# The 7 Problems for NZYPT 2018

1. Invent Yourself
Construct a simple seismograph that amplifies a local disturbance by mechanical, optical or electrical methods. Determine the typical response curve of your device and investigate the parameters of the damping constant. What is the maximum amplification that you can achieve? Invent yourself

2. Heron's Fountain
Construct a Heron's fountain and explain how it works. Investigate how the relevant parameters affect the height of the water jet.

3. Azimuthal-Radial Pendulum
Fix one end of a horizontal elastic rod to a rigid stand. Support the other end of the rod with a taut string to avoid vertical deflection and suspend a bob from it on another string (see figure). In the resulting pendulum the radial oscillations (parallel to the rod) can spontaneously convert into azimuthal oscillations (perpendicular to the rod) and vice versa. Investigate the phenomenon.
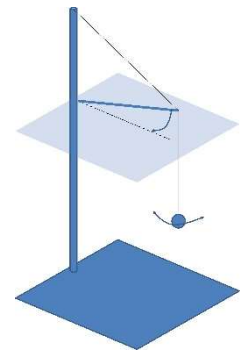
4. Water Bottle
The current craze of water bottle flipping involves launching a partially filled plastic bottle into the air so that it performs a somersault before landing on a horizontal surface in a stable, upright position. Investigate the phenomenon and determine the parameters that will result in a successful flip.

5. Weighing Time
It is commonly known that an hourglass changes its weight (as measured by a scale) while flowing. Investigate this phenomenon.

6. Drinking Straw
When a drinking straw is placed in a glass of carbonated drink, it can rise up, sometimes toppling over the edge of the glass. Investigate and explain the motion of the straw and determine the conditions under which the straw will topple.

7. Dancing Coin
Take a strongly cooled bottle and put a coin on its neck. Over time you will hear a noise and see movements of the coin. Explain this phenomenon and investigate how the relevant parameters affect the dance.