



Combined Chemistry Higher Paper 2

Name: _____

Topic 6: Rate of Chemical Change

Topic 7: Organic Chemistry

Topic 8: Chemical Analysis

Topic 9: Chemistry of the Atmosphere

Topic 10: Using Resources

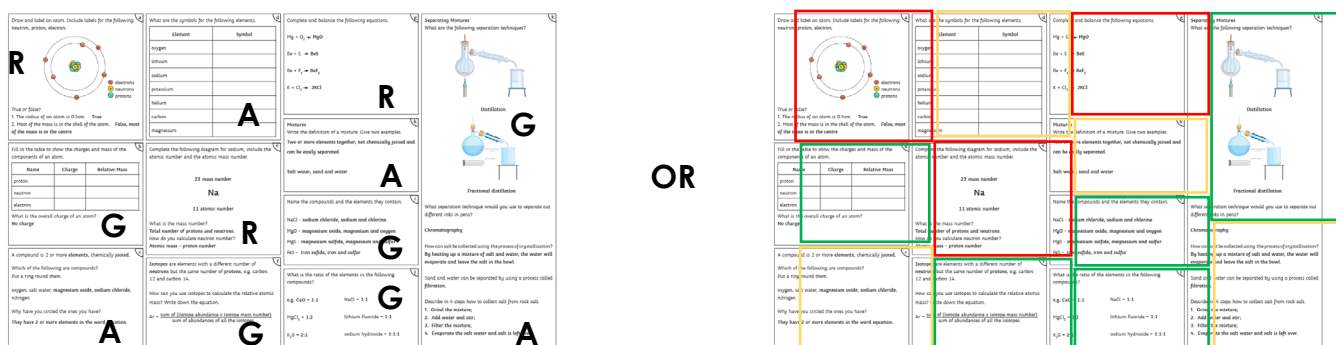
Exam Date: Friday 13th June 2025

Instructions

This booklet has been separated according to the topic that will be covered in the exam.

- Go through the revision mat for the topic and rate each box according to your understanding of that content. Use a typical RAG rating or 3 different colours of highlighter.

For example:



R = Red 😞 Low understanding

A = Amber 😐 Some Understanding

G = Green 😊 Good Understanding

- Cut along the dotted lines of the question card template provided. Then produce a set of revision questions and answers for that topic – you should focus on those you have rated as red or amber on the revision mat. **For example:**

Front

What is the mass number of an atom?

Back

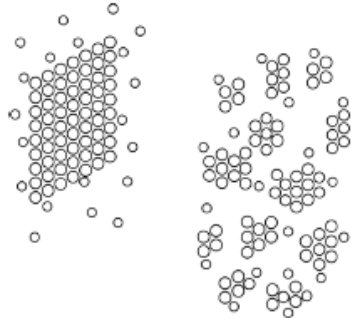
The total number of protons and neutrons found in the nucleus

- Fold along the line indicated on the following page and glue where indicated to create a storage pocket for your question cards.
- Regularly test yourself using your question cards or ask someone to test you and return them to your storage pocket for safekeeping after each use.

Topic 6: Rate of Chemical Change

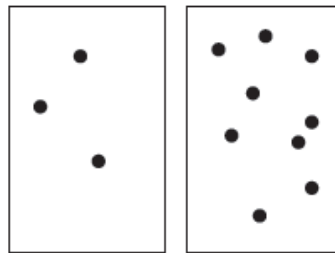
(1)

Discuss, in terms of collision theory, what happens to particles when they are heated.



When particles are heated they have more kinetic energy. Particles move around more and more collisions occur.

When concentration increases explain why rate of reaction increases.
Use diagrams to help you explain.



There are more particles in the same volume, so collisions are more frequent.

Describe how increasing the surface area of a solid reactant affects the rate of reaction.

The rate of reaction is quicker.

Why does this happen?

There is more surface area for the reactants to react with so the reaction occurs quicker.

Write down the definition of a catalyst.

A catalyst speeds up the rate of a reaction without being used up.

How do catalysts work?

They provide a surface area for the reactants to bind to.



What does this symbol show?

A reaction going forwards and backwards. (reversible reaction)

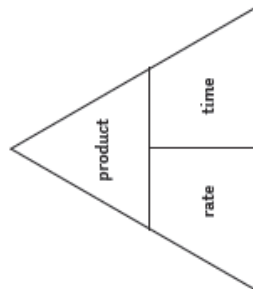
What is Le Chatelier's Principle?

If the conditions are changed in a reversible reaction then the system will counteract that change.

e.g. temperature, pressure, concentration.

Complete the formula triangle to show the formula for calculating rates of reaction.

$$\text{mean rate of reaction} = \frac{\text{quantity of product formed}}{\text{time taken}}$$



Calculate the rate of reaction when:

The amount of product made is 650g and it takes 50 seconds to produce. Show your working out.

Mean Rate = 650g/50s

Mean rate = 13g/s

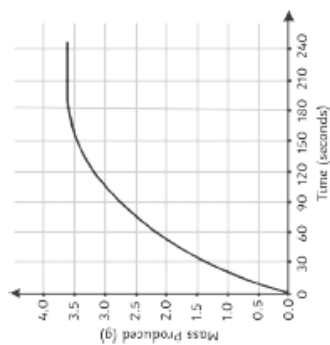
Explain what happens when a reaction is in equilibrium.

When the forwards reaction is equal to the backwards reaction.

Why can reactions only reach equilibrium in a closed system?

None of the reactants or products can escape.

Describe in detail what the rate of reaction graph shows.



The rate of reaction goes quickly to start with and then starts to level off.

Why does it have this shape?

There are more products and less reactants so less reactions occur so the graph starts to level off.

Describe how sodium thiosulfate can react with HCl in a practical.
Write it step by step.

1. Add sodium thiosulfate solution to a flask.

2. Place flask on a black cross.

3. Add HCl

4. Time how long it takes for the cross to disappear.

5. Record the results.

5. Repeat with different concentration.

a Describe how marble chips and hydrochloric acid can react to produce carbon dioxide. Write it step by step.

1. Measure out the HCl.
2. Pour into a conical flask.
3. Measure out the marble chips.
4. Add to the flask and add the bung and delivery tube.
5. Start the stop watch.
6. Gas is collected in the gas syringe, measure every 10s and write down the results.

b How can a balance be used to measure the amount of gas being produced? Choose the correct answer.

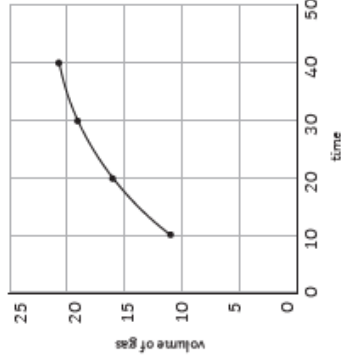
1. The quicker the mass lost, the quicker the reaction.
2. The slower the mass lost the quicker the reaction.
3. The quicker the mass is gained the quicker the reaction.

c I am feeling confident in the following topics...

I need to work on the following topics...

d Draw a graph of the following results. Add a curve of best fit.

Time	Volume of gas
0	0
10	11
20	16
30	19
40	21



Why would you add a tangent to the graph?

To see how the reaction rate changes.

What does the steepness of the tangent show?

How fast the rate of reaction is. The steeper it is, the faster the rate of reaction.

e How can a graph be used to calculate the mean reaction rate?

