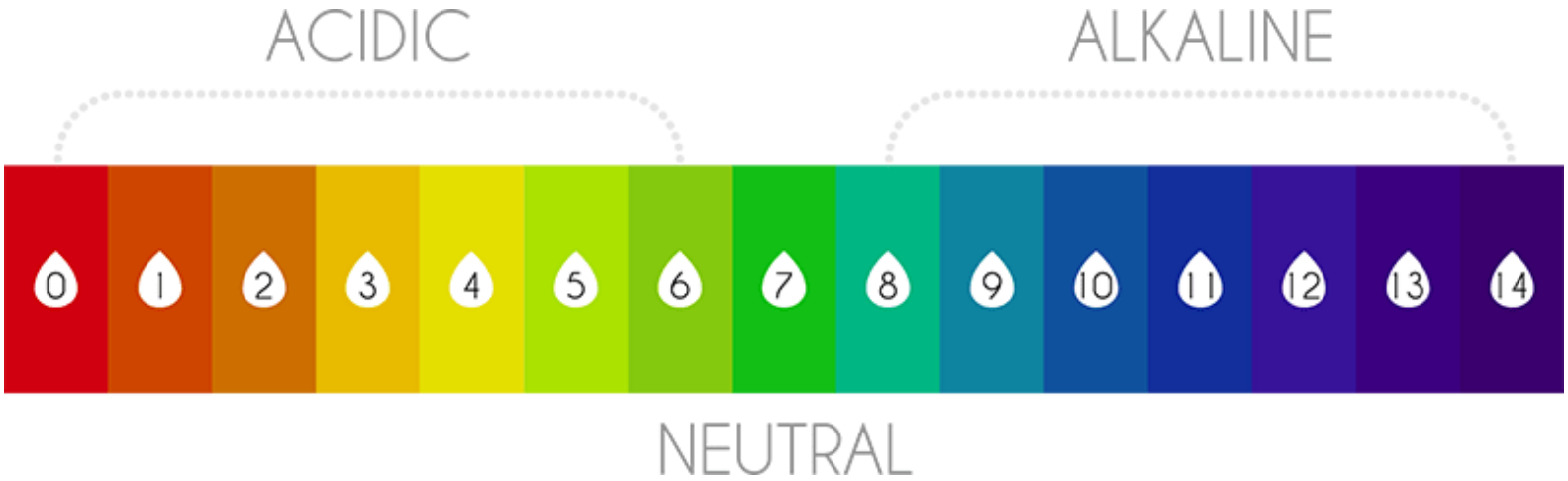
