Problems for the 9th Canadian Young Physicists' Tournament 2025

Released by the CaYPT Organizing Committee on Sept 23 rd, 2024
Adapted from the Problem for IYPT 2025

Day 1 Problems:

A. Air Muscle

Place a balloon inside a cylindrical net (as is sometimes used to wrap garlic) and inflate it. The net will expand and shorten. Investigate the properties of such a"muscle".

B. Lato Lato

Attach a ball to each end of a string and connect the center of the string to a pivot. When the pivot oscillates along the vertical direction, the balls start to collide and oscillate with increasing amplitude. Investigate the phenomenon.

C. Climbing Magnets

Attach a rod assembled from cylindrical neodymium magnets horizontally to a vertical ferromagnetic rod. Limit the motion of the magnets to the vertical direction. When the ferromagnetic rod is spun around its axis of symmetry, the magnetic rod begins to climb up. Explain this phenomenon and investigate how the rate of climbing depends on relevant parameters.

D. Sound Versus Fire

A small flame can be put out by sound. Investigate the parameters of the flame and characteristics of the sound that determine whether the flame will be extinguished.

E. Wailing Bowl

When you strike the side of a metal bowl containing some water, you can hear a characteristic sound. The sound changes when the water in the bowl is moving. Explain and investigate the phenomenon.

Day 2 Problems:

F. Spring Hysteresis

Connect two identical linear springs symmetrically to a mass in a "V" shape, and apply an adjustable force to the mass. When this force is varied, the resulting motion of the mass depends on the history of changes in the applied force under certain conditions. Investigate this phenomenon.

G. Ruler Canon

Two rulers are tightly held against each other. A round projectile (e.g. a plastic bottle cap or a ball) is inserted between them close to one of their ends. When extra force is exerted on the surface of the rulers, the projectile is ejected at a high speed. Investigate this effect and the parameters that affect ejection speed.

H. Magnetic Assist

Attach one or two magnets to a non-magnetic and non-conductive base such that they attract a magnet suspended from a string. Investigate how the motion of the moving magnet depends on relevant parameters.

I. Wirtz Pump

A Wirtz Pump is a hollow spiral, mounted vertically. It is arranged such that one end dips below water once per revolution, while the other end (at the center of the spiral) is connected to a vertical tube. When rotated, it can be used to pump water to a great height. Explain this phenomenon and investigate how relevant parameters affect the pumping height.

J. Quantum Fingerprint

Shine laser light onto an organic polymer (eg. styrofoam). The scattered light may have a higher or lower wavelength than the incident light. Explain the phenomenon and determine what can be concluded about the molecular structure of the material from the wavelength shift.

Problems selected by CaYPT problem selection subcommittee.