Toorikkonspekt kursuse “Biofüüsika” füüsikalistest küsimustest

4. DÜNAAMIKA ALUSED
BASICS OF DYNAMICS

KÄESOLEVAS FAILIS sisaldub konspekti toorik aine “Biofüüsika” **järgmiste osade jaoks:**

ALUSTEADMISED LIIKUMISTEST
Elementaarmõisted. Dünaamika seadused. Jäävusseadused.

THE PRESENT FILE contains provision for the course “Biophysics” **corresponding to the following parts of the course:**

BASIC KNOWLEDGE ABOUT MOTIONS
Elementary Notions. Laws of Dynamics. Laws of Conservation.

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Isaac Newton

1643 - 1727

1687 : "Philosophiae Naturalis Principia Mathematica"

Isaac Newton 1643 - 1727

1687 "Philosophiae naturalis principia mathematica"

I Inertsiseadus Inertia law Закон инерции

II Punktmassi dünaamika põhivõrrand
Basic equation of dynamics of mass point
Основное уравнение динамики точечной массы

$$\vec{a} = \frac{\vec{F}}{m}$$

kus
where
где $\vec{a}$:

$$a \equiv |\vec{a}| \triangleq \frac{d}{dt} v(t) =$$

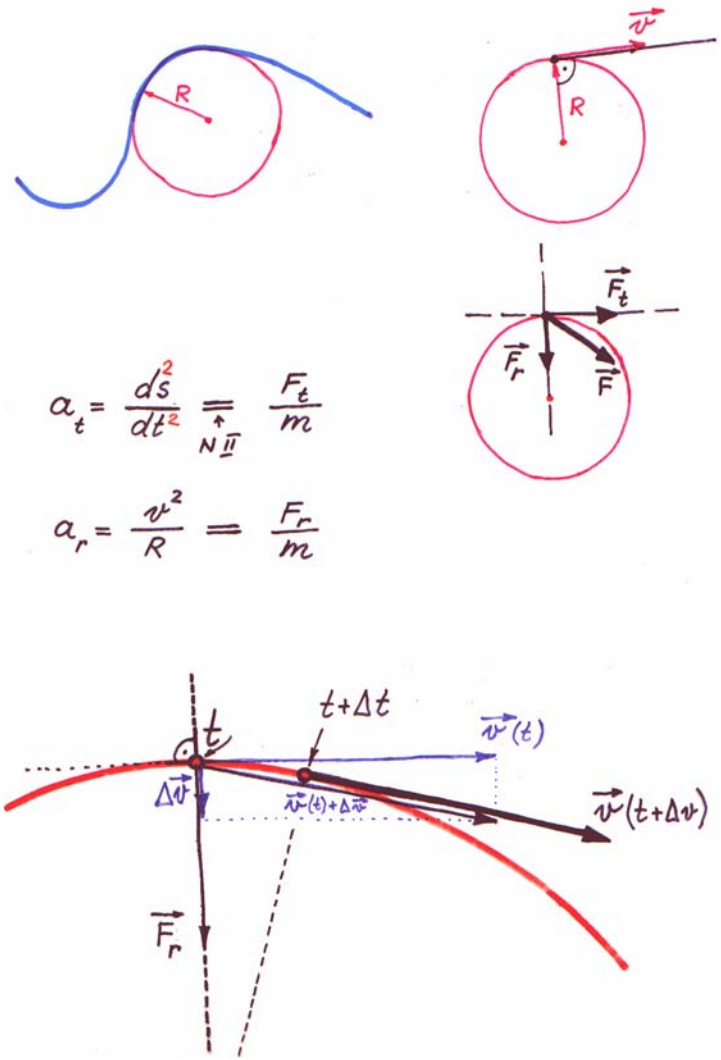
$$= \frac{d}{dt}\left(\frac{d\,s(t)}{dt}\right) = \frac{d^2 s(t)}{dt^2}$$

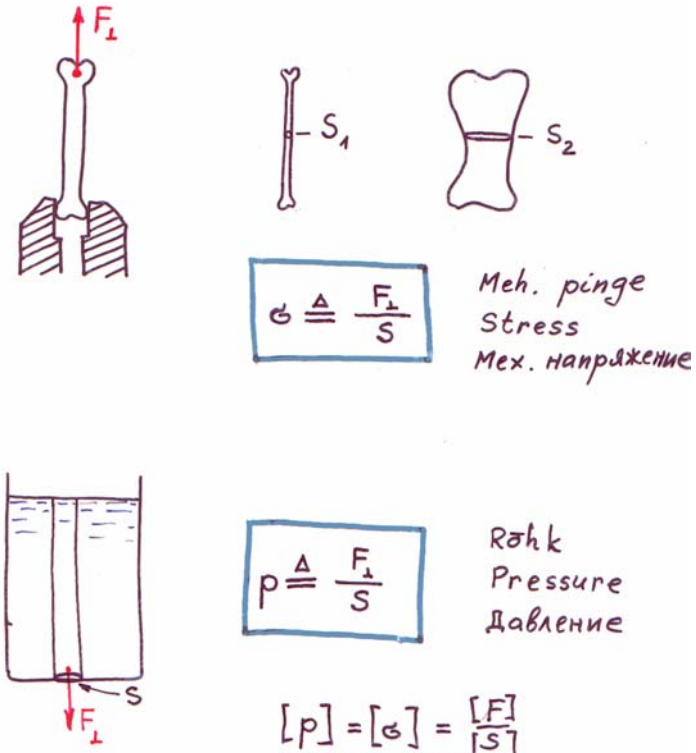
$\vec{a} \uparrow\uparrow \vec{F}$ $\quad [a] = 1\,\frac{m}{s^2}$