Answer the question using the information:

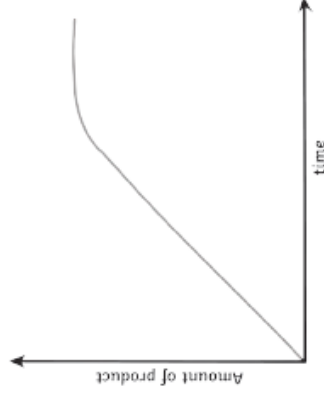
- Work out when the reaction finished;
- Work out how much product formed;
- Divide by the time taken to finish.

The line goes flat at 70s and 80cm³ of gas was produced.

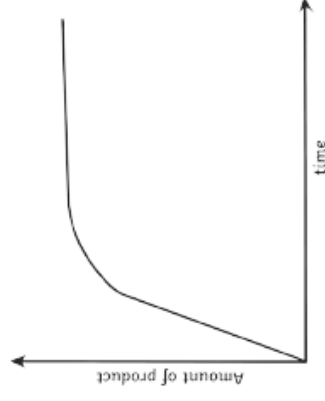
Mean rate = 80/70

Mean rate = 1.14 cm³/s

f Sketch a graph to show a slow reaction.



Sketch a graph to show a quick reaction.



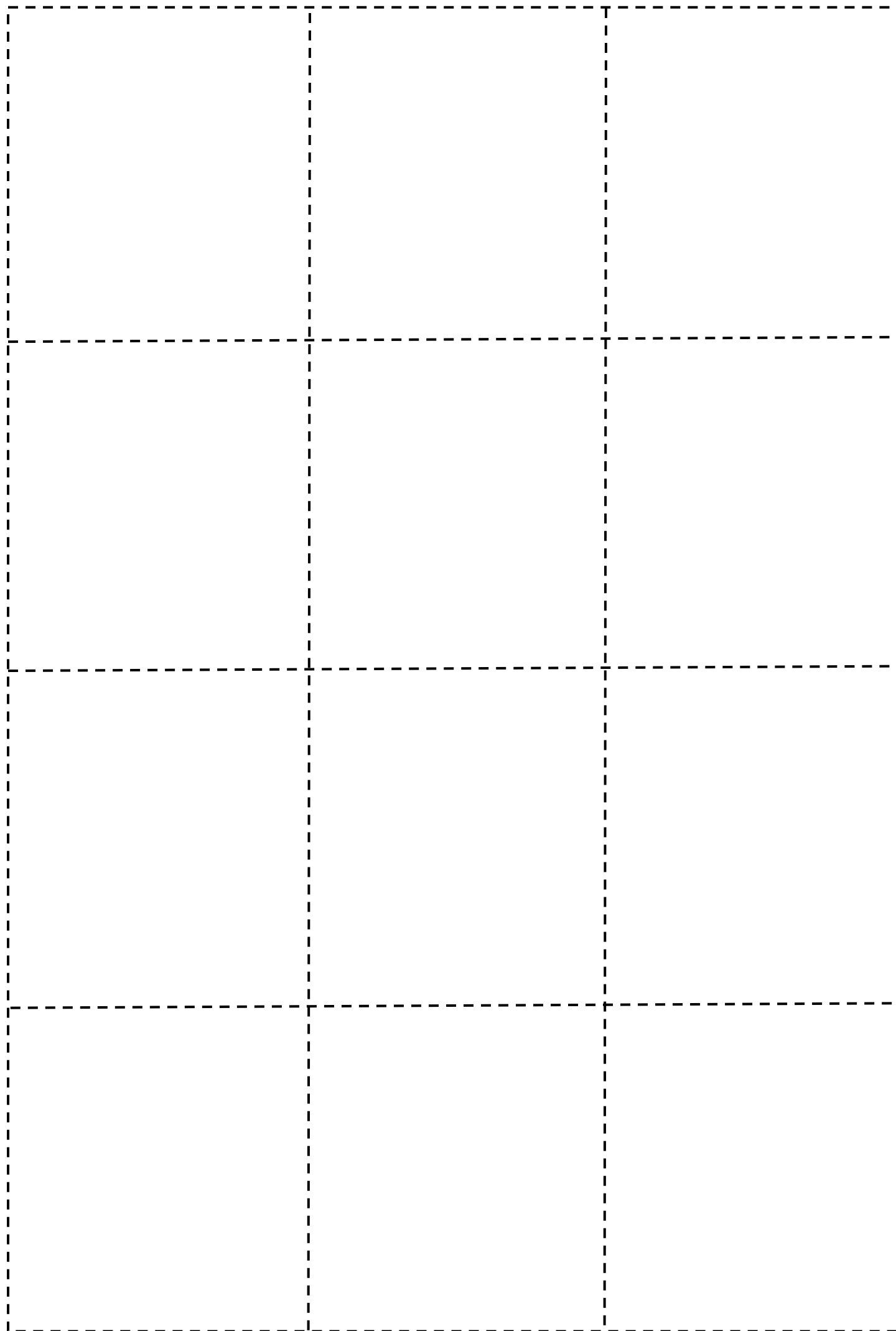
g Find the mean rate of reaction between these 2 points:

At 30s, 20cm³ of product had been produced and at 60s, 75cm³ had been produced.

