

**“Toshkent irrigasiya va meliorasiya instituti**  
**Fizika va kimyo kafedasi**



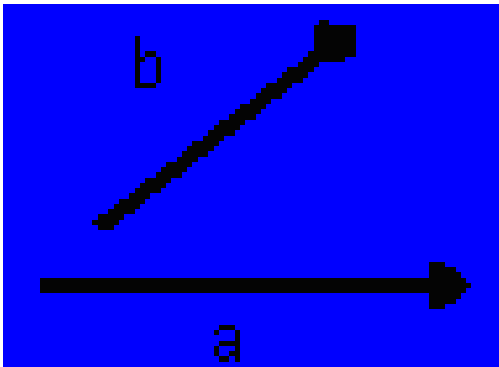
Mavzu:

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# Vektor kattaliklar.

Son qiymati va yo'nalishini ifodalaydigan kattalik vektor kattalik deyiladi.



Vektorlarni qo'shish. Ikkita  $a$  va  $b$  vektorlar yig'indisi deb, tomonlari shu vektorlardan iborat bo'lgan parallelogramning diagonaliga teng bo'lgan vektorlarga aytiladi.

$$c = a + b.$$

# Tezlik

- *Vaqt birligi ichida jismning o'tgan masofasining son qiymatiga teng bo'lgan fizik kattalik tezlik deyiladi*

$\Delta s$  masofaning  $\Delta t$  vaqt oralig'iga bo'lgan nisbati bilan o'lchanadigan fizik kattalik moddiy nuqtaning  $v_{o'r}$  o'rtacha tezligi deyiladi:

$$v_{o'r} = \frac{\Delta s}{\Delta t}$$

# Oniy tezlik

$$v = \lim_{\Delta t \rightarrow 0} v_{o'r} = \lim_{\Delta t \rightarrow 0} \frac{\Delta s}{\Delta t} = \frac{ds}{dt}$$

$$\vec{v} = \lim_{\Delta t \rightarrow 0} \vec{v}_{o'r} = \lim_{\Delta t \rightarrow 0} \frac{\Delta \vec{s}}{\Delta t} = \frac{d\vec{s}}{dt}$$

$$[v] = \frac{[\Delta s]}{[\Delta t]} = \frac{1\text{m}}{1\text{s}} = 1 \frac{\text{m}}{\text{s}}$$

- Trayektoriyaning ixtiyoriy nuqtasida harakatning oniy tezligi trayektoriyaga o'tkazilgan urinma bo'ylab yo'nalgan, kattaligi jihatidan esa s yo'ldan t vaqt bo'yicha olingan hosilaga teng bo'lgan vektor kattalikdir.*

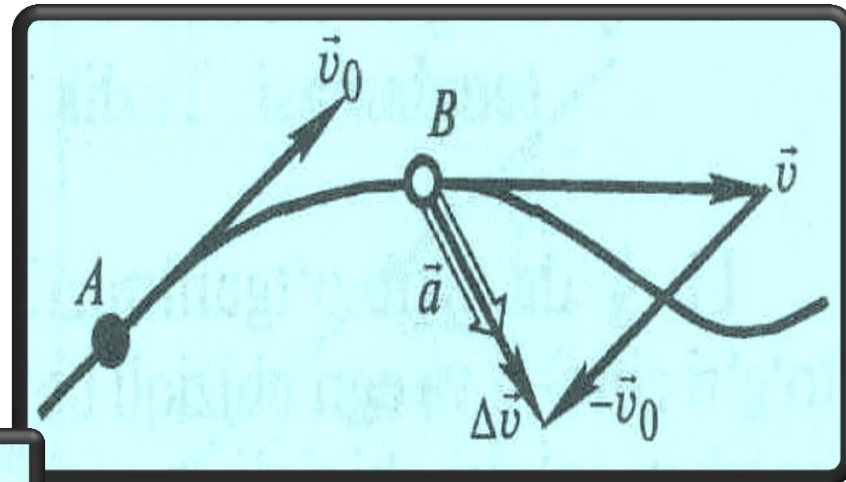
$$1 \frac{\text{sm}}{\text{s}} = \frac{10^{-2} \text{m}}{\text{s}} = 1 \cdot 10^{-2} \frac{\text{m}}{\text{s}}, \quad 1 \frac{\text{km}}{\text{soat}} = \frac{10^3 \text{m}}{3600\text{s}} = \frac{10}{36} \frac{\text{m}}{\text{s}}$$

