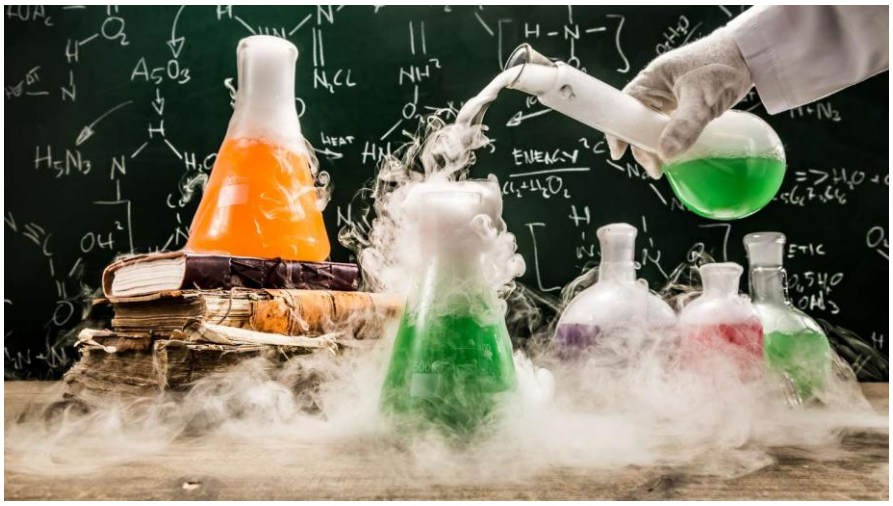
Kirkcaldy High School



S2 Unit 3 Science

Chemistry - Chemical Reactions

Name:_____

Class:_____

Teacher:_____

Expectations and Outcomes Learner Evaluation

Topic: Chemical reactions

Experience and Outcomes	Date Completed (dd/mm/yy)	Evaluation How happy are you with it? (☺ ? ☹)
I can describe the differences between physical and chemical changes.		
I can name examples of chemical and physical changes.		
I can identify when a chemical reaction has taken place.		
I can write a chemical word equation.		
I can state the terms used for the signs of a chemical reaction.		
I can identify examples of acids and bases		
I can state the difference between an alkali and a base		
I can determine if a substance is acidic or basic using an indicator		
I can identify the pH of a substance using universal indicator		
I can identify everyday acids and alkali		
I can make an indicator from plants		
I can determine if an indicator is effective or not		
I can identify a neutralisation reaction.		
I can describe what happens to the pH when a neutralisation reaction occurs.		
I can identify the products of a neutralisation reaction.		

Date: _____

Chemical and physical changes

Starter

List some examples of chemical reactions:

_____

_____

Learning Intentions

- To learn about the differences between physical and chemical changes

Tick me at the end if ***you can*** …

Success Criteria

☐ I can describe the differences between physical and chemical changes

☐ I can name examples of chemical and physical changes

Chemical or Physical Change

- A physical change is one in which _____ new substances are made.
- Physical changes are usually (but not always) quite easily _____.

- A chemical reaction is a change in which a new substance is always made.
- A chemical reaction is not easily reversed.

Chemical Reaction	Physical change

Extension

Towel Drying

Milk going sour

Heating sugar to form caramel

a) _____

b) _____

c) _____

d) _____

e) _____

f) _____

g) _____

h) _____

i) _____

j) _____

k) _____

l) _____

Date: _____

Chemical Reactions

Starter

1. *Explain* why chocolate melting is an example of a physical change.

_____

_____

2. Give an example of physical changes and chemical changes which happen in your home.

_____

_____

Learning Intentions

- To learn how to identify when a chemical reaction is taken place
- To learn how to write a chemical equation

Success Criteria

Tick me at the end if ***you can*** …

☐ I can identify when a chemical reaction has taken place

☐ I can write a chemical word equation

Chemical Reactions

The substances that react together are called the _____ .

The new substances made are called the _____ .

→

+ means "and"

→ means "changes into"

Examples

Burning coal in a fire

Coal and oxygen **react** together to **produce** carbon dioxide.

