C1.1.2 The periodic table

What do elements in the same group have in common?

In which group are the noble gases found?

C1.1.1 Atoms

Using your periodic table:

Draw a sodium atom.

Draw a chlorine atom.

C1.1.1 Atoms

Electrons in atoms occupy the lowest available energy level (shell). How many electrons can occupy the first energy shell?

How many electrons can occupy higher energy shells?

C1.1.1 Atoms

What does the atomic number tell you about an atom?

Which two sub-atomic particles are summed to represent an atom’s mass number?

C1.1.1 Atoms

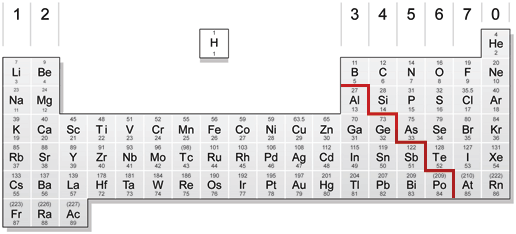
Which particles are found in the nucleus of an atom?

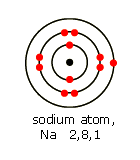
What are the relative electrical charges on a proton, neutron and electron?

C1.1.1 Atoms

What is an element?

What does this line on the periodic table separate?





* The same number of electrons in their outer shell. This gives them similar properties.
* Group 0. They are unreactive because their atoms have a stable arrangement of electrons.
* The number of protons it has.
* Protons and neutrons.
* 2 electrons
* 8 electrons
* A substance made up of only one sort of atom.
* Metals (to the left of the line) and non-metals (to the write of the line)
* Protons and neutrons
* Proton (+1)

Neutron (0)

Electron (-1)

C1.2.1 Calcium carbonate

What is the test for carbon dioxide?

What is limewater?

C1.2.1 Calcium carbonate

When calcium oxide reacts with water, what is the product?

Is the product of this reaction an acid or an alkali?

C1.2.1 Calcium carbonate

Write a symbol equation for the thermal decomposition of calcium carbonate.

Write a symbol equation for the thermal decomposition of magnesium carbonate.

C1.2.1 Calcium carbonate

What is calcium carbonate (CaCO3) otherwise known as?

Write the word equation for the thermal decomposition of calcium carbonate

C1.1.3 Chemical reactions

When a metal atom loses an electron, does it form a positive or negative ion?

When a non-metal atom gains an electron, does it form a positive or negative ion?

C1.1.2 The periodic table

How many electrons do noble gases have in their outer shell?

Which noble gas is the exception to this rule?

*heat*

*heat*

* Calcium hydroxide
* An alkali - calcium hydroxide can be used to neutralise acids.
* Carbon dioxide turns limewater cloudy.
* A solution of calcium hydroxide in water.
* Limestone

Calcium carbonate Calcium oxide . + carbon dioxide

* CaCO3CaO +CO2
* MgCO3 MgO + CO2
* 8 (a complete outer shell of electrons). Except helium.
* Helium (it has two electrons in its outer shell as it is the lowest energy shell that is complete)
* Positive ion
* Negative ion

*heat*

C1.2.1 Calcium carbonate

What environmental factor can cause damage to limestone buildings?

Complete this word equation:

Calcium carbonate + sulfuric acid 

C1.2.1 Calcium carbonate

Fill in the following gaps:

1) magnesium carbonate + hydrochloric acid

magnesium chloride + ………………………….. + water

2) Na2CO3 + HCl …………+ ……… + ………..

**3) Balance the equation in question 2**

C1.2.1 Calcium carbonate

What is limestone heated with to make cement?

What is cement mixed with to make concrete?

C1.3.1. Extracting metals

Why is gold easy to extract?

What are ores?

C1.3.1 Extracting metals

By what process is iron extracted from iron oxide in the blast furnace?

By what process are metals that are more reactive than carbon extracted?

