

# Problems for the 11<sup>th</sup> Canadian Young Physicists' Tournament 2027

Released by the CaYPT Organizing Committee on Jul 20<sup>th</sup>, 2026

Adapted from the [Problem for IYPT 2027](#)

## Day 1 Problems:

### A. Disc spectrometer

Data tracks on optical media (e.g. CDs / Blu-ray discs) behave as high-quality reflection-diffraction gratings. When illuminated, these discs can disperse light into its spectral components. Construct a spectrometer using a digital optical disc. Optimise the design to maximise the resolving power and minimise optical aberrations.

### B. Snail ball

A hollow sphere contains a heavy ball and some viscous fluid. The rolling motion of such a sphere down an inclined plane is uneven and surprisingly slow. Explain and investigate this effect.

### C. Singing capacitor

Certain types of ceramic capacitors emit an audible sound when an alternating voltage is applied across them. Investigate the characteristics of the sound produced and how they depend on relevant parameters, such as voltage, frequency, and capacitor properties.

### D. Y-shaped pendulum

Construct a Bowditch pendulum (a pendulum whose strings form a “Y” shape). Investigate how the Lissajous patterns generated by the bob depend on the relevant parameters.

### E. Air vortex

Place a small rod-shaped magnet on the bottom of a vessel filled with liquid and set it into rotation using a magnetic stirrer. Above a certain rotation speed, a thin air channel forms, extending from the liquid surface down to the rotating magnet itself. Investigate and explain this phenomenon.

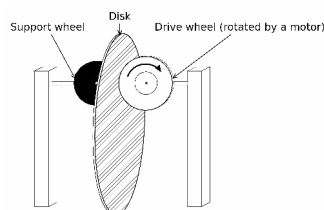


Figure 1: Schematic of Upward-driven disc

Problems selected by CaYPT problem selection subcommittee.

## Day 2 Problems:

### F. Seeing sound

A thin rubber membrane is stretched over a circular frame and driven into vibration by a loudspeaker. A small mirror is attached to the membrane, and a laser beam is reflected off it onto a distant screen. Under certain conditions, the laser spot traces out complex, steady, or evolving geometric patterns. Investigate the relationship between the driving parameters, the membrane's properties, and the resulting light patterns.

### G. Sinking funnel

When a long-stemmed and sufficiently heavy funnel is released vertically into water with the stem pointing downward, it undergoes a series of damped vertical oscillations while gradually sinking. Investigate the motion and stability of the sinking funnel and the conditions under which the funnel tips over.

### H. Upward-driven disc

A circular disc is suspended from the point where it is sandwiched between two wheels, making it free to oscillate as a pendulum. One of the wheels is driven by a motor and thus exerts an upward driving force on the disc. Investigate the motion of the disc.

### I. Cold Drink

A can or bottle of drink at room temperature can be cooled in a cooler containing ice. Adding salt and alcohol to the ice can increase the rate of cooling and affect the drink's final temperature. Investigate how the relevant parameters affect the lowest achievable temperature and the maximum cooling rate.

### J. Magnetic carousel

Several neodymium magnets are attached to a horizontal disc, with adjacent magnets oriented in opposite directions. A fixed non-magnetic plate is placed horizontally above the disc. When the disc rotates about its vertical axis and a steel ball is placed on the plate, the ball may move either in the same direction as, or opposite to, the rotation of the disc. Investigate this phenomenon and determine how the motion depends on relevant parameters.

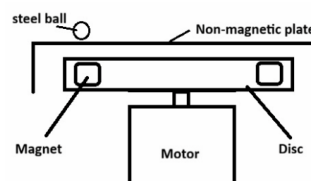


Figure 2: Schematic of Magnetic carousel