

Year 8 Science Knowledge Booklet

Term 2

Name:

Class:

Homework 1 Due: 9th November

Homework 2 Due: 23rd November

Homework 3 Due: 7th December





Science Homework 1

Read all of this knowledge organiser. The work covered will be in the first knowledge quiz of the term.

Big questions: What do we mean by inheritance?

What is variation?

How do we vary from each other?

What does adaptation mean?

What do living things compete for?

What do we mean by evolution?

What is our evidence for evolution?

How do we produce new varieties of plants and animals?

Key vocabulary

Adaptation	A feature or characteristic that helps an organism survive in the conditions of its natural environment.
Charles Darwin	A scientist who proposed the theory of evolution via natural selection.
Distribution	Where organisms are found in a particular area.
Evolution	The changing of inherited characteristics of a population over time.
Extinction	When no living individuals of a species remain.
Fossil	The remains or impression of a prehistoric plant or animal embedded in rock and preserved in petrified form.
Genetically modified organism	Organisms in which the genetic material (DNA) has been altered in a way that does not occur naturally.
Inbreeding	When closely related animals or plants breed together.
Mutation	The changing of an organisms DNA.
Natural selection	The process by which species evolve.
Organism	An individual animal, plant or single celled life form.
Predator	An animal that hunts and kills other animals.
Prey	An animal that is hunted and killed by other animals.
Selective breeding (artificial selection)	When humans artificially select the plants or animals that are going to breed so that the genes for a particular characteristic remain in the population,
Species	A group of similar organisms that can reproduce and give fertile offspring.
Variation	The differences that exist between individuals.

What is variation?

A characteristic is a feature of an organism:

- It can be something we can see (like hair colour) or something we can't see (like blood group).
- All humans have different combinations of characteristics, meaning we all look different.

A difference in our characteristics is called **variation**.

Differences in the **characteristics** of individuals may be due to:

- inherited genes
- environmental causes
- a combination of both

Characteristics	Inherited?	Environmental?	Both?
Hair colour			X
Eye colour	X		
Blood type	X		
Height			X
Weight			X
Scar		X	

How do we vary from each other?

Although all humans have the similar characteristics individuals are different to each other.

Continuous Variation

Has no limit on the value that can occur within a population. A line graph is used to represent continuous variation. Examples include height, weight, heart rate, finger length, leaf length.

Discontinuous Variation

Has distinct groups for organisms to belong to. A bar graph is used to represent discontinuous variation. Examples include tongue rolling, finger prints, eye colour, blood groups.

Inherited Variation

A characteristic that is the result of genetic inheritance from the biological parents. Examples include eye colour, hair colour, and skin colour.

Environmental Variation

Is variation caused by the surroundings. Examples include scars, tattoos, and flower colour in hydrangeas (these plants produce blue flowers in acidic soil and pink flowers in alkaline soil).