C1.3.1.Extracting metals

Why is electrolysis an expensive process?

How can copper be extracted from copper-rich ores?

1. Carbon dioxide

2)

Na2CO3 + HCl NaCl + CO2 + H2O

3)

Na2CO3 + 2HCl 2NaCl + CO2 + H2O

* Acid rain

calcium carbonate + sulfuric acid

calcium sulfate + carbon dioxide + water

* Because it is unreactive and so is found as the metal itself.
* Rocks containing enough metal to make it economical to extract the metal.
* Clay
* Sand and aggregate
* Large amounts of energy are used, making the extracting process very expensive.
* - Heat copper ores in a furnace (smelting)

- Copper can then be purified by electrolysis

* Reduction with carbon
* Electrolysis

C1.3.2 Alloys

Why is using iron straight from the blast furnace a problem?

What is the alloy of iron with carbon called?

C1.3.1 Extracting metals

Why are current methods of extraction of aluminium and titanium expensive?

C1.3.1 Extracting metals

By what process is copper obtained from solutions of copper salts?

C1.3.1 Extracting metals

What electrode do the positive ions move towards during electrolysis?

What are the benefits of recycling metals?

C1.3.1 Extracting metals

Copper can be extracted by phytomining or bioleaching. What do these terms mean?

C1.3.1 Extracting metals

Why are new ways of extracting copper from low-grade ores being investigated?

* Phytomining:
* Plants absorb copper compounds
* Plants are burned to produce ash that contains the copper compounds.
* Bioleaching:
* Bacteria absorb copper compounds
* Bacteria produce leachate solutions that contain metal compounds
* There is a limited supply of copper rich ores and people want to limit the environmental impact of traditional mining.
* Electrolysis or displacement using scrap iron (iron is more reactive than copper so it can displace copper from copper salts).
* Negative electrode
* Recycling reduces the amount of metal that needs to be extracted. Extracting metals uses limited resources, it is expensive in terms of energy and it negatively impacts on the environment.
* It’s brittle and has limited uses.
* Steel
* There are many stages in the processes and large amounts of energy are needed.

C1.3.3 Properties and uses of metals

What properties of aluminium and titanium make them useful metals?

Why is copper used in electrics and plumbing?

C1.4.2 Hydrocarbons

Draw the hydrocarbon C2H6

What is the general name for this type of hydrocarbon containing only single carbon-carbon bonds?

C1.4.1 Crude oil

What is the name given to two or more elements or compounds not chemically bonded together?

What is the name for molecules made up of only hydrogen and carbon atoms?

C1.3.3 Properties and uses of metals

What are the metals in the central block of the periodic table called?

Which transition metal is often used in electrical wiring and plumbing?

C1.3.2 Alloys

What is an alloy?

Why are metals such as copper, gold, iron and aluminium made into alloys?

C1.3.2 Alloys

Match the steels to their properties:

Steel Properties

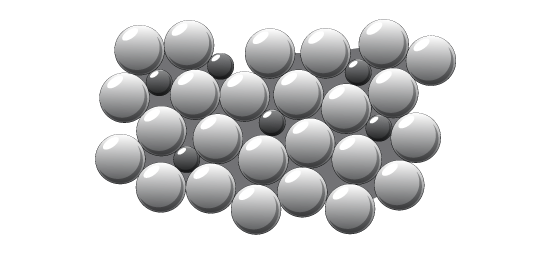
Low-carbon - Hard

High-carbon - Resistant

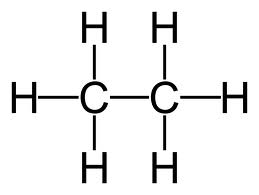
to corrosion

Stainless steel -Easily shaped

* A mixture of two or more elements, where at least one element is a metal.