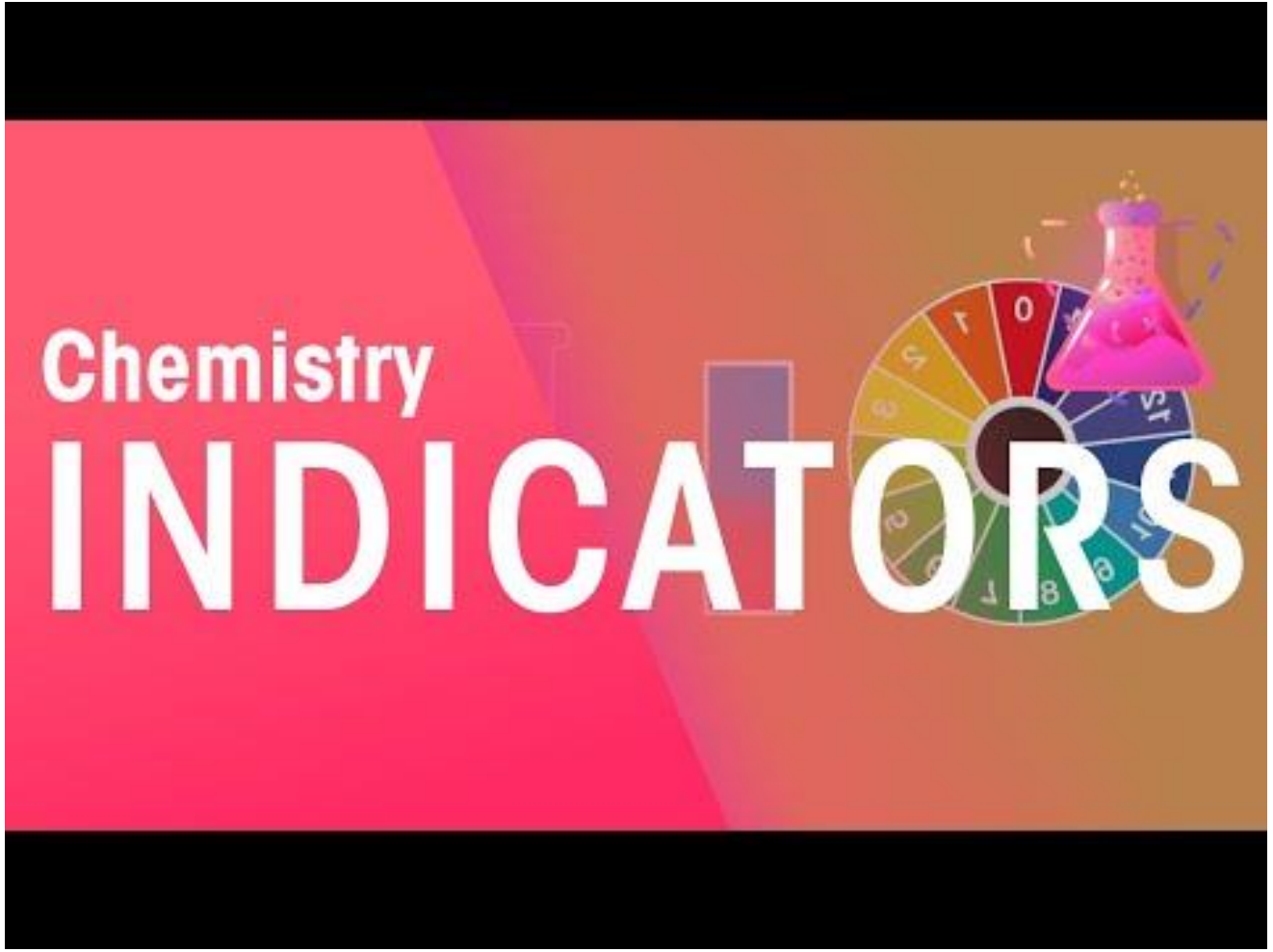
Natural pH indicator
天然酸鹼指示劑

