

TOPIC 1a - ATOMS AND ELEMENTS

1. PLUM PUDDING MODEL

What part of the atom did Thomson discover?

Draw and describe his 'plum pudding' model of the atom.

3. BOHR MODEL

What change did Bohr make to the nuclear model of the atom?

Shell	Max. Electrons
1	
2	
3	

What happens to the number of electrons / shells as you:

Go across a **period**?

Go down a **group**?

	Relative Charge	Relative Mass
Proton		
Neutron		
Electron		

How many protons, neutrons and electrons in a Mg atom?

4. SUBATOMIC PARTICLES

Who discovered neutrons?

Draw a labelled diagram showing the modern model of the atom:

2. NUCLEAR MODEL

Describe the experiment which showed that most of the mass of an atom is in the nucleus:

92.5% of lithium atoms are Li-7, and the remaining 7.5% are Li-6. Calculate the relative atomic mass (A_r) of lithium to 1dp.

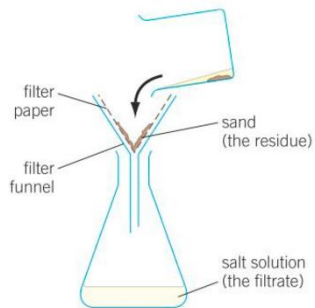
KEY WORDS:

Atom
Proton
Neutron
Electron
Relative atomic mass
Isotope
Electronic configuration

ASSESSMENT:

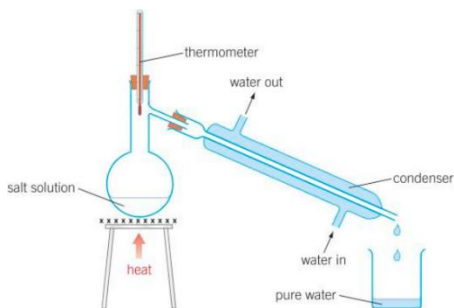


TOPIC 1a - COMPOUNDS AND MIXTURES



What method of separating mixtures is this?

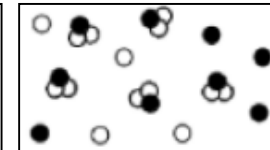
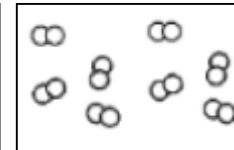
Give an example of a mixture it could be used to separate:



What method of separating mixtures is this?

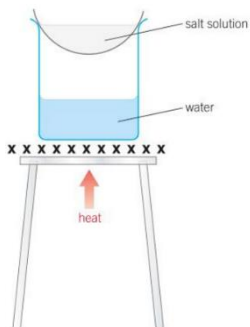
Give an example of a mixture it could be used to separate:

Label the diagrams as element, compound and mixture:



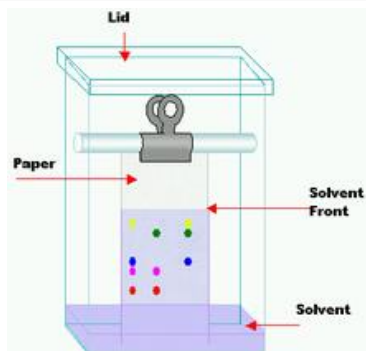
For the following statement, write a **C** if it is about compounds, an **M** if it is about mixtures, and an **E** if it is about elements:

- _ Have a fixed composition (ratio of elements is always the same)
- _ Only one type of atom present
- _ No chemical bonds between atoms of different substances
- _ Chemical reactions must be used to separate the elements
- _ Chemical bonds between the atoms of different elements
- _ The different substances can be easily separated using physical separating techniques
- _ No fixed composition (the proportions of each substance can vary)
- _ Cannot be separated into anything simpler



What method of separating mixtures is this?

Give an example of a mixture it could be used to separate:



What method of separating mixtures is this?

