International Physicists' Tournament
IPT Sweden 2017 problems

1. Handy glider
It is possible to make small gliders with paper and to make them fly for a very long time by putting your hand below the glider during flight (video on IPT website). Explain the physics behind this phenomenon and describe the optimal set of parameters for the best control of the glider.

2. Too many magnets
How many magnets can be accommodated within a given surface area before the structure collapses and the magnets stick together? (video on IPT website) How does the maximal areal number density of magnets depend on the important parameters?

3. LEGO tower
A LEGO mold, water and gelatin can be used to produce jelly, or 'gummy' LEGO bricks (video on IPT website). It is possible to build towers using these gummy LEGO bricks in the same way as can be achieved with their plastic counterparts. What is the maximum height of gummy LEGO tower that can be built and how does this depend on the concentration of gelatin in the bricks?

6. Electro-hydro entanglement
An analogy is often made between the behaviour of electric circuits and water flow in pipes. State the conditions under which this analogy holds. Can this analogy be readily applied to oscillatory circuits? electrovacuum lamps-triods? diodes? semiconductors? superconductors? logical elements? You may even try to create and demonstrate the analogy to some common electric device containing active and passive circuit elements such as "water radio".

10. Light-driven vehicle
Build a toy car that is powered by an external light source. What is the maximum speed that the car can reach if it starts moving from rest? The light source cannot be moving with the car and is limited to 5 W of power consumption. What are the important parameters that influence the final speed of the car?

11. Walking chain
If you apply a short impulse to a long chain spinning around a horizontal axis, the chain may "walk" on a short distance (video on IPT website). Explain this phenomenon and investigate the key parameters of the distance walked.

14. Flashing lamp
The flashing of a faulty fluorescent lamp appears to be random in time. What are the physical origin and the statistical properties of the flashing?

15. Tea with honey
Construct a device to continuously stir a cup of tea with a tea spoon of honey at the bottom. The device should be operated using a single 1.5V AA battery and the honey should be dissolved and uniformly distributed in the minimum possible time. Propose your own criterion for determining the homogeneity of the stirred solution. How will using the sugar instead of honey, or adding a slice of lemon to your tea influence the results?

Many thanks to all the people who contributed to the problem list and helped with the problem selection!

In case of any questions do not hesitate to contact Andreas Isacsson, the Swedish IOC representative at sweden@iptnet.info.