Lesson 1: What are acids and alkalis?

date-

Learning objectives

✓Describe what makes an acid or an alkali
✓Identify household items as acidic or alkaline
✓Investigate the relative strength of acids

Key words

Acid - A chemical with a hydrogen ion
Alkali - A chemical with a hydroxide ion
pH scale - A scale on which acids/alkalis are measured
React - When atoms combine or split to make new substances
Neutralise - When an acid and an alkali react to become neutral

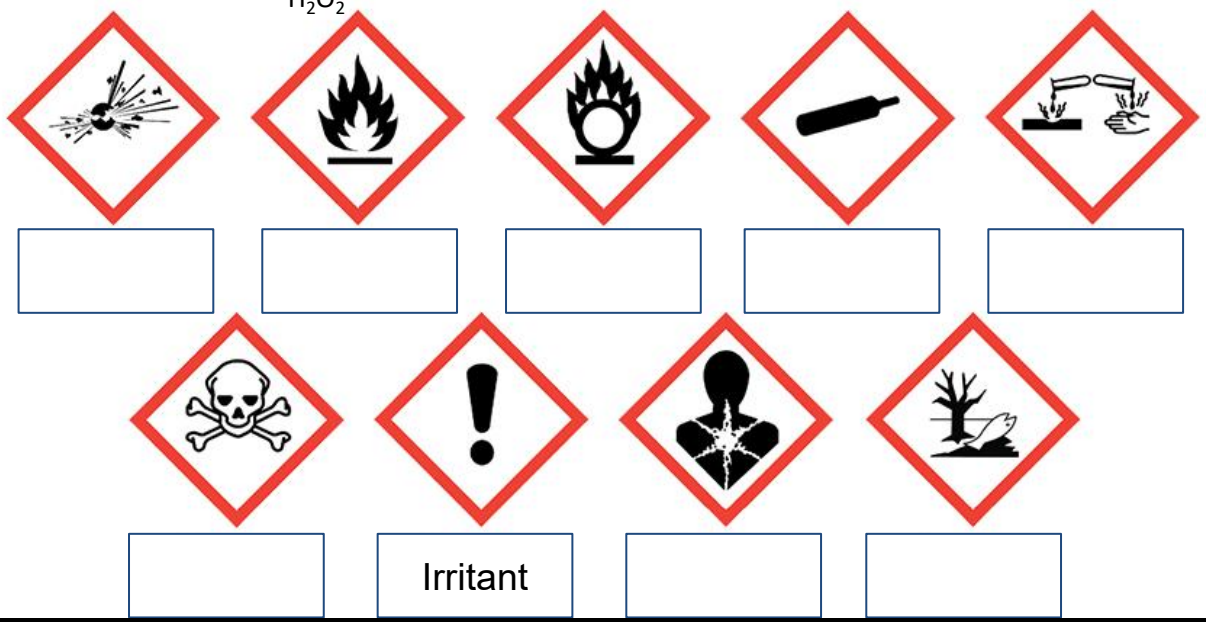
Do now: What is the scientific name for water?

Circle the correct answer

HO HO2 HO_2 H_2O H2O H_2O_2

Do now: Write in the boxes below each symbol, what you think it is a warning for.
One has been done for you.

Use the following words/phrases:
Oxidising - Compressed - Harmful to environment - Health hazard - Toxic - Corrosive - Flammable - Explosive



Watch the video and answer the questions. (https://www.youtube.com/watch?v=Ag4kqGr5wAU)

1. What 2 things can Phillips be used to treat?
   a. _____
   b. _____

2. Phillips is an example of an "antacid". What acid in the body does Phillips react with?
   _____

New information

1.An acid is a chemical which contains hydrogen ions (H^+).
2.An alkali is a chemical which contains hydroxide ions (OH^-).
3.The pH scale (potential of Hydrogen) measures how acidic or alkali something is.
4.The more hydrogen ions a chemical has the LOWER on the pH scale they are.
5.The more hydroxide ions a chemical has the HIGHER on the pH scale they are.
6.Something which contains roughly equal amounts of hydrogen and hydroxide ions has a pH of 7

1.Acids = hydrogen ions (H^+).
2.Alkalis = hydr (OH⁻).
3.pH s sures acidity/alkalinity

1.More H^+ = LOW H.

1.More OH^- = HIGH H.