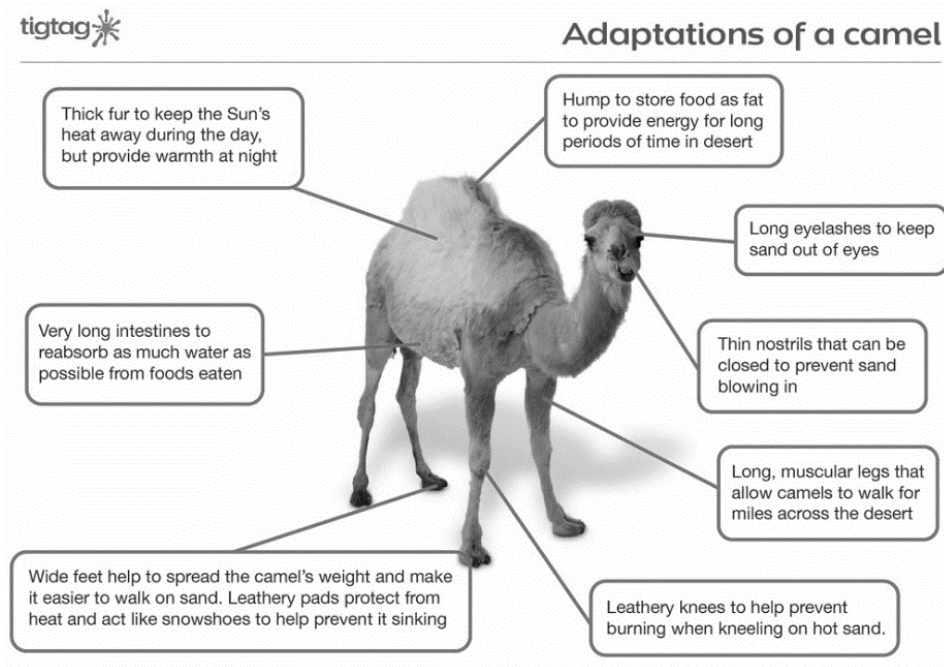


What does adaptation mean?

Adaptation is a feature or behaviour that makes an organism particularly suited to its habitat.

Adaptations may be:

- structural
- behavioural
- functional

**What do living things compete for?****What do plants compete for?**

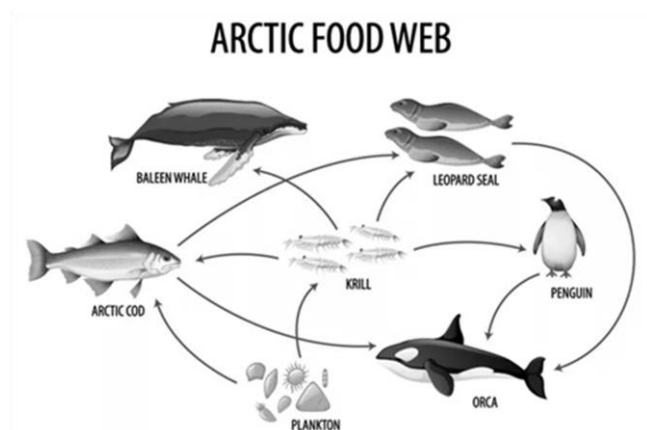
- Water
- Space
- Light

What do animals compete for?

- Food
- Water
- Space
- Mates

An ecosystem is:

An environment which includes the flora (plants) and fauna (animals) that live and interact within that environment.





Science Homework 2

Try to answer all of these key knowledge questions. Then check your answers using the last page. These are some of the questions that will be in the knowledge quizzes and the end of term Pillars tests.

Questions in *italics* are from older work.

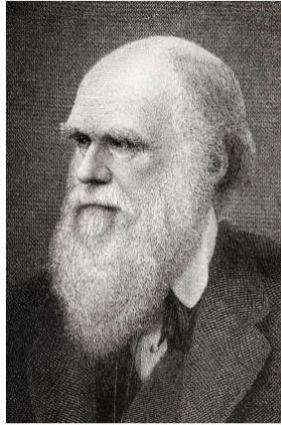
Key knowledge question	Your answer
Give an example of variation in humans caused only by genes.	
Give an example of variation in humans that is continuous.	
Give an example of variation in humans that is discontinuous.	
Give two resources that plants compete for.	
Give an example of variation in humans caused only by the environment.	
Which scientist developed the theory of evolution based on his observations of birds on the Galapagos Islands?	
Define adaptation	
Define adaptation	
Give two resources that animals compete for.	
Define evolution.	
<i>What is the function of the cell membrane?</i>	
<i>What type of organisms have eukaryotic cells?</i>	
<i>What is the name given to the structures inside cells?</i>	
<i>What is the function of the mitochondria?</i>	

What do we mean by evolution?

Evolution: The process by which different kinds of living organism are believed to have developed from earlier forms during the history of the earth.

Darwin's theory of evolution by natural selection states that ...

