FIZIKA DARSLARIDA MEXANIKA BO‘LIMIGA DOIR MASALALARNING YECHILISHINI TUSHUNTIRISHDA VEKTOR IFODALARDAN FOYDALANISHNING AFZALLIKLARI.

Qoraboyev Husniddin Soxibjonovich
Farg‘ona ―Temurbeklar maktabi‖ harbiy akademik litseyi fizika fani o‘qituvchisi

Annotatsiya: *Ma‘lumki fizika fanini o‘qitishning dastlabki bosqichi mexanika bo‘limidan boshlanadi. O‘quvchilar mexanika bo‘limini qanchalik puhta o‘zlashtirsa fanning keyingi bo‘limlarini ham oson o‘zlashtiradi. Ilmiy maqolamda masalalarni yechishda fizik kattaliklarni vektor ko‘rinishidagi ifodalaridan foydalangan holda yondashishning qulayliklari aniq masalalar yechimi orqali ko‘rsatib o‘tilgan.*

Abstract: *It is known that the first stage of teaching physics begins with the department of mechanics. The better the students master the mechanics section, the easier they will master the next sections of the science. In my scientific article, the convenience of approaching physical quantities in the form of vectors in solving problems is shown through the solution of specific problems.*

Kalit so‘zlar: *Fizik kattalik, vektor, skalyar, tezlik, koordinata, ko‘chish uchburchak.*
Keywords: *Physical quantity, vector, scalar, velocity, coordinate, displacement triangle*

Keyingi yillarda yurtimizda ta‘lim sifatini oshirish bo‘yicha ko‘plab islohotlar amalga oshirilmoqda. Ayniqsa aniq fanlarni o‘qitish, ularni o‘zlashtirishga katta e‘tibor berilmoqda. Prezidentimiz Sh. Mirziyoyevning 2020-yil 29-dekabr kungi oliy majlisga qilgan murojaatnomasida ham fizika fanining ahamiyati, mamlakat taraqqiyotidagi o‘rnini alohida ta‘kidlab o‘tdi: ―Agar tarixga nazar tashlaydigan bo‘lsak, dunyodagi deyarli barcha kashfiyot va texnologiyalarni yaratishda fizika fani fundamental asos bo‘lganini ko‘ramiz. Haqiqatan ham, fizika qonuniyatlarini chuqur egallamasdan turib, mashinasozlik, elektrotexnika, IT, suv va energiyani tejaydigan texnologiyalar kabi bugun zamon talab qilayotgan sohalarda natijaga erishib bo‘lmaydi‖[1].

Ma‘lumki mexanika bo‘limida ko‘plab vektor kattalikllar bilan ish ko‘riladi va bu kattaliklar orasidagi bog‘lanishlar ham vektor ko‘rinishidagi ifodalardan iborat, shu bilan birga bu kattaliklarni skalyar ko‘rinishida ifodalash orqali ham ular orasidagi bog‘lanish ifodalarini, o‘zgarish qonuniyatlarini (vaqt bo‘yicha, koordinata bo‘yicha, boshqa bir kattalikka bog‘liq ravishda…) yozish mumkin. Vektor ko‘rinishidagi ifodalar skalyar ko‘rinishidagi ifodalarga qaraganda uch marta ko‘proq ma‘lumot beradi.

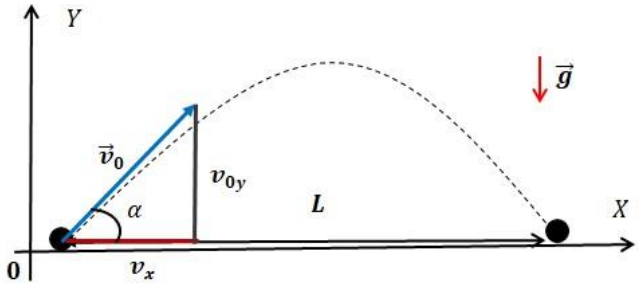
Ko‘rib turganingizdek masalalar yechishda skalyar ko‘rinishdagi ifodalarga o‘tib yechim izlashda tenglamalar soni uch marta ortib ketadi va bu katta noqulayliklar keltirib chiqarishi mumkin va eng muhimi ifodalar soni ortganda o‘quvchining xato qilish ehtimoli ham ortadi. Shuning uchun kinematika bo‘limidagi aksariyat masalalarni yechishda vektor ko‘rinishidagi ifodalardan foydalangan holda oson yechim olish mumkin. Ayniqsa olimpiada

masalalarini yechishda bu juda qo‘l keladi. Quyida ushbu usullardan foydalanishni aniq masalalar misolida tushuntirib o‘tamiz:

1- masala Nishon va zambarak bir-biridan 5 km masofada, bir satxda joylashgan. Zambarakdan 240 m/s tezlik bilan uchib chiqqan snaryad qanday minimal vaqtda nishonga uriladi?

Berilgan: L=5000 m ; v_0=240 m/s ; t_umin=?

Dastlab koordinata boshini otilish nuqtasiga biriktirib harakat tenglamalarini yozamiz:



$$\begin{cases} x = v_0 cos\alpha \cdot t & (1) \\ y = v_0 sin\alpha \cdot t - \frac{gt^2}{2} & (2) \end{cases} \quad y(t_u) = 0 \text{ va } x(t_u) = L \Rightarrow \begin{cases} L = v_0 cos\alpha \cdot t_u & (3) \\ 0 = v_0 sin\alpha \cdot t_u - \frac{gt_u^2}{2} & (4) \end{cases}$$

(3) => $\boldsymbol{v_0 cos\alpha = \frac{L}{t_u}}$ (5) va (4) => $\boldsymbol{v_0 sin\alpha = \frac{gt_u}{2}}$ (6)

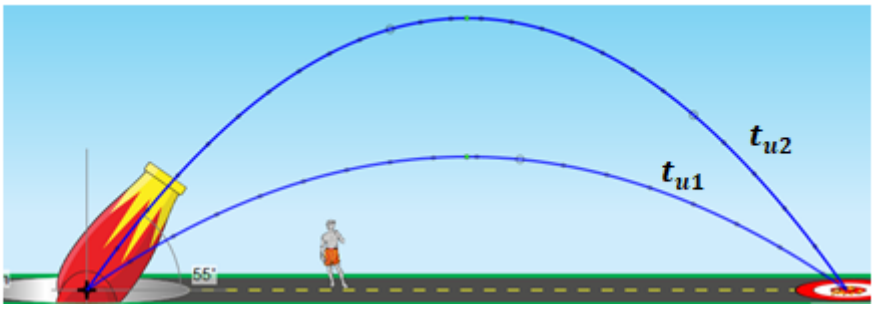
$(5)^2 + (6)^2 \Rightarrow v_0^2 = \frac{L^2}{t_u^2} + \frac{g^2}{4} \cdot t_u^2 \Rightarrow \quad \boldsymbol{\frac{g^2}{4} \cdot t_u^4 - v_0^2 t_u^2 + L^2 = 0}$ (7)

(7) ni t_u ga nisbatan yechib:

$$\boldsymbol{t_{u1} = \frac{v_0}{g} \cdot \sqrt{2\left(1 - \sqrt{1 - \frac{g^2 L^2}{v_0^4}}\right)} = \frac{240}{10} \cdot \sqrt{2 \cdot \left(1 - \sqrt{1 - \frac{10^2 \cdot 5000^2}{240^4}}\right)} = 24.1\ s}$$