Questions:

1) What are the reactants? What are the products?

---

2) Write the word equation for this reaction.

Screaming Jelly Baby

Sugar **reacts** with potassium chlorate to **produce** carbon dioxide, water and potassium chloride.

Write the word equation for this reaction.

What did you see happening?

Elephants Toothpaste

Hydrogen peroxide decomposes to **produce** oxygen and water.

Write the word equation for this reaction.

What did you see happening?

Whoosh Bottle

Alcohol burns in oxygen to **<u>produce</u>** water and carbon dioxide.

Write the *word* equation.

What did you see happening?

_____

Extension

Descriptions of Reactions and Word Equations

Word equations always have reactants on the left and products on the right:

reactants → products

For example

*Iron and oxygen **react** together to form iron oxide (rust).*

Iron + oxygen → iron oxide (rust)

You will be given descriptions of chemical reactions, and you must put them in a word equation.

Hints:

- *They will be reactants if it says phrases like reacts with, burns in, decomposes.*
- *They will be products if it says forms, formed, produced, made.*

Questions

1. **Burning of magnesium in air:** Magnesium oxide is formed when magnesium reacts with oxygen.

   →

2. **Reaction of sodium with water:** Sodium hydroxide and hydrogen gas are produced when sodium reacts with water.

   →

3. **Combustion of methane:** Carbon dioxide and water are formed when methane burns in oxygen.

   →

4. **Formation of rust:** Iron oxide (rust) is produced when iron reacts with oxygen and water.

   →

5. **Neutralization of hydrochloric acid with sodium hydroxide:** Sodium chloride and water are formed when hydrochloric acid reacts with sodium hydroxide.

   →

6. **Decomposition of hydrogen peroxide:** Water and oxygen are produced when hydrogen peroxide decomposes.

$\longrightarrow$

7. **Reaction between zinc and hydrochloric acid:** Zinc chloride and hydrogen gas are produced when zinc reacts with hydrochloric acid.

$\longrightarrow$

8. **Combustion of propane:** Carbon dioxide and water are formed when propane burns in oxygen.

$\longrightarrow$

Extension

You will now be given word equations, and you will need to write a short description of the reaction (the opposite of above).

1. Potassium + oxygen → potassium oxide

_____

_____

_____

2. Sodium + water → sodium hydroxide + hydrogen

_____

_____

_____

3. Hydrochloric acid + lithium carbonate → Lithium Chloride + water

_____

_____

Date: _____

Signs of a Chemical Reaction

Starter

You have just baked a cake; how do you know a chemical reaction has taken place?

_____

_____

Your chocolate melted in the sun, how do you know a chemical reaction has not taken place?

_____

_____

Learning Intentions

- To learn how to identify when a chemical reaction has taken place.

Success Criteria

Tick me at the end if ***you can*** …

☐ I can state the terms used for the signs of a chemical reaction.

Signs of a Chemical Reaction

There may be a _____ _____.

There may be _____.

There may be _____.

There may be an _____ _____.

A new substance is _____ formed.

<u>Effervescence</u> - A _____ is produced during a chemical reaction.

<u>Precipitation</u> - Formation of a _____ when two solutions react together.

Signs of a chemical reaction

Aim: To identify a chemical reaction.

Results:

Substances Mixed	**Observation**	**Chemical reaction?** (Yes/No)
Dilute Sulfuric Acid (0.5M) + Copper Carbonate		
Dilute Sulfuric Acid + Sodium Hydroxide		
Ethanoic Acid (vinegar) + Baking Soda		
Water + Copper Oxide		
Lead Nitrate Solution + Potassium Iodide Solution		
Dilute Sulfuric Acid + Copper		
Water + Iron nail		
Dilute Sulfuric Acid + Magnesium		
Copper Sulfate Solution + Iron Filings		

Conclusion: *What is the answer to your aim?*

_____

_____

Evaluation: *How could you improve your experiment?*

_____

_____

Extension

Given the descriptions of an experiment, explain how you know that has been a chemical reaction

1. When a few drops of phenolphthalein are added to a solution of sodium hydroxide, the solution turns from colourless to pink.

