ON4CRD

Imleabhar 05

# Scagairí a ríomh



Radio Club Durnal ON4CRD

https://on4crd.be

# Fógraí dlí

**Imleabhar 05 · Scagairí a ríomh**

Foilsitheoir láithreán gréasáin : Radio Club Durnal ON4CRD

Bainisteoir foilseachán : Coiste Radio Club Durnal ON4CRD

https://on4crd.be

Fógraí dlí

## Maoin intleachtúil

Fanann téacsanna, íomhánna, doiciméid, lógónna agus ábhair a fhoilsítear ar an láithreán faoi úinéireacht a n-údair faoi seach nó ag an gclub. Ní mór go n-urramódh aon atáirgeadh nó athúsáid an fhoinse, na cearta is infheidhme agus aon chead údair.

## Dliteanas

Oibríonn an club chun eolas úsáideach agus fíoraithe a fhoilsiú, ach ní chinntíonn sé nach mbeidh earráidí, easnaimh nó cur isteach ann. Ní mór faisnéis theicniúil nó rialála a sheiceáil i gcoinne foinsí oifigiúla nuair a thacaíonn sé le cinneadh.

Léaráidí cruthaithe le cúnamh intleachta saorga.

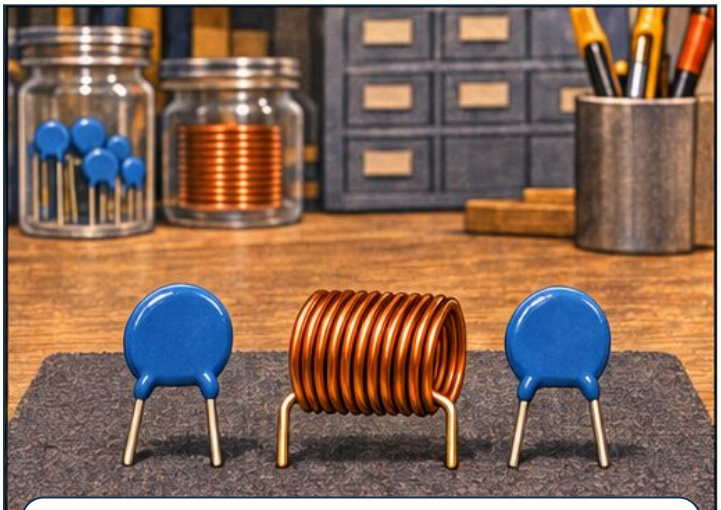
# Tasc nua



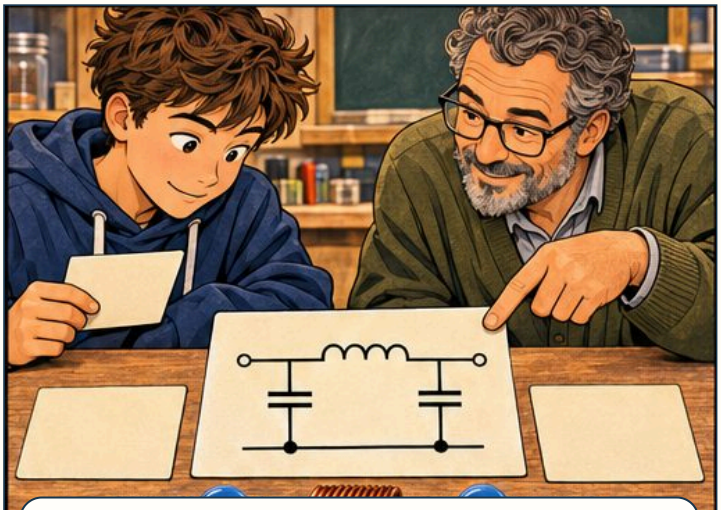
Sa chlub, osclaíonn Lucas a leabhar nótaí tar éis na ceardlainne leictreachais.



Tá Henri ag ullmhú taispeántais faoi cháilíocht comharthaí.



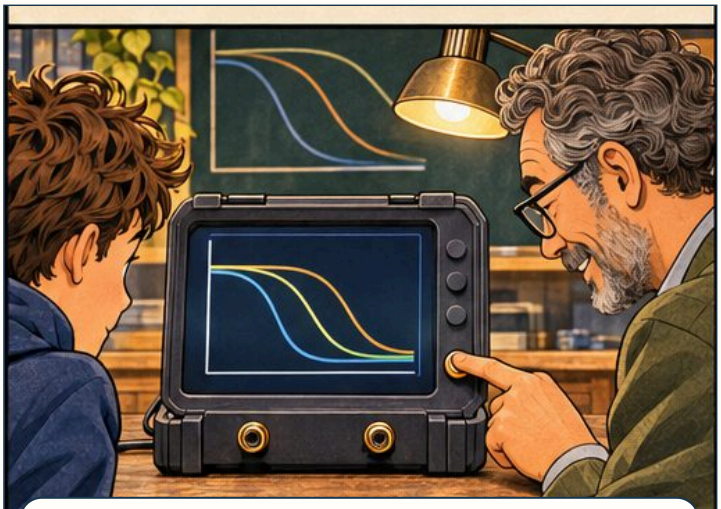
Tá dhá thoilleoir agus corna ag fanacht ar an mbord.



An tasc: scagaire pas íseal a thuiscint, a ríomh agus a thomhas.

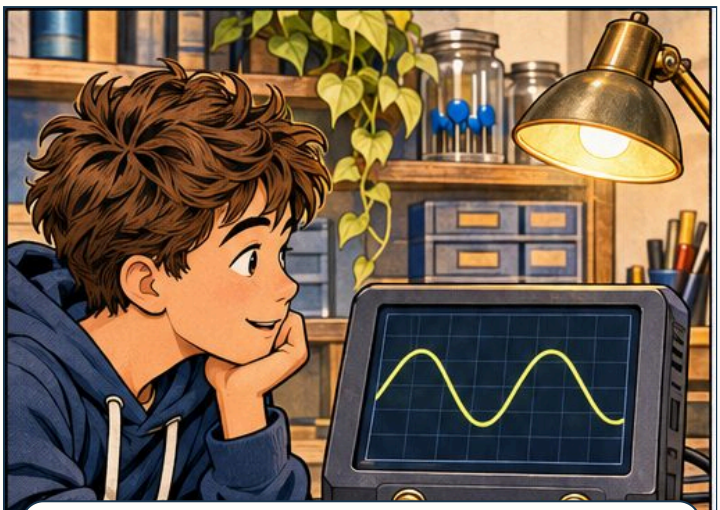


Ba mhaith leis a thuiscint cad is féidir le trí chomhpháirt a athrú.

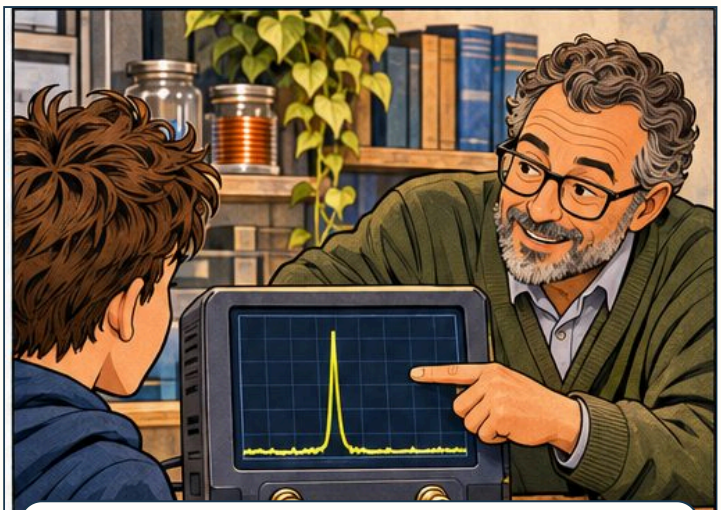


Ar dtús, scrúdaíonn siad a bhfuil i gcomhartha.

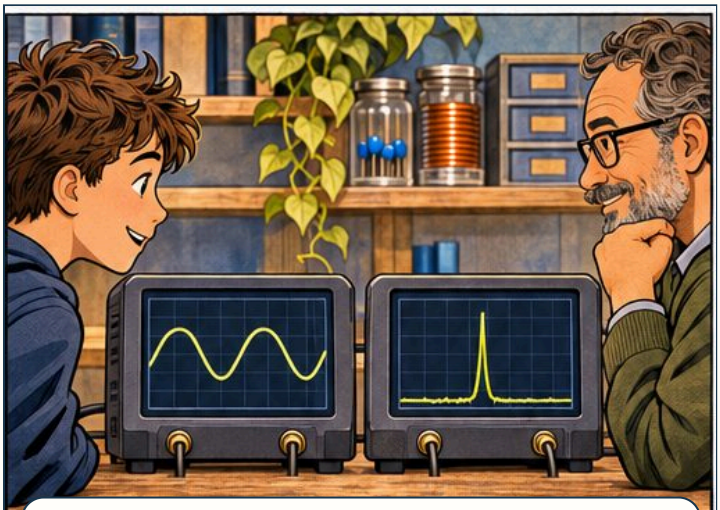
# An comhartha agus a phortráid



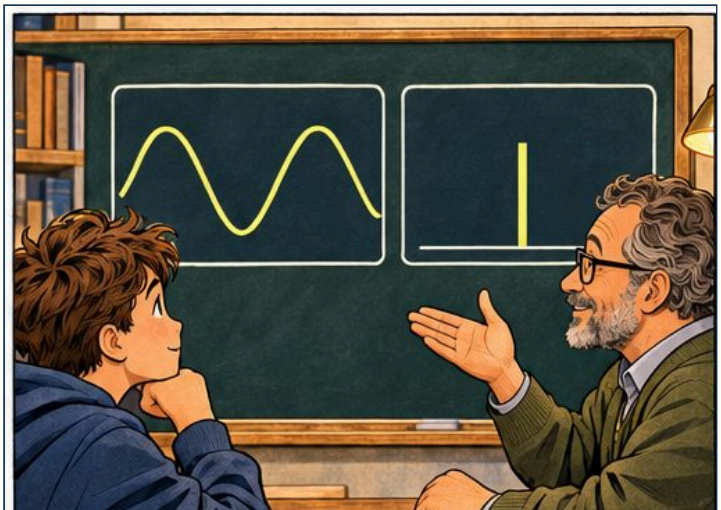
Léiríonn cuar ama conas a athraíonn comhartha.



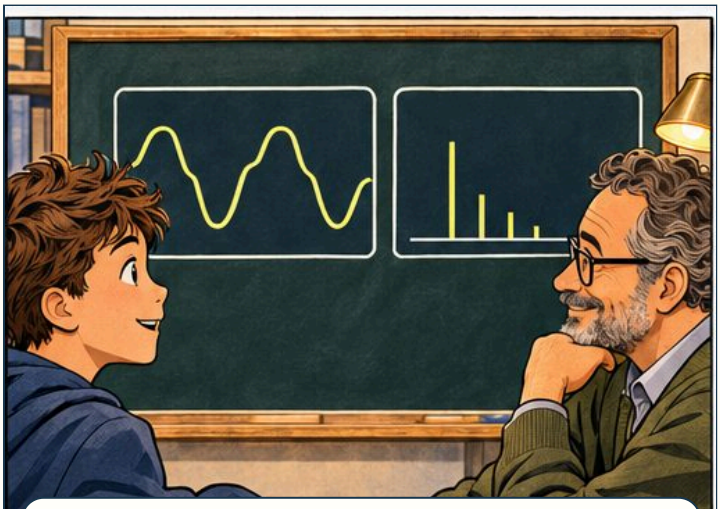
Léiríonn speictream a chomhpháirteanna de réir minicíochta.



Déanann an dá radharc cur síos éagsúil ar an gcomhartha céanna.



Níl ach minicíocht amháin i sínis idéalach.

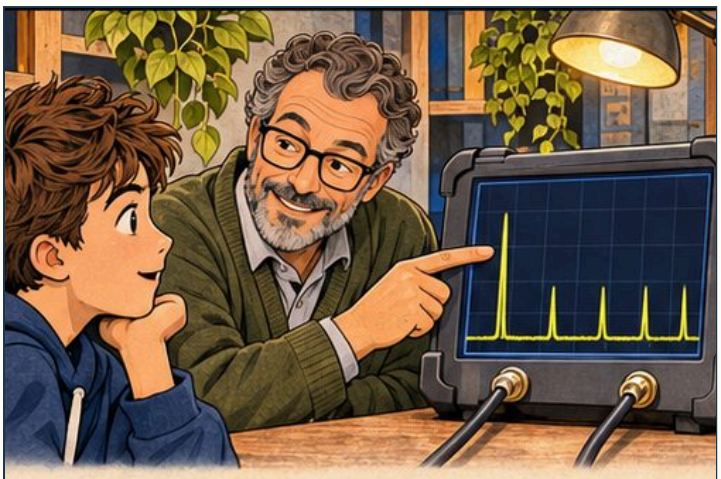


D'fhéadfadh roinnt comhpháirteanna a bheith i gcruth saofa.



Faigheann an foghlaimeoir amach conas pictiúr nua a léamh.

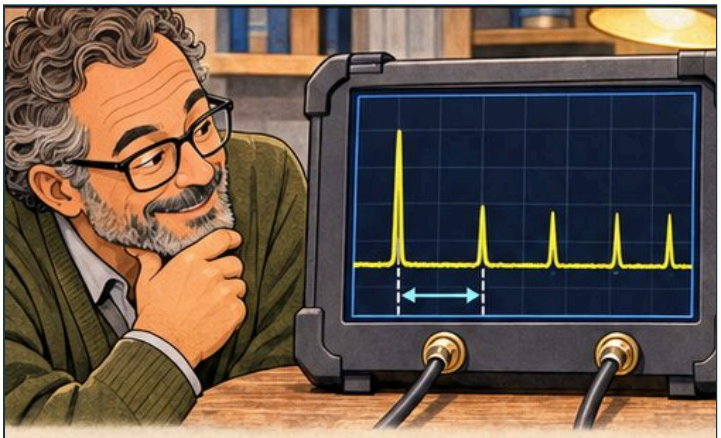
# Na harmónaigh á nochtadh



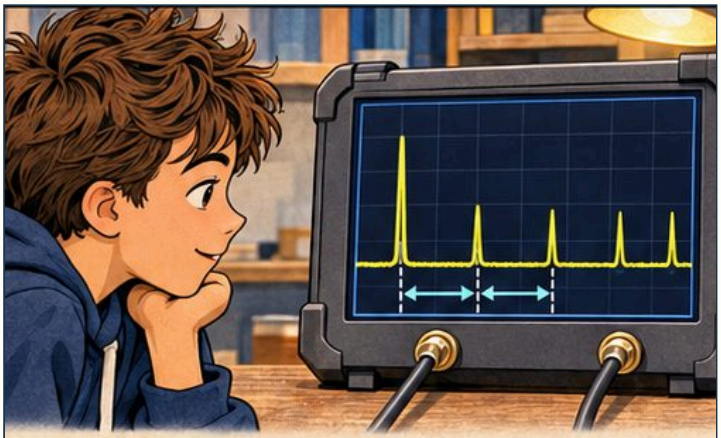
Tugann an bhunmhinicíocht an chéad phointe tagartha do chomhartha peiriadach.



Is iolraithe slánuimhreacha den mhinicíocht sin iad minicíochtaí na harmónach.



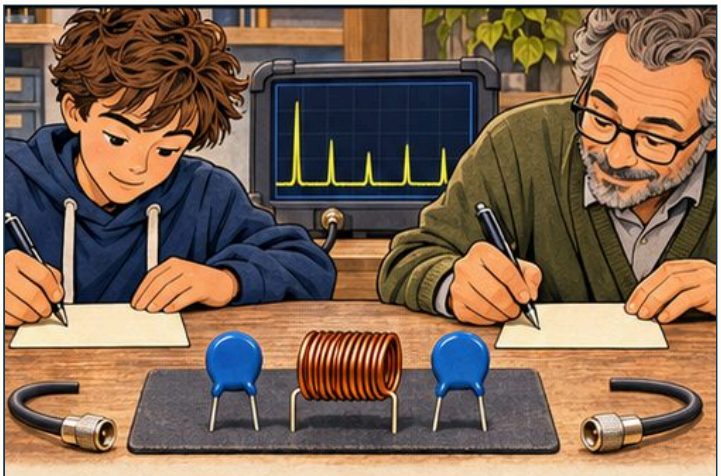
Tá an dara harmónach ag dhá oiread na bunmhinicíochta.



Tá an tríú ceann ag trí oiread na minicíochta.

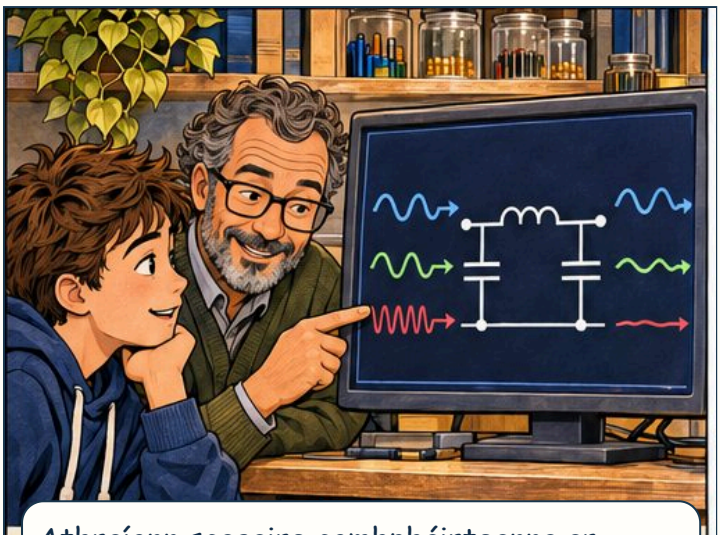


Ní harmónaigh iad gach comhpháirt neamh-inmhianaithe, áfach.

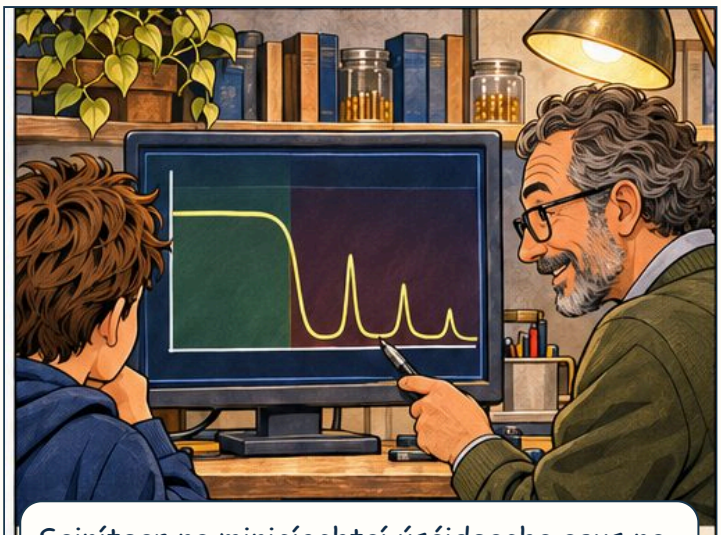


Caithfidh an scagaire freastal ar riachtanas atá sainithe go beacht.

# Roghnaigh a choinneofar



Athraíonn scagaire comhpháirteanna ar bhealaí éagsúla de réir a minicíochta.



Sainítear na minicíochtaí úsáideacha agus na minicíochtaí suaiteacha ar dtús.



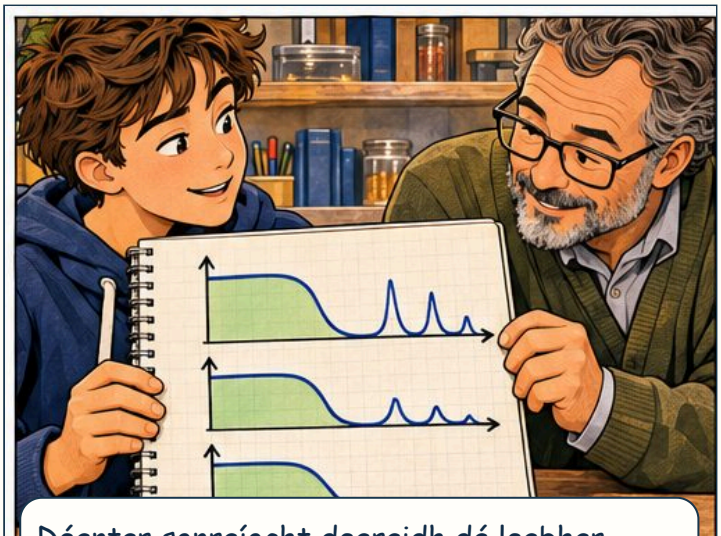
Socraítear freisin an maolú atá ag teastáil.



Gan na spriocanna sin, is beag ciall a bheadh le comhpháirteanna a ríomh.

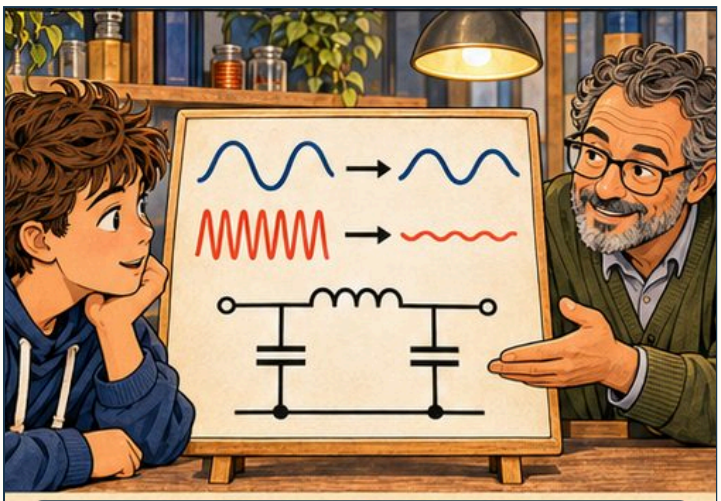


Cuireann an foghlaimeoir ciorcal timpeall limistéar úsáideach speictrim shamplaigh.



Déantar sonraíocht dearaidh dá leabhar nótaí.

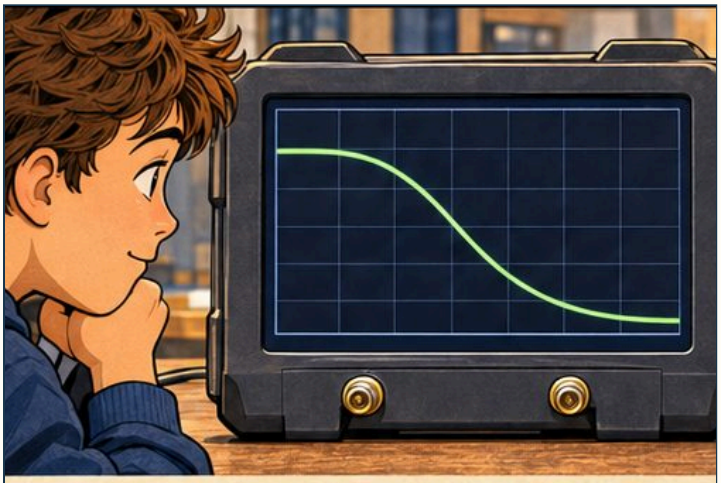
# An pas íseal a roghnú



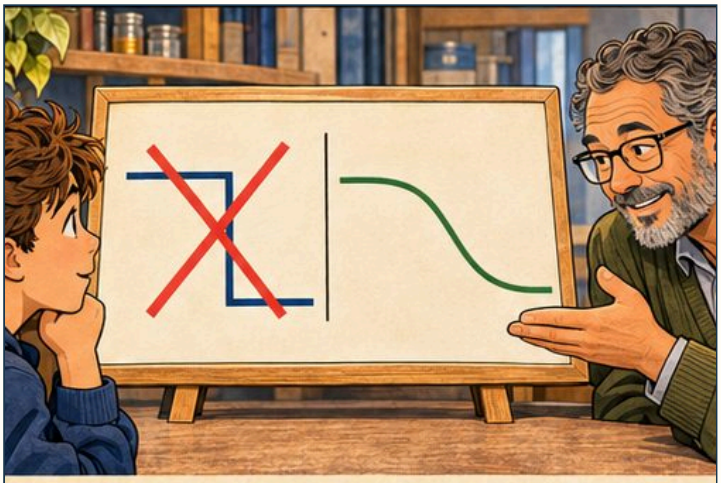
Tarchuireann scagaire pas íseal minicíochtaí ísle níos fearr ná minicíochtaí arda.



Tá a phasbhanda ar thaobh na minicíochtaí ísle.



Níos airde, méadaíonn an maolú de réir a chéile.



Ní balla ingearach foirfe é fíor-aistriú riamh.



Oireann an cineál seo do thaispeántas an lae inniu.



Tarraingíonn an foghlaimeoir fána seachas bacainn.

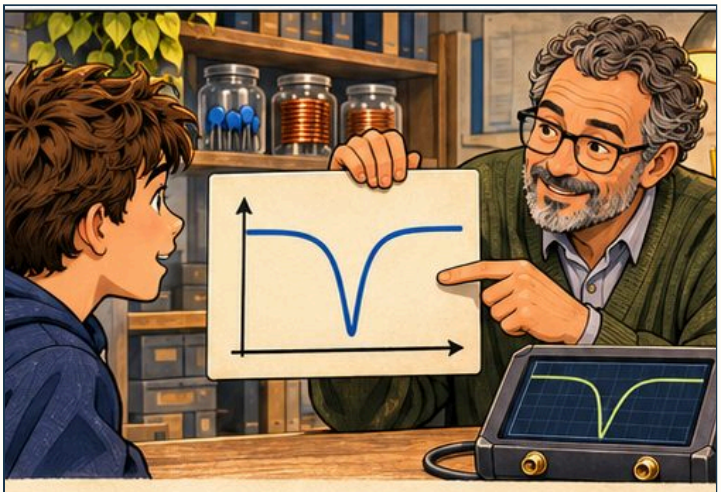
# Bealaí eile



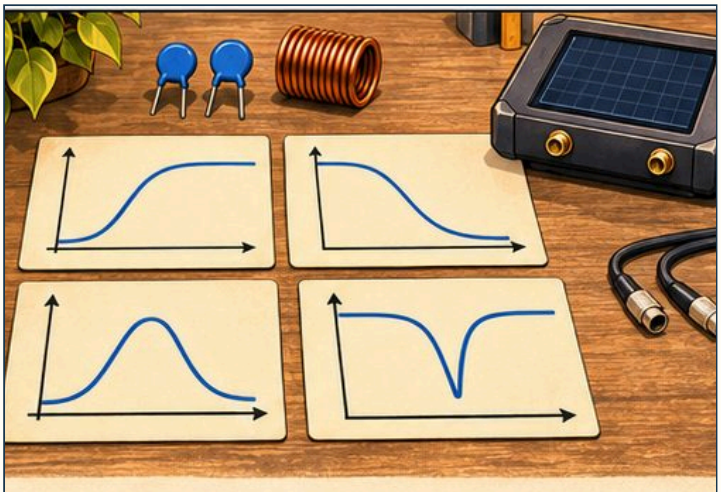
Maolaíonn scagaire pas ard minicíochtaí ísle agus coinníonn sé na harda.



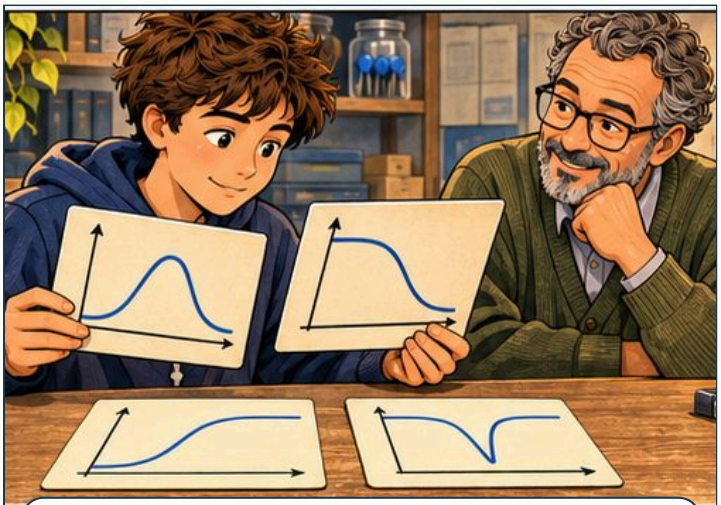
Tugann scagaire pas banda tús áite do réimse idir dhá theorainn.



Maolaíonn scagaire stop banda réimse roghnaithe ina ionad.



Freastalaíonn na teaghlaigh seo ar riachtanais éagsúla.

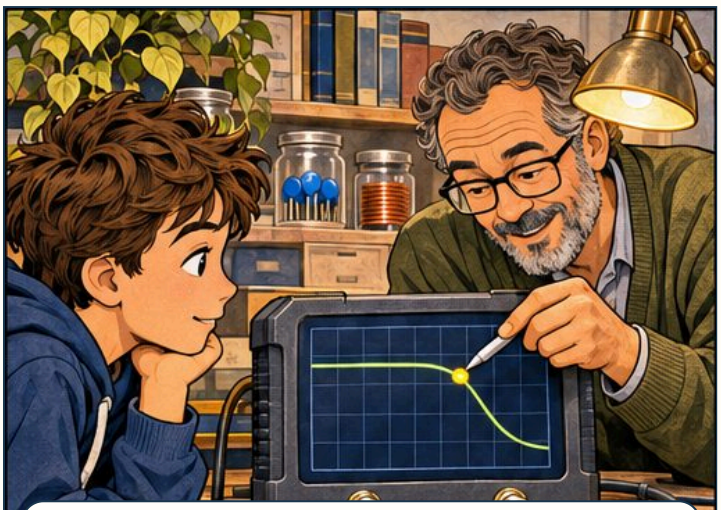


Déanann an t-ainm cur síos ar fhreagairt, ní ar fheabhas uilíoch.



Cuireann an foghlaimeoir trí chárta i leataobh do cheardlann eile.

# Teorainn a ligeann tríd fós



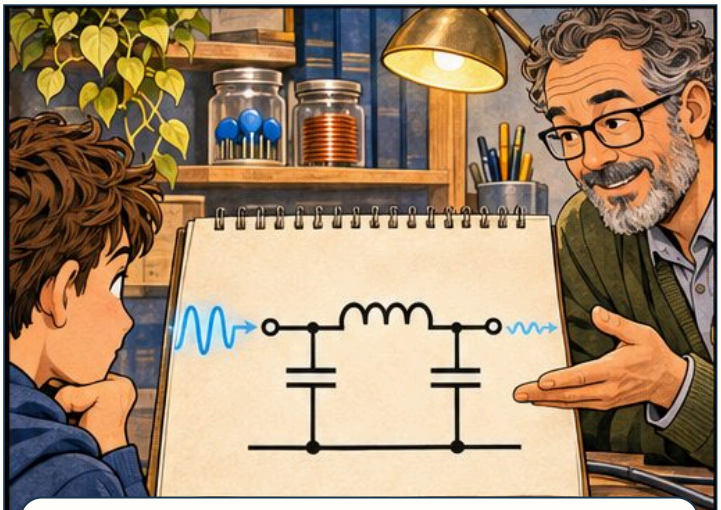
Seasann an mhinicíocht scoite anseo do leibhéal tagartha.



