit%20Diagram.png

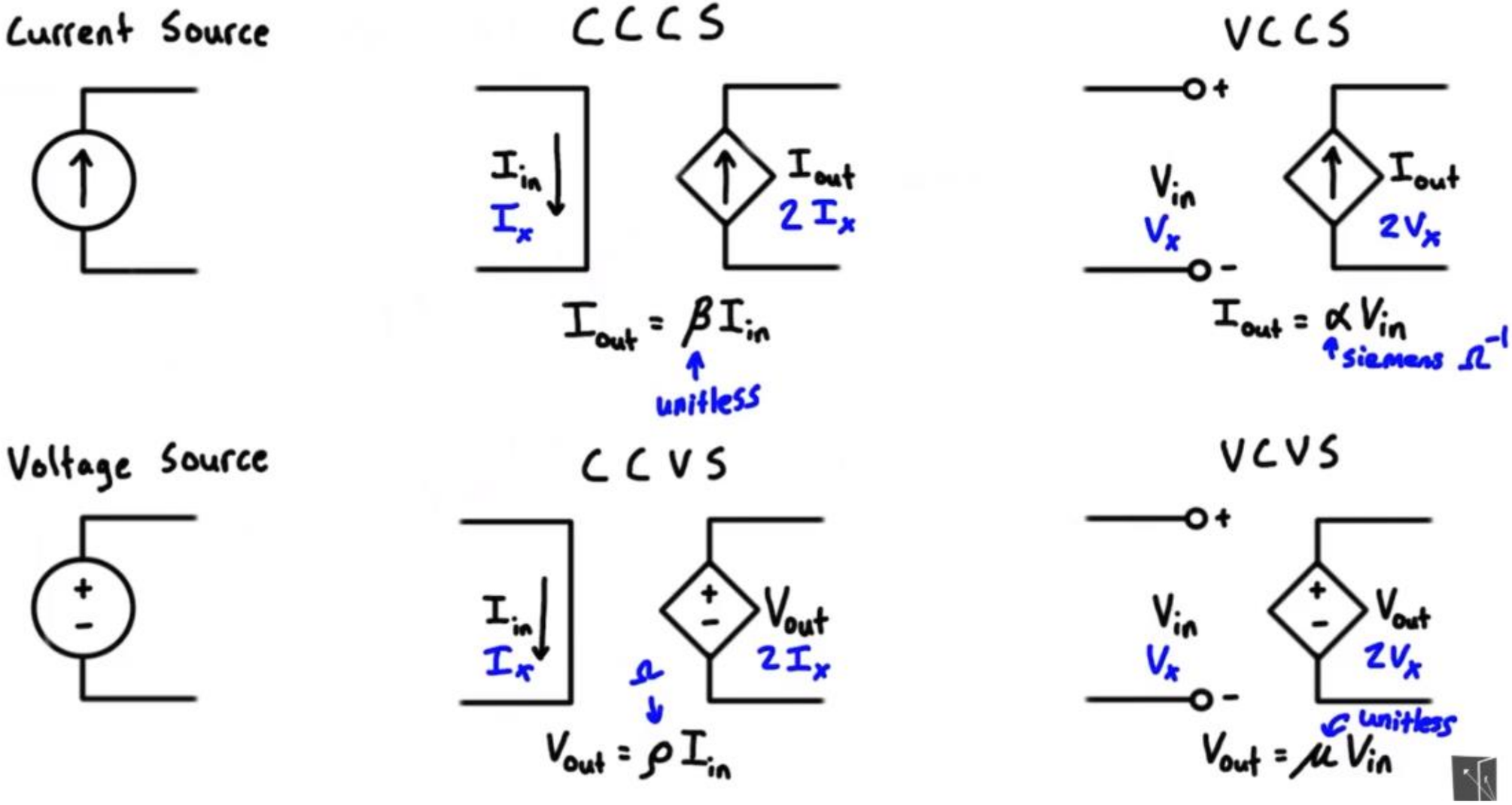