_____

2. When zinc reacts with hydrochloric acid, effervescence is observed as hydrogen gas is released. The solution becomes warm to the touch.

_____

3. When silver nitrate solution is added to a solution of sodium chloride, a white solid of silver chloride forms, and no gas.

_____

4. When a strip of magnesium metal is dropped into a solution of hydrochloric acid, bubbles of hydrogen gas form, and the solution gets warmer.

_____

5. When a piece of magnesium ribbon is burned in air, it produces a bright white flame, and a white ash forms.

_____

6. When sulfuric acid is added to a piece of calcium carbonate, effervescence occurs, and carbon dioxide gas is produced. The temperature of the solution increases.

_____

7. When you add sodium hydroxide to a solution of copper(II) sulfate a pale blue solid of copper(II) hydroxide forms

_____

8. When hydrogen peroxide is added to potassium iodide, the solution turns brown due to the formation of iodine, and effervescence is observed.

_____

Date: _____

Speeding up chemical reactions

Starter

Match the term on the left to the correct definition on the right.

1. Effervescence	**A. A change in which a new substance is made.**
2. Chemical Change	**B. Formation of a solid when two liquids chemically join.**
3. Reactant	**C. Gas produced during a chemical reaction.**
4. Physical Change	**D. Chemicals present at the start of a chemical reaction.**
5. Precipitation	**E. A change in which <u>no</u> new substance is made.**

Learning Intentions:

- To learn how to speed up the rate of reaction

Success Criteria

- ☐ I can state the factors the change the speed of a reaction.

Tick me at the end if ***you can***
…

Speeding up chemical reactions

Aim: To find out different ways we can speed up a chemical reaction.

Method:
Draw your method below

Results:

Effect	**Reaction**	**Quickest reaction** (low/high concentration) (small/large particle size) (low/high temp)
Concentration	5 ml of Low/high concentration vinegar + one small spatula of sodium bicarbonate	
Particle size	5 ml of 0.1M hydrochloric acid + marble lumps/chips	
Temperature	1 Glow stick in cold water and 1 glow stick in hot water	

Conclusion: *What is the answer to your aim?*

_____

_____

Evaluation: *How could you improve your experiment?*

_____

_____

Particle size

Potatoes cook _____ when cut up into smaller pieces.

A block of wood burns _____ than wood shavings.

Temperature

A car exhaust rusts _____ than the rest of the car.

Food goes off _____ in the fridge and even _____ in the freezer.