Give an example of a mixture it could be used to separate:

KEY WORDS:

Distillation
Chromatography
Evaporation / crystallisation
Filtration
Element
Compound
Mixture

ASSESSMENT:



TOPIC 1b - THE PERIODIC TABLE

GROUP 1 & TRANSITION METALS

Highlight the properties of G1 yellow, and the properties of TM green, and properties of both in pink

- Soft
- Very reactive
- High MP/BP
- Dense
- Form ions with a 1+ charge
- Strong
- Good conductor of heat
- Useful as catalysts
- Form white compounds
- Good conductor of electricity
- Not reactive
- Low MP/BP
- Hard
- Form coloured compounds
- Not dense
- Form ions with different charges

How were the elements originally arranged?

How are the elements arranged now?

Relative atomic mass: 1 H
Atomic (proton) number: 1

Elements 58-71 and 90-103 (all metals) have been omitted

Mendeleev produced a periodic table that was revolutionary for the time. What two things did he do that others didn't?

GROUP 0

What do we call elements in this group?

What properties do they have?

GROUP 7

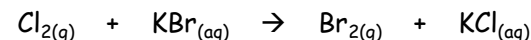
As you go down group 7:

- Melting point increases/decreases
- Reactivity increases/decreases
- Relative atomic mass increases/decreases

Give an example of a G7 compound with covalent bonds

Give an example of a G7 compound with ionic bonds

DISPLACEMENT



Balance the equation above.
Explain **why** chlorine displaces bromine.

KEY WORDS:

Proton
Neutron
Electron
Property
Mendeleev
Displacement

ASSESSMENT:



TOPIC 2a - IONIC BONDING AND STRUCTURE

What is an ion? How is it formed?

GIANT IONIC LATTICES

Draw a giant ionic lattice:

GIANT IONIC LATTICES

What holds the ions together?

Why do ionic compounds have high MPs and BPs?

Draw dot and cross diagrams to show how these elements form ions together

Magnesium oxide

Find the formula of the following ionic compounds:

Magnesium chloride

Calcium sulphide

Potassium chloride

Lithium oxide

Why can ionic compounds only conduct electricity when molten or dissolved in water?

KEY WORDS:

Ion
Electron
Outer shell
Transfer
Dot-and-cross diagram
Lattice
Electrostatic

ASSESSMENT:



TOPIC 2a - COVALENT BONDING AND STRUCTURE

Define:
Element-

Compound-

Molecule-

Atom-

Draw dot and cross diagrams to show how these elements covalently bond

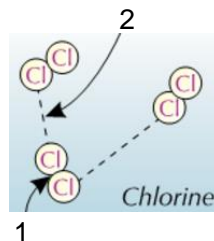
Fluorine (F_2)

Water (H_2O)

SIMPLE COVALENT MOLECULES

What holds the **atoms** together (1)? How strong are these forces?

What holds the **molecules** together (2)? How strong are these forces?

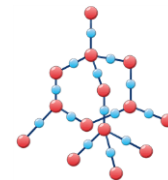


Why do simple molecular substances have low MPs and BPs?

Why can simple molecular substances not conduct electricity?

GIANT COVALENT STRUCTURES

Name 3 giant covalent substances:



Why do giant covalent substances have high MPs and BPs?

Generally, can they conduct electricity? Why?

What is a covalent bond?

KEY WORDS:
Simple molecules
Giant lattices
Electron
Outer shell
Intermolecular force
Double/triple bond

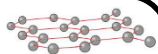
ASSESSMENT:



TOPIC 2a - ALLOTROPES OF CARBON

GRAPHENE

What can we use graphene for?



Highlight the correct properties of graphene:

Soft	Dense	Good electrical conductor
Light	Strong	Bad electrical conductor

DIAMOND

How many covalent bonds does each carbon atom form?



Match the property of diamond to the explanation:

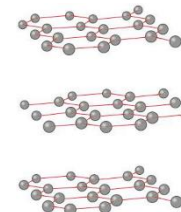
High MP and BP	No delocalised electrons or ions
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Does not conduct electricity	Rigid structure - every atom forms 4 strong covalent bonds to other atoms
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Hard	Lots of energy needed to break strong covalent bonds
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GRAPHITE

How many covalent bonds does each carbon atom form?