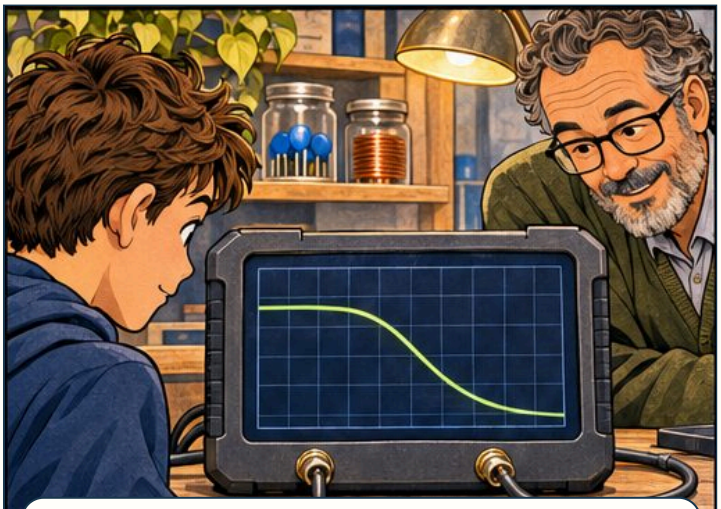
Ní chiallaíonn sí go n-imíonn an comhartha go tobann.



I gcás a scagaire idéalach Butterworth, comhfhreagraíonn sí do thart ar −3 dB.



Tarchuireann an scagaire fuinneamh fós ag an minicíocht sin.



Os a cionn, leanfaidh an maolú de bheith ag méadú.

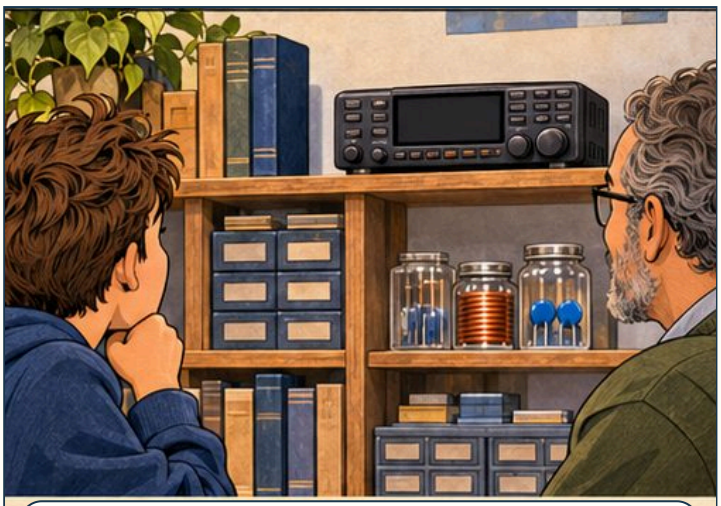


Seachnaíonn an soiléiriú seo an chéad mhíthuiscint.

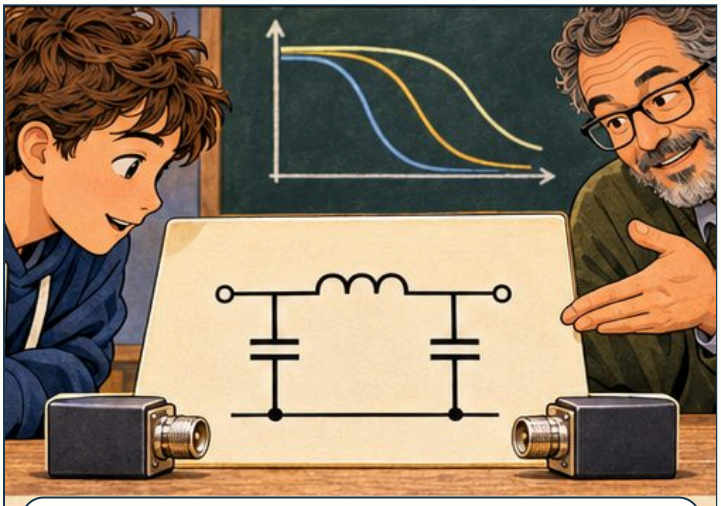
# Sampla saotharlainne



Roghnaíonn siad minicíocht scoite theoiriciúil 10 MHz.



Is luach foghlama é, ní minicíocht tarchurtha.



Beidh bac tagartha 50 Ω ag an bhfoinse agus ag an ualach.



Scrúdófar an ciorcad ar an mbinse le comhartha lag.



Ní cheanglófar aeróg ná tarchuradóir leis.

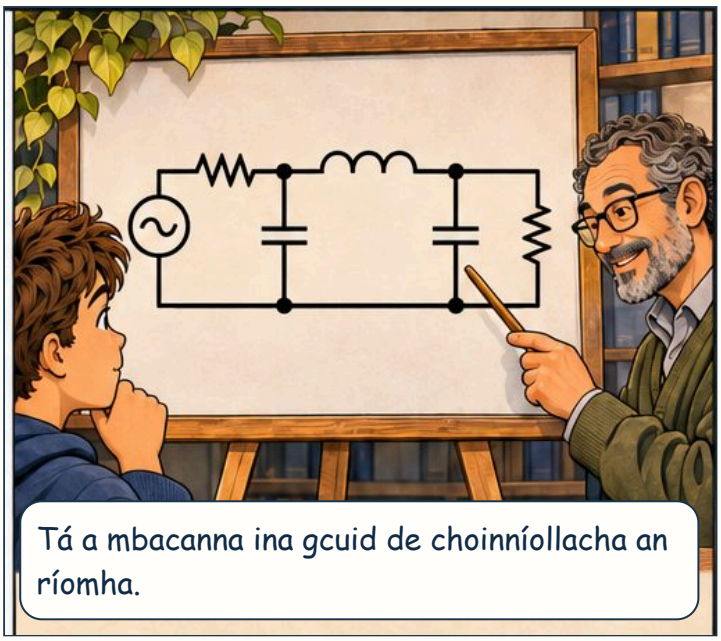


Freagairt intomhaiste atá mar sprioc, ní teagmháil raidió.

# Cén fáth 50 óm a shonrú?



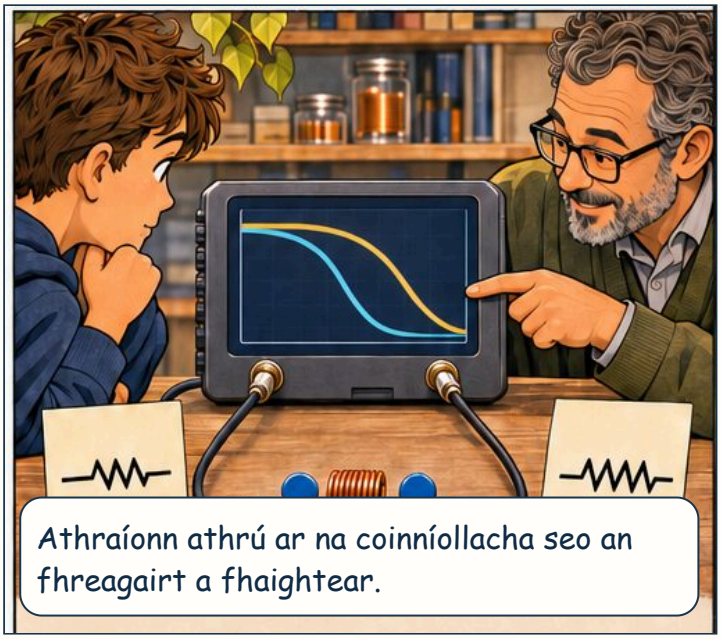
Oibríonn scagaire idir foinse agus ualach.



Tá a mbacanna ina gcuid de choinníollacha an ríomha.



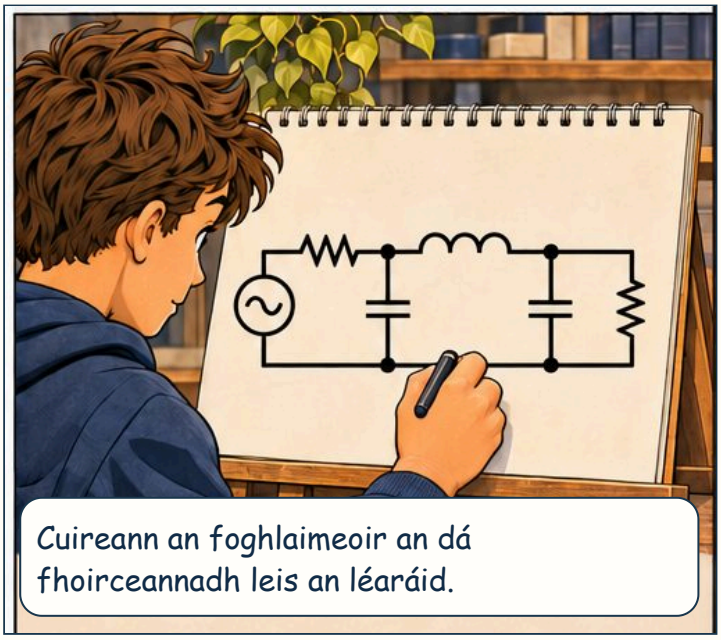
Anseo, tá gach ceann idéalach, friotaíoch, agus cothrom le 50 Ω.



Athraíonn athrú ar na coinníollacha seo an fhreagairt a fhaightear.

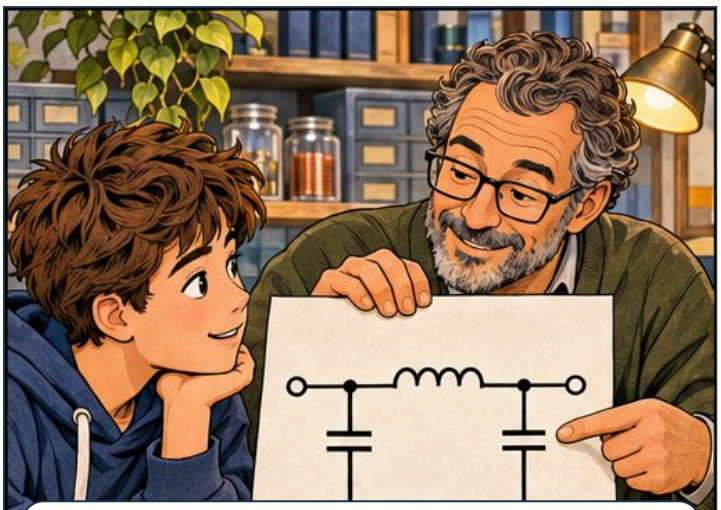


Mar sin, ní leor trí luach a chóipeáil.



Cuireann an foghlaimeoir an dá fhoirceannadh leis an léaráid.

# An tsamhail agus an ciorcad



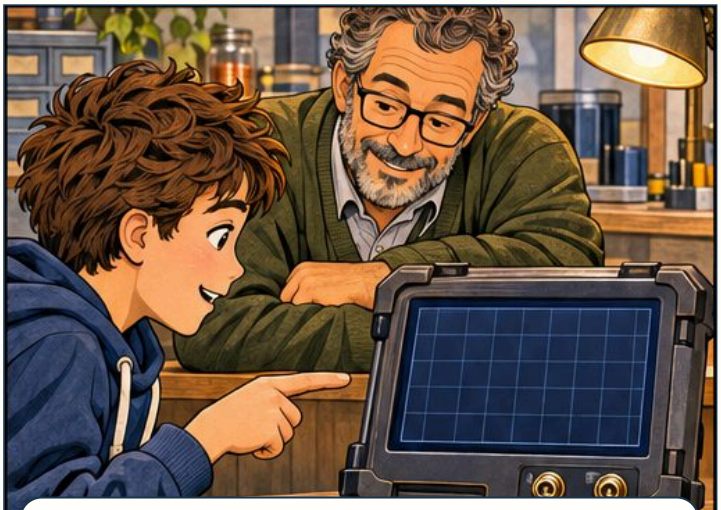
Tosaíonn an ríomh le comhpháirteanna idéalacha gan chaillteanas.



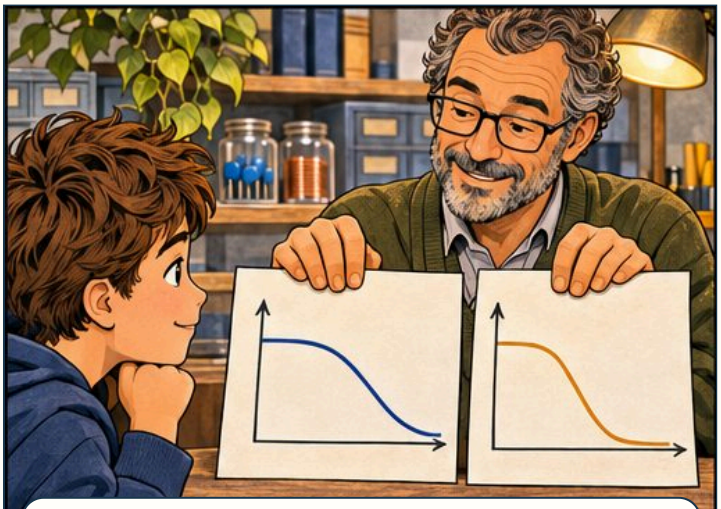
Bíonn friotaíocht agus éifeachtaí seadánacha sa chiorcad fíor.



Tugann an tsamhail an chéad tuar faoin bhfreagairt.



Cuidíonn na tomhais ansin leis na difríochtaí a scrúdú.

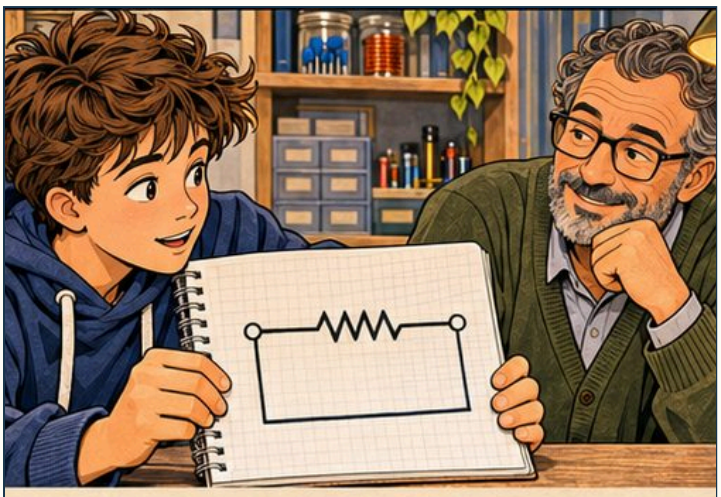


Cuireann mearbhall idir tuar agus toradh bac ar thuiscint na ndifríochtaí.

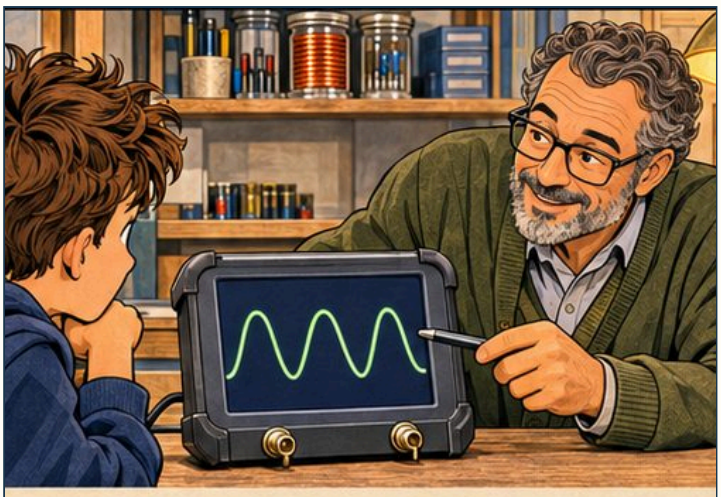


Coinníonn an leabhar áit ar leith do gach ceann.

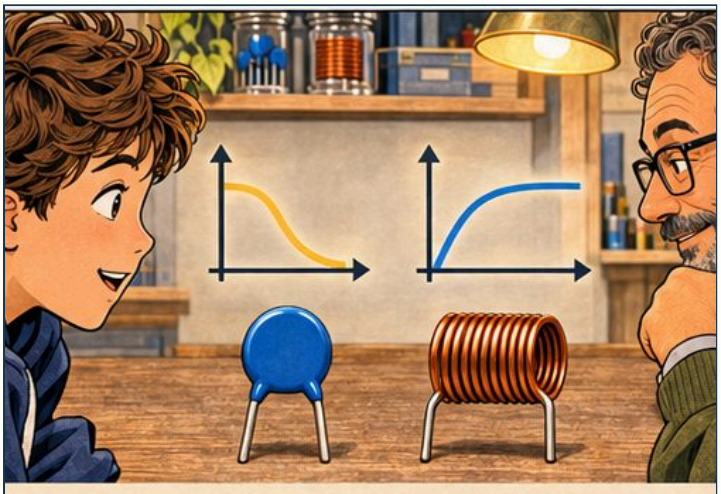
# Ní leor friotóir a thuilleadh



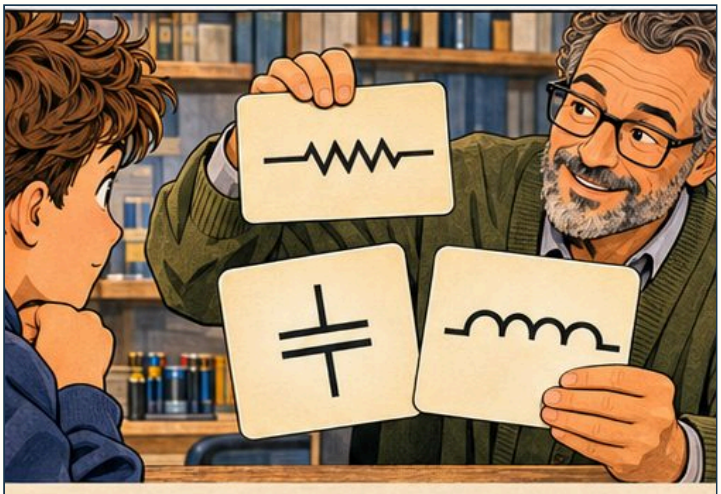
Cheangail an t-imleabhar roimhe seo voltas, sruth agus friotaíocht i sruth díreach.



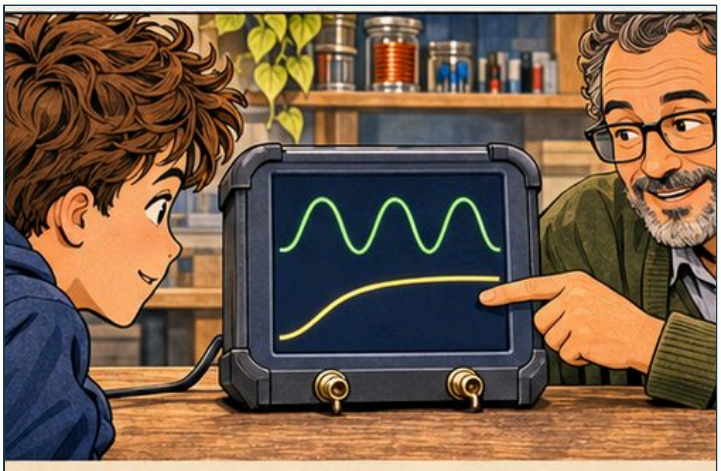
Anseo, athraíonn an comhartha go tapa agus bíonn an mhinicíocht tábhachtach.



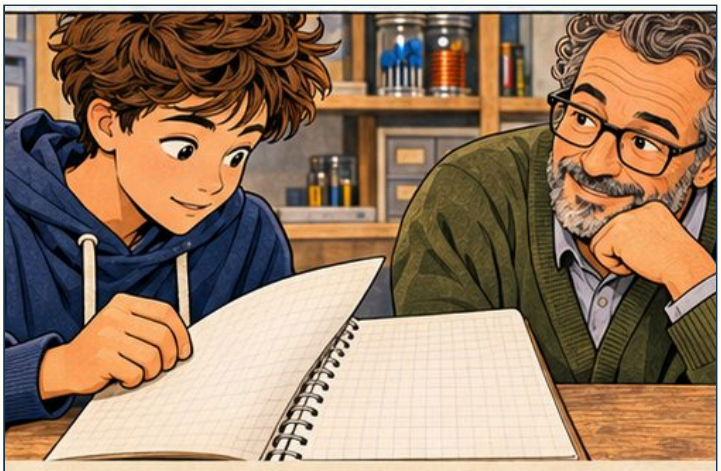
Bíonn imoibríocht ag toilleoirí agus cornaí a bhraitheann ar mhinicíocht.



Ní hionann an imoibríocht sin agus gnáthfhriotaíocht.



Déanann bac cur síos níos leithne ar iompar leictreach i sruth ailtéarnach.

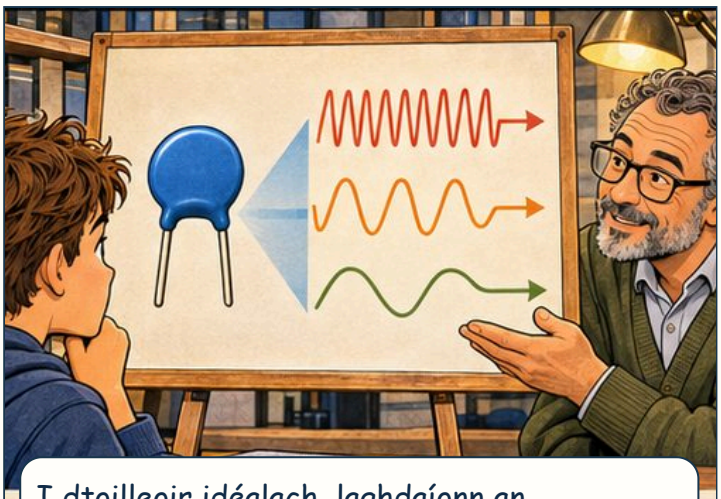


Tuigeann an foghlaimeoir cén fáth a bhfuil samhail nua de dhíth.

# Ról an toilleora



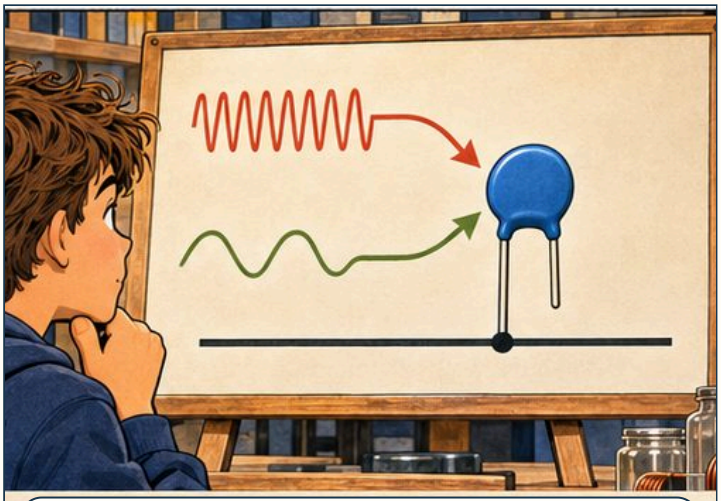
Seasann C don toilleas, a thomhaistear i bhfaraid, F.



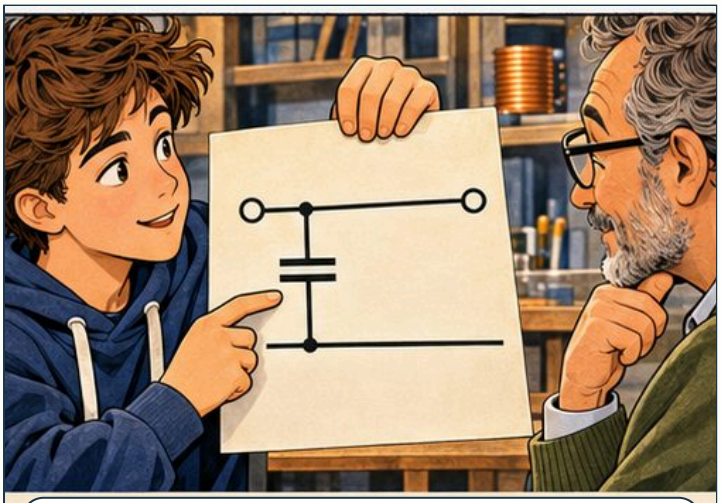
I dtoilleoir idéalach, laghdaíonn an imoibríocht de réir mar a ardaíonn an mhinicíocht.



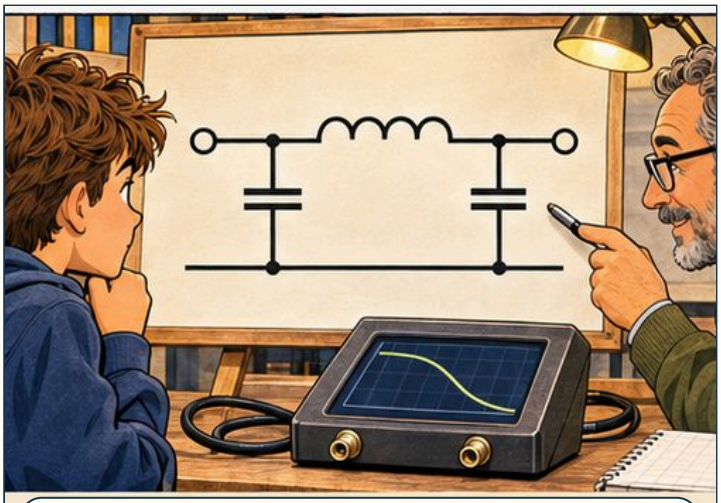
Is é a méid Xc = 1/(2πfC).



Le toilleas seasta, bíonn imoibríocht níos lú ag minicíochtaí arda.



Ina scagaire, ceanglófar na toilleoirí leis an bpointe coiteann.

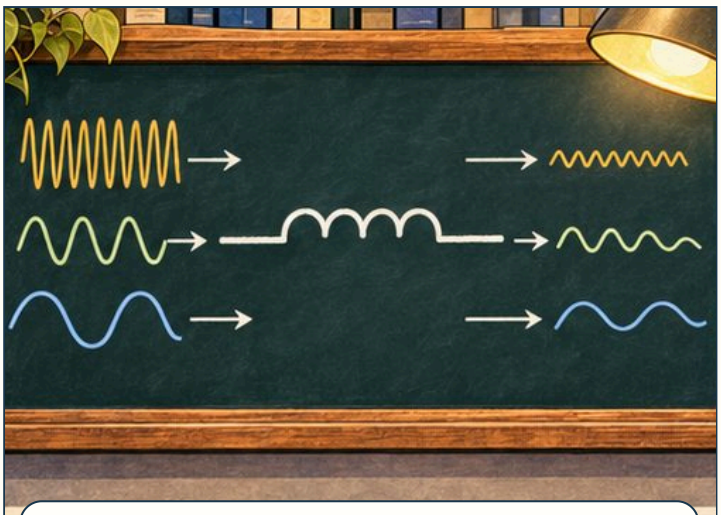


Braitheann a ról freisin ar an gcuid eile den chiorcad.

# Ról an chorna



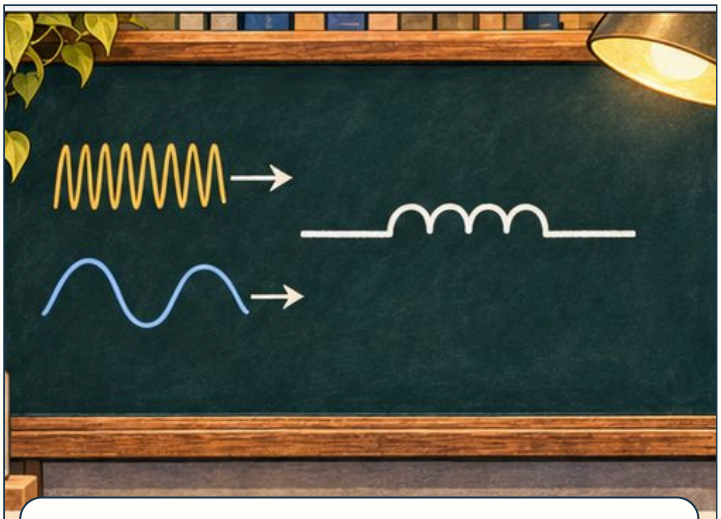
Seasann L don ionduchtas, a thomhaistear i henry, H.



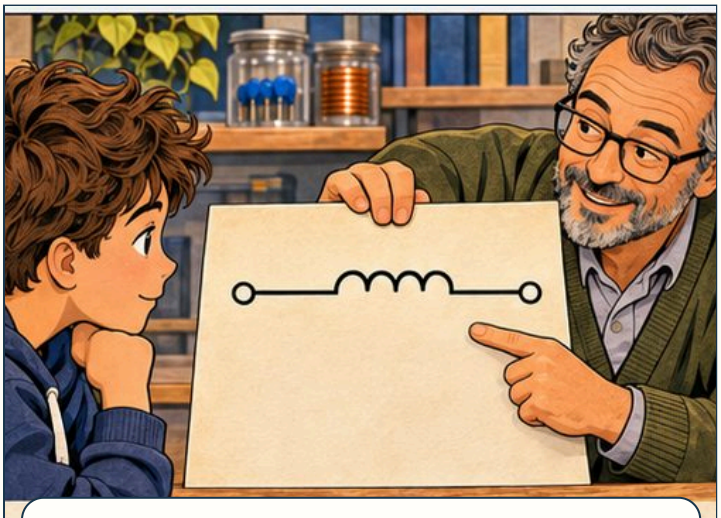
I gcorna idéalach, méadaíonn an imoibríocht leis an minicíocht.



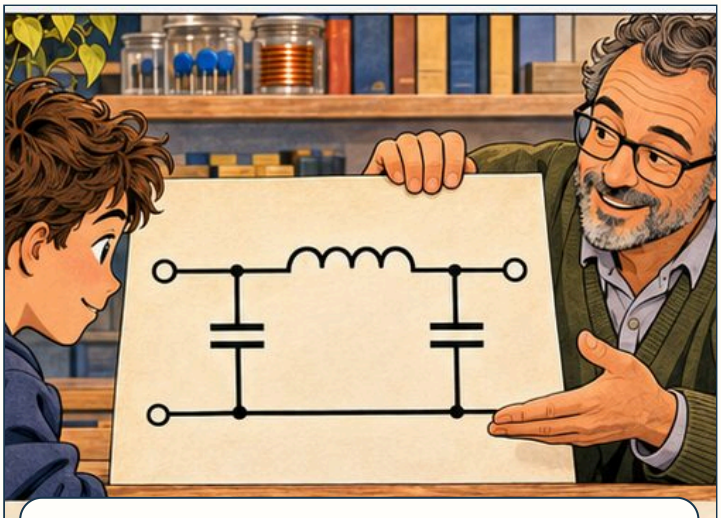
Is é a méid XL = 2πfL.



Le hionduchtas seasta, bíonn imoibríocht níos mó ag minicíochtaí arda.

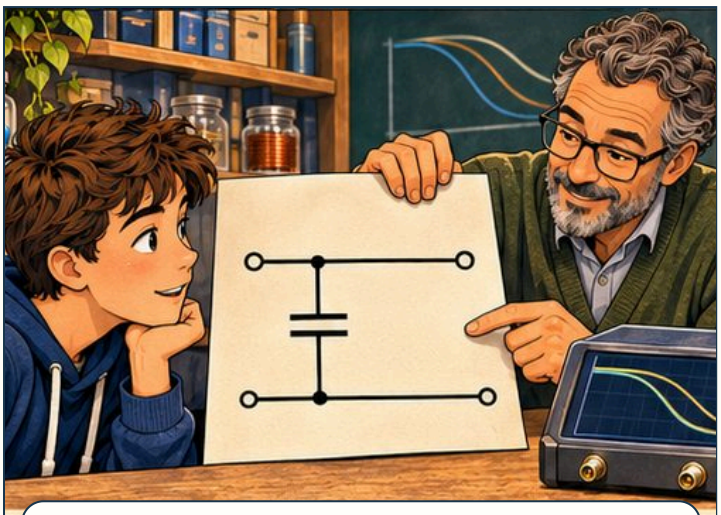


Ina scagaire, beidh an corna i gcosán an chomhartha.