'all species evolved from simple life forms that first developed more than three billion years ago'

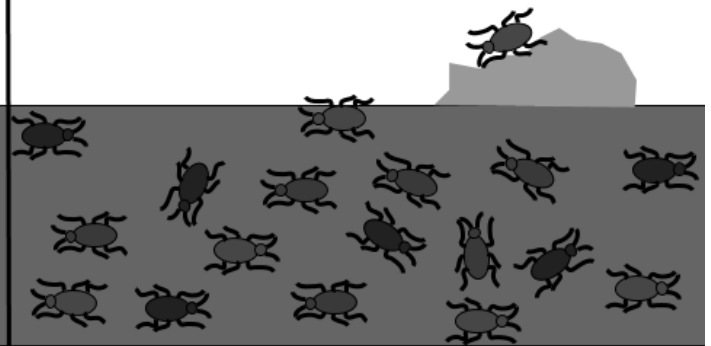
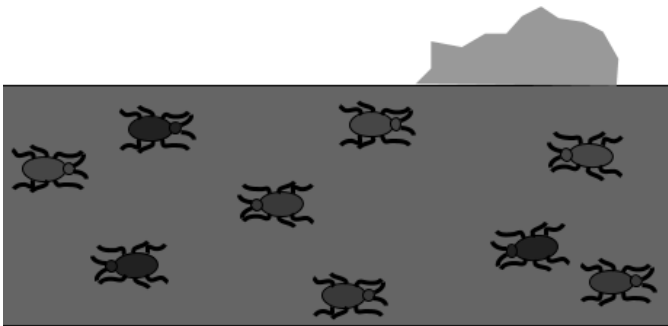


Variation

There is natural variation in the characteristics of individuals that are part of a population.

Overproduction

Ecosystems are unable to support all individuals within a population to an age of reproduction, causing competition among offspring.

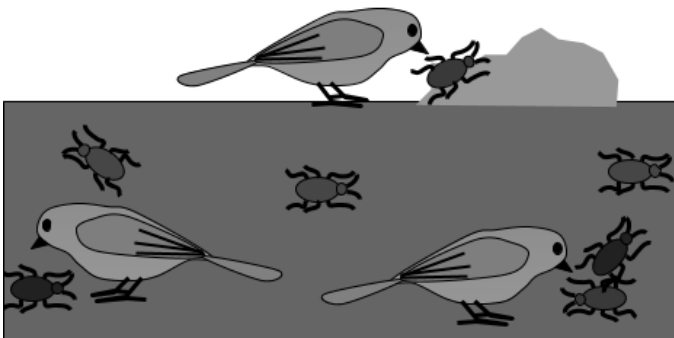


Selection

The more adapted individuals within a population are more likely to survive while those who have less adapted characteristics are less likely.

Reproduction

The better adapted individuals survive to reproduce and pass on their characteristics. Over time the population will see a shift to a higher proportion of adapted individuals.



What is our evidence for evolution?

Evidence for evolution comes from a number of different things

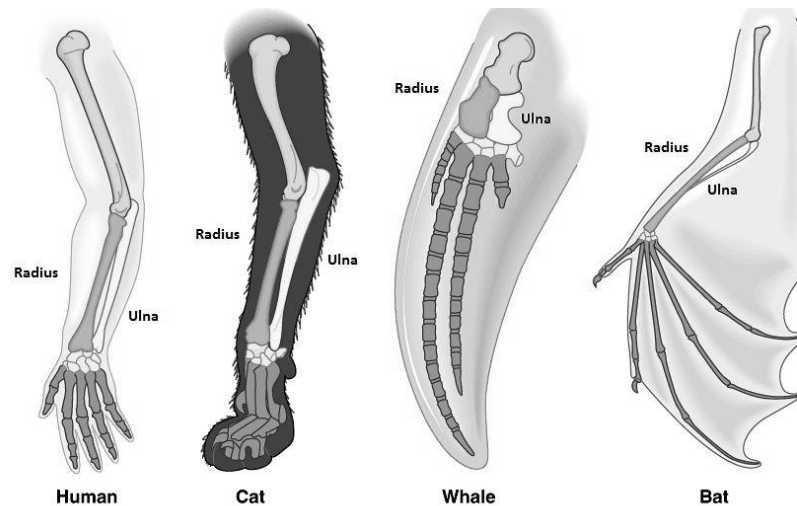
Fossils that show species that no longer exist and species that are similar to those alive now.

