

A组

A1.Invent Yourself 自己发明



A self-starting siphon can be made using a piece of rigid tubing bent into a specific shape. When the siphon is partially immersed in water, it begins siphoning water without the need for initial suction. Investigate how the relevant parameters, such as the geometry, affect the siphoning process.

一种自启动虹吸管可通过将刚性管弯曲成特定形状制成。当此虹吸管局部浸入水中时，无需初始抽吸即可开始虹吸。研究相关参数（如几何形状）对虹吸过程的影响。

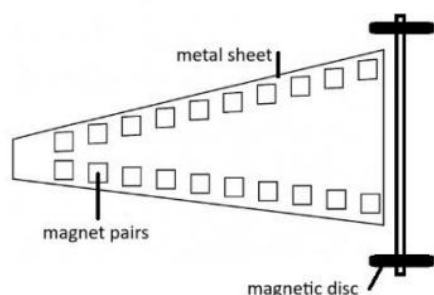
A2.Flipo Flip 翻转玩具



A Flipo Flip toy can roll for multiple turns even though its shape is not circular. Investigate how its motion depends on parameters such as geometry and the initial release conditions.

Flipo Flip 玩具能滚动多圈，即使其形状并非圆形。研究其运动如何依赖于相关参数，例如几何参数及初始释放条件。

A3.Magnetic accelerator 磁铁加速器



Fix magnets in pairs onto a metal sheet as shown. If you attach two magnetic discs onto an axle this

“vehicle” will accelerate over the rows of magnets under certain conditions. Investigate the phenomenon.

如图所示，成对的磁铁放置到金属板上。如果你将两个圆柱磁安装到一个轴上，这个“车辆”将会在特定条件下在这一排排磁铁上加速前进。探究这一现象。

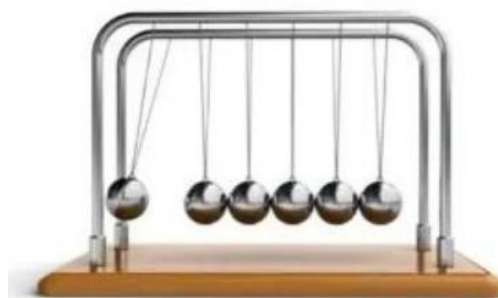
A4.Autumn coin 秋叶硬币



The motion of a coin falling to the bottom of a tank filled with liquid can be remarkably similar to the fluttering and tumbling of a falling autumn leaf. Investigate how the motion of the coin depends on relevant parameters.

一个硬币沉到充满液体的水缸里时，其运动与一片扑动(fluttering)飘落(tumbling)的树叶的颤动和翻滚的状态惊人地类似。解释硬币的这种运动如何依赖于相关参数。

A5.Magnetic Newton's cradle 磁力牛顿摆

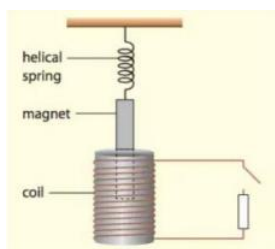


Repulsing, non-touching magnets are used instead of colliding balls to make a new type of Newton's cradle. The new cradle can act in a similar way to a regular cradle, but can also exhibit other interesting behaviour. Explain and study the movement of this magnetic cradle.

用相斥的非接触磁体替代碰撞的球体，制成新型牛顿摆。该装置既可模拟常规牛顿摆的运动，也能呈现其他有趣行为。解释并研究此磁力摆的运动规律。

B组

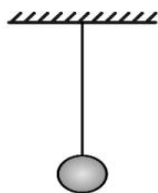
B1. Electrical damping 电阻尼



A magnet suspended by a spring will display simple harmonic motion when displaced. If the magnet oscillates within a coil connected to a resistor, its motion will be damped. Investigate the factors that affect the damping.

一个悬挂在弹簧上的磁铁在发生位移时呈现简谐运动形式。若此磁铁在与电阻相连的线圈内振动，其运动会受到阻尼。探究影响阻尼效果的因素。

B2. Elastic wave dynamics 弹性波动力学



Suspend a metal ball from a fixed support using a rubber band and twist it many times around its vertical axis. When the ball is released, standing waves are formed on the rubber band. Investigate this phenomenon and study how the wave depends on relevant parameters.

用橡皮筋将一金属球悬挂在固定支架上，并绕其竖直轴多次扭转。当松开金属球时，橡皮筋上会形成驻波。研究这一现象并探究波的特性与相关参数的依赖关系。

B3. Sweet monochromator 蔗糖单色仪



Pass linearly polarised white light through a column of sugar solution. When transmitted light is observed through a polariser it may appear

coloured. Rotate the polariser, and the transmitted light colour may change. Construct such a sweet monochromator and optimise for the narrowest light wavelength bandwidth.

让线偏振的白光通过一根充满糖溶液的柱状容器。当透射光通过偏振片观察时，它可能呈现出彩色。旋转偏振片时，透射光的颜色也可能发生变化。搭建这样的一个单色仪并优化其最窄的光谱带宽。

B4. The singing ruler 尺子之歌



When a ruler is clamped at one end and struck, it oscillates and emits a characteristic sound. Investigate how the sound depends on relevant parameters.

当尺子的一端被夹住固定并敲击时，它会振动并发出特有的声音。研究这种声音如何取决于相关参数。

B5. Twisted spaghetti 扭转的意面



When a bundle of spaghetti is twisted, it might withstand higher transverse (side) forces than a straight, untwisted bundle. Investigate the response of a twisted bundle to transverse stress and identify the optimal twist that maximises tolerance to transverse stress.

当一束意面被扭转时，其承受横向（侧向）力的能力可能强于未扭转的直面条束。研究扭转面束对横向应力的响应，确定最大化横向应力耐受下的最佳扭转方式。