

1. Invent yourself: Paper boomerang

Make a **returning boomerang** from a sheet of **paper** by **folding and/or cutting**. Investigate how its **motion** depends on **relevant parameters**.

自己发明：纸制回旋镖

通过将一张**纸**进行**折叠和/或裁剪**制作一个**回旋镖**。探究回旋镖的**运动**如何依赖于**相关参数**。

2. Air muscle

Place a **balloon** inside a **cylindrical net** (as is sometimes used to wrap garlic) and **inflate** it. The net will **expand** and **shorten**. Investigate the **properties** of such a “muscle”.

空气肌肉

将**气球**置于**柱状的网**（就像有时用于装大蒜的网）内并**充气**，网会**膨胀**并**缩短**。探究这种“肌肉”的**性质**。

3. Lato Lato

Attach a **ball** to **each end** of a **string** and connect the **center of the string** to a **pivot**. When the pivot **oscillates** along the **vertical direction**, the balls start to **collide** and **oscillate** with **increasing amplitude**. Investigate the phenomenon.

拉托拉托

在**线**的**两端**各系一个**小球**并将线的**中点**连接在一个**支点**上。当支点在**竖直方向**振动时，小球开始**碰撞**和**振荡**，且**振幅**逐渐**增加**。探究这一现象。

4. Climbing magnets

Attach a **rod assembled from cylindrical neodymium magnets horizontally** to a **vertical ferromagnetic rod**. Limit the motion of the magnets to the **vertical direction**. When the ferromagnetic rod is **spun** around its **axis of symmetry**, the magnetic rod begins to **climb up**. Explain this phenomenon and investigate how the **rate of climbing** depends on **relevant parameters**.

攀爬磁铁

将一个由**柱状钕磁铁**组成的**杆**水平附着在一个**竖直的铁磁杆**上。磁铁的运动限制在**竖直方向**。当铁磁杆**绕其对称轴转动**时，磁铁杆开始**向上攀爬**。解释这一现象并探究**攀爬速率**如何依赖于**相关参数**。

5. Dancing slinky

Twist a slinky several times and keep its bottom fixed. After releasing the top, the slinky starts to “dance” - wave-like phenomenon can be observed from the side-view. Explain the phenomenon and investigate the parameters affecting the slinky’s motion.

跳舞的弹簧

将一个弹簧玩具扭转多次并固定其底端。当释放顶端时，弹簧开始“跳舞”，即从侧面可以观察到波状的现象。解释这一现象并探究影响弹簧运动的参数。

6. Dripping faucet

A leaky faucet develops interesting dripping patterns, where the time between drops depends on the water flowrate. Investigate this phenomenon and study how it depends on relevant parameters.

滴水龙头

一个滴水的水龙头可以展现出有趣的滴水模式，其中水滴之间的时间间隔依赖于水的流速。探究这一现象并研究其如何依赖于相关参数。

7. Ruler cannon

Two rulers are tightly held against each other. A round projectile (e. g. a plastic bottle cap or a ball) is inserted between them close to one of their ends. When extra force is exerted on the surface of the rulers, the projectile is ejected at a high speed. Investigate this effect and the parameters that affect ejection speed.

尺子加农炮

将两把尺子紧紧地捏在一起，在它们一端的位置将一个圆形炮弹（如塑料瓶盖或小球）插入两尺之间。当在尺子的表面施加一个额外的力时，炮弹将以很高的速率射出。探究这个效应以及影响出射速度的参数。

8. Levitating fluid

When a container partially filled with liquid is oscillated vertically and air is injected at the bottom of the container, the fluid can “levitate”. Investigate the phenomenon.

悬浮的液体

当一个部分装有液体的容器在竖直方向振荡并在底部注入空气时，液体会“悬浮”起来。探究这一现象。

9. Magnetic assist

Attach **one or two magnets** to a **non-magnetic** and **non-conductive** base such that they **attract** a magnet **suspended from a string**. Investigate how the **motion** of the moving magnet depends on **relevant parameters**.

