國小自然領域教學研究中心
第四屆國小自然科學實驗雙語教學影片製作競賽

<table>
<tr><td colspan="2">領域/科目
Subject</td><td>自然科學</td><td>設計者
Designer</td><td>郭至軒、胡可欣、
張閎斌、王祖蓉</td></tr>
<tr><td colspan="2">單元名稱
Unit</td><td>酸鹼一試，變化花樣</td><td>指導教授
Advisor</td><td>吳宗勳</td></tr>
<tr><td colspan="5">設計依據</td></tr>
<tr><td colspan="2"></td><td>學科領域 (content)</td><td colspan="2">英語文 (language)</td></tr>
<tr><td rowspan="2">學習
重點</td><td>學習表現
Students' performance</td><td>【第一節課】
po-III-2 能初步辨別適合科學探究的問題，並能依據觀察、蒐集資料、閱讀、思考、討論等，提出適宜探究之問題。
an-III-1 透過科學探究活動，了解科學知識的基礎是來自於真實的經驗和證據。
【第二節課】
ah-III-1 利用科學知識理解日常生活觀察到的現象。
pa-III-1 能分析比較、製作圖表、運用簡單數學等方法，整理已有的資訊或數據。
pe-III-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。
pc-III-2 能利用簡單形式的口語、文字、影像（例如：攝影、錄影）、繪圖或實物、科學名詞、數學公式、模型等，表達探究之過程、發現或成果。</td><td colspan="2">【第一節課】
1-III-7 能聽懂簡易的教室用語。
3-III-3 能看懂教室用語。
【第二節課】
1-III-6 能聽懂課堂中所學的字詞。
1-III-7 能聽懂簡易的教室用語。
2-III-2 能說出課堂中所學的字詞。
2-III-7 能作簡易的回答和描述。
【第三節課】
1-III-6 能聽懂課堂中所學的字詞。
2-III-7 能作簡易的回答和描述。
6-III-1 具有好奇心，主動向教師或同學提出問題。
【第四節課】
1-III-6 能聽懂課堂中所學的字詞。
2-III-7 能作簡易的回答和描述。</td></tr>
</table>

		【第三節課】 tc-III-1 能就所蒐集的數據或資料，進行簡單的記錄與分類，並依據習得的知識，思考資料的正確性及辨別他人資訊與事實的差異。 tr-III-1 能將自己及他人所觀察、記錄的自然現象與習得的知識互相連結，察覺彼此間的關係，並提出自己的想法及知道與他人的差異。 pe-III-1 能了解自變項、應變項並預測改變時可能的影響和進行適當次數測試的意義。在教師或教科書的指導或說明下，能了解探究的計畫，並進而能根據問題的特性、資源（設備等）的有無等因素，規劃簡單的探究活動。 pe-III-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。 【第四節課】 tc-III-1 能就所蒐集的數據或資料，進行簡單的記錄與分類，並依據習得的知識，思考資料的正確性及辨別他人資訊與事實的差異。 pe-III-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。 pc-III-2 能利用簡單形式的口語、文字、影像（例如：攝影、錄影）、繪圖或實物、科學名詞、數學公式、模型等，表達探究之過程、發現或成果。	

Learning focus	**學習內容 Learning content**	INe-III-5 常用酸鹼物質的特性，水溶液的酸鹼性質及其生活上的運用。 INd-III-2 人類可以控制各種因素來影響物質或自然現象的改變，改變前後的差異可以被觀察，改變的快慢可以被測量與了解。	Ac-III-2 簡易的教室用語。 Ac-III-3 簡易的生活用語。
核心素養 Core competency		自-E-A3 具備透過實地操作探究活動探索科學問題的能力。 自-E-B1 能整理已有的自然科學資訊或數據，並表達探究過程與成果。 自-E-C2 透過探索科學的合作學習，培養與同儕溝通表達、團隊合作及和諧相處的能力。	
議題融入 Issue integration		□人權教育 □環境教育 □海洋教育 □品德教育 □生命教育 □法治教育 ☑科技教育 □資訊教育 □能源教育 □安全教育 □防災教育 □閱讀素養 □國際教育 □家庭教育 □原住民教育 □戶外教育 □多元文化教育 □性別平等教育 □生涯規劃教育 □無	
與其他領域/科目的連結 Connections to other subjects		□音樂 □體育 ☑藝術 □社會 □科技 □生活 □綜合活動 □健康與體育 □其他：_____	
教材來源 Materials **參考資料 References**		【第一節課】 1.神奇魔法水：https://www.facebook.com/watch/?v=562520988865641 2.影片資源(LIS 情境科學教材) (1)波以耳玫瑰花瓣實驗：https://www.youtube.com/watch?v=HNao9-HPbZU (2)拉瓦節紫甘藍實驗：https://www.youtube.com/watch?v=C5KdTVB6I3I 【第二節課】 1. 表格-圖片出處-Pngtree：https://zh.pngtree.com/freepng/blue-table_5398604.html 2. 試管&試管架-圖片出處-Pngfind： https://www.pngfind.com/mpng/iTbmmxJ_test-tube-rack-png-download-coffee-table-transparent/ 【第三節課】 1. 玫瑰花瓣花青素的含量：https://reurl.cc/RYlDEz 2. 紫甘藍花青素的含量：https://healthformula.com.tw/article/anthocyanidin/	

	【第四節課】 Acid-base flower show 學習單花的圖片來源：https://reurl.cc/5K7kez

<table>
<tr><td>教學設備/資源
Teaching aids/equipment</td><td colspan="2">【第一節課】
1. 自編學習單：Plant Detective探究單(如附件一)
2. 教學設備：神奇魔法水(註：教師需在上課前完成神奇魔術水的製作。製作方法：寶特瓶需要先裝八分滿的水，再將寶特瓶蓋底部加入水彩顏料，準備就完成了。教師變魔術時，將寶特瓶上下搖晃就會變色。)、影片、平板電腦。
【第二節課】
1. 自編學習單：Rose Detective學習單(如附件二)
2. 實驗器材：大燒杯(500mL)×1、小燒杯(250mL)×5、滴管×6、試管×6、濾網、量筒×6、攪拌棒×6、研缽、試管架×1。
3. 實驗溶液料：玫瑰花瓣、檸檬原汁、小蘇打水、鹽水、生活中的溶液(食用醋、肥皂水)。
【第三節課】
1. 自編學習單：Purple Cabbage Detective 學習單(如附件三)
2. 平板電腦。
3. 實驗器材：大燒杯(500mL)×2、小燒杯(250mL)×5、滴管×7、試管×12、攪拌棒×12、研缽、剪刀、試管架×2。
4. 實驗溶液：玫瑰花瓣、紫甘藍、檸檬原汁、小蘇打水、鹽水、生活中的溶液(食用醋、肥皂水)。
【第四節課】
1. 自編教材：Acid-base flower show學習單(如附件四)
2. 調色盤、水彩筆、水彩、圖畫紙(紙上已列印花的輪廓)、酸鹼指示劑(紫甘藍溶液)、燒杯、滴管、試管、試管架。
3. 酸鹼溶液(牛奶、汽水、食用醋、檸檬原汁、酒精、小蘇打水、肥皂水、鹽水)。</td></tr>
<tr><td>學生背景
Students' Background</td><td colspan="2">1. 學生已具備流暢使用平板介面的能力。
2. 學生已具備使用石蕊試紙檢驗生活中水溶液酸鹼性的能力。
3. 學生已具備歸納石蕊試紙的檢驗結果，分類及定義酸性、中性和鹼性水溶液的能力。
4. 學生已具備實驗操作能進行詳實記錄，並依據舊經驗提出主觀想法。</td></tr>
<tr><td></td><td>學科領域 (content)</td><td>英語文 (language)</td></tr>
<tr><td></td><td>【第一節課】
1-1.學生能描述波以耳與拉瓦節在進行酸鹼測試的實驗過程與發現，理解酸鹼指示劑的基本性質。
1-2.學生能利用五感觀察並提出探究問題，初步理解科學探究的歷程。</td><td>Language of learning
目標單字： soap water, lemon juice, vinegar, salt water, baking soda solution, red, pink, green, blue.
目標句型：What color does the solution turn?
It turns （color）.</td></tr>
</table>

<table>
<tr>
<td>學習目標
Learning Objectives</td>
<td>1-3.學生能運用平板電腦搜尋資料，並根據查詢結果提出假設。
【第二節課】
2-1 學生能正確按照實驗步驟操作，並觀察玫瑰花瓣遇到不同溶液所發生顏色上的改變。
2-2 學生能利用玫瑰花瓣所調配出的酸鹼指示劑得出的結論，應用到辨識生活中未知的酸鹼性溶液。
2-3 學生能歸納出辨識酸鹼溶液的方法，並分析老師所準備的溶液為何種溶液。
【第三節課】
3-1 學生能理解好的酸鹼指示劑需要具備的性質。
3-2 學生能依照步驟完成「紫甘藍」的實驗，並觀察紫甘藍遇到不同溶液所發生顏色上的改變。
3-3 學生能比較玫瑰花瓣與紫甘藍，此兩種不同溶液所發生顏色上的改變，歸納出好的酸鹼指示劑。
3-4 學生能利用平板電腦查找資料，驗證自己所提出的假說。
【第四節課】
4-1 學生能根據實驗結果說明酸鹼溶液加入指示劑的顏色變化。
4-2 學生能操作及區分不同酸鹼溶液加入指示劑的顏色變化，並做觀察記錄。
4-3學生能透過所調配出的溶液，製作並結合水彩，分享該組的圖畫，以交流彼此的調配方式。</td>
<td>
Language for learning
<table>
<tr><th>教師用語 For teachers</th><th>學生用語 For students</th></tr>
<tr><td>【The first lesson】
✧ What do you see?
【The second lesson】
✧ What color does the solution turn?
【The third lesson】
✧ What color does the solution turn?
【The fourth lesson】
✧ What color does the solution turn?
✧ What solution do you use?</td><td>【The first lesson】
✧ I see _____
【The second lesson】
✧ It turns (color). / It doesn’t turn .
【The third lesson】
✧ It turns (color). / It doesn’t turn .
【The fourth lesson】
✧ It turns (color).
✧ We use (solution).</td></tr>
</table>
Translanguaging
1. When to use Chinese: Chinese is used when explaining scientific concepts and the process of scientific inquiry. The main purpose is to help children clearly understand the concepts and inquiry process, enabling students to develop the qualities of a scientist.
2. When to use English:
(1) In experiments, the names of solutions (e.g., lemon juice, salt water, vinegar) are used in English in the classroom, accompanied by pictures from daily life to help students associate the images with English vocabulary.
(2) When students observe changes in solutions using their senses, they are encouraged to use English sentence patterns (e.g., "It turns ...") to describe the color changes of the solutions.
</td>
</tr>
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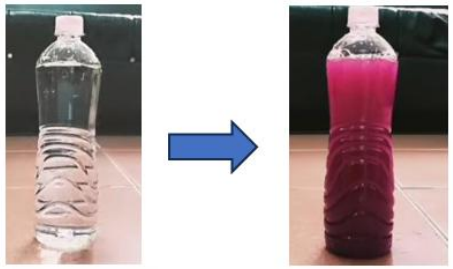
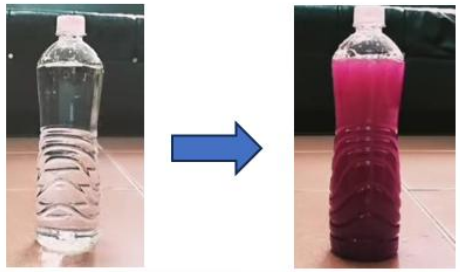
情境脈絡 **(文化/社區/公民實踐)**		◆【第一節課】 本校鄰近某傳統市場／社區花市，當地居民習慣使用紫甘藍入菜與玫瑰製作飲品。學生從觀看介紹紫甘藍與玫瑰的實驗影片出發，透過五感觀察植物的特色，並結合平板電腦搜尋，探討這些植物是否具有其他傳統用途（如染布、食材、藥用），進一步提出假設這些植物是否能作為酸鹼指示劑。 ◆【第二節課】 學生動手製作以玫瑰花瓣為基底的指示劑，透過實驗驗證其變色反應後，應用在日常生活中的液體檢測（如檸檬汁、肥皂水、醋等）。將學到的知識延伸至社區：學生回家後觀察家中常見清潔用品的酸鹼性，思考是否可自製天然檢測工具，取代部分化學檢測劑，達到環保目的。 ◆【第三節課】 學生透過比較兩種指示劑（玫瑰與紫甘藍）的變色範圍與明顯度，討論「何謂好的酸鹼指示劑」的標準，結合科技（平板電腦查詢資料），學生驗證自己所提出的假說。 ◆【第四節課】 學生將指示劑實驗的變色結果，結合水彩創作出小組的「酸鹼色彩作品」，如：設計酸鹼花瓣圖樣（繪製生活中常見液體與酸鹼指示劑混合的顏色圖），這些圖畫可於課堂中進行分享。