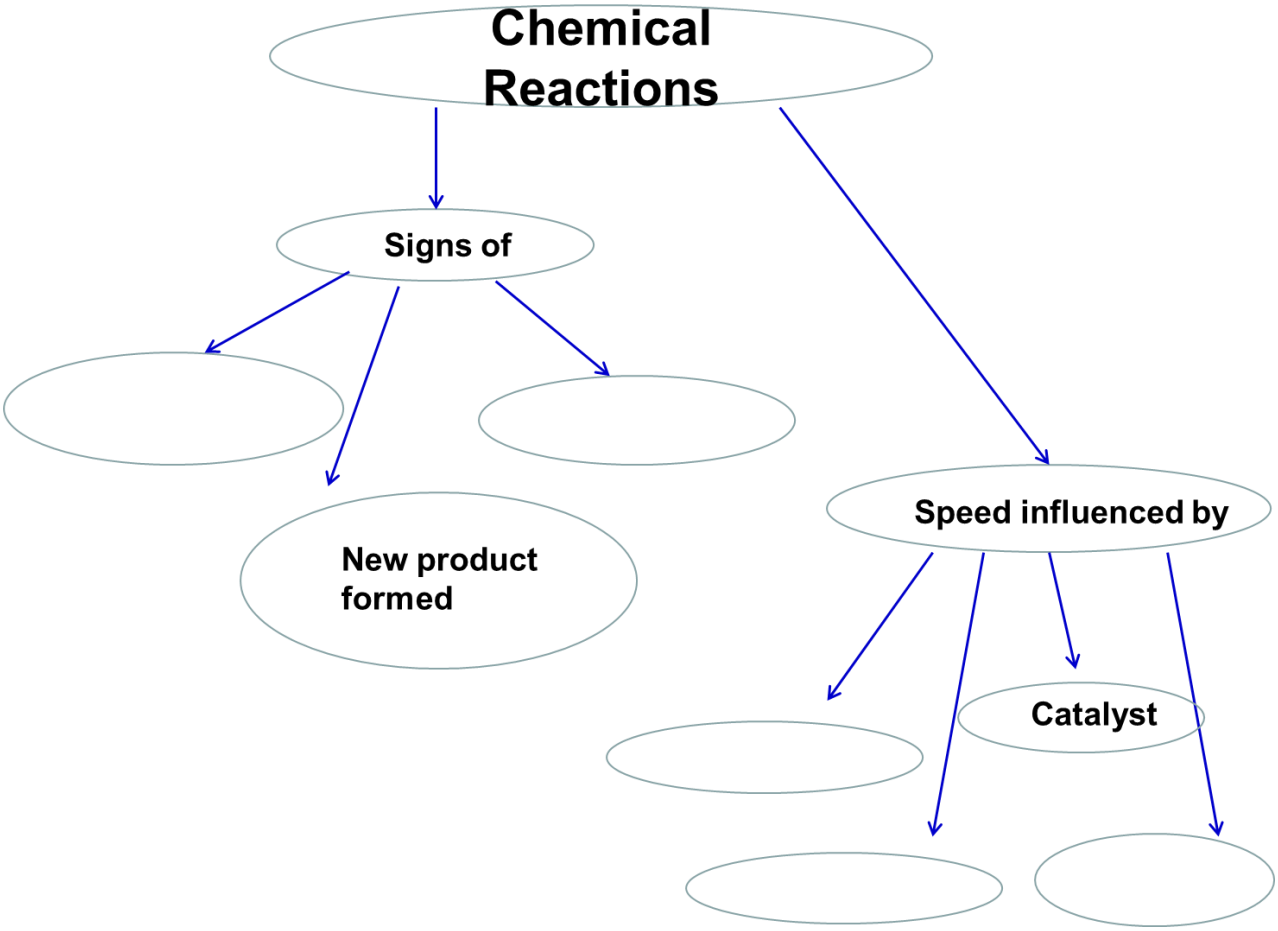
Washing powder works _____ in cold water than in warm water.

Plants grow _____ in a greenhouse than outside.

Concentration

Ships rust _____ at sea than on a river because of the higher concentration of salt.

Fill in the blanks



Date: _____

Acids and Bases

Starter

You are cooking chicken for a stir fry, list 2 different ways to speed up the cooking process?

_____

Why does keeping vegetables in the fridge prevent them from rotting quickly?

_____

Learning Intentions

- To learn about acids and bases in our home

Success Criteria

Tick me at the end if ***you can*** …

- ☐ I can identify examples of acids and bases
- ☐ I can state the difference between an alkali and a base
- ☐ I can determine if a substance is acidic or basic using an indicator

---

Acids

_____ have a _____ taste. The word "acid" comes from the Latin word, _____, meaning "sour".

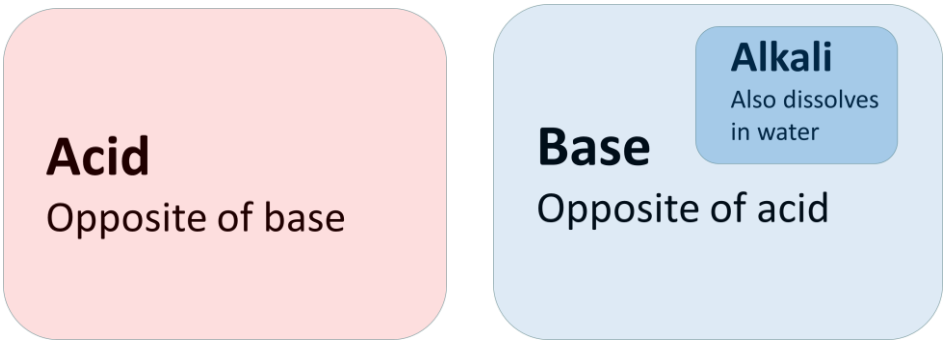
Acids are found in our food and drinks. Acids are important as they:

- Contribute to the _____ of food.
- _____ food preventing food rotting.
- Essential for providing _____ _____ for our body.