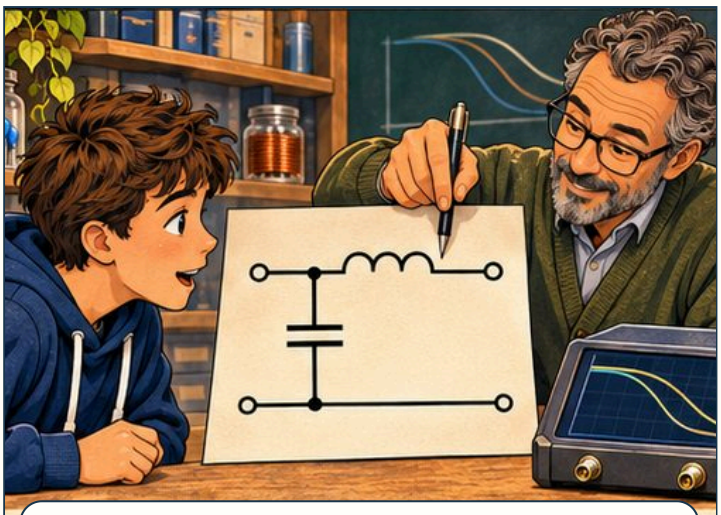


Oibreoidh an dá chineál comhpháirte le chéile.

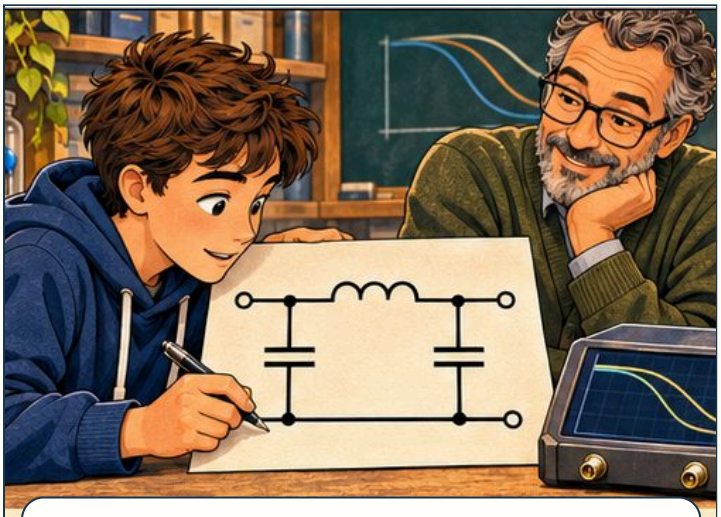
# Cruth π ar an léaráid



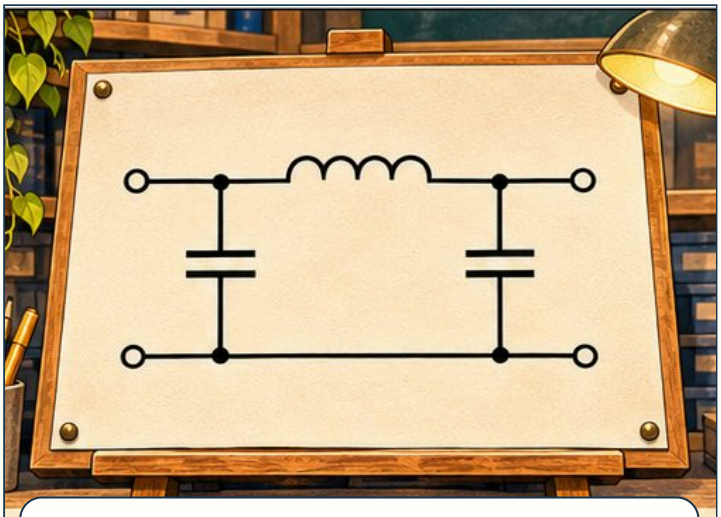
Téann an t-ionchur trí chéad toilleoir chuig an bpointe coiteann.



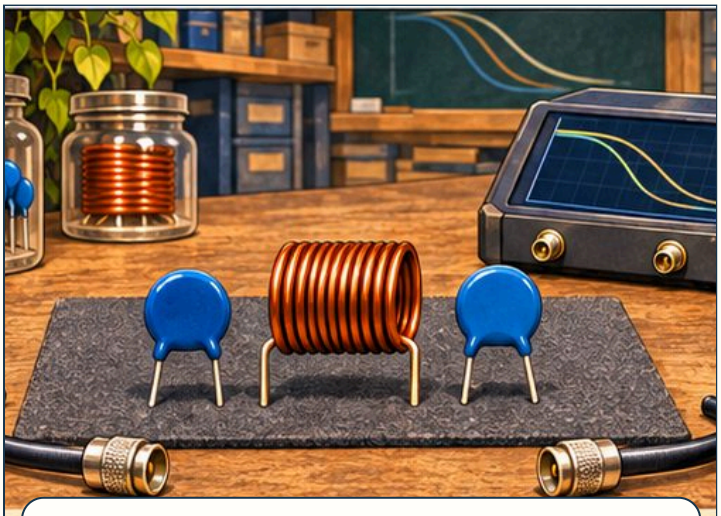
Ceanglaíonn corna an t-ionchur agus an t-aschur i sraith ansin.



Ceanglaíonn dara toilleoir an t-aschur leis an bpointe coiteann céanna.



Téann dhá chraobh síos, ceann ar gach taobh den chorna.



Tá an leagan amach cosúil leis an litir Ghréagach π.

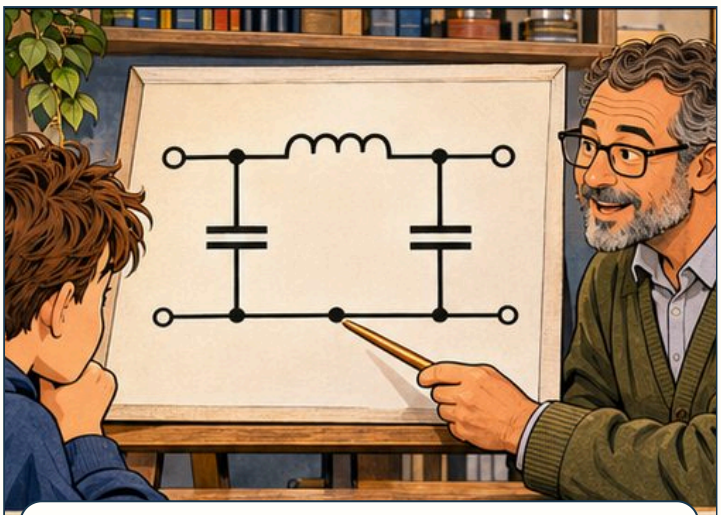


Leanann an foghlaimeoir gach nasc lena pheann luaidhe.

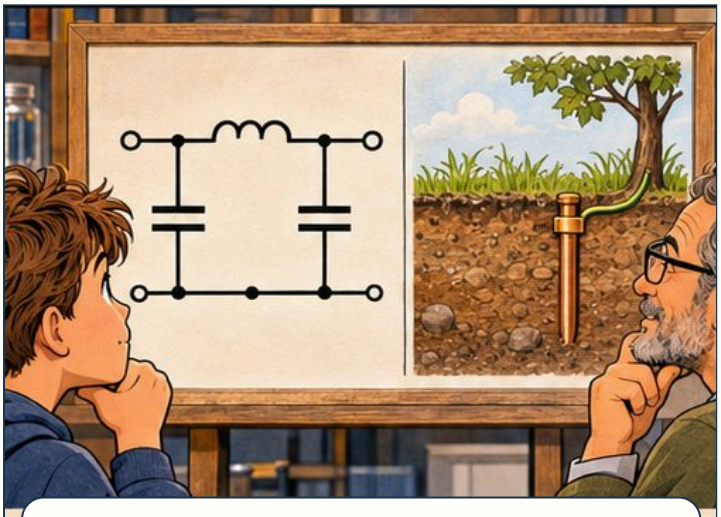
# An pointe coiteann sa léaráid



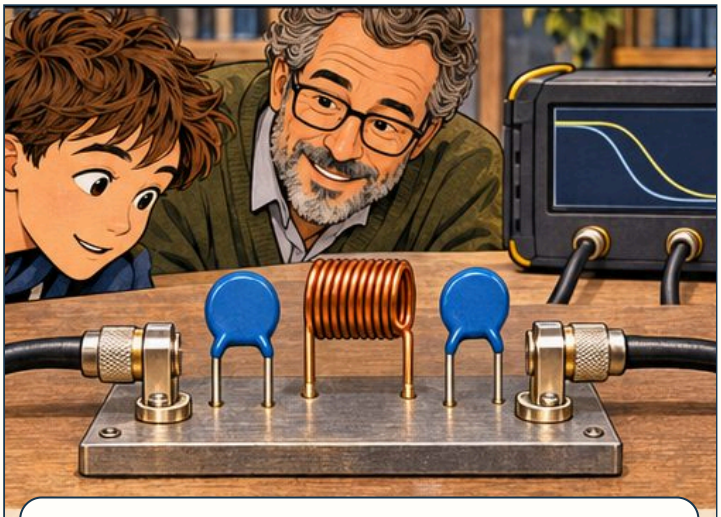
Roinneann an dá thoilleoir tagairt leictreach choiteann.



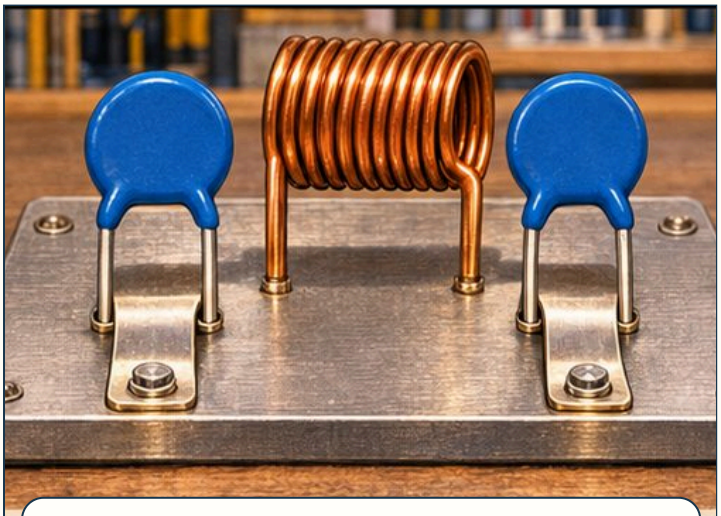
Seasann an tsiombail talmhaithe anseo don tagairt seo sa chiorcad.



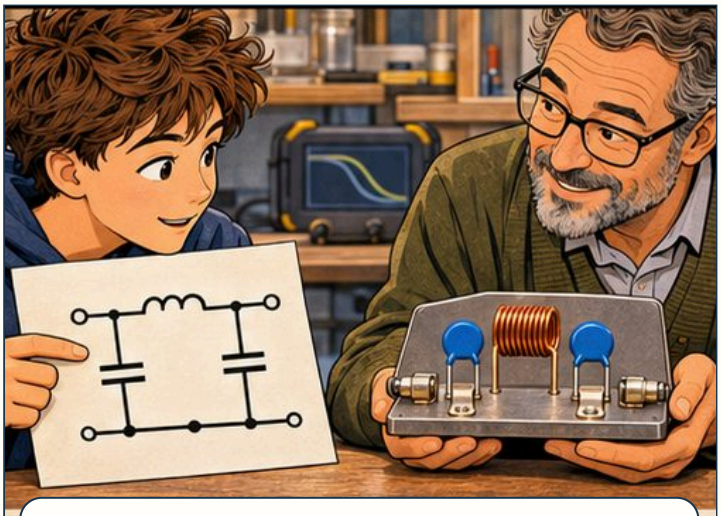
Ní chiallaíonn sé sin nasc leis an talamh go huathoibríoch.



Ceanglaíonn sciatha na gcáblaí comhaiseacha leis de réir an dearaidh.



Cuireann nasc gearr teorainn le roinnt éifeachtaí seadánacha.

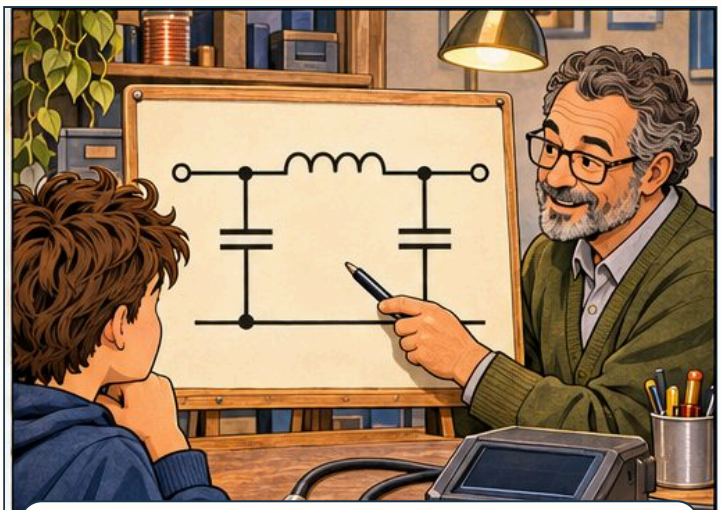


Déanann an foghlaimeoir idirdhealú idir siombail agus cur i bhfeidhm.

# Trí eilimint, ord amháin



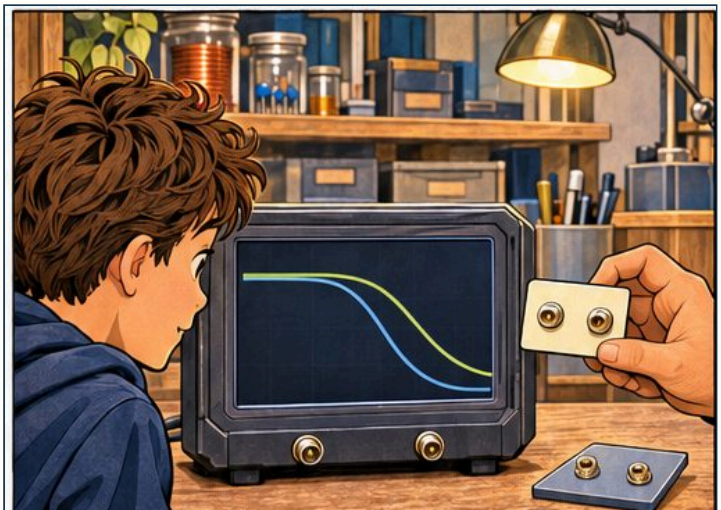
Tá trí eilimint imoibríocha sa líonra idéalach seo: C, L agus C.



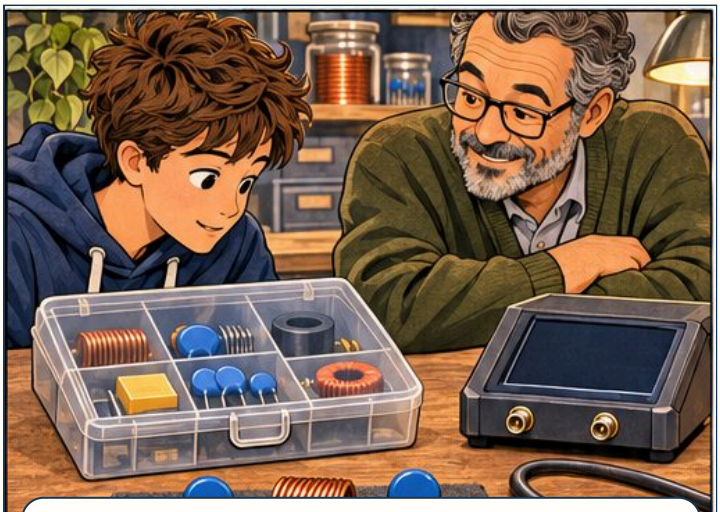
Cruthaíonn siad scagaire pas íseal den tríú hord anseo.



Sainíonn an t-ord, i measc rudaí eile, fána i bhfad ón teorainn.



D'athródh bac mícheart an fhreagairt, áfach.



Ní chruthaítear an scagaire ceart trí chomhpháirteanna randamacha a chur leis.

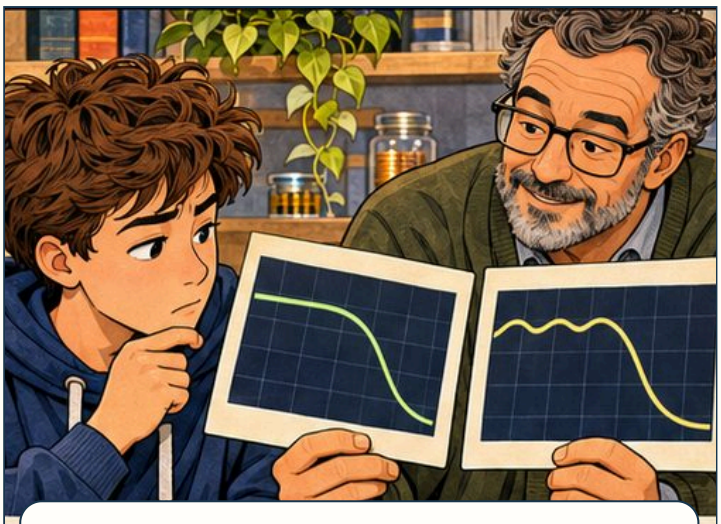


Caithfidh cruth na léaráide teacht leis an ríomh.

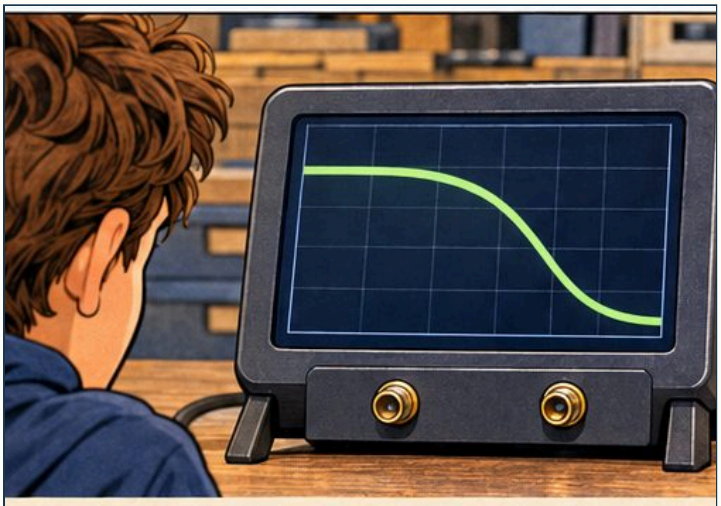
# Cén fáth Butterworth?



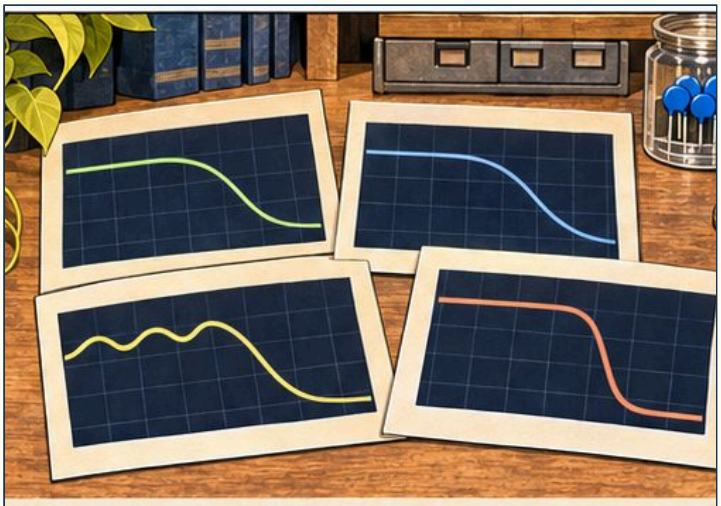
Tá freagairt Butterworth chomh cothrom agus is féidir sa phasbhanda.



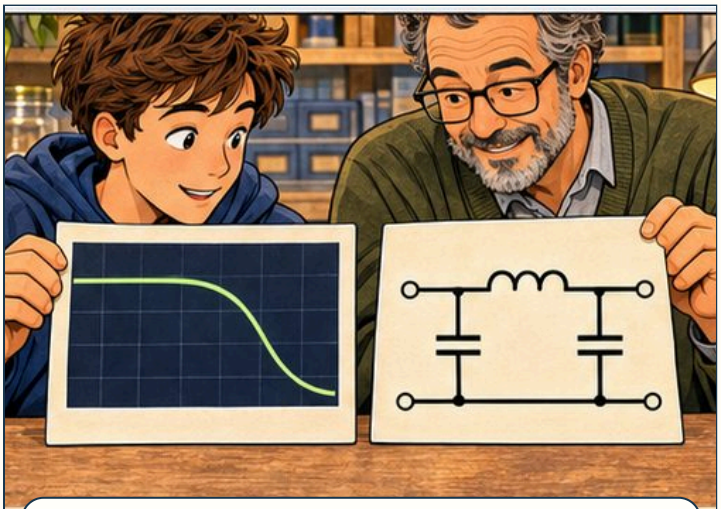
Níl círéibeacha sa bhanda sin sa tsamhail idéalach.



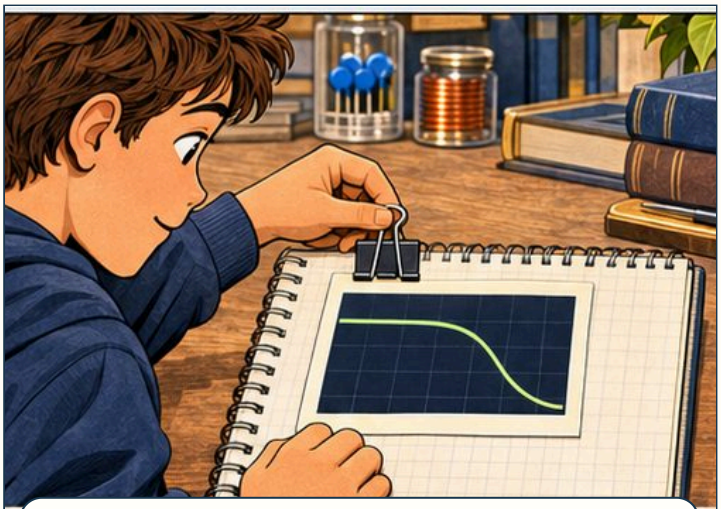
Tá an t-aistriú céimnithe, le cuaire shainiúil.



Glacann freagairtí eile le comhréitigh eile.



Roghnaíonn siad an teaghlach seo don chéad dearadh soiléir.

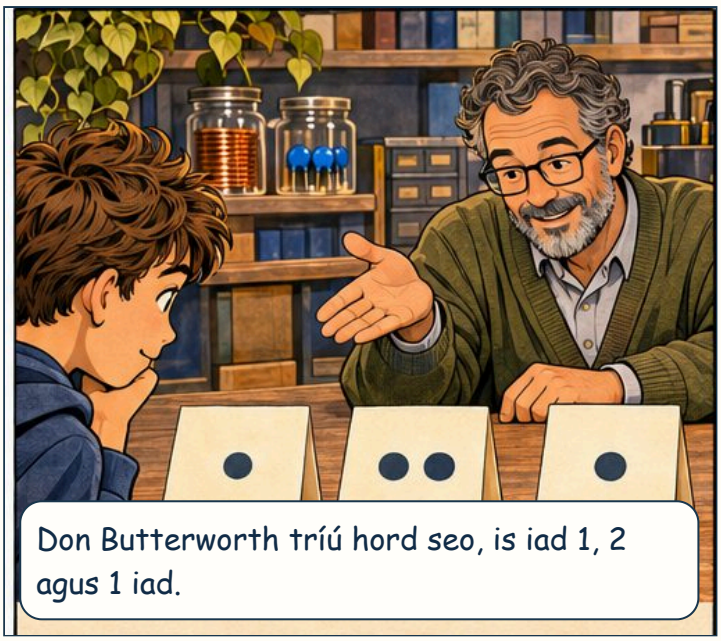


Mar sin, deir an t-ainm níos mó ná pas íseal amháin.

# Fréamhshamhail mar thús



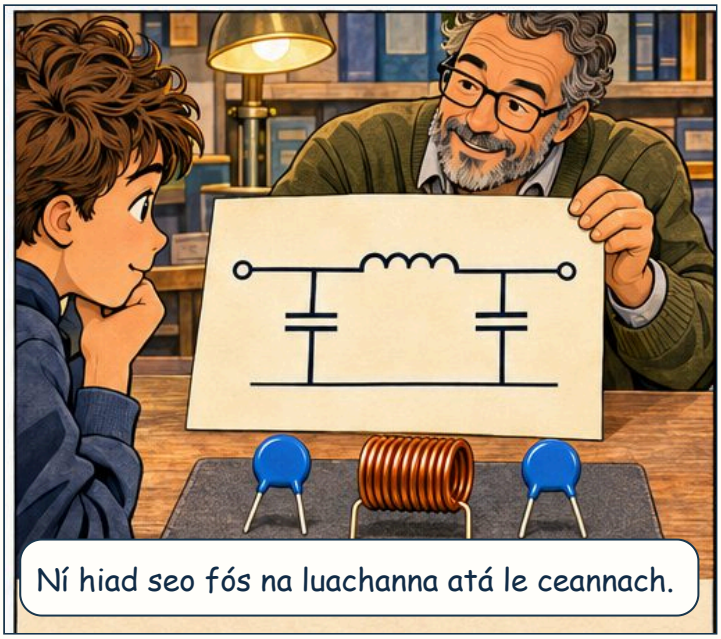
Soláthraíonn fréamhshamhail normalaithe comhéifeachtaí an dearaidh.



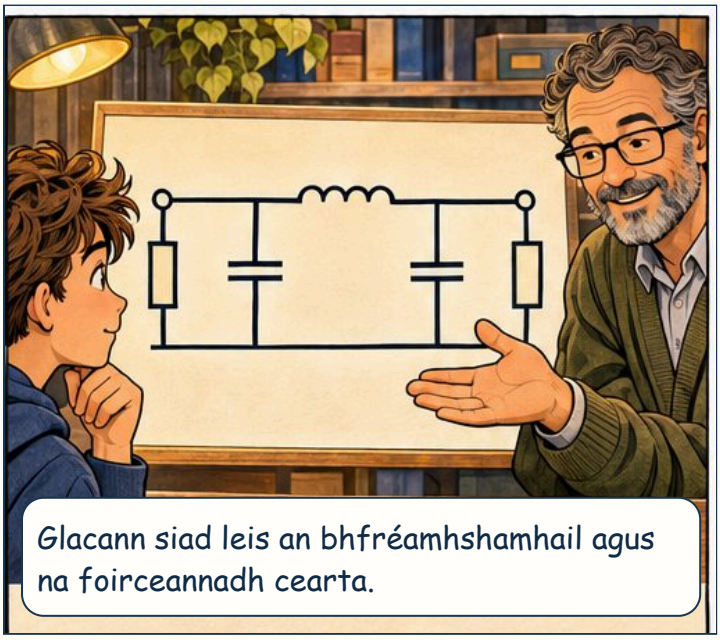
Don Butterworth tríú hord seo, is iad 1, 2 agus 1 iad.



Freagraíonn siad, san ord sin, do thoilleoir, corna agus toilleoir.



Ní hiad seo fós na luachanna atá le ceannach.



Glacann siad leis an bhfréamhshamhail agus na foirceannadh cearta.



Tá scála na minicíochta agus an bhaic fós le socrú.

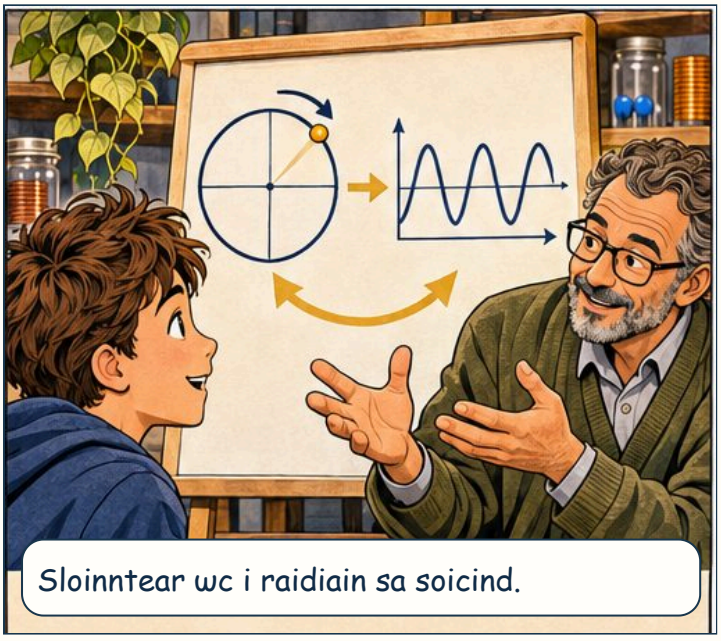
# An scála a athrú



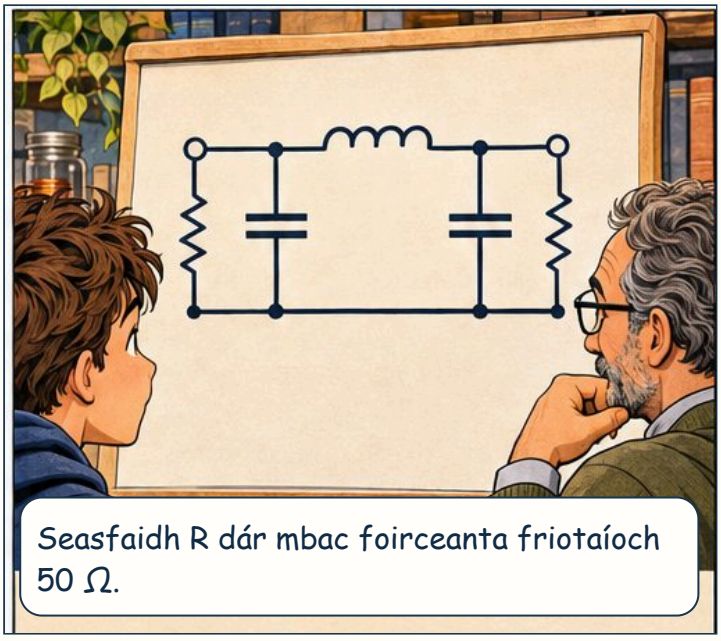
Is í an mhinicíocht uilleach scoite ωc = 2πfc.



