



ENSURING EXCELLENCE

# Combined Chemistry Foundation 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

## Instructions

1. 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.

[illegible][illegible]

G = Green 😊 Good Understanding

- ## Back

The total number of protons and neutrons found in the nucleus

- 
- 
3. Fold along the line indicated on the following page and glue where indicated to create a storage pocket for your question cards.
4. 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

**a**

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.

**b**

Describe how sodium thiosulfate can react with hydrochloric acid in a practical.  
(keywords: flask, black cross, time).

1. Add sodium thiosulfate solution to a flask.
2. Place the flask on a black cross.
3. Add hydrochloric acid.
4. Time how long it takes for the cross to disappear.
5. Record the results.
6. Repeat with different concentrations.

**c**

Write down the formula to calculate the rate of reaction.

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

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 =  $650 \div 50$   
Mean rate = 13g/s

**d**

Explain what happens when a reaction is in equilibrium.

The forwards reaction is equal to the backwards reaction.

**e**

What does this symbol show?

The forwards reaction is equal to the backwards reaction. (reversible reaction)

**f**

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 lower the activation energy. E.g. provide a surface area for the reactants to bind to.

**g**

If a reversible reaction is endothermic in one direction it will be exothermic in the other.

hydrated  
copper  
sulfate

$\rightleftharpoons$

anhydrous  
copper  
sulfate  
+ water

**h**

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.

**i**

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

When particles are heated, they have more kinetic energy. Particles move around more. More collisions occur, so the product is formed faster.

**j**

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

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

**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...

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I need to work on the following topics...

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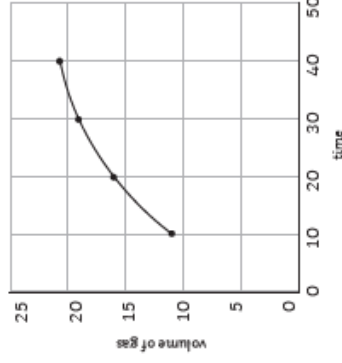
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**d**  
Draw a graph of the following results. Add a curve of best fit.

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:

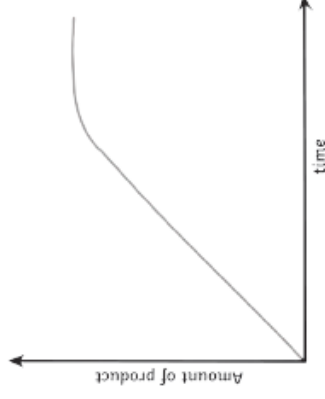
- Work out when the reaction finished;
- Work out how much product formed;
- Divide by the time taken to finish.

The line goes flat at 70s and 80cm<sup>3</sup> of gas was produced.

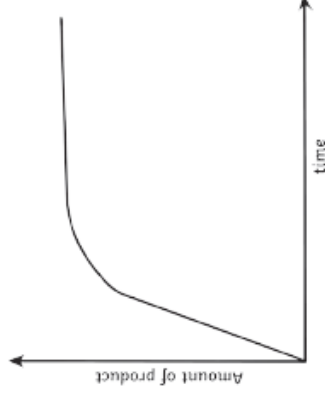
Mean rate = 80/70

Mean rate = 1.14 cm<sup>3</sup>/s

**f**  
Sketch a graph to show a slow reaction.



Sketch a graph to show a quick reaction.



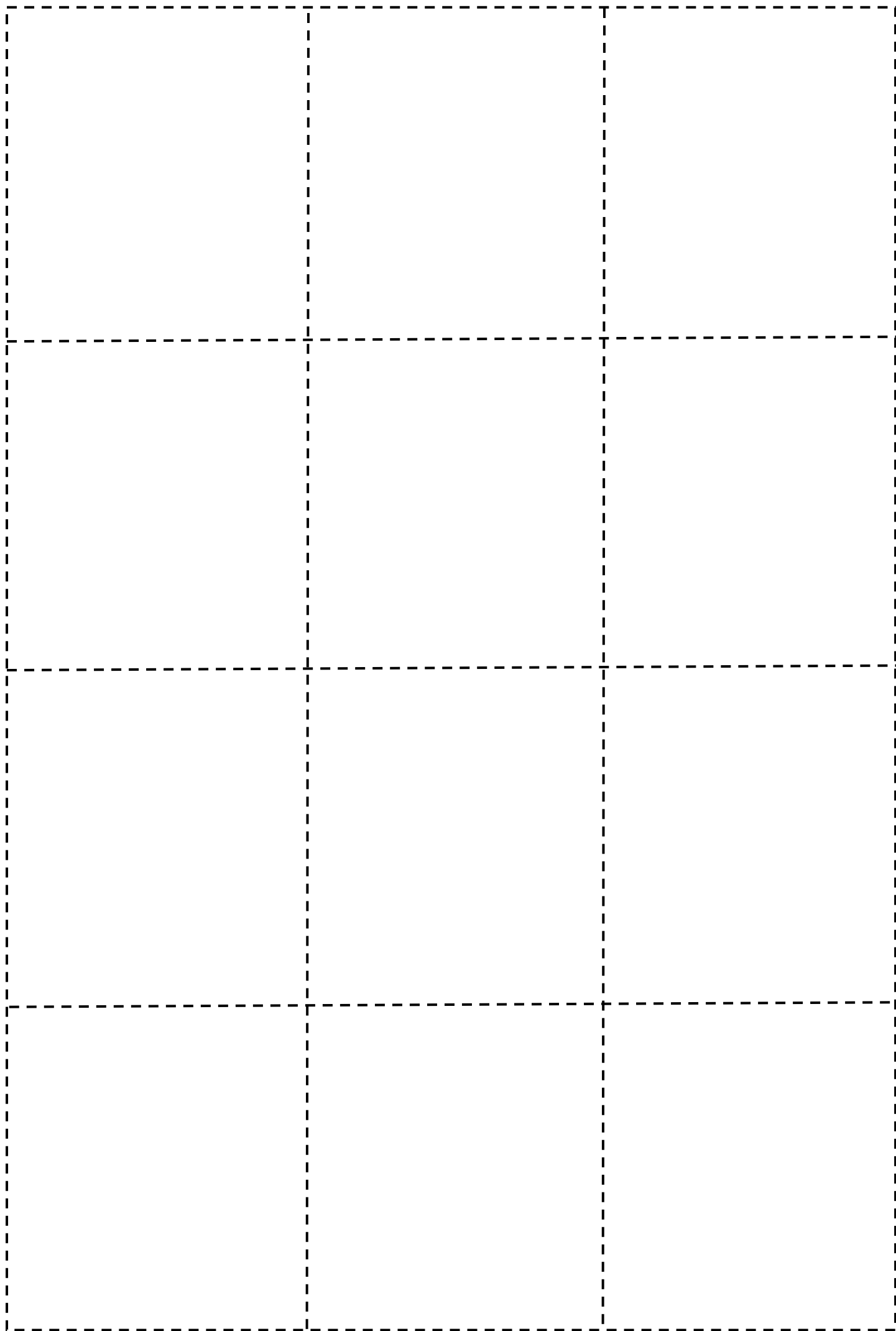
**g**  
Find the mean rate of reaction between these 2 points:

At 30s, 20cm<sup>3</sup> of product had been produced and at 60s, 75cm<sup>3</sup> had been produced.