Bases

Bases are another group of chemicals, the _____ of acids.

- We use *weak* bases daily for **cleaning purposes**.
- An _____ is a base, but alkalis also **dissolve in water**.



Indicators

Indicators are special substances used to tell the difference between acids and bases. Their colours are affected by acids and bases.

Indicator	Colour in acid	Colour in base
Litmus		
Methyl Orange		
Bromothymol Blue		
Phenolphthalein		

Date: _____

The pH Scale and Universal Indicator

Starter

Vinegar is an acid we use on our chips.

Why do you think we couldn't use hydrochloric acid on our chips?

Explain your answer.

_____

_____

Learning Intentions

- To learn about the pH scale
- To identify everyday acids and alkalis

Tick me at the end if ***you can*** …

Success Criteria

☐ I can identify the pH of a substance using universal indicator

☐ I can identify everyday acids and alkali

The pH scale

<u>Acids</u>: substance with a pH less than 7

<u>Base</u>: substance with a pH more than 7

Colour and label the pH scale below

0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**

Measuring the pH of Household Items

Aim: To find out which household items are acids and which are alkalis.

Method:
Draw your method below

Results:

Substance	Colour	pH (0-14)	Acid or Alkali
Baking soda			
Fizzy water			
Salt (sodium chloride)			
Distilled (pure) water			
Lemon juice			
Orange juice			
Oven Cleaner			
Soap solution			
Vinegar			
Washing Soda			
Ethanol			

Date: _____

Natural Indicators

Starter

What is an indicator?

_____

What would be the characteristics of a <u>good</u> indicator?

_____

Learning Intentions

- To make a natural indicator from plants

Success Criteria

☐ I can make an indicator from plants

☐ I can determine if an indicator is effective or not

Tick me at the end if ***you can*** …

Investigating Natural Indicators

<u>Aim</u>: To investigate which plant part is the best indicator

<u>Results</u>:

Plant Part	**Colour in Acid**	**Colour in Alkali**
Root (red onion, beetroot)		
Leaves (red cabbage)		
Fruit (blueberries, raspberries)		

<u>Conclusion:</u> *What is the answer to your aim?*

_____

_____

<u>Evaluation:</u> *How could you improve your experiment?*

_____

_____

Extension

Mystery liquid	Beetroot Indicator	Blueberry Indicator	Red Cabbage Indicator	Acidic, neutral or alkaline?
A	red	red	orange	
B	Red-purple	green	blue	
C	red	purple	purple	
D	purple	green	green	
E	red	red		
F			blue	

Using the table, answer the following questions.

1. Classify each mystery liquid as **acidic, neutral or alkaline** by **filling out the table** and complete the missing information

2. Which two mystery liquids give the **most similar results**?

3. Which indicator seems to show the **clearest change in alkaline solutions**?

4. Why is using **three different natural indicators** more reliable than using only one?

5. A student says, *"If two liquids give the same colours with all three indicators, they must be the same substance."* Do you agree? Explain.

Date: _____

Neutralisation Reactions

Starter

1. Why is universal indicator better than litmus indicator?

   _____

2. What is the pH range of acids?

   _____

3. What is the pH range of alkalis?

   _____

4. What is the pH of a neutral solution?

   _____

Learning Intentions

- To learn about neutralisation reactions

Success Criteria

Tick me at the end if ***you can*** …

☐ I can identify a neutralisation reaction

☐ I can describe what happens to the pH when a neutralisation reaction occurs

---

Neutralisation

Acids and alkalis are chemical _____.

They react together and "cancel each other out".

If you mix just the right volume and concentration of acid and base together, you get a **neutral** solution.

This is called a _____ reaction.

Dilution Experiment

Aim: To investigate the effect of dilution on pH.

