

# 113 年 明誠雙語小學 科學園遊會 執行計畫

日期：2023/10/24-25

組別：國際雙語科學組

關鍵字：密度 density、塑膠瓶 plastic bottle、浮力 buoyancy、水 water、鹽巴 salt、糖 sugar、食用色素 food coloring、色彩 color、蜂蜜 honey、牛奶 milk、飽和鹽水 saturated salt water

## 壹、什麼是密度？What is density？

密度定義：

密度是指一物質單位體積下的質量，常用希臘字母  $\rho$  或是英文字母 D (Density) 表示。在數學上，密度定義為質量除以體積的商。

Density refers to the mass of a substance per unit volume and is commonly represented by the Greek letter  $\rho$  (rho) or the letter D (for Density).

Mathematically, density is defined as the quotient of mass divided by volume.

$$D = \frac{M}{V}$$

想像質量是參賽者的“力量”，而體積則是他們占據的“空間”。如果一位參賽者力量大但占據的空間小，他的密度就高，反之則低。

Imagine mass as a contestant's "strength" and volume as the "space" they occupy. If a contestant has great strength but occupies little space, their density is high; conversely, if they have less strength but occupy more space, their density is low.

為什麼密度非常重要？

設計和工程：想像一位建築師在設計一座大樓，他需要知道哪些材料更重，哪些更輕，以確保大樓的穩固。密度幫助他選擇最合適的材料，像是為“重量級”比賽選擇最佳選手。

自然現象：在海洋中，海水的密度變化影響洋流，這就像一場永不停歇的比賽，改變著氣候和生態。

### **Why is Density Important?**

#### **1. Design and Engineering:**

Imagine an architect designing a building; they need to know which materials are heavier and which are lighter to ensure the building's stability. Density helps them choose the most suitable materials, just like selecting the best contenders for a "heavyweight" competition.

#### **2. Natural Phenomena:**

In the ocean, variations in the density of seawater affect ocean currents, resembling a never-ending competition that influences climate and ecosystems. Changes in density can trigger powerful currents, which in turn impact the global climate system.

## 貳、闖關活動

### 活動一：色彩密度大冒險 Color Density Adventure

目的：讓學生了解不同液體的密度差異。

Objective: To help students understand the differences in density among various liquids.

材料：

水、飽和鹽水、牛奶、蜂蜜、量杯、食用色素、各液體標籤

活動方式：

1. 說明密度定義：首先，我們將探討密度的概念。密度是物質質量與體積的比率。我們會為每種液體提供具體的密度值，幫助你們更好地理解這一概念。

Explain Density Definition: First, we will explore the concept of density. Density is the ratio of a substance's mass to its volume. We will provide specific density values for each liquid to help you better understand this concept.

2. 分辨大小：我們將討論密度對液體在杯中排列的影響。密度較大的液體會沉到底部，而密度較小的液體則會浮在上面，這一現象可以幫助我們更直觀地理解密度的大小。
- Distinguish Sizes: Next, we will discuss how density affects the arrangement of liquids in a cup. Denser liquids will settle at the bottom, while less dense liquids will float on top. This phenomenon will help us visualize the differences in density.

3. 貼上標籤：之後我們將為每種液體準備標籤，讓學生將其貼在各自的液體層上。這不僅有助於識別不同的液體，還能強化你們對液體分層的理解。

Attach Labels: Following that, we will prepare labels for each liquid, allowing students to attach them to their respective layers. This not only aids in identifying the different liquids but also reinforces your understanding of liquid layering.

4. 討論：最後我們將進行討論。請分享你們的觀察結果，觀察密度較大的液體是否位於下層，而密度較小的液體是否位於上層。這將有助於深化我們對密度概念的認識。

Discussion: Finally, we will have a discussion. Please share your observations about whether the denser liquids are positioned at the bottom while the less dense liquids are at the top. This will help deepen our understanding of the concept of density.

## 活動二：魔法密度塔 Magic Density Tower

目的：讓學生實際操作了解不同液體的密度差異。

Objective: To allow students to understand the differences in density among various liquids through hands-on experience.

材料：

不同密度的液體（如水、油、飽和糖水、飽和鹽水）、  
小塑膠罐、滴管、食品色素（紅色與藍色）

活動方式：

1. 準備液體：首先我們需要準備三種液體，分別是水、食用油以及糖水或鹽水。為了便於觀察，我們可以用食品色素為水和糖水或鹽水上色。

Prepare the Liquids: First, we need to prepare three types of liquids: water, cooking oil, and either sugar water or salt water. To make observation easier, we can use food coloring to dye the water and sugar water or salt water.

2. 倒入杯中：接下來逐步將每種液體倒入塑膠罐中。我們會從密度最小的液體（也就是油）開始，然後再逐漸添加密度較大的液體，像是水、糖水或鹽水。可以使用滴管輕輕地將液體滴入，以減少攪動，保持層次分明。

Pour into the Container: Next, gradually pour each type of liquid into the plastic container. We'll start with the least dense liquid (the oil) and then gradually add the denser liquids, such as water, sugar water, or salt water. You can use a dropper to gently add the liquids, minimizing mixing and keeping the layers distinct.

3. 觀察結果：倒好液體，我們要仔細觀察這些液體如何形成清晰的層次，這主要是由於不同液體的密度差異所造成的結果。

Observe the Results: Once the liquids are poured, we should carefully observe how these liquids form distinct layers. This phenomenon is primarily the result of the differences in density among the various liquids.

4. 討論：在指定時間內完成魔法密度塔，清楚呈現分層，闖關成功後即可把它帶回家紀念囉。

Discussion: After completing the magical density tower within the designated time, it should clearly showcase distinct layers. Once successfully completed, students can take it home as a keepsake!