# Tezlanish

- *Vaqt birligi ichida tezlik vektori o'zgarishining son qiymatiga teng bo'lgan fizik kattalik **tezlanish** deyiladi.*

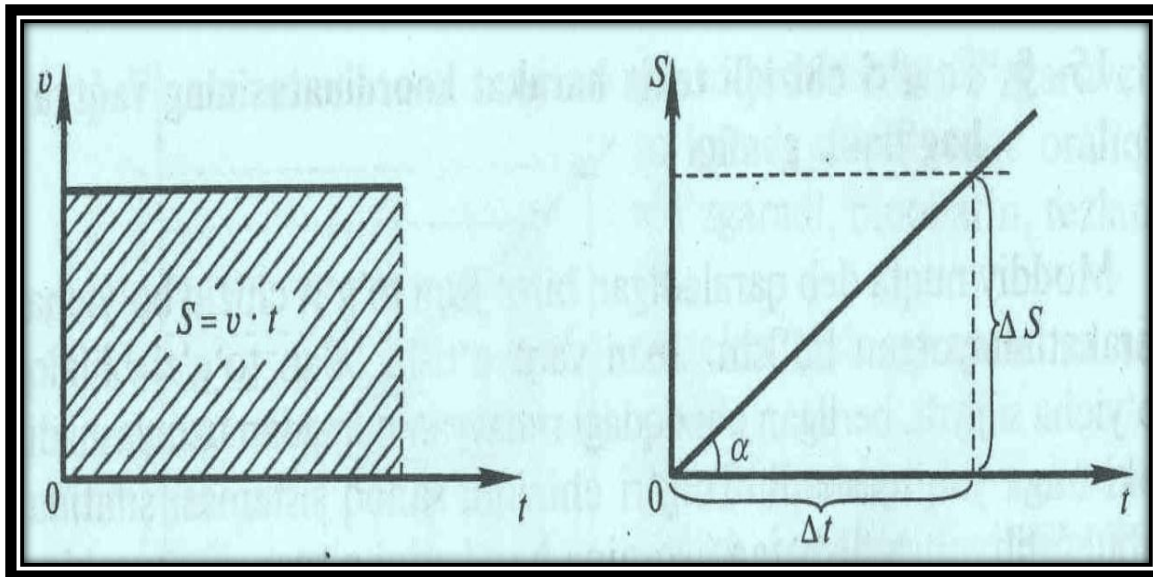
$$\vec{a}_{o'r} = \frac{\vec{v} - \vec{v}_0}{\Delta t} = \frac{\Delta \vec{v}}{\Delta t}.$$

$$\vec{a} = \lim_{\Delta t \rightarrow 0} \vec{a}_{o'r} = \lim_{\Delta t \rightarrow 0} \frac{\Delta \vec{v}}{\Delta t} = \frac{d\vec{v}}{dt}.$$



# To'g'ri chiziqli tekis harakat va uning harakat tenglamasi

- Agar jism to'g'ri chiziqli harakatida teng vaqt oraliqlarida teng masofalarni bosib o'tsa, jismning bunday harakati **to'g'ri chiziqli tekis harakat** deyiladi