Match the property of graphite to the explanation:

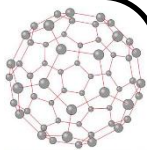
High MP and BP	Lots of energy needed to break strong covalent bonds
----------------	--

Does conduct electricity	Weak forces between layers, so they can slide past each other
--------------------------	---

Soft and slippery	Each C atom has one delocalised electron can move between the layers
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FULLERENES

Fullerenes are made of rings of carbon atoms in what shape?



What is the formula of Buckminsterfullerene?

Carbon nanotubes are cylindrical fullerenes. What properties do they have?

What can we use fullerenes for?

Define allotrope:

KEY WORDS:

Diamond
Graphite
Graphene
Fullerene
Nanotube
Delocalised

ASSESSMENT:



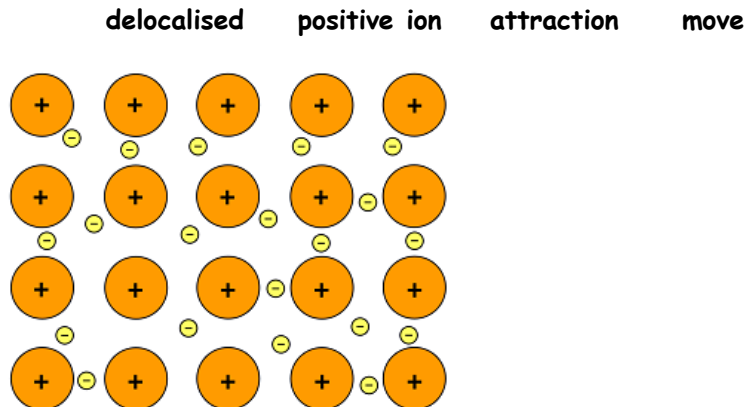
TOPIC 2a - METALLIC BONDING AND STRUCTURE

Why do metals have high MP and BPs?

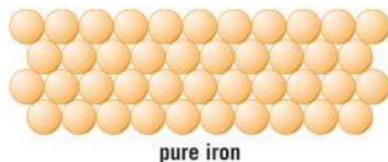
Why can metals conduct electricity?

BONDING IN METALS

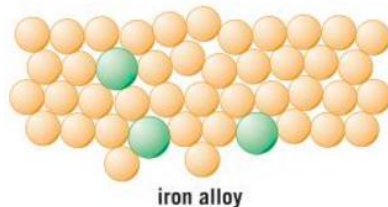
Use the diagram to explain how metallic bonds form. Use these keywords to help you:



What does malleable mean?



Define alloy:



Use the diagrams to explain why pure metals are soft and malleable, but alloys are hard.

KEY WORDS:

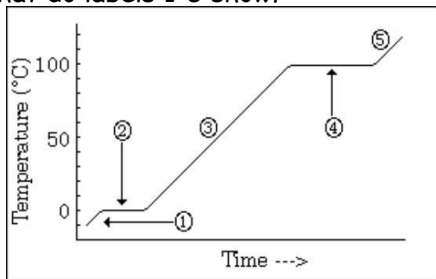
Alloy
Delocalised
Ion
Malleable
Metal
Lattice / Crystal

ASSESSMENT:



TOPIC 2b - TYPES OF MATTER

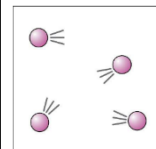
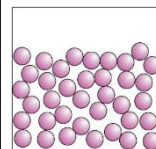
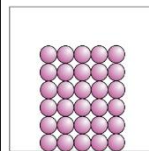
What do labels 1-5 show?



What size are nanoparticles?

Why do nanoparticles have different properties to bulk material?

For each state of matter, give a brief description of how the particles are arranged and list the properties.



The particle theory is useful for comparing the properties of solids, liquids and gases, but has limitations. What are these?