Exp 612



Learning Checklist:

1. To learn the methods for testing the pH levels of different solutions
2. Neutralization reaction between acids and bases
3. Fun facts about stomach acids


Chemistry
INDICATORS

What does pH mean?

Students, write your response!

What does a pH scale range from?

Students, write your response!

How does litmus paper change colour if it touches acid?

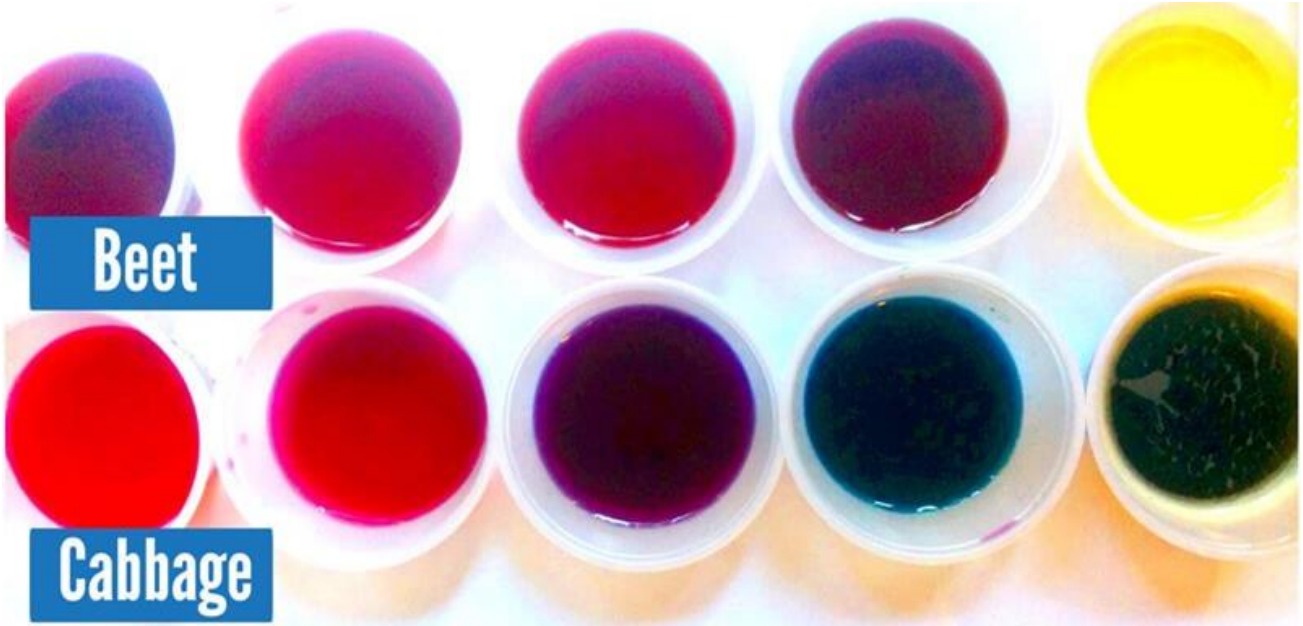
A: blue to red

B: red to blue

C: no change

Can we find out the pH value of solutions at home without professional equipment?

- To make a natural (天然) pH indicator (顯示劑)



Apparatus and materials

1.	red cabbage(紫椰菜)	1	6.	vinegar	some
2.	beaker(燒杯)	1	7.	baking soda	some
3.	mortar(缽)	1	8.	dropper(滴管)	1
4.	pestle(杵)	1	9.	spot tile	1
5.	distilled water	some			

Procedures

1. Put three drops of water, vinegar and baking soda solution on three different spots on your spot tile.
2. Put a few pieces of red cabbage in a mortar.
3. Add some water to the mortar.
4. Use the pestle to grind (磨碎) the pieces.
5. Pour the extract (提取物)(colored water) into a beaker.
6. Use a dropper to take three drops of extract from the beaker.
7. Put the extract on the water, vinegar and bleach respectively.
8. Record any change of color in the extract.

1

Boil the purple cabbage

2

Wait 30-45min until water is purple

3

Add some to a glass

4

Add in a chemical of choice

5

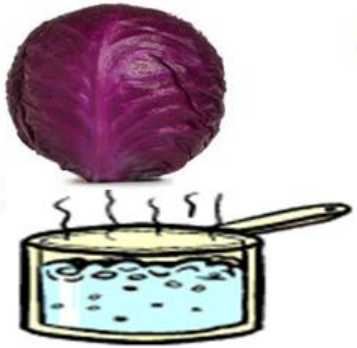
Record the results

6

Repeat 1-5 for different chemicals

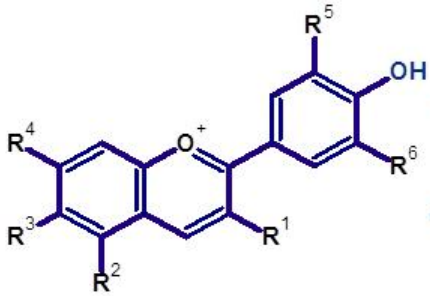
Extracting anthocyanin's from red cabbage