$$v = \frac{S}{t} \quad \text{yoki} \quad \vec{v} = \frac{\vec{S}}{t}$$

$$v = \operatorname{tg} \alpha = \frac{\Delta S}{\Delta t}$$

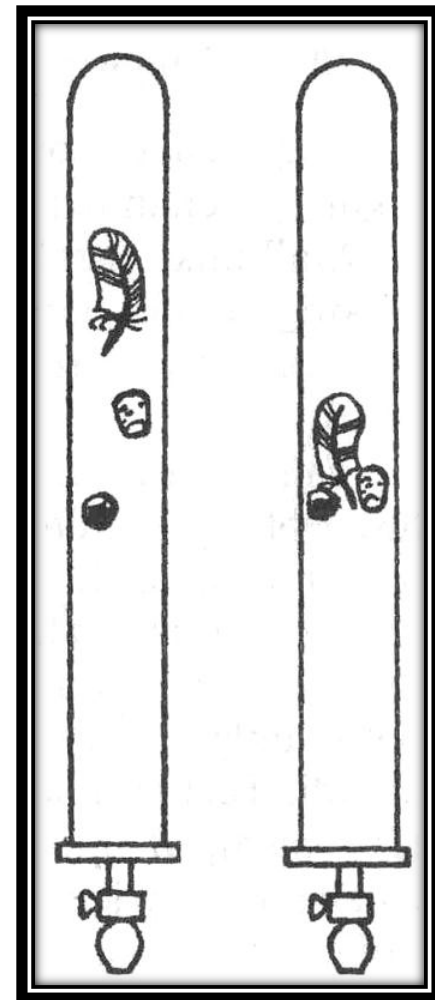


# *Jismlarning erkin tushishi*

- *Vakuumda jismlarning faqat og'irlik kuchi ta'sirida Yerga tushishi **erkin tushish** deyiladi.*

*Jismlarning erkin tushishi boshlang'ich tezliksiz to'g'ri chiziqli tekis tezlanuvchan harakatdir.*

*Yerning muayyan joyida, barcha jismlar bir xil tezlanish bilan tushadi. Bu tezlanish **erkin tushish tezlanishi** deb ataladi va  $g$  harfi bilan belgilanadi.*



Yerning turli nuqtalarida erkin tushish tezlanishi turli qiymatlarga ega bo'ladi. U ekvatorda 9,780, qutbda esa 9,832 m/s<sup>2</sup> ga teng.  $g=9,80665$  m/s<sup>2</sup> bo'lgan erkin tushish tezlanishining qiymati *normal qiymat* deb hisoblanadi.

$$g = 9,8 \frac{\text{m}}{\text{s}^2} = 980 \frac{\text{sm}}{\text{s}^2}$$

$$v = gt,$$

$$h = \frac{gt^2}{2}, \quad h = \frac{v^2}{2g}$$

$$v = \sqrt{2gh}.$$

- Jismning ma'lum balandlikdan tushishiga ketadigan vaqtni, tushayotgan jismning istalgan nuqtadagi va istalgan paytdagi tezligini va boshqa kattaliklarni yuqorida keltirilgan formulalardan foydalanib hisoblab topish mumkin.

# Yuqoriga tik otilgan jismning harakati

Jismni yuqoriga tik otishda trayektoriyaning ixtiyoriynuqtasida ko'tarilish va tushish tezliklari teng bo'ladi, ya'ni jism qanday tezlik bilan yuqoriga tik otilgan bo'lsa, shunday tezlik bilan otilishjoyiga qaytib tushadi.