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

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

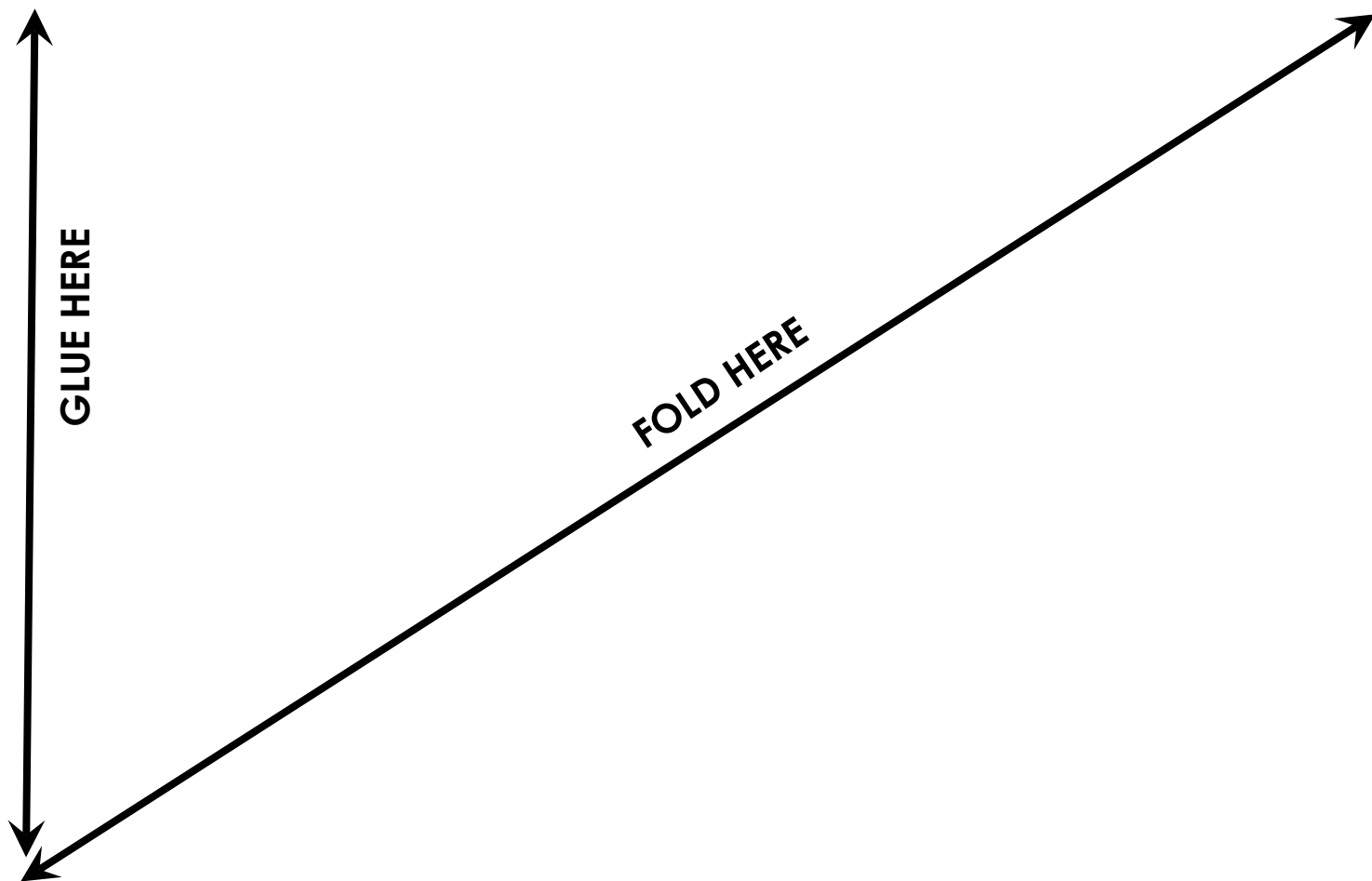
$$\text{Mean rate} = 55/30 = 1.8 \text{ cm}^3/\text{s}$$