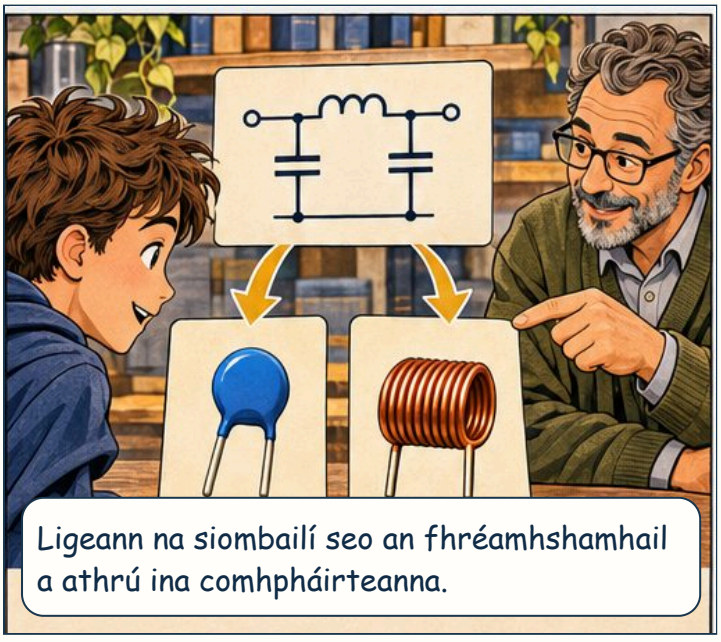
Anseo, seasann fc don mhinicíocht scoite i heirts.



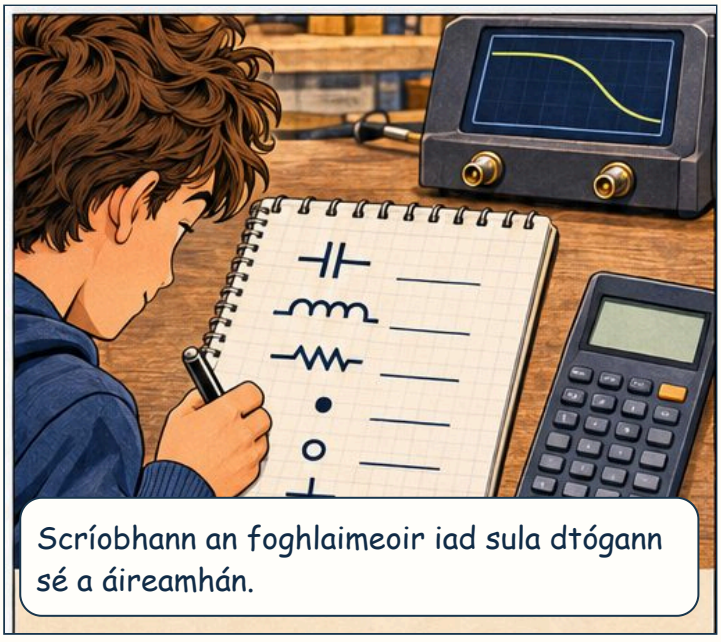
Sloinntear ωc i raidiain sa soicind.



Seasfaidh R dár mbac foirceanta friotaíoch 50 Ω.



Ligeann na siombailí seo an fhréamhshamhail a athrú ina comhpháirteanna.

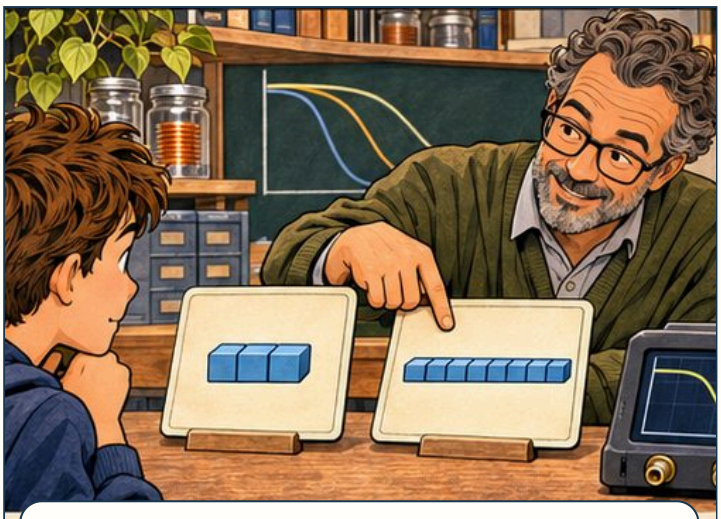


Scríobhann an foghlaimeoir iad sula dtógann sé a áireamhán.

# Aonaid roimh uimhreacha



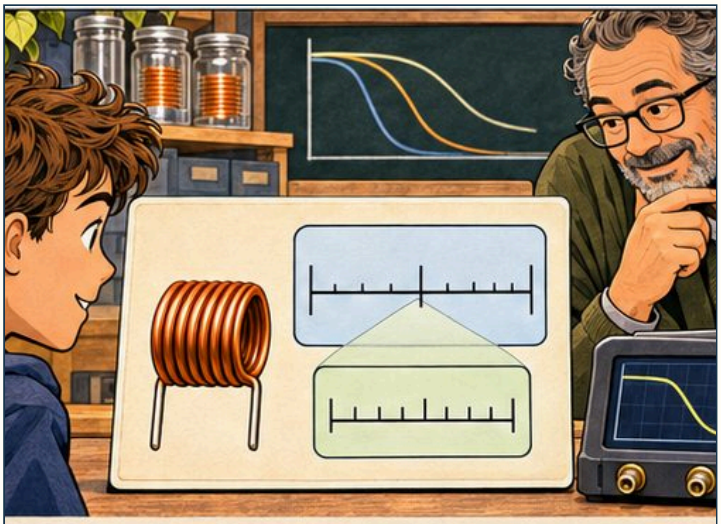
Is ionann meigiheirts amháin agus milliún heirts.



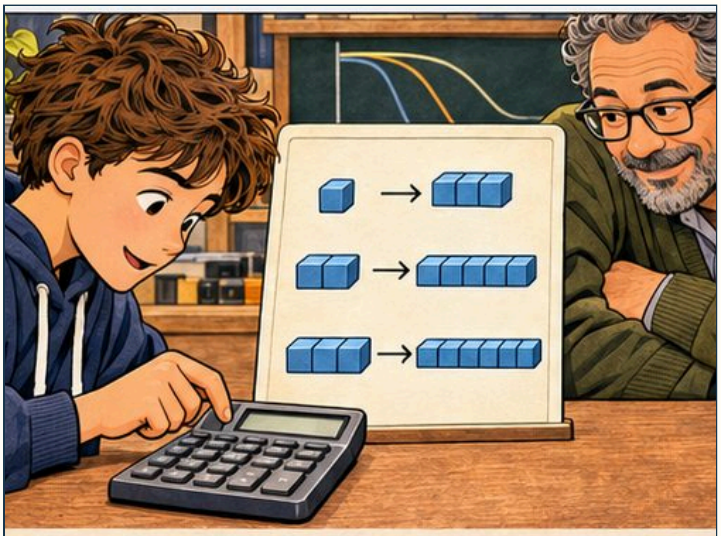
Mar sin, is ionann 10 MHz agus 10 000 000 Hz.



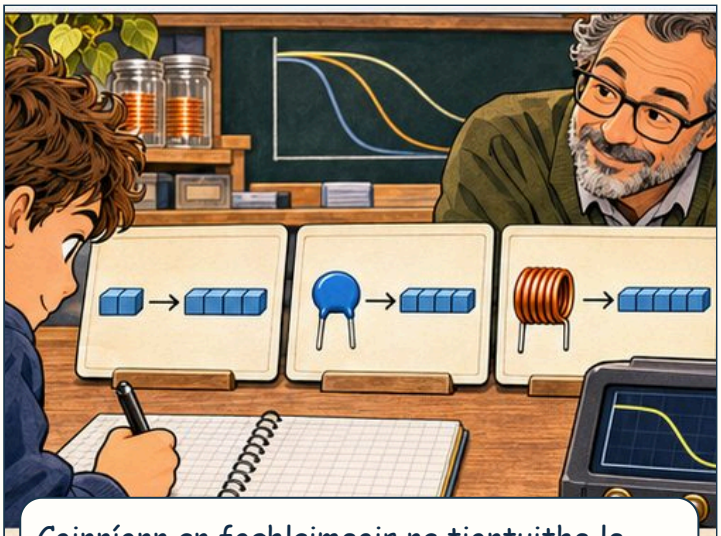
Is ionann piceafarad amháin agus $10^{-12}$ F.



Is ionann micrihenry amháin agus $10^{-6}$ H.

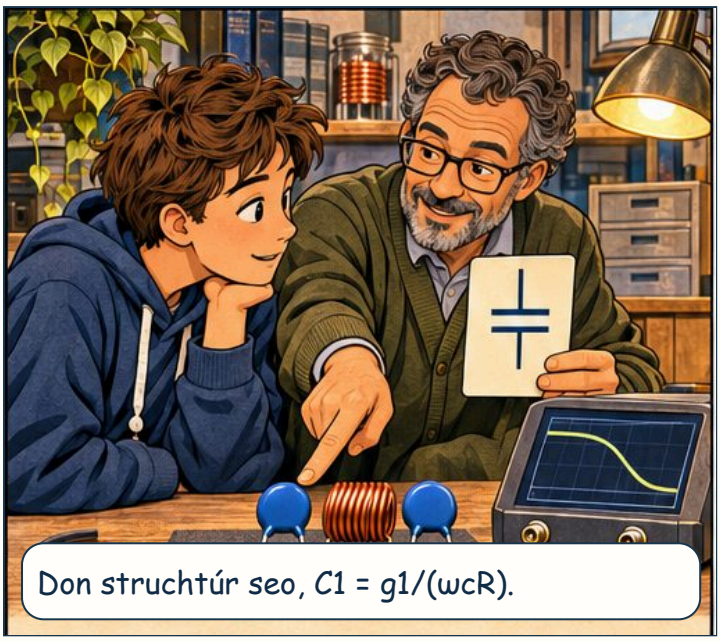


Úsáidfidh na foirmlí na bunaonaid ar dtús.

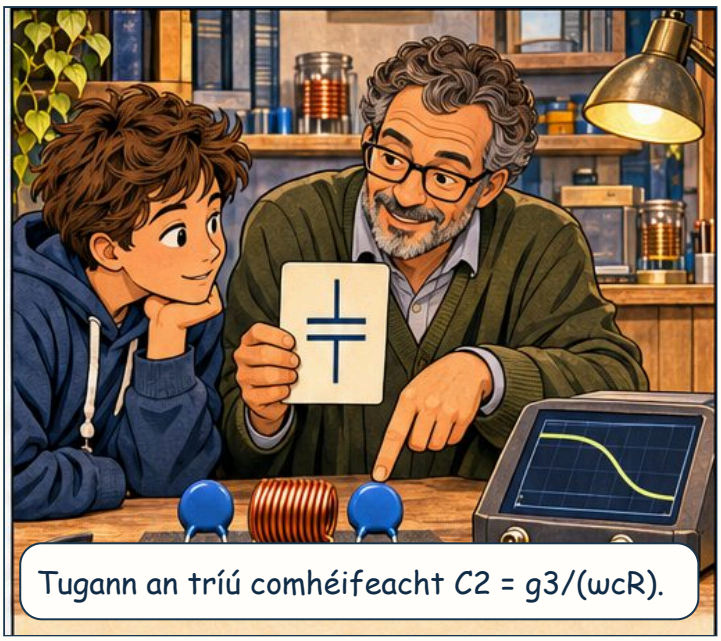


Coinníonn an foghlaimeoir na tiontuithe le feiceáil in aice leis na ríomhanna.

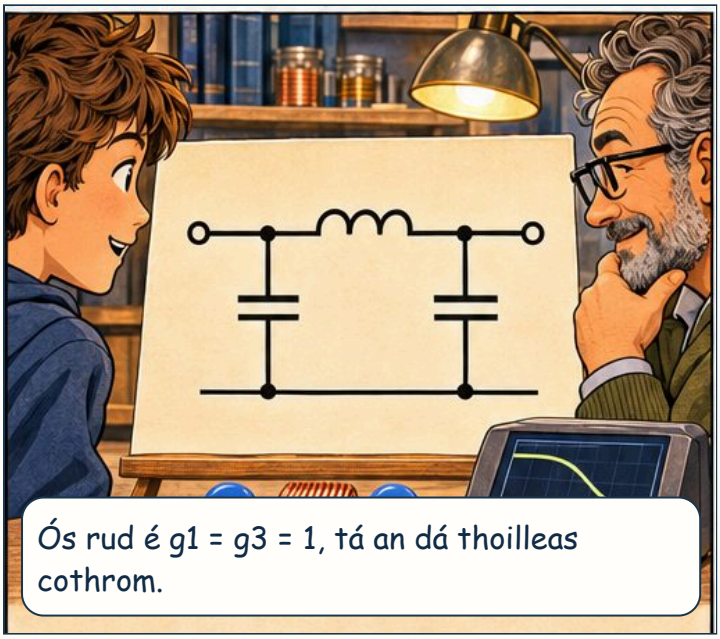
# Foirmle na dtoilleoirí



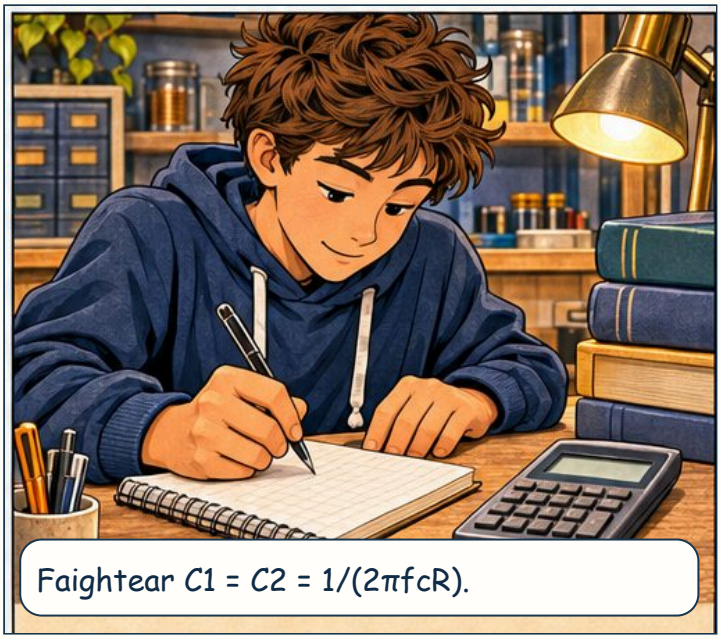
Don struchtúr seo, C1 = g1/(ωcR).



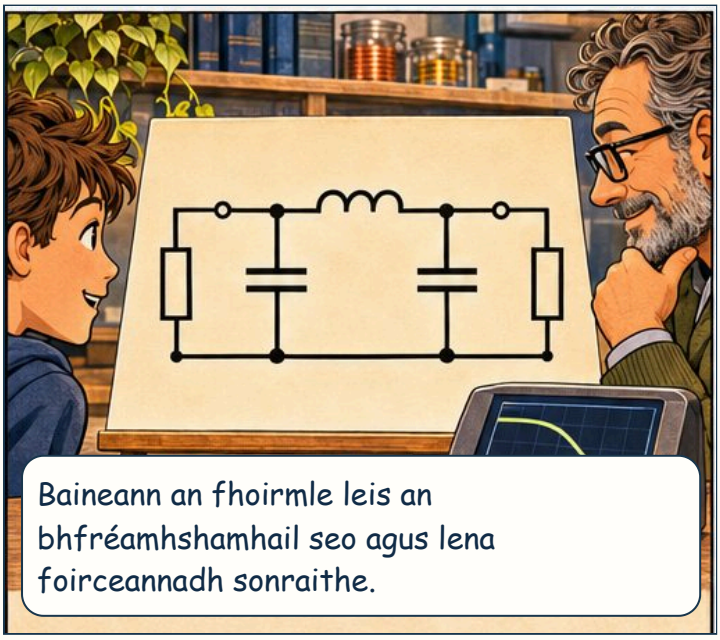
Tugann an tríú comhéifeacht C2 = g3/(ωcR).



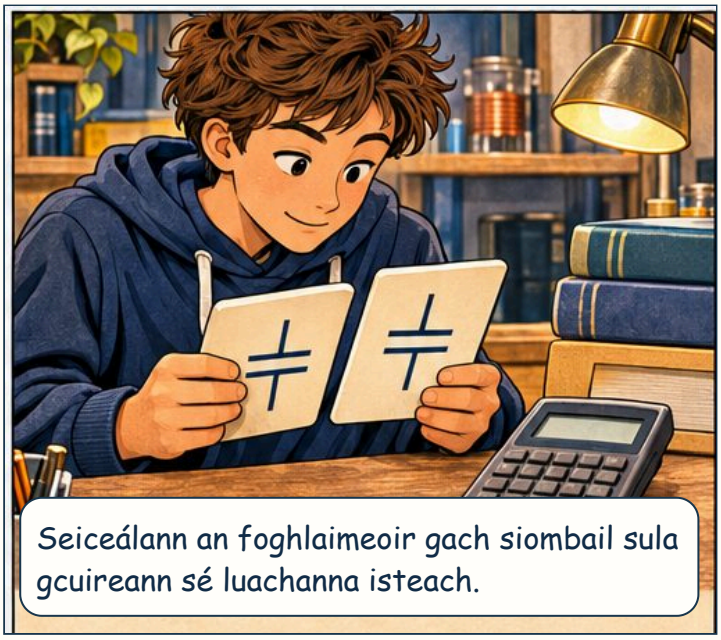
Ós rud é g1 = g3 = 1, tá an dá thoilleas cothrom.



Faightear C1 = C2 = 1/(2πfcR).

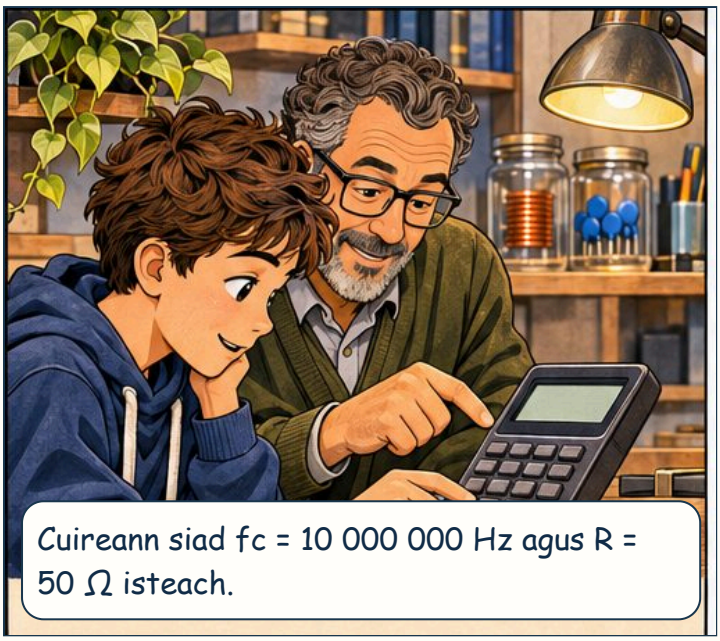


Baineann an fhoirmle leis an bhfréamhshamhail seo agus lena foirceannadh sonraithe.

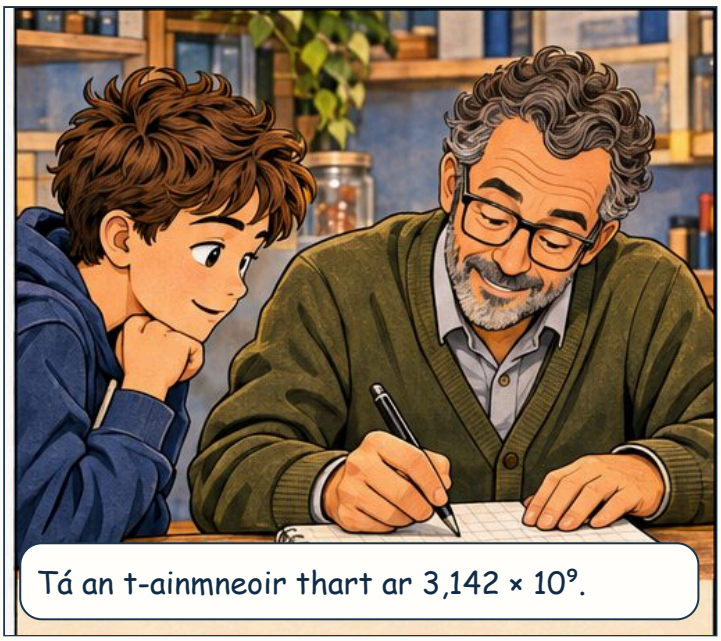


Seiceálann an foghlaimeoir gach siombail sula gcuireann sé luachanna isteach.

# Na toillis a ríomh



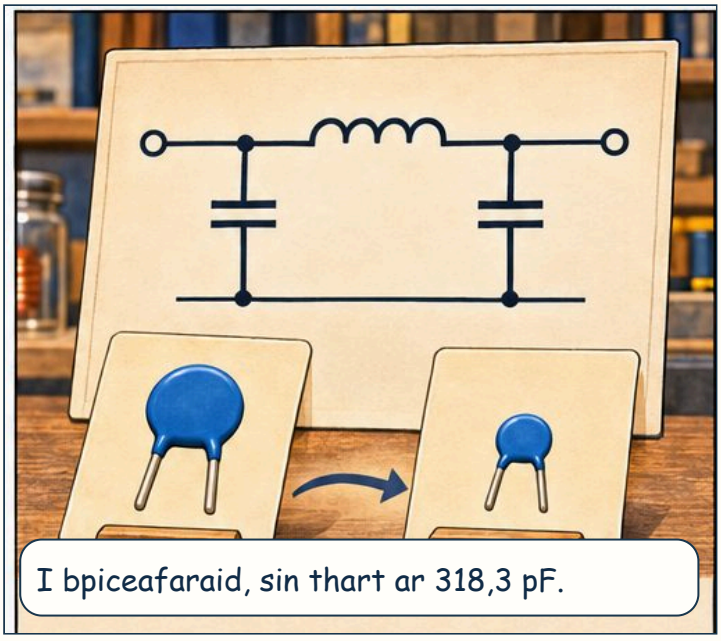
Cuireann siad fc = 10 000 000 Hz agus R = 50 Ω isteach.



Tá an t-ainmneoir thart ar 3,142 × $10^{9}$.



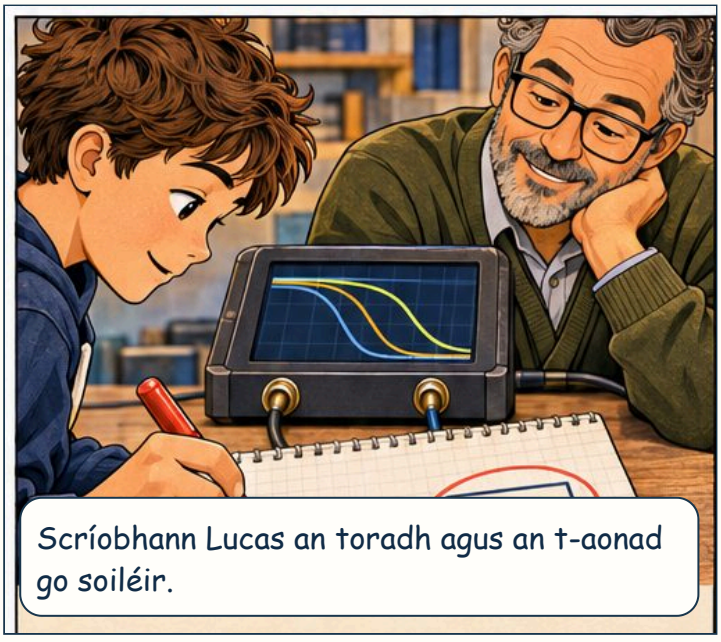
Tá gach toilleas idéalach thart ar 3,183 × $10^{-10}$ F.



I bpiceafaraid, sin thart ar 318,3 pF.

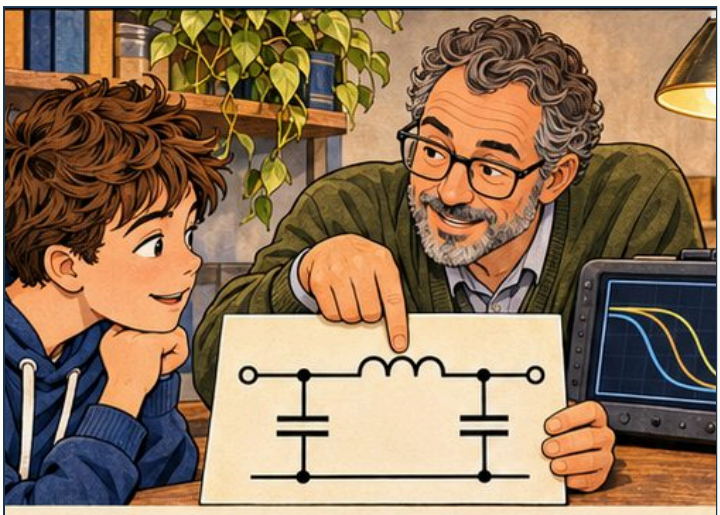


Beidh an luach teoiriciúil céanna ag an dá thoilleoir.



Scríobhann Lucas an toradh agus an t-aonad go soiléir.

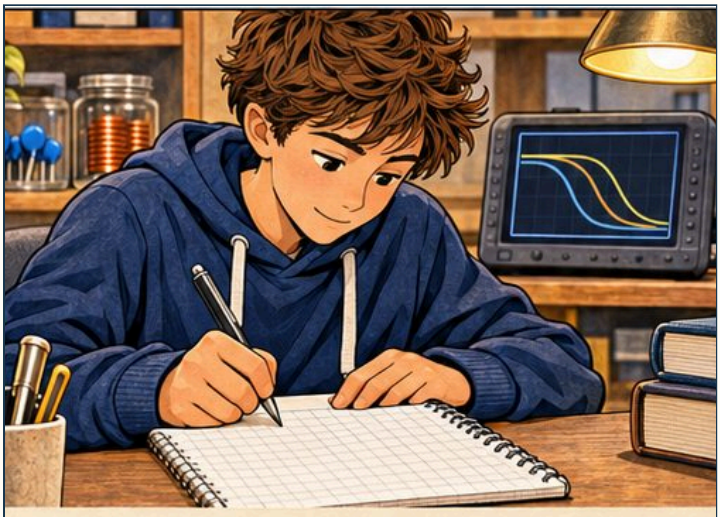
# Foirmle an chorna



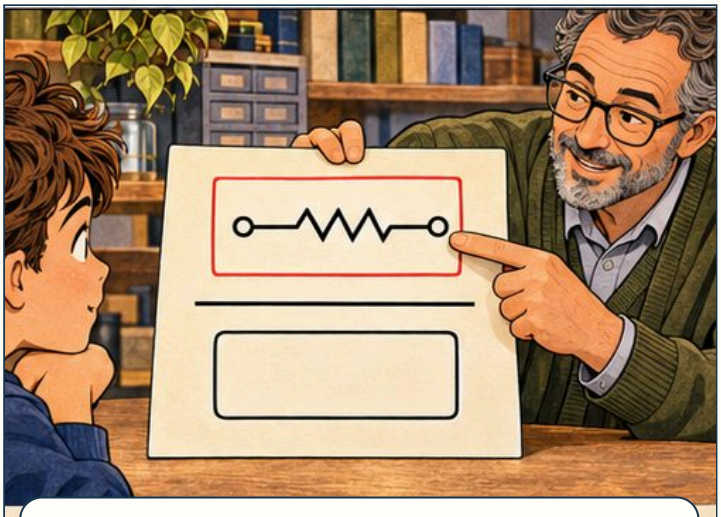
Don chorna sraithe, L = g2R/ωc.



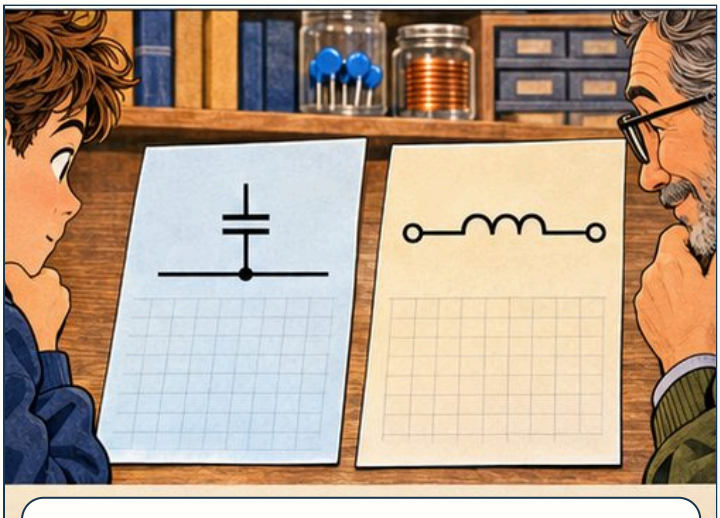
Is í an chomhéifeacht láir anseo g2 = 2.



Mar sin, L = 2R/(2πfc).



Tá an fhriotaíocht foirceanta san uimhreoir an uair seo.



Cuireann an foghlaimeoir an fhoirmle i gcomparáid le foirmle na dtoilleoirí.

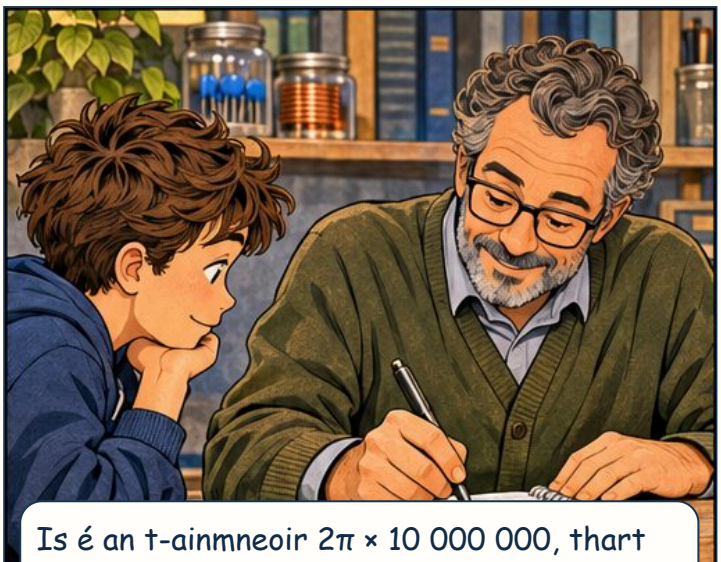


Ní leor cosúlacht amhairc in ionad athléimh.