Natural Indicator



extraction

filtration

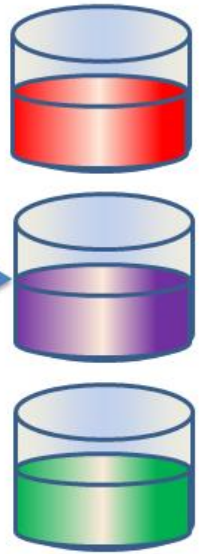


anthocyanin molecule

in acid

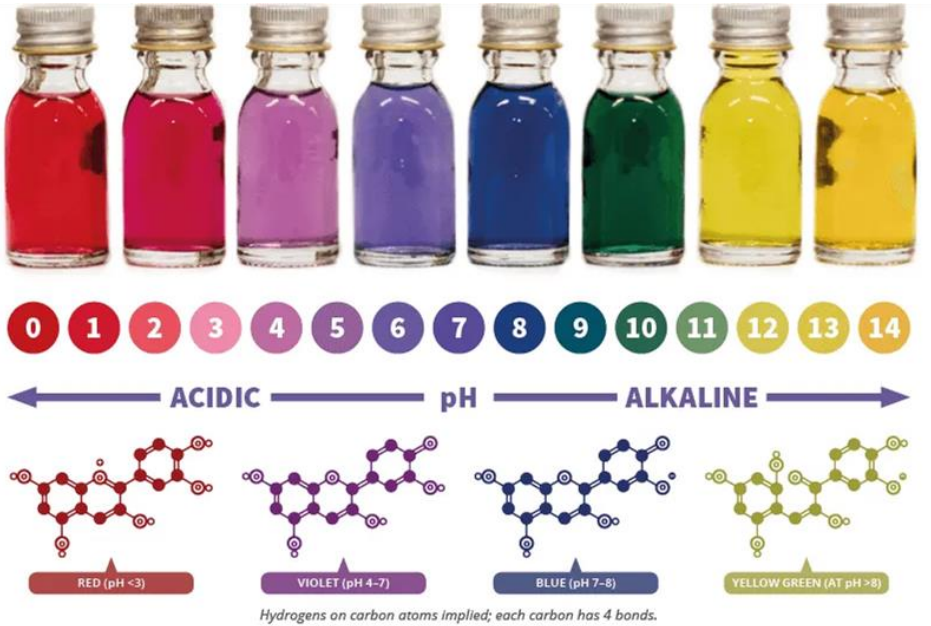
neutral

in base



Natural pH indicator - Red cabbage indicator (p.27)

- It contains **anthocyanin** (花青素)
- It responds to pH by changing the colour
- It appears purple at pH =7



The red cabbage extract can be used to determine whether substances are acidic or alkaline. The structures of the anthocyanin pigments which give the red cabbage its colour are subtly changed at varying pH. These different structures give a range of colours.

Indicator making demonstration video

1. Buy a red cabbage from supermarket/ wet market

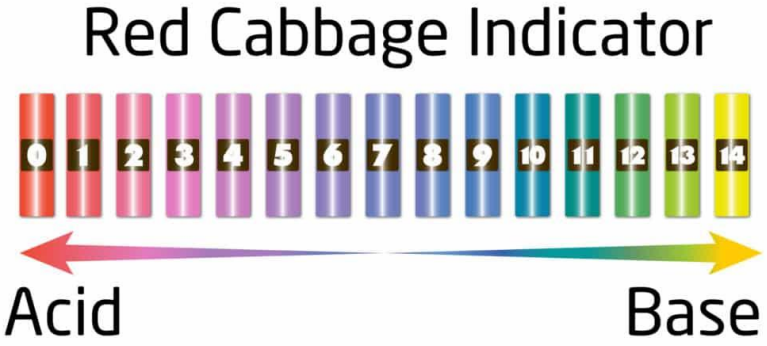
How to make?

2. Cut 1/4 of a red cabbage, and chop the red cabbage into smaller pieces under your **parental guidance** 家長指引

3. Put the cut red cabbage into a big bowl and add about 300mL warm/hot water into the bowl

4. Remove the vegetables by using a sieve 篩, then you have the pure natural pH indicator now!

Effect of red cabbage indicator on solutions



Fill in the table (turn to p.27 of textbook)

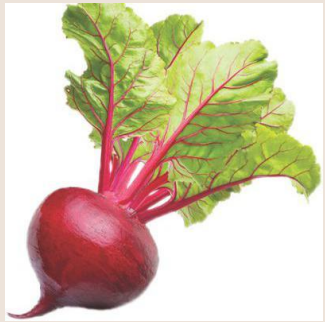
Tester	Vinegar	Water	Baking Soda solution
Colour Change	Purple →	Purple →	Purple →