# Topic 6: Rate of Chemical Change

## Question Card Storage

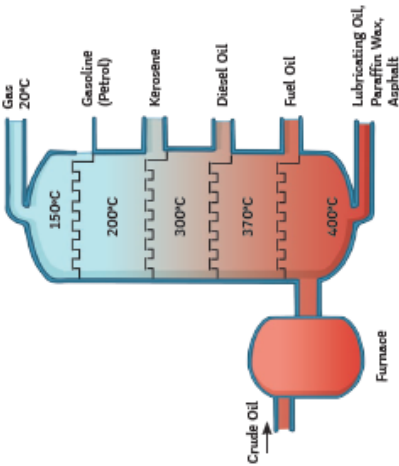




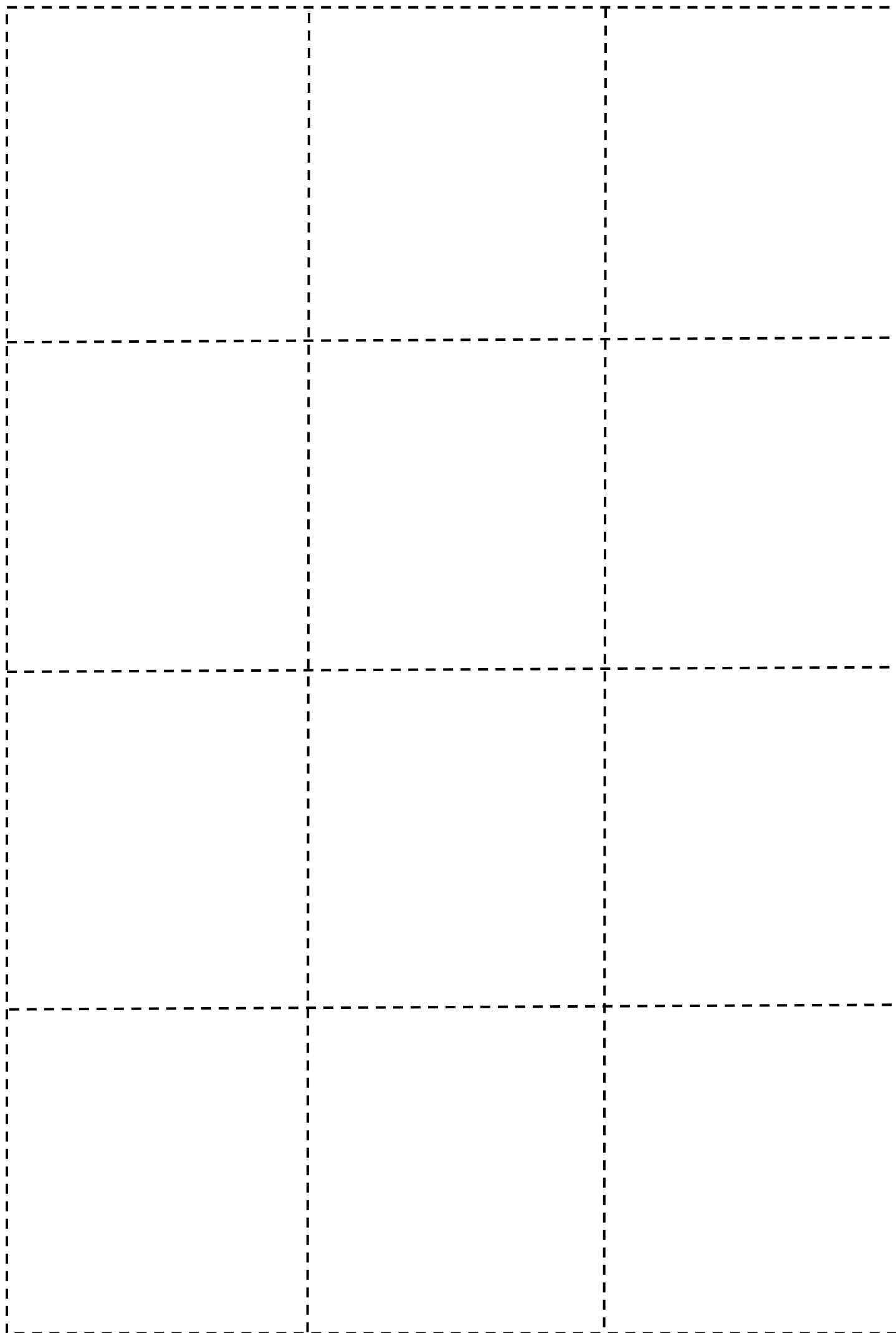


# Topic 7: Organic Chemistry

(1)

<p>a</p> <p>What is crude oil made up of? Different length hydrocarbons.</p> <p>List four alkanes. methane, ethane, propane, butane</p> <p>Draw the following alkanes: <math>C_2H_6</math> <math>C_4H_{10}</math></p> <div style="text-align: center;"> <math display="block">  \begin{array}{ccccccc}  &amp; H &amp; &amp; H &amp; &amp; H &amp; &amp; H \\  &amp;   &amp; &amp;   &amp; &amp;   &amp; &amp;   \\  H &amp; - C &amp; - &amp; C &amp; - &amp; H &amp; &amp; H \\  &amp;   &amp; &amp;   &amp; &amp;   &amp; &amp;   \\  &amp; H &amp; &amp; H &amp; &amp; H &amp; &amp; H  \end{array}  </math> </div> <p>What is the formula for alkanes? <math>C_n + H_{2n+2}</math></p>	<p>d</p> <p>Describe the process of fractional distillation. Use the diagram and keywords to help.</p>  <p>Keywords: mixture, hydrocarbons, evaporated, fractionating column, condense</p> <p>Crude oil is a mixture of hydrocarbons and they are heated until they form a gas.</p> <p>They all have different boiling points so separate out at different temperatures.</p> <p>Long chain hydrocarbons have high boiling points, short chain molecules have low boiling points.</p>	<p>g</p> <p>How does the length of the hydrocarbon affect the viscosity? Choose one answer.</p> <p>a. more viscous b. less viscous c. stays the same</p>
<p>b</p> <p>Describe how crude oil is made.</p> <p>Keywords: fossil fuel, rock, long time, plankton</p> <p>From the remains of dead plankton and other animals and plants buried in sand and mud over long periods of time.</p> <p>What are the uses of crude oil?</p> <p>Fuel for transport e.g. petrol and diesel.</p> <p>Used to make other compounds such as polymers, lubricants, solvents, detergents.</p>	<p>i</p> <p>What are the two methods of cracking? Describe how both methods are done.</p> <p>Steam – heated into a vapour, mixed with steam, heated at very high temperature.</p> <p>Catalytic – heated into a gas, passed over aluminium oxide catalyst, molecules split.</p>	<p>h</p> <p>Cracking is the breaking down of large chain hydrocarbons into shorter chains.</p> <p>It produces alkenes that have a double bond.</p> <p>Draw a diagram of an alkene.</p> <div style="text-align: center;"> <math display="block">  \begin{array}{ccccc}  &amp; H &amp; &amp; &amp; H \\  &amp;   &amp; &amp; &amp;   \\  H &amp; - C &amp; = &amp; C &amp; - H \\  &amp;   &amp; &amp; &amp;   \\  &amp; H &amp; &amp; &amp; H  \end{array}  </math> </div> <p>What is the formula for alkenes? <math>C_nH_{2n}</math></p>
<p>c</p> <p>Complete the combustion equation.</p> <p>hydrocarbon + oxygen → carbon dioxide + water</p> <p>Complete the balanced symbol equation.</p> $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$	<p>e</p> <p>How does the length of the hydrocarbon affect the boiling point?</p> <p>The longer the hydrocarbon the higher the boiling point.</p> <p>Delete the wrong answer.</p>	<p>f</p> <p>What is bromine water a test for? Choose the correct answer.</p> <p>a. alkane b. alkene</p> <p>What colour does it go? colourless</p>