III Mõju ja vastumõju seadus
Law of action and reaction
Закон действия и противодействия

$F = ma \rightarrow P = mg$ Kaal Weight Вес

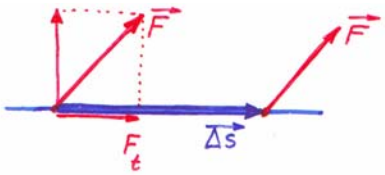
$1N = 1kg \cdot 1\,\frac{m}{s^2}$





Hüdrostaatiline rõhk:
Hydrostatic pressure:
Гидростатическое давление:

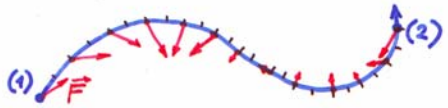
$$p = \frac{P}{S} = \frac{mg}{S} = \frac{\rho V g}{S} = \frac{\rho g \cdot Sh}{S} = \rho g h$$

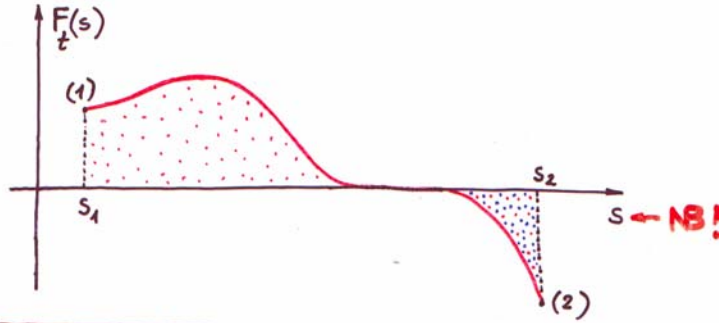


Töö:
Work:
Работа:

$$\Delta A \triangleq F_t \cdot \Delta s = F \cdot \Delta s \cdot \cos(\hat{\vec{F}, \vec{\Delta s}})$$

$1\,J = 1\,N \cdot 1\,m$





$$A = \int_{(1)}^{(2)} F_t \cdot ds = \int_{s_1}^{s_2} F_t(s)\,ds$$

Töö
Work
Работа

$$\overline{N} \triangleq \frac{\Delta A}{\Delta t}$$

$$N(t) \triangleq \frac{dA(t)}{dt}$$

Võimsus
Power
Мощность

$$1\,W = \frac{1\,J}{1\,s}$$

Mehaaniline energia
Mechanical energy
Механическая энергия

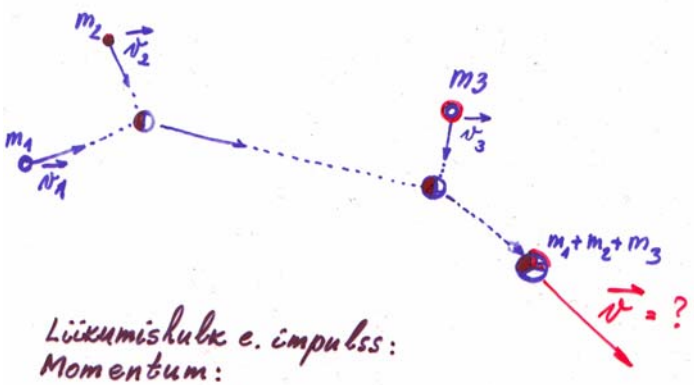
$[E] = [A] (= 1\,J)$

Masspunkti kineetiline energia:
Kinetic energy of a point mass:
Кинетическая энергия точечной массы:

$$E_K = \frac{mv^2}{2}$$

Keha potentsiaalse energia näide:
Example of potential energy of a body:
Пример потенциальной энергии тела:
Keha pot. en. Maa raskusväljas
Pot. en. of a body in Earth's gravitation field
Пот. эн. тела в поле тяжести Земли

$$E_{gr} = mgh$$



Liikumishulk e. impulss:
Momentum:
Механический импульс:

$$\vec{p} \triangleq m\vec{v}$$

$$m_1\vec{v}_1 + m_2\vec{v}_2 + m_3\vec{v}_3 = (m_1+m_2+m_3)\vec{v}$$

$$\vec{v} = \frac{m_1\vec{v}_1 + m_2\vec{v}_2 + m_3\vec{v}_3}{m_1+m_2+m_3}$$

Ülesanne on lahendatud, kasutades impulsi jäävuse seadust.
Problem solved using the law of momentum conservation.
Задача решена с использованием закона сохранения импульса.

„Soojuse mehaaniline ekvivalent"
„The mechanical equivalent of heat"
„Механический эквивалент теплоты"

$$1\,cal = 4{,}19\,J$$

1 cal :

Soojushulk, mis tõstab 1 g vee temperatuuri 1°C võrra (t = 15°C juures).
Amount of heat necessary to rise the temperature of 1 g water by 1 deg (at 15°C).
Количество теплоты, необходимое для поднятия температуры 1 g воды на 1°C (при 15°C)