Problems for the 8th IYNT 2020

*Ignorance more frequently begets
confidence than does knowledge.*
Darwin

Main Problems for Science Fight 1

1. Left-handed animals
Some animals have a preference for using one side of their body, similar to left-handed and right-handed humans. Perform experiments to obtain statistical data and investigate paw preferences of various animals.

2. Slow match
A cord in which the flame front propagates with a constant low speed has been important to ignite cannons. Produce such cords and investigate their burn rates and other properties.

3. Photography with iron salts
Mix 10 parts of ferrous oxalate (25% aqueous solution), 7 parts of concentrated ammonia solution, and 20 parts of saturated solution of oxalic acid to produce a photosensitive iron complex. Prepare separately a 25% solution of potassium ferricyanide. A sheet of paper saturated with a mix of these two solutions can be exposed to light and produce an image. What other iron salts are photosensitive? Produce photographs using various approaches and various iron salts, and investigate the role of relevant parameters.

4. Popping buoy
A light ball is held underwater and then released. The ball may sometimes pop above the water surface. Investigate this effect and the role of important parameters.

5. Disinfectants
Prepare sterile culture dishes and investigate the growth of door handle bacteria and other common microorganisms. Investigate how various disinfectants, such as antibacterial soap, affect the bacteria.

6. Piezo ignition
A common lighter uses piezoelectric crystals. Investigate the quantitative parameters describing the response of such crystals to pressure.

Main Problems for Science Fight 2

7. Caoutchouc
Milky latex is present not only in commercially cultivated rubber trees, but even in houseplants such as spurge or ficus. Produce natural rubber from plants of your choice and investigate the physical and chemical properties of the rubber.

8. Magnet and matchstick
A matchstick is not attracted to a magnet, however the head of a burned matchstick is attracted by a strong magnet. Investigate the reasons and the role of relevant parameters.

9. Venus flytrap
Investigate experimentally how Venus flytrap (*Dionaea muscipula*) catches and digests its prey.

10. Variable stars
Some variable stars, in particular Algol (*β* Persei), have sufficient magnitude to be observed with unaided eye or simple telescopes. Measure the light curve for such a star. What information can be obtained from the light curve?

11. Hydrogen release
A simple method to produce gaseous hydrogen is the reaction between metal aluminum and two salts in aqueous solution (e.g. copper sulphate and sodium chloride). Investigate how the reaction rate depends on the concentration of each salt and other relevant conditions. What salts react with aluminum to release hydrogen?

12. Onion cells
Investigate the effects of various salts on the structure of onion cells.

Problems *Invent Yourself* for Science Fight 3

13. Invent Yourself: Hearing
Each speaker can pronounce a vowel on several pitches, yet a listener is likely to recognize the phoneme (e.g. /o:/ or /u:/). Astonishing auditory illusions (e.g. *Yanny and Laurel*), so called *mondegreens*, and experiences of persons with poor hearing demonstrate nevertheless that listeners perceive sounds, words and phrases differently. Propose a problem concerning speech perception, mishearing, or physical differences between sounds of spoken language.

14. Invent Yourself: Chemical oscillators
Examples of oscillating chemical reactions are the Briggs-Rauscher reaction or the Belousov-Zhabotinsky reaction which result in periodic color changes. While some of such reactions are difficult to reproduce, there are multiple ways to produce a simpler and more reliable chemical oscillator. Propose a problem about an interesting and simple chemical oscillator.

15. Invent Yourself: Tasting food
Volunteers are given the task to judge the taste of food samples using a quantitative parameter. The results may depend on multiple factors (e.g. hunger or satiety, age of individuals, or temperature of food). Is it possible to detect statistically significant differences? Propose a study concerning the perception of taste.

16. Invent Yourself: Soap production
Vegetable and animal oils and fats are historically used to make soap. Investigate how physical and chemical properties of such soap depend on ingredients and recipes, and propose an interesting problem concerning soap-making from easily accessible ingredients.

17. Invent Yourself: Weight
The weight of a living organism is not constant. Propose an interesting study concerning short-term or long-term variations in the total body mass of a living organism.