

2024 中崙國中科學園遊會 闖關活動 關卡名稱：物本生液

一、闖關宗旨：學生透過動手做實驗來深化國中生物營養單元的基本概念，並嘗試解釋與應用，建立探究科學的精神。

二、闖關流程：操作實驗並將結果填上學習單，所有題目作答完畢即完成挑戰。

三、關卡內容：

關卡：將滴眼瓶內之舒跑運動飲料 2.5ML、可口可樂 2.5ML、零卡可口可樂 2.5ML，波蜜果菜汁 2.5ML，分別加入各 2.5ML 之本氏液，根據最終顏色判斷哪種液體比較甜。(甜度由無糖依次甜度越來越高，藍色→綠色→黃色→橘色→紅色最甜)。



四、關卡所需材料：

1. 試管 X20
2. 試管架 X5
3. 抹布 X3
4. 乳頭吸管 3MLX5
5. 10ML 量筒 X5
6. 5ML 滴眼瓶 X400
7. 250ML 燒杯 X5
8. 1000W 電磁爐 X1
9. 舒跑運動飲料 1LX2
10. 可口可樂 2LX1
11. 零卡可口可樂 2LX1

12. 波蜜果菜汁 250MLX8
13. 本氏液 500MLX4
14. 電鍋內鐵鍋 4LX1
15. 細字油性簽字筆 X5
16. 標籤紙
17. 過關印章。

四、關卡對應領綱核心內容：

pe-IV-2 能正確安全操作適合學習階段的物品、器材儀器、科技設備及資源。能進行客觀的質性觀察或數值量測並詳實記錄。

ai-IV-3 透過所學到的科學知識和科學探索的各種方法，解釋自然現象發生的原因，建立科學學習的自信心。

五、腳本流程：

1. 預先實驗測試四種飲料最終成色結果，同時訓練接待學生(分成 3 組，第 1、2 組各分配到兩組試管架，第 3 組雙語組只分配一組試管架)。
2. 科學園遊會前一天完成滴眼瓶的預裝填：瓶身先用奇異筆寫上 1、2、3、4 編號；編號 1 填入舒跑運動飲料 2.5ML、編號 2 填入可口可樂 2.5ML、編號 3 填入零卡可口可樂 2.5ML，編號 4 波蜜果菜汁 2.5ML。
3. 準備好 5 個試管架；每個試管架放置好 4 根試管(同時寫好 1、2、3、4 對應滴眼瓶)。
4. 請接待學生發給闖關學生一人一組試管+試管架，同時給編號 1、2、3、4 滴眼瓶，再加一支 3ML 吸管。
5. 接待同學指導闖關學生先將滴眼瓶液體擠入對應之試管內(需用標籤紙寫好號碼)；完成後再用吸管汲取 2.5ML 本氏液到第 1 管。完成後可以請接待學生提醒闖關學生注意吸管上面是否有 0.5ML 到 3.0 毫升的刻度。滴管吸入刻度 2.5ML 體積液體後，壓入量筒內，觀察是否也是 2.5 毫升。如果相同，則直接加入對應的試管內，第三、第四根試管也直接用吸管吸取刻度 2.5ML 液體，就略去量筒測量體積之步驟。
6. 請闖關學生將四根試管放入置有 100ML 熱水(自開飲機取熱水時務必小心!)，再將燒杯放入 500ML 的熱水鍋來隔水加熱，熱源為電磁爐，採用中功率 400W 左右保溫即可。同時注意不要讓燒杯浮起而翻覆，而完成上述步驟的學生即可放入水浴鍋，每次可放入至多五個燒杯。
7. 請闖關學生依據 4 根試管所觀察到結果(顏色)，完成學習單，並比較出那種飲料最甜。
8. 填寫完成學習單的闖關學生，接待學生即可蓋章。

2024 中崙國中科學園遊會 闖關活動學習單 關卡名稱：物本生液

學校：_____ 國民_____學 年級：_____ 性別：_____ 姓名：_____

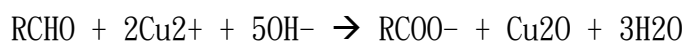
「糖」對身體而言，並非必需品，甚至是一種「有害物」，它會帶給你的負面影響包括：增加體脂肪，罹患代謝症候群、使頭腦的運作鈍化，妨礙工作或生活、引發焦慮，招致不安定的精神狀態、誘發各式疾病，如：糖尿病、高血壓、動脈硬化、過敏、增加罹癌機率、加速身體老化、更容易罹患失智症等。