Fossil layers – we can track through ages and see how there are changes over time.

Similarities in living organisms – things like most animals having five bones in their feet or hands.

Similarities in DNA that let us see how species are related.

Similarities in embryos – many very different species have very similar embryos.

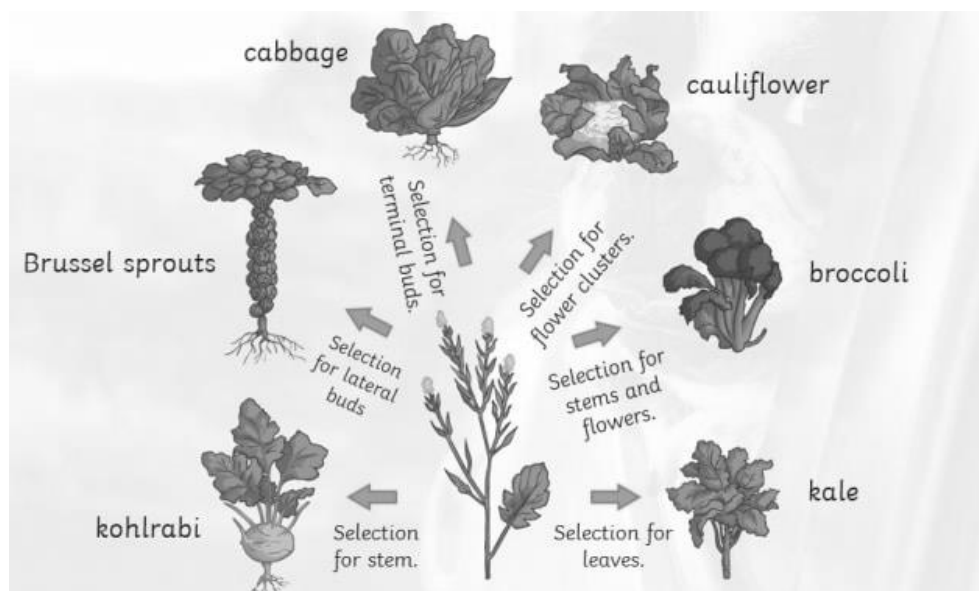


How do we produce new varieties of plants and animals?

Selective breeding or artificial selection has been used for by humans for thousands of years to produce new varieties of plants and animals.

The method:

- desired characteristics are identified
- individuals bred together
- Offspring with desired characteristics are bred
- Repeated over several generations until the desired characteristic is fully developed



Wider reading**SCIENTISTS SAY GENETICS****Scientists Say: Evolution**

This is a process by which groups of living organisms change over time



Tawny owls can come in gray or brown. As the climate changes, scientists have shown that brown owls are becoming more common — a sign of a species evolving.

JOHNDPORTER/ISTOCK/GETTY IMAGES PLUS

By **Bethany Brookshire**

November 16, 2020 at 6:30 am

Evolution (noun, “EE-vol-oo-shun”, verb “evolve,” “EE-volve”)

In biology, evolution is a process by which species change over time. Evolution is a theory — an explanation about how the world works, backed by evidence. The theory of evolution states that groups of organisms change over time. The theory also explains how groups change. That’s because some individuals in the group survive to reproduce and pass on their genes. Others do not.

Keep in mind that groups don’t evolve to become more “advanced” than their ancestors. Their ancestors did well enough to pass on their genes, after all! But species are always changing. So are their environments. Sometimes their environment might have more or less food. A new predator might appear. The climate might change. Those challenges make it harder or easier for some individuals in a group to survive.

Since every individual within a group is different, some usually have traits that help them survive the change. These individuals will be more likely to survive and reproduce. Over time, the group evolves as more and more individuals with those traits survive.

Scientists have a lot of evidence that evolution occurs. For example, fossils show how apes came to walk upright over millions of years, leading to the evolution of humans. Standing on two legs is a great way to get around. But it has some drawbacks — in the form of sprained ankles and lower back pain. Overall, though, it was beneficial to the species that tried it — which is why we’re standing here today.