$$75 - 20 = 55\text{cm}^3$$

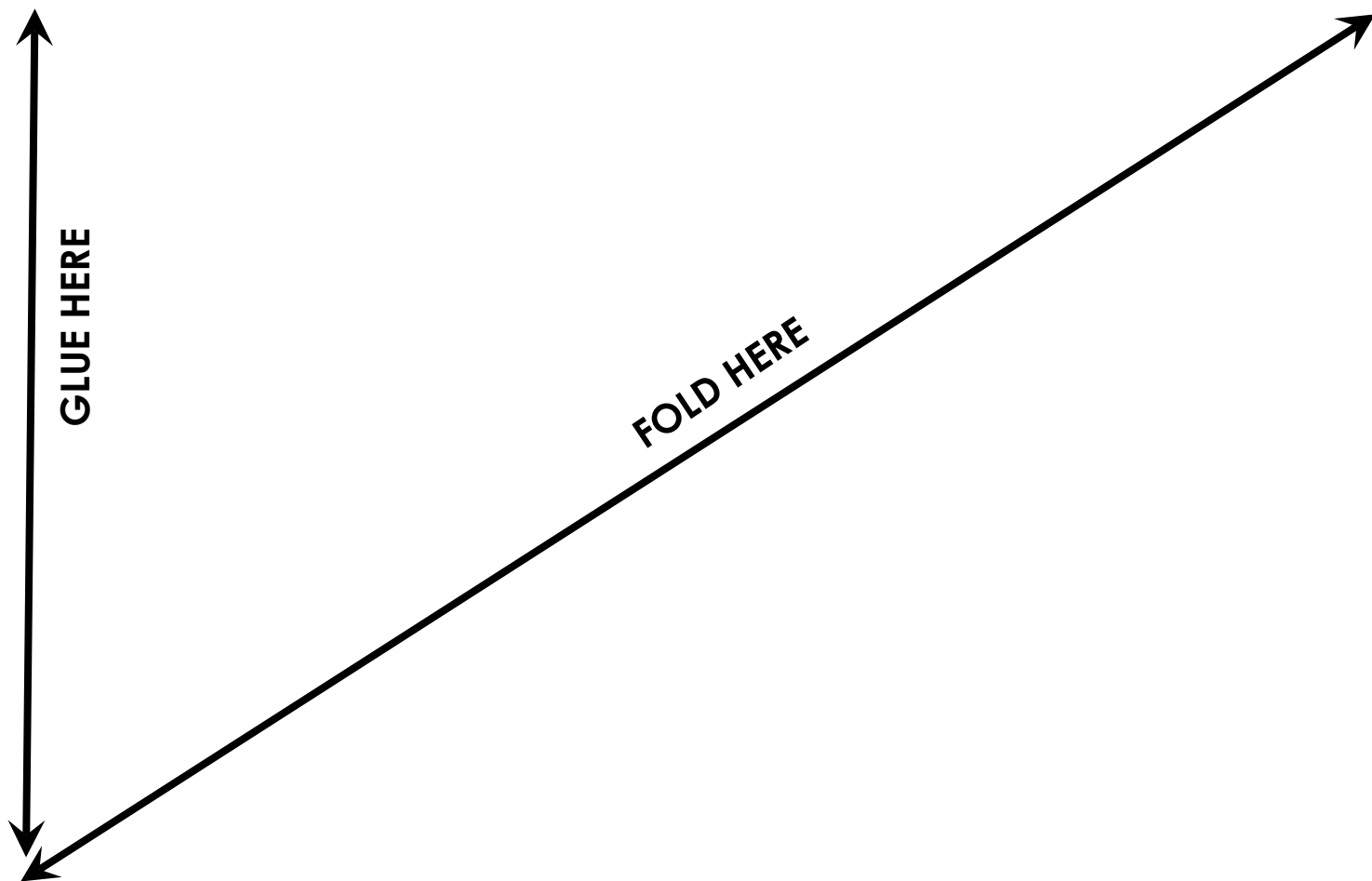
$$60 - 30 = 30\text{s}$$

$$\text{Mean rate} = 55/30 = 1.8 \text{ cm}^3/\text{s}$$



Topic 6: Rate of Chemical Change

Question Card Storage



Topic 7: Organic Chemistry

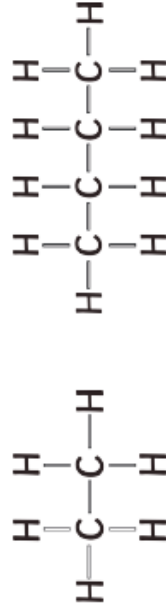
What is crude oil made up of?

Different length Hydrocarbons.

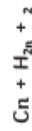
List four alkanes.

methane, ethane, propane, butane

Draw the following alkanes:



What is the formula for alkanes?



Describe how crude oil is made.

From the remains of dead plankton and other animals and plants that fall to the bottom of the sea and get covered in mud.

What are the uses of crude oil?

Fuel for transport e.g. petrol and diesel.

Used to make other compounds such as polymers, lubricants, solvents, detergents.

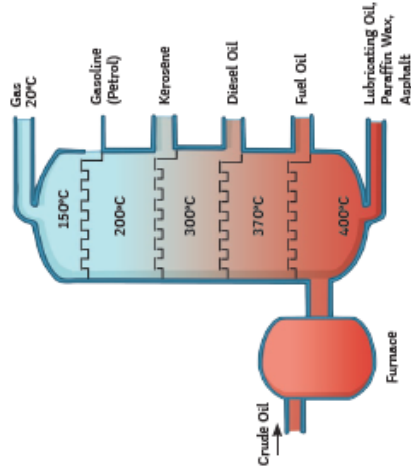
Complete the combustion equation.

hydrocarbon + oxygen → carbon dioxide + water

Complete the balanced symbol equation.



Describe the process of fractional distillation. Use the diagram to help.



Crude oil is a mixture of hydrocarbons and they are heated until they form a gas.

They all have different boiling points so separate out at different temperatures.

Long chain hydrocarbons have high boiling points, short chain molecules have low boiling points.

How does the length of the hydrocarbon affect the boiling point?

The longer the hydrocarbon the higher the boiling point - more energy is needed to break up the molecules.

What is bromine water a test for? Choose the correct answer.

- a. alkane
- b. alkene

What colour does it go?
colourless

How does the length of the hydrocarbon affect the viscosity? Choose one answer.

- a. more viscous
- b. less viscous
- c. stays the same

Cracking is the breaking down of large chain hydrocarbons into shorter chains.

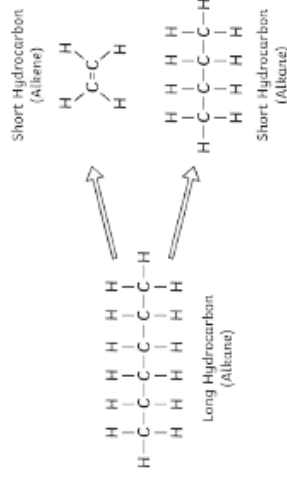
It produces alkenes that have a double bond.

Draw a diagram of an alkene.



What is the formula for alkenes?
 C_nH_{2n}

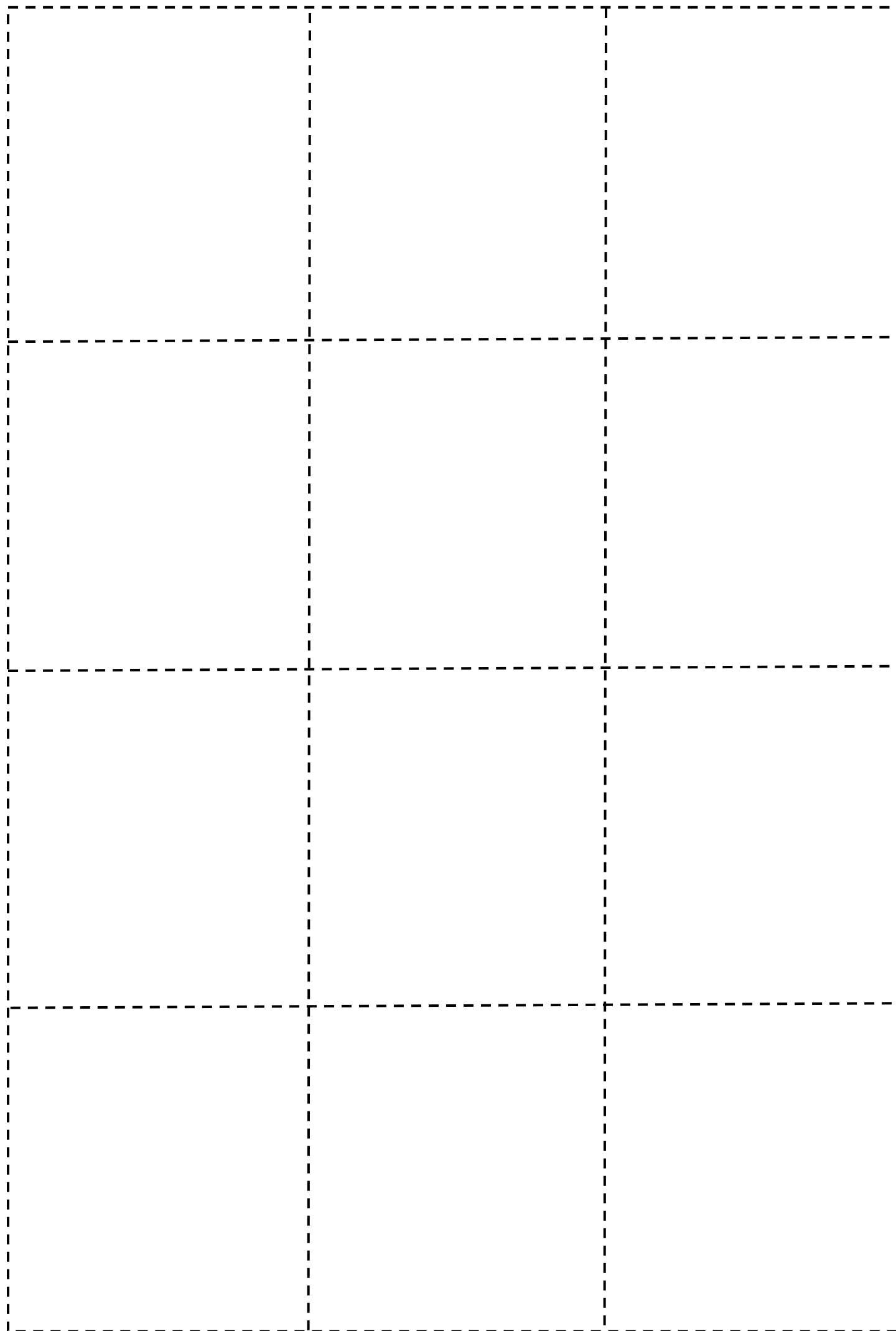
Show the cracking of a long chain molecule.



