Name:

Junior Science

Atomic Structure: Part 2

Downloadable Resource

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How do Fireworks Work?

Read the information below and then answer the questions in your workbook.

Fireworks were first made in China 2000 years ago. They were a very simple bamboo tube containing gunpowder and a basic fuse. Fireworks were used in religious ceremonies and are still used at celebrations such as weddings and birthdays today. The largest firework ever created was made in Japan and was half a tonne in weight and when it exploded it was 1 km across. The explosive part of a firework is gunpowder. Gunpowder contains 75% potassium nitrate (KNO_3), 15% carbon and 10% sulfur. These react together when heat is applied. The KNO_3 acts as an oxidiser which means it provides oxygen to the reaction. The carbon (in the form of charcoal or sugar) acts as the fuel providing the energy. The sulphur moderates the reaction and controls how it burns. The amount of sulfur can alter how explosive the gunpowder is. Another type of gunpowder is called 'flash powder' which contains aluminium and potassium perchlorate. This is very powerful and is used to make the fireworks that are used in public displays.

There are three main types of fireworks:

- Firecrackers: Noisy explosions that make a loud ground-based bang.
- Sparklers: Non-explosive, slow burning and hand held.
- Aerial Shells: Have two series of explosions and the second one explodes in the air.

In firecrackers, the fuse sets the gunpowder alight which burns and reacts producing potassium sulfide and the gases nitrogen and carbon dioxide. These are produced from the potassium nitrate, carbon and sulphur in the gunpowder. These gases build up and expand which creates a huge amount of pressure inside the tube which blows it apart, creating the bang.

In a simple sparkler, potassium perchlorate, dextrin and water are mixed together and pasted onto a metal stick. This is then dipped in aluminium flakes, with other chemicals added to make different colours. The gunpowder is in such proportions that it burns slowly and doesn't explode, which makes them safe to hold in your hand.

The aerial shells are a lot more complicated. They contain two sections where the first part has a fuse that is lit which ignites the first rocket. This heat causes the gases to be made like in a firecracker except in this case there is a small hole in the bottom of the rocket that lets the gas escape. The stream of high pressure gases propels the second half of the rocket upwards instead of exploding. Inside the second half are pellets called stars. These stars are small compartments that contain different metal salts and metals which explode into different colours. The order the stars explode at give different patterns like flowers or spheres or wheels. By having the stars as pellets it stops them from burning too fast and allows them to fall before exploding which creates the spreading pattern that you see. The size of the pellets causes them to explode at different times. Small ones burst first and then the second set of explosions are the bigger pellets. That's how you get rings of explosions.

There are different descriptions for the way the fireworks look in the sky which are determined by the size, shape and layout of pellets inside the second rocket shell. Here are a few of the possible styles:

- Palm: Solid cylinders travel out and down like palm fronds.
- Willow: Lots of charcoal so they burn for a long time and fall like branches of a willow tree, they sometimes even touch the ground.
- Serpentine: Bursts of small tubes in random patterns which explode at the end.

To the left is a list of the salts and metals that are commonly used and the colours that they produce.

Colour	Substances Involved
red	Li_2CO_3 and $SrCO_3$ and LiCl
orange	$CaCl_2$ and $CaSO_4$
gold	iron, charcoal and lampblack
yellow	$NaNO_3$ and Na_3AlF_6 and NaCl
white	magnesium, aluminium and BaO
green	$BaCl_2$ and $BaSO_4$
blue	$CuCl_2$
purple	KCl or a mixture of $SrCO_3$ and $CuCl_2$
silver	aluminium, titanium, magnesium

Clever Carbon

Read the following article and use the information to answer the questions in your workbook.

Most people don't even think about it, yet it is involved in their lives every day, in fact they owe their lives to it. Lately it has been getting a lot of negative attention because carbon dioxide is seen to be destroying our planet, even though we are the ones who make it. But did you know that life as we know it wouldn't exist without carbon. Our bodies are around 18% carbon atoms and it is in nearly all our cells, tissues and organs. 0.04% of the Earth's atmosphere is carbon dioxide and every time you breathe out you are adding more.

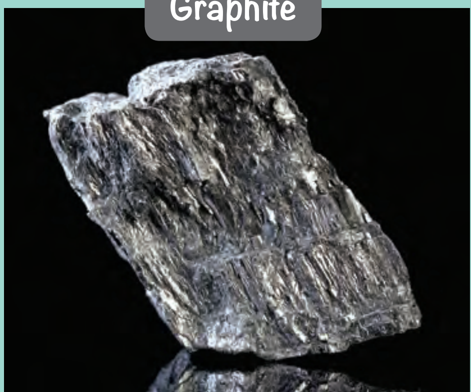
Carbon wasn't discovered by any specific person, ancient groups of people observed it in the black ash left over from fires. Carbon in the form of diamonds were known as early as 2800 BCE in China and the Romans used burnt wood to make charcoal.

There are over 10 million compounds that contain carbon which is because carbon can bond with many other non-metals. This explains why it makes up so much of living organisms – it is no wonder humans and other animals are often referred to as carbon based life forms.

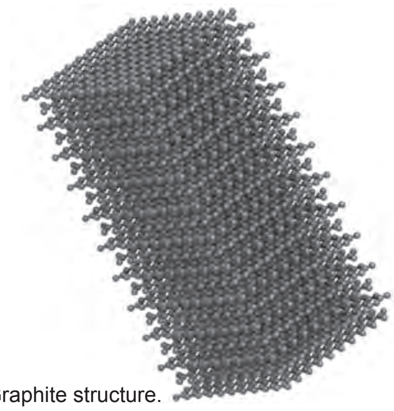
The three main ways that carbon is found in nature (not as a part of living things) is as amorphous carbon (lacking a clear obvious shape, doesn't really have any crystals) in coal and soot, diamonds and graphite. These are referred to as the three allotropes of carbon. Allotropes are different materials made from the same element – not compounds.

Diamond and graphite are identical in chemical terms because they are both made of carbon but physically they couldn't be much more different. Diamond is incredibly hard; in fact it is the hardest known naturally occurring substance. Mohs scale of hardness is used to compare the hardness of different minerals. Common objects are used to scratch the surface and what scratches it is where it sits on the scale.

Graphite

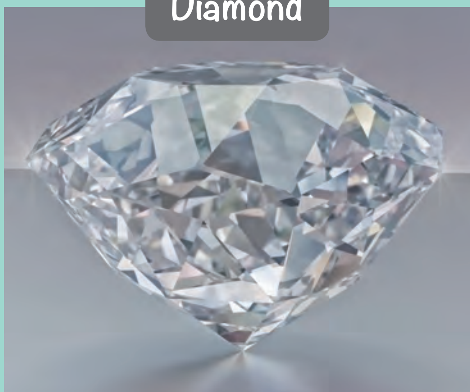


Graphite is dull, opaque, soft and common.

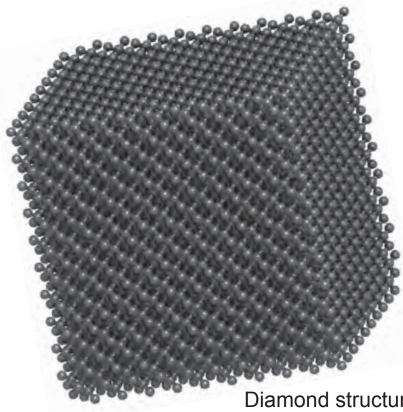


Graphite structure.