List 6 uses for nanoparticles:

-
-
-
-
-
-

Some people think we should not use nanoparticles. What are some possible risks of using nanoparticles?

KEY WORDS:

Atom
Solid
Liquid
Gas
Aqueous
Nanoparticle

ASSESSMENT:



TOPIC 3a - AMOUNTS OF SUBSTANCE

What is a limiting reactant?

What does "in excess" mean?

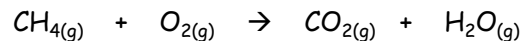
What is A_r ?

What is M_r ?

What is the M_r of C_2H_5OH ?

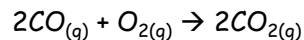
What is a mole?

Balance the equation:



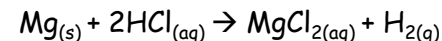
What is the volume of 1 mole of any gas at $20^\circ C$ and 1 atmosphere pressure?

How much CO_2 is formed when $50 \text{ dm}^3 O_2$ reacts with CO ?



Draw the equation triangle for finding the number of moles:

What mass of hydrogen is produced when 96g of magnesium reacts with hydrochloric acid?



0.50g of hydrogen and 4.00 g of oxygen react to form 4.50 g of water. Use this data to write a balanced symbol equation for the reaction.

KEY WORDS:

Relative formula mass (M_r)

Relative atomic mass (A_r)

Avogadro constant

Mole

Limiting reactant

In excess

ASSESSMENT:

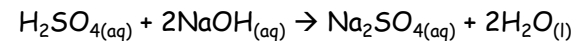


TOPIC 3b - CONCENTRATIONS

Draw the equation triangle for finding the concentration in g/dm^3 :

What is the concentration in g/dm^3 of a solution formed by dissolving 0.60 g of sodium chloride (NaCl) in 70 cm^3 of water?

In an experiment, 25 cm^3 of 0.15 mol/dm^3 sodium hydroxide was neutralised by 31 cm^3 of sulfuric acid. What is the concentration of the sulphuric acid?



Draw the equation triangle for finding the concentration in mol/dm^3 :

What is the concentration in mol/dm^3 of a solution formed by dissolving 0.45 g of sodium chloride (NaCl) in 90 cm^3 of water?

How do you convert between concentration (g/dm^3) and concentration (mol/dm^3)?

What is the concentration in mol/dm^3 of a potassium hydroxide (KOH) solution with a concentration of 0.68 g/dm^3 ?

KEY WORDS:

Concentration
Volume
Titration
Mole
 cm^3
 dm^3

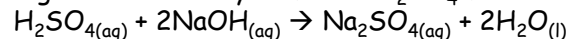
ASSESSMENT:



TOPIC 3c - ATOM ECONOMY AND YIELD

What is the formula to calculate percentage atom economy?

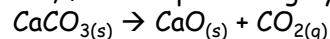
Calculate the percentage atom economy to form Na_2SO_4 from this process:



Processes with a higher atom economy are more sustainable. Why?

What is the formula to calculate percentage yield?

A company uses 200 kg limestone to produce 98.0 kg calcium oxide. By finding the theoretical yield of calcium oxide, find the percentage yield of the reaction.



Give three reasons why the percentage yield is never 100%:

-
-
-

KEY WORDS:

Atom economy
By-products
Sustainable
Theoretical yield
Yield
Percentage yield

ASSESSMENT:



TOPIC 4 - CHEMICAL CHANGES

What is a base?

What is an alkali?

What ions make something acidic?

What ions make something alkali?

1. Acid + Metal \rightarrow

2. Acid + Base \rightarrow

3. Acid + Metal Carbonate \rightarrow

4. Acid + Alkali \rightarrow

What is the name of the type of reaction in 4?

Write an ionic equation for this reaction:

Match the salt name to the acid:

Hydrochloric acid

Metal Sulfate

Nitric acid

Metal Chloride

Sulfuric acid

Metal Phosphate

Phosphoric acid

Metal Nitrate

Correctly order the steps to produce soluble salts:

- _ Filter the excess solid out of the solution
- _ Keep adding the solid until no more reacts
- _ Leave the salt solution in a warm place so it crystallises
- _ React an acid with a solid insoluble substance (e.g. metal, metal oxide, or metal carbonate)

What is an ion?