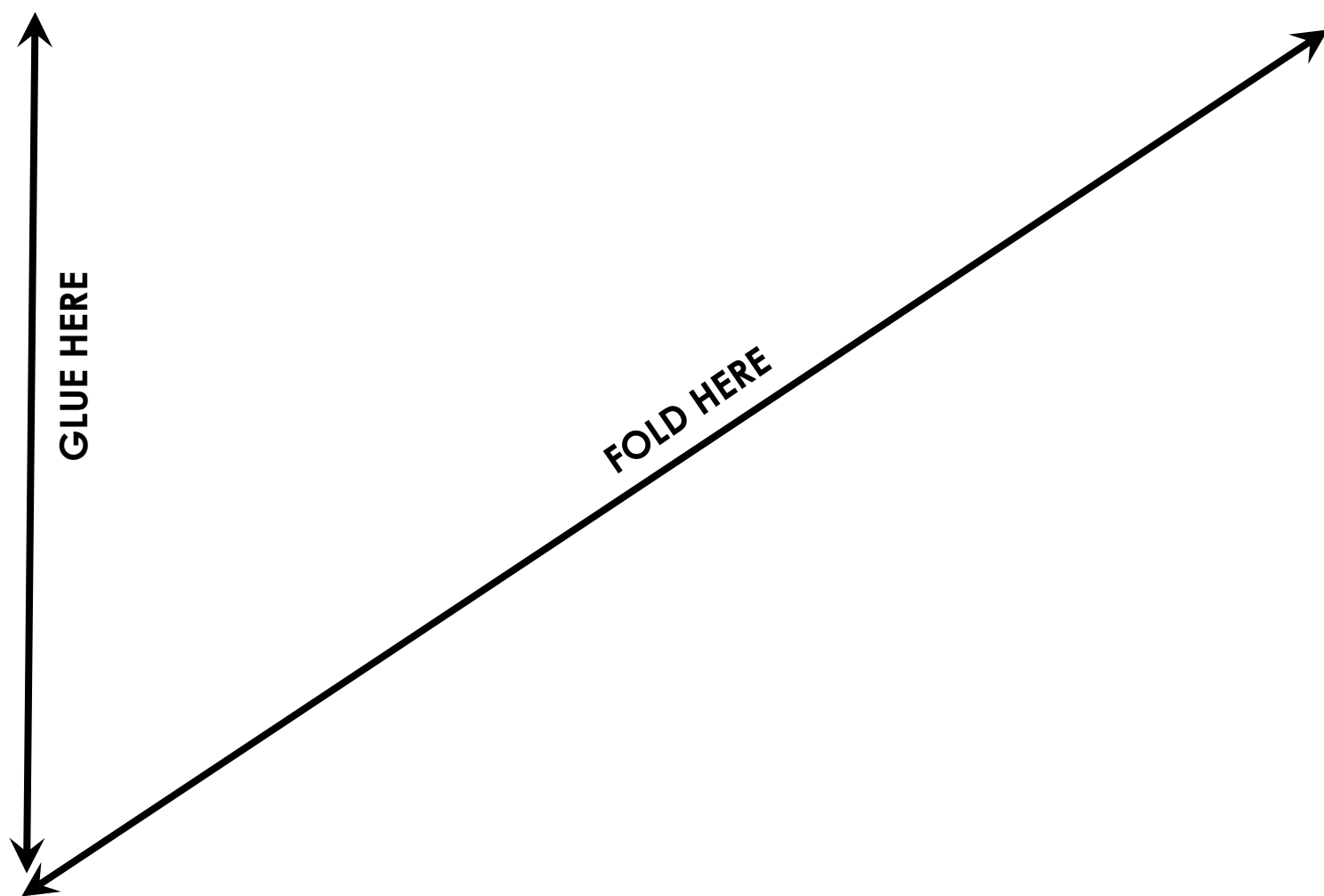






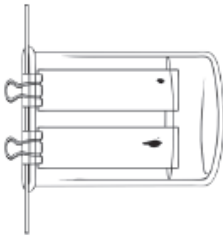
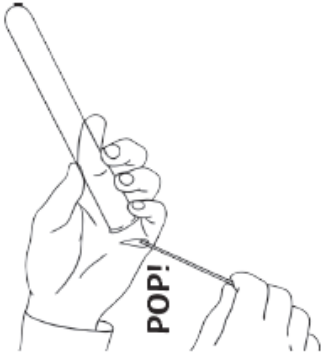
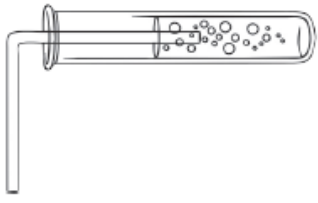
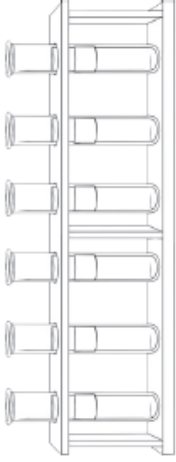
# Topic 7: Organic Chemistry

