Knowledge Revision

AQA Entry Level Certificate in Science

Chemistry Topic 4 – Reactions and The Earth

You **need to master** and be able to recall the facts so that you can make progress and complete the external assignments to the best of your ability.

You can use Google or revision guides to help you. You can email me any questions or use Zoom if you'd like some immediate face to face help.

You will need to use Zoom when we complete the assignments.

Email: jdixon@desc.herts.sch.uk

Zoom:

- Download 'Zoom' app
- Sign up for an account
- Select 'Meet & Chat' on the bottom bar
- Select 'Join' – blue + symbol at the top of the screen
- Enter meeting ID: **960 412 5303**

Name …….

C4.1 Acids and metal reactions

KEY LEARNING POINTS – Assess as you go!

	R	A	G
Acids react with metals to produce a salt and hydrogen gas. Acid + Metal → Salt + Hydrogen			
When hydrochloric acid is used, chloride salts are made, e.g. sodium chloride.			
When sulfuric acid is used, sulfate salts are made, e.g. copper sulfate			
Test for hydrogen using a lit splint. You will get a squeaky pop.			

Progression Questions

1. ***Complete*** these reactions:
    a. Magnesium + Hydrochloric acid → Magnesium chloride + _____
    b. Zinc + Hydrochloric acid → _____ + Hydrogen
    c. Iron + Sulfuric acid → _____ + _____
    d. Magnesium + _____ acid → Magnesium sulfate + Hydrogen

2. ***Describe*** how to carry out a test for the presence of hydrogen gas. Include notes about how to do this safely.

CORE

- You can test for acids and alkalis using Universal Indicator – this solution changes colour depending on the solution.

  Complete the indicator colour chart below:

Strong acid → Weak acid Weak alkali → Strong alkali

							Neutral							

- ***Add*** the numbers of the pH scale.

EXTEND

Describe how you could carry out an investigation to find out if magnesium, iron and zinc all produce the same volume of hydrogen gas when they react with sulfuric acid.

You should include:

- a method with step-by-step instructions.
- what you are going to measure and how you are going to measure it.
- How you will compare your results.

You should be able to give definitions for the following words:

Key word	Definition
Acid	
Hydrochloric acid	
Hydrogen	
Reaction	
Salts	
Sulfuric acid	

C4.2 Neutralisation

KEY LEARNING POINTS – Assess as you go!

	R	A	G
When an acid is added to an alkali a reaction takes place to produce a salt and water, both of which are neutral. For this reason, this is called a neutralisation reaction. Acid + Alkali → Salt + Water			
A base is an insoluble metal oxide. When dissolved in water it forms an alkali.			
When an acid and a carbonate react neutralisation also occurs. Acid + Metal carbonate → Salt + Water + Carbon dioxide			
When carbon dioxide gas is bubbled through limewater it turns cloudy.			
When water evaporates from a salt solution, salt crystals are left behind – this is the process of crystallisation.			

Progression Questions

1. Complete these general reactions:
   a. Acid + Alkali → _____ + _____
   b. Acid + Base → _____ + _____
2. ***Complete*** these equations for the reactions between acids and alkalis:
   a. Hydrochloric acid + Sodium hydroxide → _____ + _____
   b. Sulfuric acid + Copper hydroxide → _____ + _____
3. ***Complete*** these equations for the reactions between acids and metals carbonates:
   a. Hydrochloric acid → _____ + _____
      + Magnesium carbonate + _____
   b. Sulfuric acid → _____ + _____
      + Copper carbonate + _____
4. ***Describe*** how to safely carry out a test for carbon dioxide gas and the result you would expect.

CORE

1. What is the difference between a base and an alkali?
2. What happens when a salt solution crystallises?
3. What change of state takes place during evaporation?

EXTEND

Describe an experiment about how to investigate the rate of evaporation on the size of salt crystals produced from a reaction between an acid and an alkali. Make a prediction - do you think slow or quick evaporation will create the larger crystals?

You should be able to give definitions for the following words:

Key word	Definition
Acid	
Alkali	
Base	
Carbon dioxide	
Carbonate	
Crystallised	
Limewater	
Neutralise	

C4.3 Energy and rate of reaction

KEY LEARNING POINTS – Assess as you go!

	R	A	G
Some chemical reactions give out energy usually in the form of heat and the temperature of the surroundings goes up. These reactions include combustion, oxidation and neutralisation.			
Combustion is the scientific term for burning.			
In an oxidation reaction, oxygen is taken in.			
Neutralisation occurs when the product of a reaction is neutral, pH 7, e.g. when an acid and alkali or base react.			
Other chemical reactions take in energy during a reaction and the temperature does down.			