Match the name of the ion to its symbol.

OH^- Hydrogen ion

H^+ Oxide ion

O^{2-} Hydroxide ion

Highlight the ion that would cause universal indicator to turn red

Describe the difference between a strong and weak acid:

KEY WORDS:

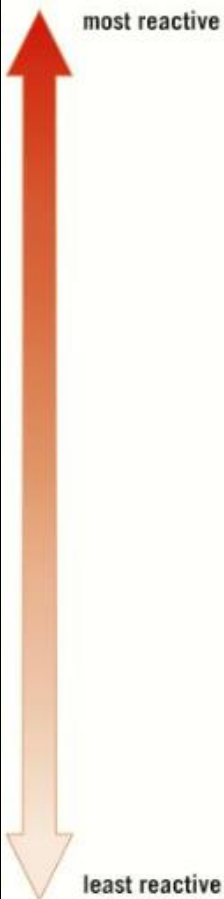
Acid
Base
Alkali
pH scale
Indicator
Salt

ASSESSMENT:



TOPIC 4 - CHEMICAL CHANGES

List these metals in order of reactivity:
Sodium, copper, zinc, potassium, iron,
magnesium, calcium, lithium



- Add carbon to your reactivity series
- Highlight in pink metals which are extracted by reduction with carbon
- Highlight in yellow metals which are extracted using electrolysis

OXIDATION OF METALS

Define oxidation:

Metal + oxygen →

e.g.

REDUCTION OF METAL OXIDES

Define reduction:

Metal oxide + carbon →

e.g.

What is displacement? Give an example using metals from the reactivity series:

GROUP 1 METALS AND WATER

G1 metal + water →

Observations:

Complete the table using the words below

Metal	Reaction with water	Reaction with acid
Potassium		
Sodium		
Lithium		
Calcium		
Magnesium		
Zinc		
Iron		
Copper		

fizz to make H₂ and metal hydroxide / explodes / no reaction / slow reaction / no reaction / fizz to make H₂ and salt

KEY WORDS:

Metal
Extract
Reactivity
Oxidation
Reduction
Ore

ASSESSMENT:

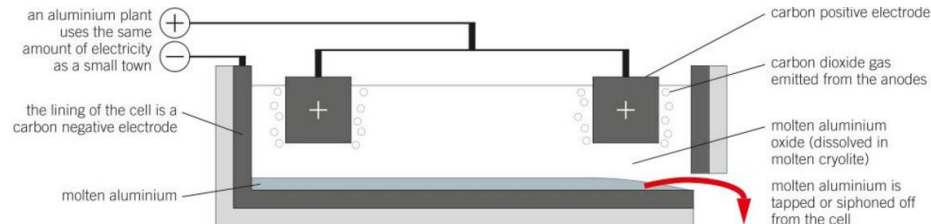


TOPIC 4 - CHEMICAL CHANGES

Match:

Electrolyte	A solid that conducts electricity
Cathode	A positive ion
Anode	The negative electrode
Cation	A liquid made of ions that conducts electricity
Anion	A negative ion
Electrode	The positive electrode

Use the diagram to explain aluminium extraction. Use the words **cryolite** and **aluminium oxide** in your answer



Which ions would be present in potassium iodide solution?

Produced at the positive electrode:

Half equation:

Produced at the negative electrode:

Half equation:

What does OILRIG stand for?

What is a REDOX reaction?

During electrolysis, _____ move to the _____ (negative electrode).

At the same time, _____ move to the _____ (positive electrode).

When the ions reach the electrode, they lose their charge and become _____.

Positive ions _____

_____ electrons, while negative

ions _____ electrons.