Diamond



Diamond is brilliant, transparent, hard and rare.

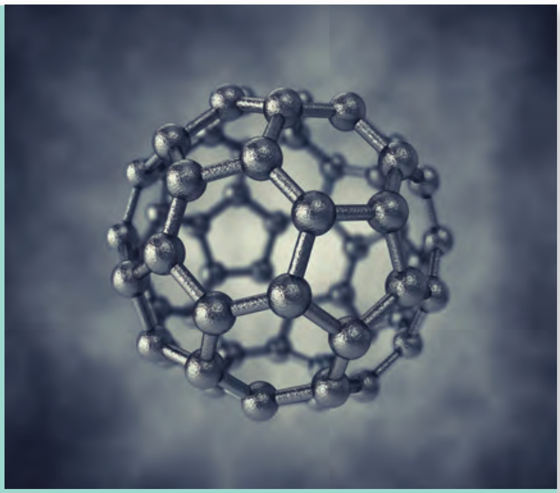


Diamond structure.

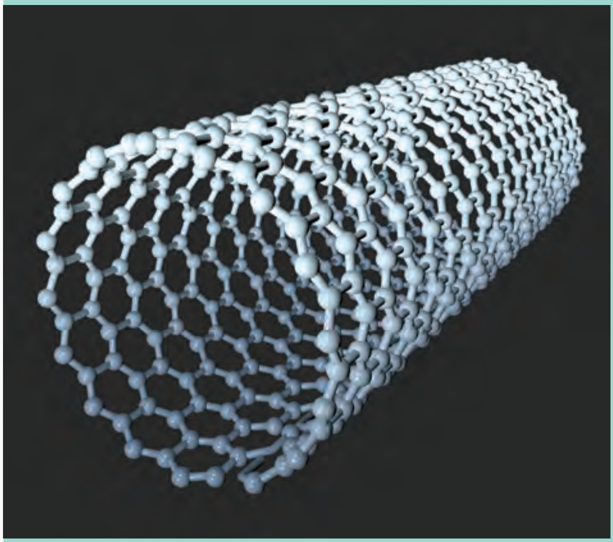
Diamond is also transparent and reflects light so it sparkles. Graphite is grey, black and soft (so soft that you can write with it, which is what pencil 'lead' is). Graphite looks almost like a metal. The reason that they have such different properties is because of how the carbon atoms are arranged. In graphite they are in hexagonal sheets but in diamond they are in a strong tetrahedron (four sided pyramid) shapes.

Graphite means 'to write' and comes from the Greek word 'graphos', whereas diamond means 'the invincible' and is from the Greek word 'adamas'.

More recently (in 1985) new formations of carbon were observed. The first is called buckminsterfullerene or buckyballs for short. This is a structure of sixty carbons in a soccer ball type shape. It is found naturally in soot in small amounts. Currently no use has been found for this type of carbon structure but C_{60} is able to inhibit the HIV virus and prevent it turning into AIDS.



buckyball



nanotube

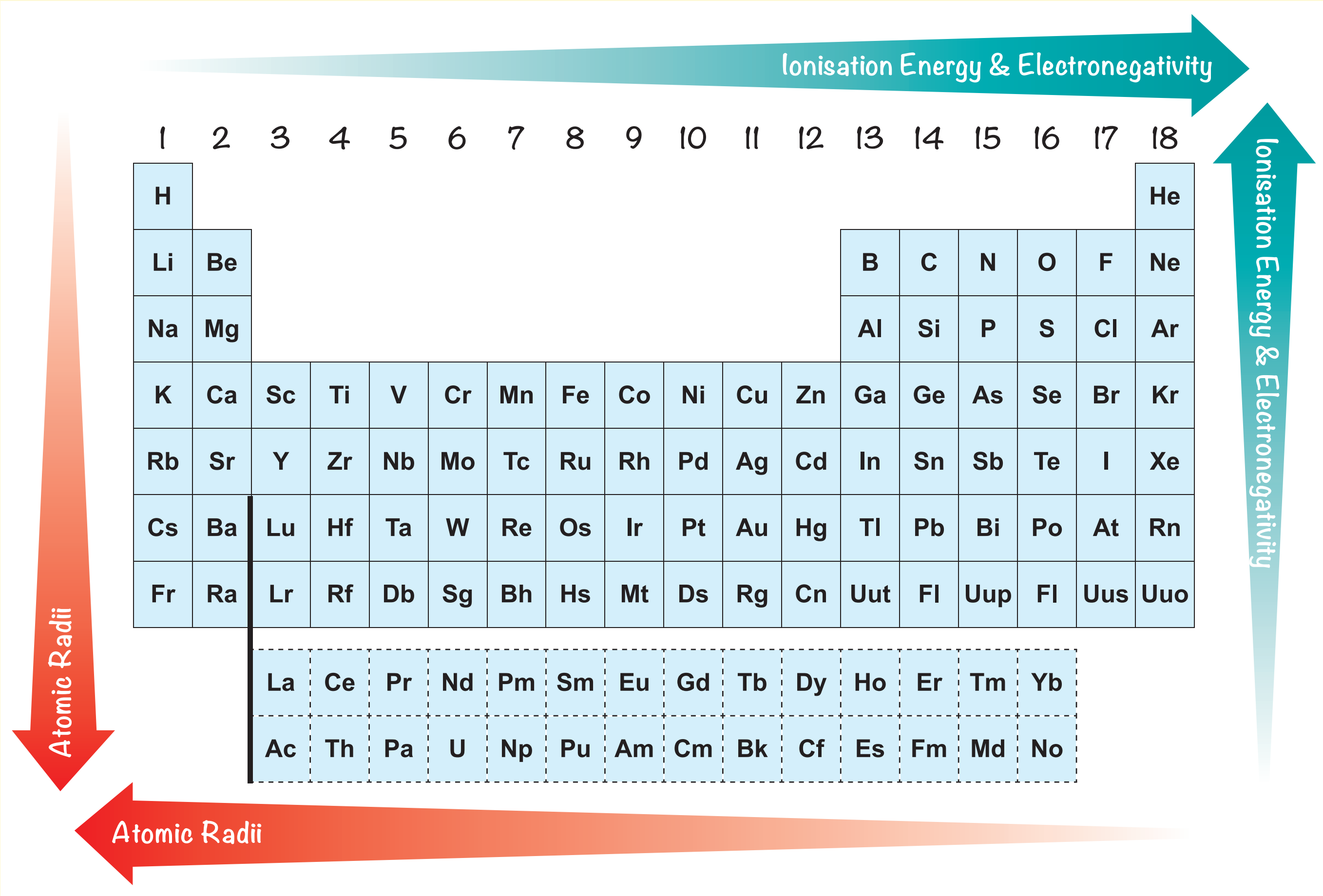
Another newly discovered structure of carbon are nanotubes which are tiny microscopic tubes made up of hexagon shaped carbon molecules. Nanotubes can come in a variety of shapes and this causes them to have a huge range of different properties. For example the peapod has a rare magnetic property and the N-doped nanotube (which contains Nitrogen) is making lithium batteries last up to three times longer. Nanotubes are amazing because they possess the following properties:

- **Strength**: Strongest and stiffest materials yet to be discovered. Tests have shown that 1 mm^2 thick nanotube can hold over six tonne.
- **Hardness**: It is harder than diamond.
- **Movement**: Having nanotubes inside other nanotubes allows them to slide on top of each other, like a telescope. This has been used to make the worlds smallest motor.
- **Temperature**: They are estimated to be able to withstand 750°C in air.