There’s also plenty of evidence that evolution is taking place now. For example, bacteria are evolving in ways that help them resist antibiotics. As the climate changes, tawny owl populations are becoming more brown than grey. There is less snow cover that might make a brown owl stand out, and browner owls hide better in brown trees.

Key knowledge question	Answer
Give an example of variation in humans caused only by genes.	Blood group, eye colour, genetic gender, tongue rolling
Give an example of variation in humans that is continuous.	Height, weight anything that can be measured on a scale
Give an example of variation in humans that is discontinuous.	Blood group, eye colour, genetic gender, tongue rolling
Give two resources that plants compete for.	Water, light, nutrients
Give an example of variation in humans caused only by the environment.	Language spoken, scars, clothes
Which scientist developed the theory of evolution based on his observations of birds on the Galapagos Islands?	Charles Darwin
Define adaptation	Features that enable organisms to survive in their habitat
Give two resources that animals compete for.	Mates, food, habitat/space, water
Define evolution.	The process by which different kinds of living organism are believed to have developed from earlier forms during the history of the earth.
Name two abiotic factors.	Water; sunlight; temperature
<i>What is the function of the cell membrane?</i>	<i>A group of similar cells performing a function</i>
<i>What type of organisms have eukaryotic cells?</i>	<i>Movement of particles from an area of low concentration into an area of high concentration, across a partially permeable membrane, involving energy</i>
<i>What is the name given to the structures inside cells?</i>	<i>Mineral ions entering roots</i>
<i>What is the function of the mitochondria?</i>	<i>Animal- sperm and egg, Plant- Pollen and egg/ ovule</i>

Big questions: What is everything made of?**What's the difference between elements and compounds?****What are atoms made up of?****How are electrons arranged in the atom?****How do we order the elements?****Why are group 1 metals not used in buildings?****What are the most reactive non-metals?****Key vocabulary**

Atom	The smallest particle of a chemical element that can exist
Boiling	The physical change in state from a liquid to a gas that occurs at the boiling point
Bond	A strong force of attraction between atoms or oppositely charged ions.
Compound	A substances made up of atoms of 2 or more elements chemically bonded together
Covalent bond	The (electrostatic) force of attraction that occurs when 2 non- metal atoms share a pair of electrons
Electron conductivity	The ability to allow a current to flow through the substance. Requires charges / delocalised electrons that are MOBILE (free to move)
Electron	A subatomic particle. It has a charge of -1 and a negligible mass
Element	A substance that cannot be broken down into other substances. It made up of the same type of atoms
Evaporation	The physical change in state from a liquid to a gas, it can occur before the boiling point
Ionic bond	The (electrostatic) force of attraction between oppositely charged ions. Typically a positive metal ion and negative non -metal ion
Melting	The physical change in state from a solid to a liquid.
Metallic bond	The (electrostatic) force of attraction between positively charged metal ions and the delocalised electrons.
Molten	Term used to describe metals / ionic compounds in a liquefied state
Neutron	A subatomic particle. It has a charge of 0 and a relative mass of 1.
Nucleus	The centre of an atom, it is made up of protons and neutrons. It is always positively charged
Properties	The characteristics or typical features, e.g melting point, density, conductivity.
Proton	A subatomic particle. It has a charge of +1 and a relative mass of 1

What's the difference between elements and compounds?

- Atom - Smallest particle of an element that can exist
- Elements - Substance made up of just one type of atom
- Compounds - 2 or more atoms of different elements bonded together in a fixed ratio

Scientists often use chemical formula to represent different substances, rather than the actual names. The advantage of this is the chemical formula tells us exactly what elements are present, and the ratio of atoms / ions of each element present.

Elements are made up of just 1 type of atom, for example Oxygen gas is O_2 which there are two atoms of oxygen in a particle of oxygen gas. This is an example of a molecule.

