

Problems for the 31st IYPT 2018

Released by the IOC on July 13th, 2017

1. Invent Yourself

Construct a simple seismograph that amplifies a local disturbance by mechanical, optical or electrical methods. Determine the typical response curve of your device and investigate the parameters of the damping constant. What is the maximum amplification that you can achieve?

1. 你来发明

构造一个简单的地震仪，能通过机械、光学或电气方法放大局部干扰。确定设备的典型响应曲线并调查阻尼常数的参数。您可以实现的最大放大倍数是多少？

2. Colour of Powders

If a coloured material is ground to a powder, in some cases the resulting powder may have a different colour to that of the original material. Investigate how the degree of grinding affects the apparent colour of the powder.

2. 粉末的颜色

如果将有色材料研磨成粉末，在某些情况下，所得到的粉末可能具有与原始材料不同的颜色。调查研磨程度如何影响粉末的表现颜色。

3. Dancing Coin

Take a strongly cooled bottle and put a coin on its neck. Over time you will hear a noise and see movements of the coin. Explain this phenomenon and investigate how the relevant parameters affect the dance.

3. 跳舞的硬币

拿一个强烈冷却的瓶子，然后把一个硬币放在瓶颈口上。一段时间后你会听到噪音并观察到这个硬币的运动。解释这一现象，并调查相关参数如何影响这个舞蹈。

4. Heron's Fountain

Construct a Heron's fountain and explain how it works. Investigate how the relevant parameters affect the height of the water jet.

4. 海伦喷泉

构造一个海伦喷泉并解释它怎样工作。研究相关参数是如何影响水柱高度的。

5. Drinking Straw

When a drinking straw is placed in a glass of carbonated drink, it can rise up, sometimes toppling over the edge of the glass. Investigate and explain the motion of the straw and determine the conditions under which the straw will topple.

5. 吸管

当吸管放置在碳酸饮料中时，它可能会升高，有时也会翻倒在杯沿上。研究并解释吸管的运动，确定吸管倒伏的条件。

6. Ring Oiler

An oiled horizontal cylindrical shaft rotates around its axis at constant speed. Make a ring from a cardboard disc with the inner diameter roughly twice the diameter of the shaft and put the ring on the shaft. Depending on the tilt of the ring, it can travel along the shaft in either direction. Investigate the phenomenon.

6. 环形润滑器

先让涂油的水平圆柱轴以恒定速度绕其轴线旋转。再用纸板盘制作一个圆环，内径约为轴直径的两倍，并将其放在圆柱轴上。由于倾斜，圆环可以沿着轴的任一方向行进。探究这个现象。

7. Conical Piles

Non-adhesive granular materials can be poured such that they form a cone-like pile. Investigate the parameters that affect the formation of the cone and the angle it makes with the ground.

7. 锥形桩

非粘性颗粒材料可以被浇筑形成一个圆锥形的桩。研究影响椎体形成的参数及其与地面形成的角度。

8. Cusps in a Cylinder

A horizontal cylinder is partially filled with a viscous fluid. When the cylinder is rotated around its axis, unusual fluid behaviour can be observed, such as cusp-like shapes on the walls of the cylinder. Investigate the phenomenon.

8. 圆柱中的尖端

一个水平圆柱内部分填充粘性流体，当圆柱体绕其轴线旋转时，可以观察到异常的流体行为，如圆柱体壁上的尖端形状。研究这个现象。

9. Candle in Water

Add some weight to a candle such that it barely floats in water. As the candle burns, it may continue to float. Investigate and explain this phenomenon.

9. 水中的蜡烛

给蜡烛加些重量，这样蜡烛就几乎无法浮在水里了。当蜡烛燃烧时，它可能继续漂浮。调查并解释这种现象。

10. Tesla Valve

A Tesla valve is a fixed-geometry, passive, one-direction valve. A Tesla valve offers a resistance to flow that is much greater in one direction compared to the other. Create such a Tesla valve and investigate its relevant parameters.

10. 特斯拉阀

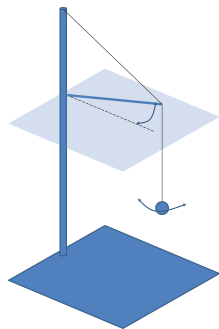
特斯拉阀是一个固定几何形状的、被动式单向阀（瓣膜管道）。选定一个方向后，一个特斯拉阀可以在相反方向上提供了一个大得多的流动阻力（即提供单向流体通道）。创建这样的特斯拉阀，并研究相关参数。

11. Azimuthal-Radial Pendulum

Fix one end of a horizontal elastic rod to a rigid stand. Support the other end of the rod with a taut string to avoid vertical deflection and suspend a bob from it on another string (see figure). In the resulting pendulum the radial oscillations (parallel to the rod) can spontaneously convert into azimuthal oscillations (perpendicular to the rod) and vice versa. Investigate the phenomenon.

11.方位径向摆

将水平弹性杆的一端固定在刚性支架上。用一根绷紧的绳子支撑弹性杆的另一端以避免垂直偏转，并将一个摆从另一根弦上悬挂下来。在产生的钟摆中，径向振荡（平行于杆）可以自发地转变为方位振荡（垂直于杆），反之亦然。研究这个现象。



12. Curie Point Engine

Make a nickel disc that can rotate freely around its axis. Place a magnet near the edge of the disc and heat this side of it. The disc starts to rotate. Investigate the parameters affecting the rotation and optimize the design for a steady motion.

12.居里点发动机

制作一个可以绕轴自由旋转的镍盘。在圆盘边缘放一块磁铁并加热它的这一面。圆盘开始旋转。研究影响旋转的参数，并对圆盘的稳定运动进行优化设计。

13. Weighing Time

It is commonly known that an hourglass changes its weight (as measured by a scale) while flowing. Investigate this phenomenon.

称重时间

众所周知，沙漏的质量（以某种方式称量）会随沙子的流动而发生变化，请探究这一现象。

14. Radiant Lantern

When taking a picture of a glowing lantern at night, a number of rays emanating from the centre of the lantern may appear in the pictures. Explain and investigate this phenomenon.

14 提灯的辐射

在晚上给一个点燃的提灯拍照，会有大量从提灯中心发出的光线显示在照片上。试解释并探究这一现象。

15. Blowing Bubbles

When blowing on a soap film in a ring, a bubble may be formed. The liquid film may pop or

continue to exist. Investigate how the number of bubbles produced from a single soap film and the characteristics of the bubbles depend on the relevant parameters.

15 吹泡泡

11.当你有一个附有肥皂膜的圆环时，可能会生成一个肥皂泡。而这之后液面可能会直接破掉，也可能会继续存在。试探究相关参数如何决定一个液面可以生成的泡泡数量以及生成的泡泡的特征。

16. Acoustic Levitation

Small objects can levitate in acoustic standing waves. Investigate the phenomenon. To what extent can you manipulate the objects?

16.声波悬浮

较小的物体可以在驻声波中悬浮，试探究这一现象。另外，你可以多大程度地操纵这个物体？

17. Water Bottle

The current craze of water bottle flipping involves launching a partially filled plastic bottle into the air so that it performs a somersault before landing on a horizontal surface in a stable, upright position. Investigate the phenomenon and determine the parameters that will result in a successful flip.

17.水瓶

当下十分火热的水瓶投掷游戏操作如下：把一个半满的塑料水瓶发射到空中，使它先翻一个筋斗然后平稳垂直地落在水平地面上。试探究这一现象，并指出怎样的参数可以使游戏成功。

以上题目均以英语原文为准，中文翻译仅供参考。想要获取更多信息，可以扫描下方二维码，关注 IYPT 公众号。