Fill in the table (p.27 of textbook)

Tester	Vinegar	Water	Baking Soda solution
Colour Change	Purple → Pink	Purple → Purple	Purple → Blue

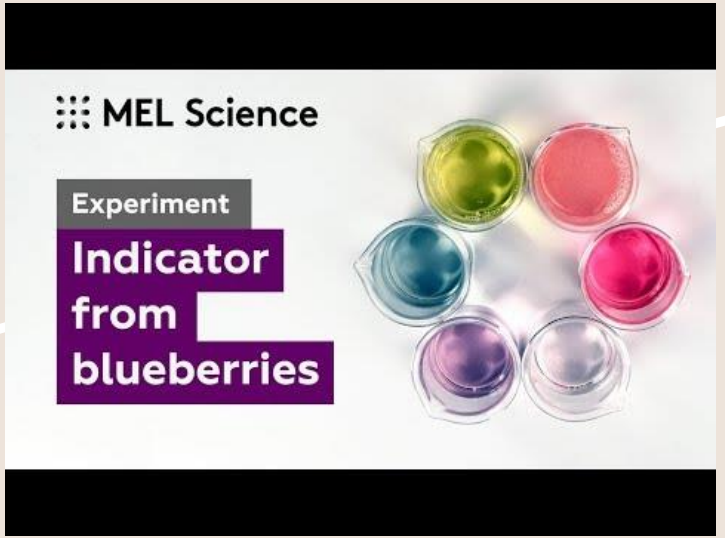
Other natural pH indicators

Cranberries



Beetroot

Blackberries



Blueberries

Tumeric


Red cabbage (conc)
Red cabbage
Universal pH indicator
Butterfly pea
pH paper

Which is the better pH indicator, red cabbage or butterfly pea?

	red cabbage	butterfly pea
Clear colour change?		
Range?		
Easy to prepare?		
Easy to obtain?		
Other reasons?		

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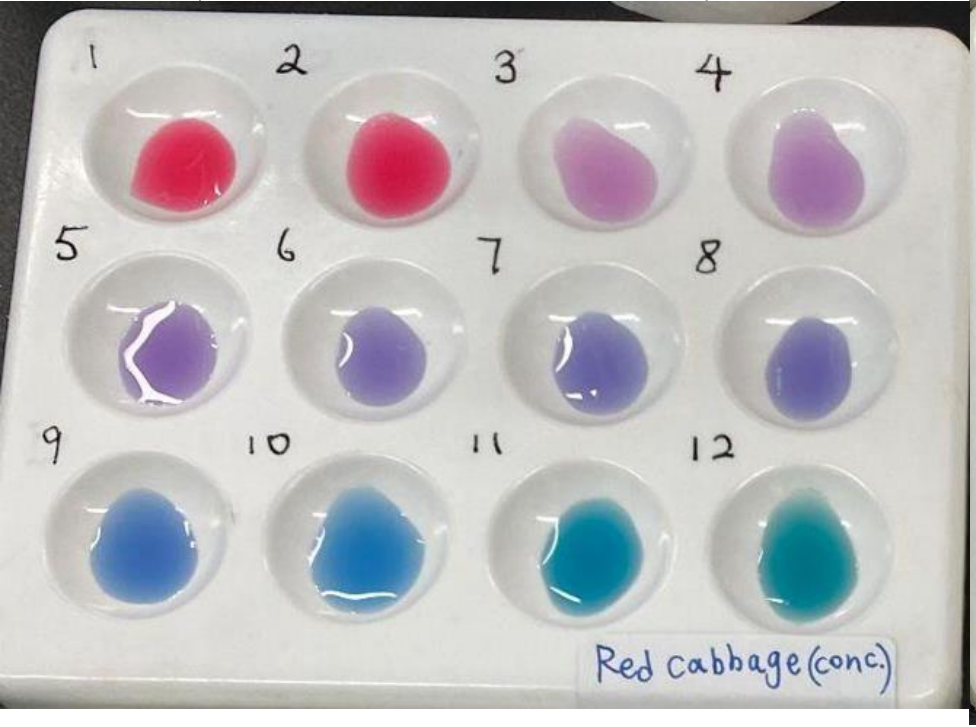