Carbon is also a main component in plastics and fuels. Fuels like petrol and diesel are derived from oil which in turn is from decomposed, pressurised living things such as plant material and sea life. Because it is made from living things it is mostly carbon. Plastics can also be made from oil, these are long chains of carbon molecules. Not only this but steel is an alloy of iron and carbon. The addition of the carbon makes the iron harder and stronger but also less malleable (able to be shaped). Different amounts of carbon are added to make different strength steels. As you can see life would not exist without carbon, so let's stop giving it a hard time by blaming it for Earth's climate problems, it is here to stay. Instead look at all the positive things that carbon is part of and try to help the Earth. I think I will go and plant a tree now so that it can recycle some carbon for me.

Periodic Table Arrangement and Organisation

Read the following article and use the information to answer the questions in your workbook.



The **Periodic Table** has many patterns as to how it is arranged. The first one is the **Groups** which run down the vertical columns; they are like families because they share similar chemical properties. Their properties are similar because they all have the same electron configuration in their valency (outer) shell.

For example, if we look at Group 1, they have the following electron arrangements:

hydrogen: 1 lithium: 2,1 sodium: 2,8,1 potassium: 2,8,8,1

They all have one electron in their valency shell. This causes them all to behave in very similar ways.

The groups are numbered from 1-18 and all have names, however, only a few of these names are still used today; the others are far less common. Group 1 are the alkali metals, Group 2 the alkali earth metals, Group 11 the coinage metals, Group 12 the volatile metals, Group 17 the halogens and Group 18 the noble gases.

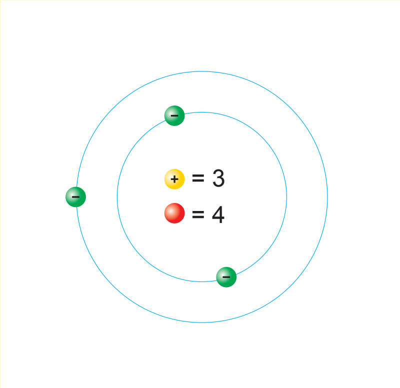
You might have heard of halogen lamps or halogen light bulbs. These use a small amount of bromine or iodine and produce a lot of light even if they are small. They work well at higher temperatures. This makes them really useful in projectors, outdoor floodlights and car headlights.

As you go down the groups from top to bottom, there is an increase in the **atomic radii** of the atoms. This is the size of the atom and is usually the distance from the centre of the nucleus to the outermost electrons.

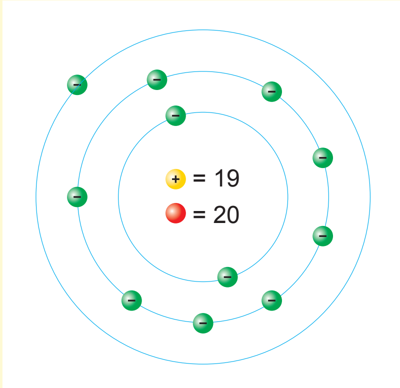
There are also different **Categories** based on their similar physical and chemical properties. For example, the majority of the metals are shiny, conduct electricity and heat, are solid and form alloys (brass is an alloy of copper and zinc and bronze is an alloy of copper and tin) with other metals and salts with non-metals. **Metalloids** have a mixture of metal and non-metal properties. They include the six commonly recognised elements of boron, silicon, germanium, arsenic, antimony and tellurium. There are also five other elements that are sometimes recognised as metalloids: carbon, aluminium, selenium, polonium and astatine. For example, carbon is not shiny or silver, it is quite crumbly (in some forms) but can conduct electricity. The other category is the non-metals which are mostly gases, are either coloured or colourless and have insulating properties. There are always exceptions to these sections and the system is not perfect but the current periodic table of elements is seen as the best fit.

Extension

Also as you go from top to bottom there is a decrease in ionisation energy (the energy needed to remove electrons and become a positive ion). This is because as the atoms get larger in size, the less hold they have on their outer electrons. The closer to the nucleus that electrons are, the better the hold the atom has on them. This is why in Group 1 Francium is extremely reactive. It is large so it has a weak hold on its electrons and has only one electron in its valency shell.



Lithium has a greater hold on its outer electron because it only has two shells. The electron is still close to the nucleus.

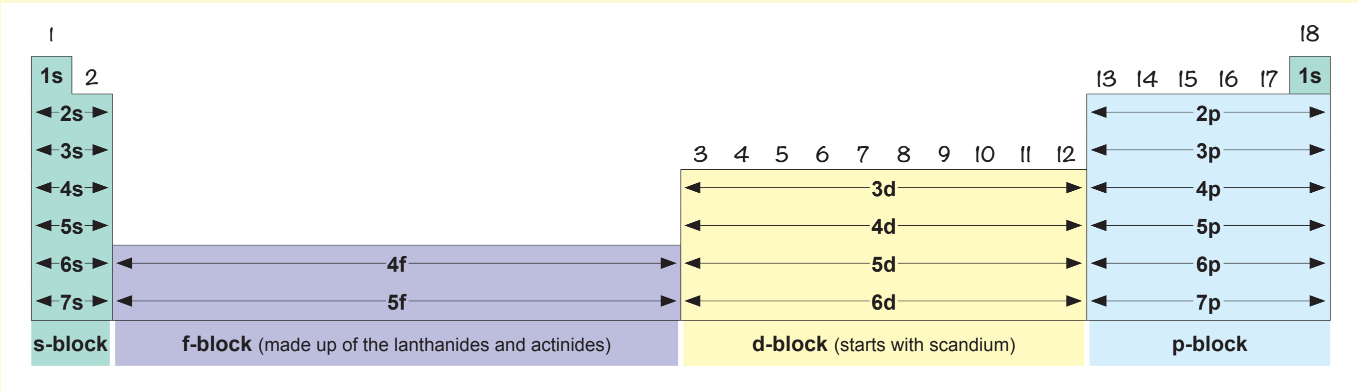


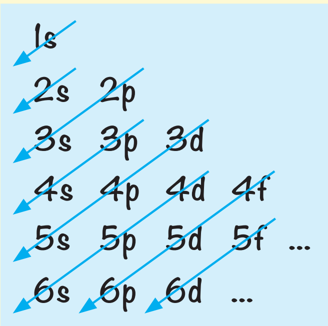
Potassium has a weaker hold in its outer electron because it is farther away from the nucleus. It is much more reactive than lithium.

The **electronegativity** of the atoms also decreases as you go down the groups. This is the atom's ability to attract electrons and become a negative ion. This is also due to the increasing size and less pull from the nucleus on the outer shells.

The second structure are called the **Periods**, which are the rows. These show less trends and patterns than the groups but there are still some. For example, as you go from left to right across a period, the atomic radii decreases (size). This is because there are more protons and neutrons in the nucleus, resulting in more pull on the electrons, bringing them closer in. It is like gravity and planets; the bigger the planet, the more gravitational pull it has so they usually pull in more moons and space junk closer to them.