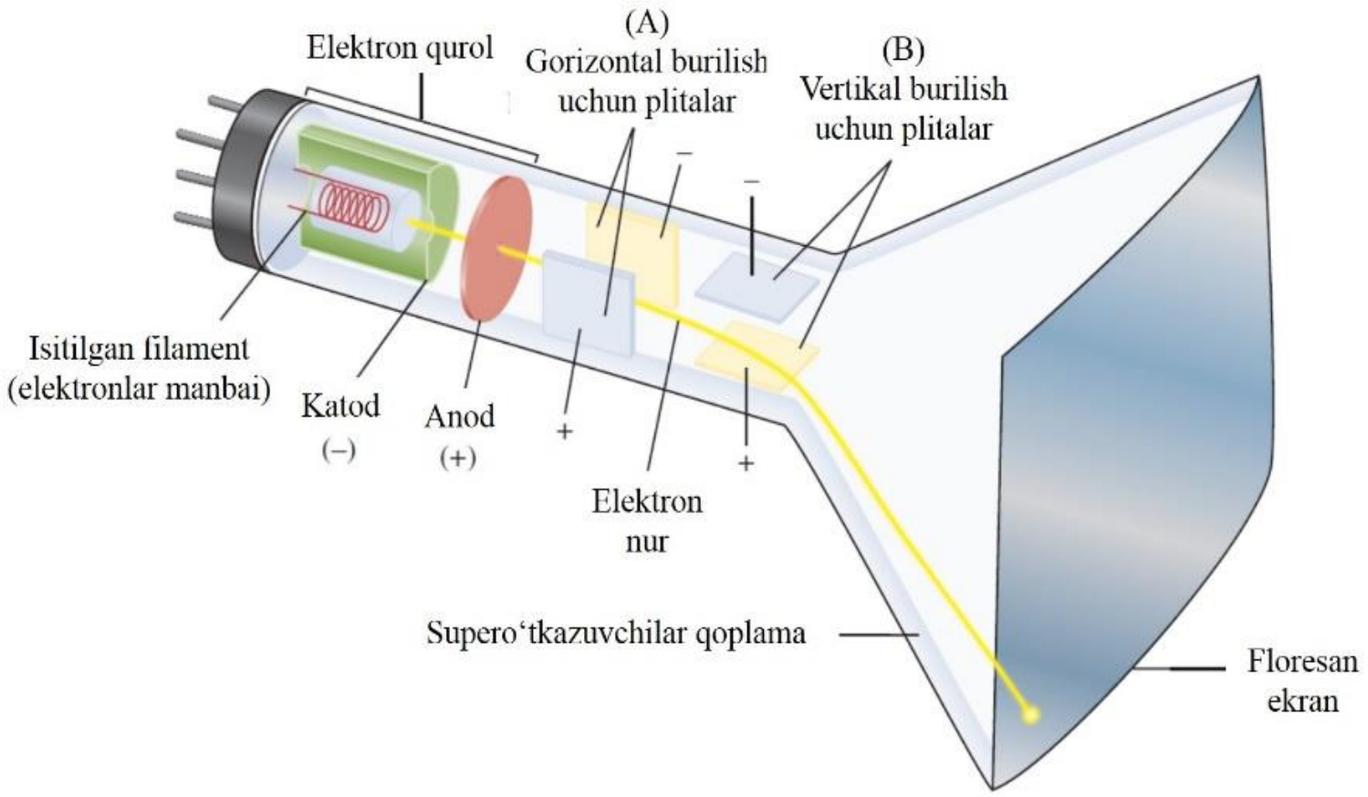