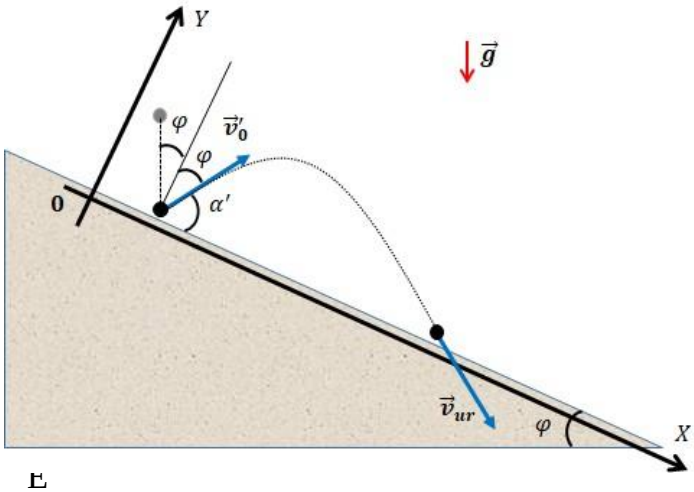
$$\boldsymbol{t_{u2} = \frac{v_0}{g} \cdot \sqrt{2\left(1 + \sqrt{1 - \frac{g^2 L^2}{v_0^4}}\right)} = \frac{240}{10} \cdot \sqrt{2 \cdot \left(1 + \sqrt{1 - \frac{10^2 \cdot 5000^2}{240^4}}\right)} = 41.5\ s}$$

Minimal vaqt so‘ralgani uchun: J: $t_{u1} = 24.1\ s$



2-masala Kichik sharcha yuqoridan qiya tekislikka tushadi va unga elastik urilib qaytadi. Sharchaning harakat yo‗nalishi tekislika ikkinchi marta urilish oldidan tekislik bilan qanday burchak hosil qiladi? Tekislikning qiyalik burchagi 30^0, tekislikka birinchi urilish vertikal pastga yo‗nalgan va 1 m/s ga teng.

Berilgan:
$\varphi = 30^o$;
$v_0' = 1\ m/s$;
$\alpha_{ur}' = ?$



Koordinata o‘qlarini rasmdagidek yo‘naltirdik. Sharcha birinchi marta tekislik normaliga φ burchak ostida uriladi va undan xuddi shunday burchak ostida $\vec{v}_0'$ tezlikda qaytadi. Birinchi marta urilishdan so‘ng sharchaning tezlik vektori tekislik bilan quyidagicha burchak hosil qiladi: $\alpha' = 90^o - \varphi$ (1)

Tezlikni o‘zgarish qonuni: $\vec{v} = \vec{v}_0 + \vec{g}t$ => $v_x = v_{0x} + g_x \cdot t$; $v_y = v_{0y} + g_y \cdot t$

$v_{0x} = v_0' \cdot cos\alpha'$; $v_{0y} = v_0' \cdot sin\alpha'$; $g_x = gsin\varphi$; $g_y = -gcos\varphi$ =>

$v_x = v_0' \cdot cos\alpha' + gsin\varphi \cdot t$ yoki (1) => $v_x = sin\varphi(v_0' + gt)$ (2)

$v_y = v_0' \cdot sin\alpha' - gcos\varphi \cdot t$ yoki (1) => $v_y = cos\varphi(v_0' - gt)$ (3)

Y o‘qidagi harakat tenglamasini yozib, ikkinchi marta urilguncha sarflangan vaqtni (uchush vaqtini) aniqlaymiz:

$y = v_{0y} \cdot t + \frac{g_y t^2}{2}$ => $y = v_0' \cdot sin\alpha' \cdot t - \frac{gcos\varphi \cdot t^2}{2}$; $y(t_u) = 0$ =>

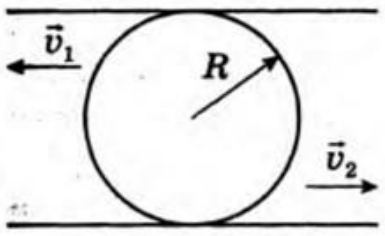
$v_0' \cdot sin\alpha' \cdot t_u - \frac{gcos\varphi \cdot t_u^2}{2} = 0$ => $t_u = \frac{2v_0' \cdot sin\alpha'}{gcos\varphi} = \frac{2v_0' \cdot sin(90^o - \varphi)}{gcos\varphi} = \frac{2v_0' \cdot cos\varphi}{gcos\varphi} = \frac{2v_0'}{g}$

