

Problems 19th IYPT (2006)

1. Froth

Investigate the nature of the decay in height of the 'froth' or 'foam' on a liquid. Under what conditions does the froth remain for the longest time?

2. Shades

If small non-transparent objects are illuminated with light, patterns in the shadows are observed. What information can be obtained about these objects using these patterns?

3. Duck's cone

If one looks at the wave pattern produced by a duck paddling across a pond, this reminds one of Mach's cone. On what parameters does the pattern depend?

4. Whispering Gallery

The Whispering Gallery at St Paul's Cathedral in London, for example, is famous for the fact that the construction of the circular gallery makes a whisper against its walls on one side of the gallery audible on the opposite side of the gallery. Investigate this phenomenon.

5. Probability

A coin is held above a horizontal surface. What initial conditions will ensure equal probability of heads and tails when the coin is dropped and has come to rest?

6. Wet cleaning

A wet rag is hard to drag when it is spread out and pulled across the floor. What does the resistive force depend on?

7. Airglider

A paper sheet is on a table. If one blows along the table the sheet begins to glide over it. Determine the flight characteristics of the paper.

8. Electrostatics

Propose and make a device for measuring the charge density on a plastic ruler after it has been rubbed with a cloth.

9. Sound and foam

Investigate the propagation of sound in foam.

10. Inverted pendulum

It is possible to stabilise an inverted pendulum. It is even possible to stabilise an inverted multiple pendulum (one pendulum on top of the other). Demonstrate the stabilisation and determine on which parameters this depends.

11. Singing tube

A tube open at both ends is mounted vertically. Use a flame to generate sound from the tube. Investigate the phenomenon.

12. Rolling magnets

Investigate the motion of a magnet as it rolls down an inclined plane.

13. Sound

Measure the speed of sound in liquids using light.

14. Cellular materials

Investigate the behaviour of a stream of fluid when it strikes the surface of a sponge-like material.

15. Heat and temperature.

A tube passes steam from a container of boiling water into a saturated aqueous salt solution. Can it be heated by the steam to a temperature greater than 100°C? Investigate the phenomenon.

16. Hardness

A steel ball falls onto a horizontal surface. If one places a sheet of paper onto the surface with a sheet of carbon paper on top of it, a round trace will be produced after the impact. Propose a hardness scale based on this method.

17. Magnetohydrodynamics

A shallow vessel contains a liquid. When an electric and magnetic field are applied, the liquid can start moving. Investigate this phenomenon and suggest a practical application.