Progression Questions

1. What apparatus could you use to determine energy changes that happen in a chemical reaction?
2. Write down a reaction that gives out heat that isn't combustion (burning)? It does not have to be a reaction you have seen in the lab!
3. Write down an everyday reaction / situation that takes in heat and makes the surroundings colder?

CORE

Analyse this data and answer the questions.

Reaction	**Temperature at start (°C)**	**Temperature at end (°C)**	**Temperature change (°C)**
sodium hydroxide + hydrochloric acid	20	23	
ammonium chloride + water	22	18	
cooling pack	22	13	

CORE continued

1. ***Complete the table*** by adding the temperature change.
2. In which reaction is the temperature change greatest?
3. In which reaction is energy lost to the surroundings?
4. What impact does this have on the surroundings?

EXTEND

Some reactions take in heat from the surroundings – this happens when you mix ammonium chloride with water.

Design an experiment to investigate the temperature decrease in this reaction. What variables could you change to increase the temperature change?

You should be able to give definitions for the following words:

Key word	Definition
Combustion	
Neutralisation	
Oxidation	

C4.4 Rates of reaction

KEY LEARNING POINTS – Assess as you go!

	R	A	G
The rate of a reaction is measured by how quickly a reactant is used OR how quickly a product is made.			
The rate of a reaction is increased when: • Temperature increases • Concentration of reactants increases • Surface area of reactants increases • A suitable catalyst is added			

Progression Questions

1. ***Suggest*** four things you could time in a chemcial reaction to measure its rate.
2. Why is it difficult to time some reactions, e.g. rusting and explosions?
3. What is a catalyst?
4. Calcium carbonate reacts with hydrochloric acid to produce calcium chloride, water and carbon dioxide.

   Outline three experiments to investigate the difference made when you compare:

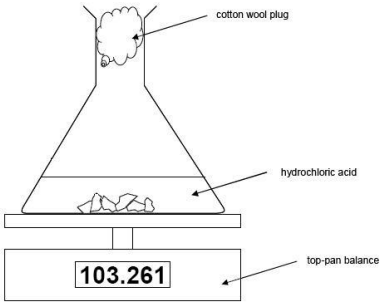
   - Warm and cold acid
   - Lumps of calcium carbonate to powdered calcium carbonate
   - Strong and weak acid

   What will you measure so that you can make a conclusion about the rate of reaction?

   Predict the outcomes for each experiment.

CORE

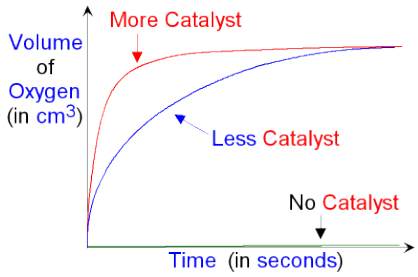
The following reaction takes place in a conical flask placed on a balance:



a. During the reaction, the mass stayed the same. Why?
b. ***Describe*** how you could adapt this experiment to measure the rate of the reaction.

EXTEND

The graph shows the volume of oxygen produced in a reaction with different amounts of catalyst added:



a. What is the effect of adding catalyst on the volume of oxygen produced?
b. Does more catalyst always produce a greater rate of reaction that less catalyst?
c. What are the advantages of using a catalyst in this reaction?

You should be able to give definitions for the following words:

Key word	Definition
Catalyst	
Explosion	
Rusting	

C4.5 Changes in Earth's atmosphere

KEY LEARNING POINTS – Assess as you go!

	R	A	G
Earth is surrounded by a layer of air called the atmosphere, held in place by the force of gravity.			
The current Earth's atmosphere is very different to the atmosphere on Earth four billion years ago.			
The first atmosphere was created by volcanic activity; this produced lots of carbon dioxide and water vapour. The water vapour condensed to form oceans.			
About three billion years ago the first plants on the planet started to change the atmosphere. Plants take in carbon dioxide and release oxygen during photosynthesis.			
Photosynthesis is a chemical reaction carried out by plants: Carbon dioxide + Water → Glucose (sugar) + Oxygen			

Progression Questions

1. ***Complete the table to compare*** the first atmosphere to the modern atmosphere:

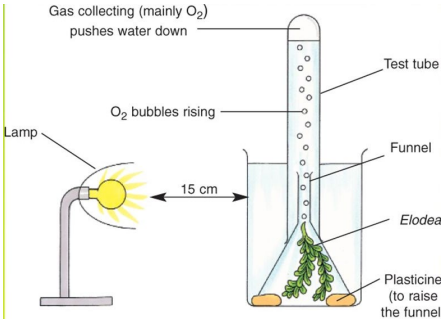
	Early atmosphere	***Modern atmosphere***
Nitrogen		78%
Oxygen	None	
Carbon dioxide	95%	
Water vapour		

2. If the atmosphere had not changed animal life could not exist on the planet. Explain why.
3. Why are plants essential to life on Earth?