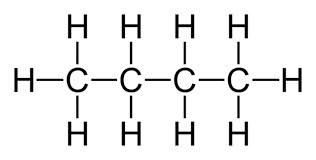
* Because they are too soft. Mixing them with small amounts of similar metals makes them harder.
* Low-carbon steel (easily shaped)
* High-carbon steel (hard)
* Stainless steel (resistant to corrosion).
* Low density & resistant to corrosion
* It’s a good conductor of heat and electricity. It can be bent, but is hard enough to make pipes. It does not react with water.
* Transition metals
* Copper



* Alkane
* A mixture
* Hydrocarbons

C1.4.2 Hydrocarbons

What type of bond does ­‘–‘ represent in the following molecule?



What is this molecule called?

C1.4.2 Hydrocarbons

Why do hydrocarbons with small molecules make better fuels?

Where in the fractionating column is bitumen (for roads) collected?

C1.4.2 Hydrocarbons

Which fuel is collected higher up the fractionating column: diesel or petrol?

C1.4.2 Hydrocarbons

Are fractions at the top of the fractionating column more or less flammable than fractions at the bottom?

Are fractions at the top of the fractionating column more or less viscous than fractions at the bottom?

Do fractions at the top of the fractionating column have lower of higher boiling points than the fractions at the bottom?

C1.4.2 Hydrocarbons

Put these alkanes in size order:

Butane, methane, propane, ethane

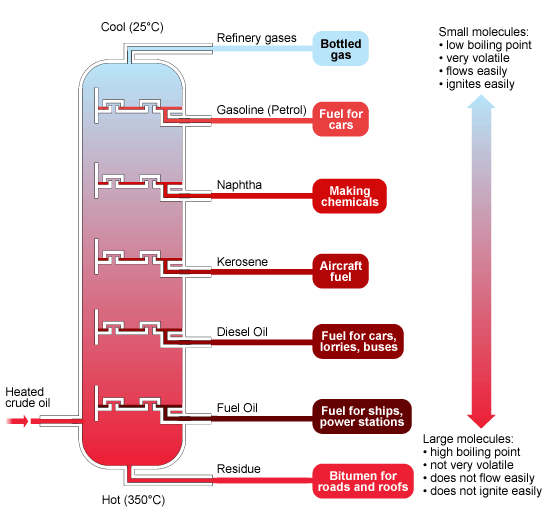
What is the chemical formula for propane?

C1.4.2 Hydrocarbons

By what process can the hydrocarbons in crude oil be separated?

How are the hydrocarbons in crude oil separated in a fractionating column?

* Methane, ethane, propane, butane
* C3H8
* Fractional distillation
* Crude oil is heated and evaporated. Its vapours are allowed to cool and condense at different temperatures. Hydrocarbon molecules with a similar number of carbon atoms are collected at different points in the column.



* Petrol
* More flammable
* Less viscous
* Lower boiling point
* Covalent bond (or single carbon-carbon bond)
* Butane
* They are volatile, flow easily (less viscous) and are easily ignited (flammable).
* At the bottom

C1.4.4 Hydrocarbon fuels

What are biofuels produced from?

C1.4.3 Hydrocarbon fuels

Sulfur can be removed from fuels before they are burned, or sulfur dioxide can be removed after combustion before the waste gases are released into the atmosphere. Why is the removal of sulfur good for the environment?

C1.4.3 Hydrocarbon fuels

Which products of combustion can cause acid rain?

Which gas causes global warming?

What causes global dimming?

C1.4.3 Hydrocarbon fuels

When fuels containing sulfur are burned, what gas containing sulfur is released into the atmosphere?

Oxides of which gas can be produced when combustion occurs at high temperatures (e.g. in an engine or furnace)?

C1.4.3 Hydrocarbon fuels

Energy is released in the combustion of hydrocarbon fuels. Carbon and hydrogen are oxidized in this process to produce what?

C1.4.3 Hydrocarbon fuels

What gas is produced when incomplete combustion occurs?

What are the products of complete combustion of hydrocarbons?