KEY WORDS:

Electrolysis
Electrolyte
Cathode
Anode
Oxidation
Reduction

ASSESSMENT:



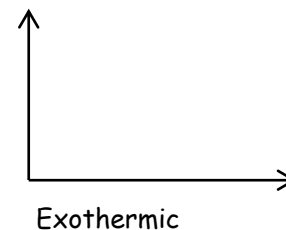
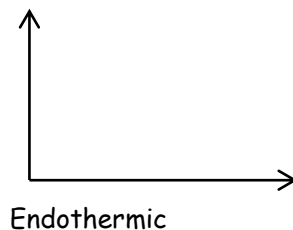
TOPIC 5 - ENERGY CHANGES

A student sets up a simple cell and records the following data:

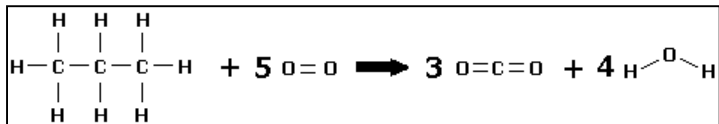
Left electrode	Right Electrode	Voltage
Iron	Zinc	0.32
Iron	Tin	-0.30
Iron	Lead	-0.31

Order the metals by their reactivity.

- Sketch an energy level diagram for each reaction
- Label the overall energy change
- Label the activation energy
- Explain the graph in terms of bond breaking and bond making



Use the following data to calculate the overall energy change for this reaction:

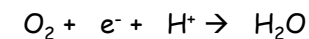


Bond	Bond energy kJ/mol
C-H	413
C-C	348
C=O	805
O=O	498
O-H	464

In a hydrogen fuel cell, hydrogen _____ electrons to produce H^+ ions at the negative electrode. This process is called _____.

At the positive electrode, oxygen _____ electrons and reacts with the H^+ ions to produce _____. This process is called _____.

Balance the half equations of a H_2/O_2 fuel cell:



KEY WORDS:

Exothermic
Endothermic
Activation energy
Bond energy
Fuel cell
Electrode
Battery

ASSESSMENT:



TOPIC 6a - RATES OF REACTION

Define:

Collision Theory:

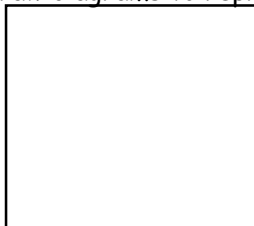
Rate of reaction:

Activation energy:

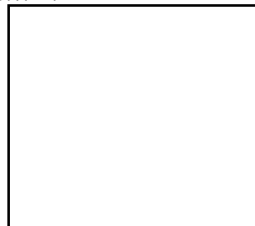
Catalyst:

Explain the effect of concentration on the rate of reaction

Draw diagrams to represent it:



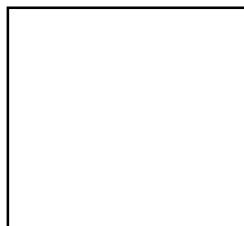
Low concⁿ



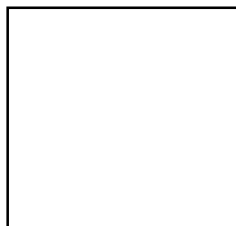
High concⁿ

How does surface area affect rate of reaction?

Draw diagrams to represent it:



Small surface area



Large surface area

Explain the effect of temperature on the rate of reaction [think about: kinetic energy & number of collisions]

Draw diagrams to represent it:



Low temp



High temp

KEY WORDS:

Collision Theory
Catalyst
Activation Energy
Rate of Reaction
Concentration
Temperature

ASSESSMENT:



TOPIC 6b - REVERSIBLE REACTIONS

Define:

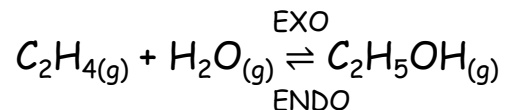
Reversible reaction:

Dynamic Equilibrium:

Closed system:

'Equilibrium lies on the left':

For the following reaction:



If the temperature is increased, what happens to the yield of $\text{C}_2\text{H}_5\text{OH}$?