1.If H^+ = OH^- then pH is 7

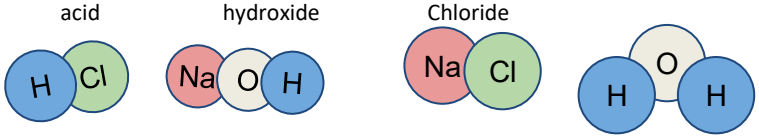
1. If an acid (with a hydrogen ion - H^+) and an alkali (with a hydroxide ion - OH^-) react together, what will be produced?

_____ (HINT - What has two atoms of Hydrogen and one atom of Oxygen?)

1. Complete the following symbol and word equation:

HCl + NaOH -> NaCl + _____

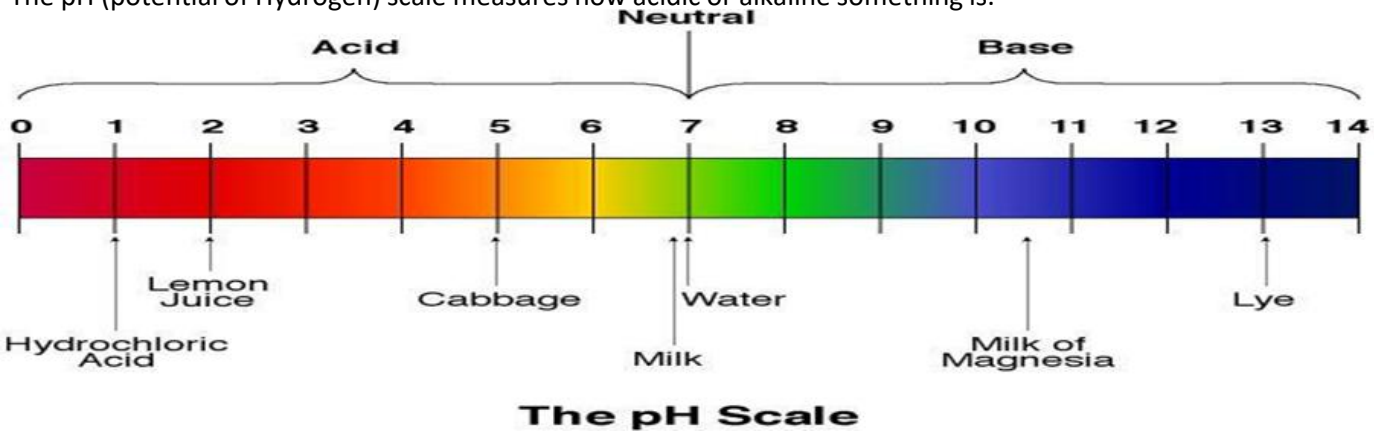
Hydrochloric acid + Sodium hydroxide -> Sodium Chloride + _____



New information

pH scale

The pH (potential of Hydrogen) scale measures how acidic or alkaline something is.



The pH Scale

pH scale questions - Use the pH scale above to answer the questions

1.State 3 acidic substances

_____

_____

_____

2.State 2 alkaline substances

_____

_____

3.What pH are neutral substances?

4.State 1 neutral substance

_____

5.State 1 substance which is nearly neutral

_____

6.State the most acidic substance on the scale below

_____

7.State the most alkaline substance on the scale below

_____

What have we learned so far?

1.Acids are chemicals containing *hydrogen ions/hydroxide ions* (*Circle the right answer)*

2.Alkalis are chemicals containing *hydrogen ions/hydroxide ions*(*Circle the right answer)*

3.A chemical's acidity or alkalinity is measured on _____

4.Examples of acids are _____

5.Examples of alkalis are _____

6.Water is acidic / alkaline / neutral (*Circle the right answer)*

7. When you mix an acid (H^+) and an alkali (OH^-) you make _____

Testing the relative strength of acids



First - Fill in the missing column header in the table.

Then - Follow the method to complete the practical

After that - In the method, highlight/underline the following things in 3 different colours:

- Steps which tell you to record or measure something.
- Steps which tell you to change something in the experiment
- Anything which tells you to use a specific amount of something

Method

1. Fill a test tube ⅓ full of acid A.
2. Measure the temperature of acid A.
3. Add a marble chip to acid A.
4. When the reaction has stopped record the temperature of acid A.
5. Empty the contents of the test tube in to a sink and rinse it out.
6. Repeat steps 1 - 5 with acids B, C and D, ensure the marble chips are the same size.
7. Repeat steps 1 - 6 with magnesium strips which are the same size, instead of marble chips.
8. Calculate the temperature change for each reaction.

Acid		Temperature start (°C)	Temperature end (°C)	
Marble chip	A			
	B			
	C			
	D			
Magnesium strip	A			
	B			
	C			
	D			

Finally - Answer the questions below

Which acid A, B, C or D is the strongest? _____

Explain your answer (Use evidence from your table in your answer).

