

IYPT2025| 第 38 届国际青年物理学家竞赛题目(中文翻译供参考)

Problems for the 38th IYPT 2025

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.

1. 自己发明：纸回旋镖

通过将一张纸折叠/裁剪可以做出回旋镖。探究其运动是如何依赖于相关参数的。

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".

2. 空气肌肉

将一个气球放入圆柱形网(譬如经常用来包裹大蒜的那种)并且向气球中充气，网将会膨胀并且变短。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.

3. 拉拖球

将两个球分别连接到绳子的两端并且将绳子的中点固定到一个支点上，当支点在竖直方向振动时，球将会相撞并且以不断增大的幅度进行震荡。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.

4. 攀爬的磁铁

将一个由钕磁铁堆积形成的棒水平地吸到竖直放置的铁磁体棒上，限制钕磁铁棒只能竖直运动。当铁磁体棒绕其对称轴旋转时，钕磁铁棒将会向上攀爬。解释这一现象并探究相关参量如何影响攀爬速度。

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.

5. 跳舞的彩虹圈

将玩具彩虹圈扭转几圈并且保持其底部固定。松开其顶部后，彩虹圈会开始 "跳舞"。从侧面可以观察到类波状的现象。解释这一现象并研究影响彩虹圈运动的相关参数。

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.

6. 滴水的水龙头

滴水的水龙头会出现有趣的滴水模式：滴水间隔时间将取决于水流量，研究这一现象以及它如何取决于相关参数。

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.

7. 尺子加农炮

把两把尺子紧紧靠在一起，将一个圆形弹丸(如塑料瓶盖或小球)插入两尺之间靠近任一端末尾的位置。当对两把尺子表面施加额外的力时，弹丸会高速射出。研究这一现象以及影响弹射速度的相关参数。

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.

8. 悬浮的液体

当部分装满液体的容器垂直震荡并在容器底部注入空气时，液体会 "悬浮"。研究这一现象。

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.

9. 磁性辅助

将 1 或 2 个磁铁连接到非磁性且不导电的基座上，使得它们吸引被绳子悬挂的磁铁。研究移动磁铁的运动如何依赖相关参数。

10. Rayleigh–Bénard 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.

10. 瑞利-贝纳德对流

均匀且温和地加热装有含粉末悬浮物的油(如云母粉在硅油中)的容器底部，可能会形成细胞状结构。解释并研究此现象。

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.

11. 弹簧滞回

将两个完全相同的线性弹簧以“V 型”对称地连接到一个物块上，然后向物块施加一个可调节的力。当这个力变化时，物块的运动将依赖于在一定条件下外加力的变化历史。研究这个现象。

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.

12. 声音与火焰

一个小火焰可以被声音扑灭。研究火焰的参数和声音的特性如何决定火焰是否被扑灭。

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.

13. 意面加速器

当一根意大利面被推进一个弯管，意面的小碎片将以惊人的速度从管子的另一端喷出。研究此现象。

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.

14. 水火箭

向部分装水的塑料水瓶中泵入空气。在一定条件下，瓶子会被发射并飞向空中。研究火箭离地升空过程中的加速度如何取决于相关参数。

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.

15. 哀鸣碗

当你敲击装有一定量水的金属碗的侧面时，你会听到一种特有的声音。当碗中的水在移动时，这种声音会产生变化。解释并研究这一现象。

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.

16. 威尔茨泵

威尔茨泵是一种垂直安装的中空的螺旋装置。它被如此设计以使得使得螺旋的一端在每次旋转时都会浸入水中，而螺旋的另一端(位于螺旋中心)连接到一根垂直管道。每当旋转时，它可以用于将水提升到很高的高度。解释这一现象，并研究相关参数是如何影响提升高度的。

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.

17. 量子指纹

将激光照射到有机聚合物(例如泡沫聚苯乙烯)上，散射光的波长可能比其入射光波长更长或更短。解释这一现象并确定可从波长的位移中得出的关于材料的分子结构的结论。