What are the two methods of cracking? Describe the two processes in detail.

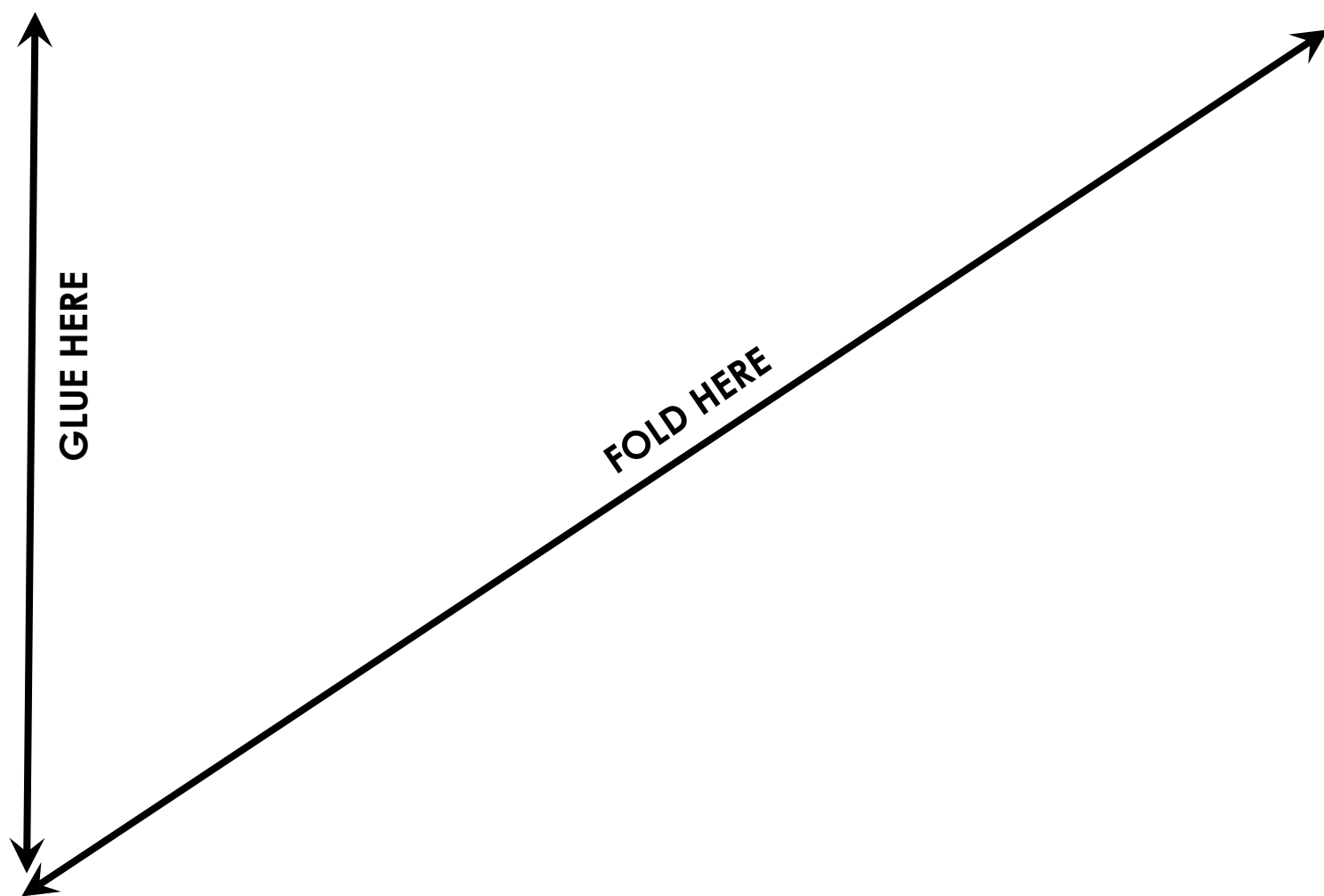
Steam - heated into a vapour, mixed with steam, heated at very high temperature.

Catalytic - heated into a gas, passed over aluminium oxide catalyst, molecules split.



Topic 7: Organic Chemistry

Question Card Storage



Topic 8: Chemical Analysis

a Define a pure substance.

When nothing has been added to a substance.

How can you distinguish a pure substance from an impure substance?

The melting and boiling points of substances allows you to distinguish one substance from another. e.g. pure water boils at 100°C.

What will happen to the above if there are impurities in the sample?

They will lower the melting point.

They will increase the boiling point.

b What is a formulation?

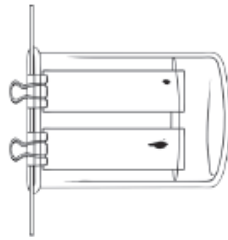
Useful mixtures that have a particular use.

Give some everyday examples of where formulations are used.

paint, fertilisers, cleaning products, fuels, cosmetics, nail polish, perfume, medicine, pesticides, inks.

c What does chromatography separate?

It separates 2 or more soluble substances in a mixture.



Describe how the process works. Use the diagram to help. The solvent moves up the paper. As it moves, it takes the mixture with it.

The more soluble the substance, the farther it moves up the paper.

Some are not as soluble so do not travel as far. They separate into different spots.

Complete the word equation for calculating the R_f value.

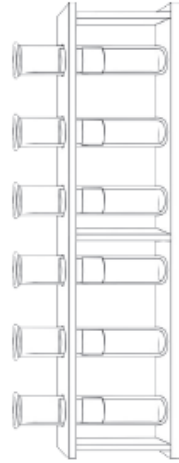
$$R_f = \frac{\text{distance moved by substance (B)}}{\text{distance moved by solvent (A)}}$$

How does the R_f value allow you to identify a substance?

Each solvent has a different R_f value.

e What colour does litmus go if chlorine is present?

It turns white.



f What is the R_f value of the following chromatogram?

The distance moved by substance B is 30mm and the distance moved by solvent A is 52mm.

$$R_f = \frac{30}{52} = 0.58$$

g What are the 2 phases of chromatography?

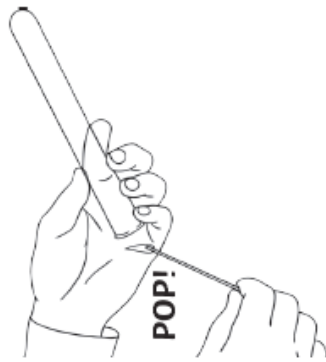
1. Mobile phase
Where the molecules can move.
2. Stationary phase
Where the molecules can not move.

h Describe the test for oxygen.

If a glowing splint is put into a test tube filled with oxygen, the splint will relight.

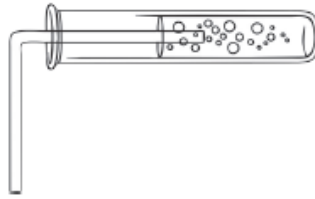
What gas does this experiment test for?