I think this acid is the strongest because

_____

_____

Which is more reactive marble chips or magnesium strips? _____

Explain your answer (Use evidence from your table in your answer).

I think _____ is more reactive because _____

_____

Lesson 2: Indicators

date-

Learning objectives

- ✓ Describe how to determine the acidity or alkalinity of a substance
- ✓ State 2 different indicators
- ✓ Predict the results of testing acids and alkalis with an indicator

Key words

Indicator - A chemical which is used to tell if something is an acid or an alkali

Do now: Circle and correct the four mistakes below

All acids are dangerous

Alkalis have a pH of 1 - 6

Lemon juice is an example of an acid

Acids and alkalis are measured on the pH scale

Most cleaning products are acids

When an acid and an alkali react, water is made

All acids have a Hydrogen ion in them

Acids have a pH of 7 = 14

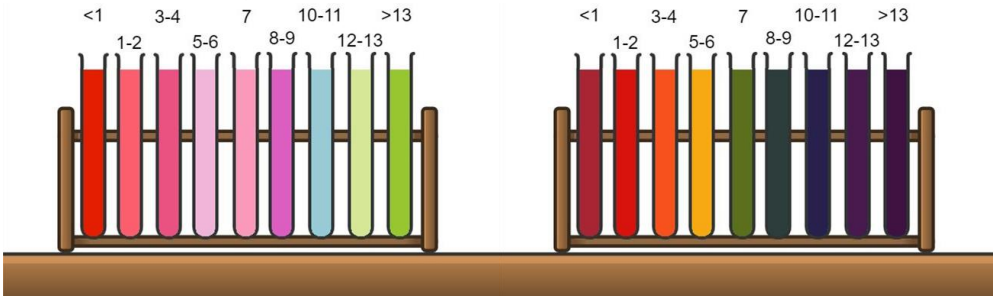
New information

Chemicals called "Indicators" can be used to determine if something is an acid or an alkali.

They can do this because a chemical reaction takes place when they are mixed with an acid or alkali which changes their colour.

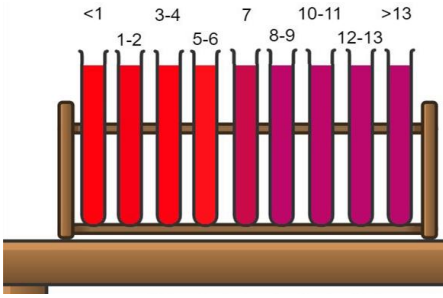
The diagrams show 4 common indicators and what colour they turn at different pHs

Red cabbage indicator

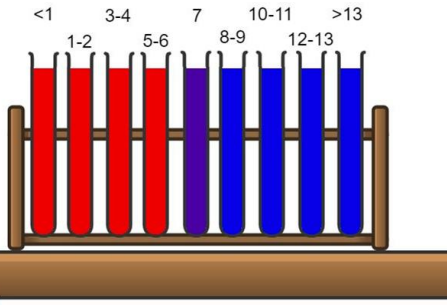


Universal indicator

Beetroot indicator



Litmus paper indicator



Now: Complete the table to state what colour each indicator will turn when mixed with a chemical

Chemical	Indicator result			
	Red cabbage	Beetroot	Universal	Litmus paper
Hydrochloric acid				
Sodium Hydroxide				
Bleach				
Lemon juice				
Toothpaste				

Now: In the below table, predict if each chemical is an acid or an alkali in the "prediction" column.
Then: Fill in the acid and alkali columns during the teacher demonstration.

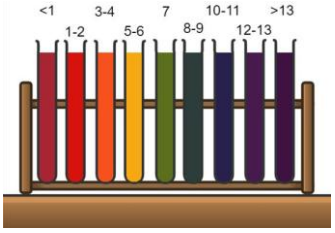
Chemical	Prediction	Acid	Alkali
Hydrochloric Acid			
Sodium Hydroxide			
Vinegar			
Orange Juice			
Hand Soap			
Washing up liquid			
Carbonated water			
Lemonade			
Bleach			
Shampoo			

Finally: Suggest an advantage to using universal indicator instead of litmus paper to test chemicals.