CORE

1. The atmosphere contains a mixture of gases. What is a mixture?
2. How do green plants contribute to the gases in the atmosphere?

EXTEND



In this experiment a lamp shines on *Elodea* (pondweed). The plant is photosynthesising. ***Describe*** how you could use this experiment to help ***explain*** the differences plants made to the early atmosphere.

You should be able to give definitions for the following words:

Key word	Definition
Atmosphere	
Billion	
Photosynthesis	

C4.6 Current atmosphere

KEY LEARNING POINTS – Assess as you go!

	R	A	G
The level of carbon dioxide from the early atmosphere has decreased because it dissolved in oceans, formed carbonates (now in rocks) and fossil fuels.			
Plants and algae use carbon dioxide when they photosynthesise and produce oxygen.			
The modern atmosphere contains approximately 78% nitrogen, 21% oxygen, 0.04 % carbon dioxide and small amounts of water vapour and argon.			

Progression Questions

1. Why has the level of carbon dioxide in the early atmosphere decreased from approximately 95 % to 0.04 % in the modern atmosphere?
2. What part do plants play in regulating carbon dioxide and oxygen in the current atmosphere?
3. What do all living organisms need oxygen for?
4. How do you carry out a test for the presence of oxygen and what result do you expect?

CORE

Write the word equation for photosynthesis. ***Annotate*** the equation to show where the reactants come from and where the products go.

EXTEND

Planet Mars has a carbon dioxide rich atmosphere. The atmosphere is also very thin as gases escape due to the lower gravity. If humans want to live on Mars in the future ***suggest*** how we could create a breathable atmosphere.

You should be able to give definitions for the following words:

Key word	Definition
Carbonates	
Fossil fuels	
Photosynthesis	

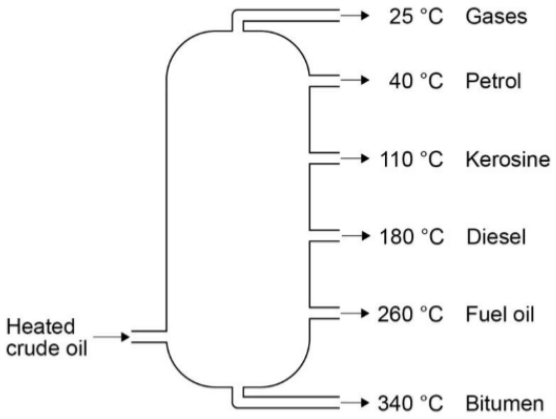
C4.7 Crude oil and fuels

KEY LEARNING POINTS – Assess as you go!

	R	A	G
Crude oil is a fossil fuel.			
Cruse oil is a mixture of hydrocarbon compounds: these contain only hydrogen and carbon.			
Crude oil is found underground in deposits, e.g. oilfields under Siberia and the North Sea.			
Compounds are extracted from crude oil using a technique called fractional distillation. These compounds include lubricating oil, bitumen, petrol, diesel and kerosene. This is done at an oil refinery.			

Progression Questions

The diagram shows a fractionating column used in the fractional distillation of crude oil:



(AQA Teachers Guide)

Use information from the diagram to help you answer these questions:

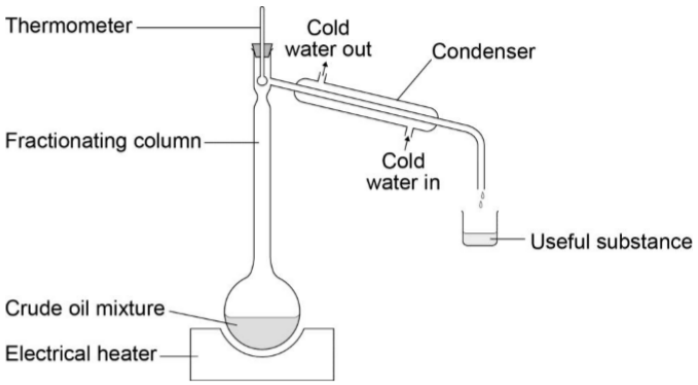
a. These fractions are hydrocarbons. Which elements do they contain?
b. What property is used to separate the compounds?
c. Which fraction is distilled first?
d. Annotate the column to show the patterns for increasing flammability and increasing viscosity (stickiness).

CORE

Crude oil is a fossil fuel that will run out – it is a non-renewable resource. ***Provide*** advice on how to reduce the amount of oil we use as a human population.

EXTEND

The diagram shows fractional distillation that you can carry out in a school laboratory:



(AQA Teachers Guide)

Describe and ***explain*** how it works. You must be clear about the changes of state that take place.

