

Úlohy 10. Turnaje mladých fyziků (Problems of 10th IYPT)

1 Invent yourself

Construct and demonstrate a device which moves in a definite direction under chaotic influence.

2 Coin

A coin lying heads up is let to fall without a push. At what height heads and tails of falling coin have equal probability?

3 Paper

How does the tensile strength of paper depend on its humidity?

4 Electron Beam

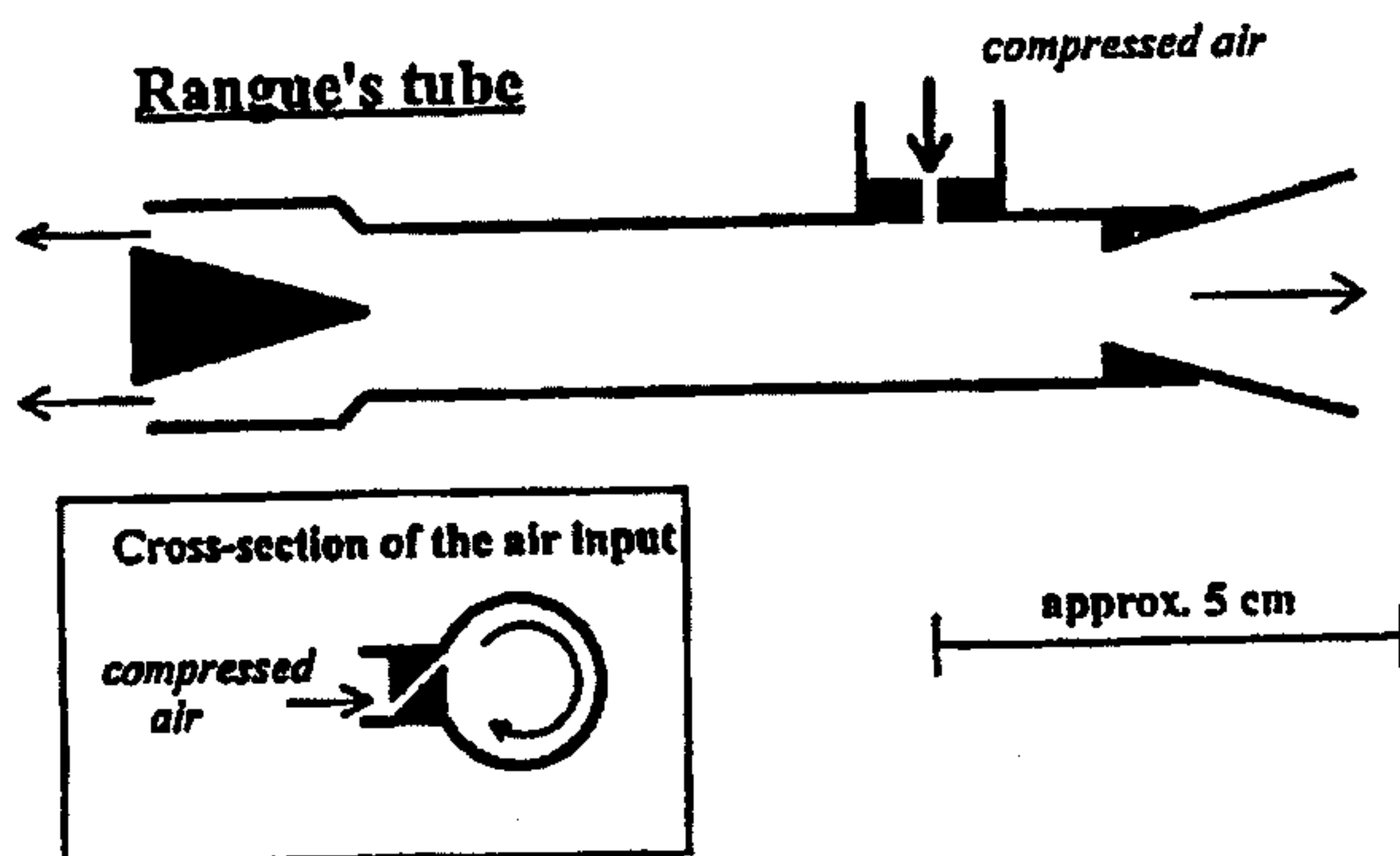
An electron beam is cast upon a planparallel plate of known homogeneous material. Some of the electrons get through it some do not. Try to simulate processes taking place, e.g. using Monte Carlo method and compare results obtained with literature.

5 Blue Blood

Human blood is known to be red, but the veins seem to be blue. Explain this phenomenon and illustrate it by a model.

6 Magic Rauge's Tube

Compressor blows air under pressure of 0,5 MPa or higher into Rauge's T-shape



tube so that it begins to circulate. In such a case hot air is coming out from one end of the tube and cold air from the opposite one. Find out which end of the tube is the „hot“ one and explain the difference of the temperatures obtained. Investigate the parameters this difference depends on.

7 Water Jet

A water jet flowing from the tube vertically downwards divides into drops at some distance from the tube. Choose the conditions under which the length of the unseparated jet is the largest. What maximum length have you managed to obtain?

Úlohy 10. Turnaje mladých fyziků

8 Floatation

A piece of chocolate dropped into a glass of soda water periodically sinks and comes back to the surface. Investigate the dependence of the period of the oscillations on various parameters.

9 Jet and spread

A water jet falling onto a horizontal plane spreads out radially. At some distance from the centre the thickness of the layer dramatically increases. Explain the phenomenon.

10 Cooling the Earth

Estimate how would the temperature of the Earth change with the time if the Earth suddenly stopped to radiate.

11 Candle Generator

Construct a device to charge an electric capacitor using the energy of a burning candle. Charge the capacitor ($1000 \mu\text{F}/100 \text{V}$) using a candle which burns 10 minutes.

12 Static Friction

A force of kinetic friction is known to be independent on the surface area of the body. What about the dependence of the maximum static friction on the surface area?

13 Tea Cup

If one fills a cup with hot tea ($60 - 80^\circ \text{C}$), a thin layer of steam emerges above the surface. One can see that some parts of the steam layer disappear suddenly and reappear after a few seconds. Investigate and explain this phenomenon.

14 Rain

On a long-exposure photograph of night rain taken in light of a projector, the streaks of drops look broken. Explain this phenomenon.

15 Cell and Accumulator

How does the voltage-current characteristics of a cell and of an accumulator change during discharging?

16 Roghe spiral

The Roghe spiral is a device where a source of current is connected to a vertically suspended spring, the lower end of which touches mercury. As the work with mercury is dangerous and not allowed investigate behaviour of this device substituting mercury by something else.

17 Jump

To make a jump is necessary to squat. How does the height of a jump depend on the depth of squatting?

Autoři úloh: E. Junosov, Z. Klumber, G. Laskhishvili, R. Lehn, V. Lobysev, A. Nadolny, M. Prouza, A. Urban, Z. Urickij