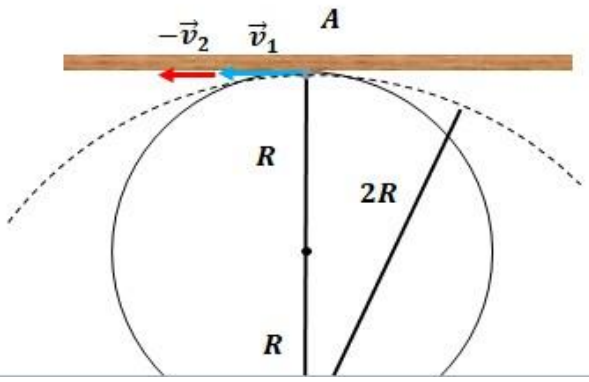
Urilish momentida: $tg\alpha_{ur}' = \frac{-v_y(t_u)}{v_x(t_u)}$ => $tg\alpha_{ur}' = \frac{-cos\varphi(v_0' - gt_u)}{sin\varphi(v_0' + gt)} = \frac{-cos\varphi\left(v_0' - g\left(\frac{2v_0'}{g}\right)\right)}{sin\varphi\left(v_0' + g\left(\frac{2v_0'}{g}\right)\right)}$ =>

$tg\alpha_{ur}' = \frac{cos\varphi}{3sin\varphi} = \frac{\frac{\sqrt{3}}{2}}{3\cdot\frac{1}{2}} = \frac{\sqrt{3}}{3}$ => $\alpha_{ur}' = arctg\left(\frac{\sqrt{3}}{3}\right) = 30'$

3-masala Radiusi 20 sm bo’lgan slindr tezliklari $v_1 = 15$ sm/s va $v_2 = 5$ sm/s bo’lgan ikki paralel va yog’och orasida joylashgan(rasmga qarang). Siprpanish yo’q. Slindr qanday burchak tezlik bilan aylanadi?

Berilgan: $R = 0.2\ m$; $v_1 = 0.15\ m/s$; $v_2 = 0.05\ m/s$; $\omega = ?$





Ikkinchi yog‘ochninig slindrga urinish nuqtasi (B nuqta) bilan bog‘langan sanoq sistemasiga nisbatan A nuqtaning harakatini ko‘raylik. A nuqtani B nuqta atrofida 2R radiusli aylana bo‘ylab harakatlanmoqda deb qarash mumkin (B nuqta oniy aylanish markazi).

$$v' = v_1 + v_2 \quad (1) \; ; \; R' = 2R \; (2) \; ; \; v = \omega R \quad (3)$$

$$(3) => \boldsymbol{\omega} = \frac{v'}{R'} = \frac{v_1 + v_2}{2R} = \frac{0.15 + 0.05}{2 \cdot 0.2} = 0.5 \; rad/s$$

Yuqoridagilardan ko‘rib turganingizdek vektor ko‘rinishidagi ifodalardan foydalanish orqali aksariyat masalalar matematikadagi ―Kosinuslar teoremasi‖ ya‘ni ―Uchburchakning ikki tomoni va ular orasidagi burchak berilgan holda uning uchinchi tomonini toping‖ tipidagi masalalarga kelib qoldi va oson yechimga ega bo‘ldik. Vektor ko‘rinishidagi ifodalarni afzalliklari har bir bo‘limdagi masalalarni yechishda, mavzuni to‘liqroq tushunishda, o‘quvchiga sodda holatda yetkazib berishda katta natija beradi.

ADABIYOTLAR:

1. O‘zbekiston Respublikasi Prezidenti Shavkat Mirziyoyevning Oliy Majlisga Murojaatnomasi 29.12.2020. https://president.uz/oz/lists/view/4057

2. Сборник задач по физике. 10-11 классы/Авт.-сост.Е.Г.Московкина, В.А.Волков.-М.:ВАКО,2017.