

## PROBLEMS FOR THE IYPT 2007

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### 1. Filament

There is a significant current surge when a filament lamp is first switched on. Propose a theoretical model and investigate it experimentally.

### 2. Slinky

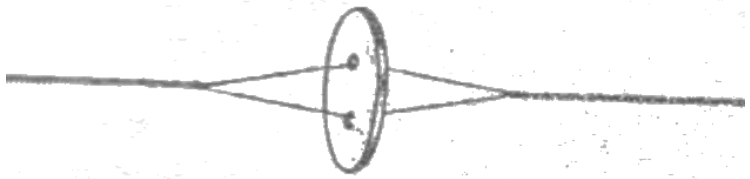
Suspend a Slinky vertically and let it fall freely. Investigate the characteristics of the Slinky's free-fall motion.

### 3. Water jets.

What can be observed when two water jets collide at different angles?

### 4. Spring thread

Pull a thread through the button holes as shown in the picture. The button can be put into rotating motion by pulling the thread. One can feel some elasticity of the thread. Explain the elastic properties of such a system.



### 5. Razor Blade

A razor blade is placed gently on a water surface. A charged body brought near the razor makes it move away. Describe the motion of the razor if an external electric field is applied.

### 6. Rheology

It has been said that if you are sinking in soft mud, you should not move vigorously to try to get out. Make a model of the phenomenon and study its properties.

### 7. Crickets

Some insects, such as crickets, produce a rather impressive sound by rubbing together two parts of their body. Investigate this phenomenon. Build a device producing a sound in a similar way.

### 8. Condensation

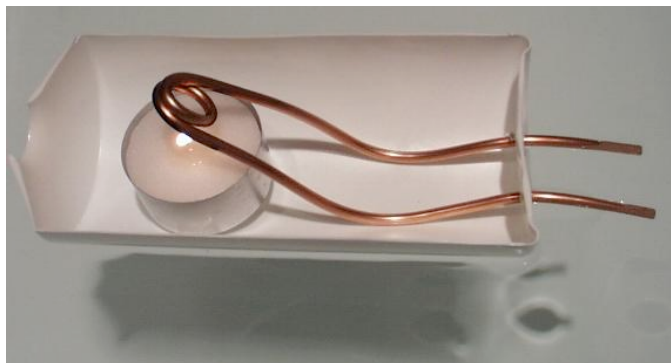
Water droplets form on a glass filled with cold water. Explain the phenomenon and investigate the parameters that determine the size and number of droplets on the glass.

### 9. Ink Droplet

Place a droplet of ball pen ink on a water surface. The droplet begins to move. Explain the phenomenon.

### 10. Steam Boat

A boat can be propelled by means of a candle and metal tubing with two open ends (an example is shown in the picture). Explain how such a boat is propelled and optimize your design for maximum velocity.



### 11. Water Ski

What is the minimum speed needed to pull an object attached to a rope over a water surface so that it does not sink. Investigate the relevant parameters experimentally and theoretically.

### 12. Fluid lens

Develop a fluid lens system with adjustable focus. Investigate the quality and possible applications of your system.

### 13. Balloon

Measure the change of the optical properties of the skin of a balloon during its inflation.

### 14. Earthquake

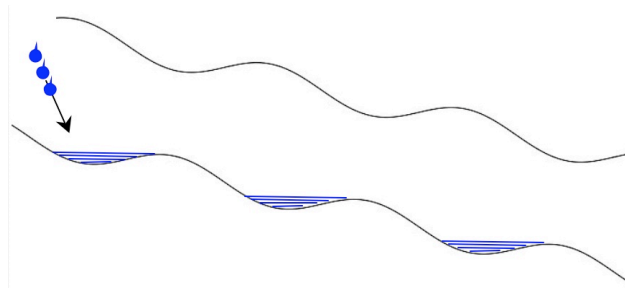
Suggest a mechanism that makes buildings resistant to earthquakes. Perform experiments and explain the results.

### 15. Blowpipe

Investigate the motion of a projectile inside a blowpipe. Determine the conditions for maximum exit velocity when blown by mouth.

### 16. Water Cascade

Arrange a corrugated drainage pipe, or similar, on an incline. Allow water to flow through the pipe and then carefully stop the flow. Investigate the behaviour of the system when water is dropped into the pipe.



### 17. Ice Bulge

Fill a plastic tray with water. When frozen, under certain conditions, a bulge can appear on the surface. Investigate this phenomenon.