## Question Card Storage



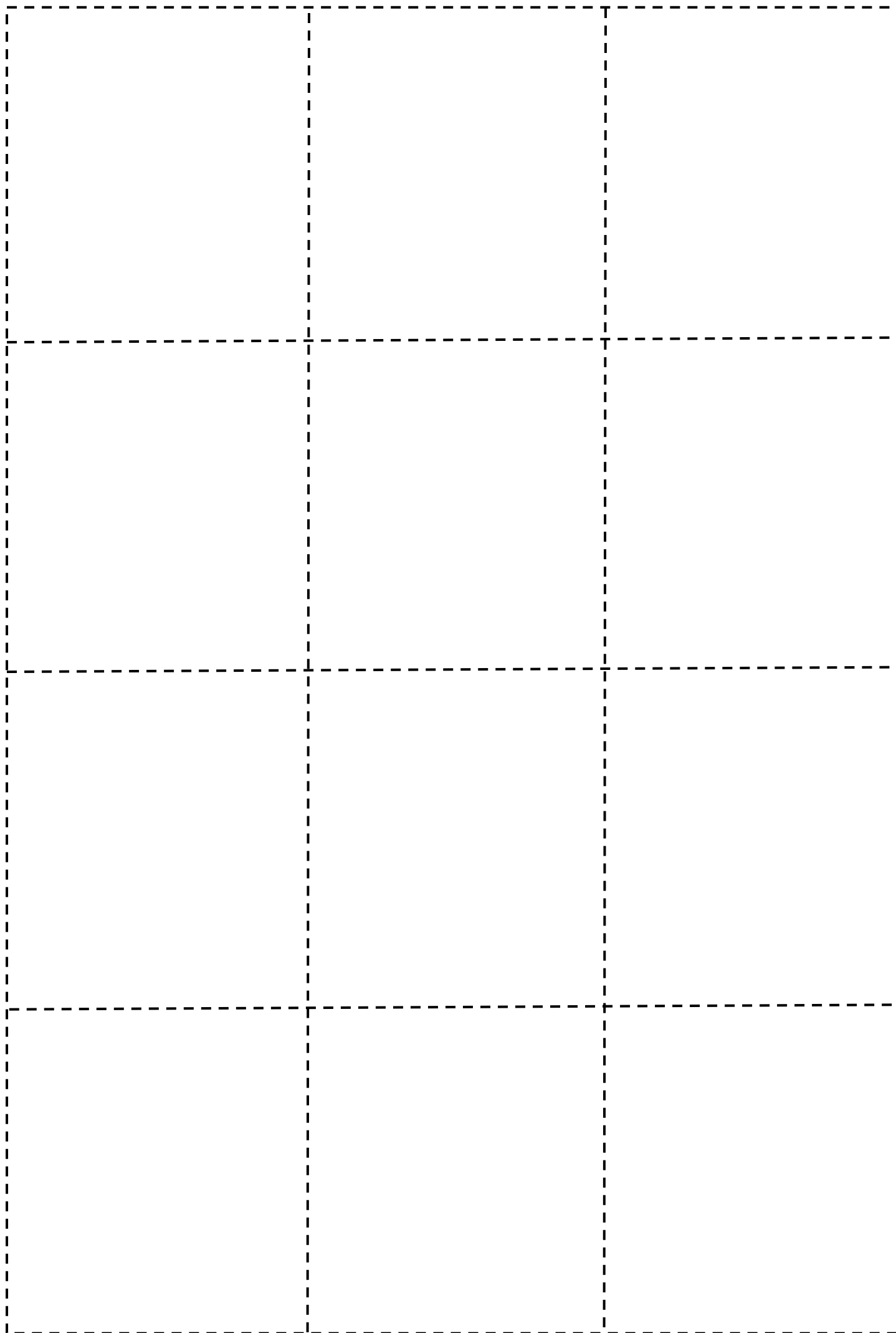


# Topic 8: Chemical Analysis

<p><b>a</b></p> <p>Define a pure substance.  <b>When nothing has been added to a substance.</b>          How can you distinguish a pure substance from an impure substance?  <b>The melting and boiling points of substances allows you to distinguish one substance from another. e.g. pure water boils at 100°C.</b>          What will happen to the above if there are impurities in the sample?  <b>They will lower the melting point.</b>  <b>They will increase the boiling point.</b></p>	<p><b>c</b></p> <p>What does chromatography separate?  <b>It separates 2 or more soluble substances in a mixture.</b></p>  <p>Describe how the process works. Use the diagram to help.  <b>The solvent moves up the paper. As it moves, it takes the mixture with it.</b>  <b>The more soluble the substance, the farther it moves up the paper.</b>  <b>Some are not as soluble so do not travel as far. They separate into different spots.</b>          Complete the word equation for calculating the R<sub>f</sub> value.  <math display="block">R_f = \frac{\text{distance moved by substance (B)}}{\text{distance moved by solvent (A)}}</math>          How does the R<sub>f</sub> value allow you to identify a substance?  <b>Each solvent has a different R<sub>f</sub> value.</b></p>	<p><b>f</b></p> <p>What is the R<sub>f</sub> value of the following chromatogram?          The distance moved by substance B is 30mm and the distance moved by solvent A is 52mm.</p> $R_f = \frac{B}{A}$ $R_f = \frac{30}{52} = 0.58$	<p><b>i</b></p>  <p>What gas does this experiment test for?  <b>It is the test for hydrogen gas.</b></p>	<p><b>b</b></p> <p>What is a formulation?  <b>Useful mixtures that have a particular use.</b>          Give some everyday examples of where formulations are used.  <b>paint, fertilisers, cleaning products, fuels, cosmetics, nail polish, perfume, medicine, pesticides, inks.</b></p>	<p><b>g</b></p> <p>What are the 2 phases of chromatography?  <b>Mobile phase. Describe this phase.</b>  <b>Where the molecules can move.</b>  <b>Stationary phase. Describe this phase.</b>  <b>Where the molecules can not move.</b></p>	<p><b>h</b></p> <p>Describe the test for oxygen.  <b>If a glowing splint is put into a test tube filled with oxygen, the splint will relight.</b></p>	<p><b>j</b></p>  <p>What gas does this experiment test for?  <b>It is the test for carbon dioxide.</b></p>	<p>What colour does the limewater go if the gas is present?  <b>Cloudy white.</b></p>	<p><b>e</b></p>  <p>What colour does litmus go if chlorine is present?  <b>It turns white.</b></p>	<p>I understand the following topic...</p> <p>I need to work on the following topic...</p>
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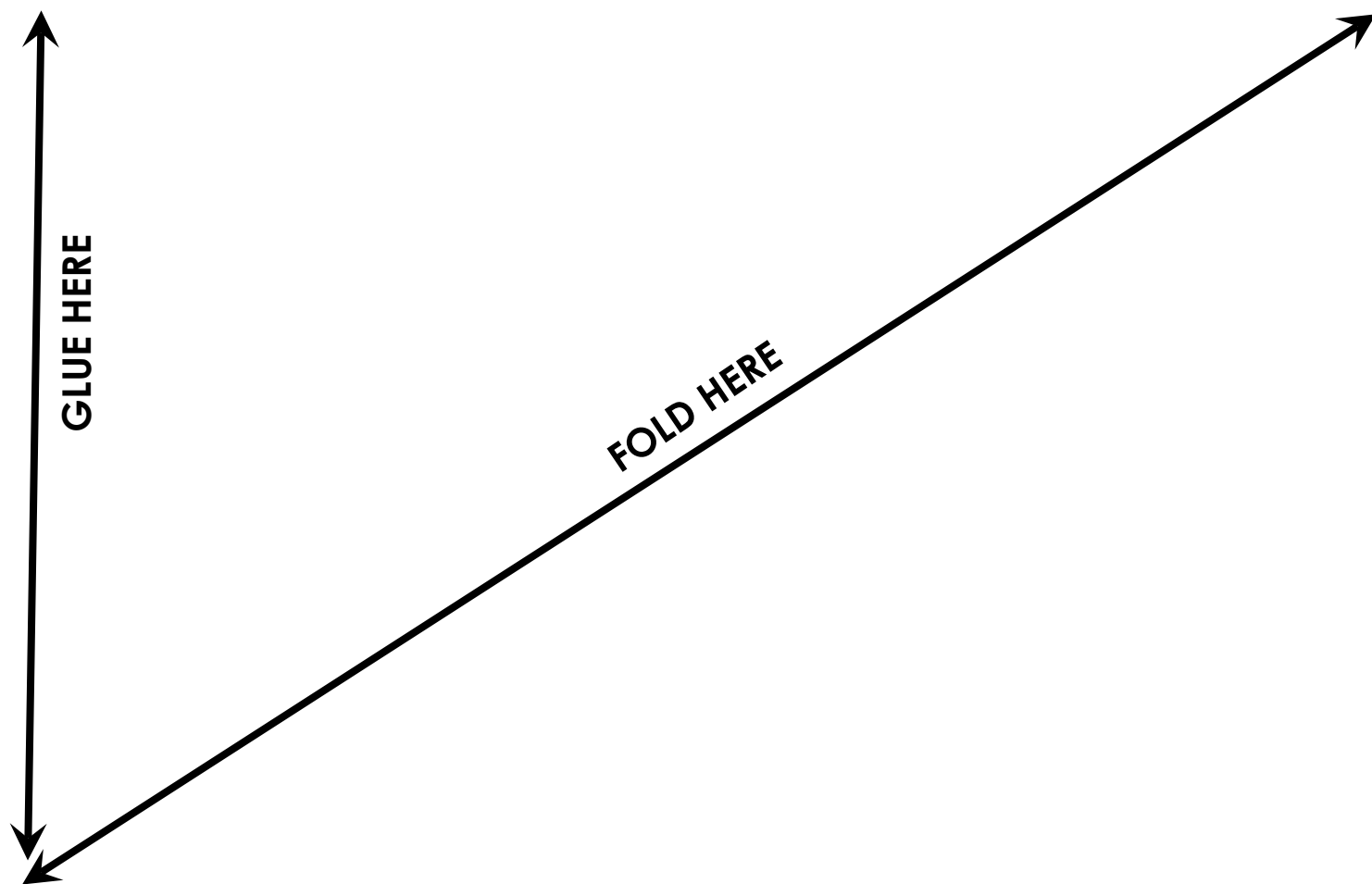