It is the test for hydrogen gas.



What gas does this experiment test for?

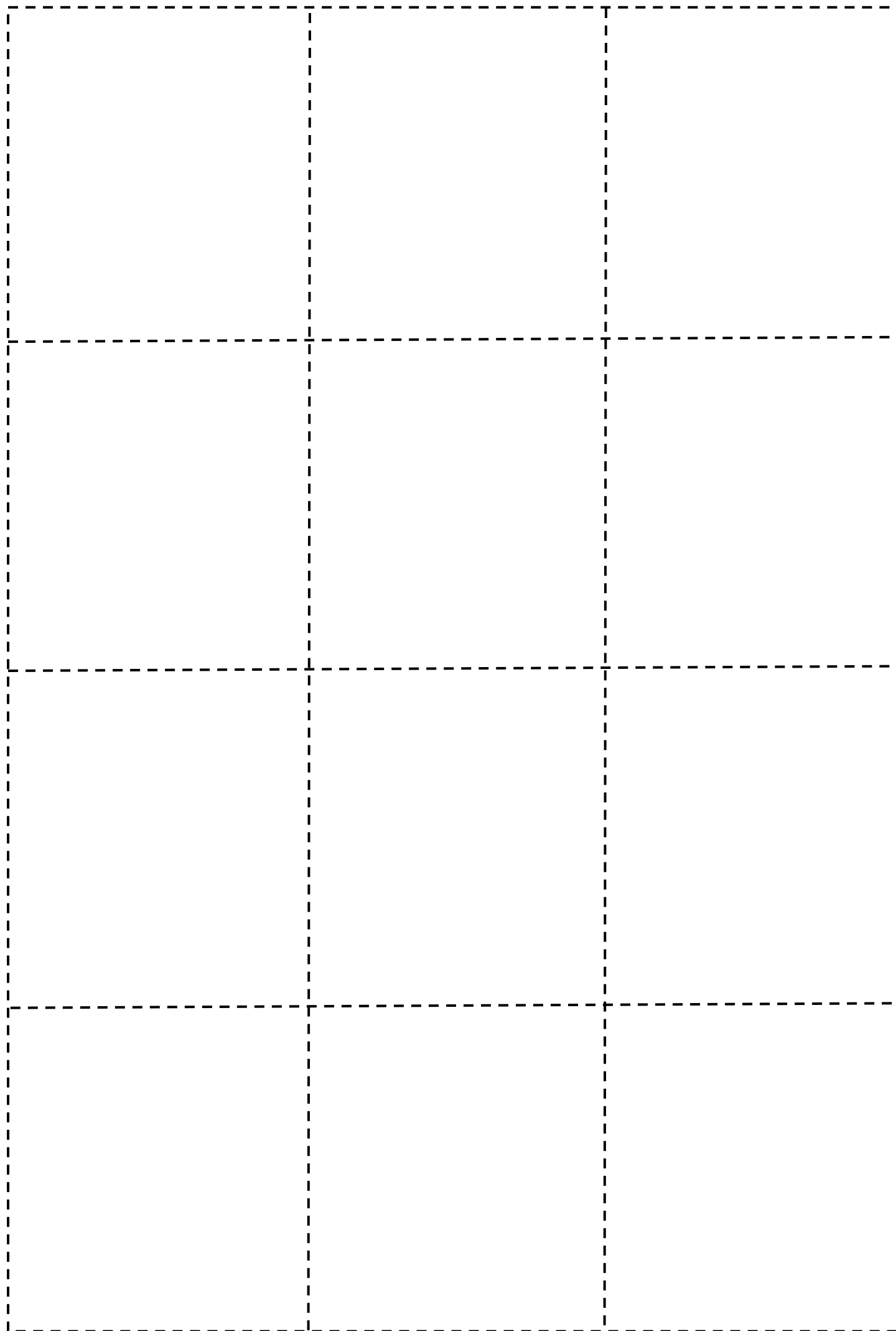
It is the test for carbon dioxide



What colour does the limewater go if the gas is present?
Cloudy white.

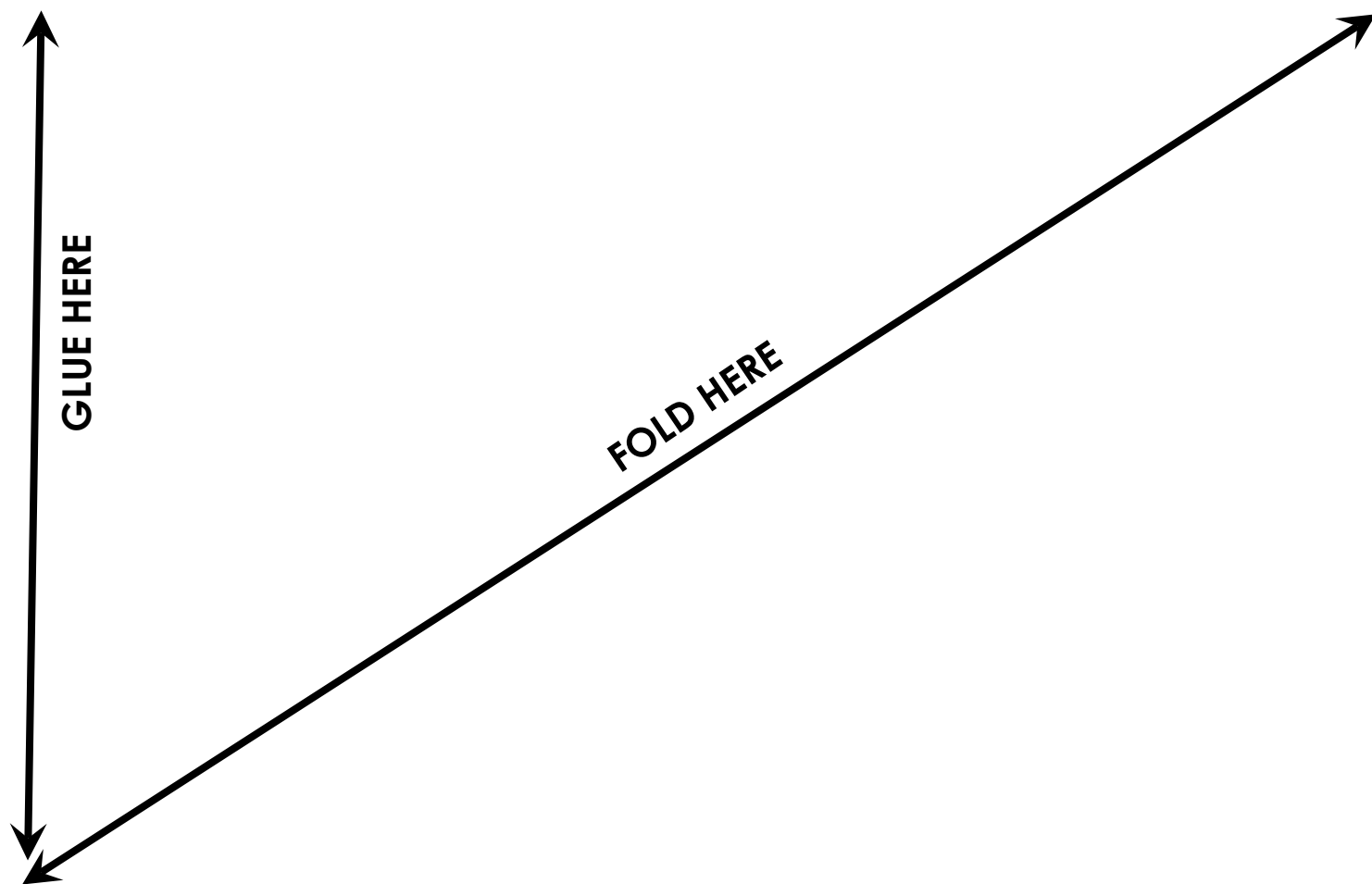
I understand the following topic...