教學活動設計　Classroom procedure	
教學重點及學科概念說明 Main points of teaching	
學科領域 (content)	**英語文 (language)**
一、各節課教學重點 **(一)第一節-利用五感觀察與發現花青素** 1.學生能觀察與比較植物顏色變化特性。 2.學生能提出問題與建立假說。 **(二)第二節-結合石蕊試紙去驗證假說(以玫瑰花瓣溶液為例)** 1.學生能設計與進行實驗驗證假說。 2.學生能了解酸鹼指示劑的概念。 **(三)第三節-比對兩種酸鹼指示劑(以紫甘藍與玫瑰花瓣為例)** 1.學生能了解設計實驗組與對照組的重要性。 2.學生能比較不同植物酸鹼指示劑效果。 **(四)第四節-運用指示劑的酸鹼變色特性，融合藝術創作** 1.學生能說明酸鹼指示劑的顏色變化特性。 2.學生能創造性統整與藝術表達。 二、學科概念說明 (一)**植物中的天然色素與酸鹼變色原理**：紫甘藍與玫瑰花瓣中含有天然色素（如花青素），這些色素具有敏感性，會因為溶液的酸鹼性而呈現不同顏色。 (二)**酸鹼指示劑的概念**：指示劑是一種在不同酸鹼環境中會改變顏色的物質，可用來判斷溶液的酸鹼性。常見的指示劑有石蕊試紙。天然指示劑如紫甘藍溶液也具有相似功能。 (三)**實驗控制與對照組的重要性**：在進行指示劑測試時，需要有標準對照（如石蕊試紙）來校正觀察結果，確保資料的準確性與可解釋性。 (四)**科學探究歷程**：學生透過「觀察－提問－假說－實驗－結論」的歷程，培養科學思維與問題解決能力。 (五)**跨領域素養整合**：將自然科學知識與藝術表達結合，鼓勵學生運用所觀察到的自然科學實驗結果進行創造性展現，提升統整與表達能力。	● Key teaching points of each lesson. **【The first lesson】** 1. Students can discover the phenomenon by looking, smelling, and touching. 2. Students can describe what they find by using these sentences. "[Something] looks [color]." "[Something] smells [good/bad]." **【The second lesson】** 1. Students can record the names and colors of the solutions. **【The third lesson】** 1. Students can understand the difference between two acid-base indicators. 2. Students can record and say the color changes in English. "It turns [color]." **【The fourth lesson】** 1. Students can describe the solution by using these sentences. "It turns [color]. It is a/an _____ solution." 2. Students can use English to share their own creations. ● Scientific Observation and Communication in English 1. **Scientific Vocabulary and Sentence Use**: Students learn key words (e.g., soap water, vinegar, baking soda solution, red, green, blue) and practice simple sentence patterns like "What color does the solution turn?" and "It turns (color)." These help them describe observations clearly. 2. **English Comprehension and Communication**: Through bilingual instruction, students follow basic classroom language, pronounce scientific terms correctly, and describe simple experiments using full sentences—building both understanding and speaking confidence.

學習目標 Learning objectives	教學活動 Teaching activities		教學設備/資源 Teaching Aids/equipment	時間(分) Time	評量 Evaluation
	中文 (In Chinese)	英語文 (In English)			
	【第一節課】 一、引起動機 (一)教師拿出神奇魔法水，向學生變魔術，將寶特瓶搖一搖，讓學生利用眼睛觀察，神奇水溶液發生的變化。  搖晃前　　搖晃後 ***<u>模擬師生問答</u>*** **教師**：It's science class. Take out your book. Please turn to page 45. **教師**：老師這邊有一瓶神奇的魔法水，你們覺得它會變出什麼魔法？ **學生**：水會不見。 **教師**：Does anyone want to share another idea? **學生**：水會變顏色。 **教師**：Excellent! 接下來老師要搖一搖，請你們利用眼睛仔細觀察瓶子內的水發生了什麼變化？ What do you see in the bottle? **學生**：我看到顏色改變了。	**【The first lesson】** I. Motivation Introduction (1) The teacher takes out the magical water and performs a magic trick for the students. By shaking the plastic bottle, the teacher lets the students observe with their eyes the changes that occur in the magical water.  **before shaking**　　**after shaking** ***<u>Simulated Teacher-Student Dialogue:</u>*** **Teacher**: It's science class. Take out your book. Please turn to page 45. **Teacher**: I have a bottle of magical water here. What kind of magic do you think? **Student**: The water in the bottle will disappear. **Teacher**: Does anyone want to share another idea? **Student**: The water in the bottle will change the color. **Teacher**: Excellent! Now I'm going to shake the bottle. Please watch carefully	神奇魔法水	2分鐘	

1-1.學生能描述波以耳與拉瓦節在進行酸鹼測試的實驗過程與發現，理解酸鹼指示劑的基本性質。	**教師**：You see color change. **教師**：能不能再多說一點點，顏色是怎麼改變的呢？ **學生**：從透明的變成粉紅色。 **教師**：That's right. 這是老師要給你們的小魔術。 (二)教師播放兩部影片，從兩部影片當中找出波以耳與拉瓦節利用什麼植物進行實驗，並觀察溶液的顏色變化。教師能夠複習上一節課石蕊試紙遇到酸鹼的變化。 ***模擬師生問答：*** **教師**：等一下老師要播放兩段影片，這是有關波以耳與拉瓦節的實驗，請你張開眼睛耳朵仔細聽，等等會詢問你們影片當中波以耳與拉瓦節利用什麼植物進行實驗？還有溶液的顏色有沒有改變？將你看到的結果寫在紀錄單上。 **教師**：波以耳影片當中有提到石蕊試紙，還記得上一次上課石蕊試紙遇到酸性溶液會發生什麼變化嗎？ **學生**：變成紅色。 **教師**：Well done! 石蕊試紙會變成紅色。那當石蕊試紙遇到鹼性溶液時，會變成什麼顏色呢？ **學生**：變成藍色。 **教師**：Good job! 石蕊試紙會變成藍色。	with your eyes and observe what happens to the water inside. **Teacher**: What do you see in the bottle? **Student**: I see the color changing. **Teacher**: You see the color change. **Teacher**: Can you describe it more? What color does it turn ? **Student**: It turns pink. **Teacher**: That's right. This is a little magic trick I prepared for you! (2) The teacher plays two videos, asking students to find what plants are used in Boyle's and Lavoisier's experiment. Later, students observe the color of the solution. Therefore, the teacher has the chance to help students review how litmus papers change the color in the last class through the videos. ***Simulated teacher-student dialogue:*** **Teacher**: The teacher is going to play two videos about the experiments of Boyle and Lavoisier. Please open your eyes and ears and pay attention. I will ask you some questions about what you see in the videos: What plants do Boyle and Lavoisier use in their experiments? Does the color of the solution change? Write down the results you observed on your worksheet. **Teacher**: In the video about Boyle, litmus paper was mentioned. Do you remember what happens to litmus paper when it meets the acid solution? **Student**: It turns red. **Teacher**: Well done. It turns red. What color does the litmus paper turn when it	1.影片資源 (1)波以耳玫瑰花瓣實驗(4：50~6：50) (2)拉瓦節紫甘藍實驗(0：00~1：00) 2.Plant Detective探究單(如附件一)	4分鐘	口頭評量 (學生能透過影片理解波以耳與拉瓦節的實驗過程。)

	教師：從波以耳影片當中，他是利用什麼植物進行實驗的？ **學生**：玫瑰花瓣。 **教師**：Well done. What color does it turn when the teacher adds the acid solution into it? **學生**：Red. **教師**：Very good！波以耳認為玫瑰花瓣跟石蕊試紙一樣碰到酸性物質，就會變成紅色。 **教師**：從拉瓦節影片當中，他是利用什麼植物進行實驗的？ **學生**：紫甘藍 **教師**：What color does it turn? **學生**：顏色變成藍色了。 **教師**：Well done. 那麼你覺得這兩部影片的共同性是什麼？ **學生**：碰到酸鹼顏色發生改變。 **教師**：That's great.	meets the basic solution? **Student:** It turns blue. **Teacher**: Good job! It turns blue. **Teacher**: From the video about Boyle, what plant did he use in his experiment? **Student**: Rose petals. **Teacher**: Well done. What color does it turn when the teacher adds the acid solution into it? **Student**: Red. **Teacher**: Very good! Boyle believed that rose petals, like litmus paper, turn red when they touch an acidic substance. **Teacher**: From the video about Lavoisier, what plant did he use in his experiment? **Student**: Purple cabbage. **Teacher**: What color does it turn? **Student**: The color turns blue. **Teacher**: Well done! So, what's the common point between these two videos? **Student**: The color changes when they touch acids or bases. **Teacher**: That's great.			
1-2.學生能利用五感觀察並提出探究問題，初步理解科學探究的歷程。	二、發展活動 (一)教師將玫瑰花瓣與紫甘藍帶入教室，讓學生利用五感觀察並提出問題。 ***模擬師生問答：*** **教師**：老師現在將玫瑰花瓣與紫甘藍發下到各組，等一下會請你們用眼睛看一看，用鼻子聞一聞，以及用手揉一揉。 **教師**：你們用眼睛看一看，發現到	II. Development Activities (1) The teacher brings rose petals and purple cabbage into the classroom for students to observe using their five senses and ask questions. ***Simulated teacher-student dialogue:*** **Teacher**: Now I'm going to hand out rose petals and purple cabbage to each group. Please use your eyes to look, your nose to smell, and your hands to touch. **Teacher**: What do you find when you	玫瑰花瓣、 紫甘藍 Plant Detective探究單(如附件一)	10分鐘	觀察評量 (學生能利用五感觀察玫瑰花瓣與紫甘藍。)