# Topic 8 Chemical Analysis

## Question Card Storage

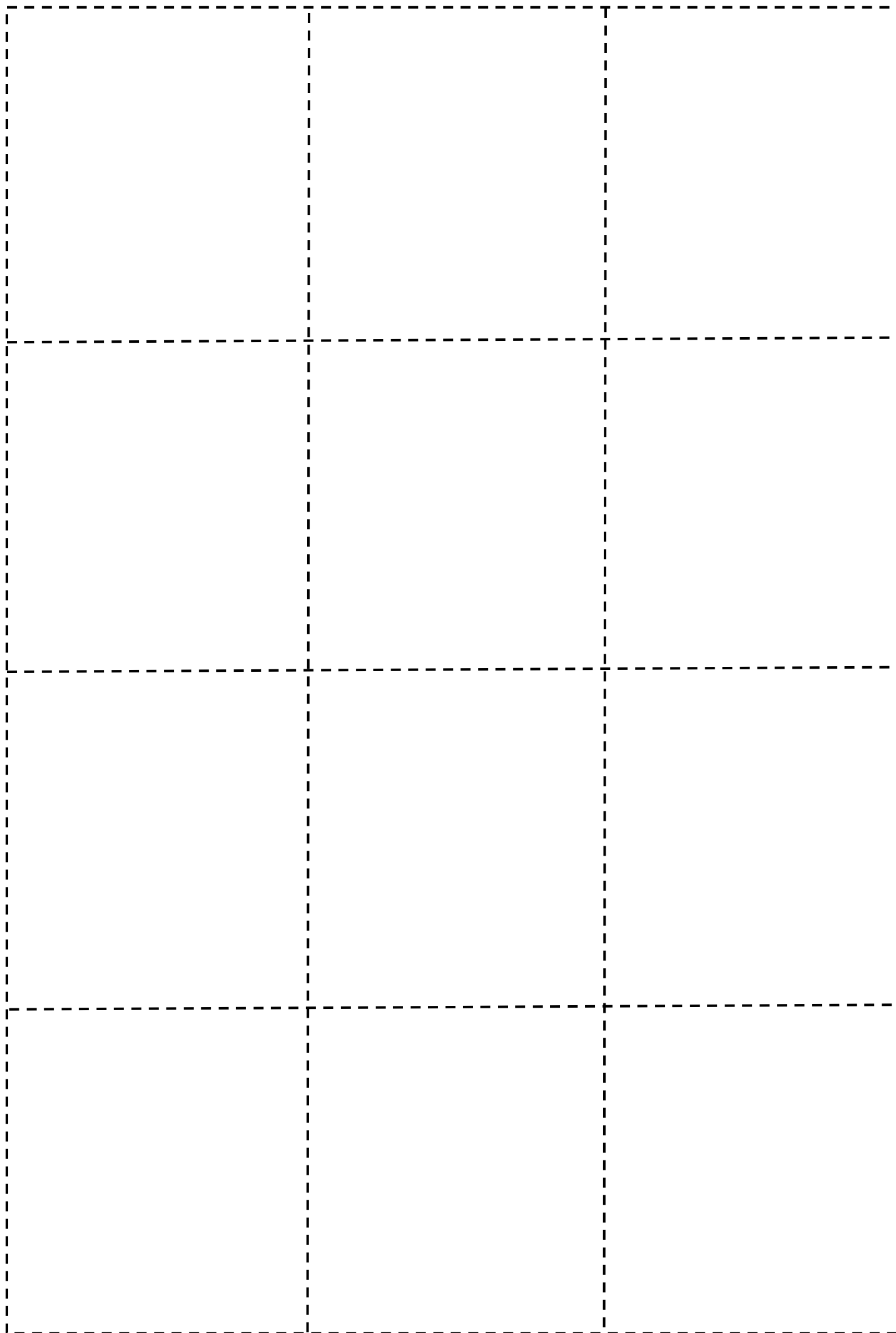




# Topic 9: Chemistry of the Atmosphere

<p><b>a</b></p>  <p>Billions of years ago, what was the surface of the Earth covered in? <b>volcanoes</b></p> <p>What gas made up most of the Earth's early atmosphere? Circle one of the following.</p> <p>oxygen      <b>carbon dioxide</b>      nitrogen      helium ammonia      methane      water vapour</p>	<p><b>e</b></p> <p>Name two other gases that are produced from burning fossil fuels.</p> <ol style="list-style-type: none"> <li>1. sulphur dioxide</li> <li>2. nitrogen oxides</li> </ol> <p>What problems can they cause? <b>Acid rain, damage to buildings, kills animals and plants and causes respiratory problems.</b></p>	<p><b>h</b></p> <p>What is a greenhouse gas? <b>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. Another example could be methane.</b></p> <p>How do greenhouse gases work? <b>They stop heat escaping from Earth into space (they absorb it), warming the Earth's atmosphere up.</b></p>	<p><b>i</b></p> <p>Scientists use the term carbon footprint. Define what this term means. Clue: CO<sub>2</sub></p> <p><b>The amount of greenhouse gases released over the full life cycle of something.</b></p>						
<p><b>b</b></p> <p>How was carbon dioxide removed from the atmosphere? <b>Dissolved into the oceans.</b></p> <p>What evolved to carry out photosynthesis? <b>Green plants and algae.</b></p> 	<p><b>f</b></p> <p>How many billions of years ago did algae evolve? Choose the correct answer.</p> <ol style="list-style-type: none"> <li>a. 1.0</li> <li>b. <b>2.7</b></li> <li>c. 5.6</li> <li>d. 6.4</li> </ol>	<p><b>i</b></p> <p>Why is carbon dioxide linked to climate change? Clue: think about the Earth's average temperature.</p>  <p><b>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.</b></p>	<p><b>n</b></p> <p>What is the biggest reason for governments not lowering their carbon footprint? <b>Economic reasons.</b></p> 						