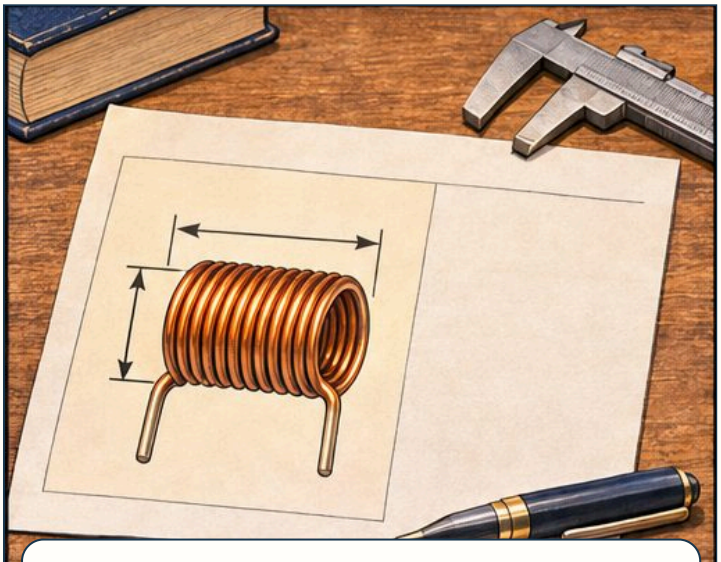
# An t-ionduchtas a ríomh



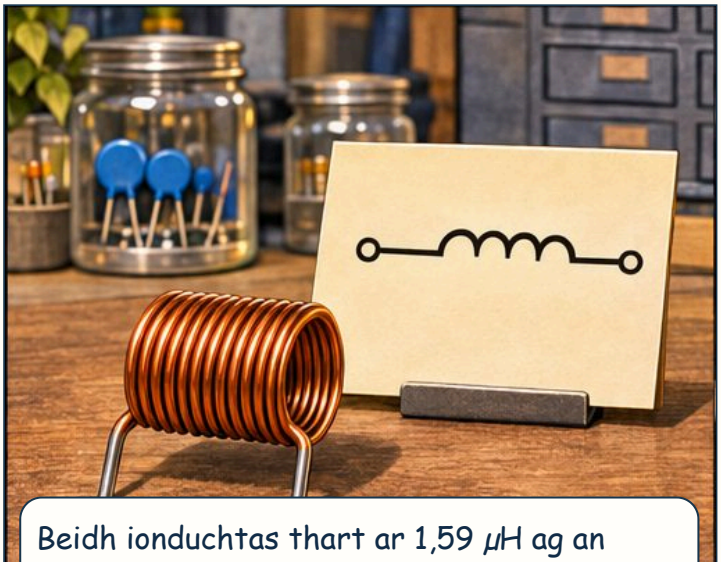
Is é an t-uimhreoir 2 × 50, nó 100 Ω.



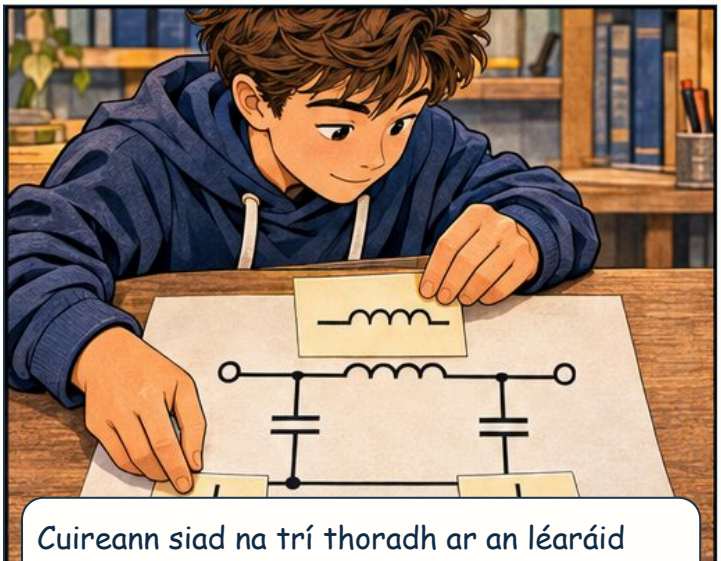
Is é an t-ainmneoir $2\pi \times 10\,000\,000$, thart ar $6{,}283 \times 10^{7}\ s^{-1}$.



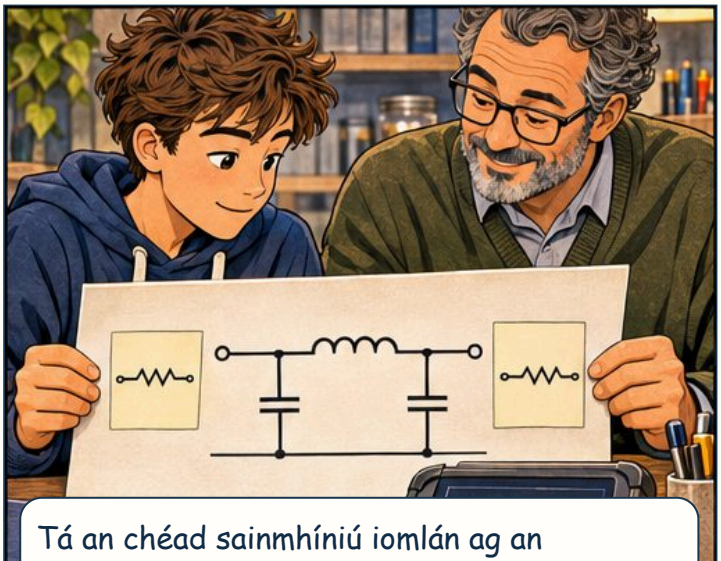
Tugann an ríomh thart ar $1{,}592 \times 10^{-6}$ H.



Beidh ionduchtas thart ar 1,59 μH ag an gcorna idéalach.



Cuireann siad na trí thoradh ar an léaráid chéanna.



Tá an chéad sainmhíniú iomlán ag an tionscadal anois.

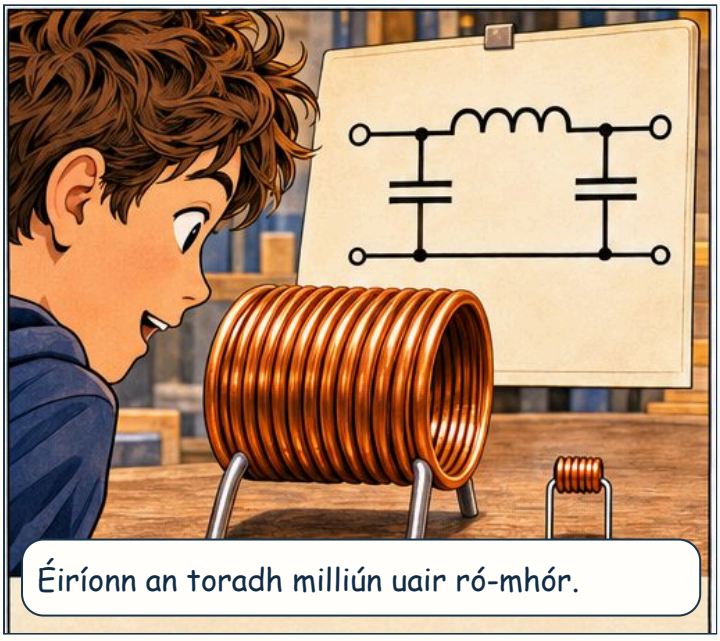
# Botún an mhilliúin



Déanann an foghlaimeoir iarracht an ríomh a chlóscríobh arís go tapa.



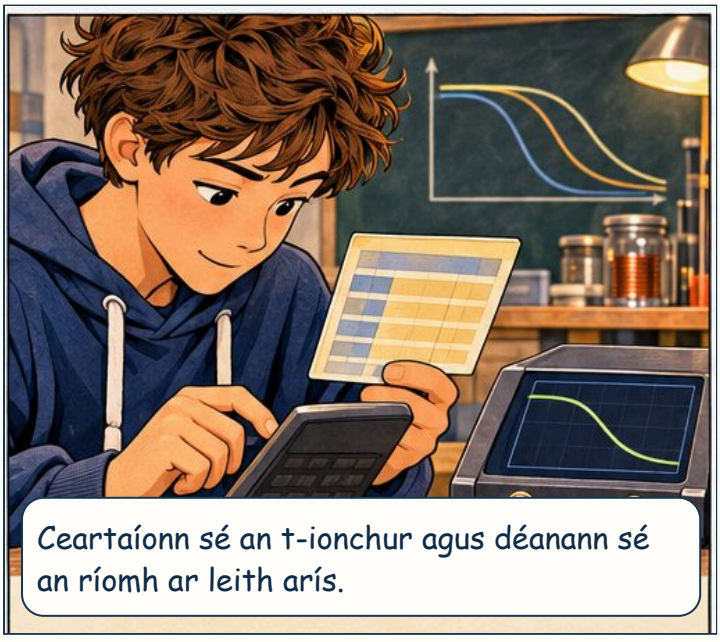
Cuireann sé 10 isteach in áit 10 000 000.



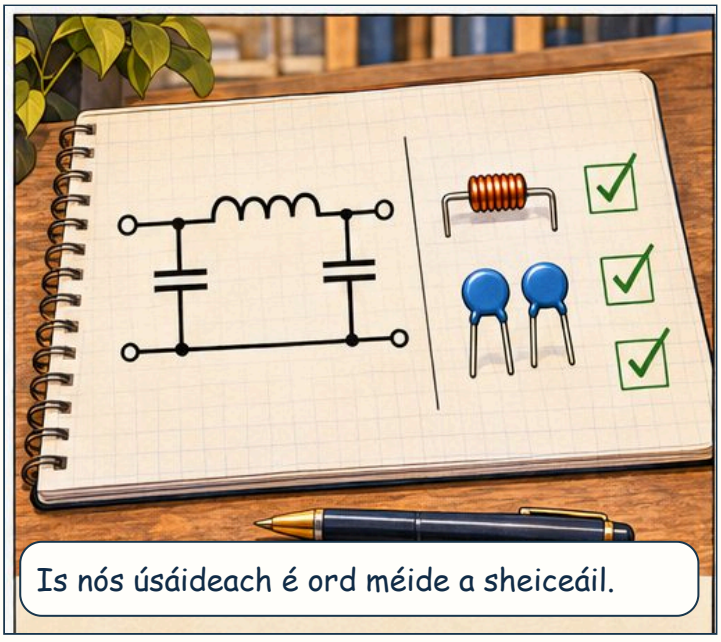
Éiríonn an toradh milliún uair ró-mhór.



Nochtann comparáid leis na comhpháirteanna ionchais an fhadhb láithreach.



Ceartaíonn sé an t-ionchur agus déanann sé an ríomh ar leith arís.

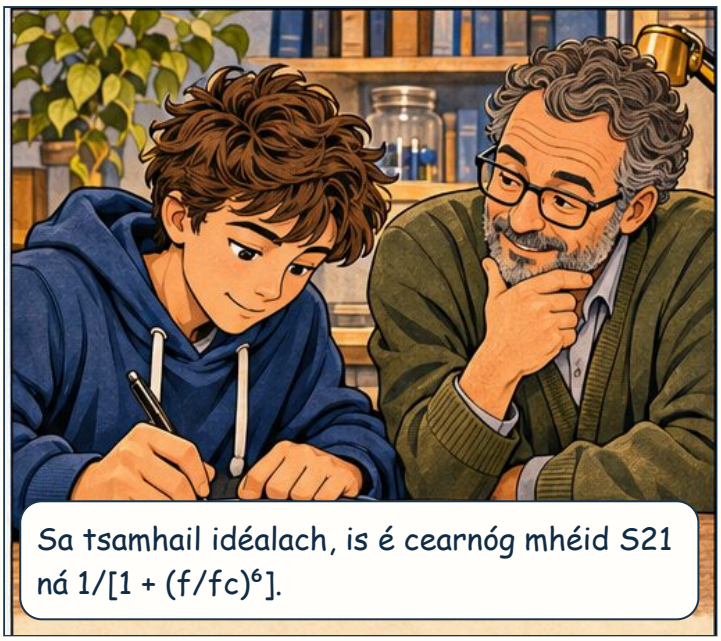


Is nós úsáideach é ord méide a sheiceáil.

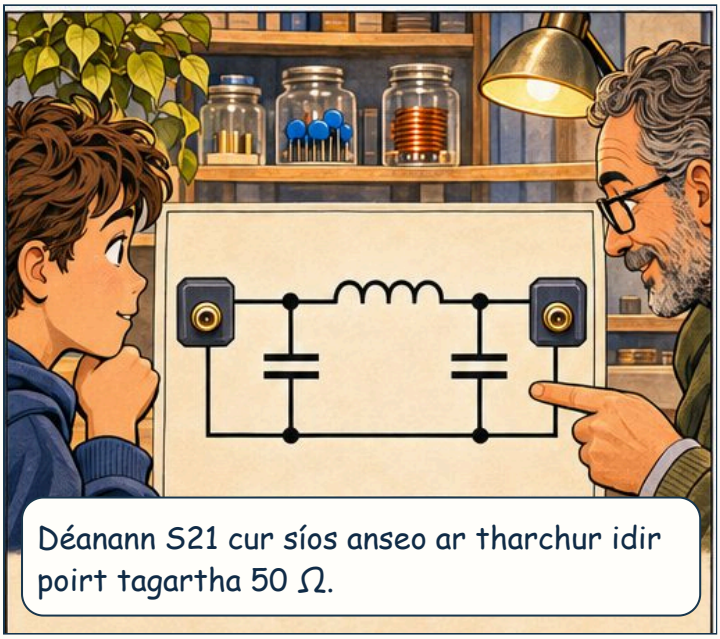
# Cuar iomlán a thuar



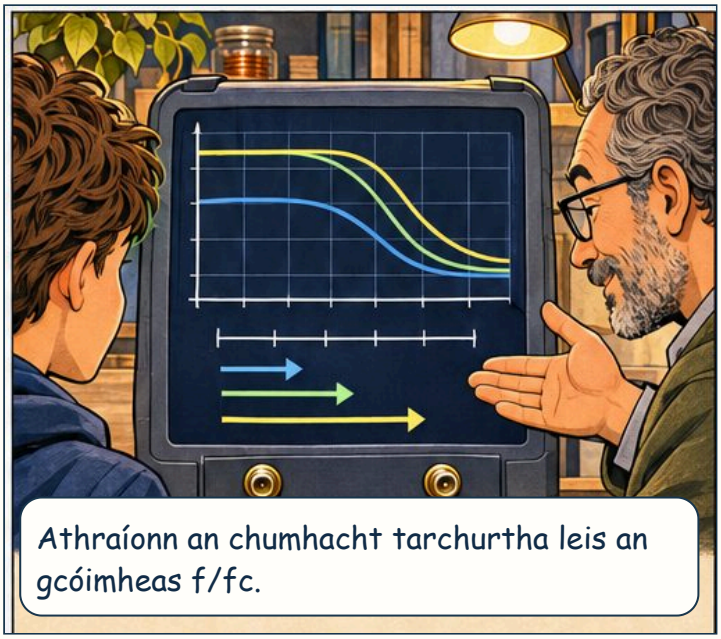
Ní insíonn trí luach an fhreagairt iomlán fós.



Sa tsamhail idéalach, is é cearnóg mhéid S21 ná $1/[1 + (f/fc)^6]$.



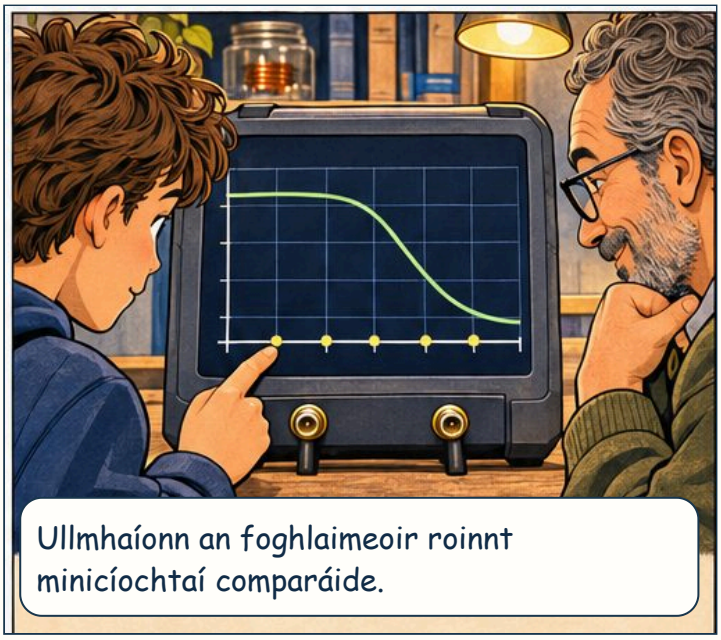
Déanann S21 cur síos anseo ar tharchur idir poirt tagartha 50 Ω.



Athraíonn an chumhacht tarchurtha leis an gcóimheas f/fc.



Tugann an cuar teoiriciúil tagairt roimh an tomhas.



Ullmhaíonn an foghlaimeoir roinnt minicíochtaí comparáide.

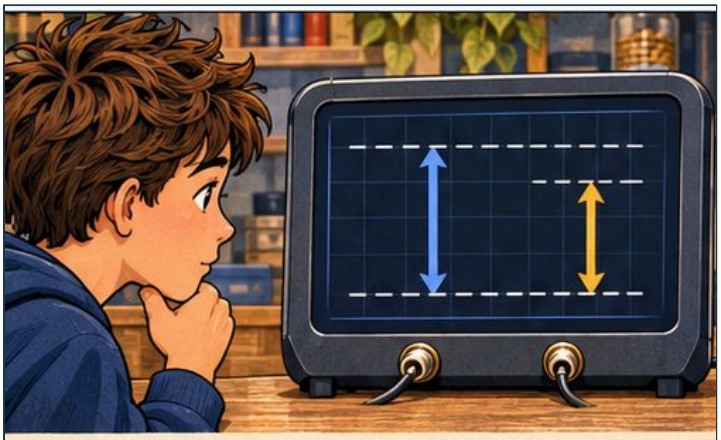
# Cad is brí le lúide trí dheicibeil?



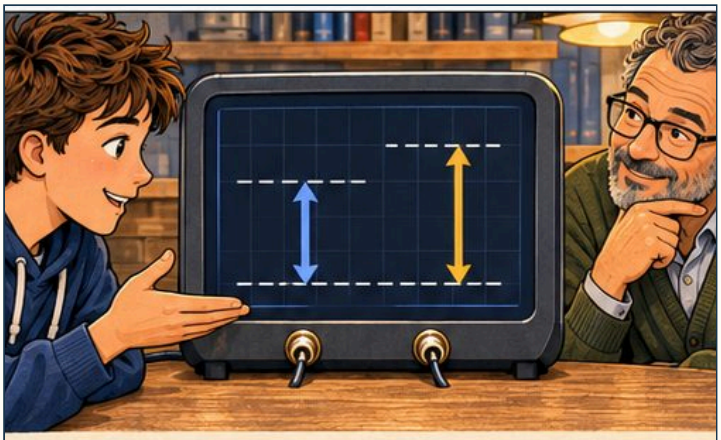
Ag f = fc, is é an cóimheas idéalach cumhachta tarchurtha 1/2.



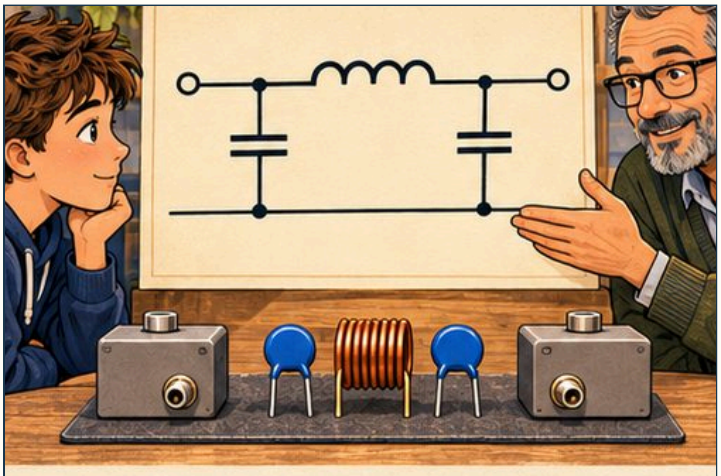
I ndeicibeilí, tugann 10 log10(1/2) thart ar −3,01 dB.



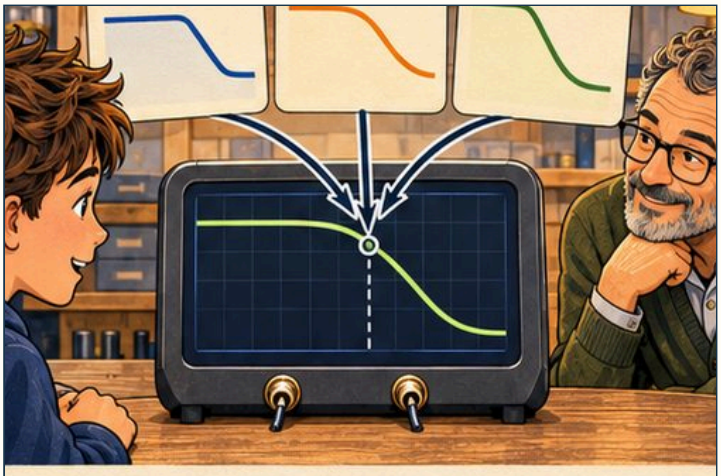
Tá méid S21 thart ar 0,707 ansin.



Ní leath den aimplitiúid atá ann mar sin.



Úsáideann an ríomh na tagairtí meaitseáilte 50 Ω.

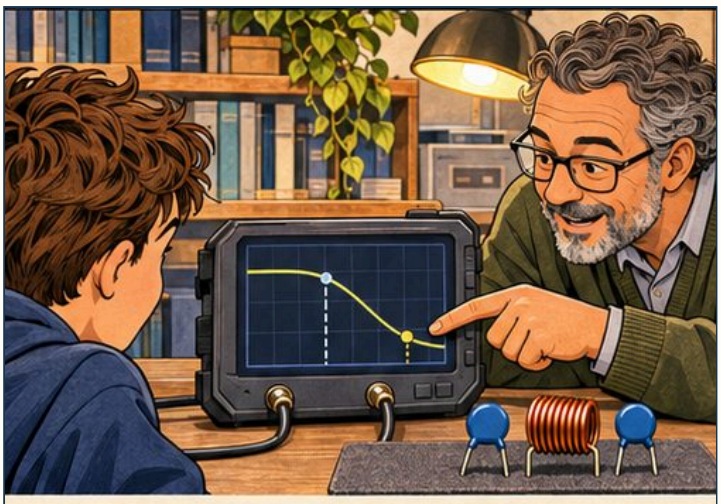


Ceanglaíonn an foghlaimeoir trí léiriú den phointe céanna ar an gcuar.

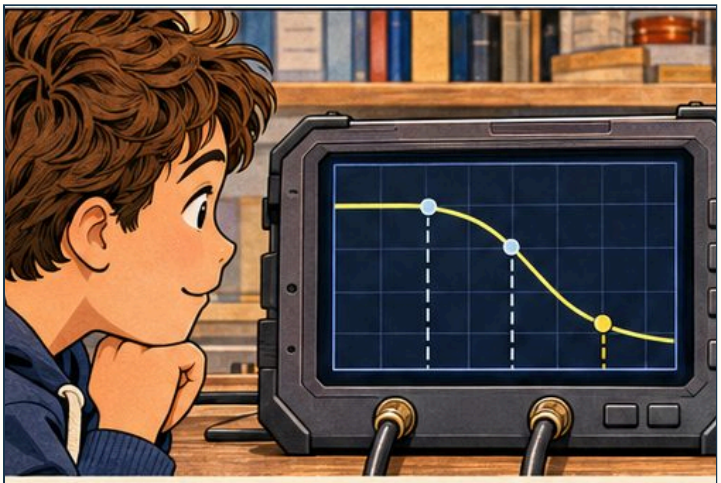
# Os cionn na minicíochta scoite



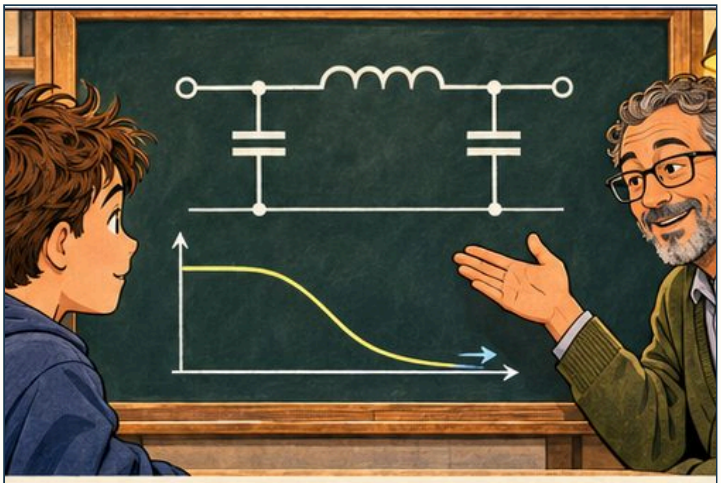
Ag 20 MHz, tá f/fc cothrom le 2.



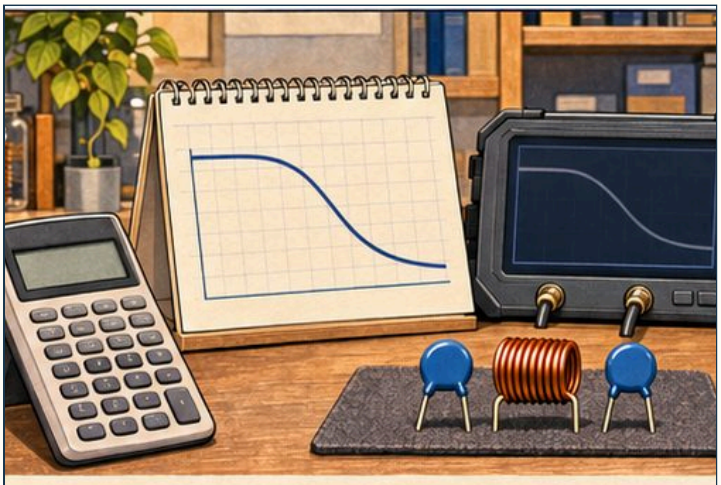
Bíonn an tarchur idéalach thart ar −18,13 dB.



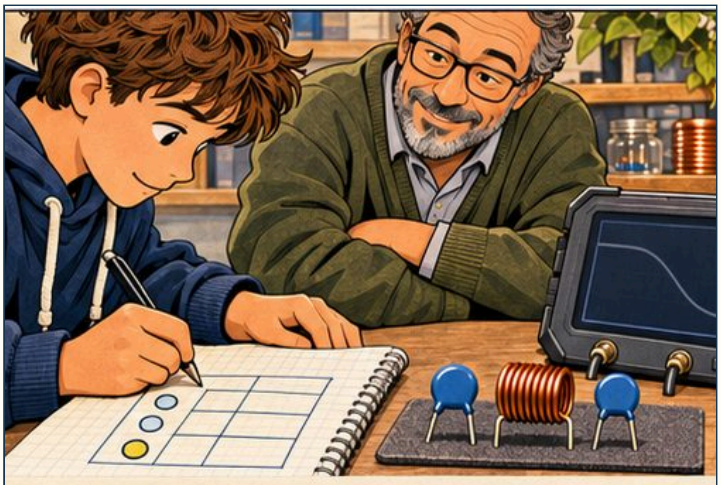
Ag 30 MHz, f/fc = 3: thart ar −28,63 dB.



Méadaíonn an maolú ach fanann sé críochta.

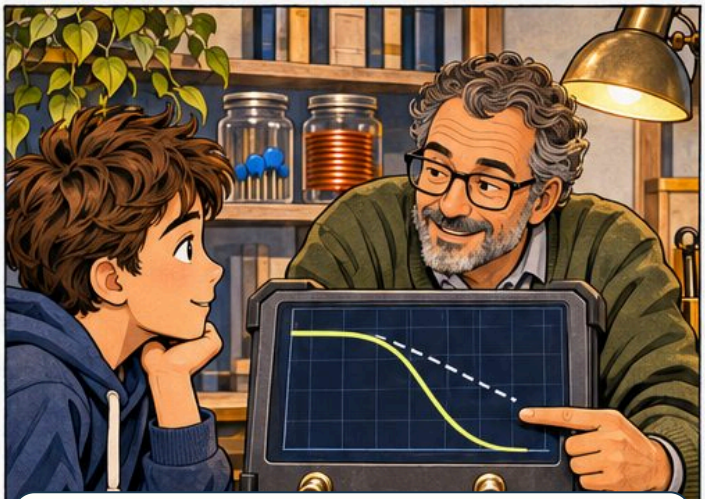


Is uimhreacha ríofa iad, ní tomhais ar a gciorcad.

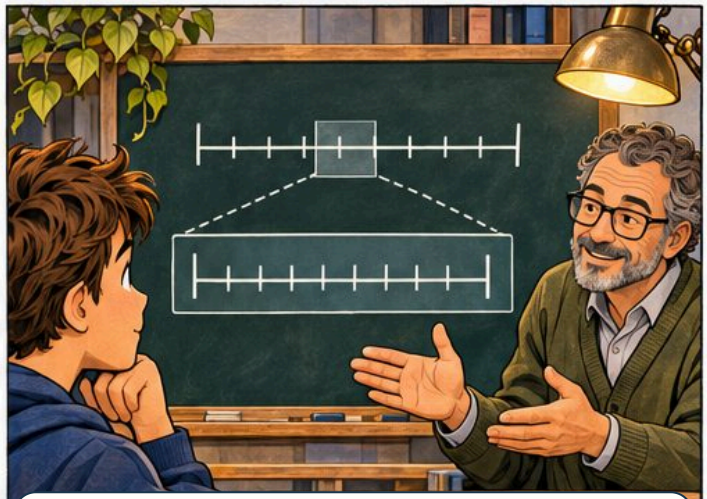


Cuireann an foghlaimeoir iad sa cholún tuartha.

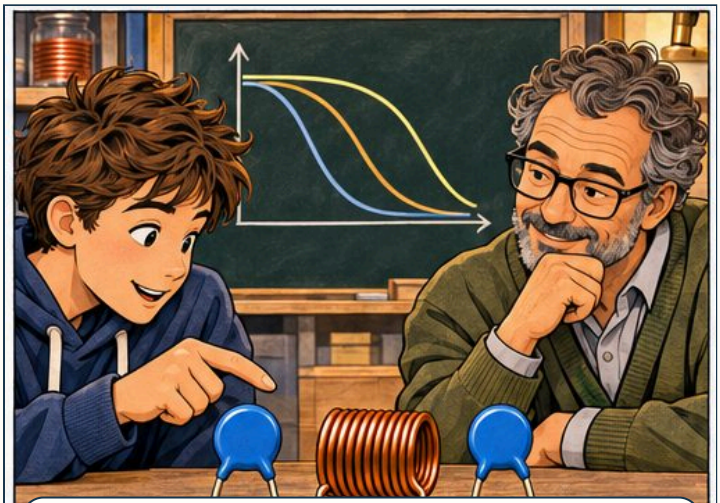
# Ní gealltanas í an fhána



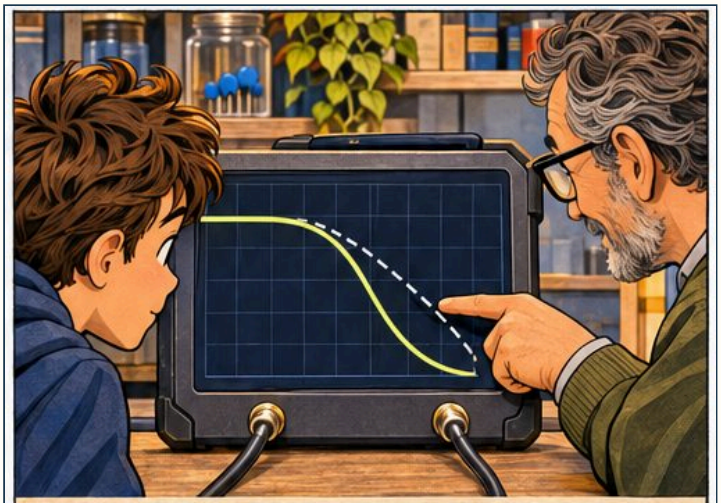
I bhfad ón teorainn, téann an maolú idéalach i dtreo 60 dB sa deacáid.