1-2.學生能利用五感觀察並提出探究問題，初步理解科學探究的歷程。	了什麼？ **學生**：玫瑰花瓣是紅色的，紫甘藍是紫色的。 **教師**：Well done.你們用鼻子聞一聞，發現到了什麼？ **學生**：玫瑰花瓣很香，紫甘藍沒味道。 **教師**：Great! 你們用手揉一揉，發現到了什麼？ **學生**：我的手有顏色殘留。 **教師**：所以你們表示玫瑰花瓣與紫甘藍的共同性會在手上殘留顏色。 (二)從影片觀察到的內容以及剛才的五感覺察，引導孩子提出問題。 ***模擬師生問答：*** **教師**：波以耳的玫瑰花瓣以及拉瓦節紫甘藍在影片當中是被當作什麼用途？ **學生**：測試酸鹼。 **教師**：沒錯！當成酸鹼指示劑。而還記得剛才透過用手揉一揉你們發現了什麼？ **學生**：會殘留顏色。 **教師**：Well done.在哪裡殘留顏色？ **學生**：手上會殘留顏色 **學生B**：老師！是不是手上會殘留顏色的植物，就可以當作酸鹼指示劑？ **教師**：Good job! 你們提出了一個很棒的問題。	look at them? **Student**: The rose petals are red, and the purple cabbage is purple. **Teacher**: Well done. What do you find when you smell them? **Student**: The rose petals smell nice, but the purple cabbage doesn't have any smell. **Teacher**: Great! What do you find when you touch them? **Student**: I find that some color remained on my hand. **Teacher**: So you're saying that both rose petals and purple cabbage can leave color on your hands. (2) Using observations from the videos and sensory exploration, guide students to ask questions. ***Simulated teacher-student dialogue:*** **Teacher**: In the videos, what are Boyle's rose petals and Lavoisier's purple cabbage used for? **Student:** To test acid and basic solution. **Teacher**: That's right! They are used as acid-base indicators. What do you see just now when you touch the plants? **Student**: They leave some color on our hands. **Teacher**: Well done. Where does the color remain? **Student**: On our hands. **Student B**: Teacher! Can the plant which leaves the color on our hands be used as acid-base indicators? **Teacher**: Good job! That's a great question!	Plant Detective探究單(如附件一)	5分鐘	

1-3.學生能運用平板電腦搜尋資料，並根據查詢結果提出假設。	(三)教師發下平板電腦蒐集玫瑰花瓣與紫甘藍的資料，並從蒐集到的資料當中提出假說。 ***模擬師生問答：*** **教師**：剛才你們提出了是不是手上會殘留顏色的植物，就可以當作酸鹼指示劑？現在老師要發下平板電腦，給各組十分鐘時間，讓你們上網搜尋相關資料。等等老師會問大家查到了什麼資訊。 **第A組**：我們這一組查到紫甘藍與玫瑰花瓣可以當作酸鹼指示劑。 **教師**：Great! 那為什麼可以當作酸鹼指示劑？ **第B組**：我們這一組找到能當酸鹼指示劑的資訊是需要有植物色素的汁液。 **教師**：Great! 你們這一組可以去再找找這個植物色素是什麼？ **第C組**：我們這一組查到這兩個植物都是有花青素的。 **教師**：Excellent! 這一組提供的資訊剛好可以補充第二組的內容，這個植物的色素就是花青素。 **學生**：所以老師只要擁有花青素的植物就能夠當作是酸鹼指示劑？ **教師**：**Great! 同學剛才提出了一個假說了，只要擁有花青素的植物就能夠當作是酸鹼指示劑。或者是花青素越多的植物，就很適合做酸鹼指示劑。**	(3) The teacher distributes tablets for students to research rose petals and purple cabbage, and guides them to form hypotheses based on the information they find. ***Simulated teacher-student dialogue:*** **Teacher**: Just now, you asked, "Can the plant which leaves the color on our hands be used as acid-base indicators? " I'm now giving each group a tablet. You will have ten minutes to search for related information. Later, I will ask what you've found. **Group A**: We find that both purple cabbage and rose petals can be used as acid-base indicators. **Teacher**: Great! Why can they be used as acid-base indicators? **Group B**: We find that the plants which can be used as indicators have the plant pigments in their juice. **Teacher**: Great! Can your group try to find out what kind of pigment is? **Group C**: We find that both of these plants contain anthocyanins. **Teacher**: Excellent! That's a great complement to Group B's finding — the pigment is called anthocyanin. **Student**: So teacher, does that mean as long as a plant has anthocyanins, it can be used as an acid-base indicator? **Teacher**: **Great! A student just proposes a hypothesis: as long as a plant contains anthocyanins, it can be used as an acid-base indicator. The more anthocyanins a plant contains,**	Plant Detective探究單(如附件一) 平板電腦	15分鐘	實作評量 (學生能完成學習單上的任務。)

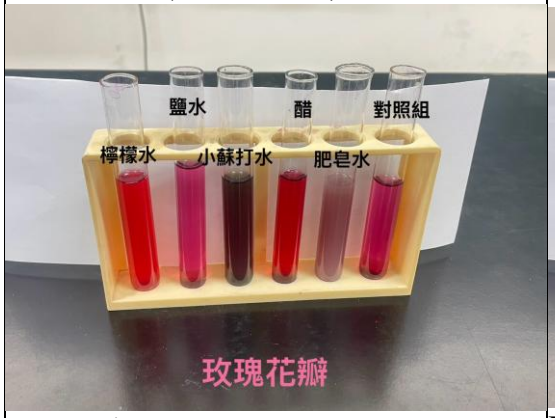
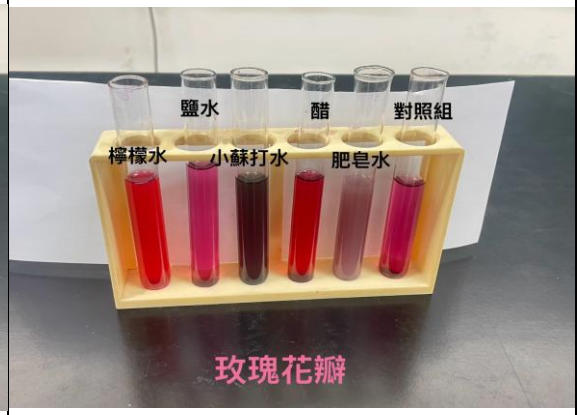
	三、綜合活動 教師統整今天課程內容。 **教師**：今天我們的課程一開始觀看了波以耳以及拉瓦節的實驗，你們也利用了五感去觀察了玫瑰花瓣與紫甘藍並且從中提出了問題。接著我們再利用平板電腦去搜尋相關資料，各組所查找的資料都相當不錯，你們也從這些資料提出了假設內容，接下來，我們下一節課就要進行驗證了！	**the more the solution is suitable for using as an acid-base indicator.** III. Wrap-Up Activity (1) Teacher summarizes today's lesson. **Teacher**: Today, we started our lesson by watching the experiments of Boyle and Lavoisier. You also used your five senses to observe rose petals and purple cabbage, and you asked some thoughtful questions. Then, we used tablets to search for related information. Each group found excellent materials, and you used the information to form hypotheses. Next time, in our following lesson, we're going to test and verify those hypotheses!		4分鐘	
	【第二節課】 一、引起動機 教師複習上次上課提出假說的內容，向學生提問關於製備玫瑰花瓣的實驗目的，並發下實驗器具給小組。 ***模擬師生問答：*** **教師**：同學還記得上次上課我們提出什麼假說嗎？ **學生**：只要含有花青素的植物，是否能作為酸鹼指示劑。 **教師**：沒錯，那想請問同學，影片中玫瑰花瓣的功用是什麼呢？ **學生**：可以用來測試酸鹼。 **教師**：Good job! 那麼這一堂課，要利用玫瑰花瓣，來檢測生活中的酸	**【The second lesson】** I. Motivation Introduction The teacher reviews the hypothesis proposed in the previous lesson and asks students about the purpose of the experiment using rose petals. Distribute the experimental tools to each group. ***Simulated teacher-student dialogue:*** **Teacher**: Do you remember the hypothesis we proposed in our last class? **Student**: A plant that contains anthocyanin may be used as an acid-base indicator. **Teacher**: That's right! Now, can anyone tell me what the rose petals in the video were used for? **Student**: They can be used to test the	實驗器材： 大燒杯(500mL)×1、小燒杯(250mL)×5、滴管×6、試管×6、量筒×6、濾網、攪拌棒×6、研缽、試管架×1玫瑰花瓣、檸檬原汁、小蘇打水、鹽水、食用醋、肥皂水。	3分鐘	

	鹼溶液。 **教師**：老師在這節課中，準備了什麼呢? What do you see? (教師拿起肥皂讓學生觀察。) **學生A**：味道香香的，應該是肥皂。 **學生B**：Soap. **教師**：Yes. It is a soap. Very good. 那這瓶溶液是什麼呢? What do you see? (教師拿起醋讓學生觀察。) **學生**：味道聞起來很酸，應該是醋。 **教師**：沒錯，這瓶是醋。 **教師**：看來大家都有認真觀察今天所要檢測的溶液噢，大家都很有精神喔，非常棒~~那我們就開始進入到今天的實作課程吧！Please carefully take the beakers on your lab tables. Group members 1, please come to the teacher's desk to measure out 50mL of rose petal juice. Member 2 and 3, please measure out 10mL of baking soda solution, salt solution, and lemon juice. Member 4 and 5, please measure out 10mL of vinegar and soap water.	acid and basic solution. **Teacher**: Good job! In this lesson, we will use rose petals to test the common household solutions. **Teacher**: What does the teacher prepare for today lesson? What do you see? (The teacher picks up a bar of soap for the students to observe.) **Student A**: It smells nice. It should be soap. **Student B**: Soap. **Teacher**: Yes. It is a soap. Very good. **Teacher**: So, what is the solution in the bottle? What do you see? The teacher picks up vinegar for the students to observe. **Student**: It smells sour. It should be vinegar. **Teacher**: That's right, this bottle is vinegar. **Teacher**: It seems that everyone has carefully observed the solutions we test today. You all are very attentive — great job! Now, let's begin today's hands-on lesson! Please carefully take the beakers on your lab tables. Group member 1, please come to the teacher's desk to measure out 50 mL of rose petal juice. Members 2 and 3, please measure out 10 mL each of baking soda solution, salt water, and lemon juice. Members 4 and 5, please measure out 10 mL each of vinegar and soap water.			

