

15th IYPT (2002)

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Selected at the [Preparatory Seminar in Odessa](#) on Oct. 11—14, 2001

[Exemplary solutions for 2002 →](#)

1. Heat engine

A tall glass cylinder is half-filled with hot water and topped up with cold water. A small ampule, containing a few drops of ether or alcohol (and closed off by a rubber pipette cap), is then put in. Describe the phenomena occurring in the system. How does the motion of the ampule change with time?

2. Spider's web

A spider's thread looks like a string of pearls. What is the reason for this? Make experiments to investigate the relevant parameters.

3. Flying colours

Why do flags flutter in the wind? Investigate experimentally the airflow pattern around a flag. Describe this behaviour.

4. Hazy

The colour of a distant forest appears not green, but hazy blue. What is the minimum distance at which this phenomenon is observed? How do weather conditions affect this? Is it possible that a forest can appear grey?

5. Pond-skater

It is known that unwettable small bodies can float on water due to the surface tension force. Construct a floating raft based on this principle and calculate its static and dynamic parameters.

6. Stop and start

Sometimes a flow of traffic can experience sudden stops and starts for no apparent reason. Build a physical model to explain why this occurs.

7. Ohm's Law for a liquid

It is often said that electric current “flows”. Is this the only analogy between electric current and the flow of a liquid? Investigate theoretically and experimentally other analogies between these two things.

8. Charged sand

Fine, well-dried quartz sand is poured out of a short thin tube into a conical metallic vessel connected to an electrometer. Investigate the behaviour of the sand stream as the vessel fills up. What changes if the stream is lit by a UV-lamp?

9. Chromatography

Put a drop of coloured liquid on a piece of absorbant paper. Describe quantitatively the observed phenomena.

10. Sound cart

Construct and demonstrate a device that can be propelled solely by sound. Investigate its properties.

11. Equilibrium

Fill a glass with water up to the point where a convex meniscus is formed. Place a table tennis ball on the surface of the water. Investigate and explain the stability of its equilibrium. Repeat your experiment with other liquids?

12. Electroconductivity

How can you measure the electroconductivity of salt solutions without using direct contact electrodes? Analyse the problem and demonstrate your device.

13. Spinning ball

A steel ball of diameter 2—3 cm is put on a horizontal plate. Invent and construct a device, which allows you to spin the ball at high angular velocity around a vertical axis. The device should have no mechanical contact with the ball.

14. Torn sail

Determine the dependence of the efficiency of a sail on its degree of perforation. What would be the effect of using a fishing net as a sail?

15. Pulsating air bubble

Trap an air bubble of radius 1—2 cm under an inverted watch glass beneath a water surface. Introduce alcohol into the bubble through a thin tube, controlling and adjusting the rate of flow until the bubble pulsates rhythmically. Study the phenomenon and explain your observations.

16. Elastic pendulum

Study and describe the behaviour of a pendulum where the bob is connected to a spring or an elastic cord rather than to a stiff rod.

17. Bottle battle

Take two opened glass bottles of cola and knock one against the other. After a short while, the cola spurts out of one of the bottles. Investigate and explain the phenomenon.