I need to work on the following topic...




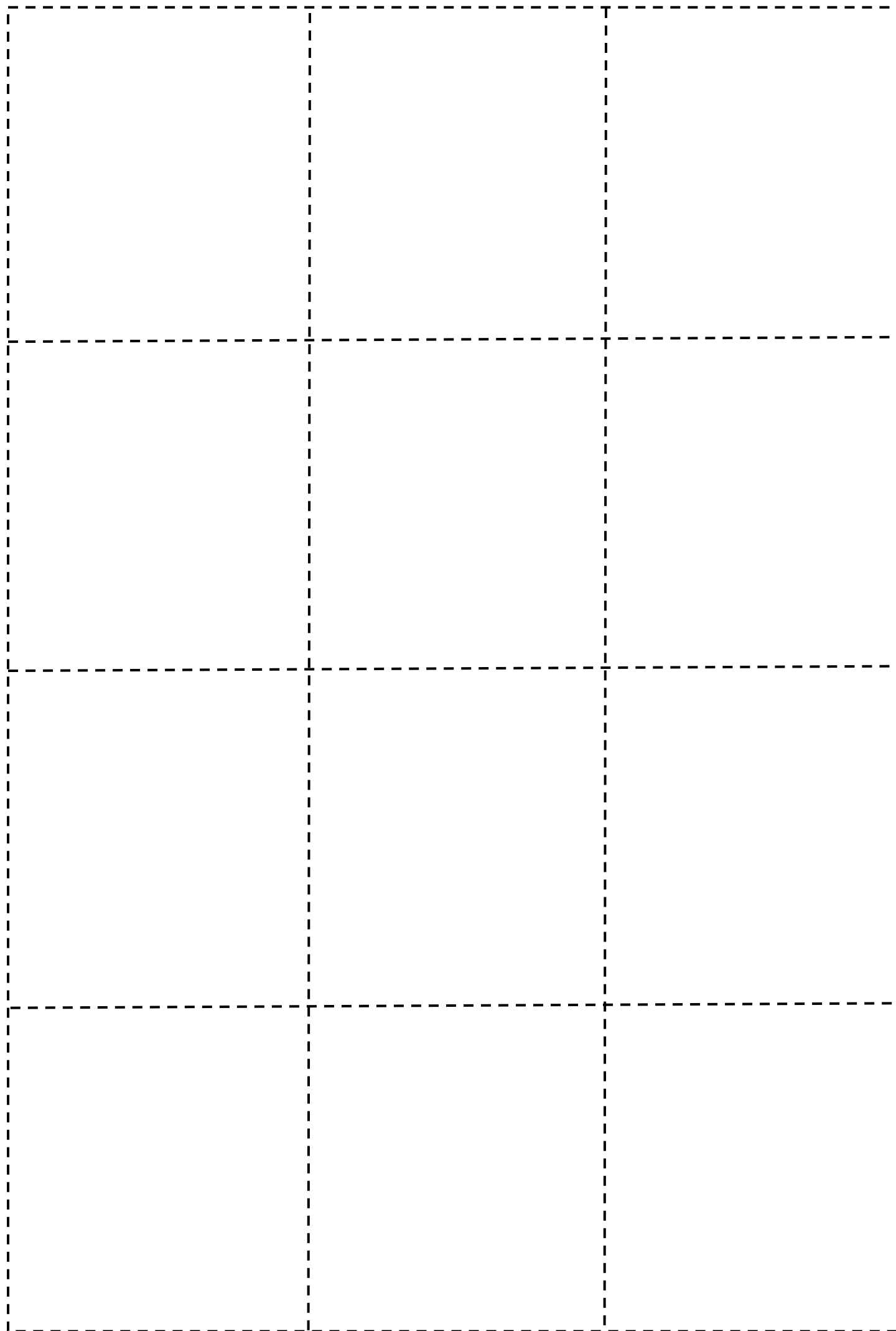
Topic 8 Chemical Analysis

Question Card Storage



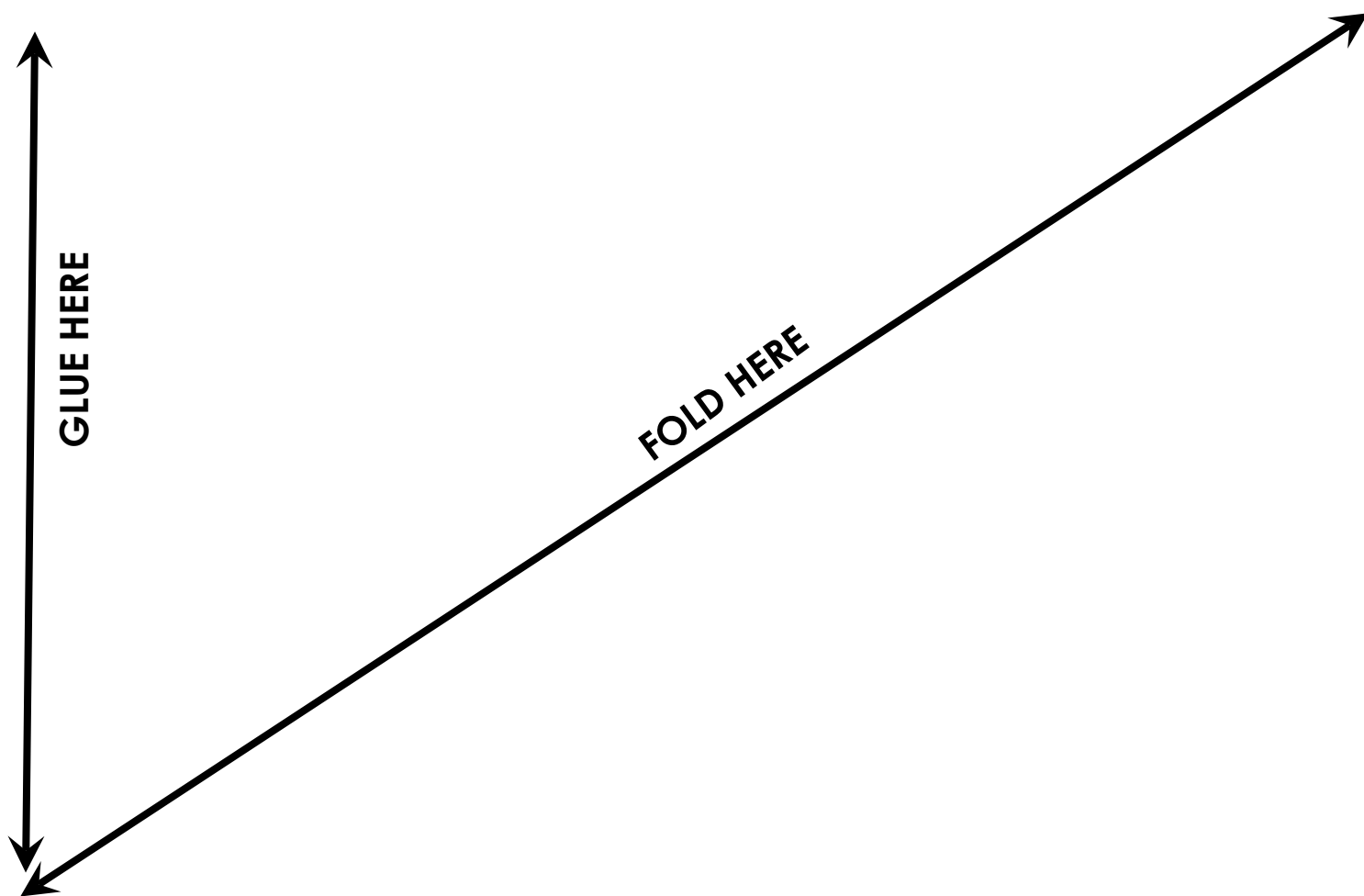
Topic 9: Chemistry of the Atmosphere

<p>a</p> <p>Billions of years ago, what was the surface of the Earth covered in?</p> <p>volcanoes</p> <p>What gas made up most of the Earth's early atmosphere? Circle one of the following.</p> <p>oxygen carbon dioxide nitrogen helium</p> <p>ammonia methane water vapour</p>	<p>e</p> <p>Name two other gases that are produced from burning fossil fuels.</p> <p>1. sulphur dioxide</p> <p>2. nitrogen oxides</p> <p>What problems can they cause?</p> <p>Acid rain, damage to buildings, kills animals and plants and causes respiratory problems.</p>	<p>h</p> <p>What is a greenhouse gas?</p> <p>They keep the Earth warm enough to support life, e.g. carbon dioxide. Too many of these gases in the atmosphere may lead to climate change.</p> <p>How do greenhouse gases work?</p> <p>They stop heat escaping from Earth into space (they absorb it), warming the Earth's atmosphere up.</p>	<p>l</p> <p>Scientists use the term carbon footprint. Define what this term means.</p> <p>The amount of greenhouse gases released over the full life cycle of something.</p>						
<p>b</p> <p>How was carbon dioxide removed from the atmosphere? Dissolved into the oceans.</p> <p>What evolved to carry out photosynthesis? Green plants and algae.</p>	<p>f</p> <p>How many billions of years ago did algae evolve? Choose the correct answer.</p> <p>a. 1.0</p> <p>b. 2.7</p> <p>c. 5.6</p> <p>d. 6.4</p>	<p>i</p> <p>Why is carbon dioxide linked to climate change?</p>  <p>The Earth's surface temperature has been increasing. Scientists believe this is due to the extra carbon dioxide being produced by human activity. This may lead to climate change.</p>	<p>m</p> <p>List three ways of reducing the carbon footprint.</p> <p>Answers could include:</p> <ul style="list-style-type: none">• renewable energy resources;• governments could tax companies on the amount of gases they give out,• limits on greenhouse gases;• carbon capture to store CO₂ underground.						
<p>c</p> <p>Match up the proportions of gases with the percentage for today's atmosphere.</p> <table><tr><td>nitrogen</td><td>less than 1%</td></tr><tr><td>oxygen</td><td>30%</td></tr><tr><td>other gases</td><td>20%</td></tr></table>	nitrogen	less than 1%	oxygen	30%	other gases	20%	<p>g</p> <p>Complete the equation for photosynthesis.</p> <p>carbon dioxide + water → glucose + oxygen</p> <p>$6\text{CO}_2 + 6\text{H}_2\text{O} \longrightarrow \text{O}_2 + \text{C}_6\text{H}_{12}\text{O}_6$</p> <p>Why is this equation so important for the evolution of the atmosphere?</p> <p>This built up the amount of oxygen in the atmosphere, and it also removes carbon dioxide.</p> <p>What could then evolve?</p> <p>This meant that oxygen dependant lifeforms could then evolve.</p>	<p>j</p> <p>Why is climate change such a problem? What are the consequences of it?</p> <p>Answers can refer to: melting of the polar ice caps; sea levels may rise; more flooding; changes in rainfall; more severe/frequent storms; may affect food production.</p>	<p>n</p> <p>What is the biggest reason for governments not lowering their carbon footprint?</p> <p>economic reasons</p>
nitrogen	less than 1%								
oxygen	30%								
other gases	20%								