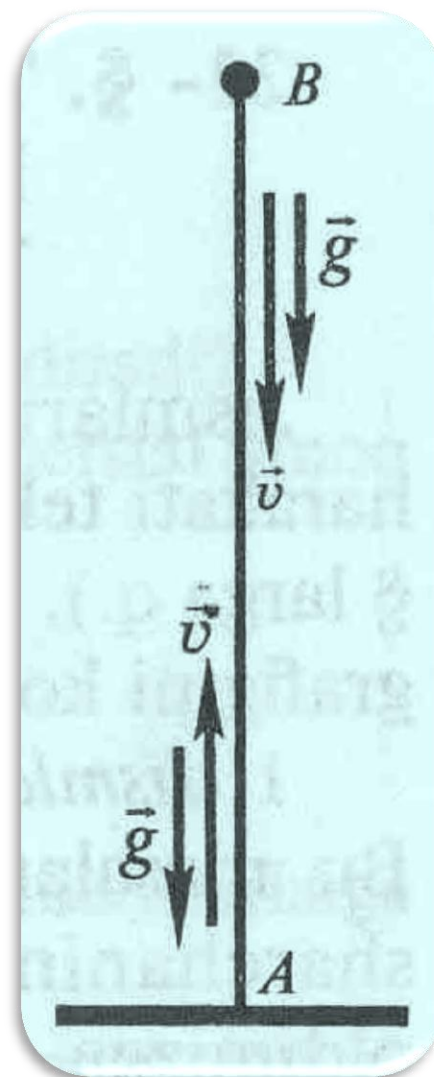
$$v = v_0 - gt.$$

$$h = v_0 t - \frac{1}{2} g t^2,$$

$$h = \frac{v_0^2 - v^2}{2g}.$$

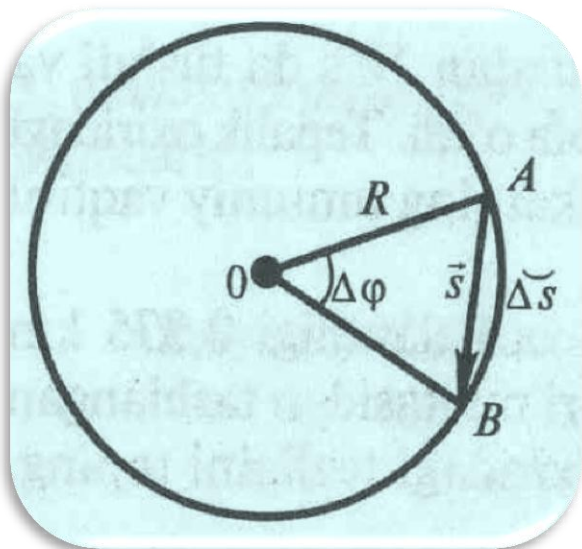
$$h_{\max} = v_0 \frac{v_0}{g} - \frac{g}{2} \frac{v_0^2}{g^2} = \frac{v_0^2}{2g}$$

$$h_{\max} = \frac{v^2}{2g}$$



# *Egri chiziqli harakat. Aylana bo'ylab tekis harakat*

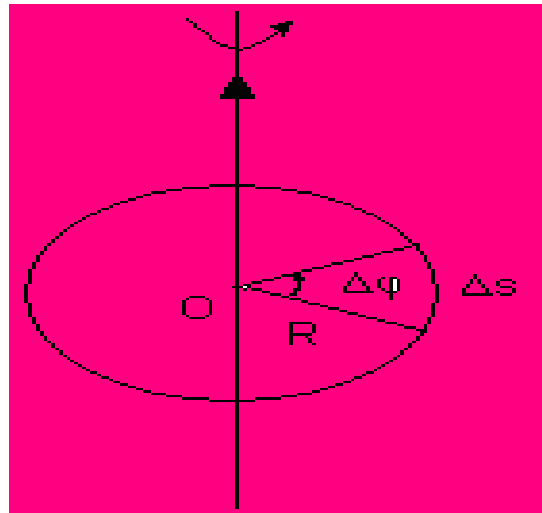
- *Agar jism aylana bo'yicha teng vaqtlar ichida teng yoylarni bosib o'tsa, bunday harakat aylana bo'ylab tekis harakat deyiladi*
- *Traektoriyasi egri chiziqdan iborat bo'lgan harakat egri chiziqli harakat deyilad*



*Jismning vaqt birligi ichida burilish burchagi aylana bo'ylab tekis harakatning burchak tezligi deyiladi, ya'ni*