* Sulfur dioxide causes acid rain.
* Plant material
* Sulfur dioxide
* Nitrogen
* Sulfur dioxide and oxides of nitrogen
* Carbon dioxide
* Solid particles (e.g. carbon and un-burnt fuels).
* Carbon monoxide
* Carbon dioxide and water
* Carbon dioxide & water

C1.5.1 Obtaining useful substances from crude oil

By what process are smaller, more useful molecules produced from hydrocarbons?

What is a hydrocarbon containing a double bond between two carbons called?

C1.5.1 Obtaining useful substances from crude oil

The products of cracking include alkanes and unsaturated hydrocarbons called …………………

What type of bond do alkenes contain?

C1.5.1 Obtaining useful substances from crude oil

What is the chemical formula for ethene?

Draw the structure of propene.

C1.5.1 Obtaining useful substances from crude oil

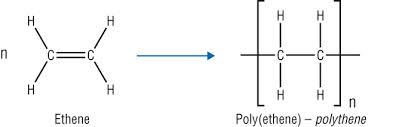
Bromine water turning from orange to colourless is a test for what type of hydrocarbon?

C1.5.2 Polymers

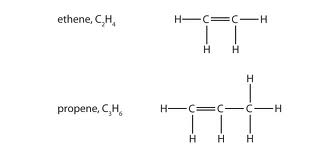
Alkenes can join together to make polymers. What is the polymer of ethene called?

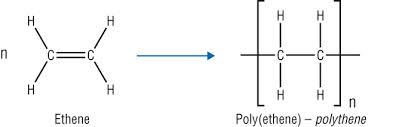
C1.5.2 Polymers

The structure below shows the monomer ethene. Can you draw the repeating polymer unit?



* Alkenes
* A double bond between two carbon molecules
* Cracking
* Alkene
* Alkene (unsaturated hydrocarbon)
* C2H4





* Poly(ethene) or polythene

C1.6.2 Emulsions

Why does an emulsion form when oil is put into water?

Emulsions are thicker than the oil or water alone. What desirable properties do emulsions have?

Can you give an example of an emulsion?

C1.6.1 Vegetable oils

What differences are there between food cooked in water and food cooked in oil?

How can vegetable oils be used to cook foods at higher temperatures?

C1.6.1 Vegetable oils

Why are vegetable oils important foods?

How are vegetable oils extracted?

C1.5.3 Ethanol

How is ethanol produced using steam?

Ethanol can also be produced by fermentation with yeast. What word equation describes this process?

C1.5.2 Polymers

Why are there waste disposal problems associated with polymers?

What are many plastic bags now being partly, or entirely, made from to help make them biodegradable?

C1.5.2 Polymers

Can you name any ways in which polymers are used in everyday objects?

* They are not biodegradable (not broken down by microorganisms).
* Cornstarch
* E.g. Packaging materials, waterproof coatings for fabrics, dental polymers, wound dressings, hydrogels, smart materials.
* They are high in nutrients and provide a lot of energy.
* Plant material (e.g. fruits, seeds and nuts) is crushed and the oil is removed by pressing, or in some cases distillation. Water and other impurities are removed.
* Hydration of ethene with steam in the presence of a catalyst.

Sugar 🡪 carbon dioxide +ethanol

* Oil does not dissolve in water.
* Provide a better texture, coating ability and appearance.
* Salad dressings, paint, icecreams, cosmetics.
* Food cooks quicker in oil and tastes differently. Food cooked in oil releases more energy when it is eaten.
* Vegetable has a higher boiling point than water so food can be cooked at a higher temperature.

C1.6.2 Emulsions

What do emulsifiers do?

C1.6.3 Saturated and unsaturated oils

What type of bonds do unsaturated vegetable oils contain?

What is the test for unsaturation?