2-1學生能正確按照實驗步驟操作，並觀察玫瑰花瓣遇到不同溶液所發生顏色上的改變。	二、發展活動 (一)教師解說實驗步驟，將玫瑰花瓣進行研磨後，浸泡在熱水中，過程中觀察水色變化，最後利用濾網進行過濾。 ***模擬師生對話：*** **教師**：第一步：請將你們玫瑰花瓣放入到研缽中「磨碎」。第二步：將磨碎的玫瑰花瓣放入大燒杯。第三步：設定計時器，用熱水浸泡3分鐘。使用熱水的時候要注意安全。 **教師**：目前都有聽懂嗎? **學生**：有！ **教師**：Great! 第四步：最後用濾網過濾，將玫瑰花瓣濾出，再觀察水的顏色。	II. Development Activity (1) The teacher explains the experiment steps: Grind the rose petals and soak them in water, observing the color change of the water during the process. Finally, use a strainer to filter out the petals. ***Simulated Teacher-Student Dialogue:*** **Teacher**: Step one: Please crush your rose petals. **Teacher**: Step two: Put the rose petals squeezed into the beaker. **Teacher**: Step three: Set a timer and soak them in hot water for three minutes. Be careful when using hot water. **Teacher**: Is everyone following so far? **Students**: Yes! **Teacher**: Great! Step four: use a strainer to filter out the rose petals and then observe the color of the water.	玫瑰花瓣 研缽 燒杯 量筒x6 濾網 攪拌棒 Rose Detective學習單(如附件二)	3分鐘	實作評量 (學生能夠按照實驗步驟製作出玫瑰花瓣溶液。)
2-1學生能正確按照實驗步驟操作，並觀察玫瑰花瓣遇到不同溶液所發生顏色上的改變。	(二)教師發下學習單並引導學生進行玫瑰花瓣酸鹼變色實作。 ***模擬師生問答：*** **教師**：使用滴管，在六支試管中滴入玫瑰花瓣溶液，並在學習單上記錄各試管的顏色。 **教師**：再使用另一支滴管，將小蘇打水滴入玫瑰花瓣中，並用攪拌棒小心攪拌。 What color does the solution turn? (Teacher shows the solution with his right hand.) **學生A**：在滴入小蘇打水的時候，玫瑰花瓣溶液變色了耶！	(2) The teacher distributes worksheets and guides students to conduct the rose petal color change experiment. ***Simulated Teacher-Student Dialogue:*** **Teacher**: Use a dropper to add rose petal juice into six test tubes, and write down the color of each test tube on your worksheet. **Teacher**: Use another dropper and add baking soda solution into the rose petals and gently stir with a stirring rod." **Teacher**: What color does the solution turn? (Teacher shows the solution with his right hand.) **Student A**: When I add baking soda solution into the rose petal juice, the	小蘇打水 鹽水 檸檬原汁 滴管 Rose Detective學習單(如附件二)	10分鐘	實作評量 (學生能利用滴管將溶液滴入玫瑰花瓣溶液當中，並記錄顏色變化。)

	學生B：我觀察到玫瑰花瓣的顏色，隨著小蘇打水的滴入量增加而變得越來越藍。 **教師**：Good job! Please write down the color of the solution in your group's test tube on your worksheet. **教師**：接下來，再請各小組另外一位同學，分別使用不同支滴管，將鹽水與檸檬汁，滴入到試管中，在滴入的同時，請記得利用攪拌棒將溶液混合均勻。What color does the solution turn? (Teacher shows the solution with his right hand.) What color does the solution turn? (Teacher shows the solution with his left hand.) **學生A**：我觀察到玫瑰花瓣又變成不同樣顏色了。在滴入鹽水的時候，玫瑰花瓣的顏色變淡，在滴入檸檬汁的時候，顏色變紅了。 (It doesn't change color when we add salt solution.) (It turns red when we add lemon juice.) **教師**：Excellent! Please write down the color of the solution in your group's test tube on your worksheet.	color of it will change. **Student B**: It turns blue. Also, I observe that if we add much baking soda solution, the rose petal juice will become bluer. **Teacher**: Good job! Please write down the color of the solution in your group's test tube on your worksheet. **Teacher**: Next, each group needs to assign a member to use different droppers to add salt water and lemon juice into the test tubes. While adding, everyone must remember to use a stirring rod to mix the solutions evenly. What color does the solution turn? (The teacher shows the solution with his right hand.) What color does the solution turn? (The teacher shows the solution with his left hand.) **Student A**: I observe that the rose petal juice turns to different color again. When we add salt solution, the color remains pink. When we add lemon juice, it turns red. (It doesn't change color when we add salt solution.) (It turns red when we add lemon juice.) **Teacher**: Excellent! Please write down the color of the solution in your group's test tube on your worksheet.			

2-1學生能正確按照實驗步驟操作，並觀察玫瑰花瓣遇到不同溶液所發生顏色上的改變。	(三)利用剛才的實驗結果與石蕊試紙所測出量的結果進行比較。 ***模擬師生對話*** **教師**：還記得我們之前學過哪一個工具也能測出酸鹼性嗎？ **學生**：石蕊試紙。 **教師**：Great! 老師有把你們準備的溶液滴入到酸鹼指示劑當中。 **教師**：你們觀察比較一下跟你們做的玫瑰花瓣有什麼異同？ **學生**：跟石蕊試紙一樣，遇到酸性變成紅色，遇到鹼性是藍色。 **教師**：Well done. 這也就代表什麼意思？ **學生**：玫瑰花瓣可以當作酸鹼指示劑。	(3) Comparison of Experimental Results with Litmus Paper ***Simulated Teacher-Student Dialogue:*** **Teacher**: Do you remember what tool we learned to test acid and basic solutions in the last lesson? **Student**: Litmus paper. **Teacher**: Great! I've added the solutions you prepared into the acid-base indicator. **Teacher**: Now, compare and observe—what are the similarities and differences between the results from litmus paper and the rose petal juice? **Student**: Just like litmus paper, It turns red when we add the acid solution; while it turns blue when we add the basic solution. **Teacher**: Well done. What does that tell us? **Student**: Rose petals can be used as an acid-base indicator.	石蕊試紙	4分鐘	
2-2學生能利用玫瑰花瓣所調配出的酸鹼指示劑得出的結論，應用到辨識生活中未知的酸鹼性溶液。	(四)教師引導學生進行生活中溶液的酸鹼性觀測實作。 ***模擬師生對話：*** **教師**：接下來，我們要用玫瑰花瓣溶液來檢測我們生活中的酸鹼溶液。我們這次所挑選的溶液是什麼呢? **學生**：食用醋與肥皂水 **教師**：That's right, you're all paying attention in class! Well done! 接下來請同學使用不同支滴管，分別將食	(4) The teacher guides students to test the solution in our daily lives. ***Simulated Teacher-Student Dialogue:*** **Teacher**: Next, we will use the rose petal solution to test the acid and basic solution in our daily lives. What solutions are we using in today's lesson? **Student**: Vinegar and soap water. **Teacher**: That's right, you're all paying attention in class! Well done! Next, please use different droppers to respectively add vinegar and soap water into test tubes 4 and 5. Then, observe the color in the test	食用醋 肥皂水 滴管×6 試管×6 試管架×1 Rose Detective學習單(如附件二)	10分鐘	實作評量 (學生能利用滴管將溶液滴入玫瑰花瓣溶液當中，並記錄顏色變化。)

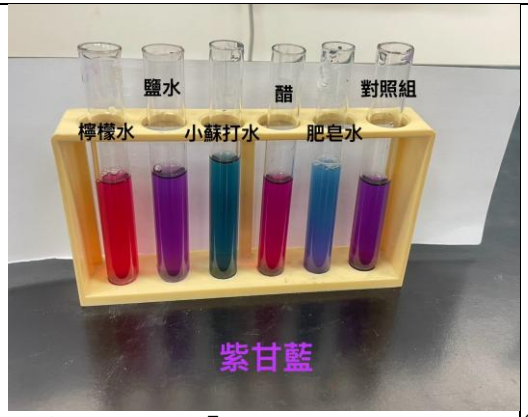
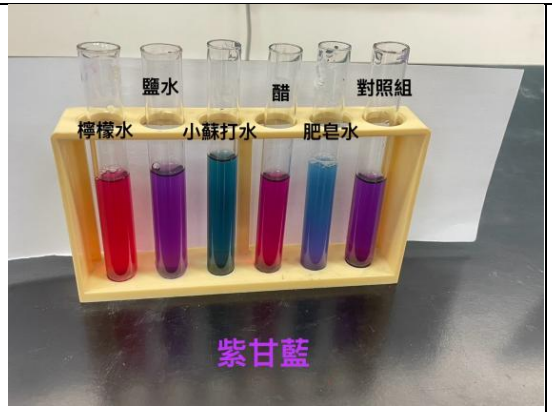
	用醋與肥皂水滴入到第4與第5支試管，並觀察試管的顏色變化。 **教師**：What color does the solution turn? **學生A**：滴入肥皂水的試管中，顏色變成紫色 (It turns purple.) **學生B**：滴入食用醋的試管中，顏色變成紅色(It turns red.)	tubes. **Teacher**: What color does the solution turn? **Student A**: It turns purple when we add soap water. **Student B**: It turns red when we add vinegar.			
2-3學生能歸納出辨識酸鹼溶液的方法，並分析老師所準備的溶液為何種溶液。	 三、綜合活動 (一)結果整理與小組發表 ***模擬師生對話*** **教師**：請小組同學，拿著小組的學習單，到講台上分享今天小組的觀察，並說明原因。 (Please come to the stage and share your observations with classmates.) **小組A**：我們這組發現，在裝有玫瑰花瓣溶液的試管中，滴入食用醋時，溶液會變成紅色，顏色變化跟用石蕊試紙一樣，都會變成紅色，因此我們這組認為食用醋是酸性。 **小組B**：我們這組發現，在裝有玫瑰	 III. Wrap-Up Activity (1) Results Summary and Group Presentations ***Simulated Teacher-Student Dialogue***: **Teacher**: The teacher will invite some group members to bring their worksheet to the front and share their group's observations from today. Please explain your reason. **Group A**: Our group finds that when we add vinegar into the test tube containing rose petal juice, it turns red. The color is similar to the litmus paper, which also turns red. Therefore, our group thinks that vinegar is acid. **Group B**: Our group finds that when we		8分鐘	口頭評量 (學生能說明辨識酸鹼溶液的方法。)