The **ionisation energy** (energy needed to remove electrons) also increases from left to right because the electrons are more tightly bound to the nucleus. This means that more energy is needed to remove the outer electrons. This links to the electronegativity of the atoms which also increases from left to right, as the bigger ones have more pull so it is easier for them to drag electrons into their orbits.





Another level of organisation are the **Blocks**. The periodic table is divided into four blocks. These blocks are based on the order the electrons fill up the shells. In junior science (and even at Level 1) we work on the principle that each shell can contain 8 electrons (except for the first shell which has 2) and that each shell is filled before electrons are added to the next. In reality, it is a little more complicated than that and there are levels that the electrons fill in a certain order. The **orbitals**, as they are sometime referred to as, are filled in the order shown in the diagram to the left. The first one filled is the 1s which only fits 2 electrons, then the 2s, 2p, 3s, 3p, 4s, and so on. As a general rule, the s-shells fit 2 electrons, the p's 6 and the d's 10.

Writing Word Equations

Reaction 4

If we were to neutralise hydrochloric acid with sodium hydroxide then water and sodium chloride would be made.

a. The reactants are:

b. The products are:

c. The word equation for this reaction is:

+ → +

Reaction 5

When we make a pancake we use flour, eggs, milk, sugar and heat.

a. The reactants are:

b. The products are:

c. The word equation for this reaction is:

+ + + →

Reaction 6

Energy is made in our bodies through a process called respiration. Our cells take oxygen and sugar and create the energy. Waste products also made include water (which we turn into urine) and carbon dioxide (which we breathe out).

a. The reactants are:

b. The products are:

c. The word equation for this reaction is:

+ → + +

Reaction 7

When you combine lead nitrate and potassium iodide together it creates a bright yellow mixture made of lead iodide and potassium nitrate.

a. The reactants are:

b. The products are:

c. The word equation for this reaction is:

+ → +

Reaction 8

When you heat up calcium carbonate in a Bunsen burner flame it goes through decomposition to form calcium oxide and carbon dioxide.

a. The reactants are:

b. The products are:

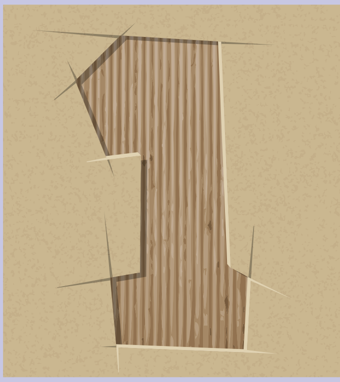
c. The word equation for this reaction is:

→ +

Rates of Reaction

Before you start these experiments, be sure to read and follow the **General Safety Notes and Practical Tips** on page 2. Then answer the questions in your workbook.

Experiment One: Effect of Concentration



Equipment:

- 4 test tubes
- 1 test tube rack
- 4 small equal sized pieces of magnesium ribbon
- 1 stopwatch
- paper
- 4 mL of 0.5 mol L^{-1} hydrochloric acid
- 4 mL of 1.0 mol L^{-1} hydrochloric acid
- 4 mL of 2.0 mol L^{-1} hydrochloric acid
- 4 mL of 3.0 mol L^{-1} hydrochloric acid

Method:

Step 1. Place 4 mL of each of the concentrations of acid into the 4 test tubes; Label the test tubes with a piece of paper.

Step 2: Put each test tube into the test tube holder.

Step 3: Put 1 piece of magnesium into each test tube and start the stopwatch.

Step 4: Watch **VERY** carefully. As each piece reacts away **COMPLETELY** write down the time.

Step 5: When they have all reacted wash out the test tubes and put the equipment away.

Results:

	0.5 mol L^{-1}	1.0 mol L^{-1}	2.0 mol L^{-1}	3.0 mol L^{-1}
Time to React (sec)				

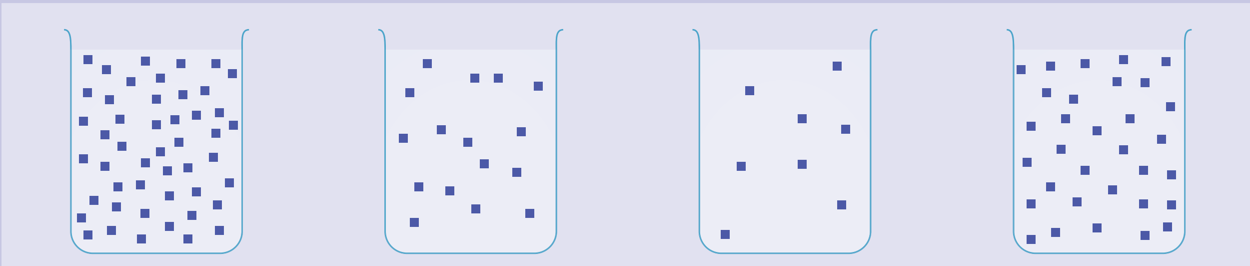
Conclusion:

a. The acid that reacted the fastest was ______. It took ______.

b. The acid that reacted the slowest was ______. It took ______.

c. The more concentrated the acid, the FASTER / SLOWER it reacts with the magnesium. (Circle your answer.)

d. Label each of the following diagrams as either 0.5 mol L^{-1}, 1.0 mol L^{-1}, 2.0 mol L^{-1} or 3.0 mol L^{-1}.



e. If something is concentrated, it means that there is a LOT / LITTLE of the substance. (Circle your answer.)

f. The more concentrated the substance is, the FASTER / SLOWER the reaction goes. (Circle your answer.)

g. The opposite of concentrated is DILUTE / WATERY / MINIMUM. (Circle your answer.)

h. In this experiment, the amount of products made would have been the same in each reaction because while the concentration of the acid differed, the amount of magnesium didn't. Is this statement TRUE or FALSE ?

Experiment Two: Effect of Temperature

Equipment:

- Bunsen burner
- thermometer
- test tube rack
- 2 small pieces of calcium carbonate
- tripod
- 100 mL tap water
- 4 mL of 2.0 mol L^{-1} hydrochloric acid
- gauze mat
- 2 test tubes
- heatproof mat
- beaker
- stopwatch

Method:

Part One:

Step 1. Set up the Bunsen burner and light it. Put the 100 mL of water into the beaker and put it on the tripod.

Step 2: Heat the water to 80°C. When it reaches 80°C, put 4 mL of 2.0 mol L^{-1} hydrochloric acid **into the test tube** and **place the test tube into the beaker** of water. Leave it for 1 minute.

Step 3: Turn off the Bunsen burner.

Step 4: Add 1 piece of calcium carbonate to the test tube (leaving it in the beaker on top of the tripod). Start the stop watch.

Step 5: Watch it carefully and when it has fully reacted, stop the stopwatch and record the time.

Step 6: When the gear has cooled down, wash it and put it away.

Part Two:

Step 1: Put 4 mL of 2.0 mol L^{-1} hydrochloric acid into the test tube.

Step 2: Add 1 piece of calcium carbonate and start the stopwatch.

Step 3: Watch it very carefully and when it has fully reacted, stop the stopwatch and record the time.

Step 4: Wash and clean up the gear.

Results:

Time taken to react in heated acid: ____________

Time taken to react in cool acid: ____________

Conclusion:

a. HOT / COLD acid reacted with the calcium carbonate fastest.