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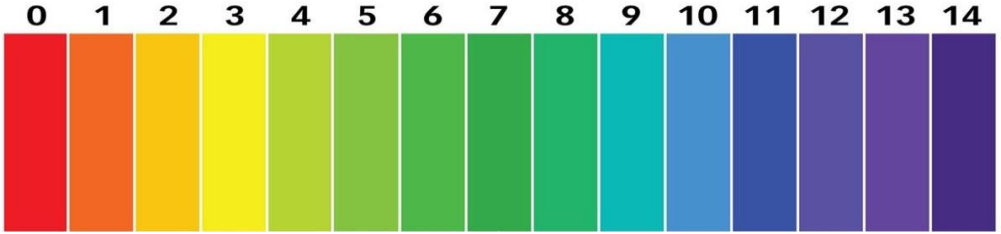
Conclusion

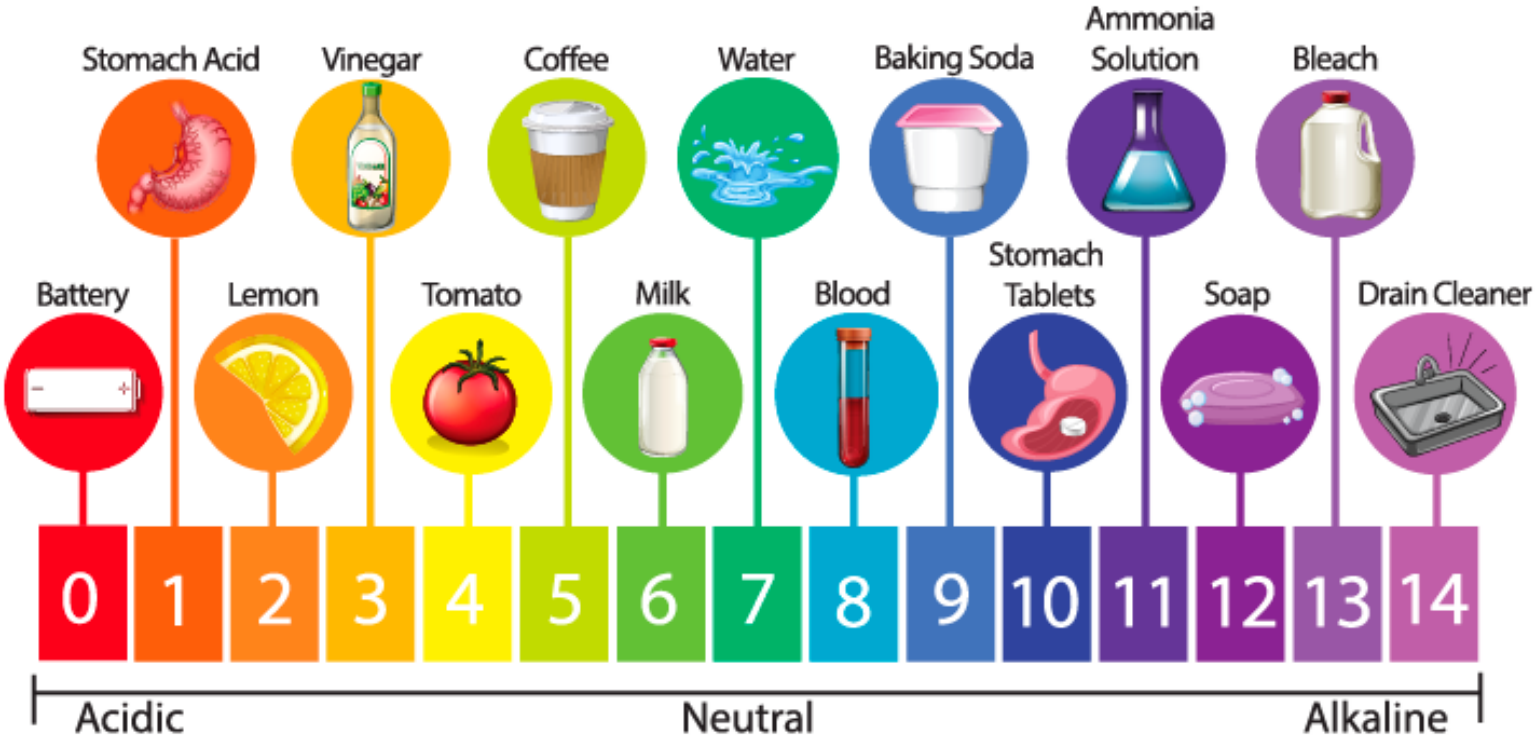


- pH values refer to the level of acidity/ alkalinity of a substance
- More H+: more acidic / more OH-: more alkaline
- pH scale ranges from 0 to 14
- pH paper and red cabbage solution can be used to test for pH value of solutions

Reminders for Home experiment 家居實驗注意事項

- **Wear gloves** for handling acidic/ alkaline solutions, detergent (家居清潔劑，例如通渠佬/漂白水) is **NOT recommended** for this test
- **Write labels** next to the cups to show what solutions you have tested like the following picture:

The pH Scale



https://studiousguy.com/acids-and-bases-we-use-in-everyday-life/

Good:

- More accurate
- Can use for any coloured solution

Bad:

- Need calibration (校準), e.g. distilled water as standard
- Need more solution

How acid and base help us in daily life?

Acids –

Some common acids we use in our daily life are

- ***Hydrochloric acid (HCl)*** *in gastric juice*
- ***Acetic acid (CH $_3$ COOH), vinegar*** *– vinegar is used in cooking, preserving food and in cleaning.*
- ***Carbonic acid (H $_2$ CO $_3$), soft drinks*** *– carbonic acid is used in soft drinks as a preservative.*
- *Sulphuric acid* ***(H $_2$ SO $_4$)*** *is used in car batteries.*
- ***Nitric acid (HNO $_3$)*** *is used in explosives and in the making of fertilizers.*

How acid and base help us in daily life?

Base –

Some common bases we use are

- **Sodium hydroxide (NaOH)** or caustic soda used in washing soaps.
- **Potassium hydroxide** (KOH) or potash used in bathing soaps.
- **Calcium hydroxide** ($Ca(OH)_2$) or lime water used in white wash.