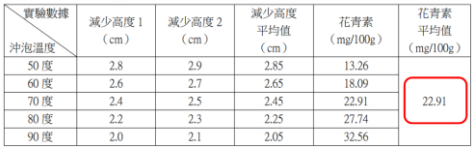
	花瓣溶液的試管中，滴入肥皂水時，溶液會變成藍綠色，顏色變化跟用石蕊試紙一樣，都會變成藍色，因此我們這組認為肥皂水是鹼性。 **教師**：Excellent answers! Let's give every group a big hand! (二)教師統整今日課程 **教師**：今天上課所用到的玫瑰花瓣，跟石蕊試紙一樣都是可以用來測量酸鹼！When the rose petal juice turns red, what kind of solution is it? **學生**：It's an acid solution. **教師**：Great! When the rose petal juice turns green, what kind of solution is it? **學生**：It's a basic solution. **教師**：Excellent! If the color only becomes lighter but doesn't change, what kind of solution is it? **學生**：It's a neutral solution. **教師**：Good job! 這樣同學們知道如何使用我們生活中的酸鹼指示劑了！ That's all for the class. See you next time.	add soap water into the test tube containing rose petal juice, it turns green. The color is similar to the litmus paper, which also turns blue. Therefore, our group thinks that soap water is basic. **Teacher**: Excellent answers! Let's give every group a big hand! (2) Teacher summarizes today's lesson. ***Simulated Teacher-Student Dialogue:*** **Teacher**: The rose petals we used in today's experiment, like litmus paper, can be used to test acid and basic solution! When the rose petal juice turns red, what kind of solution is it? **Students**: It's an acid solution. **Teacher**: Great! When the rose petal juice turns green, what kind of solution is it? **Students**: It's a basic solution. **Teacher**: Excellent! If the color only becomes lighter but doesn't change, what kind of solution is it? **Students**: It's a neutral solution. **Teacher**: Good job! Now everyone knows how to use acid-base indicators from our daily lives! That's all for the class. See you next time!		2分鐘	

	【第三節課】 一、引起動機 (一)複習上一節課所做的玫瑰花瓣實驗。 ***模擬師生問答：*** **教師**：同學們，還記得上節課提到了哪些蔬果含有花青素嗎？ **學生**：有紫甘藍、玫瑰花。 **教師**：Very good! Now, let's think about it, when we put rose petals into water, what color does the solution turn? **學生**：It turns red! **教師**：很棒喔！還記得我們前面提到「波以耳」做的事嗎？他是拿來做什麼實驗的？ **學生**：玫瑰花瓣，他用來測酸鹼。 **教師**：對，我們上一節課做了玫瑰花瓣實驗發現玫瑰花瓣是一個可作為酸鹼指示劑。	【The third lesson】 I. Motivation Introduction (1) Reviewing the rose petal experiment from the last class ***Simulated Teacher-Student Dialogue:*** **Teacher**: Do you remember which fruits or vegetables you found out contain anthocyanins in the last lesson? **Students**: Purple cabbage and rose petals. **Teacher**: Very good! Now, let's think about it, when we put rose petals into water, what color does the solution turn? **Students**: It turns red! **Teacher**: Excellent! Do you also remember what we mentioned earlier about what Boyle did? What kind of experiment did he conduct? **Students**: He used rose petals to test the acid and basic solution. **Teacher**: That's right. In our last class, we saw the rose petal experiment that rose petals can act as an acid-base indicator.	實驗器材： 燒杯(500mL) ×2、燒杯(250mL)×5、滴管×7、試管×12、攪拌棒×12、研缽、剪刀、試管架×2、玫瑰花瓣、紫甘藍檸檬原汁、鹽水、小蘇打水、食用醋肥皂水。	3分鐘	
3-1學生能理解好的酸鹼指示劑需要具備的性質。	二、發展活動 (一)教師帶著學生討論什麼是好的酸鹼指示劑？ ***模擬師生問答：*** **教師**：上一節課我們有一個成功經驗，玫瑰花瓣可以當作酸鹼指示劑，那麼老師想問同學，什麼是好的酸鹼指示劑？ **學生**：像石蕊試紙一樣。 **教師**：Great! Can you explain a bit	2. Development Activities (1) The teacher leads a discussion on what makes a good acid-base indicator. ***Simulated teacher-student dialogue:*** **Teacher**: In our last class, we had a successful experience — rose petals can be used as an acid-base indicator. Now I want to ask you: What makes a good acid-base indicator? **Students**: Something like litmus paper. **Teacher**: Great! Can you explain a bit		5分鐘	口頭評量 (學生能說出好的酸鹼指示劑的性質。)

	more? **學生**：像石蕊試紙一樣可以變色。 **教師**：Good job! 只要可以變色就可以了嗎？如果他的變色無法用肉眼觀察出來也是可以的嗎？ **學生**：不行！顏色變化越明顯越好。 **教師**：Exactly.好的酸鹼指示劑，是能夠顏色變化越大代表越好，方便我們進行觀察。	more? **Students**: It changes color like litmus paper. **Teacher**: Good job! Does changing color mean that it is a good acid-base indicator? If the color change is so subtle that we can't see it with our eyes, can it also be a good acid-base indicator? **Students**: No. The more obvious the color change is, the better the acid-base indicator is. **Teacher**: Exactly. A good acid-base indicator shows a clear and noticeable color change, which makes it easier for us to observe.			
3-2學生能依照步驟完成「紫甘藍」的實驗，並觀察紫甘藍遇到不同溶液所發生顏色上的改變。	(二) 教師引導學生進行紫甘藍酸鹼變色實作。 ***模擬師生問答：*** **教師**：還記得影片當中除了玫瑰花瓣的植物以外還有什麼植物嗎？ **學生**：紫甘藍。 **教師**：Well done.老師這邊有幫大家準備好了紫甘藍溶液。請拿出滴管，將檸檬汁滴入紫甘藍溶液中，並用攪拌棒小心攪拌。 What color does the solution turn? Does the color change when we add lemon juice? **學生A**：在滴入檸檬汁的時候，紫甘藍溶液變色了耶！ **教師**：What color does it turn? **學生A**： It turns red. **教師**： Good job! Please record the color of the solution in the test tube on	(2) The teacher guides students through a hands-on experiment using rose petals and acid-base solutions. ***Simulated teacher-student dialogue:*** **Teacher**: Do you remember the other plant besides rose petals appeared in the video? **Student**: Purple cabbage. **Teacher**: Well done. I've prepared some purple cabbage solution for you. Please take your dropper and carefully add some lemon juice into the purple cabbage solution. Stir gently with your stirring rod. What color does the solution turn? Does the color change when we add lemon juice? **Student A**: When we add lemon juice, the purple cabbage solution changes color! **Teacher**：What color does it turn? **Student A**： It turns red.	紫甘藍溶液 玫瑰花瓣溶液 小蘇打水 檸檬原汁 鹽水 食用醋 肥皂水 試管×12 滴管×7 試管架×2 Purple Cabbage Detective 學習單(如附件三)	15分鐘	實作評量 (學生能利用滴管將溶液滴入紫甘藍溶液當中，並記錄顏色變化。)

	your worksheet. **教師**：接下來，再請各小組另外一位同學，將鹽水與小蘇打水，分別滴入到紫甘藍中，在滴入的同時，用攪拌棒小心攪拌。 **學生B**：在滴入鹽水的時候，紫甘藍溶液的顏色維持紫色。 **教師**：What color does it turn? **學生B**： It doesn't turn. **學生C**：在滴入小蘇打水的時候，顏色改變了。 **教師**：What color does it turn? **學生C**：It turns green. **教師**：Great! Please record these color changes in your worksheet. 接下來老師會在各組隨機發下生活中的溶液，燒杯上有標示生活中溶液的字卡。溶液滴入紫甘藍溶液時，你們需要觀察：What color does the solution turn? **Group A**：我們這一組拿到的是醋，紫甘藍變成紅色了。 **教師**：What color does it turn? **Group A**：It turns red. **教師**：Well done. **Group B**：我們這一組拿到的是肥皂水，紫甘藍變成藍色了。 **教師**：What color does it turn? **Group B**：It turns blue. **教師**：Excellent!	**Teacher**: Good job! Please record the color of the solution in the test tube on your worksheet. **Teacher**: Now, another group member will add salt water and baking soda solution into the purple cabbage juice. Stir gently with your stirring rod while adding. **Student B**: When we add the salt water, the color of the purple cabbage juice remains purple. **Teacher:** What color does it turn? **Student B**: It doesn't turn. **Student C**: When we add the baking soda solution, the color of the purple cabbage juice changes. **Teacher:** What color does it turn? **Student C**: It turns green. **Teacher**: Great! Please record these color changes in your worksheet. Next, I will randomly hand out the household solutions to each group. There is a label on each beaker indicating what the solution is. When the solution is dropped into the purple cabbage juice, you need to observe: What color does the solution turn? **Group A**: Our group gets vinegar. The purple cabbage turns red. **Teacher**: What color does it turn? **Group A**: It turns red. **Teacher**: Well done. **Group B**: Our group gets soap water. The purple cabbage turns blue. **Teacher**: What color does it turn? **Group B**: It turns blue. **Teacher**: Excellent!			

3-3學生能夠比較玫瑰花瓣與紫甘藍，此兩種不同溶液所發生顏色上的改變，歸納出好的酸鹼指示劑。	 (三)藉由討論出「好的酸鹼指示劑」的結論，利用眼睛觀察進行玫瑰花瓣與紫甘藍的比較。 ***模擬師生問答：*** **教師**：還記得我們剛才討論的內容，什麼是好的酸鹼指示劑？ **學生**：顏色變化越大越好。 **教師**：Well done. 那們請你們觀察，上一節課的玫瑰花瓣與這一節課的紫甘藍哪一個有比較明顯的顏色變化？ **學生**：紫甘藍。 **教師**：為什麼呢？ **學生**：在鹼性的時候，紫甘藍溶液的顏色比玫瑰花瓣還要深。 **教師**：Great! 那你們覺得哪一個是比較好的酸鹼指示劑？ **學生**：紫甘藍。因為顏色變化大。 **教師**：Good job. 你們覺得紫甘藍相對於玫瑰花瓣是好的酸鹼指示劑。	 (3) Compare rose petals and purple cabbage based on the earlier discussion of good indicators. ***Simulated teacher-student dialogue:*** **Teacher**: Let's recall what we discussed earlier — what is a good acid-base indicator? **Students**: The more obvious the color change of the solution is, the better the acid-base indicator is. **Teacher**: Well done. So now, let's compare the rose petals from last class and the purple cabbage from today. Which one shows a more noticeable color change? **Students**: Purple cabbage. **Teacher**: Why? **Students**: Under alkaline conditions, the color of the purple cabbage is deeper and more noticeable than that of the rose petal. **Teacher**: Great! So which one is a better acid-base indicator? **Students**: Purple cabbage, because the color change is more obvious.	Purple Cabbage Detective 學習單(如附件三)	5分鐘	觀察評量 (學生能專注比較玫瑰花瓣與紫甘藍的顏色變化程度。)