Method/results:

Draw your method below, to show your results colour in each test tube with the corresponding colour shown with universal indicator:

Conclusion: *What is the answer to your aim?*

_____

_____

Evaluation: *How could you improve your experiment?*

_____

_____

Neutralisation Experiment

Aim: To find out when a neutralisation reaction has taken place.

Method:

Draw your method below

Results:

Volume of alkali added (cm^3)	Colour of solution	pH
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Conclusion:

The exact final volume of alkali needed to neutralise the acid was _____ cm^3.

Date: _____

Neutralisation Reactions

Starter

1. Name 2 everyday neutralisation reactions.

   _____ _____

2. Universal Indicator was added to an acid, an alkali and a neutral substance. Match **acid**, **alkali** and **neutral** to their correct colours below:

   Red: _____

   Purple: _____

   Green: _____

3. (a) What is the name given to the reaction where an acid is added to an alkali and they cancel each other out?

   _____

   (b) What will be the pH of the final solution?

   _____

Learning Intentions

- To learn how to obtain a salt from a neutralisation reaction

Success Criteria

Tick me at the end if ***you can*** …

☐ I can identify a neutralisation reaction

☐ I can describe what happens to the pH when a neutralisation reaction occurs

☐ I can identify the products of a neutralisation reaction

Word Equations

The new substances made when a base is exactly neutralised by an acid are **a salt** and **water**.

The reaction can be shown by a **word equation**.

acid + base → _____ + _____

Forming Salt Experiment

Aim: To obtain a salt from a neutralisation reaction.

Method:

Results: *What did you observe?*

_____

_____

Conclusion: *what is the answer to your aim?*

_____

_____

Experiment extension:

We can identify the metal in the salt we have made by carrying out a **flame test**.

