

# 2022 年 IYPT 题目清单

## Problems for the 35<sup>th</sup> IYPT 2022

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### 1. Invent Yourself 自己创造

Create a non-invasive device that determines the direction of fluid flow inside an opaque pipe. Optimise your device so that you can measure the smallest flow possible.

创造一种非侵入式的设备以确定流体在不透明管道内的流动方向。优化你的创造，让它能尽可能地测量较小的液流。

### 2. Rayleigh Disk 瑞利盘

A disk suspended vertically by a thin thread is placed in an acoustic field. This device can be used to measure the intensity of sound by turning about the axis of the thread. Investigate the accuracy of such a device.

在声场中放置一个由细线垂直悬挂的圆盘，可以通过测量圆盘的绕线扭转来测量声场中的声强，讨论这种设备的测量准确性。

### 3. Ring on the Rod 杆上的环

A washer on a vertical steel rod may start spinning instead of simply sliding down. Study the motion of the washer and investigate what determines the terminal velocity.

套在竖直钢杆上的垫圈可能开始旋转，而不是简单地滑下。研究垫圈的运动并探讨那些变量决定了垫圈的最终速度。

### 4. Unsinkable Disk 不会沉的盘子

A metal disk with a hole at its centre sinks in a container filled with water. When a vertical water jet hits the centre of the disc, it may float on the water surface. Explain this phenomenon and investigate the relevant parameters.

一个中间有孔的金属盘沉入一个装满水的容器中，当垂直的射流击中圆盘的中心的时候，圆环就会浮在水面上。解释这一现象并探究相关参数。

### 5. Bimetallic Oscillator 双金属振荡器

A simple electric oscillator can be made using a bimetallic contact-breaker. Investigate the relevant parameters that affect the frequency of such an oscillator.

简单的电子振荡器可以使用双金属接触断路器制成。调查影响这种振荡器频率的相关参数。

### 6. Tennis Ball Tower 网球塔

Build a tower by stacking tennis balls using three balls per layer and a single ball on top. Investigate the structural limits and the stability of such a tower. How does the situation change when more than three balls per each layer and a suitable number of balls on the top layer are used?

通过每层使用三个球，顶部放置一个球来制造一个塔。研究这种塔的结构极限和稳定性。如果每层使用超过三个球，并且在顶层上使用适量的球，情况会如何变化？

### 7. Three-Sided Dice 三面骰子

To land a coin on its side is often associated with the idea of a rare occurrence. What should be the physical and geometrical characteristics of a cylindrical dice so that it has the same probability to land on its side and one of its faces?

在抛硬币时，硬币能够竖着立起来的情况是罕见的。如果一个圆柱状骰子立在侧边上和立在面上的概率是相等的，那么这个骰子应当具备什么样的物理和几何特征？

## 8. Equipotential Lines 等势线

Place two electrodes into water, supply a safe voltage and use a voltmeter to determine electric potential at various locations. Investigate how the measured equipotential lines deviate from your expectations for different conditions and liquids.

在水中放置两个电极，通入一个安全的电压并利用一个电压表来确定不同位置的电势。探究在不同的情况和液体中，实际的电势分布是如何偏离你所预计的电势分布的。

## 9. Water Spiral 螺旋状的水

If a stream of liquid is launched through a small hole, then under certain conditions it twists into a spiral. Explain this phenomenon and investigate the conditions under which the spiral will twist.

如果一个射流穿过一个小孔，在一些特定的情况下，它就会扭成螺旋状。解释这个现象并探究在什么情况下水流将会扭转。

## 10. Droplet Explosion 液滴爆炸

When a drop of a water mixture (e.g. water-alcohol) is deposited on the surface of a hydrophobic liquid (e.g. vegetable oil), the resulting drop may sometimes fragment into smaller droplets. Investigate the parameters that affect the fragmentation and the size of the final droplets.

当一滴水基溶液（比如乙醇和水互溶）滴在疏水性液体（比如菜油）的表面上时，由此产生的小液滴有时会碎裂成更小的液滴，研究影响这一现象的相关参数和液滴最终的大小。

## 11. Balls on an Elastic Band 橡皮筋儿上的球

Connect two metal balls with an elastic band, then twist the elastic band and put the balls on a table. The balls will begin to spin in one direction, then in the other. Explain this phenomenon and investigate how the behaviour of such a "pendulum" depends on the relevant parameters.

用一个橡皮筋把两个球连在一起，然后扭转橡皮筋并把这两个球放在桌面上。两个球会先向一个方向旋转，再向另一个方向旋转。解释这种现象并探究这种类似“摆”的现象是如何取决于相关参数的。

## 12. Strange Motion 奇怪的运动

Sprinkle small floating particles on the surface of water in a bowl. Bring a strong magnet above and near to the water surface. Explain any observed motion of the particles.

在水面上撒一些小的可以浮起来的颗粒，在接近水面的上方放置一个强磁铁，解释任何观察到的现象。

## 13. Candle Powered Turbine 蜡烛带动的涡轮

A paper spiral suspended above a candle starts to rotate. Optimise the setup for maximum torque.

一张悬挂在蜡烛上方的螺旋纸片可以开始旋转，优化其初始条件以获得最大力矩。

## 14. Ball on Membrane 膜上的球

When dropping a metal ball on a rubber membrane stretched over a plastic cup, a sound can be heard. Explain the origin of this sound and explore how its characteristics depend on relevant parameters.

当一个金属球掉落到覆盖在塑料杯上的橡胶膜时，可以听到声音。解释声音的来源并探究声音的特性是如何被相关参数所决定的。

## 15. Boycott Effect 阻抗现象

If particles are suspended in a liquid that has a lower density than the particles, the particles will settle to the bottom of the container. The rate of settling can be affected by tilting the container that holds the liquid. Explain this phenomenon and investigate the effect of relevant parameters.

如果一个颗粒被放在密度小于它的液体中，最终它会落在容器的最底端。倾斜容器可以影响这一下落速度。解释这一现象并探究相关参数对其的影响。

## **16. Saving Honey 拯救蜂蜜**

When rotating a rod coated with a viscous liquid (e.g. honey), under certain conditions the liquid will stop draining. Investigate this phenomenon.

当一根被粘稠液体覆盖的杆旋转时（比如：蜂蜜）。在特定的条件下液体会停止往下流。研究这一现象。

## **17. Invisibility 隐形**

Lenticular lenses can be used to distort light and make objects disappear. Investigate how changing the properties of the lens and the geometry of the object affect the extent to which the object can be detected.

透镜可以用来折射光线并使物体消失。研究改变透镜性质和所测物体几何形状如何影响物体的可见度。