3-4 學生能利用平板電腦查找資料，驗證自己所提出的假說。	(四)回到之前的假說，透過平板電腦搜尋資料來驗證其假說。 ***模擬師生問答：*** **教師**：還記得你們第一節課所提出的假說嗎？ **學生**：花青素越多的植物，就很適合做酸鹼指示劑？ **教師**：沒錯喔，這是我們之前所做的假設。剛才你們認為紫甘藍因為顏色變化大適合當做酸鹼指示劑，老師現在要你們利用平板電腦尋找，玫瑰花瓣與紫甘藍的花青素是多少？ **學生**：老師我查到了！玫瑰花瓣的花青素 22.91 mg/100g 。  **學生**：上網找到紫甘藍的花青素 321mg/100g。  **教師**：Well done.根據所查到的資	**Teacher**: Good job! So you think purple cabbage is a better acid-base indicator compared to rose petals. (4) Use the tablets to search for information and verify the earlier hypothesis. ***Simulated teacher-student dialogue:*** **Teacher**: Do you remember the hypothesis you came up with in the first class? **Students**: Are indicators that contain more anthocyanins better acid-base indicators? **Teacher**: That's right — it is your original hypothesis. You say purple cabbage is a better indicator because of the greater color change. Now, I'd like you to use your tablets to find out how much anthocyanin is in rose petals compared to purple cabbage. **Students**: Teacher, I find it! Rose petals contain 22.91 milligrams of anthocyanins per 100 grams.  **Students**: I find online that purple cabbage contains 321 milligrams of anthocyanins per 100 grams.	平板電腦 Purple Cabbage Detective 學習單(如附件三)	10分鐘	實作評量 (根據各小組的實驗結果，教師可以得知學生是否正確操作實驗)

實驗數據 / 沖泡溫度	減少高度 1（cm）	減少高度 2（cm）	減少高度平均值（cm）	花青素（mg/100g）	花青素平均值（mg/100g）
50 度	2.8	2.9	2.85	13.26	
60 度	2.6	2.7	2.65	18.09	
70 度	2.4	2.5	2.45	22.91	22.91
80 度	2.2	2.3	2.25	27.74	
90 度	2.0	2.1	2.05	32.56	

	料，我們可以發現，紫甘藍的花青素比玫瑰花瓣的花青素還要高。**剛好也符合大家的假說，只要花青素越多的植物，就適合當作酸鹼指示劑。** 三、綜合活動 教師總結課程內容 **教師**：今天的課程讓你們去實驗紫甘藍當作酸鹼指示劑的顏色變化，後來你們利用觀察比較玫瑰花瓣與紫甘藍顏色變化的方式，發現紫甘藍比玫瑰花瓣更適合做酸鹼指示劑。接著你們在使用平板電腦搜尋兩者花青素的含量，後來發現紫甘藍的花青素比玫瑰花瓣高，證實了之前的假說，大家已經是小小科學家了呢！That's all for the class, class dismissed.	 **Teacher**: Well done. Based on the information we find, we can see that purple cabbage contains more anthocyanins than rose petals. **This supports your hypothesis — the more anthocyanins a plant contains, the more suitable it is as an acid-base indicator.** III. Wrap-Up Activity Teacher summarizes the lesson content **Teacher**: Today's lesson allows you to experiment with how purple cabbage, which is used as the acid-base indicator changes color. Then, through observation and comparison, you discover that purple cabbage shows more noticeable color changes than rose petals, making it more suitable as an acid-base indicator. After that, you use tablets to search for the anthocyanin content in both plants and find that purple cabbage has a higher anthocyanin content than rose petals, which confirmed your earlier hypothesis. You're already becoming little scientists! That's all for the class, class dismissed.		2分鐘	

4-1 學生能根據實驗結果說明酸鹼溶液加入指示劑的顏色變化。	【第四節課】 一、引起動機 (一) 複習上節課的課程內容，回憶酸性、鹼性及中性溶液分別加入紫甘藍溶液中，顏色的變化為何。 ***模擬師生問答：*** **教師**：有哪位同學要舉手說一下，上一節課老師教了什麼內容？ **學生A**：上一節課老師教我們怎麼判斷酸性、鹼性跟中性溶液。 **教師**：Very good. 那我們要怎麼判斷呢？ **學生B**：可以把未知溶液倒進去紫甘藍溶液裡面，如果變紅色，就是酸性，變綠色或藍色就是鹼性，沒有變色的話，就是中性。 **教師**：Good job! 同學對於上一節課的內容記得很清楚~	【The fourth lesson】 I. Motivation (1) Reviewing the content from the previous lesson: recalling the color changes when acidic, basic, and neutral solutions are added to purple cabbage juice. ***Simulated teacher-student dialogue:*** **Teacher**: Does anyone want to raise your hand and tell us what we learned in the last class? **Student A**: We learned how to identify acidic, basic, and neutral solutions. **Teacher**: Very good. So, how do we identify them? **Student B**: We can add the unknown solution into the purple cabbage juice. If it turns red, it's acidic; if it turns green or blue, it's basic; and if there is no color change, it's neutral. **Teacher**: Good job! You all remember what we learned last lesson~		3分鐘	
	(二) 老師拿出自己（老師準備檸檬汁、小蘇打水、酒精）、各組所準備的溶液，讓學生回憶各溶液為酸性、鹼性、中性。 ***模擬師生問答：*** **教師**：Everyone, let's think together. These solutions are acid, basic, or neutral. What is the solution? (The teacher points to the lemon juice.) **同學A**：It is lemon juice. **教師**：Good job! What color does the solution turn? **同學B**：It turns red.	(2) The teacher takes out the solutions teacher prepared (lemon juice, baking soda solution, and alcohol), along with the solutions prepared by each group, to help students recall whether solutions are acidic, basic, or neutral. ***Simulated teacher-student dialogue:*** **Teacher**: Everyone, let's think together. These solutions are acidic, basic, or neutral. What is the solution? (The teacher points to the lemon juice.) **Student A**: It is lemon juice. **Teacher**: Good job! What color does the solution turn?		5分鐘	

	教師：Well done. Why does it turn red? **同學C**：It is an acid solution. **教師**：Very good! Lemon juice is an acid solution and it turns to red. Next, what is the solution? (The teacher points to the baking soda solution.) **同學D**：It is a baking soda solution. **教師**：Well done. What color does the solution turn? **同學E**：It turns blue. **教師**：Very good! Why does it turn blue? **同學F**：It is a basic solution. **教師**：Good job! Baking soda solution is a basic solution and it turns blue. Next, what is the solution? (The teacher points to alcohol.) **同學G**：It is alcohol. **教師**：Good job! What color does the solution turn? **同學H**：It doesn't change color. **教師**：Great! Why doesn't it change color? **同學I**：It is a neutral solution. **教師**：Well done. Alcohol is a neutral solution. (The teacher continues the dialogue in the same way, asking students about each solution in turn.)	**Student B**: It turns red. **Teacher**: Well done. Why does it turn red? **Student C**: It is an acid solution. **Teacher**: Very good! Lemon juice is an acid solution and it turns red. Next, what is the solution? (The teacher points to the baking soda solution.) **Student D**: It is a baking soda solution. **Teacher**: Well done. What color does the solution turn? **Student E**: It turns blue. **Teacher**: Very good! Why does it turn blue? **Student F**: It is a basic solution. **Teacher**: Good job! Baking soda solution is a basic solution and it turns blue. Next, what is the solution? (The teacher points to alcohol.) **Student G**: It is alcohol. **Teacher**: Good job! What color does the solution turn? **Student H**: It doesn't change color. **Teacher**: Great! Why doesn't it change color? **Student I**: It is a neutral solution. **Teacher**: Well done. Alcohol is a neutral solution. (The teacher continues the dialogue in the same way, asking students about each solution in turn.)			
4-2 學生能操作及區分不同酸鹼溶液加	二、發展活動 (一) 老師請各組派一位學生拿試管、試管架，一位拿裝有紫甘藍溶液的燒	II. Development Activity (1) The teacher asks each group to send one student to get the test tubes and the test tube		8分鐘	實作評量

入指示劑的顏色變化，並做觀察記錄。	杯，一位拿6支滴管。 ***模擬師生問答：*** **教師**：現在請各組派三位同學來前面拿等一下實驗的用具，一位拿試管與試管架，一位拿裝有紫甘藍溶液的燒杯，一位拿6支滴管。誰可以說說看等一下一組要派幾位同學來前面拿實驗用具呢？ **同學A**： 3個人。 **教師**：Great! 每組要派3個人。那這3個人要分別拿什麼東西呢？ **同學B**：有一個人要拿試管跟裝試管的架子。 **教師**：Very good! 有一個人要拿試管跟試管架。有人要說說看還有要拿什麼嗎？ **同學C**：6支滴管。 **教師**：Good job! 有一個人要拿6支滴管。還有呢？ **同學D**：還有需要拿裝有紫甘藍溶液的燒杯。 **教師**：Well done.有一個人要拿有裝紫甘藍溶液的燒杯。 （各組拿完實驗用具） **教師**：老師現在要來看每一組是不是都拿到實驗用具了。都有拿到5支試管、試管架嗎？Show them to the teacher! **教師**：Very good! Each group has gotten them. 接下來是裝有紫甘藍溶液的燒杯，各組都有拿到嗎？ Show it to the teacher.	rack, one student to get the beaker with purple cabbage juice, and one student to get six droppers. ***Simulated teacher-student dialogue:*** **Teacher**: Now, each group, please assign three students to come to the front to get the materials for the experiment. One student will take the test tubes and the test tube rack, one will take the beaker with purple cabbage juice, and one will take six droppers. Can anyone tell me how many students each group needs to assign to come to the front to get the experiment materials? **Student A**: Three. **Teacher**: Great! Each group needs to assign three students. What should each of them be responsible for? **Student B**: One student needs to take the test tubes and the test tube rack. **Teacher**: Very good! One student needs to take the test tubes and the test tube rack. Can anyone tell me what else needs to be taken? **Student C**: Six droppers. **Teacher**: Good job! One student needs to take six droppers. Does anything else need to be taken? **Student D**: The beaker with purple cabbage juice. **Teacher**: Well done. One student needs to take the beaker with purple cabbage juice. (All the groups have picked up their materials.) **Teacher**: Now, the teacher is going to check if each group has received all the			（各小組透過實驗完成屬於該組的圖畫創作）