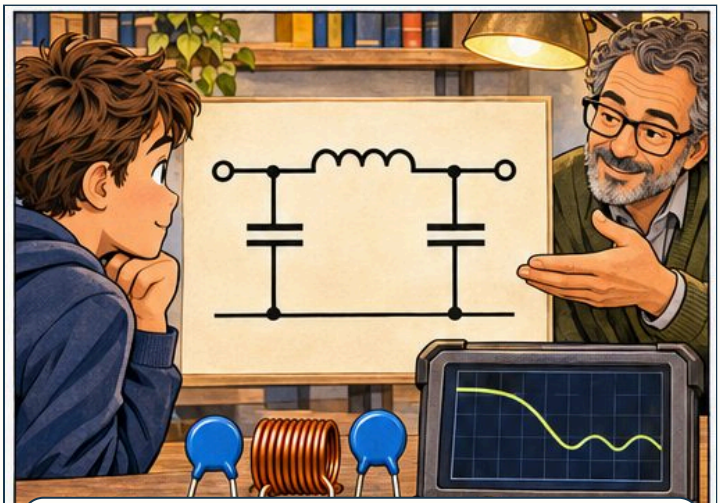
Ciallaíonn deacáid minicíocht a iolrú faoi dheich.



Baineann an fhána asamtóiteach seo leis an tsamhail tríú hord.



Gar don teorainn, ní líne dhíreach é an cuar.

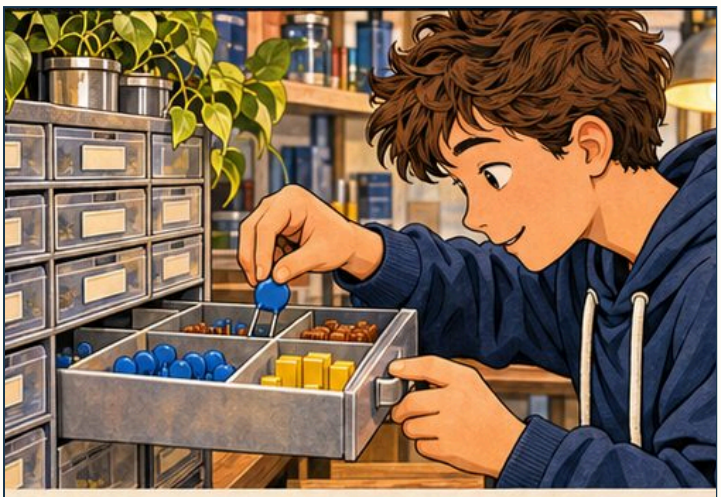


Cuireann fíorchomhpháirteanna teorainn leis an bhforbairt seo freisin.

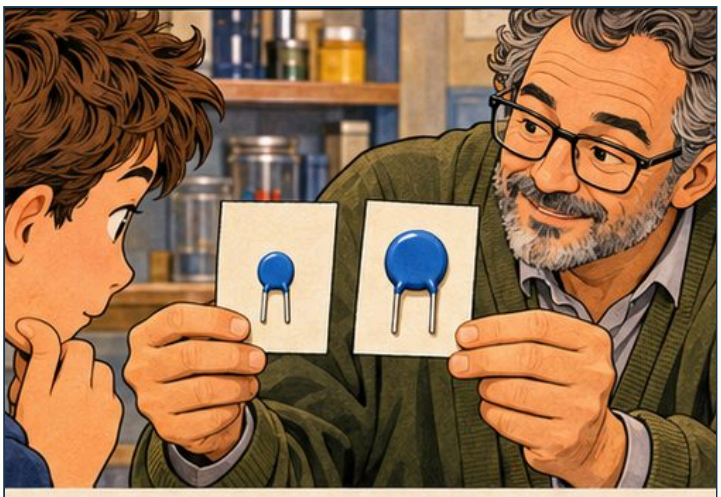


Ní shíneann an foghlaimeoir riail thar a coinníollacha.

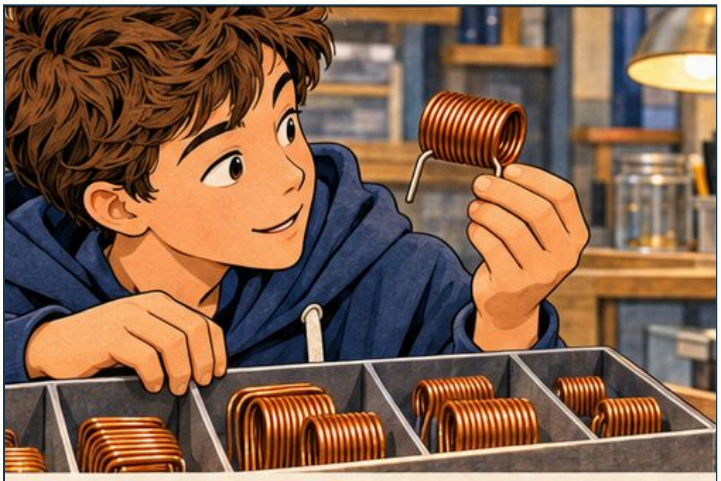
# Luachanna atá ar fáil



Seans nach bhfuil toilleoirí de 318,3 pF go díreach sa tarraiceán.



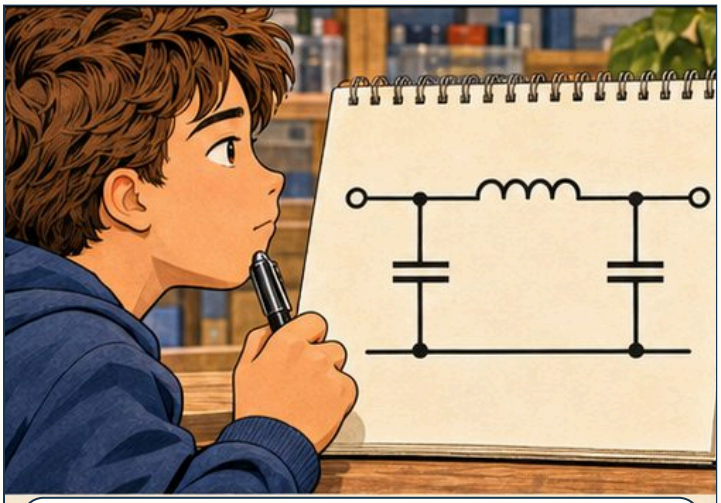
Ní ionann gnáthluach 330 pF agus an luach sin.



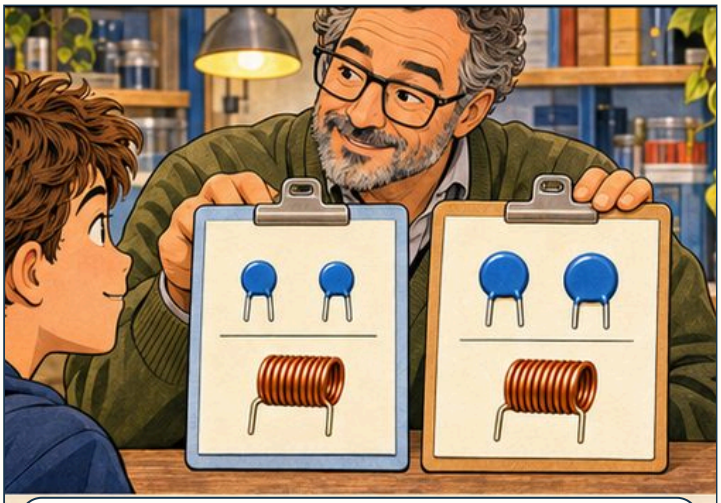
Tá corna 1,6 µH gar don luach ríofa.



Éilíonn na roghanna seo ríomh nó ionsamhlú nua ar an bhfreagairt.

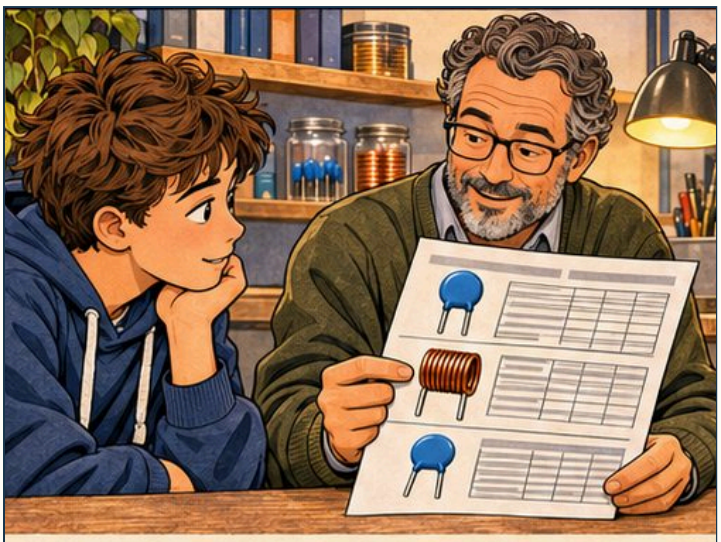


Ní féidir 10 MHz go díreach a thabhairt ar an gciorcad go huathoibríoch.

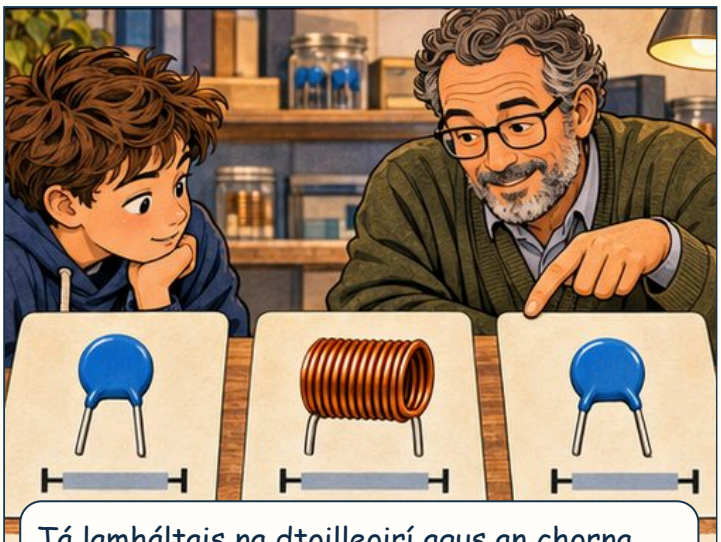


Coinníonn an foghlaimeoir luachanna idéalacha agus roghnaithe ar leith.

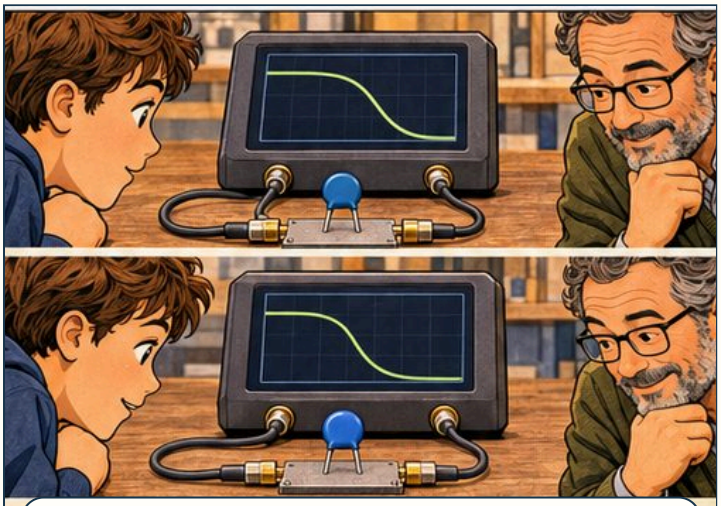
# Tá lamháltas ag gach píosa



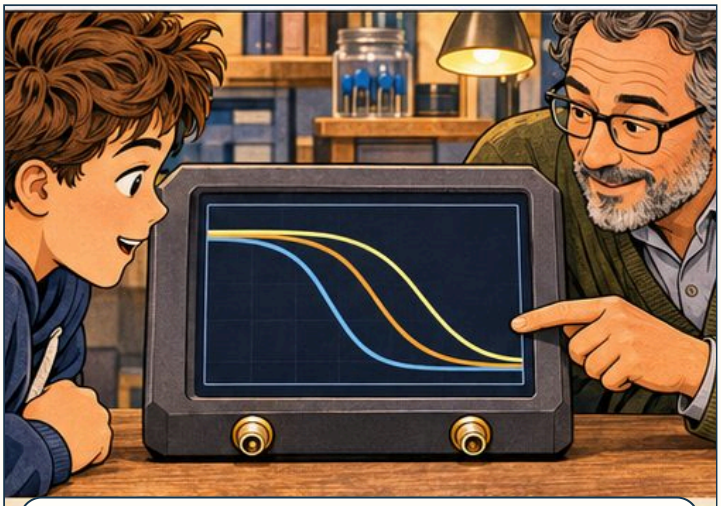
Ní luach cruinn ráthaithe é luach ainmniúil.



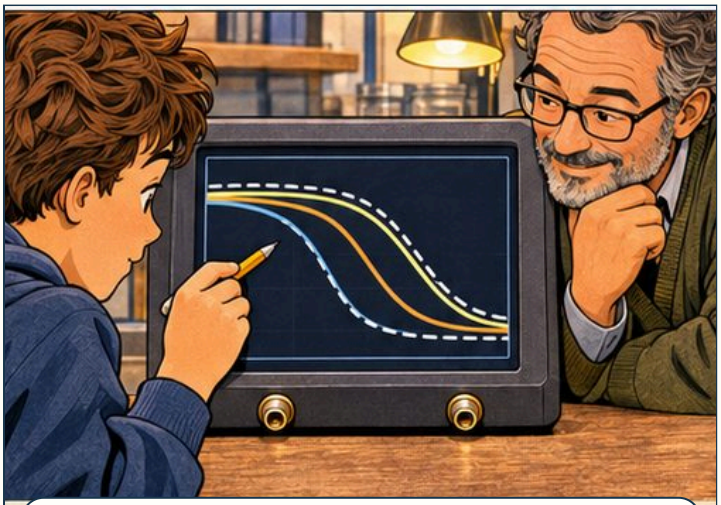
Tá lamháltais na dtoilleoirí agus an chorna tábhachtach.



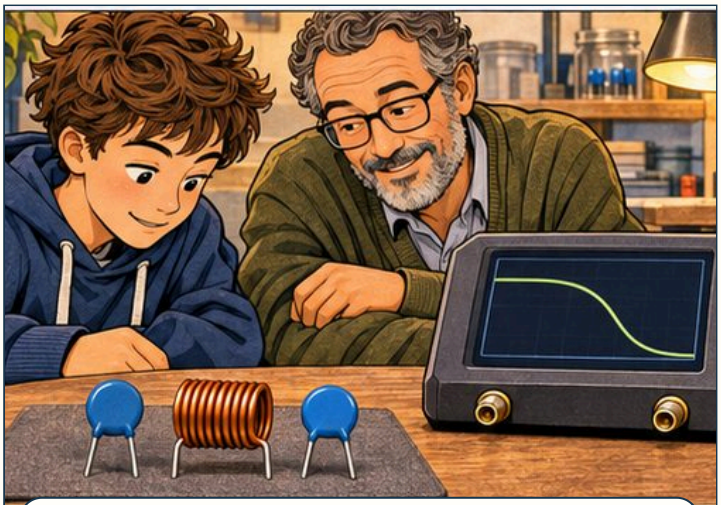
Féadfaidh dhá chomhpháirt leis an marc céanna a bheith beagán éagsúil.



Is féidir le hionsamhlú roinnt teaglamaí luachanna a scrúdú.



Cuidíonn sé le raon freagairtí féideartha a thuar.



Scrúdóidh an tomhas na píosaí a úsáideadh i ndáiríre ansin.

# Na comhpháirteanna ceilte



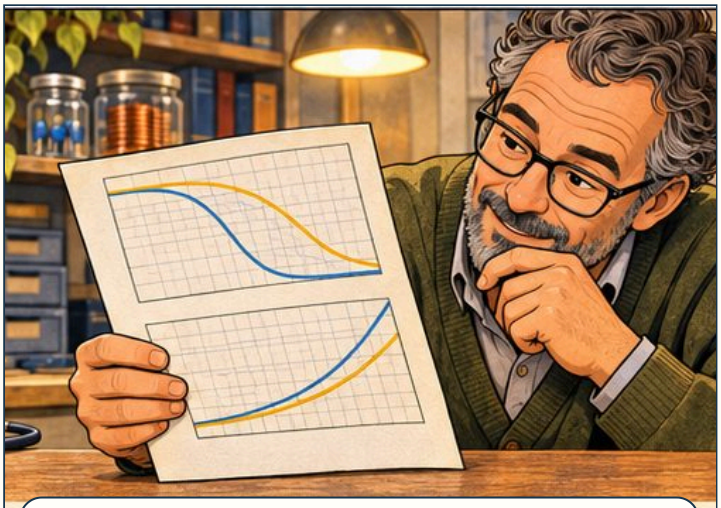
Tá friotaíocht agus toilleas seadánach ag fíorchorna freisin.



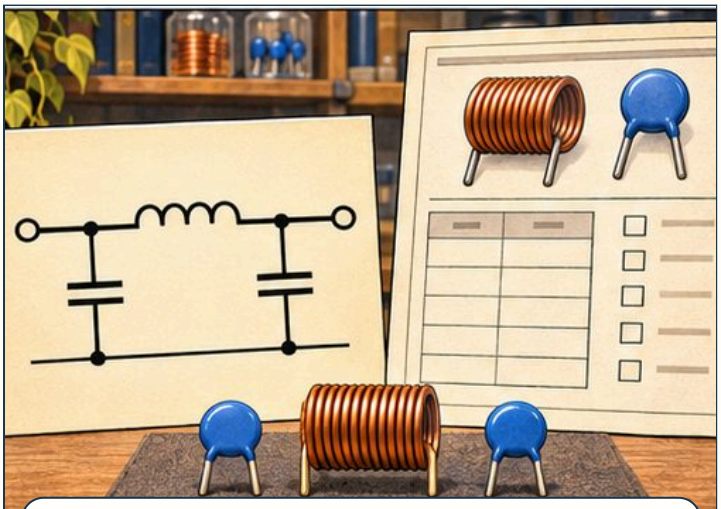
Tá caillteanais agus ionduchtas seadánach ag toilleoir, i measc nithe eile.



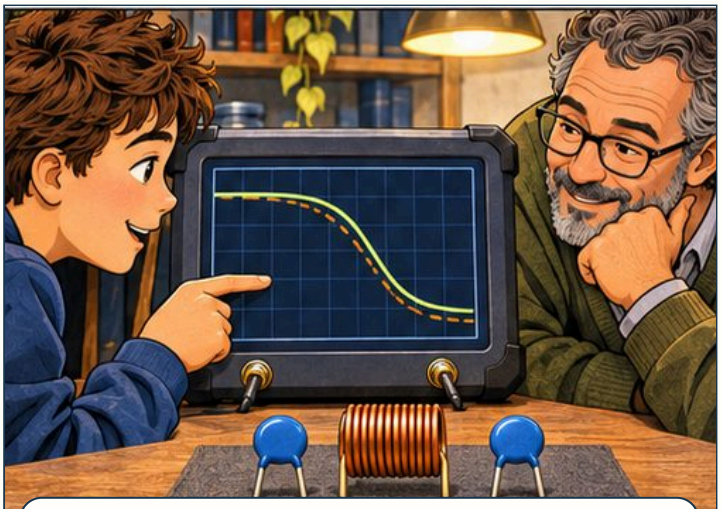
Athraíonn a n-iompar gar d'athshondais áirithe.



Tugann bileoga sonraí teorainneacha atá le scrúdú.



Ní leor an luach i bpiceafaraid nó micrihenry mar sin.

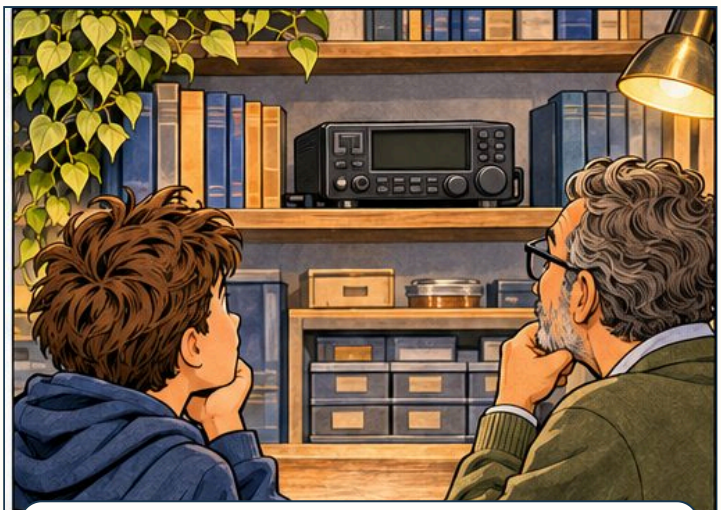


Foghlaimíonn an foghlaimeoir léamh níos faide ná an chéad líne.

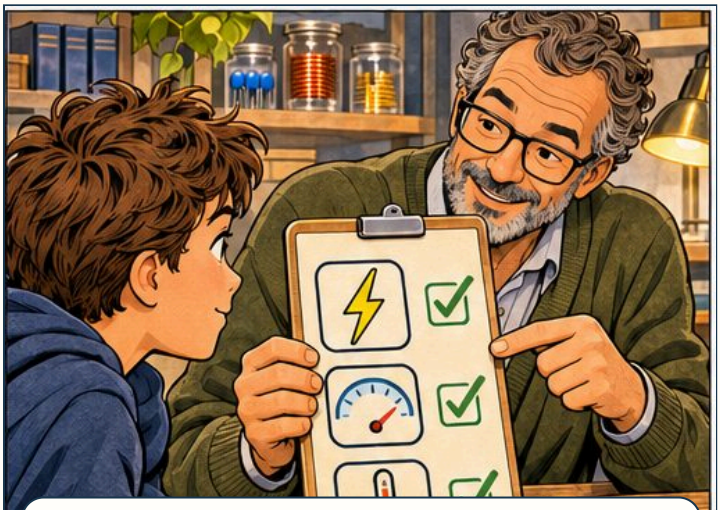
# Ní cháilíonn tomhas binse tarchuradóir



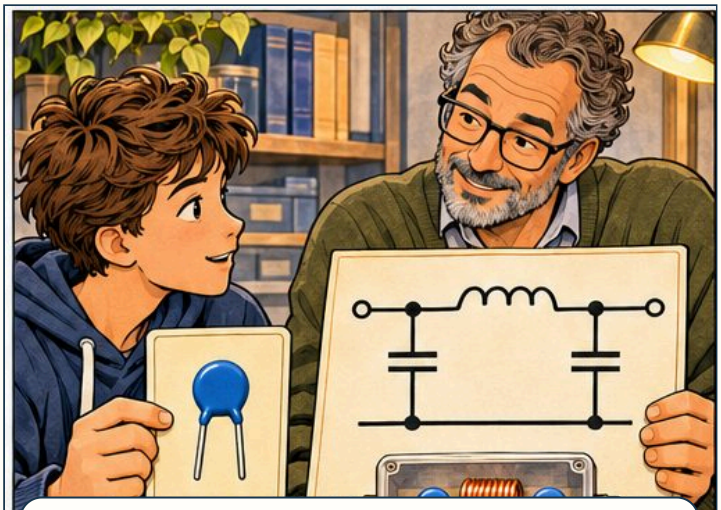
Ní fhaigheann a dtaispeántóir ach comhartha lag sonraithe an anailíseora.



Bheadh seiceálacha eile de dhíth le húsáid i dtarchur.



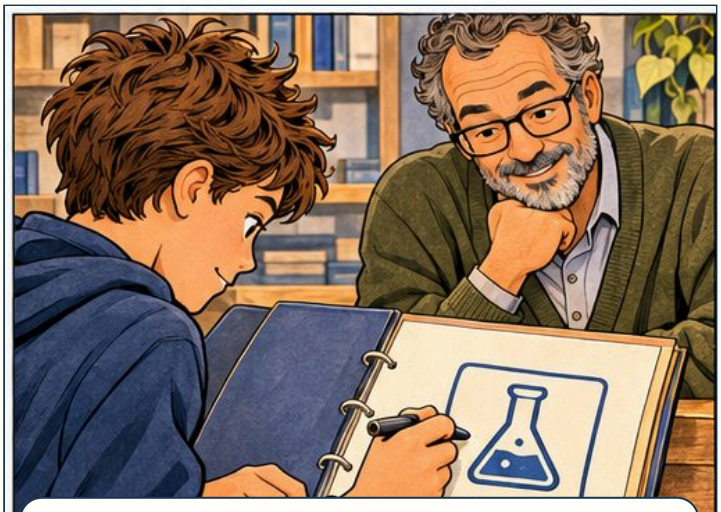
Chaithfí voltais, sruthanna, téamh agus cumhacht incheadaithe a scrúdú.



Ní cháilíonn rátáil voltais toilleora an scagaire ar fad.

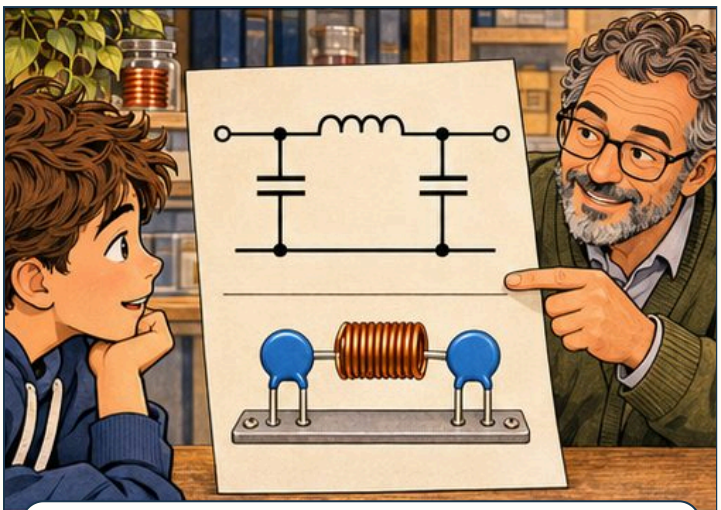


Ní cuid den cheardlann seo tástáil chumhachta.

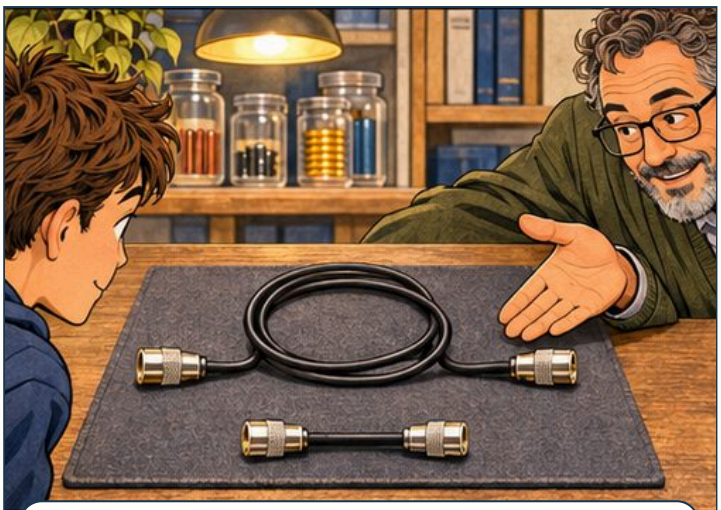


Scríobhann an foghlaimeoir teorainn a dtógála go soiléir.

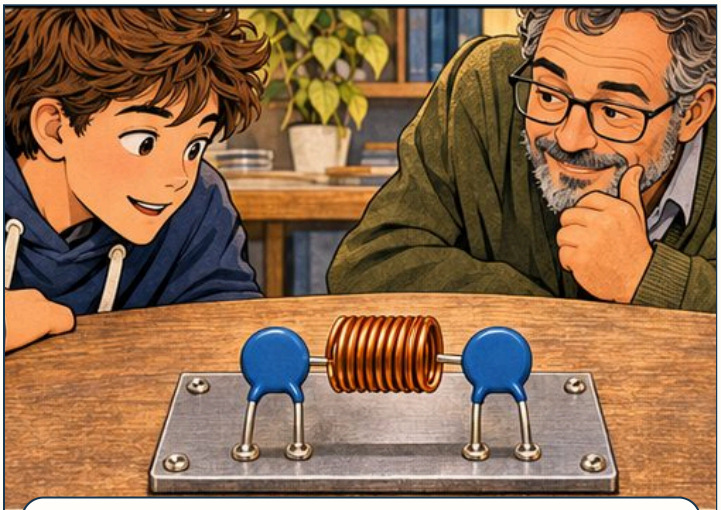
# An leagan amach a tharraingt



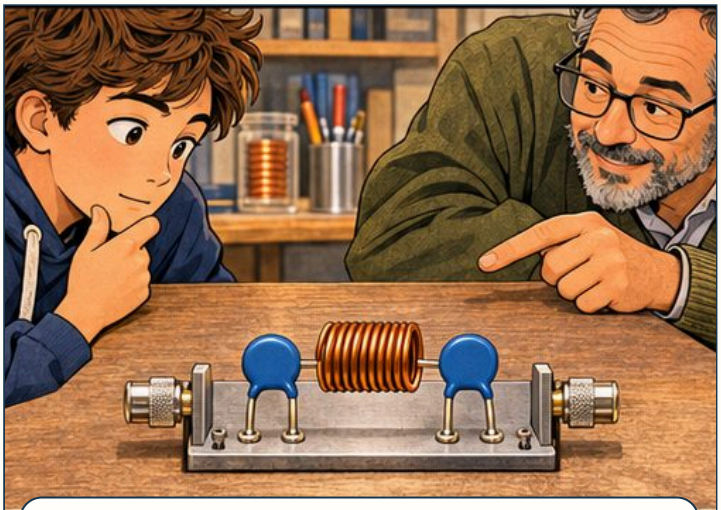
Léiríonn an léaráid na naisc ach ní a ngeoiméadracht iomlán.



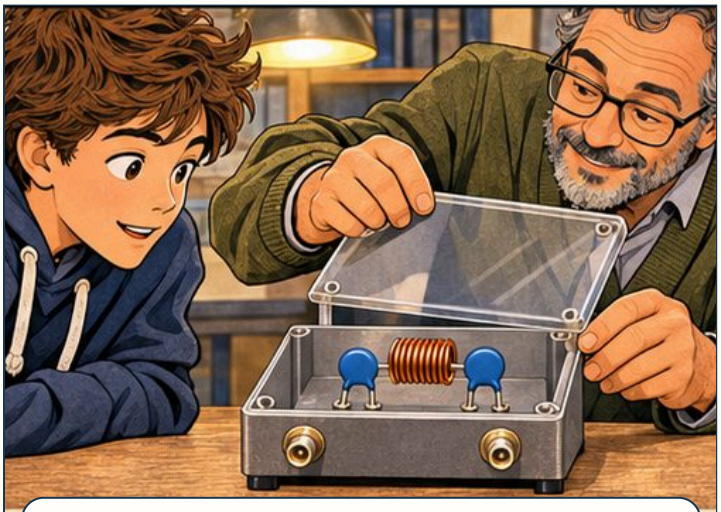
Ag na minicíochtaí seo, d'fhéadfadh fad nasc agus leagan amach a bheith tábhachtach.