<p><b>c</b></p> <p>Match up the proportions of gases with the percentage for today's atmosphere.</p> <table border="1"> <tbody> <tr> <td>nitrogen</td> <td>less than 1%</td> </tr> <tr> <td>oxygen</td> <td>80%</td> </tr> <tr> <td>other gases</td> <td>20%</td> </tr> </tbody> </table>	nitrogen	less than 1%	oxygen	80%	other gases	20%	<p><b>g</b></p> <p>Complete the equation for photosynthesis. carbon dioxide + water → glucose + oxygen</p> $6\text{CO}_2 + 6\text{H}_2\text{O} \longrightarrow 6\text{O}_2 + \text{C}_6\text{H}_{12}\text{O}_6$ <p>Why is this equation so important for the evolution of the atmosphere? <b>This built up the amount of oxygen in the atmosphere, and it also removes carbon dioxide.</b></p> <p>What could then evolve? <b>This meant that oxygen dependant lifeforms could then evolve.</b></p>	<p><b>j</b></p> <p>Why is climate change such a problem? What are the consequences of it? Clue: think about the weather and the polar ice caps.</p>  <p><b>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.</b></p>	<p><b>o</b></p> <p>Complete combustion is... <b>plenty of oxygen available and all the fuel burns.</b></p> <p>Incomplete combustion is... <b>not enough oxygen available and some of the fuel does not burn.</b></p> <p>During incomplete combustion, what other things are released into the atmosphere?</p> <ol style="list-style-type: none"> <li>1. soot</li> <li>2. carbon monoxide</li> <li>3. unburnt fuel</li> </ol>
nitrogen	less than 1%								
oxygen	80%								
other gases	20%								
<p><b>d</b></p> <p>Why is it difficult to be sure about the evolution of the atmosphere? Clue: think about the length of time. <b>The atmosphere started to evolve around 4.6 billion years ago, so there is a lack of evidence.</b></p>	<p><b>k</b></p> <p>Why is releasing particulates a problem? <b>If breathed in they can cause lung damage and breathing problems. Also, they can contribute to global dimming.</b></p> <p>What can carbon monoxide do to the body? <b>Stops the blood carrying oxygen around the body, a lack of oxygen could kill.</b></p>								



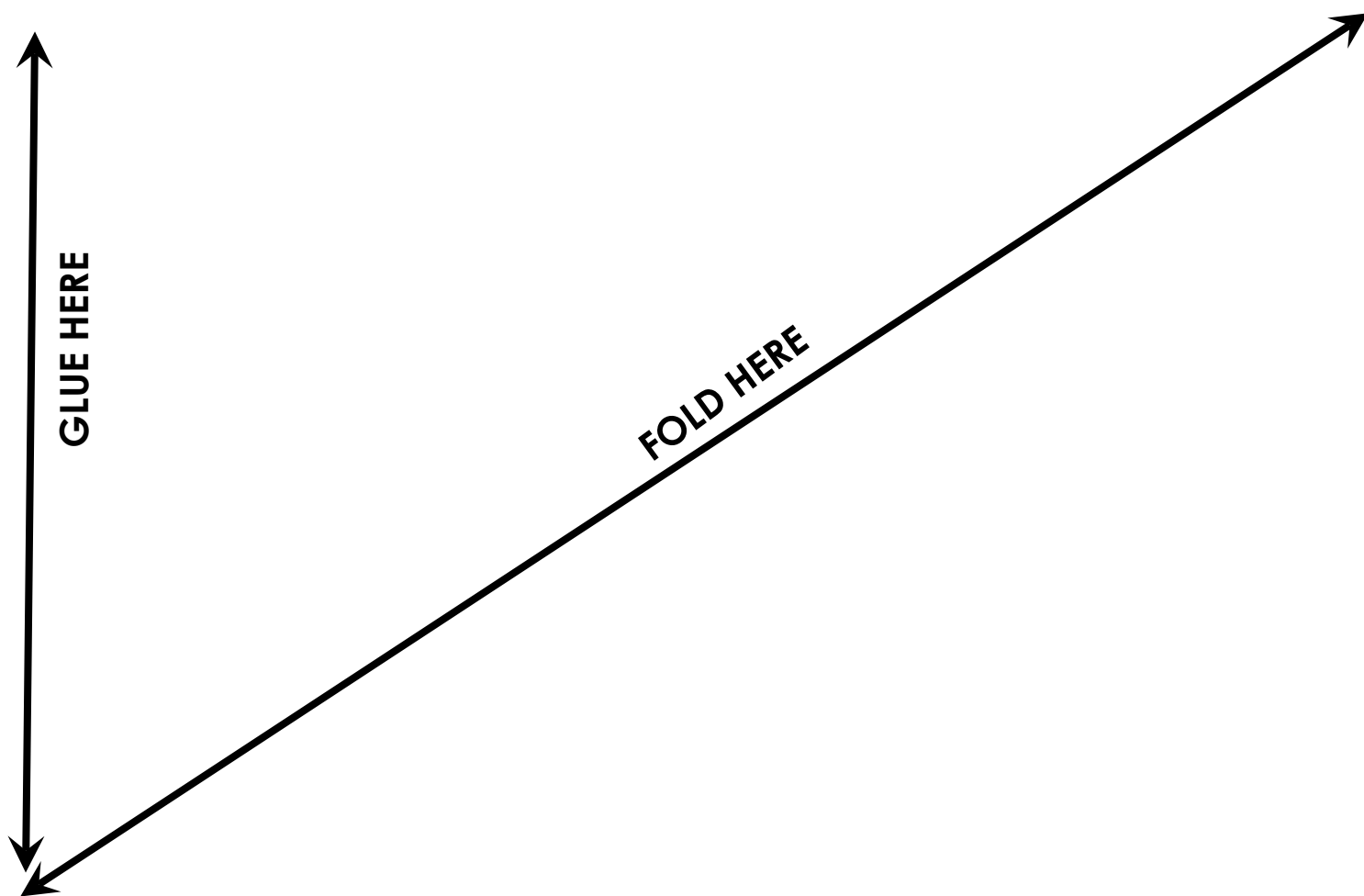






# Topic 9: Chemistry of the Atmosphere

## Question Card Storage





# Topic 10: Using Resources

**a**

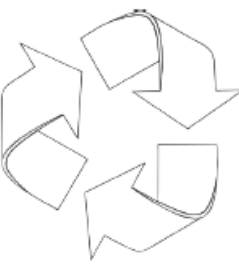
Natural resources form by themselves.  
Name the three places they come from.