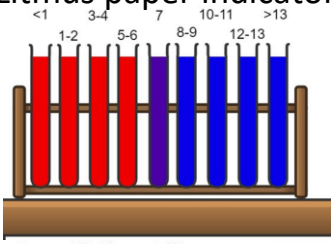
An advantage of using universal indicator is …

_____
_____
_____
_____

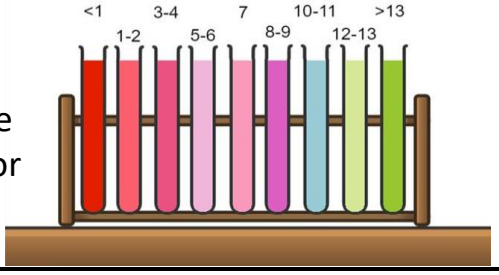
Universal indicator



Litmus paper indicator



Red cabbage indicator



Chemical	Indicator colour	Suggested pH	Acid or alkali
Hydrochloric acid			
Sodium hydroxide			
Vinegar			
Orange juice			
Hand soap			
Washing up liquid			
Carbonated water			
Lemonade			
Bleach			
Shampoo			

1. Grind red cabbage/beetroot in the mortar, using the pestle, with 40ml of water
2. Filter the red cabbage/beetroot into a beaker
3. Add 3 ml of a hydrochloric acid to a test tube
4. Add 2-4 drops of your indicator to the test tube
5. Record the colour change
6. Rinse out the test tube
7. Repeat steps 3 - 6 for each different chemical
8. For each chemical, suggest a pH and state if it is an acid or alkali

[Challenge] How would you change the method to show the strengths of the acids and alkalis?

_____
_____
_____
_____

Identify 3 hazards, their risk level (How likely or dangerous) and how you would reduce the risk.		
Hazard	Risk (Low, medium, high)	I will reduce the risk by...

1. Reread the learning objectives for the lesson.
2. Score each objective between 1 - 10 based on how confident you are at it

Learning objectives

✓ Describe how to determine the acidity or alkalinity of a substance

✓ State 2 different indicators

✓ Predict the results of testing acids and alkalis with an indicator

3. Find someone in the room who has a different score to you for a learning objective
4. Teach the person what you know about that objective
5. If you understand the objective more, change your score in a different coloured pen

Lesson 3: Neutralisation

date-

Learning objectives

- ✓ Using universal indicator, determine the pH of unknown chemicals
- ✓ Describe and explain the products of a neutralisation reaction

Key words

Acid - A chemical with a hydrogen ion
Alkali - A chemical with a hydroxide ion
pH scale - A scale on which acids/alkalis are measured
React - When atoms combine or split to make new substances
Neutralise - When an acid and an alkali react to become neutral

Do now: Circle and correct the four mistakes below

Suggest the pH of an acid

_____

Suggest the pH of an alkali

_____

What pH is neutral?

_____

When using universal indicator, what colour indicates an acid?

_____

When using litmus paper, what colour indicates an alkali?

_____

When using red cabbage indicator, what pH ?

_____

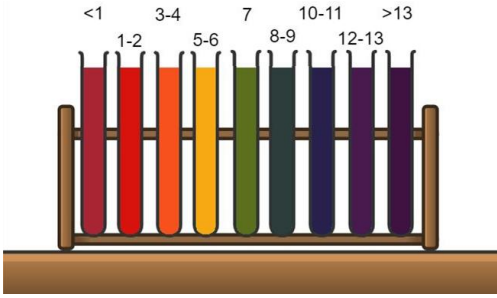
New information

Chemicals called "**Indicators**" can be used to determine if something is an **acid** or an **alkali**.

Universal indicator will turn red when mixed with an **acid** and purple when mixed with an **alkali**.

If an **acid** is mixed with an **alkali**, they will **neutralise** each other. The chemicals made are **neutral**

Universal indicator



Now: In the table below, state the colour universal indicator would turn when mixed with each chemical by itself and then what colour universal indicator will turn when the 2 chemicals are mixed together

Chemical A	Colour of universal indicator when mixed with chemical A	Chemical B	Colour of universal indicator when mixed with chemical B	Colour of universal indicator when chemical A and B are mixed
Sodium hydroxide		Hydrochloric acid		
Potassium hydroxide		Nitric acid		
Lemon juice		Hand soap		
Lemon juice		Hydrochloric acid		
Bleach		Sodium hydroxide		
Bleach		Milk		

First: Read the method below and fill in the 4 headers of the table to show what information you will record during this practical.

1. Add 2 ml of a solution to a test tube
2. Add 3 drops of universal indicator to the test tube
3. Swirl the test tube gently to mix the chemicals
4. Record the colour of the solution
5. Suggest a pH for the solution
6. State if the solution is acidic, alkaline or neutral
7. Rinse out the test tube
8. Repeat steps 1 - 7 for all solutions (A - E)

Then: On the method above, highlight/underline the following things in 3 different colours:

- Steps which tell you to record or measure something.
- Steps which tell you to change something in the experiment
- Anything which tells you to use a specific amount of something

After that: Follow the method and record your results in the table

Finally: Based on your results, finish the following sentences.