Flame colour: _____ Metal identified: _____

Extension Tasks

Word Search

Chemistry in our home

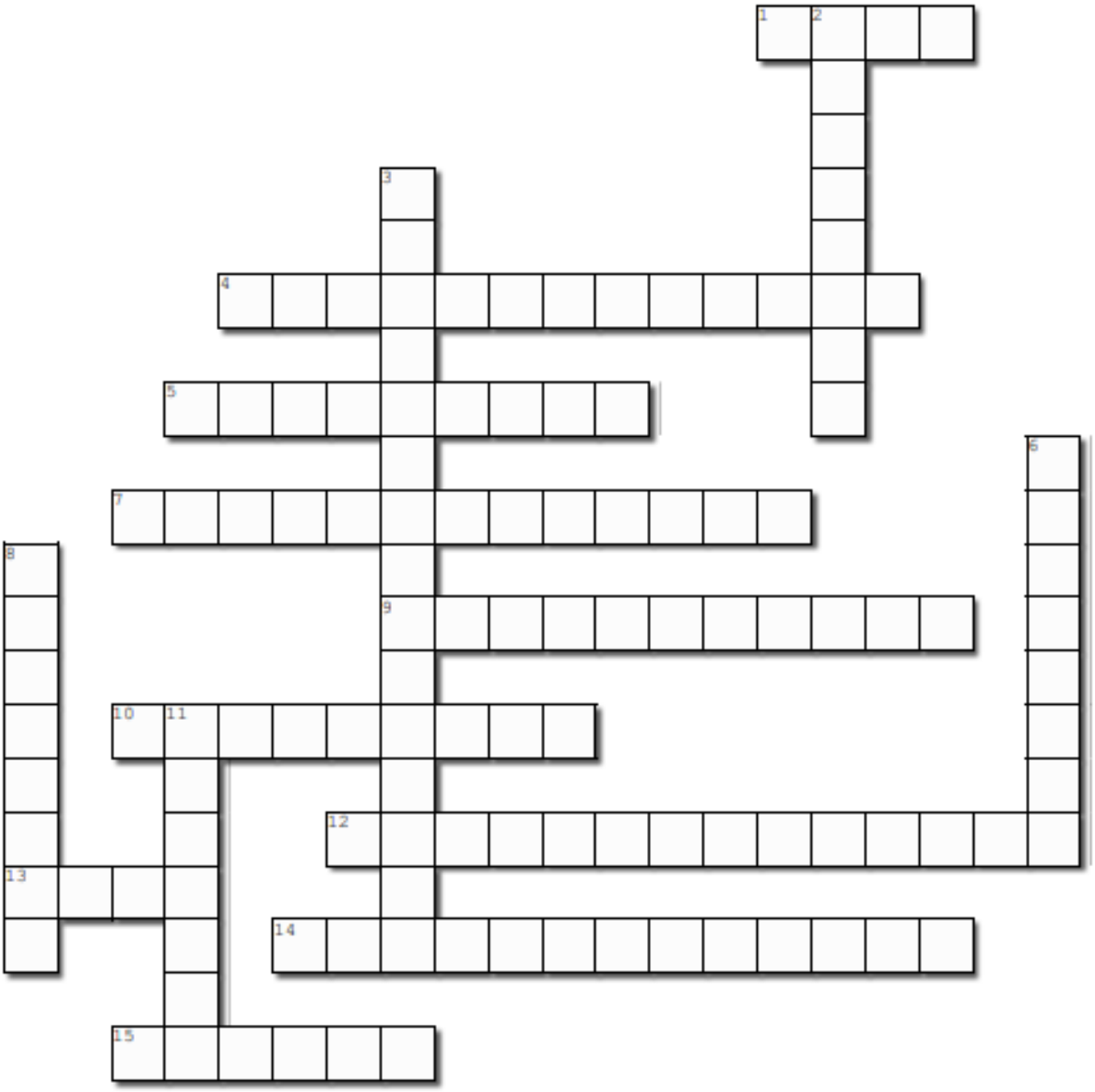
C	O	N	C	E	N	T	R	A	T	I	O	N	R
S	A	I	S	A	L	T	T	S	N	A	R	S	E
N	B	L	P	U	N	A	A	T	E	I	C	U	A
O	A	A	S	P	H	Y	S	I	C	A	L	M	C
I	M	K	S	E	C	A	T	A	L	Y	S	T	T
S	S	L	I	E	T	T	F	N	N	E	T	I	I
O	O	A	A	C	I	D	E	I	T	I	T	L	O
L	L	P	A	R	T	I	C	L	E	I	P	N	N
P	E	F	F	E	R	V	E	S	C	E	N	C	E
X	I	C	T	L	A	C	I	M	E	H	C	R	T
E	O	I	T	E	M	P	E	R	A	T	U	R	E
R	L	A	I	N	D	I	C	A	T	O	R	C	N
N	O	I	T	A	T	I	P	I	C	E	R	P	D
N	E	U	T	R	A	L	I	S	A	T	I	O	N

NEUTRALISATION
PHYSICAL
EFFERVESCENCE
ALKALI
PRECIPITATION
CONCENTRATION
ACID
TEMPERATURE
PARTICLE
LITMUS
CATALYST
INDICATOR
SALT
BASE
REACTION
EXPLOSION
CHEMICAL

Crossword

Chemistry in our home

Complete the crossword below



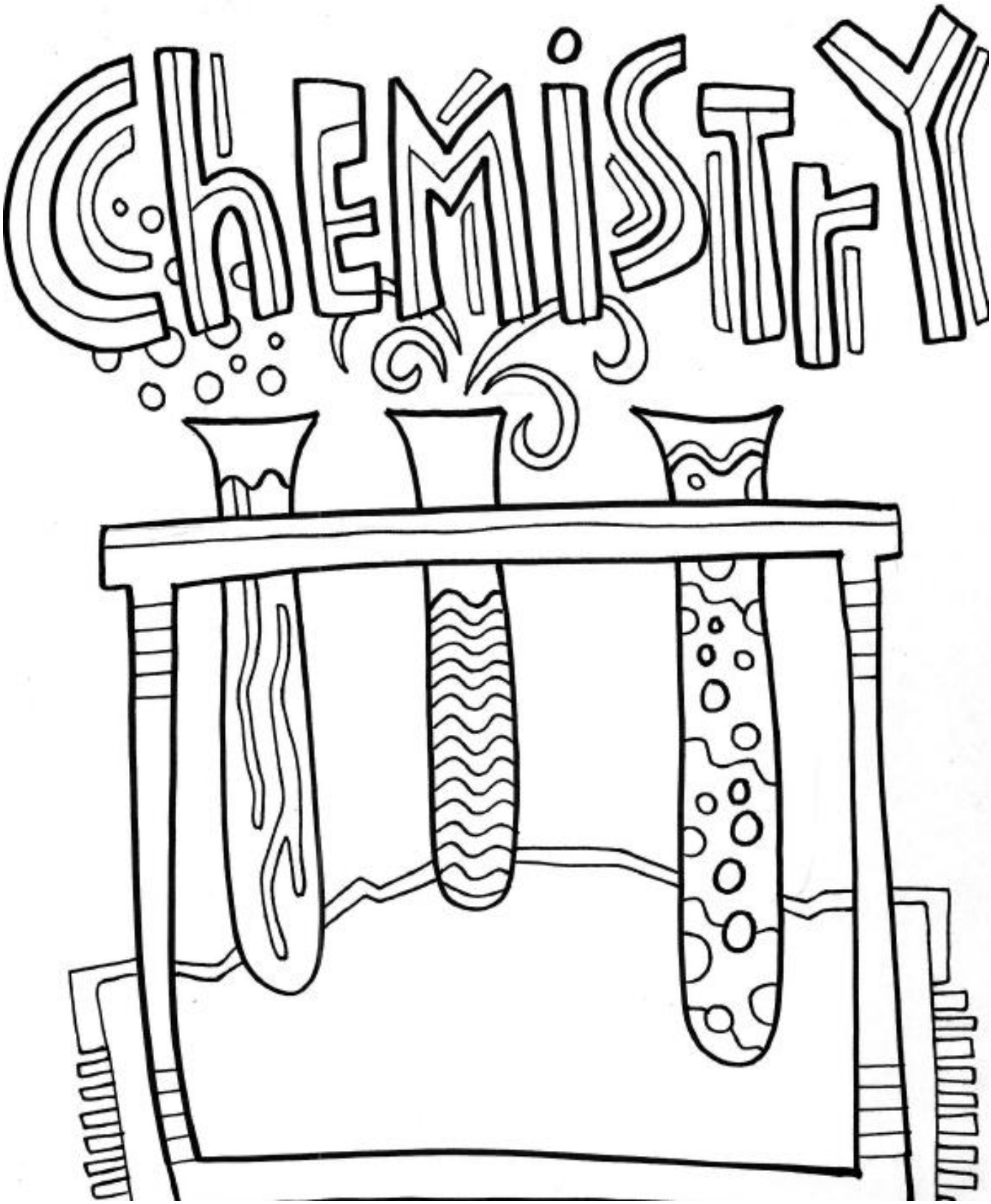
Across

1. A solution with a pH less than 7.
4. The word given for a reaction that forms a gas (bubbles).
5. An example of a very fast chemical reaction.
7. A reaction where a solid forms when two solutions react.
9. The _____ of the room can be increased to increase the rate of chemical reactions.
10. A substance added to a solution to show the pH.
12. A reaction where an acid and alkali are added together to form a neutral solution
13. The product of a neutralisation reaction, which can be extracted by evaporation.
14. The _____ of an acid can be increased to increase the rate of reaction.
15. A solution with a pH more than 7

Down

2. A _____ reaction is one where a new substance is always made:
3. A pH indicator that is colourless in acid and pink in alkaline solutions.
6. A chemical _____ occurs when a new substance is made.
8. A substance that speeds up a chemical reaction.
11. A solution with a pH of 7.

Plenary (end of lesson summaries)

Lesson	Key Concepts Learned	Real-World Applications
Chemical and physical changes		
Chemical Reactions		
Signs of a Chemical Reaction		
Speeding up chemical reactions		
Acids and Bases		
The pH Scale and Universal Indicator		
Neutralisation Reactions		

Colouring Sheet