<p>d</p> <p>Why is it difficult to be sure about the evolution of the atmosphere?</p> <p>The atmosphere started to evolve around 4.6 billion years ago, so there is a lack of evidence.</p>		<p>k</p> <p>Why is releasing particulates a problem?</p> <p>If breathed in they can cause lung damage and breathing problems. Also, they can contribute to global dimming.</p> <p>What can carbon monoxide do to the body?</p> <p>Stops the blood carrying oxygen around the body, a lack of oxygen could kill.</p>	<p>o</p> <p>Complete combustion is...</p> <p>plenty of oxygen available and all the fuel burns.</p> <p>Incomplete combustion is...</p> <p>not enough oxygen available and some of the fuel does not burn.</p> <p>During incomplete combustion, what other things are released into the atmosphere?</p> <p>1. soot</p> <p>2. carbon monoxide</p> <p>3. unburnt fuel</p>						



Topic 9: Chemistry of the Atmosphere

Question Card Storage



Topic 10: Using Resources

(1)

a

Natural resources form by themselves.

Name the three places they come from.

1. earth
2. sea
3. air

b

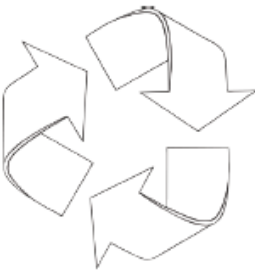
Why is recycling metals better than mining and extracting new metals?

Mining and extraction of metals uses a lot of energy. Recycling uses a lot less energy and it saves the earth's metals.

It also cuts down on landfill waste.

How can metals be recycled?

Metals can be recycled by melting them down and then re-shaping them.



c

What are the '3 Rs' connected with recycling?

1. reduce
2. reuse
3. recycle

Why is this easy to do with glass?

Glass can be reused without reshaping. Some has to be recycled - it is crushed, melted and re-shaped.

d

Life Cycle Assessments

This looks at every stage of a product's life and checks the effect on the environment.

Add three points under each heading explaining what it means.

1. Getting the Raw Material
Extraction damages the environment and uses a lot of energy. Results in pollution and some things need processing to turn them into useful materials.
2. Manufacturing and Packaging
Making packaging can cause pollution. Chemical reactions are sometimes used and they make waste products that have to be disposed of.
3. Using the Product
Using the product can damage the environment. For example, fossil fuels produce greenhouse gases and fertilisers can get into streams and rivers.
4. Product Disposal
Products thrown away in landfill sites take up space and pollute the earth. Energy is also needed to take the product to the landfill. They may also be incinerated which will cause air pollution.

What are the problems with Life Cycle Assessments?

1. Sometimes it is hard to give a numerical value.
2. They can be biased (depends on the person carrying them out).
3. They can be selective to provide a company with positive advertising.

e

Compare the life cycle of a plastic bag vs a paper bag.

Compare them for the following factors:

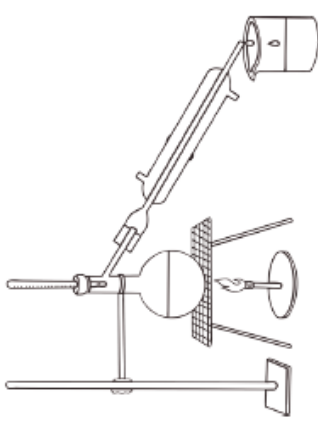
raw material, manufacturing, packaging, using the product, product disposal.

Plastic Bag	Paper Bag
from crude oil	from wood
Manufactured by fractional distillation, cracking, and polymerisation.	Made from pulped wood – lots of energy is needed.
Reused, most are non-biodegradable, take up space in landfill.	Usually only used once, recycled, biodegradable.

f

Desalination

Describe this process.



Neutralise the water first by adding either acid or alkali depending on the pH.