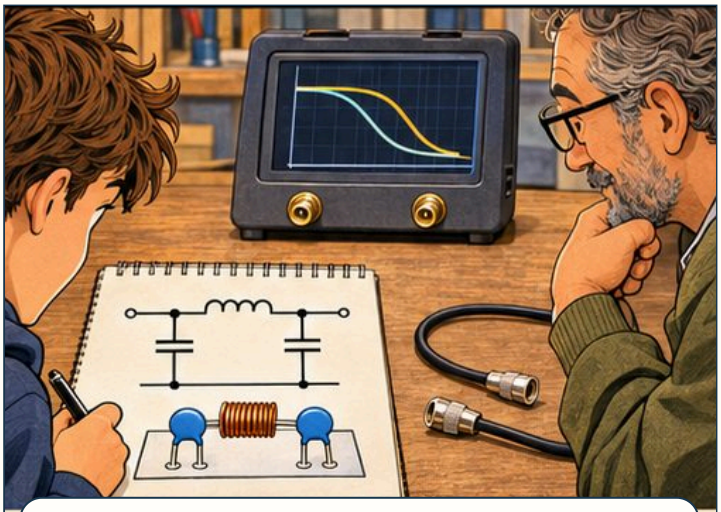
Pleanálann siad tagairt choiteann agus naisc ghearra.



Scarann siad freisin cosáin a d'fhéadfadh cúpláil dhíreach a dhéanamh.



Ullmhaíonn Henri taispeántóir atá oiriúnach do thomhas.

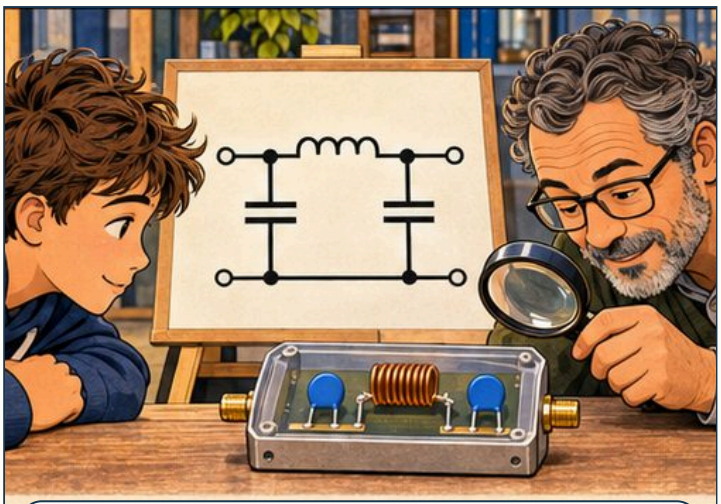


Cuireann Lucas an leagan amach i gcomparáid leis an léaráid, nasc ar nasc.

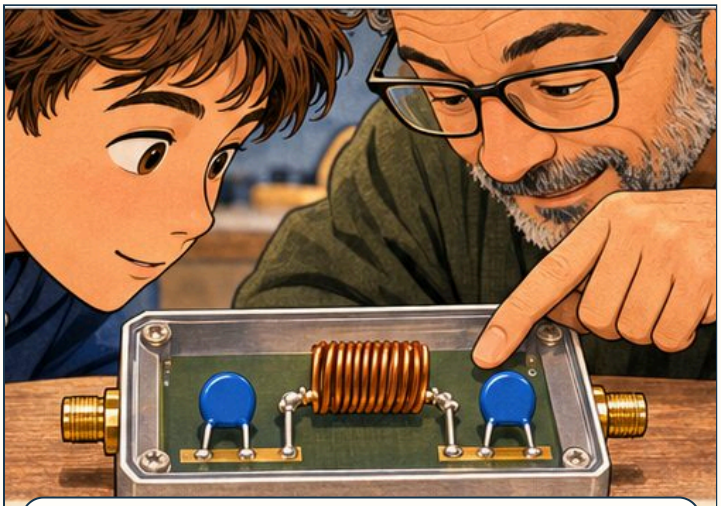
# Seiceáil roimh cheangal



Fanann an fhoinse tomhais múchta le linn an ullmhúcháin.



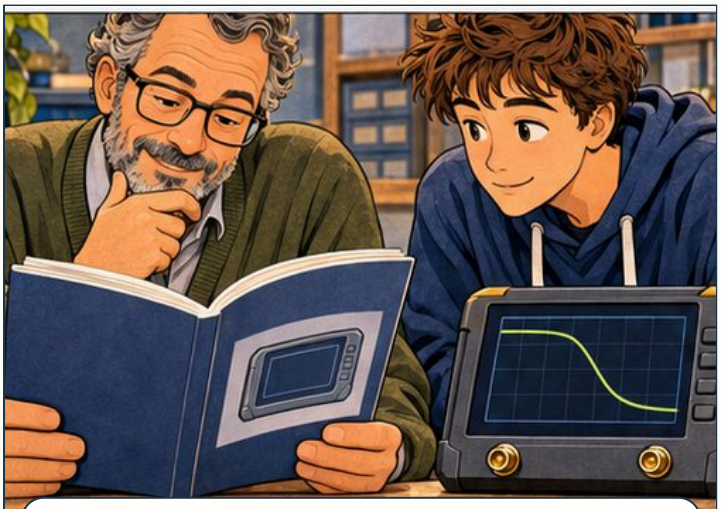
Seiceálann siad naisc, comhpháirteanna agus an pointe coiteann.



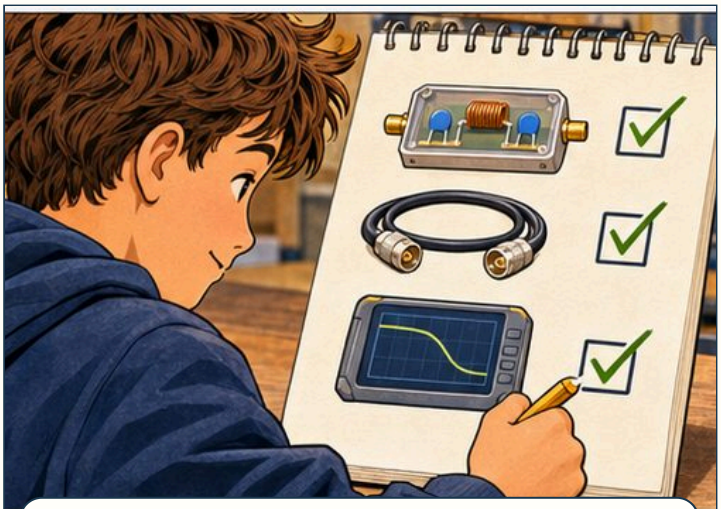
Lorgaíonn siad gearrchiorcad, mícheangal nó comhpháirt dhamáistithe.



Scrúdaíonn siad na nascóirí agus na cáblaí ansin.



Seiceálann an meantóir teorainneacha ionchuir na huirlise.

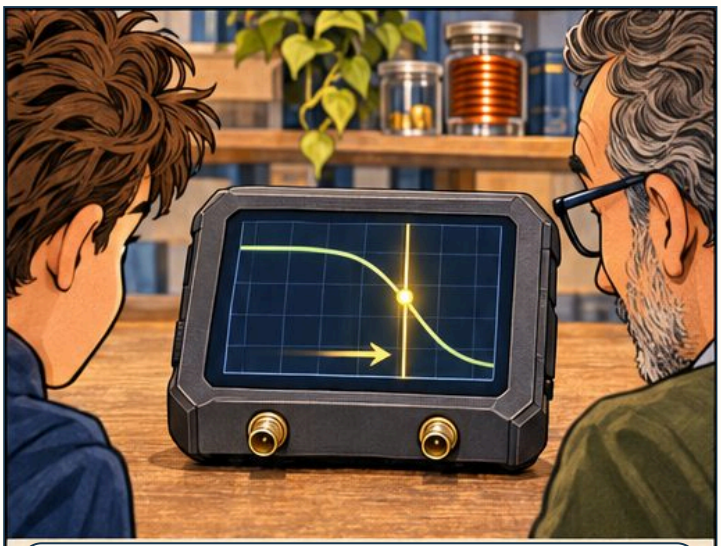


Críochnaíonn an foghlaimeoir a liosta roimh an gcéad scuabadh.

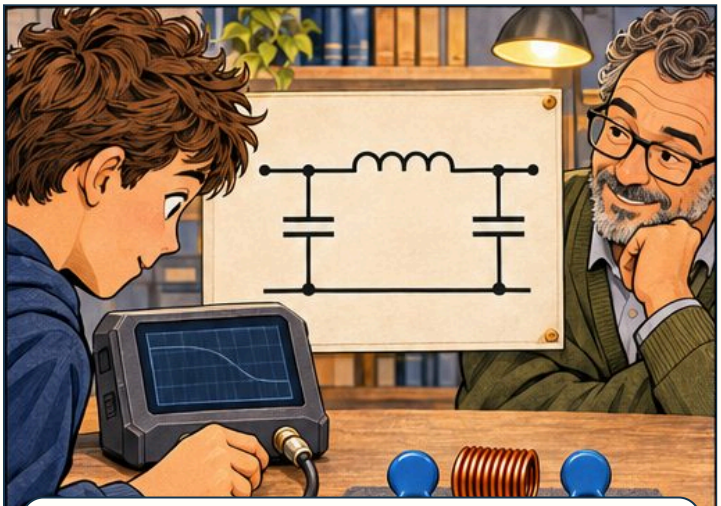
# Cuireann an t-anailíseoir a cheisteanna



Seolann an t-anailíseoir líonra comhartha lag aitheanta.



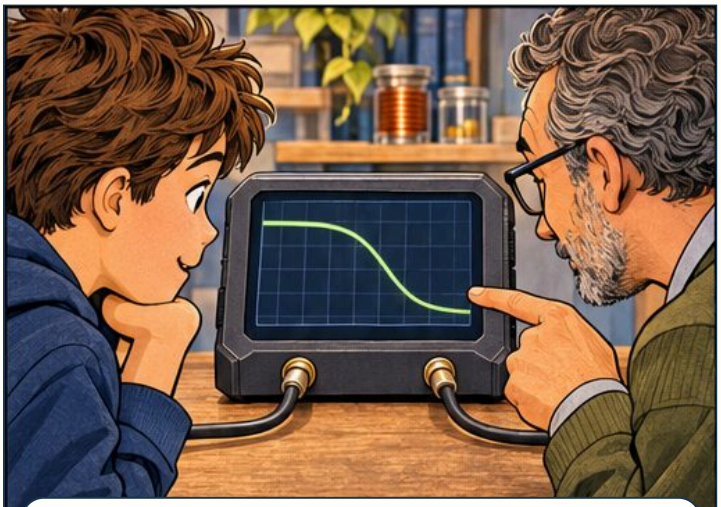
Scuabann sé réimse roghnaithe minicíochtaí.



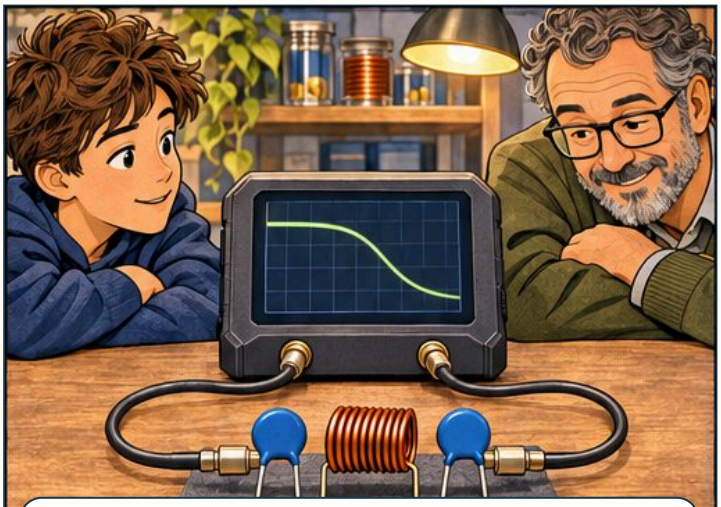
Cuireann port 1 comhartha isteach sa scagaire.



Breathnaíonn port 2 ar an tarchur ag an aschur.



Ligeann paraiméadar S21 an tarchur seo a leanúint.



Soláthraíonn na poirt na tagairtí beartaithe 50 Ω.

# Calabrú san áit cheart



Bíonn na cáblaí agus na hoiriúnóirí páirteach sa tomhas.



Leanann siad nós imeachta calabrúcháin na huirlise mar sin.



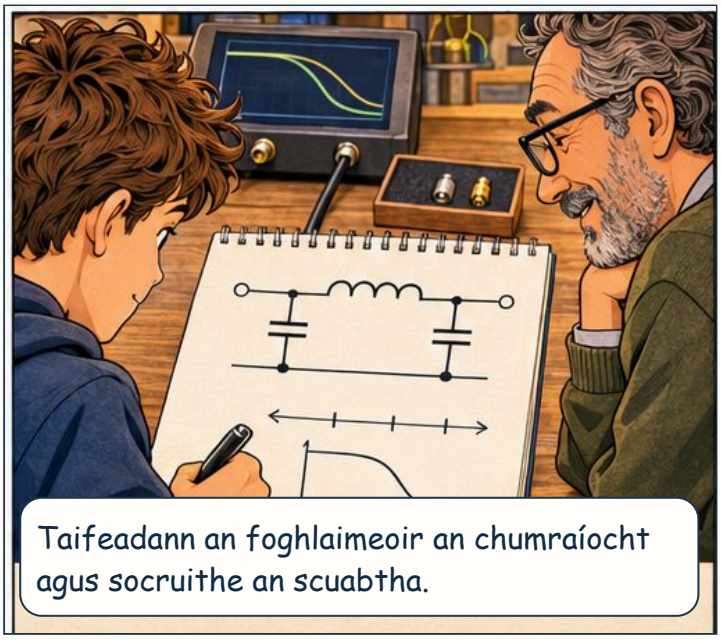
Ceanglaítear caighdeáin oiriúnacha de réir an lámhleabhair.



Cuirtear na plánaí tagartha ag foircinn na gcáblaí.



Tar éis calabrúcháin, coinnítear na naisc seo chomh seasta agus is féidir.



Taifeadann an foghlaimeoir an chumraíocht agus socruithe an scuabtha.

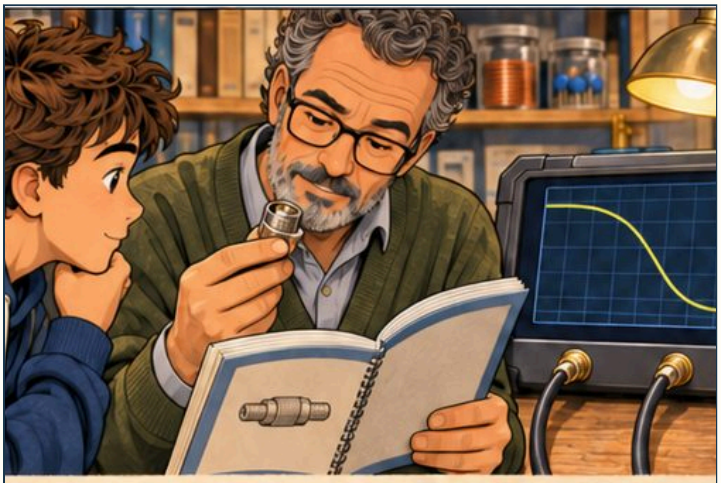
# An cosán díreach a sheiceáil



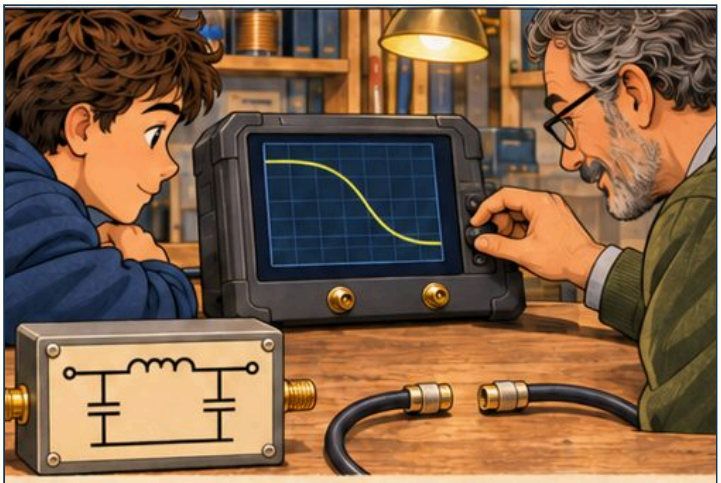
Roimh an scagaire, seiceálann nasc díreach an tagairt.



Caithfidh an tarchur ionchais teacht leis an nasc seo.



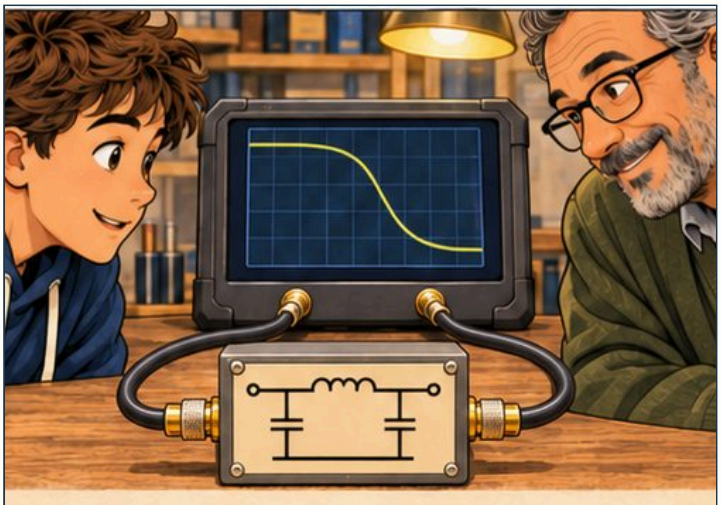
Éilíonn aimhrialtacht scrúdú ar cháblaí, calabrú agus socruithe.



Ní athraítear scagaire chun locht sa bhinse a cheilt.



Tar éis na seiceála, múchtar an fhoinse sula gceanglaítear é.

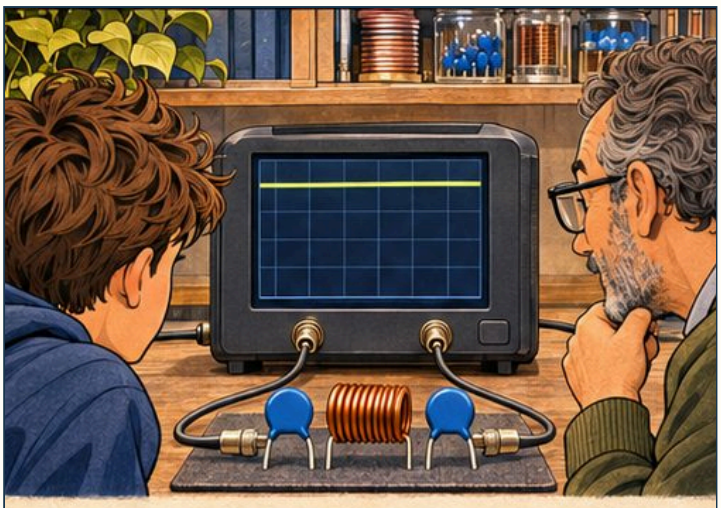


Cuirtear an scagaire ansin idir an dá chábla.

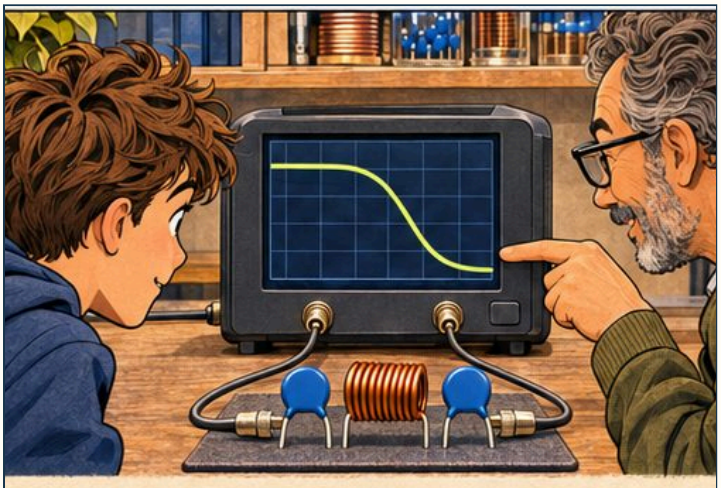
# An chéad scuabadh



Tosaíonn siad scuabadh a chlúdaíonn an banda úsáideach agus an t-aistriú.



Fanann an rian níos airde ag minicíochtaí ísle.



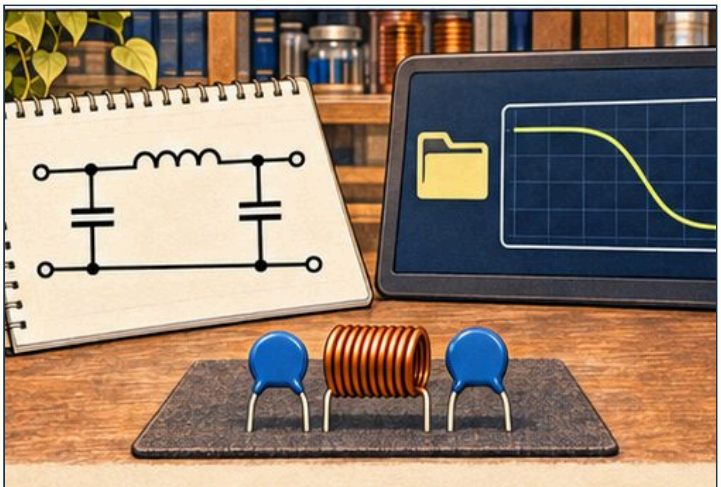
Titeann sé ansin de réir mar a ardaíonn an mhinicíocht.



Aithníonn an foghlaimeoir an cruth tuartha gan comhionannas foirfe a ghlacadh.

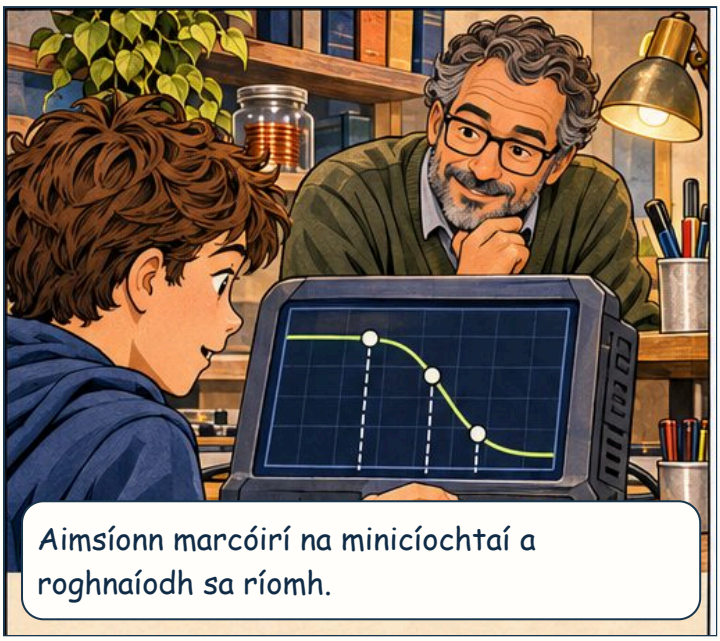


Sábhálann sé an rian agus na coinníollacha tomhais.



Is féidir toradh coinnithe a chur i gcomparáid tar éis gach athraithe.

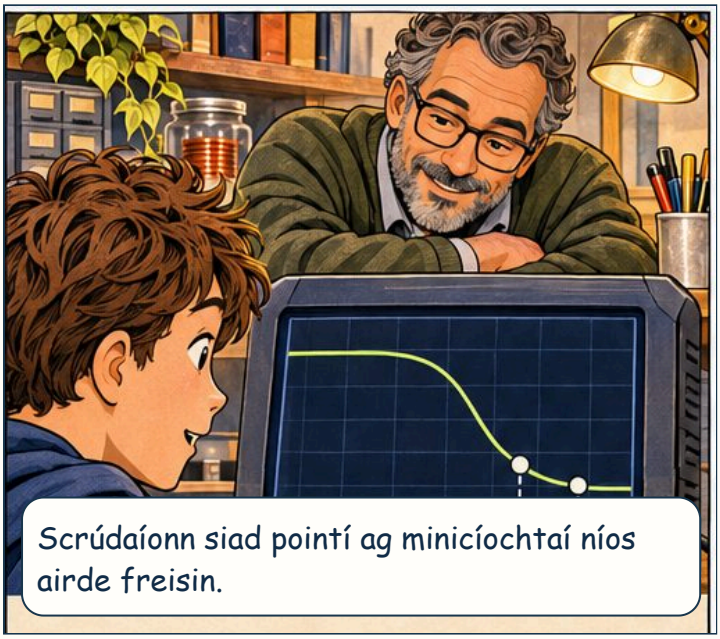
# Pointí beachta a léamh



Aimsíonn marcóirí na minicíochtaí a roghnaíodh sa ríomh.



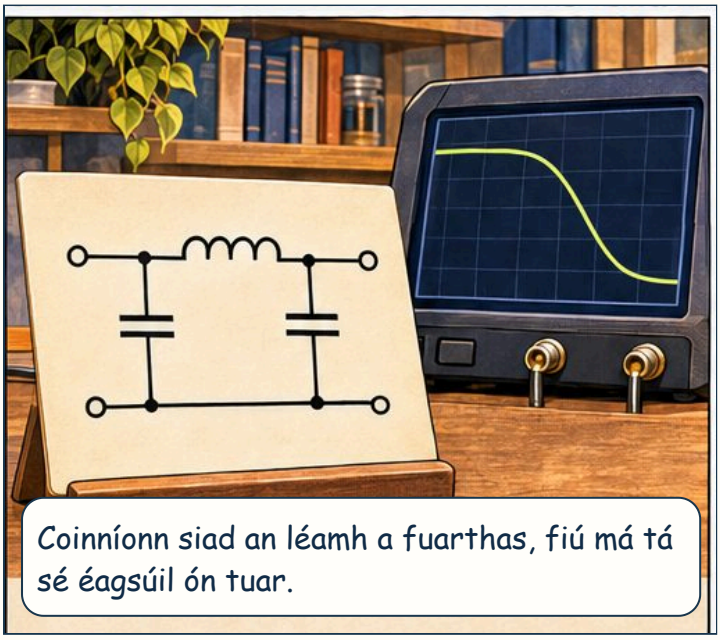
Léann siad an tarchur timpeall na teorann ionchais.



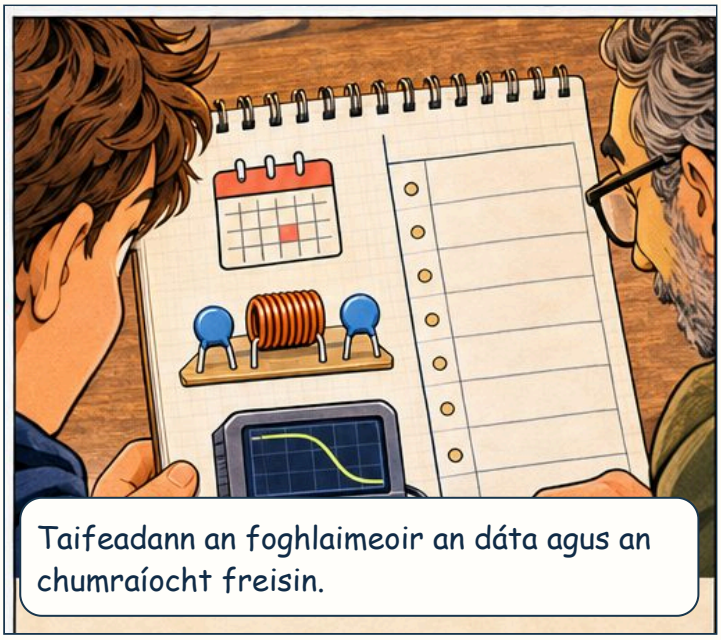
Scrúdaíonn siad pointí ag minicíochtaí níos airde freisin.



Téann na fíorléamha isteach sa cholún tomhais.

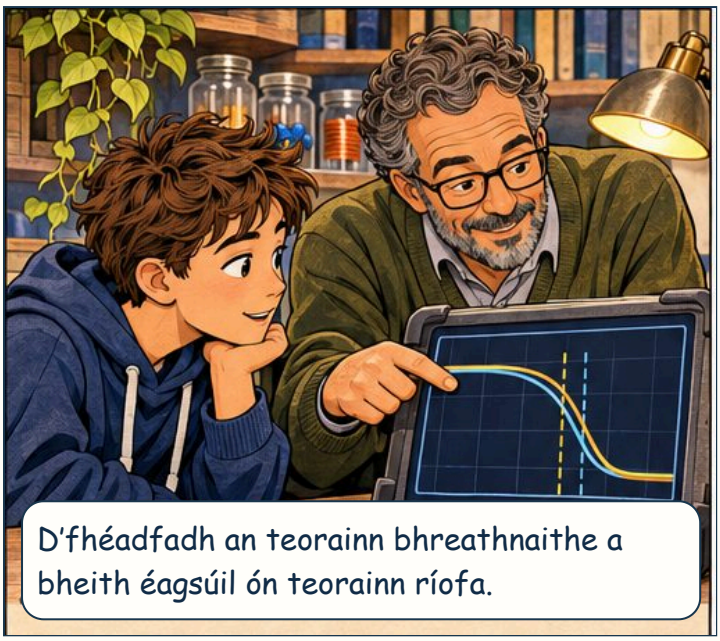


Coinníonn siad an léamh a fuarthas, fiú má tá sé éagsúil ón tuar.

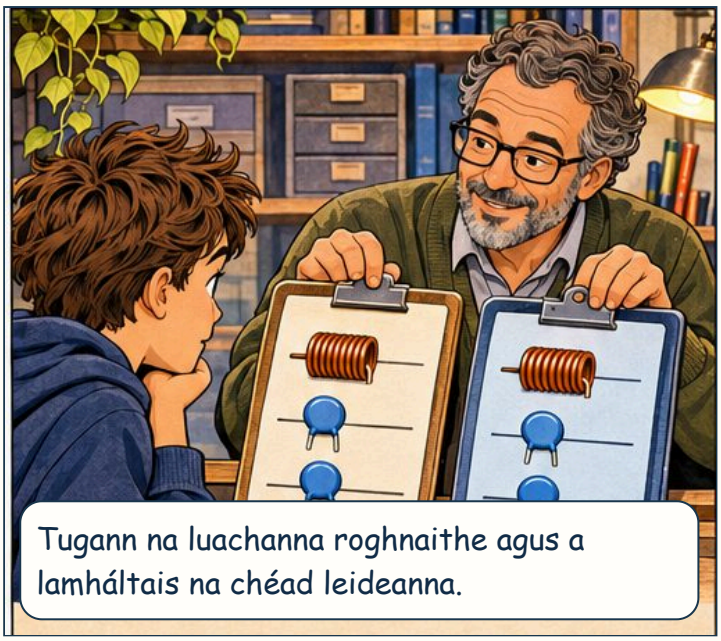


Taifeadann an foghlaimeoir an dáta agus an chumraíocht freisin.