1) The solution most likely to be hydrochloric acid is _____ because

_____

_____

__

1) The solution most likely to be bleach is _____ because

_____

_____

__

1) The solution most likely to be toothpaste is _____ because

_____

_____

__

1) The solution most likely to be lemon juice is _____ because

_____

_____

New information

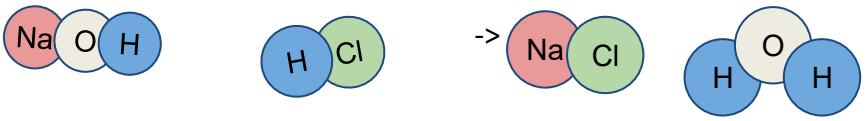
Neutralisation reactions – When an **acid** and an **alkali react** together, you end up with a **neutral** solution, with a **pH** of 7.

e.g. – When sodium hydroxide **reacts** with hydrochloric acid, a salt and water are produced

Word: Sodium hydroxide + hydrochloric acid -> sodium chloride + water

Symbol: NaOH(aq) + HCl(aq) -> NaCl(aq) + $H_2O(l)$

Diagram:



You can predict what **reactants** are used or what **products** are formed from **chemical reactions**.

Iron hydroxide + Hydrochloric acid -> Iron Chloride + Water
Iron hydroxide + Nitric acid -> Iron Nitrate + Water
Magnesium hydroxide + Sulfuric acid -> Magnesium Sulfate + Water

The acid and alkali react to make a salt and water.

Hydrochloric acid always makes Chloride salts
Nitric acid always makes Nitrate salts
Sulfuric acid always makes Sulfate salts

TOP TIP FOR WRITING SALTS

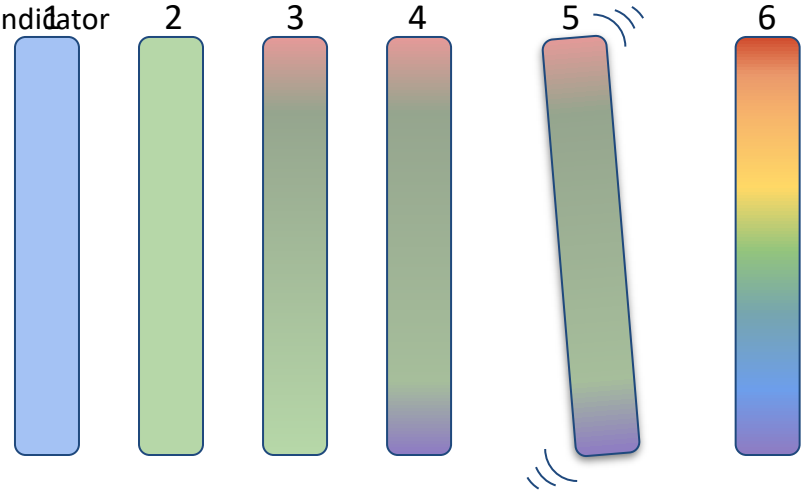
A salt is a chemical with a metal atom bonded to a non metal atom.

The metal comes from the alkali, the non metal comes from the acid

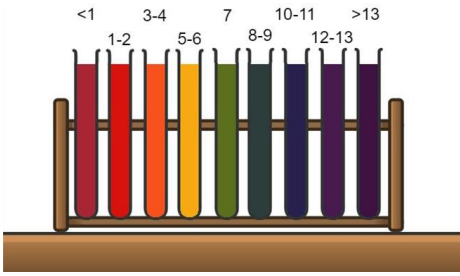
Now: In the table below, fill in all the missing chemicals for each reaction

Acid +	Alkali ->	Salt +	Water
Hydrochloric acid	Potassium hydroxide		Water
Hydrochloric acid	Magnesium hydroxide		Water
Nitric acid	Sodium hydroxide		Water
Sulphuric acid	Sodium hydroxide		Water
Sulphuric acid	Iron (III) hydroxide		Water
Nitric Acid		Potassium nitrate	Water
	Magnesium hydroxide	Magnesium chloride	Water
		Sodium chloride	Water

First: Watch the teacher demonstration/video on the rainbow indicator



Universal indicator



Then: Fill in the missing words from the method below. Use each work from the box only once

Universal indicator - Neutral - Universal indicator - Orange - Purple - Green - 14 - Alkaline - Acidic - Purple - Red - 1 - Hydrochloric - 7

Method

1) The water is added to the tube
2) _____ is added to the water. It turns green because the water has a pH of _____. It is _____.
3) _____ acid is added to the top of the tube. The solution turns _____ because the hydrochloric acid has a pH of _____. It is _____.
4) The tube is rotated. _____ is added to the other side of the tube. The solution turns _____ because sodium hydroxide has a pH of _____. It is _____.
5) The tube is rotated several times to mix the solution.
6) The solution has layers of colour: Red; _____ ; Yellow; _____ ; Blue; _____. This is because the acid is mixing with the water from one end and the alkali is mixing with the water from the other end.