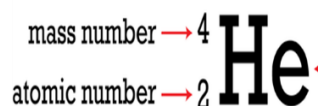
- Molecules - Contain 2 or more atoms chemically bonded together. Molecules of a specific substance are always in a fixed ratio

Non-metals can make molecules when they are bonded to other non-metals.

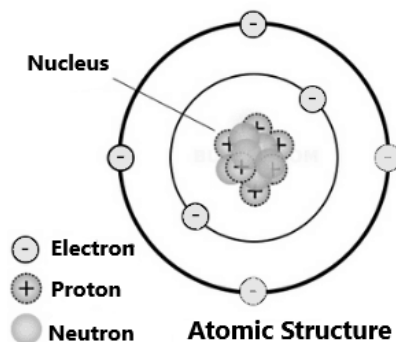
Elements or compounds containing metals do not form molecules. Instead they form something called a lattice

What are atoms made up of?

- **Subatomic particles** - The particles that make up an atom, there are 3 types, protons, electrons and neutrons.



- In order to work out the number of subatomic particles in an atom, we need to use the Periodic table.
- Mass number - The total number of protons and neutrons in an atom.
- Atomic number - The number of protons in an atom (if an atom, it is also the number of electrons)



Subatomic particle	Relative charge	Relative mass	Position in atom
Proton	+1	1	In nucleus
Electron	-1	1/1836 (Negligible)	In shells
Neutron	0	1	In nucleus

- An atom of an element has the same number of protons and electrons.
- Each proton has a charge of +1 while each electron has a charge of -1.
- In an atom, the number of protons = the number of electrons.
- So the charges cancel out leaving with no overall charge (neutral).

How are electrons arranged in the atom?

The electrons are not just randomly arranged in the atom, they are found in specific shells, depending on the number of electrons. The way the electrons are ordered is referred to as the electron configuration.

The rule is 2,8,8

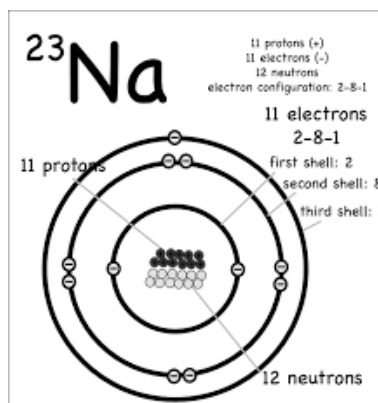
- Maximum of 2 electrons in first shell
- Maximum of 8 electrons in second shell
- Maximum of 8 electrons in third shell

How to work out the electron configuration

- Work out the number of electrons in the atom
- Maximum of 2 go into the first shell (1 top and 1 bottom)
- If any more electrons, start to fill the next shell, maximum of 8 in second shell (top bottom left right then start to pair up)
- If any more electrons, start to fill the next shell, maximum of 8 in third shell (top bottom left right then start to pair up)
- If any more electrons, add to last shell (won't be asked any more than Calcium so 2)

Metals lose the outer electrons, so that the last shell that had electrons in is now **empty**. For every electron lost, there is a **positive charge left overall**

Non-Metals gain electrons into the outer shell, so that the last shell that had electrons in is now **full**. For every electron gained, there is a **negative charge left overall**





Science Homework 3

Try to answer all of these key knowledge questions. Then check your answers using the last page. These are some of the questions that will be in the knowledge quizzes and the end of term tests.



Questions in *italics* are from older work.

Key knowledge question	Your answer
What do we call the smallest particle of a chemical element that can exist?	
What is an element?	
What is the mass of a proton?	
What is the mass of an electron?	
Which 2 particles are found in the nucleus of an atom?	
Which particle is found in "shells" around the nucleus?	
What is the difference between a compound and a mixture?	
What is the electron configuration for $^{24}_{12}\text{Mg}$?	
What happens to the reactivity of group 1 as you move down the group?	
What name is given to group 7 in the Periodic Table?	
<i>Define specific heat capacity of a substance.</i>	
<i>How can you tell from heating curve when state change occurs?</i>	
<i>In which state of matter do particles have the greatest energy?</i>	
<i>Name the change of state that happens when a solid becomes a liquid.</i>	

How do we order the elements?

