

10th IYPT (1997)

Source: [Školská fyzika, 1996/1997, 1, 99–100, Vlado Koutny ca. 1999](#)

Problems selected at an unknown time

[Exemplary solutions for 1997 →](#)

1. Invent yourself

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

2. Coin

From what height must a coin with heads up be dropped, so that the probability of landing with heads or tails up is equal?

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 homogenous 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 your results with the ones described in 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 tube

A compressor blows air into Ranque-Hilsch T-shaped tube at a pressure of 0.5 MPa or higher so that the air 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 streaming vertically downwards from a tube is divided into drops at some distance from the tube. Choose the conditions under which the length of the unseparated jet is largest. What maximum length did you obtain?

8. Floatation

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

9. Jet-spread

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

10. Cooling the Earth

How would the temperature of the Earth change with time, if the Sun suddenly stopped radiating?

11. Candle generator

Construct a device for charging an electric capacitor ($1000 \mu\text{F} / 100 \text{V}$) using the energy of a candle burning for a period of one minute.

12. Static friction

A force of motion friction is known to be independent on the rubbing surface area of a body. How does the static friction depend on the rubbing surface area?

13. Tea cup

If one fills a cup with hot tea ($60^\circ\text{C} - 80^\circ\text{C}$), 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-time exposure photograph of night rain taken in the light of a projector, the tracks of drops appear interrupted. Explain this phenomenon.

15. Cell and accumulator

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

16. Roget's spiral

The Roget's Spiral is a device where a source of current is connected to a vertically suspended spring, the lower end of which dipped into mercury. Mercury is a highly dangerous chemical substance and thus the experiments with it are not permitted. Substitute the mercury with a less dangerous substance and investigate the functioning of this device.

17. Leap

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