$$\omega = \Delta\varphi / \Delta t$$

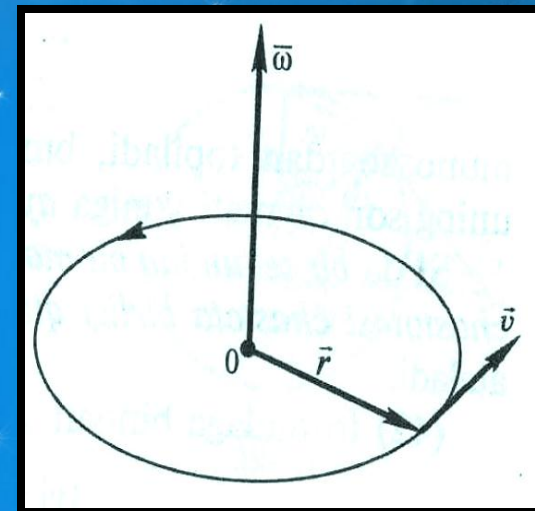
# ***Chiziqli tezlik bilan burchak tezlik orasidagi bog'lanish. Aylanish davri va aylanish***



- *aylana bo'ylab harakat qilayotgan jismning chiziqli tezligi burchak tezlik bilan aylana radiusining ko'paytmasiga teng:  $v = \omega R$ .*

✓ **Jismning bir marta to'liq aylanib chiqishi uchun ketgan vaqt bilan o'lchanadigan kattalik aylana bo'ylab harakatning *aylanish davri* deyiladi.**

✓ **Jismning vaqt birligi ichida to'liq aylanishlari soni bilan o'lchanadigan kattalik aylana bo'ylab harakatning *aylanish***



$$\omega = \frac{2\pi}{T} = 2\pi\nu,$$

$$v = \frac{2\pi R}{T} = 2\pi\nu R = \omega R$$

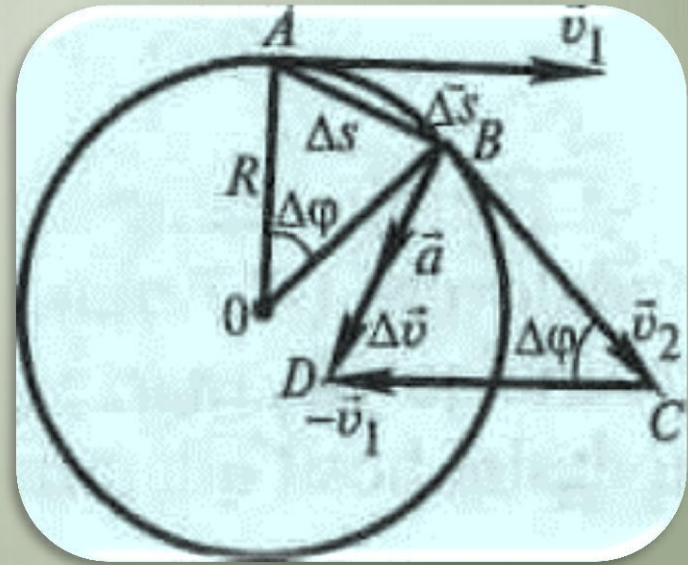
# *Jismning aylana bo'ylab tekis harakatidagi tezlanishi*

$$\frac{\Delta v}{v} = \frac{\Delta s}{R}, \text{ bundan } \Delta v = \frac{\Delta s}{R} \cdot v = \frac{v}{R} \cdot \Delta s.$$

$$a = \frac{\Delta v}{\Delta t} = \frac{v}{R} \cdot \frac{\Delta s}{\Delta t}$$

$$\Delta t \rightarrow 0 \text{ da } a = \lim_{\Delta t \rightarrow 0} \frac{v}{R} \cdot \frac{\Delta s}{\Delta t} = \frac{v}{R} \lim_{\Delta t \rightarrow 0} \frac{\Delta s}{\Delta t},$$

$$\lim_{\Delta t \rightarrow 0} \frac{\Delta s}{\Delta t} = v.$$



$$a = v^2/R$$

✓ *jismning aylana bo'ylab tekis harakatida tezlanish har doim radius bo'ylab aylana markaziga tomon yo'nalgan bo'ladi. Bu tezlanishni markazga intilma tezlanish deb ataladi va u  $a_{m.i}$  bilan belgilanadi.*

✓ 
$$a_{m.i} = v^2/R$$

✓ 
$$a_{m.i} = (\omega R)^2/R = \omega^2 R$$