# Difríocht a thuiscint



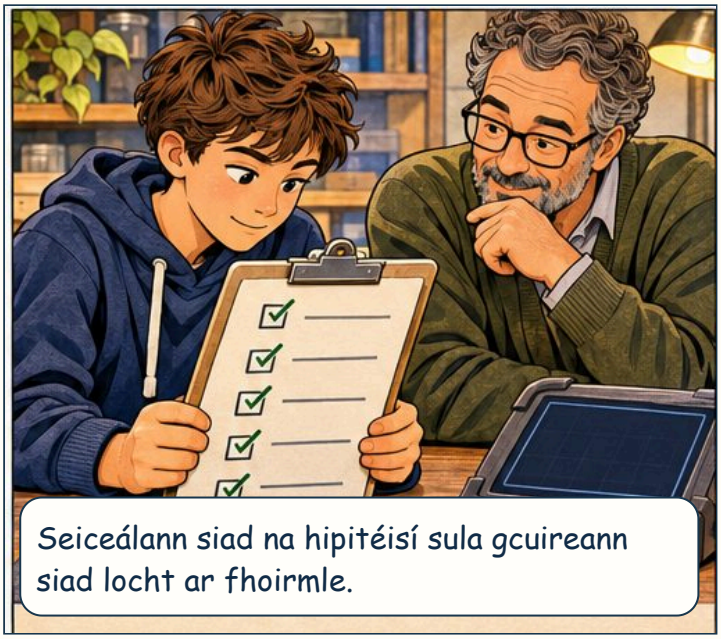
D'fhéadfadh an teorainn bhreathnaithe a bheith éagsúil ón teorainn ríofa.



Tugann na luachanna roghnaithe agus a lamháltais na chéad leideanna.



Is fiú caillteanais, leagan amach agus calabrú a scrúdú freisin.



Seiceálann siad na hipitéisí sula gcuireann siad locht ar fhoirmle.

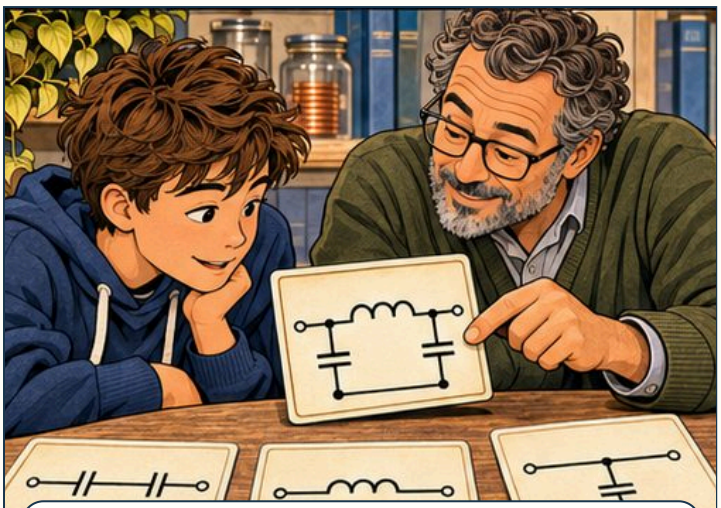


Ní mhíníonn cuar éagsúil a bhunús leis féin.

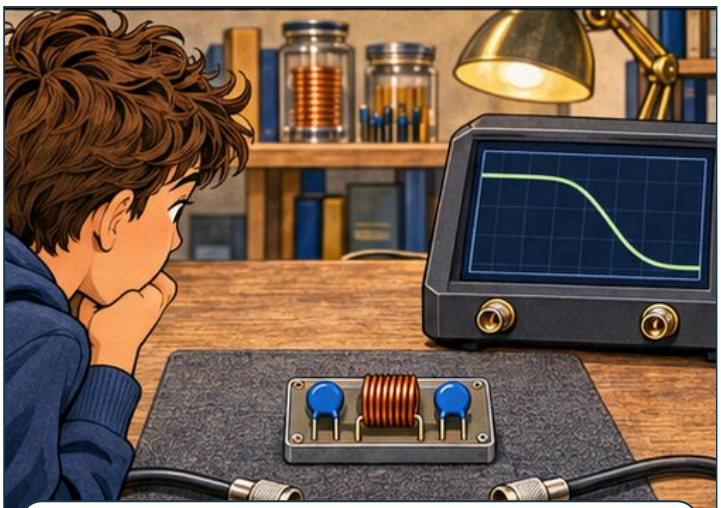


Déanann an foghlaimeoir ceist nua den iontas.

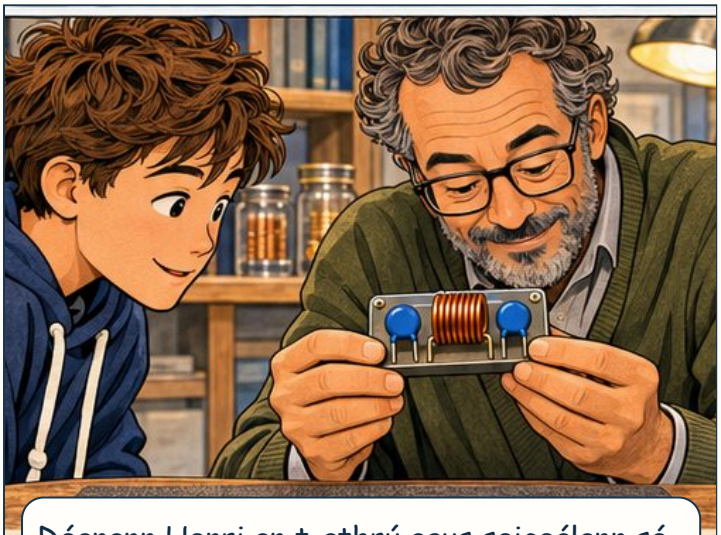
# Athrú amháin ag an am



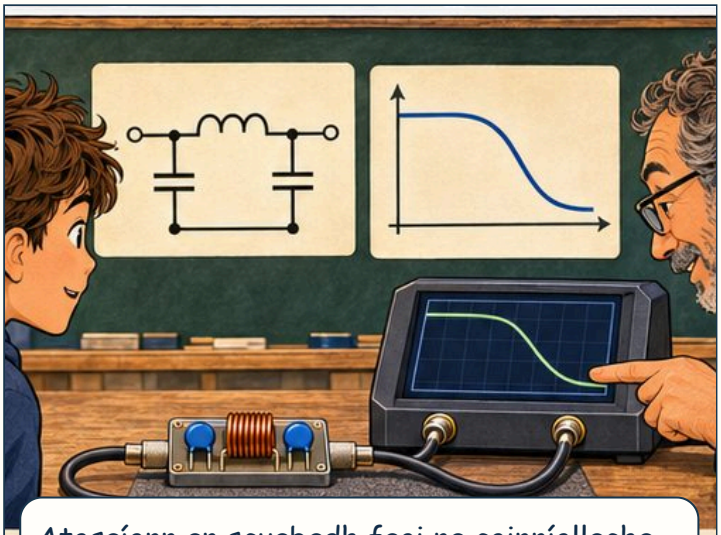
Roghnaíonn siad hipitéis amháin agus ullmhaíonn siad athrú a bhfuil údar leis.



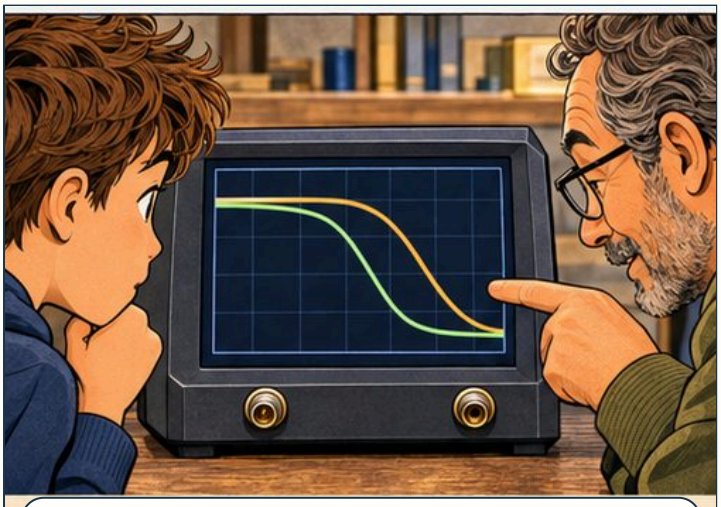
Múchtar an fhoinse agus dícheanglaítear an modúl roimh idirghabháil.



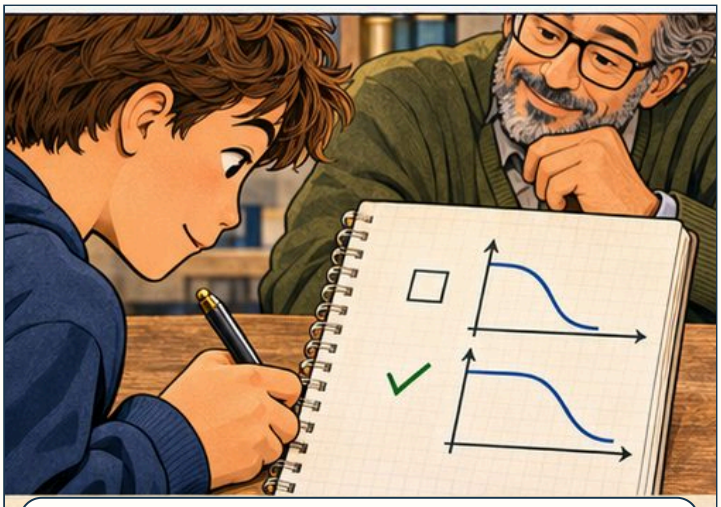
Déanann Henri an t-athrú agus seiceálann sé an ciorcad.



Atosaíonn an scuabadh faoi na coinníollacha doiciméadaithe céanna.

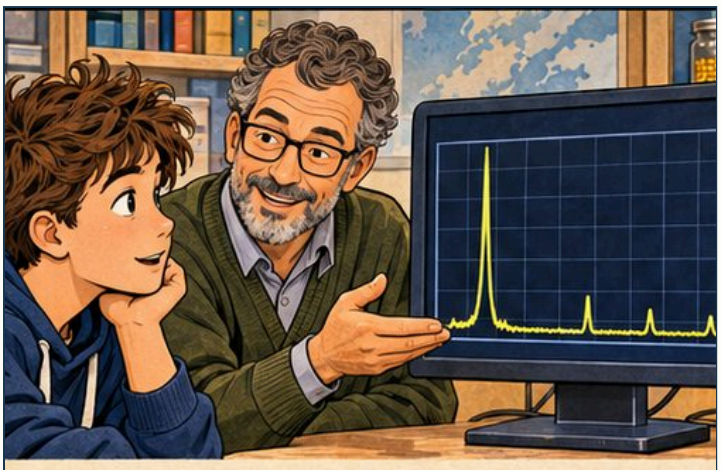


Cuireann siad an seanrian agus an rian nua i gcomparáid.

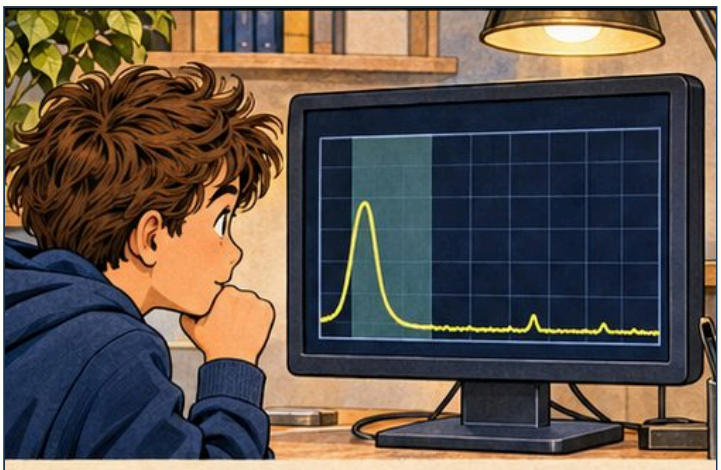


Seachnaíonn an modh roinnt cúiseanna féideartha a mheascadh.

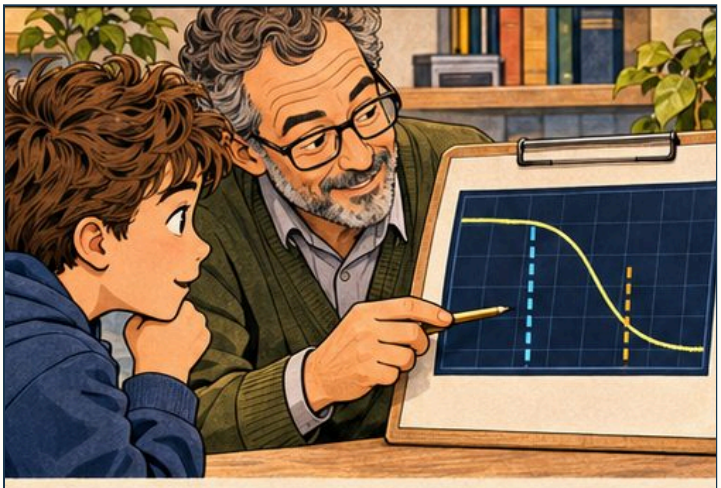
# Tá teorainneacha leis an maolú



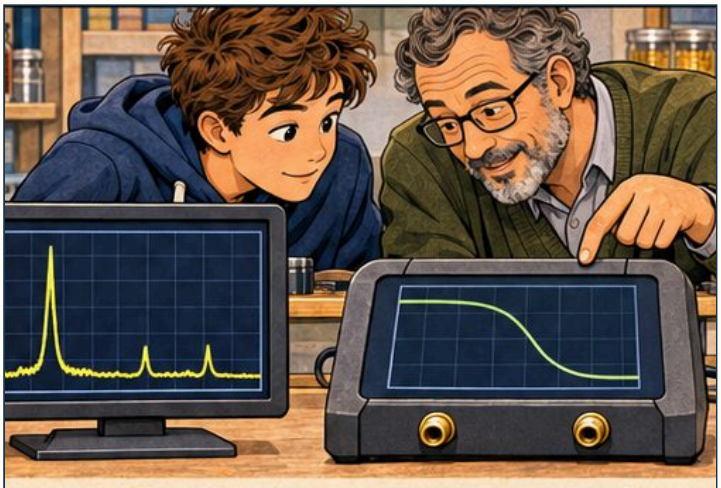
Ní scriosann scagaire pas íseal gach comhpháirt neamh-inmhianaithe.



Ní mhaolófar comhpháirt ina phasbhanda ach beagán.



Braitheann an diúltú ar an minicíocht agus ar an tógáil.



Bheadh tomhais oiriúnacha bhreise de dhíth chun an speictream iomlán a sheiceáil.

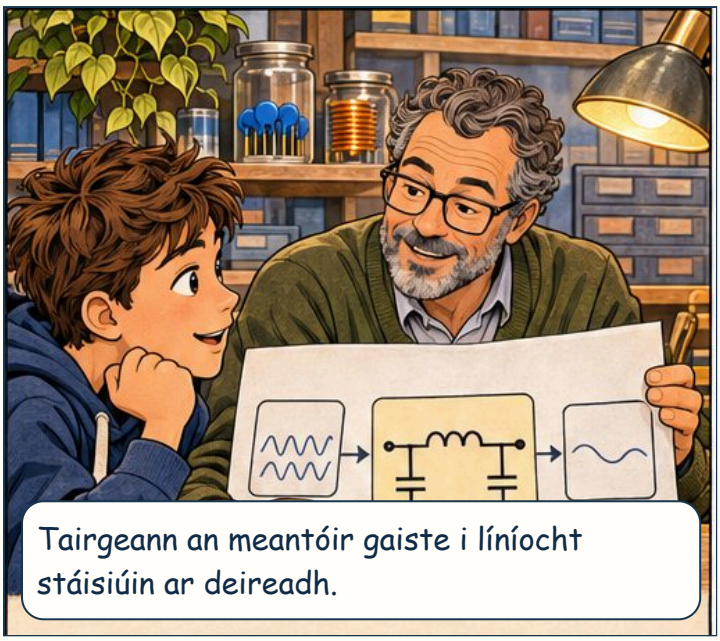


Ní chruthaíonn láithreacht an scagaire comhlíonadh stáisiúin.

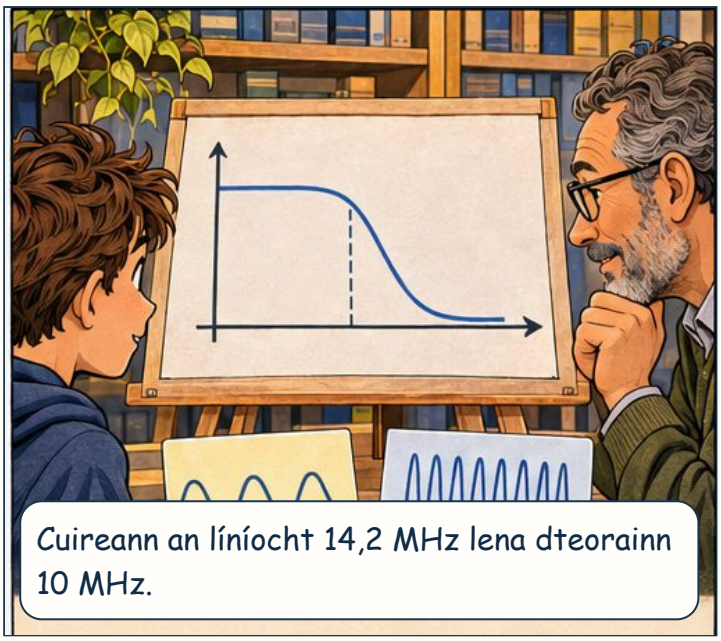


Déanann an foghlaimeoir idirdhealú idir feidhm úsáideach agus ráthaíocht ghinearálta.

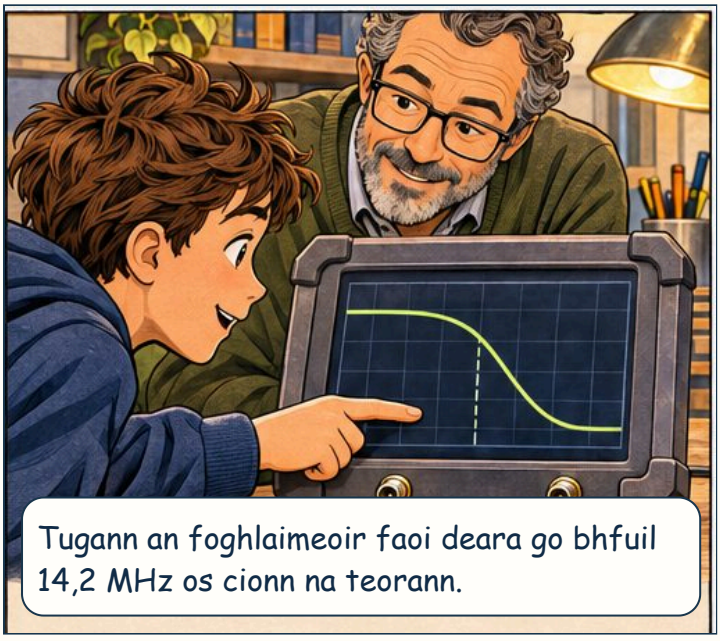
# Caithfidh an mhinicíocht úsáideach dul tríd



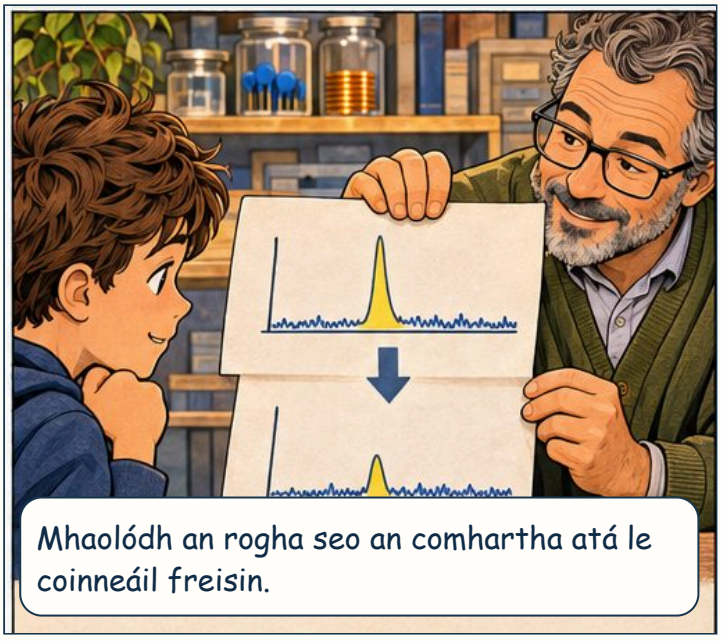
Tairgeann an meantóir gaiste i líníocht stáisiúin ar deireadh.



Cuireann an líníocht 14,2 MHz lena dteorainn 10 MHz.



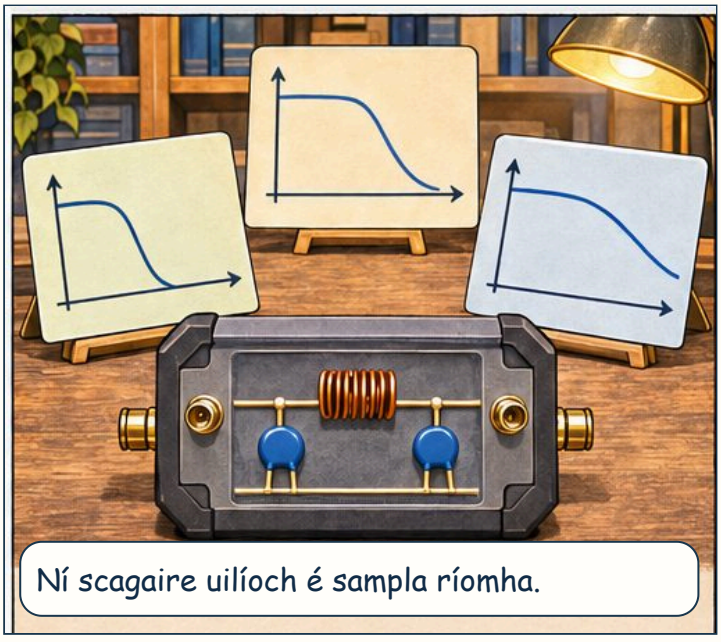
Tugann an foghlaimeoir faoi deara go bhfuil 14,2 MHz os cionn na teorann.



Mhaolódh an rogha seo an comhartha atá le coinneáil freisin.



Caithfear filleadh ar an sonraíocht roimh aon úsáid.

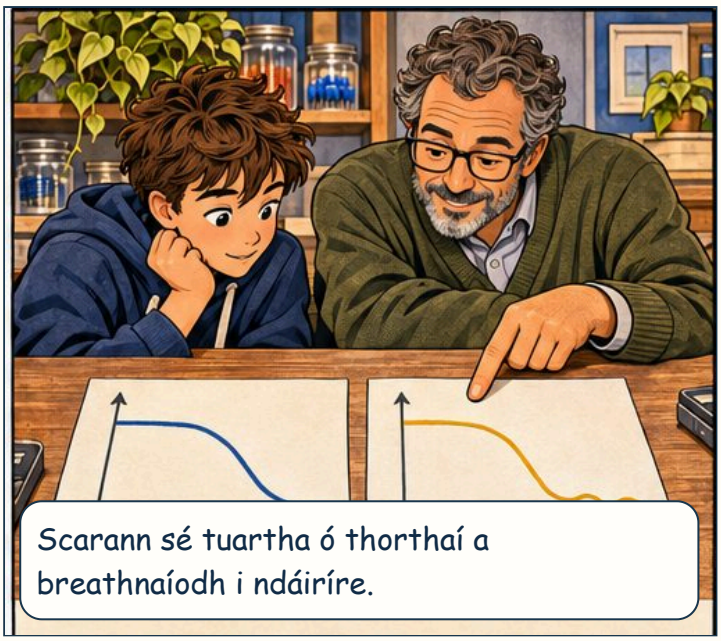


Ní scagaire uilíoch é sampla ríomha.

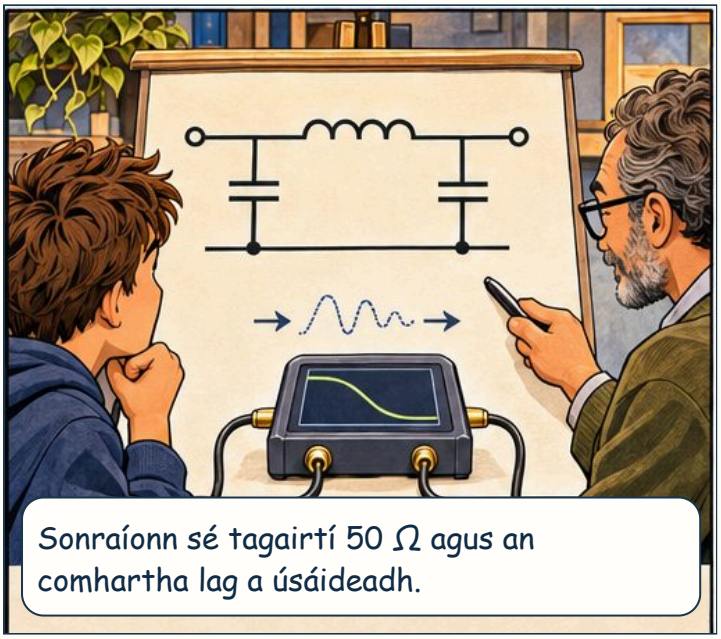
# Míniú le roinnt



Bailíonn Lucas an riachtanas, an léaráid, ríomhanna agus roghanna comhpháirteanna.



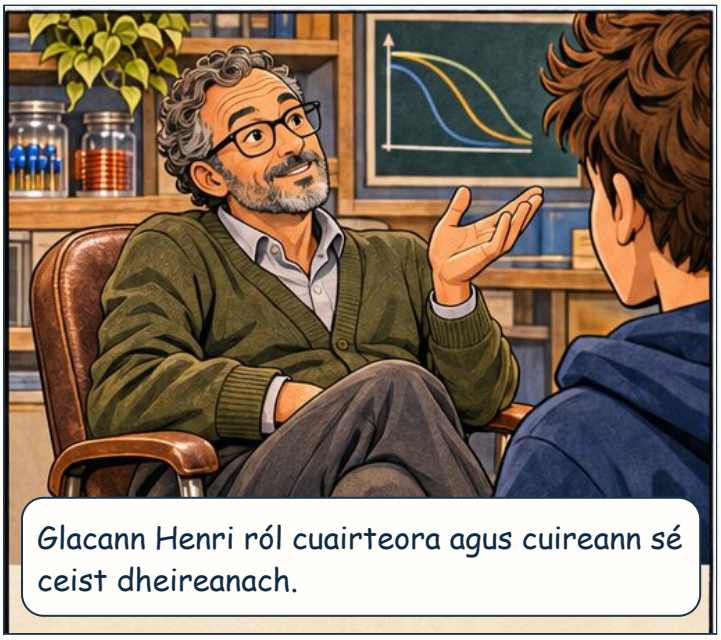
Scarann sé tuartha ó thorthaí a breathnaíodh i ndáiríre.



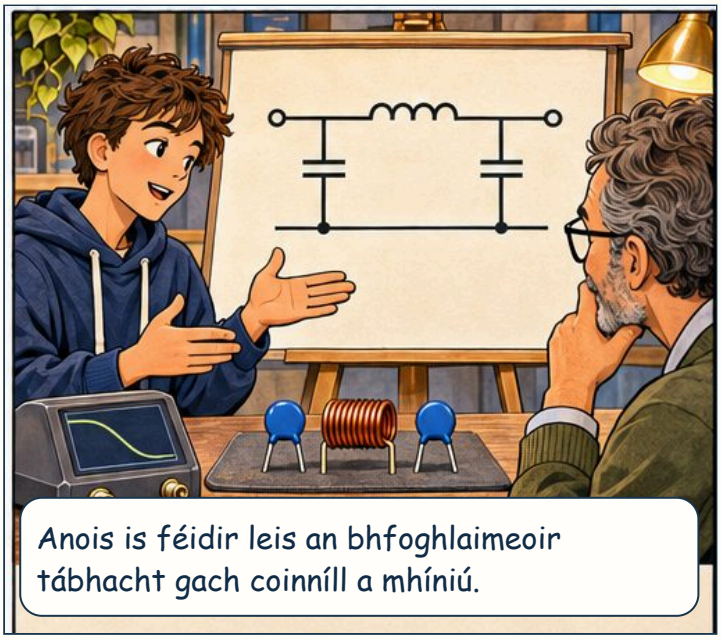
Sonraíonn sé tagairtí 50 Ω agus an comhartha lag a úsáideadh.



Coinníonn sé rianta, calabrú agus teorainneacha an turgnaimh.



Glacann Henri ról cuairteora agus cuireann sé ceist dheireanach.



Anois is féidir leis an bhfoghlaimeoir tábhacht gach coinníll a mhíniú.

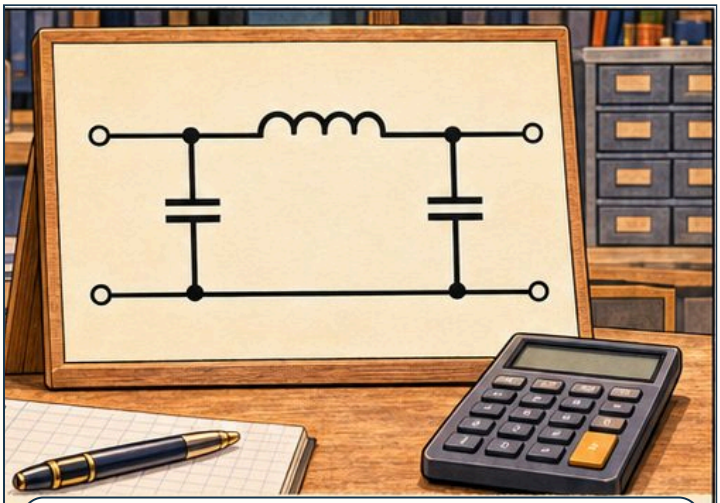
# Tuig, ríomh, tomhais



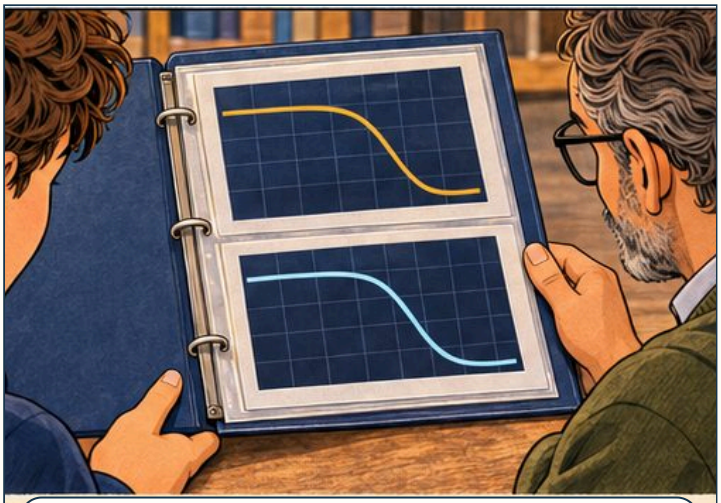
Filleann na trí chomhpháirt ar an mbosca teagaisc.



Is féidir leis an bhfoghlaimeoir riachtanas a cheangal le freagairt scagaire anois.



Is féidir leis an Butterworth π seo a ríomh agus na haonaid a sheiceáil.



Is féidir leis tomhas, comparáid agus ceistiú a dhéanamh ar dhifríochtaí freisin.



Coinníonn a leabhar modh, mar aon lena thoimhdí agus a theorainneacha.



Sa chlub, tosaíonn an chéad fhionnachtain eile le ceist cheana féin.