Salt water is heated and the water reaches boiling point. When it does, it is evaporated. The vapour goes into the condenser and cools down, forming pure water. Salt crystals are left behind in the flask.

g

Renewable Resources vs Finite (Non-Renewable)

Complete the table with the following keywords: nuclear fuels, timber, fossil fuels, minerals, metals, fresh water, food.

Renewable	Finite
timber	nuclear
fresh water	fossil fuel
food	minerals
	metals

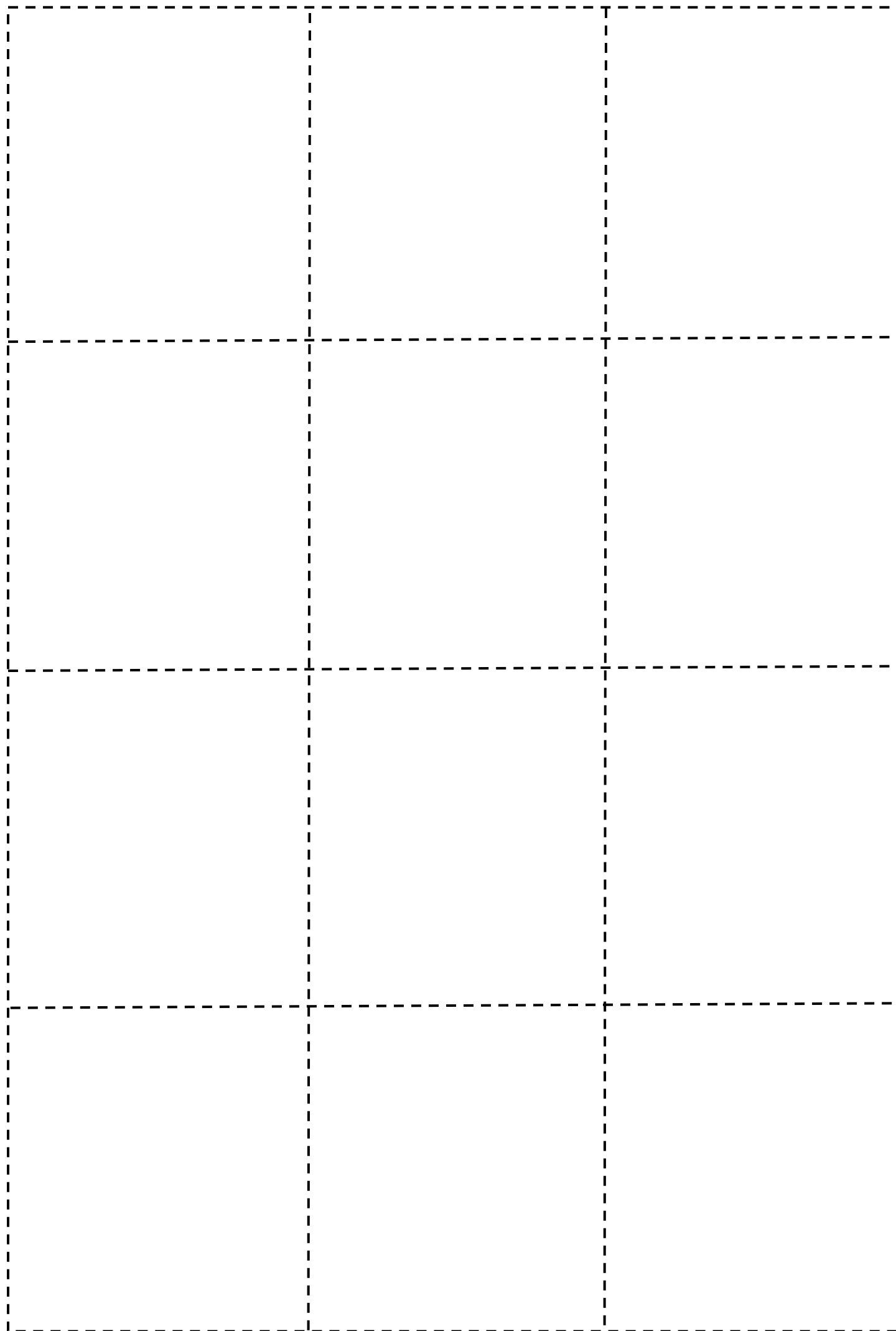
h

Potable water is water you can drink.

For water to be safe to drink, it must...

1. not have high levels of dissolved salts ;
2. a pH between 6.5 and 8.5 ;
3. not have any bacteria.

<p>a</p> <p>Where does surface water collect? lakes, rivers and reservoirs</p> <p>Where does ground water collect? Collects in rocks trapped underground.</p>	<p>b</p> <p>Where does waste water come from? Give four examples.</p> <ol style="list-style-type: none">bath/toilet/showerwashing-upfarmingindustrial processes	<p>c</p> <p>Sewage treatment occurs in several stages (as shown below).</p> <p>Number the statements in the correct order.</p> <ol style="list-style-type: none">Screening and grit removal.Sedimentation to produce sewage sludge and effluent.Anaerobic digestion of sewage sludge.Aerobic biological treatment of effluent.	<p>d</p> <p>Why is it important to use sustainable resources?</p> <ol style="list-style-type: none">To preserve the environment.Resources are needed for future generations.To allow ourselves to live comfortably.	<p>e</p> <table><tr><th></th><th>Pros</th><th>Cons</th></tr><tr><td>coal</td><td>cheaper</td><td>Non-renewable and takes a long time to form/ pollutes the environment/ produces many greenhouse gases/ leads to global warming and climate change.</td></tr><tr><td>renewable energy</td><td>less of an impact on the environment/ can be re-used</td><td>Can be dependent on factors such as the weather or the environment.</td></tr></table>		Pros	Cons	coal	cheaper	Non-renewable and takes a long time to form/ pollutes the environment/ produces many greenhouse gases/ leads to global warming and climate change.	renewable energy	less of an impact on the environment/ can be re-used	Can be dependent on factors such as the weather or the environment.	<p>f</p> <p>What are the two processes involved in water treatment?</p> <p>Name them and describe the process.</p> <ol style="list-style-type: none">Filtration Water is passed through a wire mesh and filter beds to filter out any solid parts.Sterilisation Water is sterilised to kill bacteria or microbes by bubbling chlorine gas through it and using UV or ozone gas.	<p>g</p> <p>List the positives of extracting resources.</p> <ol style="list-style-type: none">Useful products made/collected.Jobs for the local area.Brings money to the area.	<p>h</p> <p>List the negatives of extracting resources.</p> <ol style="list-style-type: none">Bad for the environment.Uses lots of energy.Produces waste.Destroys habitats.	<p>i</p> <p>Choose the correct answer to complete the sentence below:</p> <p>Phytomining is the use of plants to extract copper.</p> <ol style="list-style-type: none">bacteriaplantsanimalsfungi <p>Explain how this process occurs.</p> <p>The copper builds up in the leaves of the plants. The leaves are picked, burnt and the ash is collected. The ash contains the copper.</p>	<p>j</p> <p>Bioleaching is the use of bacteria to obtain copper.</p> <p>Explain how this process occurs.</p> <p>Bacteria convert copper compounds found in the ore into soluble copper. The solution produced by the process can be extracted by electrolysis.</p>
	Pros	Cons																
coal	cheaper	Non-renewable and takes a long time to form/ pollutes the environment/ produces many greenhouse gases/ leads to global warming and climate change.																
renewable energy	less of an impact on the environment/ can be re-used	Can be dependent on factors such as the weather or the environment.																



Topic 10: Using Resources

Question Card Storage

