EXCEL DASTURIDAN FOYDALANIB ELEKTR MAYDONNI ANIQLASH

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***Annotatsiya**: Excel dasturi asosid elektr maydon kuchlanganligi va potensialning o'zgarishini masofaga bog'liqligini xisoblash orqali talabalarga tushuntirib berish.*

***Kalit so'zi:** Xalqa, kuchlanganlik vektori, potensiallar farqi, elektrostatik maydon, superpozitsiya prinsipi.*

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***Аннотация:** Объясните учащимся, что Excel основан на расчете напряженности электрического поля и изменения потенциала в зависимости от расстояния.*

***Ключевые слова:** кольцо, вектор напряжения, разность потенциалов, электростатическое поле, принцип суперпозиции.*

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***Annotation:** Explain to students that Excel is based on calculating the electric field strength and potential change as a function of distance.*

***Keywords:** Ring, voltage vector, potential difference, electrostatic field, superposition principle.*

Radiusi R bo'lgan zaryadlangan xalqa o'qi bo'ylab, xalqa markazidan L masofada yotuvchi A nuqtadagi elektr maydon kuchlanganligi va potensialini aniqlash uchun superpozitsiya prinsipidan foydalaniladi.

Avvalo, xalqani n ta kichik dl elementlarga ajratamiz: $l = \sum_{i=1}^{n} dl_i$ (1). Har bir dl elementga to'g'ri keladigan zaryad dq bo'lsin. Bu zaryadning A nuqtadagi $d\vec{E}$ kuchlanganlik vektori dl element bilan A nuqtani tutashtiruvchi r chiziq bo'ylab yo'nalgan. Butun xalqaning A nuqtadagi elektr maydon kuchlanganligini topish uchun barcha dl elementlarning $d\vec{E}$ vektorlarini geometrik qo'shish lozim. $d\vec{E}$ vektorni ikkita tashkil etuvchiga ajratamiz: 1) gorizontal tashkil etuvchisi $dE_x = dE\cos\alpha$; 2) vertikal tashkil etuvchisi $dE_y = dE\sin\alpha$. Har bir diametral qarama-qarshi ikki elementning dE_y tashkil etuvchilari bir birini so'ndiradi, ya'ni vertikal yo'nalish bo'yicha natijaviy maydon kuchlanganligi nolga teng bo'ladi ($E_y = 0$). Shuning uchun umumiy maydon kuchlanganligi gorizontal tashkil etuvchilarning yig'indisidan iborat bo'ladi: $E = E_x$; $E = \sum_{i=1}^{n} dE_{xi}$ (2). Zaryadning xalqa bo'ylab uzluksiz taqsimlanganligini e'tiborga olib, (2) ni integral ko'rinishda yozamiz: $E = \int dE_x = \int dE\cos\alpha$ (3). dl elementning A nuqtadagi elektr maydon kuchlanganligi $dE = k\frac{dq}{r^2}$ (4). Chizmaga ko'ra $\frac{L}{r} = \cos\alpha$ ni hisobga olib, (4) ni

$dE\cos\alpha = k\frac{L\cdot dq}{r^3}$ (5) ko‘rinishda yozamiz. (5) asosida (3) integralni hisoblash orqali natijaviy elektr maydon kuchlanganligini topamiz: $E = k\frac{L}{r^3}\int dq = k\frac{L\cdot q}{r^3}$ (6). Agar r masofani R va L masofalar orqali ifodalasak, $r = \sqrt{R^2 + L^2}$ (7). (6) formulani quyidagi ko‘rinishda yozib olamiz: $E = k\frac{L\cdot q}{r^2\cdot r}$ (8) yoki $E = k\frac{L\cdot q}{(R^2+L^2)\cdot\sqrt{R^2+L^2}} = k\frac{L\cdot q}{(R^2+L^2)^{3/2}}$ (9). (9) formula xalqa o‘qida yotuvchi A nuqtadagi elektr maydon kuchlanganligini ifodalaydi.

(9) formulaning bir necha xususiy hollarini qarab chiqamiz: 1) Agar L>>R bo‘lsa, katta masofalarda zaryadlangan xalqani nuqtaviy zaryad sifatida qarash mumkin, u holda (9) ni $E = k\frac{q}{L^2}$ (10) ko‘rinishda yozamiz; 2) Agar L=0 bo‘lsa, ya’ni xalqaning markazida $E = 0$ bo‘ladi; 3) Qanday L_m masofada elektr maydon kuchlanganligi eng katta (**maksimum**) bo‘ladigan nuqtani topishga urinib ko‘raylik. Buning uchun r va L kattaliklarni α burchak orqali ifodalaymiz: $R = r\sin\alpha$ $L = r\cos\alpha$ (11) $E = k\frac{q}{R^2}\cos\alpha\sin^2\alpha$ (12).