**C1.6.2 Emulsions**

**Higher tier**

**Emulsifiers have a hydrophilic and a hydrophobic end.**

**What does the hydrophilic end bond to?**

**What does the hydrophobic end bond to?**

**C1.6.3 Saturated and unsaturated oils**

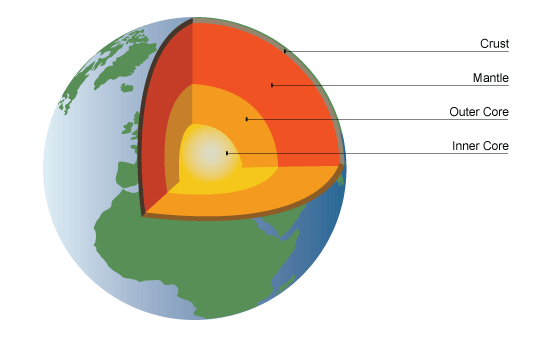
**Higher tier**

**How and why are vegetable oils hardened for use in foods?**

C1.7.1 The Earth’s Crust

Can you add the following labels to the Earth?

Inner core, outer core, crust, mantle



C1.7.1 The Earth’s crust

The Earth’s crust and upper mantle are divided into a number of pieces, what are these called?

How do the plates move?

C1.7.1 The Earth’s crust

What natural events can the sudden movements of tectonic plates at plate boundaries cause?

* Tectonic plates.
* Natural radioactive processes release heat. This drives convection currents within the Earth’s mantle which cause the plates to move.
* Earthquakes and/or volcanic eruptions.
* **Unsaturated vegetable oils are reacted with hydrogen in the presence of a nickel catalyst at about 60oC in a process called hydrogenation.**
* **The double carbon-carbon bond converts to a single bond and hydrogen is added to make a saturated molecule.**
* **Hydrogenated oils have higher melting points so they are solids at room temperature, making them useful as spreads and in cakes and pastries.**
* From outer layer to centre: crust, mantle, outer core, inner core.
* Stabilise emulsions to stop them separating out.
* Double carbon-carbon bonds.
* Reaction with bromine water (turns from orange to colourless).
* **Hydrophilic means ‘water-loving’. This end forms bonds with water, but not oil.**
* **Hydrophobic means ‘water-hating’. This end forms bonds with oil but not with water.**

**C1.7.2 The Earth’s atmosphere**

**Higher tier**

**How did the Miller-Urey experiment lead to one theory as to how life on Earth was formed?**

**What did the electric sparks in the Miller-Urey experiment represent?**

**C1.7.2 The Earth’s atmosphere**

**Higher tier**

**How can gases in the air be separated for use in a variety of industrial processes?**

C1.7.2 The Earth’s atmosphere

How do the oceans act as a reservoir for carbon dioxide?

What effect does burning fossil fuels have on the atmosphere?

C1.7.2 The Earth’s atmosphere

How was the oxygen that is now in our atmosphere first produced?

What happened to most of the carbon from the carbon dioxide in the early atmosphere?

C1.7.2 The Earth’s atmosphere

Which gases may have been present in the early atmosphere?

C1.7.2 The Earth’s atmosphere

Which is the most abundant gas in the Earth’s atmosphere?

Which gas makes up approx. 20% of the Earth’s atmosphere?

* Mainly carbon dioxide and little oxygen. There may have also been small amounts of water vapour, methane and ammonia.
* Nitrogen (approx. 80%)
* Oxygen
* Carbon dioxide dissolves in the oceans.
* Increases the percentage of carbon dioxide in the atmosphere, contributing to global warming.
* Produced by plants and algae (through the process of photosynthesis).
* It became locked up in sedimentary rocks as carbonates and fossil fuels.
* **Miller and Urey sealed a mixture of water, ammonia, methane and hydrogen. This was heated to produce water vapour. Electric sparks were passed through the water vapour and other gases. After a week, amino acids, the building block for proteins, were found.**
* **Lightning**
* **Air is a mixture of gases with different boiling points that can be fractionally distilled.**