Rainbow Fizz practical

1. Place a boiling tube in a test tube rack
2. Add a spatula of sodium carbonate
3. Add one pipette full of universal indicator to the ethanoic acid
4. Fill the boiling tube with 10cm^3 of ethanoic acid
5. Write your observations

Observations

_____

_____

_____

Finally: Complete the sentences by filling in the gaps.

When the universal indicator was first added the solution turned _____ because the sodium carbonate has a pH of _____ . It is _____ .

When the ethanoic acid was added a chemical reaction took place. I know this because _____.

During the reaction the solution changed colour from _____ to _____ to _____ because the reaction produced a(n) _____ chemical.

Lesson 4: Planning a neutralisation practical date-

Learning objectives

✓Define and identify independent, dependent and control variables
✓Plan a practical
✓Describe and explain results

Key words

Variable - Something which could change
Independent - The variable which has an effect on the dependent variable
Dependent - The variable which is affected by the independent variable
Control - A variable which could have an effect on the dependent

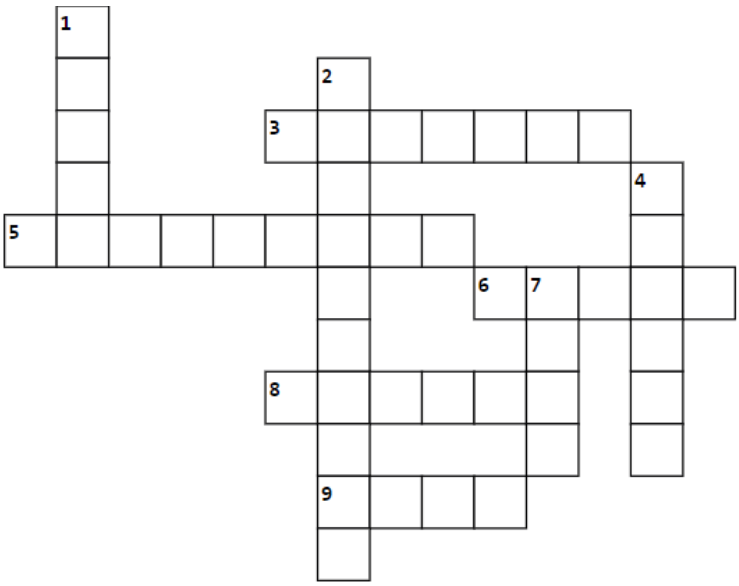
Do now: Complete the crossword

Across

3. A chemical with a pH of 7
5. A chemical which will determine acidity or alkalinity
6. A product of a neutralisation reaction
8. A chemical with a pH between 8 - 14
9. A product of a neutralisation reaction

Down

1. An example of a fruit with acidic juice
2. When an acid reacts with an alkali
4. An example of a household alkali
7. A chemical with a pH between 1 - 6



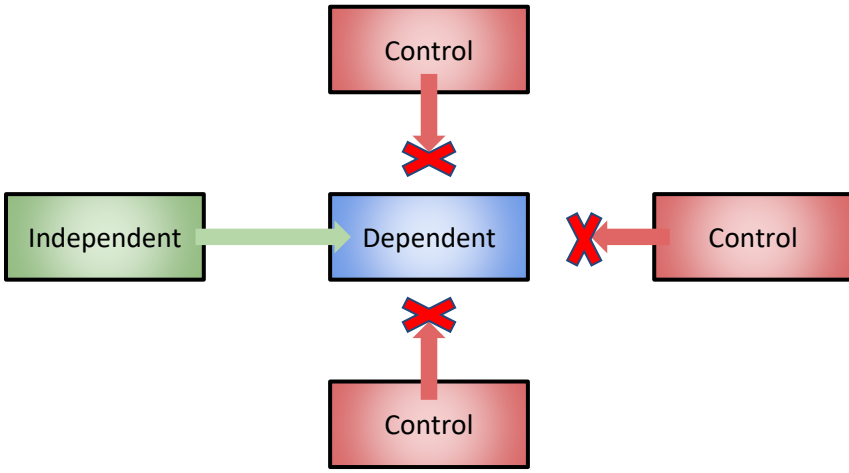
New information

In a Science experiment things can change. These things are called variables - They vary.
In a Science experiment there are three kinds of variable: Dependent; Independent and Control.