Photo source: [35] - https://www.engineer4free.com/4/independent-and-dependent-power-sources

1.9. Qo‘llanishishi.

Televizor tasvir trubkasi. Elektronlar harakatining muhim qo‘llanilishi televizor signallarini uzatishda ham, qabul qilishda ham mavjud. Uzatish oxirida televizor kamerasi sahnani optik tasvirdan elektr signaliga qisqartiradi. Skanerlash ikonoskop kamerasi trubkasidagi ingichka elektronlar nurlari yordamida amalga oshiriladi.

Qabul qilish uchida tasvir televizor qabul qilgichida joylashgan katoder trubkasi (CRT-cathoderay tube) yordamida qayta tiklanadi. CRT 1.22-rasmda tasvirlangan.



1.22-rasm. Katod-nurli trubka.

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Doimiy intensivlikdagi elektron nurni ishlab chiqaradigan ikonoskop naychasidan farqli o‘laroq, CRT nurlari kiruvchi signalga ko‘ra intensivlikda o‘zgaradi. Yuqori potensialda saqlanadigan elektron qurol elektron nurni o‘qqa tutadi.

Nur vertikal va gorizontal burilishlar uchun ikkita plastinka to‘plamidan o‘tadi, shunda ekrandagi nurning urilgan joyi o‘ngga va chapga va yuqoriga hamda pastga siljiydi.

Elektron nur lyuminesent ekranga tushganda, u o‘sha nuqtada yorug‘lik chiqaradi. Shunday qilib, nurni televizor ekranida rasmni hosil qilishi mumkin.

Elektr to‘lovlari. Bu qo‘llanishda elektr ta’minoti kompaniyasi o‘z mijozlariga qanday haq to‘lashi bilan bog‘liq. Elektr energiyasining narhi kilovatt-soatda (*kVt-soat*) iste’mol qilingan energiya miqdoriga bog‘liq.

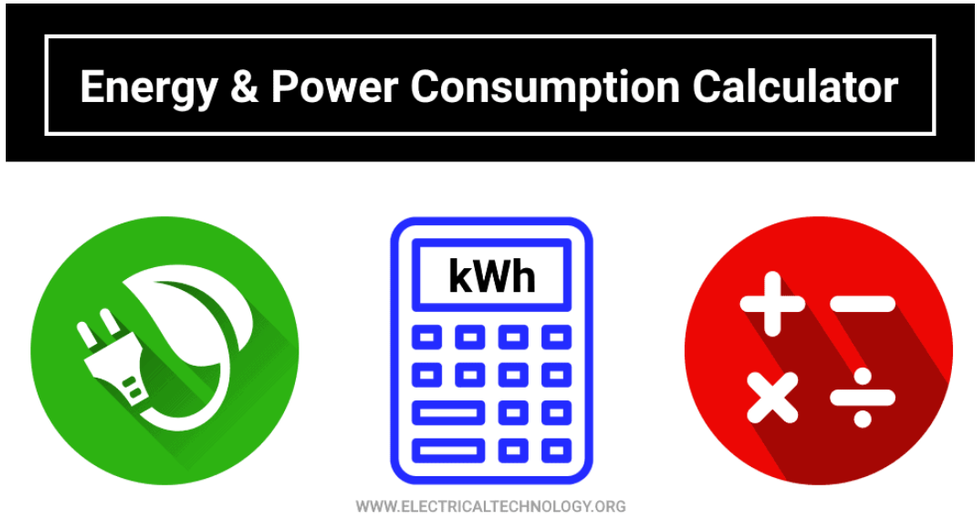


Photo source: [36] - https://www.electricaltechnology.org/wp-content/uploads/2020/12/Energy-and-Power-Consumption-Calculator.png

FOYDALANILGAN FOTO MANBAALAR:

26. https://www.youtube.com/watch?v=S9yX4Ws1q_U
27. https://integral-led.com/en/image/getthumbnail/7485
28. https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcQfwNnxL0Y1uZSbnrqn9QKZ5SpEXpRjd8pE3Y8roOm891dzOkyxhK7g1F7e1OKNkdWbRTA&usqp=CAU
29. https://faculty.math.illinois.edu/~dpv/ECE110Notes/content/course_notes/course_notes_files/images/power/IVPower.png
30. https://upload.wikimedia.org/wikiversity/en/thumb/9/95/EE-102-L01-Fig1.4.png/400px-EE-102-L01-Fig1.4.png
31. https://blogger.googleusercontent.com/img/b/R29vZ2xl/AVvXsEge1GHWPzKpBvNerWXygRtEpPzTPxDH-1C81uORWURt9s-bysF9AUF6tTrMtXDsx9tPGCvnDvFSN6ZevDjqNHOh3uJG8JcGIT5y6rsdA0jppBLgu7bCsyAb8kO0NX2M9lkOHSzAfvmNvqvu9HGvIp_Axmo4CftvYA_8kr-66HdF14TDfUlTEhiMPZXd/s482/Voltage%20Controlled%20Voltage%20Source%20or%20VCVS%20Circuit.png
32. https://blogger.googleusercontent.com/img/b/R29vZ2xl/AVvXsEhgfjMESNw-6lKErPPWlkHCHYSyVvrnyXiGv4mHNZrNrpGbcHLma0qxmB19WvKsZF4Y6r0NSBeTotnXJxrUL-aIHTsWlJRN_wMfAHQonFifqaXY52lUZe83cmOLHdc0SWItVGJdVjM-CCkF3yuLxkhhRHiG_JMDaktOI3TpeYrFATa34wFbK1YOvdBH/s541/Current%20Controlled%20Voltage%20Source%20or%20CCVS%20Circuit%20Diagram.png
33. https://blogger.googleusercontent.com/img/b/R29vZ2xl/AVvXsEiCL_5vJjRr2jpesxGuuuB9qq_0iC_Kpc-rw787DhilYEkzhJOY3-weHOlFHpTFw739SOlHjKD9NHPNjIHYJwphL5CACBP6S8g2QJkRBvUNPbsBFhFzBjfr2_KPvYPwrPcATzy6hsvQwBUNPJrKRfp_aAC0y_gLpvrnID0bwZNOLbSMZBmIGaFcCeCc/s593/Voltage%20Controlled%20Current%20Source%20or%20VCCS%20Circuit%20Diagram.png
34. https://blogger.googleusercontent.com/img/b/R29vZ2xl/AVvXsEhenCf8EbSlmIZMnu5hQE2TE9DXDnlO19Nx3xdZu6OtPIMxkFka0Bjy7GDSwLS16JXRR74zOKlYIdKdYLNMLJOiUwfj8DEQTGWk_pxRwTLVuuSycP-xOK1stsn-p8F5PDcei7sLBmCt5Lz023sUxcsNLUqklqZK57re7HvlxZ_7dkcsogmrEYWCERGH/s570/Current%20Controlled%20Current%20Source%20CCCS%20Circuit%20Diagram.png
35. https://www.engineer4free.com/4/independent-and-dependent-power-sources
36. https://www.electricaltechnology.org/wp-content/uploads/2020/12/Energy-and-Power-Consumption-Calculator.png

TEKSHIRISH UCHUN SAVOLLAR!

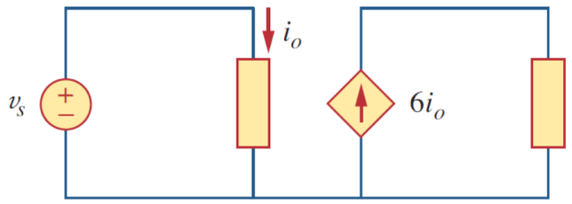
1.1. Bir millivolt voltning milliondan bir qismidir.
A) to‘g‘ri. B) noto‘g‘ri.

1.2. *Mikro* prefiks quyidagini anglatadi.
A) 10^{6}. B) 10^{3}. C) 10^{-3}. D) 10^{-6}.

1.3. 2 000 000 V kuchlanishni SI ning o‘nli karrali ifodalanishini belgilang.
A) 2 mV. B) 2 kV. C) 2 MV. D) 2 GV.

1.4. Har soniyada ma’lum bir nuqtadan o‘tadigan 2 C zaryad 2 A tok kuchiga tengdir.
A) to‘g‘ri. B) noto‘g‘ri.

1.5. Tok kuchining birligi nima?
A) kulon. B) amper. C) volt. D) joul.



1.24-rasm.

1.6. Kuchlanish nimada o‘lchanadi?
A) vatlarda. B) amperlarda. C) voltlarda.
D) soniyadagi joul.

1.7. Dielektrik materialni zaryadlovchi 4 A tok 6 soniyadan keyin 24 C zaryad to‘playdi.
A) to‘g‘ri. B) noto‘g‘ri.

1.8. 10 A tok ishlab chiqaradigan 1,1 kVt tosterdagi kuchlanishni toping.
A) 11 kV. B) 1100 V. C) 110 V. D) 11 V.

1.9. Bulardan qaysi biri elektr kattalik emas?
A) zaryad. B) vaqt. C) kuchlanish. D) tok kuchi.
E) quvvat.

1.10. 1.24-rasmdagi bog‘liq bo‘lgan manbani toping.
A) kuchlanish bilan boshqariladigan kuchlanish manbai.
B) tok kuchi bilan boshqariladigan kuchlanish manbai.
C) kuchlanish bilan boshqariladigan tok kuchi manbai.
D tok kuchi bilan boshqariladigan tok kuchi manbai.

E'TIBORINGIZ UCHUN RAHMAT!!!

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