而日常生活中的飲料百百種，你以為含糖量不高的飲料，往往比想像中含有更多的糖；進而認識被隱藏的高糖食物、學會看食品營養標示，找出隱形的糖，有意識的控制與選擇攝取，是本活動的主要目標。

本次活動中會利用本氏液的顏色變化來告訴你，飲料其實危機四伏，大家以為健康的飲料，可能還是少喝為妙。本氏液原色為淡藍色，跟飲料加熱反應後，甜度濃度由無糖依次甜度越來越高，顏色變化由藍色→綠色→黃色→橘色→紅色，紅色就是代表甜度爆表)。

◎本氏液的反應原理：

本氏液與醛基反應會產生氧化亞銅(Cu₂O)的紅色沉澱，葡萄糖、半乳糖是醛糖，而果糖雖是酮糖，但其酮基之相鄰 C 上有 OH 基，可轉變成醛基，也會反應。



還原糖 \rightarrow 有機酸； $Cu^{2+} \rightarrow Cu^{+}$ (紅色的氧化亞銅 Cu₂O)

氧化

還原

闖關題目：(請將結果打勾即可)

1. ★舒跑運動飲料最終顏色變化：藍色. 綠色. 黃色. 橘色. 紅色
2. ⊙可口可樂 最終顏色變化：藍色. 綠色. 黃色. 橘色. 紅色
3. ⊕零卡可口可樂最終顏色變化：藍色. 綠色. 黃色. 橘色. 紅色
4. ■波蜜果菜汁 最終顏色變化：藍色. 綠色. 黃色. 橘色. 紅色
5. 哪一種飲料最甜？舒跑運動飲料可口可樂零卡可口可樂波蜜果菜汁
6. 哪一種飲料含糖量最低？舒跑運動飲料可口可樂零卡可口可樂波蜜
7. 寫出你的發現跟心得：_____

活動設計組分工表：

1. 流程腳本設計：陳俊呈
2. 訓練學生實驗：江文雄
3. 訓練接待：陳俊呈
4. 現場指導：黃玉華、陳俊呈、SHANE、梁富閔、楊亭好

2024 Zhonglun Junior High School Science Fair Challenge Activity

Checkpoint Name: Determination of Reducing Sugars

Objective of the Challenge: Students will deepen their understanding of the basic concepts of the junior high school biology nutrition unit through hands-on experiments. They will also attempt to explain and apply these concepts, fostering a spirit of scientific inquiry.

Challenge Process: Conduct the experiment and fill in the results on the worksheet. The challenge is completed once all questions are answered.

Checkpoint Content:

Checkpoint: Add 2.5ML of each of the following liquids into separate dropper bottles: Super Supau sports drink, Coca-Cola, Coca-Cola Zero, and Pomelo vegetable juice. Then, add 2.5ML of Benedict's solution to each. Determine which liquid is the sweetest based on the final color. (Sweetness increases from sugar-free to the sweetest in the following order: blue → green → yellow → orange → red).



Materials Needed for the Checkpoints: :

1. Test tubes X20
2. Test tube racks X5
3. Cloths X3

- 4.3ML pipettes X5
- 5.10ML graduated cylinders X5
- 6.5ML dropper bottles X400
- 7.250ML beakers X5
- 8.1000W induction cooker X1
- 9.Supau sports drink 1L X2
- 10.Coca-Cola 2L X1
- 11.Coca-Cola Zero 2L X1
12. Bomi vegetable juice 250ML X8
- 13.Benedict' s solution 500ML X4
- 14.Inner pot for electric cooker 4L X1
- 15.Fine-tip oil-based pens X5
- 16.Label paper
- 17.Approval stamp 5% starch solution 500ML

4. Core Curriculum Content Corresponding to the Checkpoints:

- **PE-IV-2:**Ability to correctly and safely operate appropriate items, equipment, instruments, technological devices, and resources for the learning stage. Ability to conduct objective qualitative observations or quantitative measurements and record them accurately.
- **AI-IV-3:**Using learned scientific knowledge and various methods of scientific exploration to explain the causes of natural phenomena, building confidence in scientific learning.

5.Script Process:

1. Pre-experiment Testing and Training:

- Conduct pre-experiment tests to determine the final color results of four types of beverages.
- Train the reception students (divided into 3 groups: Group 1 3persons and Group 2 3persons each get two test tube racks, Group 3 (bilingual group) gets one test tube rack).