Dependent
The dependent variable is affected by something else - It **depends** on something else.

Independent
The independent variable is the value that the experimenter changes on purpose - It affects the dependent variable

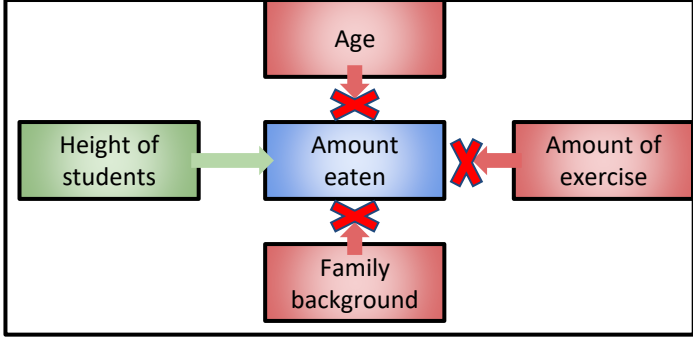
Control
The control variable is anything else which **could** affect the dependent variable

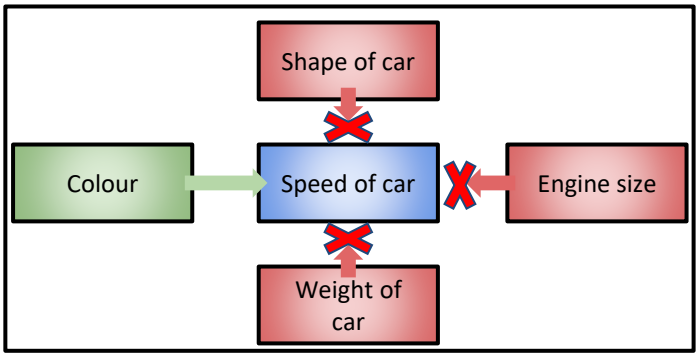


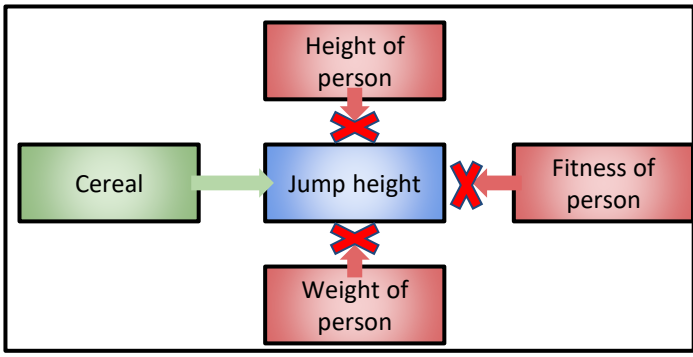
New information

The diagram shows how the variables go together.

Here are some specific examples of investigations or practicals represented in the same way.







Now: Fill in the table to state the independent, dependent and control variables in each investigation. Some investigations are highlighted to help.

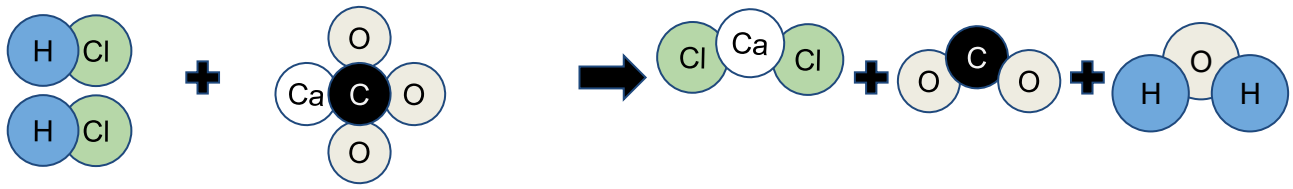
Investigation	Independent	Dependent	Control
James wants to find out the effect of colour on how fast a car can go.	Colour	Speed of car	Weight of car
Phillipa wants to see if the breakfast cereal you eat affects how high you can jump.	Cereal eaten		Height of person
Chris is going to measure the height of students and see if it affects how much they eat per day.		Amount of food eaten	Age
Alfie has been asked to find out if the size of your feet depends on how old you are.		Foot size	Height of person
Jenny wants to do an experiment to find out if the amount of noise around her affects how long she can hold her breath for.			Fitness of person
Jeremy wants to find out if how much fruit you eat affects how much money you earn			GCSE grades
Jenny does an investigation to see if someone's eye colour depends on their nationality			Parent's eye colour
Tom does an experiment to find out if the amount of oxygen a plant gives off depends on the room temperature			Size of the plant

New information

Sometimes stomach acid can travel up the oesophagus (food pipe). This causes a burning, painful sensation called “Heartburn”.

