1. Fractal Fingers 分形手指

The effect of fractal fingering can be observed if a droplet of an ink-alcohol mixture is deposited onto diluted acrylic paint. How are the geometry and dynamics of the fingers influenced by relevant parameters?

如果将一滴墨水与酒精的混合物滴在稀释的丙烯酸涂料上，则可以观察到分形手指的效果。请问手指的几何形状和 动力学是如何受相关参数影响的？

2. Oscillating Sphere 摆动球

A light sphere with a conducting surface is suspended from a thin wire. When the sphere is rotated about its vertical axis (thereby twisting the wire) and then released, it starts to oscillate. Investigate how the presence of a magnetic field affects the motion.

将一个表面导电的轻球悬挂在一根细电线上，当球体绕其垂直方向旋转（从而使电线转动扭曲）后释放，轻球开始 振荡。请研究磁场的存在是如何影响该运动的。

3. Siren 汽笛

If you direct an air flow onto a rotating disk with holes, a sound may be heard. Explain this phenomenon and investigate how the sound characteristics depend on the relevant parameters.

如果你将气流引导到一个带孔的旋转盘上，可能会听到声音。请解释这一现象并调查声音特性如何依赖于相关参数。

4. Coloured Line 彩色线

When a compact disc or DVD is illuminated with light coming from a filament lamp in such a way that only rays with large angles of incidence are selected, a clear green line can be observed. The colour varies upon slightly changing the angle of the disc. Explain and investigate this phenomenon.

利用白炽灯发出的大入射角的光照射光盘或 DVD 上，可以观察到一条清晰的绿线。颜色会随着圆盘角度的轻微变 化而变化。请解释和研究这一现象。

5. Whistling Mesh 口哨网

When a stream of water hits a rigid metal mesh within a range of angles, a whistling tone may be heard. Investigate how the properties of the mesh, stream and angle affect the characteristics of the sound produced.

当水流在一定角度范围内撞击刚性金属网时，可能会听到哨声。研究金属网格、水流和角度的特性是如何影响所产 生的声音的。

6. Magnetic-Mechanical Oscillator 磁机械振荡器

Secure the lower ends of two identical leaf springs to a non-magnetic base and attach magnets to the upper ends such that they repel and are free to move. Investigate how the movement of the springs depends on relevant parameters.

将两个相同的叶片弹簧的下端固定到非磁性底座上，并将磁铁连接到弹簧上端，使它们相互排斥并可以自由移动。 研究弹簧的运动是如何取决于相关参数的。

7. Faraday Waves 法拉第波

A droplet of less viscous liquid floating in a bath of a more viscous liquid develops surprising wave-like patterns when the entire system is set into vertical oscillation. Investigate this phenomenon and the parameters relevant to the production of stable patterns.

当整个系统处于垂直振荡的状态时，漂浮在粘度更高的液体中的粘度较低的液滴会产生令人惊讶的波浪状图案。研 究这种现象以及产生该稳定状态的相关参数。

8. Euler's Pendulum 欧拉摆

Take a thick plate of non-magnetic material and fix a neodymium magnet on top of it. Suspend a magnetic rod (which can be assembled from cylindrical neodymium magnets) underneath it. Deflect the rod so that it touches the plate only with highest edge and release it. Study the motion of such a pendulum under various conditions.

取一块厚的无磁性的板子，在上面固定一块钕磁铁。在其下方悬挂一根磁棒（可以由圆柱形钕磁铁组装而成）。将 磁棒偏转，使其只有最高处的边缘接触到板子，然后释放它。研究这种摆在各种条件下的运动。

9. Oscillating Screw 振荡的螺丝钉

When placed on its side on a ramp and released, a screw may experience growing oscillations as it travels down the ramp. Investigate how the motion of the screw, as well as the growth of these oscillations depend on the relevant parameters.

当把一个螺丝放在斜坡上并松开时，它沿着斜坡向下运动的同时可能会产生越来越大的振荡。研究螺丝的运动，以 及这些振荡的增长所依赖的相关参数。

10. Upstream Flow 上游流

Sprinkle light particles on a water surface. Then allow a water stream to be incident on the surface from a small height. Under certain conditions, the particles may begin to move up the stream. Investigate and explain this phenomenon.

在水面上撒上轻粒子。然后允许水流从很小的高度入射到水面。在某些条件下，粒子可能开始沿水流向上移动。研究并解释这一现象。

11. Ball on Ferrite Rod 铁氧体棒上的球

A ferrite rod is placed at the bottom end of a vertical tube. Apply an ac voltage, of a frequency of the same order as the natural frequency of the rod, to a fine wire coil wrapped around its lower end. When a ball is placed on top of the rod, it will start to bounce. Explain and investigate this phenomenon.

铁氧体棒放置在垂直管的底端。将频率与铁氧体棒固有频率同阶的交流电压加到细线圈上（包裹在棒下端）。当一个球放在铁氧体棒顶部时，球就会开始反弹。研究并解释这一现象。

12. Rice Kettlebells 米壶铃

Take a vessel and pour some granular material into it, for example, rice. If you dip e.g. a spoon into it, then at a certain depth of immersion, you can lift the vessel and

contents by holding the spoon. Explain this phenomenon and explore the relevant parameters of the system.
取一个容器，并倒入一些颗粒状物质，如大米。如果把勺子浸入其中，并达到一定浸入深度，可以通过勺子举起该 容器及其内部颗粒物质。解释这一现象并探索系统的相关参数。

13. Ponyo's Heat Tube　Ponyo 热管
A glass tube with a sealed top is filled with water and mounted vertically. The bottom end of the tube is immersed in a beaker of water and a short segment of the tube is heated. Investigate and explain the periodic motion of the water and any vapour bubbles observed.
将一个玻璃管（顶部密封）中灌满水并垂直安装。玻璃管底端浸在盛有水的烧杯中，对玻璃管的一小段进行加热。研究并解释水和观察到的气泡的周期性运动。

14. Jet Refraction 射流折射
A vertical jet can be refracted when passing through an inclined sieve with a fine mesh. Propose a law for such refraction and investigate relevant parameters.
一束垂直射流通过带有细网的斜筛时，会发生折射。总结提出这类折射的规律并研究相关参数。

15. Pancake Rotation 煎饼旋转
Place a few balls in a round container. If you move the container around a vertical axis, the balls can move co-directionally with the movement of the container, or they can move in the opposite direction. Explain this phenomenon and investigate how the direction of movement depends on relevant parameters.
将几个球放入圆形容器中。如果围绕垂直轴移动容器，则球可以随容器的移动一起同向移动，也可以沿相反方向移 动。解释这种现象，并研究运动方向取决于哪些相关参数。

16. Thermoacoustic Engine 热声发动机
A piston placed in the open end of a horizontal test tube which has its other end partially filled with steel wool may oscillate when the closed end is heated up. Investigate the phenomenon and determine the efficiency of this engine.
将一个活塞放在水平放置的试管的开口端，试管另一端封闭端部分用钢丝绒填充。当试管封闭端被加热时，活塞可 能会振动。研究该现象并确定该发动机的效率。

17. Arrester Bed 沙池
A sand-filled lane results in the dissipation of the kinetic energy of a moving vehicle. What length is necessary for such an arrester bed to entirely stop a passively moving object (e.g. a ball)? What parameters does the length depend on? 被沙子覆盖的车道会导致行驶车辆的动能损耗。如果要使一个被动移动的物体（例如一个球）完全停止，这样的沙 地需要多长。长度取决于哪些参数。


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