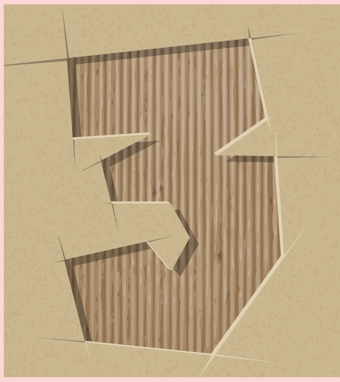
b. HOT / COLD acid particles move around the quickest in the solutions.

c. HOT / COLD acid particles crashed into the calcium carbonate with more force.

d. Tilly was making homemade lemonade. She used 1 cup of boiling water to dissolve 2 cups of sugar before adding the lemon juice, cold water and ice. Explain why she added boiling water to start with.

e. Why do you think we keep products like meat, cheese and milk in a cold place like the fridge?

Experiment Three: Effect of Particle Size



Equipment:

- 2 test tubes
- stopwatch
- test tube rack
- pestle and mortar
- 2 calcium carbonate crystals (of the same mass)
- 2 x 4 mL of 2.0 mol L^{-1} hydrochloric acid

Method:

Step 1. Place the two test tubes in the test tube rack.

Step 2: Put 4 mL of 2.0 mol L^{-1} hydrochloric acid into each test tube.

Step 3: Add one crystal of calcium carbonate to one test tube and start the stop watch.

Step 4: Watch it carefully until it has fully reacted, then stop the stop watch and record the time.

Step 5: Take the other crystal and grind it to a powder using the pestle and mortar.

Step 6: Now repeat steps 3-4 with the powdered calcium carbonate.

Step 7: When you are finished, wash and put away the gear.

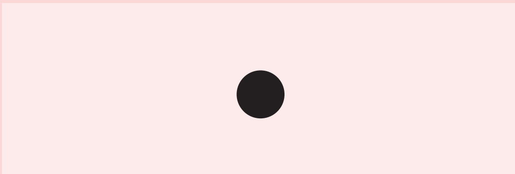
Results:

Time taken for calcium carbonate **crystal** to react:

Time taken for calcium carbonate **powder** to react:

Conclusion:

a. Label the following diagrams as either calcium carbonate crystal or calcium carbonate powder.



b. Which type of calcium carbonate reacted the fastest? and it took .

c. The LARGER / SMALLER particles reacted fastest.

d. The LARGER / SMALLER particles had greater total surface area.

e. The LARGER / SMALLER particles have more area for the acid to react on so it reacts faster.

f. When you light a fire, it is best to use small pieces of wood NOT a large log. Explain why.

g. When you make a stir-fry, it is best to cut all the vegetables the same small size. Explain why.

Summary Questions

1. Write **true** or **false** beside each of the following statements:

   a. Smaller particles react **faster** than larger particles.

   b. Dilute acid reacts **faster** than concentrated acid.

   c. Hotter acid will react **slower** than colder acid.

   d. If you add concentrated acid to water, it makes it dilute.

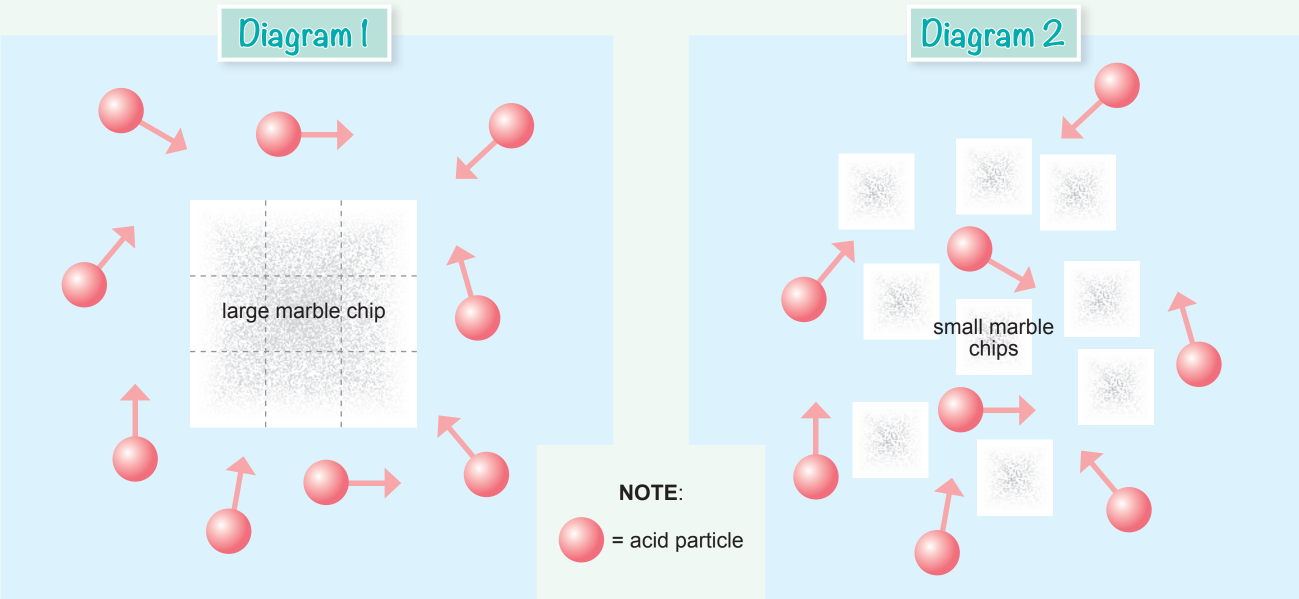
   e. If you crush up calcium carbonate, it will react **slower** than a whole piece.

   f. 60°C acid will react **slower** than 98°C acid.

   g. Stirring or swirling salt as it is added to water will make it dissolve **faster**.

   h. 4 mol L^{-1} nitric acid will react **faster** than 0.1 mol L^{-1} nitric acid.

2. Use the diagrams below to answer the following questions.



   a. i. In Diagram 1, the $CaCO_3$ has a perimeter of 3 units / 9 units / 12 units . (Circle your answer.)

      ii. In Diagram 1, the acid particles CAN / CAN'T get to the middle easily to react. (Circle your answer.)

   b. i. In Diagram 2, the $CaCO_3$ has a perimeter of 4 units / 9 units / 36 units . (Circle your answer.)

      ii. This is a BIGGER / SMALLER surface area than in the first diagram. (Circle your answer.)

      iii. So, the reaction in the second diagram would be FASTER / SLOWER than Diagram 1. (Circle your answer.)

   c. Overall, when there is more a ______ for c ______ to occur on, the reaction can occur f ______.

Formula Grid

Write the correct formula that would be made if each of the following ions were crossed.

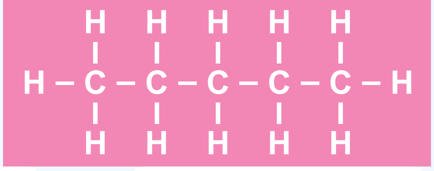
Cation \ Anion	Cl^-	S^{2-}	NO_3^-	SO_4^{2-}	OH^-
NH_4^+					
Al^{3+}					
Mg^{2+}					
Ca^{2+}					
Na^+					

Isomers

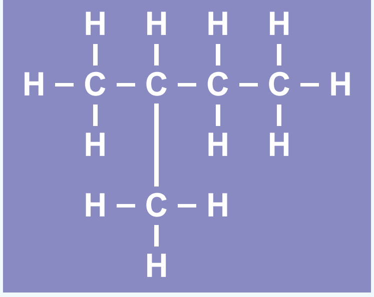
Sometimes a chemical formula isn't as straightforward as it seems. Pentane is a compound that has the formula C_5H_{12} which seems simple enough and if you drew it out it looks nice and simple like in the diagram opposite.