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.

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

What does it mean if a company shows bias?  
They say their product is better than it perhaps is.

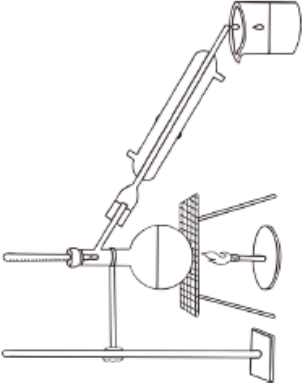
**e**

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

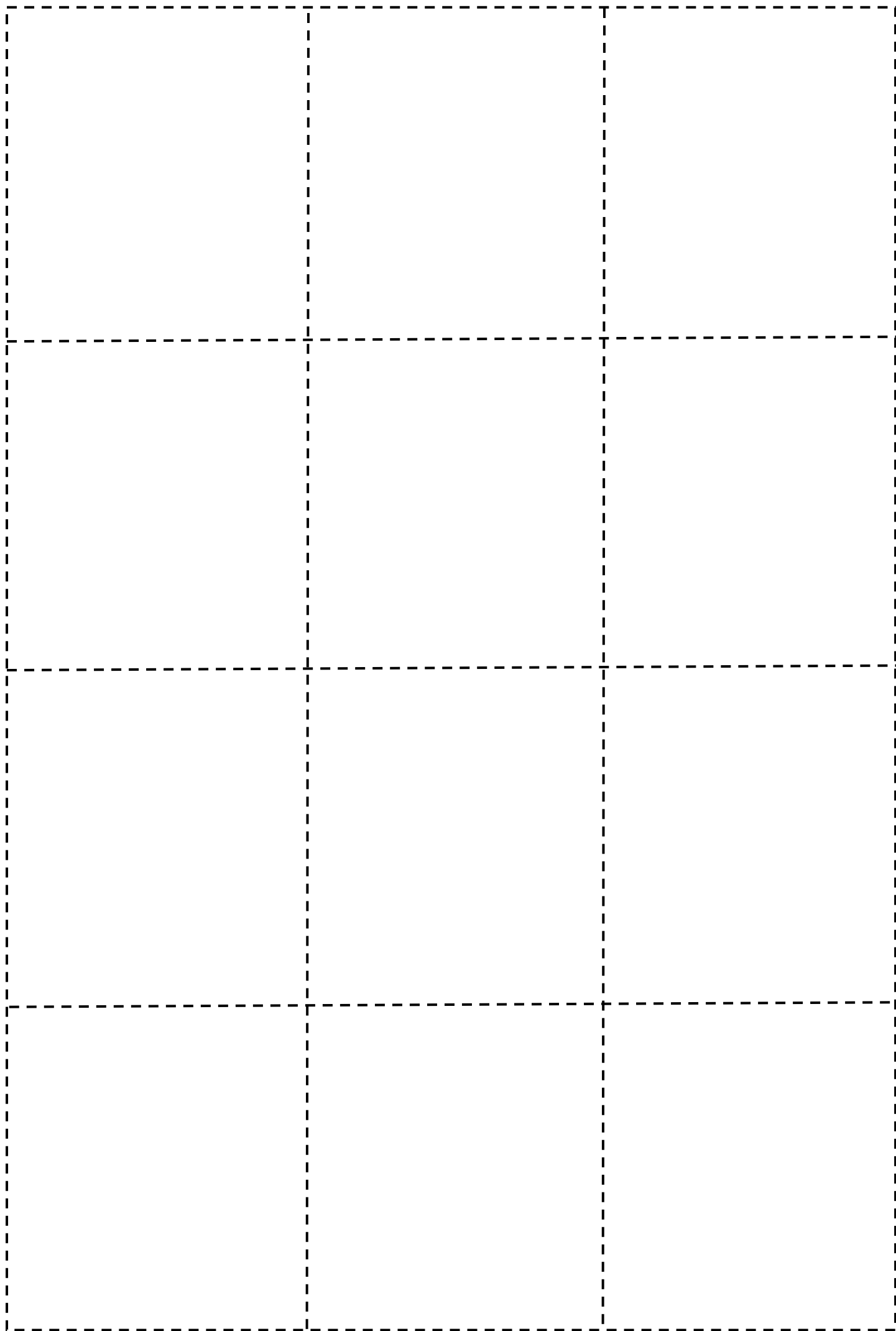
**h**

Potable water is water you can drink.  
For water to be safe to drink, it must...

1. not have high levels of \_\_\_\_\_;
2. a pH between \_\_\_\_\_ and \_\_\_\_\_;
3. not have any \_\_\_\_\_.

2

<p><b>a</b></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>What water tends to dry up the quickest, surface or ground water? surface water</p>	<p><b>b</b></p> <p>Where does waste water come from? Give four examples.</p> <ol style="list-style-type: none"> <li>1. bath/toilet/shower</li> <li>2. washing-up</li> <li>3. farming</li> <li>4. industrial processes</li> </ol>	<p><b>d</b></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"> <li>1. Screening and grit removal.</li> <li>2. Sedimentation to produce sewage sludge and effluent.</li> <li>3. Anaerobic digestion of sewage sludge.</li> <li>4. Aerobic biological treatment of effluent.</li> </ol>	<p><b>f</b></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"> <li>1. <b>Filtration</b> Water is passed through a wire mesh and filter beds to filter out any solid parts.</li> <li>2. <b>Sterilisation</b> Water is sterilised to kill bacteria or microbes by bubbling chlorine gas through it and using UV or ozone gas.</li> </ol>									
<p><b>c</b></p> <p>Evaluate the pros and cons of using coal compared to a renewable energy.</p> <table border="1"> <thead> <tr> <th></th> <th>Pros</th> <th>Cons</th> </tr> </thead> <tbody> <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> </tbody> </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><b>e</b></p> <p>Waste water may contain toxic substances and need extra treatment.</p> <p>Three types of treatment include...</p> <ol style="list-style-type: none"> <li>1. adding chemicals;</li> <li>2. UV radiation;</li> <li>3. use of membranes.</li> </ol>	<p><b>g</b></p> <p>What is sustainable development? <b>Developing products for the now, but also thinking about the future.</b></p> <p>Why can some processes be unsustainable? <b>Some resources are running out and are non-renewable.</b></p> <p>How can we be more sustainable? <b>Use more renewable resources and reduce, reuse and recycle.</b></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