磁力辅助

将**一或两个磁铁**固定在**非磁性的绝缘**底座上,在上方用**细线悬挂**另一个磁铁使之可以与底座上的磁铁**相互吸引**。探究上方磁铁的**运动**如何依赖于**相关参数**。

10. Rayleigh-Benard convection

Uniformly and gently heat the **bottom** of a container containing a **suspension of powder in oil** (e. g. mica powder in silicon oil), **cell-like structures** may form. Explain and investigate this phenomenon.

瑞利-伯纳德对流

将一个装有**油中加入粉末**(如硅油中加入云母粉)**悬浊液**的容器从**底部温和且均匀地加热**,悬浊液中可能会出现**细胞状的结构**。解释并探究这一现象。

11. Spring hysteresis

Connect **two identical linear springs symmetrically** to a mass in a **“V” shape**, and apply an **adjustable force** to the mass. When this force is **varied**, the resulting motion of the mass depends on the **history of changes** in the applied force under **certain conditions**. Investigate this phenomenon.

弹滞现象

将**两个相同的线性弹簧**以**“V”字形对称**地连接在一个物体上,并在物体上施加一个**可以调节的力**。当力**变化**时,在**特定条件**下,物体的运动会依赖于施加力的**变化历史**。探究这一现象。

12. Sound versus fire

A **small flame** can be **put out** by **sound**. Investigate the **parameters of the flame** and **characteristics of the sound** that determine **whether** the flame will be **extinguished**.

声音灭火

声音可以**扑灭小的火焰**。探究**火焰的参数**和**声音的特征**以确定声音**是否可以扑灭火焰**。

13. Spaghetti accelerator

When a piece of **spaghetti** is pushed into a **bent tube**, **small debris** of spaghetti may be **ejected** from **the other end** of the tube at a **surprisingly**

high speed. Investigate this phenomenon.

意大利面加速器

将一根**意大利面**推进一段**弯管**，意大利面的**小碎屑**可能会以**惊人的速率**从管的**另一端**射出。探究这一现象。

14. Water bottle rocket

Pump air into a **plastic water bottle partially filled** with water. Under **certain conditions**, the bottle is **launched** and **flies into the air**. Investigate how the **acceleration** during **lift-off** depends on **relevant parameters**.

水瓶火箭

向**部分装水**的**塑料瓶子**中**打气**，在**特定的条件下**，瓶子可以被**发射**并**飞向空中**。探究**起飞过程中的加速度**如何依赖于**相关参数**。

15. Wailing bowl

When you **strike** the **side** of a **metal bowl** containing **some water**, you can hear a **characteristic sound**. The sound **changes** when the water in the bowl is **moving**. Explain and investigate the phenomenon.

哭泣的碗

当**敲击**一个装有**一些水**的**金属碗**的**侧面**时，你会听到一种**特定的声音**。当碗中的水**运动**时，听到的声音也会发生**变化**。解释并探究这一现象。

16. Wirtz pump

A **Wirtz pump** is a **hollow spiral**, mounted **vertically**. It is arranged such that one end **dips below water once per revolution**, while the other end (at the center of the spiral) is connected to a **vertical tube**. When **rotated**, it can be used to **pump water** to a **great height**. Explain this phenomenon and investigate how **relevant parameters** affect the **pumping height**.

维尔茨泵

维尔茨泵是一个**竖直**安装的**空心螺旋**装置。它被设计成**每转一圈**，其一端就会**浸入水中**一次。而其另一端（位于螺旋的中心）则连接到一根**竖直的管**上。当装置**旋转**时，它可以用来将水**泵到很高的高度**。解释这一现象并探究**相关参数**是如何影响**泵水高度**的。

17. Quantum fingerprint

Shine **laser light** onto an **organic polymer** (eg. styrofoam). The **scattered**

light may have a higher or lower wavelength than the incident light. Explain the phenomenon and determine what can be concluded about the molecular structure of the material from the wavelength shift.

量子指纹

将激光照射到有机多聚物（如聚苯乙烯泡沫）上。与入射光相比，散射光的波长将会增加或减小。解释这一现象并确定通过波长的移动可以得到哪些关于材料分子结构的结论。