	教師：好，每組都有拿到6支滴管嗎？Hold them high and show them to the teacher! **教師**：Good job! 每一組都有拿到實驗用具了。	experiment materials. Does each group get five test tubes and a test tube rack? Show them to the teacher. **Teacher**: Very good! Each group has gotten them. Next is the beaker with purple cabbage juice. Does each group get one? Show it to the teacher. **Teacher**: Does each group get six droppers? Hold them high and show them to the teacher! **Teacher**: Good job! Every group gets all their experiment materials.			
	（二）老師將五朵花瓣畫在黑板上，並請學生將試管以花的形狀排列於試管架上。 ***模擬師生問答：*** **教師**：現在看到黑板上有五朵花瓣的花，等一下同學要把試管按照花瓣的形狀排在試管架上面。	(2) The teacher draws five petals on the blackboard and asks the students to arrange the test tubes on the rack in the shape of a flower. ***Simulated teacher-student dialogue:*** **Teacher**: You can see a flower with five petals on the blackboard. Later, you will arrange the test tubes on the rack in the shape of the petals.	Acid-base flower show(如附件四)	1分鐘	
	（三）老師開始說明實驗步驟，先請學生利用滴管，將紫甘藍溶液加入試管中，再將自己組內與老師所準備的溶液加入試管中，觀察試管中溶液的顏色變化，並記錄其顏色、溶液名稱及酸鹼性。 ***模擬師生問答：*** **教師**：各組都把試管排好了嗎？還沒排好的舉個手讓老師知道。 **教師**：Good job! 各組都排好了。接下來，我們要把燒杯裡的紫甘藍溶液用一支滴管加到5支試管裡。可以看到滴管上面有刻度，每支試管總	(3) The teacher explains the steps of the experiment. First, students are asked to add the purple cabbage juice into the test tubes. Then, they add the solutions prepared by their group and the teacher into the test tubes, observe the color changes, and record the color and the type of solution. ***Simulated teacher-student dialogue:*** **Teacher**: Has every group finished arranging the test tubes? If you haven't done it yet, raise your hand and let the teacher know. **Teacher**: Good job! All the groups have finished arranging them. Next, we will use a dropper to add the purple cabbage		15分鐘	

	共要加5刻度的溶液。 **教師**：之後，我們就要開始加各溶液進去試管裡囉~接著要觀察這5支試管的顏色變化，再用水彩把顏色塗在圖畫紙上，也要把顏色、溶液名稱都填上喔。 **教師**：老師要來問同學們，試管都加入紫甘藍溶液之後，要做什麼事呢？ **同學F**：要把老師準備的溶液跟每一組準備的溶液加進去試管裡面。 **教師**：Very good! 要把老師跟每一組準備的溶液分別加進去每一個試管裡面。加完每一個溶液之後，有誰可以說說看要觀察什麼？ **同學G**：要觀察溶液的顏色變化。 **教師**：Good job! 要觀察溶液的顏色變化。觀察後，接著要做什麼呢？ **同學H**：記錄下來。 **教師**：要記錄什麼呢？ **同學I**：把顏色用水彩畫在圖畫紙上，然後把加到試管裡面的溶液、酸鹼性寫上去。 **教師**：Good job！觀察顏色變化之後，要用水彩把顏色畫在圖畫紙上，再寫上溶液跟對應的酸鹼性。現在每一組可以開始進行實驗了。	juice from the beaker into the five test tubes. You can see that the dropper has markings. For each test tube, add five marks solution. **Teacher**: Later, we will start adding the different solutions into them. Then, observe the color changes in these five test tubes, use watercolor to paint the colors on the drawing paper, and remember to write down the colors and the names of the solutions. **Teacher**: The teacher is going to ask some questions. After adding the purple cabbage juice into the test tubes, what should we do next? **Student F**: We need to add the solutions prepared by the teacher and each group into the test tubes. **Teacher**: Very good! We need to add the solutions prepared by the teacher and each group separately into each test tube. After adding each solution, can someone tell me what we should observe? **Student G**: We need to observe the color changes of the solutions. **Teacher**: Good job！We need to observe the color changes of the solutions. After observing, what should we do next? **Student H**: Write it down. **Teacher**: What should we write? **Student I**: Paint the colors on the drawing paper with watercolors, then write down the solutions added to the test tubes and whether they are acidic or basic. **Teacher**: Good job！After observing the			

4-3 學生能透過所調配出的溶液，製作並結合水彩，分享該組的圖畫，以交流彼此的調配方式。	三、綜合活動 (一)各組將塗完顏色的花，按照組別上台發表各花瓣所呈現的顏色是使用什麼溶液與紫甘藍溶液所調配出。 ***模擬師生問答：*** **教師**：Now let's invite Group 1 to come up and share with everyone which solutions they used to create the colors of their five flower petals. **小組A**：我們的第一個花瓣是紅色的。 **教師**：What solution do you use? **小組A**：We use lemon juice. **教師**：Is lemon juice an acid, base, or neutral solution? **小組A**：It is an acid solution. **教師**：Very good! Lemon juice is an acid solution. Next petal is pink, so What solution do you use? **小組A**：We use soda. **教師**：Is soda an acid, base, or neutral solution? **小組A**：It is an acid solution. **教師**：Great! Soda is also an acid solution. How about the next petal? **小組A**：It is green. **教師**：Yes, it is green. What solution do you use?	color changes, use watercolors to paint the colors on the drawing paper, then write down the solutions and their acid-base properties. Now, each group can start the experiment. III. Wrap-Up Activity (1)Each group presents their colored flower on stage, explaining which solutions are mixed with purple cabbage juice to produce each petal's color. ***Simulated teacher-student dialogue:*** **Teacher**: Now let's invite Group 1 to come up and share with everyone which solutions they used to create the colors of their five flower petals. **Group A**: Our first petal is red. **Teacher**: What solution do you use? **Group A**: We use lemon juice. **Teacher**: Is lemon juice an acid, base, or neutral solution? **Group A**: It is an acid solution. **Teacher**: Very good! Lemon juice is an acid solution. Next petal is pink, so what is the solution? **Group A**: We use soda. **Teacher**: Is soda an acid, base, or neutral solution? **Group A**: It is an acid solution. **Teacher**: Great! Soda is also an acid solution. How about the next petal? **Group A**: It is green. **Teacher**: Yes, it is green. What solution do you use? **Group A**: We use baking soda solution. **Teacher**: Is baking soda solution an acid, base, or neutral solution?		6分鐘	實作評量 (學生透過實驗，將結果由作品呈現，教師可根據每組學生的分享，了解學生是否理解各溶液的顏色變化及酸鹼性。)

	小組A：We use baking soda solution. **教師**：Is baking soda solution an acid, base, or neutral solution? **小組A**：It is a basic solution. **教師**：Good job! Baking soda solution is a basic solution. I see the next petal is blue. What solution do you use? **小組A**：We use soap water. **教師**：Is soap water an acid, base, or neutral solution? **小組A**：It is a basic solution. **教師**：Great! Soap water is a basic solution. (The teacher continues in the same way, inviting each group to come up and present the solutions they used and the corresponding colors they produced.) (二)教師統整單元所學到的內容 **教師**：同學們，這四節課我們從觀察、做實驗、查資料到動手應用，完成了一次有趣的科學探險。第一節課，我們學會用觀察和查資料來找答案。第二節課，我們用玫瑰花瓣做實驗，看它在不同液體中變什麼顏色，並且應用在生活中。第三節課，我們用紫甘藍再做一次實驗，跟玫瑰花瓣比較，看看哪個效果更 好。第四節課，我們用自己做的指示劑畫畫，把科學和藝術結合起來，互相分享成果。這幾堂課，我們學會觀察、動手做、合作和思考，大家越來越像科學家囉！	**Group A**: It is a basic solution. **Teacher**: Good job! Baking soda solution is a basic solution. I see the next petal is blue. What solution do you use? **Group A**: We use soap water. **Teacher**: Is soap water an acid, base, or neutral solution? **Group A**: It is a basic solution. **Teacher**: Great! Soap water is a basic solution. (The teacher continues in the same way, inviting each group to come up and present the solutions they used and the corresponding colors they produced.) (2) Teacher summarizes the unit. **Teacher**: Everyone, over these four lessons, we went on an exciting science adventure — from observing and doing experiments to searching for information and applying what we learned. In the first lesson, we learned how to observe and look up information to find answers. In the second lesson, we used rose petals to do experiments and saw how the color changed in different liquids. We also applied this in everyday life. In the third lesson, we repeated the experiment using purple cabbage and compared it with rose petals to see which one worked better. In the fourth lesson, we used the indicator we made to create paintings, combining science and art, and shared our results with each other. Through these lessons, we learned how to observe, experiment, cooperate, and think critically. You're all becoming scientists!		2分鐘	

第一節課(形成性評量)

口頭評量			
	優	良	待加強
學生能透過影片理解波以耳與拉瓦節的實驗過程	學生能透過影片清楚理解波以耳與拉瓦節的實驗過程，並能夠完整回應老師所提出的問題。	學生能透過影片清楚理解波以耳與拉瓦節的實驗過程，但是無法完整回應老師所提出的問題。	學生能透過影片清楚理解波以耳與拉瓦節的實驗過程，但是無法回應老師所提出的問題。

觀察評量			
	優	良	待加強
學生能利用五感觀察玫瑰花瓣與紫甘藍。	學生能利用五感觀察玫瑰花瓣與紫甘藍，並能夠說出自己觀察到的內容。	學生能利用五感觀察玫瑰花瓣與紫甘藍，但無法完整說出自己觀察到的內容。	學生無法利用五感觀察玫瑰花瓣與紫甘藍，且說出的內容與玫瑰花瓣與紫甘藍無關。

實作評量			
	優	良	待加強
學生能完成學習單上的任務。	學生能根據老師的引導，完成學習單上的任務。	學生能聽懂老師的引導，但是在學習單上撰寫不夠清楚。	學生聽不懂老師的引導，且無法完成學習單上的任務。

回教案

第二節課(形成性評量)

實作評量			
	優	良	待加強
學生能夠按照實驗步驟製作出玫瑰花瓣溶液	學生能按照教師的實驗步驟，成功配製出濃度適宜的玫瑰花瓣溶液。	學生未完全按照教師的實驗步驟，未完全磨碎玫瑰花瓣，因此配製出濃度太淡的玫瑰花瓣溶液。	學生未按照教師的實驗步驟操作實驗，破壞實驗器材，且也未配製出玫瑰花瓣溶液。

實作評量			
	優	良	待加強
學生能利用滴管將溶液滴入玫瑰花瓣溶液當中，並記錄顏色變化	學生能正確操作實驗，並完整記錄玫瑰花瓣溶液的顏色變化。	學生能正確操作實驗，但實驗記錄不完整，有些顏色變化為詳細記錄。	學生未分別使用不同支滴管進行實驗操作，因此實驗記錄不正確。

口頭評量			
	優	良	待加強
學生能說明辨識酸鹼溶液的方法	學生能比對石蕊試紙的變色特性，並使用目標句型（It turns 顏色.)，說明以玫瑰花瓣溶液作為酸鹼指示劑的顏色變化相似之處。	學生比對石蕊試紙的變色特性之後，並使用目標句型（It turns 顏色.)，但無法說出以玫瑰花瓣溶液作為酸鹼指示劑的顏色變化相似之處。	學生無法結合石蕊試紙的變色特性，進行單元重點歸納。

回教案

第三節課(形成性評量)

口頭評量			
	優	良	待加強
學生能說出好的酸鹼指示劑的性質。	學生能完整說明指示劑需具備的特性，並舉例說明。	學生能指出一到兩個指示劑的性質，表達尚清楚。	學生無法清楚表達指示劑的性質或答非所問。