BUT 2-methylbutane and 2,2-dimethylpropane also have the formula C_5H_{12} but they look nothing like pentane as you can see in the diagrams opposite. That is because they are **isomers**. **Isomers** have the **same molecular formulae** but have **different atom arrangements**. This is a specific example of a structural isomer because the structures are different. There are three types of structural isomers, these are shown in the table below.

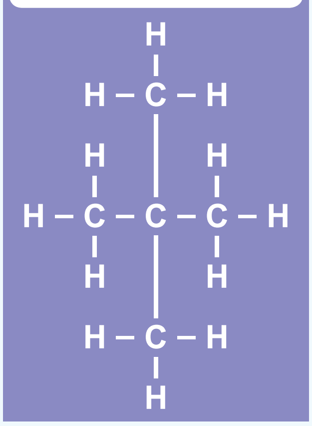
pentane



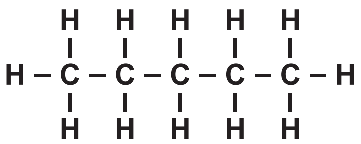
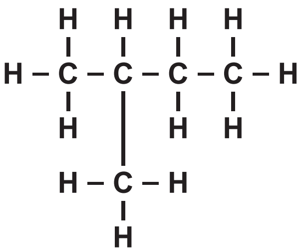
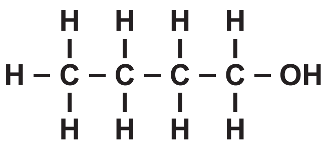
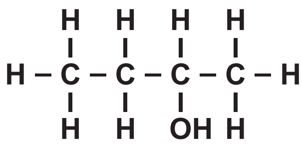
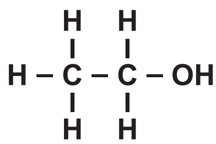
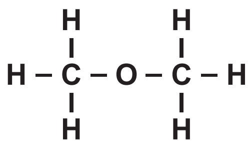
2-methylbutane



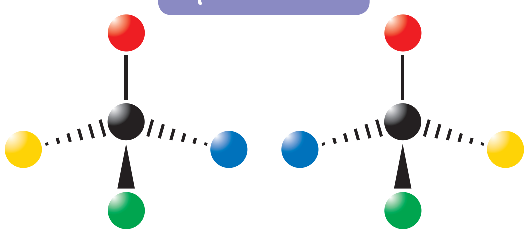
2,2-dimethylpropane



Structural Isomers

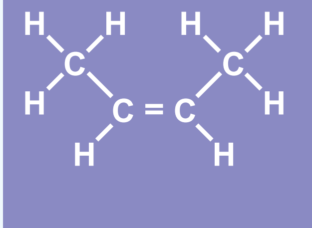
Chain	Positional	Functional
The way the carbon atoms are linked differs.	The groups attached to the carbons are in different places.	Some form different functional groups.
 OR 	 OR 	 OR 
both C_5H_{12}	both $C_4H_{10}O$	both C_2H_6O
The first compound has all carbons in a chain. The second compound has carbons in a branch.	The first compound has an OH off the first carbon. The second compound has the OH off the second carbon.	The first compound contains an OH (hydroxyl group). The second compound has a R-O-R group.

Optical Isomer

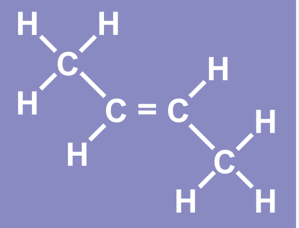


The other main type of isomerism is **stereoisomerism** and is where they are arranged differently in space. This means the angles that the groups are positioned at are different. In **optical stereoisomers** they are mirror images of each other. The other type are **geometrical stereoisomers** which have a different arrangement or angle of the parts. ***Cis*** means they are one the same side and ***trans*** on different sides. These differences in layout and structure cause them to have different properties, such as melting and boiling point, reactivity and strength.

Geometric Isomers

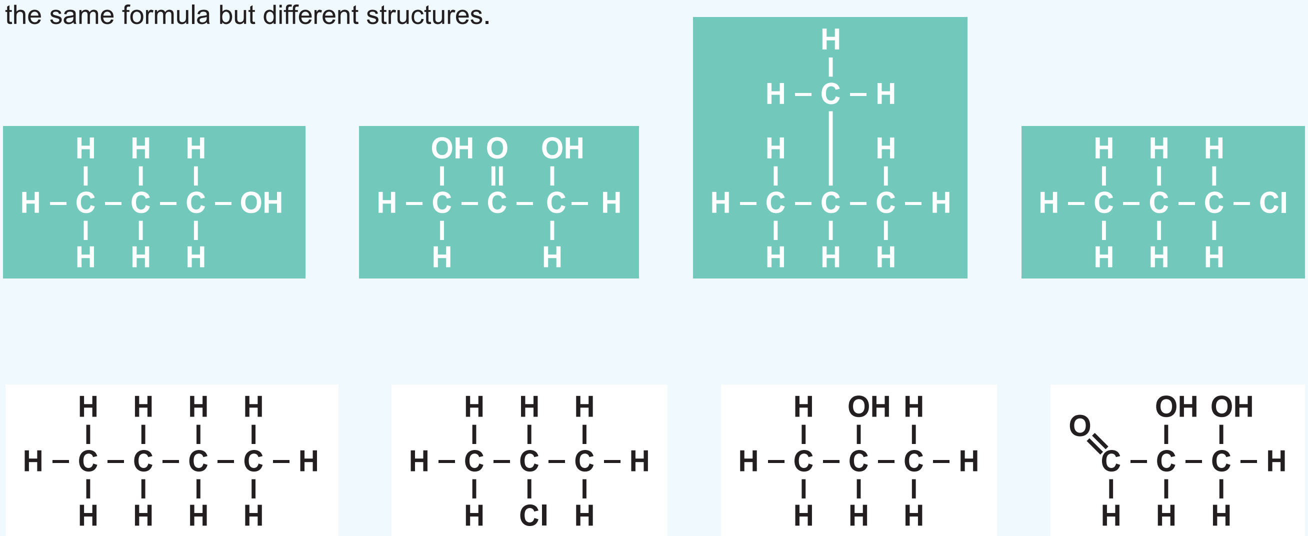


cis-but-2-ene



trans-but-2-ene

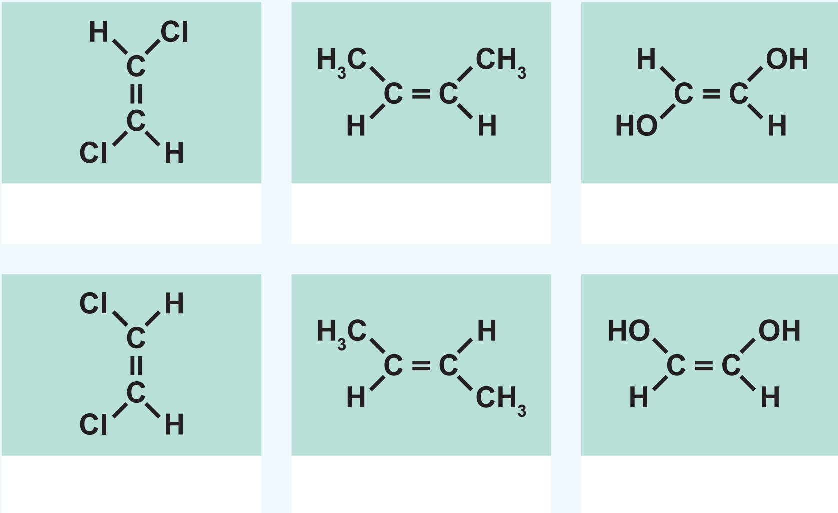
1. Match the following structural isomers together by drawing a line between them. Look for matching pairs with the same formula but different structures.