You should be able to give definitions for the following words:

Key word	Definition
Compound	
Crude oil	
Distillation	
Fuel	
Fraction	
Fractional distillation	
Mixture	
Oil refinery	
Oilfield	

C4.8 Burning fuels

KEY LEARNING POINTS – Assess as you go!

	R	A	G
When hydrocarbon fuels burn completely carbon dioxide and water are produced: Hydrocarbon + Oxygen → Carbon dioxide + Water			
When air is limited fuels only partially combust and produce carbon monoxide and sometimes soot.			
Coal contains impurities of sulphur and will produce sulphur dioxide when burnt.			
Burning fossil fuels can harm the environment, for example: • Acid rain from nitrogen oxides • Suffocation / death from carbon monoxide • Global dimming from solid particles • Global warming from greenhouse gases such as carbon dioxide and methane (more in C4.9)			

Progression Questions

1. Name the three things needed for combustion.
2. Why is carbon monoxide so dangerous?
3. Incomplete or partial combustion happens when fuels burn with a limited supply of oxygen. Complete the word equation for this reaction:

   Fuel + Limited oxygen → _____ + _____

4. What causes acid rain?

CORE

Plan an experiment to investigate the effect of acid rain on the growth of cress seeds.

How will you analyse your results to know the impact of acid rain?

EXTEND

1. ***Explain*** how burning fossil fuels is linked to gases in the atmosphere.
2. ***Describe*** the environmental impacts of burning fossil fuels.

You should be able to give definitions for the following words:

Key word	Definition
Burning	
Carbon monoxide	
Fossil fuels	
Global warning	
Greenhouse gases	
Soot	

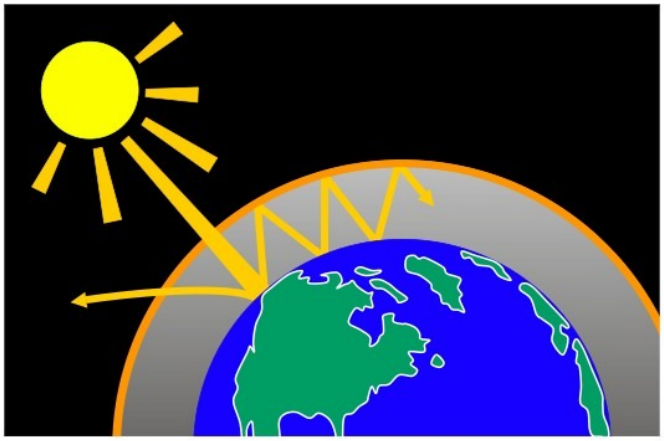
C4.9 Human influences on the atmosphere

KEY LEARNING POINTS – Assess as you go!

	R	A	G
Burning fossils fuels produces carbon dioxide and water vapour, both of which are greenhouse gases.			
Methane is another greenhouse gas. This is produced by cows and from landfills.			
Greenhouse gases cause the greenhouse effect and global warming – the average temperature of the Earth is increasing. This in turn leads to climate change with increased chances of flooding / droughts, increased sea levels, habitat changes and species extinction.			
Carbon dioxide is also released into the atmosphere when living organisms respire.			

Progression Questions

1. How has human activity increased greenhouse gases in the atmosphere?
2. ***Annotate*** the diagram below to describe the greenhouse effect:



CORE

Describe three pieces of evidence for climate change due to global warming.

EXTEND

Explain why replanting may be key to controlling global warming.

Explain why a meat-free diet might reduce global warming.

You should be able to give definitions for the following words:

Key word	Definition
Carbon dioxide	
Greenhouse gases	

C4.10 Water for drinking

KEY LEARNING POINTS – Assess as you go!

	R	A	G
Water is safe to drink if it has low levels of dissolved substance and microbes.			
Safe drinking water is made safe using processes that include filtration and sterilisation.			
Salty water can be desalinated (salt removed) to produce fresh water. This requires a large amount of energy.			

Progression Questions

1. At a sewage treatment works water goes through many stages to make sure that it is clean and safe for drinking. Complete the table describing the purpose of each stage:

Stage	***Purpose***
a. Screening	
b. Coarse filtering	
c. Fine filtering	
d. Sterilsing	

2. If fresh water is difficult ti find it is possible to distill salt water. What happens during distillation?

CORE

1. What needs to be removed from water to make it safe to drink?
2. ***Suggest*** how to produce a sample of clean water using a simple water filter. Would you be happy to drink this sample? Why?

EXTEND

Bottled water often makes claims about being mineral rich and cleaner than tap water. ***Plan*** a test or tests to challenge these ideas. Would you be able to detect a difference using school laboratory equipment?

You should be able to give definitions for the following words:

Key words	Definition
Distillation	
Filtering	
Microbes	
Sterilising	