If the pressure is increased, what happens to the yield of $\text{C}_2\text{H}_5\text{OH}$?

If the concentration of C_2H_4 is increased, what happens to the yield of $\text{C}_2\text{H}_5\text{OH}$?

What effect does adding a catalyst have on the position of equilibrium? Explain your answer.

KEY WORDS:

Reversible reaction
Equilibrium
Endothermic
Exothermic
Le Chatelier's principle
Position of equilibrium
Yield

ASSESSMENT:



TOPIC 7a - HYDROCARBONS AND CRUDE OIL

Delete the incorrect word:

As hydrocarbon chains get longer:

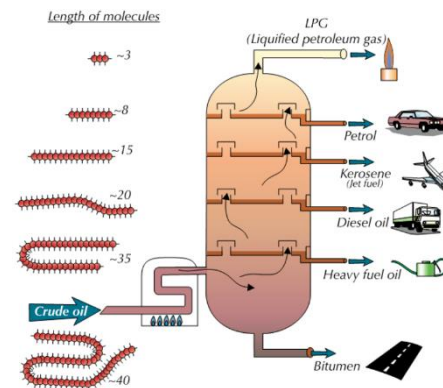
- Boiling point increases/decreases
- Viscosity increases/decreases
- Flammability increases/decreases

Alkanes burn completely in oxygen to form which two products?

What does 'cracking' mean? How do we do it?

Name the process by which we separate crude oil into useful components:

Use the diagram below to explain **how** this process separates the different components of crude oil.



Complete the table to summarise alkanes and alkenes:

	ALKANES	ALKENES
Saturated or unsaturated		
General formula		
Name an example		
Draw an example		

KEY WORDS:

Alkane
Alkene
Saturated
Fractional distillation
Complete Combustion
Cracking

ASSESSMENT:



TOPIC 7b - ORGANIC COMOUNDS

Alcohols:

Draw propanol. Circle the functional group:

State three uses of alcohols:

-
-
-

What is made when an alcohol combusts (burns in oxygen)?

Describe the reaction of alcohol with sodium. What gas is made?

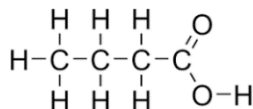
How do we make alcohols by fermentation?

Esters:

Draw ethyl ethanoate. Circle the functional group.

Explain how esters are made:

Name this molecule:



Carboxylic acids:

Draw propanoic acid. Circle the functional group.

What type of reaction turns an alcohol into a carboxylic acid? List two ways of doing this.

Explain why carboxylic acids are weak acids:

KEY WORDS:

Alcohol
Functional group
Homologous series
Carboxylic Acid
Ester
Weak acid
Catalyst

ASSESSMENT:



TOPIC 7b - ORGANIC COMPOUNDS

Link the monomer to the polymer

Alkenes

Proteins

Glucose

Addition
polymers

Amino acids

DNA

Nucleotides

Starch

Alkenes tend to undergo incomplete combustion when burnt in air. Which products could be formed?

ADDITION REACTIONS OF ALKENES

Alkenes react with hydrogen to make _____.
What reaction conditions are needed?

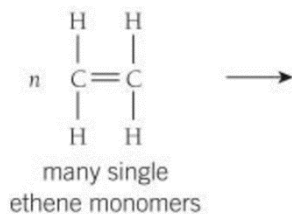
Alkenes react with water (steam) to make _____.
What reaction conditions are needed?

ADDITION POLYMERS

Define monomer:

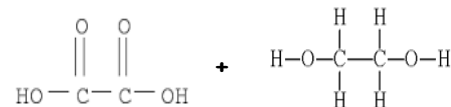
Define polymer:

Complete the diagram to show the polymerisation of ethene. What is the name of the polymer?



CONDENSATION POLYMERS

Draw the polyester formed from these monomers:



KEY WORDS:

Alkane
Alkene
Saturated
Bromine water
Incomplete Combustion
Addition reaction
Polymerisation

ASSESSMENT:



TOPIC 8 - CHEMICAL ANALYSIS

Testing for common gases

Match the gas to the test and result.