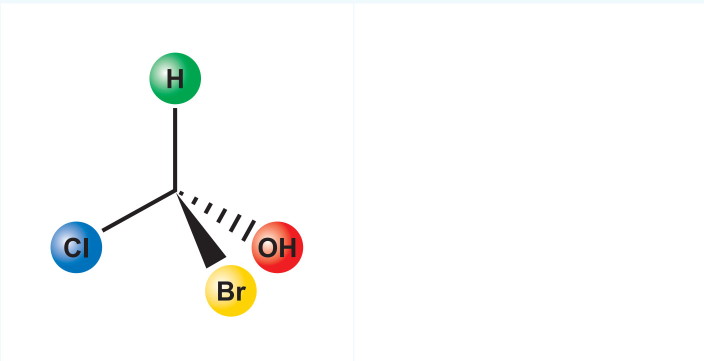
2. Write the formula for each of the pairs above along the line that you have drawn. The formulae are given below.

C_3H_8O C_3H_7Cl C_4H_{10} $C_3H_6O_3$

3. Label each of the following geometrical stereoisomers as either **cis** or **trans**.



4. Draw an optical stereoisomer of the following compound.



Graphing Reactions

1. a. Graph the following information about an experiment that Gina did in her Science class where she reacted hydrochloric acid and calcium carbonate together then measured the amount of carbon dioxide gas made over time.

Time (s)	0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34
Amount of Gas (mL)	0	0	2.5	5	10	15	25	28	29	30	32	33	34	35	35	35	35	35

b. At what time did the reaction stop making gas?

c. What was the maximum amount of gas made in the reaction?

d. How long did it take for the reaction to finish?

e. How long did it take for the reaction to start making gas?

f. Because Gina used calcium carbonate, we can guess the name of the gas made in this experiment is: (Circle your answer.)

oxygen nitrogen carbon dioxide hydrogen

g. Because gas was made, we would see BUBBLES / STEAM in the liquid in the beaker. (Circle your answer.)

h. Because gas was made, we would hear A SQUEAKY POP / FIZZING if we listened to the beaker. (Circle your answer.)

2. a. Below is the temperature change of water in a sealed container as it is heated from ice over time on a Bunsen burner. Draw a graph to show this information.

Time (s)	0	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300
Temperature (°C)	-10	-5	0	0	0	20	40	60	80	100	100	100	100	100	110	120

b. What temperature was the ice?

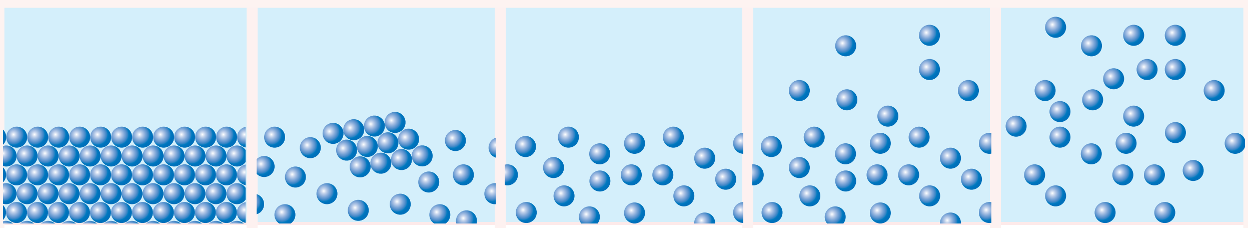
c. At what temperature do you think the ice melted?

d. How long did it take the water to reach 100°C?

e. What was the hottest temperature that the water reached?

f. What happened to the water when it reached 100°C?

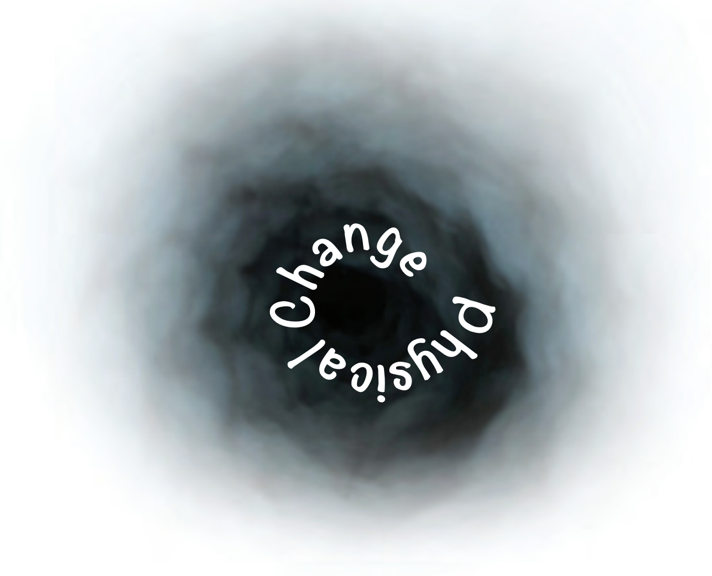
g. Match each of the diagrams below to the temperature that you think they are showing. The temperatures are 0°C, 100°C, 120°C, -10°C and 25°C. Write the correct temperature underneath each one.



Word Games

1. Terminology Tornado

Using the following science term, see how many words of 3 or more letters you can make in 10 minutes.



Points
3-4 letters = 1 point
5+ letters = 2 points

Scores
0-5 points = awful
6-10 = average
10+ = amazing

2. Six Word Scramble

Use the clues to work out what the 6 key science words are and then spell the word in the grid by colouring in the squares that make up the word. Use different colours for each answer.

ADII	VE	TLE	BR
MER	MIC	ATO	ISO
CHE	MICR	GRO	AL
IT	UPS	ATI	NEG

Clues

a. The size of an atom. (6,5) ____________
b. A type of change that is reversible. (8) ____________
c. Property that means breaks easily, often crumbly. (7) ____________
d. What an atom becomes if it gains electrons. (8) ____________
e. The name for the vertical columns on the Periodic Table. (6) ____________
f. Name for molecules with same formula but different layout. (6) ____________

3. Block Buster

Cross out each of the words that fit with one of the clues. You will be left with one word that doesn't fit; this is your answer.