There are 118 known elements. There are many similarities, patterns and trends in properties between these elements, and scientists need a way of collating this information into an easy to use table where these similarities can be easily identified. This is the periodic table.

1	2															3	4	5	6	7	0
																					He
Li	Be															B	C	N	O	F	Ne
Na	Mg															Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr				
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe				
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn				
Fr	Ra	Ac																			

 Metals
  Non-metals

Elements in the same group share similar properties. Properties are characteristics like how reactive it is, whether it's a metal or non-metal, how dense it is, what state it's in.

- Group 1 - The alkali metals
- Group 2 - The alkaline-earth metals
- Group 7 - The halogens
- Group 0 - The noble gases

Why are group 1 metals not used in buildings?

As you can see in the table below group 1 metals are far too reactive to be used in buildings.

	Group 1 Element		
Test	Lithium	Sodium	Potassium
Hard or soft?	Soft → Easily cut with knife	Soft → Easily cut with knife	Soft → Easily cut with knife
What happens in air?	Once cut initially shiny, turns a dull grey colour after a while	Once cut initially shiny, turns a dull grey colour quickly after	Once cut initially shiny, turns a dull grey colour almost immediately
What happens in water	Floats, moves around quickly on surface, effervesces (fizzes) and dissolves to form a solution. Universal indicator solution turns blue / purple	Floats, moves around quickly on surface, effervesces violently (fizzes), partially melts to form a sphere as reacting and dissolves to form a solution. Universal indicator solution turns blue / purple	Floats, violently moves around quickly on surface, effervesces (fizzes) and catches fire, burning with a lilac flame and dissolves to form a solution. Universal indicator solution turns blue / purple

The alkali metals get more reactive down the group. This was shown by the more violent reaction in potassium compared to sodium, and sodium being more violent compared to Lithium

Rubidium is below Potassium, so would react more violently than Potassium with water, and would tarnish even faster than Potassium when cut.

As the group 1 metals have a density less than water's density (1g/cm^3) the group 1 metals will float on water.

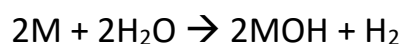
Typically metals have high density, greater than 1g/cm^3 so metals typically won't float.

When added to water, the metal reacts with water to form a metal hydroxide solution and hydrogen gas

Word equation



Symbol equation (group 1 metals only)



What are the most reactive non-metals?

- Group 7 are called the halogens, these are the most reactive non-metals.
- The halogens all look different, and exist in different states at room temperature as they all have different melting and boiling points.
- The halogens typically react to form salts. The word halogen actually means salt former.
- The halogens in their pure form are very reactive and hazardous.
- The halogens become less reactive as you move down the group.

Halogen	Appearance	Appearance when dissolved in water
Fluorine	Yellow gas	X
Chlorine	Green gas	Very pale green
Bromine	Orange liquid	Orange
Iodine	Grey solid (purple vapours)	brown

Key knowledge question	Answer
What do we call the smallest particle of a chemical element that can exist?	An atom
What is an element?	A substance made of only one type of atom
What is the mass of a proton?	1
What is the mass of an electron?	Negligible/1/1836
Which 2 particles are found in the nucleus of an atom?	Protons and neutrons
Which particle is found in "shells" around the nucleus?	Electrons
What is the difference between a compound and a mixture?	In a compound atoms are bonded together in a fixed ratio
What is the electron configuration for $^{24}_{12}\text{Mg}$?	2,8,2
What happens to the reactivity of group 1 as you move down the group?	They become more reactive
What name is given to group 7 in the Periodic Table?	The halogens
<i>Define specific heat capacity of a substance.</i>	<i>The energy needed to raise the temperature of 1kg of substance by 1°C</i>
<i>How can you tell from heating curve when state change occurs?</i>	<i>Time is continuing but there is no change in temperature</i>
<i>In which state of matter do particles have the greatest energy?</i>	<i>Gases</i>
<i>Name the change of state that happens when a solid becomes a liquid.</i>	<i>Melting</i>