Elektr maydon kuchlanganligining maksimal qiymatini topish uchun Ye dan α bo‘yicha hosila olinib, bu hosilani nolga tenglash lozim: $\frac{dE}{d\alpha} = 0$ (13) ya’ni $\frac{dE}{d\alpha} = k\frac{q}{R^2}(\cos^2\alpha\cdot 2\sin\alpha - \sin^3\alpha) = 0$ (14) bundan $\cos^2\alpha\cdot 2\sin\alpha = \sin^3\alpha$ $2\cos^2\alpha = \sin^2\alpha$ $2 = tg^2\alpha$ (15). Chizmaga asosan $\frac{R}{L} = tg\alpha$; $\frac{R^2}{L^2} = tg^2\alpha$; $L_m = \frac{R}{\sqrt{2}}$ (16) demak, elektr maydon kuchlanganligining maksimal qiymati L_m masofadagi nuqtada bo‘lar ekan. U holda (9) formulani boshqacha ko‘rinishda yozamiz: $E_m = k\frac{L_m\cdot q}{(2L_m^2+L_m^2)^{3/2}} = k\frac{L_m\cdot q}{(3L_m^2)^{3/2}}$ (17); $E_m = k\frac{q}{5{,}196L_m^2}$ (18) L_m masofaning yarmiga teng ($L=0{,}5L_m$) masofada yotuvchi nuqtaning elektr maydon kuchlanganligi: $E = k\frac{L_m\cdot q}{2(2L_m^2+\frac{L_m^2}{4})^{3/2}} = k\frac{L_m\cdot q}{2(\frac{9}{4}L_m^2)^{3/2}}$ (19) $E = k\frac{L_m\cdot q}{2\cdot 2{,}25^{3/2}L_m^3} = k\frac{q}{6{,}75L_m^2}$ (20). (18) va (20) ifodalarning nisbatini olamiz: $\frac{E_m}{E} = \frac{6{,}75}{5{,}196} = 1{,}3$ (21). Bundan ko‘rinadiki, $L=0{,}5L_m$ masofadagi elektr maydon kuchlanganligi (Ye) maksimal elektr maydon kuchlanganligi (Ye_m) dan 1,3 marta kichik ekan.

4) Agar xalqa zaryadining chiziqli zichligi berilgan bo‘lsa, A nuqtadagi natijaviy potensialni ham topish mumkin. dl kichik elementning A nuqtadagi potensiali $d\varphi = k\frac{dq}{r}$ (22). 2 $\tau = \frac{dq}{dl} \Rightarrow dq = \tau\cdot dl$ (23) ni hisobga

olib, $d\varphi = k\frac{\tau \cdot dl}{r}$ (24).

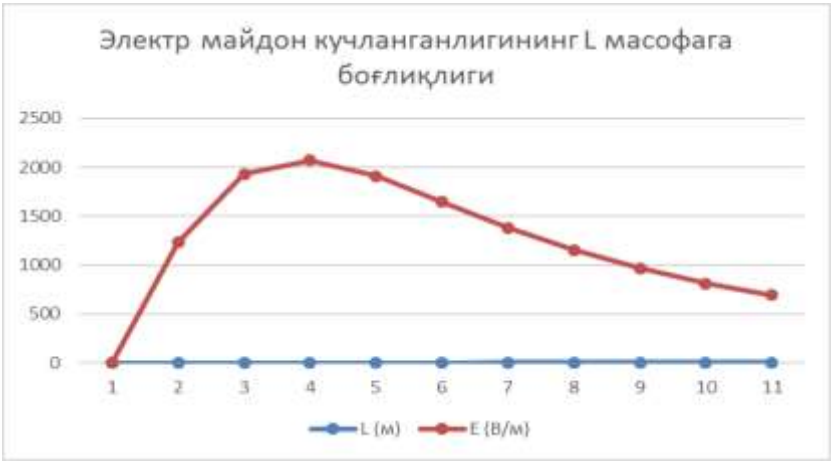
Butun xalqaning A nuqtadagi potensialini topish uchun esa integrallashdan foydalanamiz: $\varphi = \int d\varphi = k\frac{\tau}{\sqrt{R^2+L^2}}\int_0^{2\pi R} dl$ (25) $\varphi = k\frac{\tau \cdot 2\pi R}{\sqrt{R^2+L^2}}$ (26)