2. Preparation of Dropper Bottles:

- On the day before the science fair, pre-fill the dropper bottles: label the bottles with numbers 1, 2, 3, and 4 using a marker.
- Fill bottle 1 with 2.5ML of Supau sports drink, bottle 2 with 2.5ML of Coca-Cola, bottle 3 with 2.5ML of Coca-Cola Zero, and bottle 4 with 2.5ML of Pomi mixed vegetable and fruit juice.

3. Preparation of Test Tube Racks:

- Prepare 5 test tube racks; place 4 test tubes in each rack (label the test tubes with numbers 1, 2, 3, and 4 corresponding to the dropper bottles).

4. Distribution to Participants:

- Reception students distribute one set of test tubes and a test tube rack to each participant, along with dropper bottles numbered 1, 2, 3, and 4, and a 3ML pipette.

5. Guidance for Participants:

- Reception students guide participants to squeeze the liquid from the dropper bottles into the corresponding test tubes (label the test tubes with numbers).
- After this, use the pipette to draw 2.5ML of Benedict' s solution into the first test tube. Remind participants to check the pipette for the 0.5ML to 3.0ML scale.
- After drawing 2.5ML of liquid into the pipette, squeeze it into a graduated cylinder to check if it is also 2.5ML. If it matches, add it directly to the corresponding test tube. For the third and fourth test tubes, directly draw 2.5ML of liquid with the pipette, skipping the graduated cylinder measurement step.

6. Water Bath Heating:

- Participants place the four test tubes into a beaker containing 100ML of hot water (be careful when getting hot water from the dispenser!).
- Place the beaker into a 500ML water bath for heating, using an induction cooker set to medium power (around 400W) to maintain the temperature. Ensure the beaker does not float and tip over.
- Participants who complete the above steps can place their beakers into the water bath, with up to five beakers at a time.

7. Observation and Worksheet Completion:

- Participants observe the results (color) of the four test tubes and complete the worksheet, comparing which beverage is the sweetest.

8. Stamping the Worksheet:

- Reception students stamp the worksheets of participants who have completed them.

2024 Zhonglun Junior High School Science Fair Challenge Activity

Checkpoint Worksheet

Subject: Determination of Reducing Sugars

School: _____ Grade: _____ Gender: _____ Name: _____

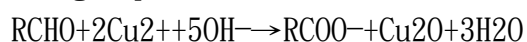
Sugar is not a necessity for the body and can even be considered harmful. Its negative effects include: increasing body fat, causing metabolic syndrome, dulling brain function, hindering work or daily life, inducing anxiety, leading to an unstable mental state, and triggering various diseases such as diabetes, hypertension, arteriosclerosis, allergies, increasing cancer risk, accelerating aging, and increasing the likelihood of dementia.

There are many types of beverages in daily life, and those you think have low sugar content often contain more sugar than expected. The main goal of this activity is to recognize hidden high-sugar foods, learn to read food nutrition labels, identify hidden sugars, and consciously control and choose your intake.

In this activity, the color change of Benedict's solution will be used to show you that beverages are actually full of hidden dangers. Even drinks that are considered healthy might be better consumed in moderation. The original color of Benedict's solution is light blue. After reacting with heated beverages, the sweetness concentration increases from sugar-free to high sugar, with color changes from blue → green → yellow → orange → red (red indicates extremely high sweetness).

Principle of Benedict's Solution Reaction:

Benedict's solution reacts with aldehydes to produce a red precipitate of cuprous oxide (Cu₂O). Glucose and galactose are aldoses, while fructose is a ketose, but its adjacent C atom has an OH- group that can convert into an aldehyde group, thus it also reacts.



Reducing sugar → Organic acid; Cu²⁺ → Cu⁺ (red cuprous oxide Cu₂O)

Oxidation

Reduction

Checkpoint Questions: (Please check the result)

Final color Supau Drink : Blue Green Yellow Orange Red

Final color Coca-Cola : Blue Green Yellow Orange Red

Final color Coke Zero : Blue Green Yellow Orange Red

Final color Bomi Juice : Blue Green Yellow Orange Red

Which drink is the sweetest? Supau Sports Drink Coca-Cola

Coke Zero Bomi Vegetable Juice

Which drink has the lowest sugar content? Supau Sports Drink

Coca-Cola Coke Zero Bomi Vegetable Juice

Write down your findings and thoughts: _____