Ce	shell	shiny	gas made	electron	irreversible	
Th	neutron	transparent	dull	orbit	Rh	
colour change	flexible	new product	Lr	Wi	Hg	proton
opaque	conductor	Lv	nucleus	liquid		

Clues

a. properties
b. Parts of an atom.
c. Element symbols from the Periodic Table.
d. Features of chemical changes.

Answer

4. Atomic Number Word Puzzle

Use the atomic numbers from the periodic table to work out the silly sentences below. The first word has been done for you.

74 2 7 / 16 85 / 92 60 68 / 22 66 / 4 7 6 1 99

52 7 / 6 85 16 / 14 15 / 9 53 16 1 / 3 23 68

15 33 52 / 85 / 71 7 6 1.

74 1 8 / 1 33 / 42 92 16 99 / 6 2 99 99?

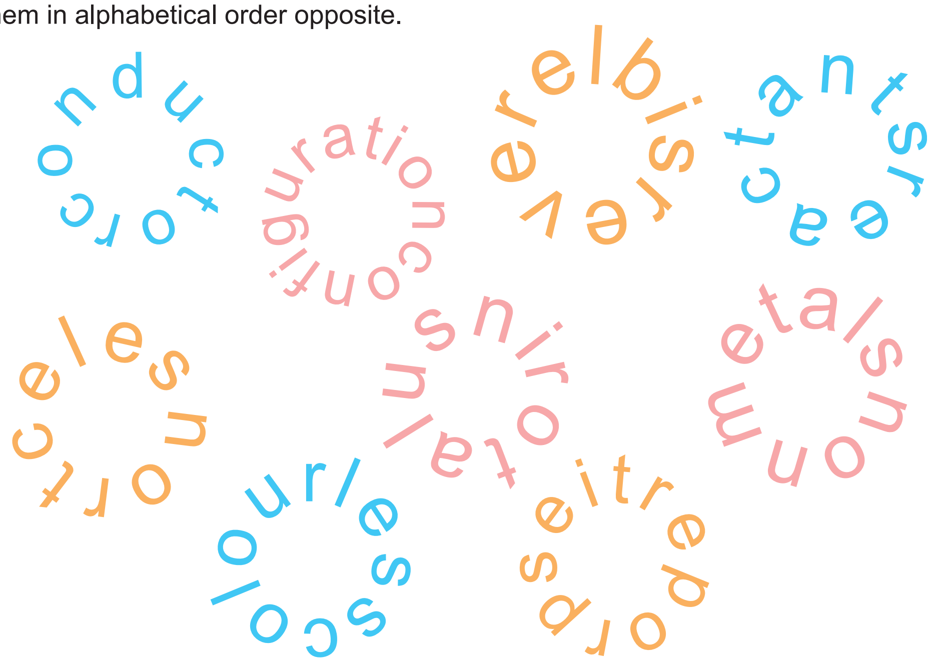
42 92 34 / 53 16 / 5 68 16 68 19 / 16 8 / 2

1 33 / 39 8 92 / 2 3 6 8 78 68

6 1 8 6 8 57 52 / 85 / 1 53 16 / 42 92 90

5. Roundabouts

Find the 9 science terms related to this topic by solving the puzzle below. Each circle contains a term (one or two words) which runs either clockwise or anti-clockwise and can start anywhere in the circle. When you have worked out each answer, put them in alphabetical order opposite.



Answers (in alphabetical order)

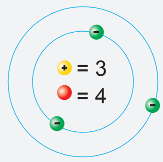
6. Lingo Lattice

All of the answers to the questions are in the lattice below, either as a word or picture. Once you have found each one, there will be one left over, this is the final answer.

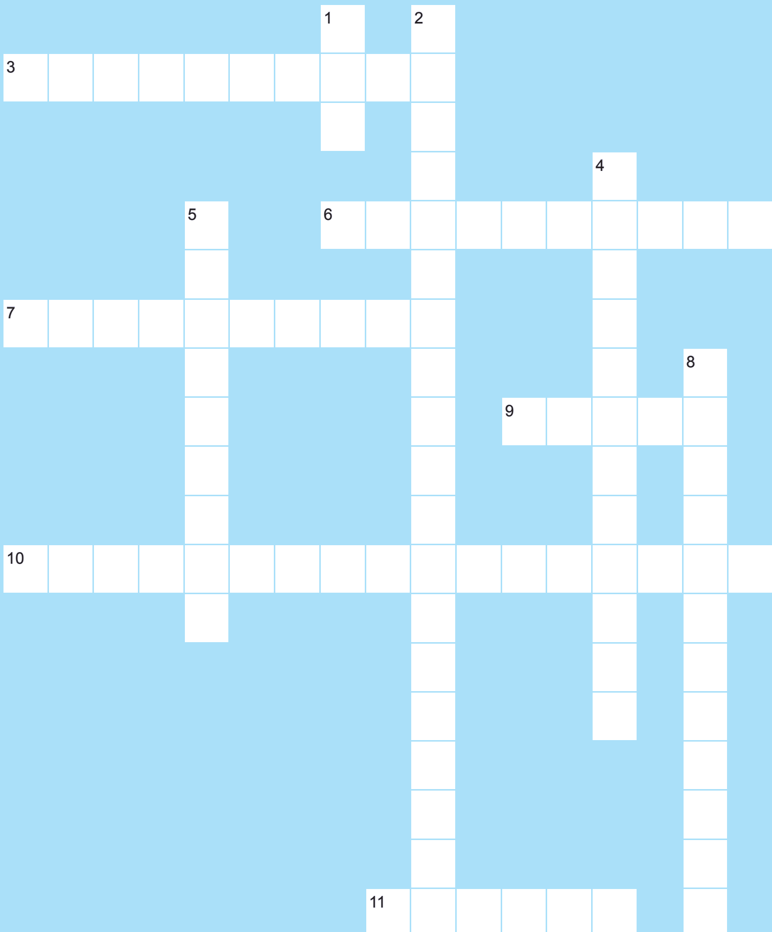
Questions

1. What does an atom become when it loses electrons?
2. What is an example of a physical change?
3. Which is showing the third element from the Periodic Table?
4. What is the formula for iron oxide?
5. What goes cloudy when CO_2 is bubbled into it?
6. What is an example of a chemical change?
7. What is used to prove the presence of hydrogen gas?
8. Which word describes something that can be seen through?
9. Which is the formula for calcium nitrate?
10. Which compound contains 3 atoms?
11. What is formed when potassium loses one electron?

Final Answer

$Ca(NO_3)_2$		limewater
negative	FeO	positive
K^+	transparent	
	pop test	SO_3

7. Crossword



Across

3. A short paragraph that summarises the findings, linking back to the hypothesis and aim.
6. A prediction of what will happen, starts with 'That …'.
7. A long paragraph that explains the findings using science.
9. A short description of the experiment.
10. The factor that you measure and is affected by the independent variable. (2 words)
11. Step-by-step instructions.

Down

1. Starts with 'To find out …'.
2. The factor you are changing in an experiment. (2 words)
4. Data findings are recorded in this special grid. (2 words)
5. A list of the gear to be used.
8. A special picture that shows the data gathered, usually a line format. (2 words)

8. Topic Word Find

The following word find contains…

- 9 properties.
- 7 physical and chemical changes.
- 5 terms about ions.

Find each of these in the word find below then write their names in the correct column in the table that follows.

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

Properties	Physical and Chemical Changes	Terms About Ions