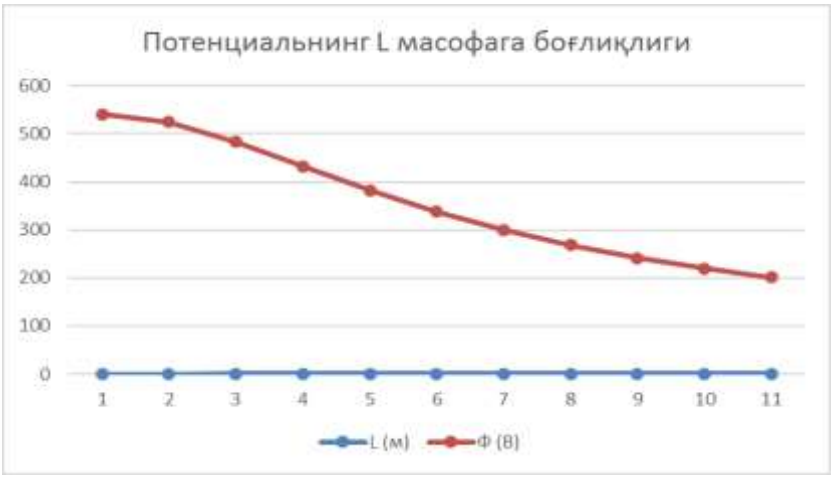
$\varphi = \frac{1}{4\pi\varepsilon_0}\frac{\tau \cdot 2\pi R}{\sqrt{R^2+L^2}} = \frac{\tau \cdot R}{2\varepsilon_0\sqrt{R^2+L^2}}$ (27). Bu formula xalqaning markazidan L masofadagi maydon potensialini hisoblashga imkon beradi.

L=0 bo‘lgandagi, ya’ni xalqa markazidagi potensial quyidagi ko‘rinishda bo‘ladi: $\varphi = \frac{\tau}{2\varepsilon_0}$ (28). Shuni alohida ta’kidlash lozimki, potensialning ishorasi faqat elektrostatik maydon manbai bo‘lgan zaryadning ishorasi bilan aniqlanar ekan.

Quyida (9) va (27) formulalar asosida elektr maydon kuchlanganligi va potensialni Exsel dasturidan foydalanib hisoblaymiz va grafik ko‘rinishida tasvirlaymiz:

A	B	C	D	E	F	G	H	I	J
№	k	q (Kl)	R (m)	stepen (R;2)	L (m)	stepen (L;2)	(E9+G9)	E (B/m)	F (V)
1	9,00E+09	6,00E-09	0,1	0,01	0	0	0,01	0	540
2	9,00E+09	6,00E-09	0,1	0,01	0,025	0,000625	0,01063	1232,7	523,9
3	9,00E+09	6,00E-09	0,1	0,01	0,05	0,0025	0,0125	1932,0	483,0
4	9,00E+09	6,00E-09	0,1	0,01	0,075	0,005625	0,01563	2073,6	432,0
5	9,00E+09	6,00E-09	0,1	0,01	0,1	0,01	0,02	1909,2	381,8
6	9,00E+09	6,00E-09	0,1	0,01	0,125	0,015625	0,02563	1645,5	337,3
7	9,00E+09	6,00E-09	0,1	0,01	0,15	0,0225	0,0325	1382,5	299,5
8	9,00E+09	6,00E-09	0,1	0,01	0,175	0,030625	0,04063	1154,1	267,9
9	9,00E+09	6,00E-09	0,1	0,01	0,2	0,04	0,05	966,0	241,5
10	9,00E+09	6,00E-09	0,1	0,01	0,225	0,050625	0,06063	814,0	219,3
11	9,00E+09	6,00E-09	0,1	0,01	0,25	0,0625	0,0725	691,6	200,6





Foydalanilgan adabiyotlar

1. S.Orifjonov. Elektromagnitizm. Toshkent. Noshir. 2011. -300 b.
2. V.S.Volkenshteyn. Sbornik zadach po obщemu kursu fiziki. M.: Nauka. 1976. 330, 382 str.
3. Berkinov, A. A., Ergashev, J. K., Turaqulov, B. T. U., Toshpulatova, D. K., & Ungarov, M. N. U. (2020). Technology for the development of students 'Educational and creative activities in solving problems in molecular physics. South Asian Journal of Marketing & Management Research, 10(11), 71-74.
4. Berkinov A. Technologies For The Development Of Educational And Creative Activities Of Students In The Process Of Solving Problems In Molecular Physics //European Journal of Research and Reflection in Educational Sciences Vol. – 2019. – Т. 7. – №. 12.
5. Dildora Haydarkulovna Toshpulatova, Alisher Abdurashidovich Berkinov, Bekzod Tirkashev ENERGY PARAMETERS OF HETEROSTRUCTURAL SOLAR PHOTOCELLS // Academic research in educational sciences. 2021. №11
6. Berkinov, A. (2019). TECHNOLOGIES FOR THE DEVELOPMENT OF EDUCATIONAL AND CREATIVE ACTIVITY OF

STUDENTS IN THE PROCESS OF SOLVING TASKS ON MOLECULAR PHYSICS.
7. Berkinov, A. (2021). UZLUKSIZ TA’LIM TIZIMIDA FIZIKANI O‘QITISHDA O‘QUVCHILARNI KASBGA YONALTIRISH IMKONIYATLARI.