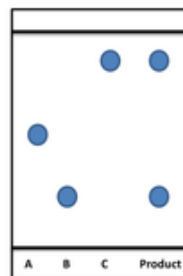
O_2	Bleaches damp litmus
Cl_2	Relights a glowing splint
CO_2	Lit splint produces a squeaky pop
H_2	Limewater turns cloudy

Flame tests for positive ions

Metal ion	Flame colour
Lithium, Li^+	
	Lilac
Sodium, Na^+	
Copper, Cu^{2+}	
	Orange-red

Chromatography

What does this chromatogram tell you about the product?



How do you calculate R_f values?

Sodium hydroxide tests for positive ions

Metal ion	Precipitate colour
Aluminium, Al^{3+}	
Iron (II), Fe^{2+}	
	Brown
Calcium, Ca^{2+}	
	Blue
Magnesium, Mg^{2+}	

Testing for negative ions

Match the ion to the test and result.

CO_3^{2-}	Add hydrochloric acid and barium chloride, white precipitate
SO_4^{2-}	Add nitric acid and silver nitrate, white precipitate
Cl^-	Add acid, fizzes and gas turns limewater cloudy

Instrumental methods

List three advantages of instrumental methods over chemical tests:

-
-
-

KEY WORDS:

Pure
Mixture
Formulation
Precipitate
Ion
Chromatography

ASSESSMENT:



TOPIC 9 - THE ATMOSPHERE

What is the composition of the atmosphere today?

State 2 ways the amount of CO_2 decreased from the early atmosphere

State 1 way the amount of O_2 increased from the early atmosphere

Name 3 greenhouse gases

State 2 human activities that have increased the amount of greenhouse gases in the atmosphere

The Greenhouse Effect

Order the statements to explain the greenhouse effect

- ___ The Earth re-emits long-wavelength radiation
- ___ The sun emits short-wavelength radiation which passes through the atmosphere to Earth
- ___ Greenhouse gases re-radiate the long-wavelength radiation in all directions
- ___ The Earth absorbs the short-wavelength radiation
- ___ Greenhouse gases absorb the long-wavelength radiation

Air Pollution

Match the pollutant to the cause and effect

Cause	Pollutant	Effect
Nitrogen and oxygen in the air react in high temperatures	Sulfur dioxide	Poisonous gas
Incomplete combustion of hydrocarbon fuels	Carbon dioxide	Global dimming / breathing problems
Incomplete combustion of hydrocarbon fuels	Nitrogen oxides	Global warming
Complete combustion of hydrocarbon fuels	Carbon particulates	Acid rain / breathing problems
Sulfur impurities in fuel burn in oxygen	Carbon monoxide	Acid rain / breathing problems

Carbon footprints

List 3 ways carbon footprints can be reduced:

-
-
-

KEY WORDS:

Atmosphere
Greenhouse gas
Greenhouse effect
Global warming
Global dimming
Climate change

ASSESSMENT:



TOPIC 10 - USING RESOURCES

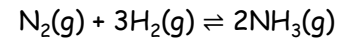
Draw a diagram to show how to distil salt water:

Why is distillation an expensive method of producing potable water?

Briefly describe the following sustainable methods of extracting copper

Bioleaching:

Phytomining:



Where is the nitrogen obtained from?

Where is the hydrogen obtained from?

What are the reaction conditions for this process?

What elements do NPK fertilisers contain?

Give the names of the substances produced in the following reactions:

Reactant 1	Reactant 2	Product(s)
Ammonia solution	Nitric acid	
Ammonia solution	Phosphoric acid	
Phosphate rock	Nitric acid	
Phosphate rock	Phosphoric acid	
Phosphate rock	Sulfuric acid	

What is corrosion?

State 2 ways that corrosion can be prevented.

KEY WORDS:

Alloy
Sustainable
Corrosion
Potable
Distillation
Renewable
Finite

ASSESSMENT:

