

### 1. Invent Yourself

Design an instrument for measuring current using its heating effect. What are the accuracy, precision and limits of the method?

#### 1. 自己发明

设计一种利用热效应测量电流的仪器。该方法的准确度、精密度和局限性是什么？

### 2. Inconspicuous Bottle

Put a lit candle behind a bottle. If you blow on the bottle from the opposite side, the candle may go out, as if the bottle was not there at all. Explain the phenomenon.

#### 2. 不起眼的瓶子

将点燃的蜡烛放在瓶子后面。如果你从蜡烛的对面吹瓶子，蜡烛同样可能熄灭，好像瓶子根本就不在那里。解释这个现象。

### 3. Swinging Sound Tube

A Sound Tube is a toy, consisting of a corrugated plastic tube, that you can spin around to produce sounds. Study the characteristics of the sounds produced by such toys, and how they are affected by the relevant parameters.

#### 3. 摇摆的声管

声管是一种玩具，由波纹塑料管组成，你可以旋转声管产生声音。研究这些玩具发出的声音的特性，以及它们如何受到相关参数的影响。

### 4. Singing Ferrite

Insert a ferrite rod into a coil fed from a signal generator. At some frequencies the rod begins to produce a sound. Investigate the phenomenon.

#### 4. “歌神”铁氧体

将铁氧体棒插入信号发生器供电的线圈中。在某些频率下，铁氧体棒开始发出声音。研究这一现象。

### 5. Sweet Mirage

Fata Morgana is the name given to a particular form of mirage. A similar effect can be produced by shining a laser through a fluid with a refractive index gradient. Investigate the phenomenon.

#### 5. 甜蜜的海市蜃楼

法塔莫干纳是一种特殊形式的海市蜃楼的名字。而使用激光照射具有折射率梯度的流体时，也会产生类似的效果。研究这一现象。

### 6. Saxon Bowl

A bowl with a hole in its base will sink when placed in water. The Saxons used this device for timing purposes. Investigate the parameters that determine the time of

sinking.

#### 6. 撒克逊碗

一个底部有洞的碗放在水中会下沉。撒克逊人用这个装置来计时。研究决定下沉时间的参数。

#### 7. Balls on a String

Put a string through a ball with a hole in it such that the ball can move freely along the string. Attach another ball to one end of the string. When you move the free end periodically, you can observe complex movements of the two balls. Investigate the phenomenon.

#### 7. 绳子上的球

将绳子穿过一个带有洞的球，这样球就可以沿着绳子自由移动。把另一个球系在绳子的一端。当你周期性地移动绳子的自由端时，你可以观察到两个球的复杂运动。研究这一现象。

#### 8. Soap Membrane Filter

A heavy particle may fall through a horizontal soap film without rupturing it. However, a light particle may not penetrate the film and may remain on its surface. Investigate the properties of such a membrane filter.

#### 8. 肥皂膜过滤器

一个重颗粒可以通过一个水平的肥皂膜而不会使其破裂。然而，轻粒子可能无法穿透膜并可能停留在其表面上。研究这种膜过滤器的性能。

#### 9. Magnetic Levitation

Under certain circumstances, the “flea” of a magnetic stirrer can rise up and levitate stably in a viscous fluid during stirring. Investigate the origins of the dynamic stabilization of the “flea” and how it depends on the relevant parameters.

#### 9. 磁悬浮

在某些特定情况下，磁力搅拌器的“搅拌子”在搅拌时，能在粘性流体中稳定地上升和悬浮。研究“搅拌子”动态稳定的起源，以及它如何依赖相关参数。

#### 10. Conducting Lines

A line drawn with a pencil on paper can be electrically conducting. Investigate the characteristics of the conducting line.

#### 10. 画出来的导线

用铅笔在纸上画的线可以导电。研究这种导线特性。

#### 11. Drifting Speckles

Shine a laser beam onto a dark surface. A granular pattern can be seen inside the spot.

When the pattern is observed by a camera or the eye, that is moving slowly, the pattern seems to drift relative to the surface. Explain the phenomenon and investigate how the drift depends on relevant parameters.

#### 11. 漂移的斑点

将激光束照射到黑暗表面上。在斑点内可以看到颗粒状图案。当用相机或人眼观察这个图案时，图案似乎在缓慢移动，图案相对于表面似乎在漂移。解释现象并研究漂移如何取决于相关参数。

#### 12. Polygon Vortex

A stationary cylindrical vessel containing a rotating plate near the bottle surface is partially filled with liquid. Under certain conditions, the shape of the liquid surface becomes polygon-like. Explain this phenomenon and investigate the dependence on the relevant parameters.

#### 12. 多边形涡流

在瓶面附近装有旋转板的静止圆柱形容器中，部分装有液体。在一定条件下，液体表面的形状会变成多边形。解释这一现象并研究其对相关参数的依赖性。

#### 13. Friction Oscillator

A massive object is placed onto two identical parallel horizontal cylinders. The two cylinders each rotate with the same angular velocity, but in opposite directions. Investigate how the motion of the object on the cylinders depends on the relevant parameters.

#### 13. 摩擦振子

一个大块的物体被放置在两个相同的平行水平圆柱体上。两个圆柱各自以相同的角速度旋转，但方向相反。研究物体在圆柱体上的运动如何依赖于相关参数。

#### 14. Falling Tower

Identical discs are stacked one on top of another to form a freestanding tower. The bottom disc can be removed by applying a sudden horizontal force such that the rest of the tower will drop down onto the surface and the tower remains standing. Investigate the phenomenon and determine the conditions that allow the tower to remain standing.

#### 14. 下落的塔

相同的圆盘，一个叠在另一个上面，形成一个独立的塔。当塔底部的圆盘通过施加一个突然的水平力来移除，塔身的其余部分就会掉落到底面上，并依然保持直立状态。研究该现象并确定允许塔保持静止直立的条件。

#### 15. Pepper Pot

If you take a salt or pepper pot and just shake it, the contents will pour out relatively slowly. However, if an object is rubbed along the bottom of the pot, then the rate

of pouring can increase dramatically. Explain this phenomenon and investigate how the rate depends on the relevant parameters.

#### 15. 胡椒罐

如果你拿一个盐或胡椒罐，摇晃罐子，里面的东西就会慢慢地倒出来。然而，如果一个物体沿罐底摩擦，则倒出速度会显著增加。解释这种现象，并研究倒出速度如何依赖于相关参数。

#### 16. Nitinol Engine

Place a nitinol wire loop around two pulleys with their axes located at some distance from each other. If one of the pulleys is immersed into hot water, the wire tends to straighten, causing a rotation of the pulleys. Investigate the properties of such an engine.

#### 16. 镍钛合金发动机

将镍钛合金线圈绕在两个滑轮上，同时两个滑轮的轴彼此相距一定距离。如果其中一个滑轮浸入热水中，金属丝就会变直，导致滑轮转动。研究这种发动机的性能。

#### 17. Playing Card

A standard playing card can travel a very long distance provided that spin is imparted as it is thrown. Investigate the parameters that affect the distance and the trajectory

#### 17. 玩纸牌

一张标准的扑克牌只要在投掷的过程中旋转，就可以运动很长的一段距离。研究影响距离和轨迹的参数