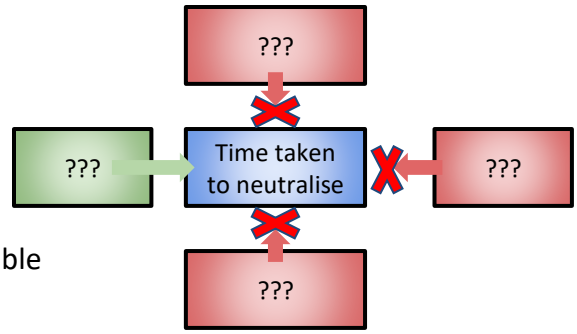
Indigestion tablets contain a chemical which reacts with acid to neutralise it. This reaction is shown below.

(Stomach acid) Hydrochloric acid + (Indigestion tablet) Calcium Carbonate ----> Calcium Chloride + Carbon Dioxide + Water



You have been given 3 different indigestion tablets. Which one is the best?

You must plan an experiment to investigate which indigestion tablet neutralises acid quickest.



First: Write an equipment list, risk assessment and results table

Method

1. Fill a beaker with 10cm3 of stomach acid
2. Add 3 drops of universal indicator
3. Grind an indigestion tablet into powder using a mortar and pestle
4. Pour the powdered indigestion tablet in to the the beaker containing acid
5. Begin timing immediately
6. Stop timing when the solution turns green
7. Repeat steps 1 - 6 using the different indigestion tablets

Equipment list

_____

_____

_____

_____

_____

_____

_____

Hazard	Risk (Low, medium, high)	I will reduce the risk by...

	Attempt 1	Attempt 2	Attempt 3	Average

Then: Follow the method and fill in the table with your results

New Information

Describing and explaining results

In Science you will often be asked to **describe** and **explain** results from practicals or experiments.

Describing means saying what the results are and if there are any patterns, like increases or decreases (You should not say the word "Because" in a description)

Explaining means saying why the results are that way, using Scientific knowledge (You should use the word "Because" in an explanation)

Because Lord Voldemort performed a killing curse on him as a baby but it backfired

Because his father had brown hair (He inherited them from him)

He has brown hair

He has a lightning bolt shaped scar on his forehead

Because his mother had green eyes (He inherited them from her)

He has green eyes



He has a red and gold coloured scarf

He has a wand

Because he is in house Gryffindor

Because he is a wizard

Indigestion tablet	Average time taken to neutralise $10cm^3$ of stomach acid (s)
Rennies	15
Gaviscon	8
Boots	10
Tesco	17
Zantak	14

Describing the results

In order from fastest time taken to neutralise stomach acid to slowest the indigestion tablets are:

_____, _____, _____, _____, _____ .

The fastest indigestion tablet was _____ seconds faster than the slowest.

Explaining the results

Heartburn is caused by excess stomach _____ . This is neutralised by the indigestion tablet, which contains a(n) _____ .

When an acid and an alkali react, a(n) _____ and a(n) _____ are produced. This is called a(n) _____ reaction.

The indigestion tablet which neutralised the stomach acid the quickest was the most _____.

Flashcard making

- Flashcards are a method to help you remember facts.
- They should have a question on one side and an answer or a diagram on the other.
- Flash cards could be coloured or have silly diagrams which help you remember the answer.

Frist: Read the flashcards below. **Then:** Complete the answer for the third flashcard
Finally: Write three flashcards of your own

Q: What do all acids contain?	A: A hydrogen ion	Q: What do all alkalis contain?	A: A hydroxide ion
Q: What is the word equation for a neutralisation reaction?	A: Acid + Alkali -> Salt + _____	Q:	A:

Q:	A:	Q:	A:
Q:	A:	Q:	A:
Q:	A:	Q:	A:
Q:	A:	Q:	A:
Q:	A:	Q:	A:
Q:	A:	Q:	A:

Homework

Homework -

Glossary - List all the keywords from the booklet and summarise their definitions. You can use symbols such as "+" and "=" in your definitions to reduce the word count of them.

Keyword	Definition

Extra notes page

Extra notes page