實作評量			
	優	良	待加強
學生能利用滴管將溶液滴入紫甘藍溶液當中，並記錄顏色變化。	學生能正確使用滴管操作，並依據觀察結果正確、清楚記錄每次顏色變化。	學生基本能操作滴管，記錄結果有部分遺漏或敘述不完整。	學生使用滴管不當，記錄結果不明確或未完成，需他人協助。

觀察評量			
	優	良	待加強
學生能比較玫瑰花瓣與紫甘藍的顏色變化程度。	學生能口頭或書面清楚比較兩者變化，並提出可能的原因。	學生能指出顏色變化的差異，但較少進一步分析或表達不夠清楚。	學生無法說出兩者的明顯差異。

實作評量			
	優	良	待加強
根據各小組的實驗結果，教師可以得知學生是否正確操作實驗。	小組合作順暢，依步驟正確操作，數據與紀錄完整，能解釋結果。	大致能完成實驗步驟，偶有錯誤但能修正，紀錄尚可。	操作順序錯誤或依賴他人協助，紀錄不完整或缺乏理解。

回教案

第四節課(總結性評量)

總結性評量規準					
領綱學習表現	pc-III-2 能利用簡單形式的口語、文字、影像（例如：攝影、錄影）、繪圖或實物、科學名詞、數學公式、模型等，表達探究之過程、發現或成果。				
評量基準	使用創作的形式深化酸鹼指示劑遇到酸鹼溶液的變化，並進行分享				
基準向度/規準等級	A	B	C	D	E
能否正確操作實驗，並透過記錄完成圖畫創作	學生能完全正確操作實驗，並完整記錄所變化的顏色，以完成圖畫創作	學生能大部分正確操作實驗，並完整記錄所變化的顏色，以完成圖畫創作	學生能部分正確操作實驗，並部分記錄所變化的顏色，以完成圖畫創作	學生能少部分正確操作實驗，並少部分記錄所變化的顏色，以完成圖畫創作	未達D級
在口頭分享時，能否清楚說明該組所使用的溶液、顏色變化、酸鹼性	學生能用目標句型（It turns 顏色. / We use 溶液.）清楚且完整的說明所使用的溶液、其對應到的顏色變化、酸鹼性	學生能用目標句型（It turns 顏色. / We use 溶液.）清楚說明大部分所使用的溶液、其對應到的顏色變化、酸鹼性	學生能用目標句型（It turns 顏色. / We use 溶液.）清楚說明部分所使用的溶液、其對應到的顏色變化、酸鹼性	學生能用目標句型（It turns 顏色. / We use 溶液.）說明少部分所使用的溶液、其對應到的顏色變化、酸鹼性	未達D級

回教案

【附件一】

Plant Detective Name:

1. 波以耳與拉瓦節的影片當中，將你所觀察到的內容記錄在表格中。

	plant	color
波以耳		
拉瓦節		

2. 用眼睛、鼻子、雙手觀察，將結果記錄在表格中。

	see	smell	touch
Purple cabbage			
Rose petal			

3. 提出問題

4. 平板蒐集資料紀錄

5. 假說

Plant Detective

Name: 教師版

1. 波以耳與拉瓦節的影片當中，將你所觀察到的內容記錄在表格中。

	plant	color
波以耳	玫瑰花瓣	紅色
拉瓦節	紫甘藍	紅色、藍色

2. 利用眼睛、鼻子、雙手，將結果記錄在表格中。

	see	smell	touch
Purple cabbage	紫色	沒味道	手有殘留紫色
Rose petal	紅色	香香的	手有殘留紅色

3. 提出問題

手有殘留顏色的植物就可以當酸鹼指示劑？

4. 平板蒐集資料紀錄

1. 玫瑰花瓣和紫甘藍都是植物。
2. 玫瑰花瓣和紫甘藍都是擁有花青素。

5. 假說

有花青素的植物，就適合當作酸鹼指示劑。

回教學設備/資源　　回教案

【附件二】

Roses Detective　Group：_____

1. 提出問題：_____

2. 實驗假設：_____

3. 記錄每支試管的溶液與顏色變化

Solutions	Color
 Vinegar	Red
 Lemon juice	Purple
 Salt water	Pink
 Soap water	Green
 Baking soda solution	Blue

Test tube	Solutions	Color	Acid, Base, Neutral
A			
B			
C			
D			
E			

4. 實驗結論：_____

Roses Detective　Group：教師版

1. 提出問題：玫瑰花瓣在手上殘留顏色，可當作酸鹼指示劑嗎?

2. 實驗假設：玫瑰花瓣遇到不同溶液會變色，可作酸鹼指示劑。

3. 記錄每支試管的溶液與顏色變化

Solutions	Color
Vinegar	Red
Lemon juice	Purple
Salt water	Pink
Soap water	Green
Baking soda solution	Blue

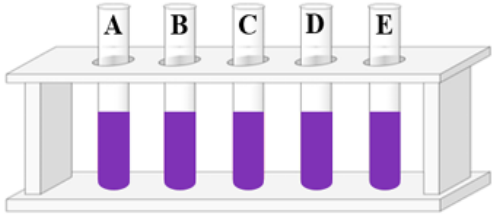
Test tube	Solutions	Color	Acid, Base, Neutral
A	Lemon juice	Red	Acid
B	Salt water	Pink	Neutral
C	Baking soda solution	Green	Base
D	Vinegar	Red	Acid
E	Soap water	Purple	Base

4.實驗結論：玫瑰花瓣溶液在不同溶液中會發生顏色改變，可作為酸鹼指示劑。

回教學設備/資源　回教案

【附件三】

Purple cabbage Detective　　Group：_____



1. 什麼是好的酸鹼指示劑？_____

2. 實驗假設：_____

3. 記錄每支試管的溶液與顏色變化

Solutions	Color
Vinegar	Red
Lemon juice	Purple
Salt water	Pink
Soap water	Green
Baking soda solution	Blue

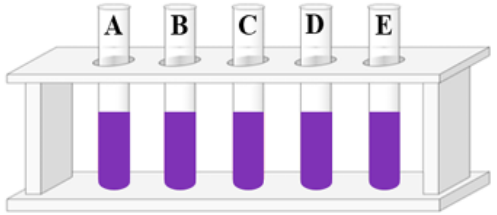
Test tube	Solutions	Color	Acid, Base, Neutral
A			
B			
C			
D			
E			

4.上網找花青素含量　Rose petal: _____　Purple cabbage: _____

5.實驗結論：_____

Purple cabbage Detective

Group：教師版



1. 什麼是好的酸鹼指示劑？顏色變化越明顯越好。

2. 實驗假設：紫甘藍有更多花青素，比玫瑰花瓣更適合當指示劑。

3. 記錄每支試管的溶液與顏色變化

Solutions	Color
Vinegar	Red
Lemon juice	Purple
Salt water	Pink
Soap water	Green
Baking soda solution	Blue

Test tube	Solutions	Color	Acid, Base, Neutral
A	Lemon juice	Red	Acid
B	Salt water	Purple	Neutral
C	Baking soda solution	Green	Base
D	Vinegar	Pink	Acid
E	Soap water	Blue	Base

4.上網找花青素含量 Rose petal: 22.9mg/100g Purple cabbage: 321mg/100g

5.實驗結論：紫甘藍有更多花青素，比玫瑰花瓣更適合當酸鹼指示劑。

回教學設備/資源 回教案

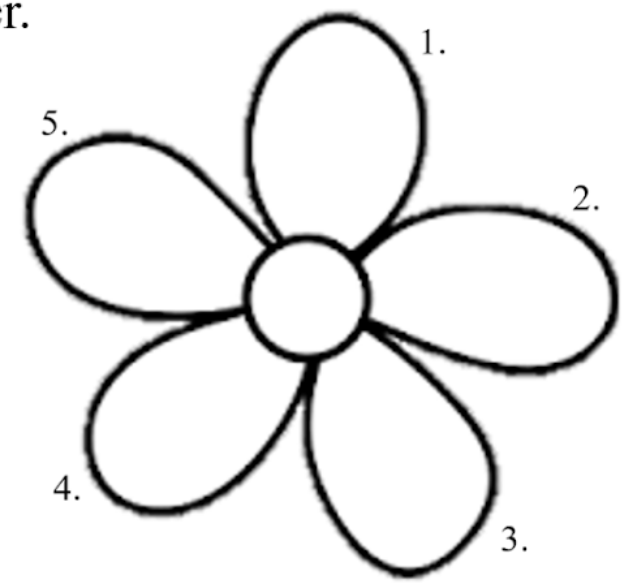
【附件四】

Acid-Base Flower Show

Group：_____

- Please choose the correct answer.

A. acid	B. base	C. neutral
D. lemon juice	E. soda	F. vinegar
G. alcohol	H. milk	I. soap water
J. salt water	L. baking soda solution	



1. _____（A/B/C）
_____＋紫甘藍溶液

2. _____（A/B/C）
_____＋紫甘藍溶液

3. _____（A/B/C）
_____＋紫甘藍溶液

4. _____（A/B/C）
_____＋紫甘藍溶液

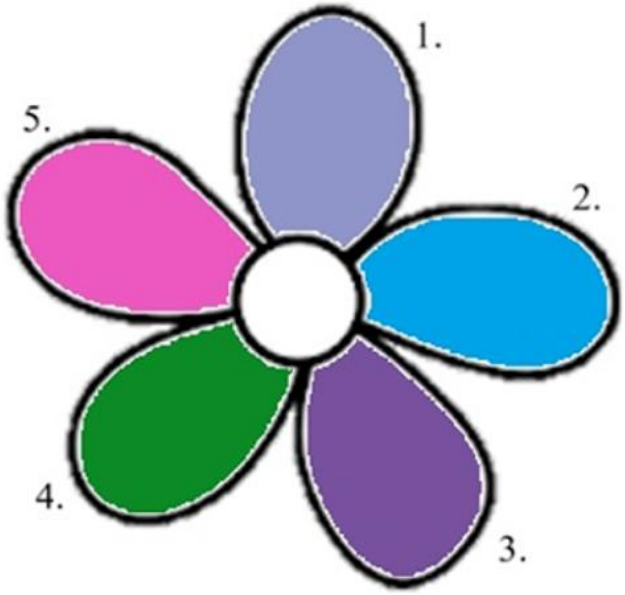
5. _____（A/B/C）
_____＋紫甘藍溶液

Acid-Base Flower Show

Group：教師版

- Please choose the correct answer.

A. acid	B. base	C. neutral
D. lemon juice	E. soda	F. vinegar
G. alcohol	H. milk	I. soap water
J. salt water	L. baking soda solution	



1. C H （A/B/C）+ 紫甘藍溶液
2. B I （A/B/C）+ 紫甘藍溶液
3. C G （A/B/C）+ 紫甘藍溶液
4. B L （A/B/C）+ 紫甘藍溶液
5. A F （A/B/C）+ 紫甘藍溶液

回教學設備/資源　回教案