- **Magnesium hydroxide** ($Mg(OH)_2$) or milk of magnesia used to control acidity (it is an antacid).
- **Ammonium hydroxide** (NH_4OH) used in hair dyes.

Salt:

Some common examples of salts are

- ***Sodium Chloride (NaCl)*** *– It is commonly known as table salt.*
- *Epsom Salt ($MgSO_4$) – It is used as a bath salt*

NEUTRALISATION

Chemistry

STOMACH ACID

Reading 612 – Red Cabbage

Red cabbage is a sort of cabbage. Its leaves are coloured dark purple. However, the plant changes its colour according to the pH value of the soil. In acidic soils, the leaves grow more reddish, while alkaline soil will grow blue coloured cabbages. This explains the fact that the very same plant can be different colours in different places. When in neutral environment, red cabbage is purple. To keep the red color it is necessary to add vinegar or acidic fruit.

Red cabbage contains **pigment(色素)** called flavin **(an anthocyanin 花青素)**. Water-soluble flavin is also found in apple skin, plums, poppies, cornflowers and grapes. Very acidic liquids will turn anthocyanin a red color. Neutral liquids result in a purplish color. Alkaline liquids appear greenish-yellow. Therefore, it is possible to find the pH of a liquid based on the color it turns in cabbage juice.

Challenging corner

1. What color will the red cabbage grow if it planted on acidic soils?

_____

2. What color will the red cabbage grow if it planted on alkaline soils?

_____

3. What color will the red cabbage grow if it planted on neutral soils?

_____

4. What pigment can be found in red cabbage?

_____

5. What other fruits and plants have flavin?

_____