



## KS4 Rates and Equilibrium

### KS4 Curriculum Intent:

This unit includes how to find out the rate of reaction, calculating the rate of reaction, factors affecting reaction rate in terms of collision theory, energy and reversible reactions including energy profiles, dynamic equilibrium and altering conditions.

### Sequence 1:

**Lesson 1: Rate of reaction:** To calculate the rate of a chemical reaction. To calculate the rate of a reaction at a specific time (H)

**Lesson 2: Collision theory and surface area** to investigate surface area and rate of reaction using different sizes of marble chips. To calculate the mean rate of reaction for each size used.

**Lesson 3 Required practical Part 1** To investigate concentration and rate of reaction.

**Lesson 4 Required practical Part 2** To investigate concentration and rate of reaction using production of gas

**Lesson 5: Effect of temperature** To investigate temperature and rate of reaction. To describe how increasing temperature affects the rate of reaction using collision theory

**Lesson 6: The effects of catalysts** to know how catalysts affect the rate of reaction to draw a reaction profile for catalysed reactions to investigate the action of catalysts in reactions.

**Assessment: low stakes testing. Homework (google form)**

### Sequence 2:

**Lesson 7 Reversible reactions** to be able to describe what a reversible reaction is how to represent it. To be able to explain how reversible reactions are exothermic in one direction and endothermic in the other. To draw a reaction profile for a reversible reaction. To be able to explain the term dynamic equilibrium.

**Lesson 8 Altering conditions (H)** To describe how changing the reaction conditions can change the amount of products and reactants in a reaction mixture at equilibrium.

To recognise the effects of changing conditions on a system at equilibrium can be predicted using Le Chatelier's Principle

**Lesson 9 Assessment**

**Lesson 10 Reflection and improvement**

**Assessment: Low stakes testing. Homework (google form) EOU exam.**

### Big picture

This unit has a number of opportunities for practical work, extended writing in response to exam style questions and the embedding of mathematic skills.

This unit builds on basic knowledge from KS3 whereby students are familiar with the particle model, signs of a reaction, how to speed up a reaction and what catalysts do,

The topic develops further by applying the particle model in the collision theory how catalyst affect activation energy including reaction profile diagrams, energy and reversible reactions, altering conditions and dynamic equilibrium.

### Developing Cultural Capital:

This unit provides opportunities for students to develop their self-knowledge, self-esteem and self-confidence through group and paired work and develop their knowledge of how scientists have shaped understanding of the world taking initiative on wide and environmental issues and establish ways they can help on an individual, local, national and global scale. They will also be able to relate science topics to career pathways such as in Medicine, Pharmacy, Beauty therapists and Chemical engineering and Energy industries.

### Reinforcement and retrieval practice

- All learning sequences are consolidated through a homework, which is reviewed in the next sequence to Space Learning.
- Every third lesson 'Memory joggers' are formally completed as the Do Now, these will be evidenced in the students books.
- AfL is used regularly to evidence gaps in knowledge and inform planning so that learning is consolidated before being moved on.
- Regular questioning is embedded in all lessons and should be a key feature on learning walks.
- End of unit assessment will be cumulative involving questions from previous units.

### Progression Model:

- Students will build on and develop practical skills within this topic that will link into further units within science as well as an understanding of the fundamental building block of Chemistry that allow the higher-level learning to occur later in the GCSE.
- The learning will be revisited throughout the KS4 course through cumulative assessments and memory joggers.
- Also, their metacognitive skills will improve as they use self-assessment, low stakes testing, memory joggers and responding to teacher's feedback to take control of their own learning.



## KS4 Organic Chemistry

### KS4 Curriculum Intent:

This unit includes hydrocarbons, fractional distillation of oil, burning hydrocarbons and cracking hydrocarbons.

### Sequence 1:

**Lesson 1: Hydrocarbons** To know what crude oil is made to know what alkanes are.

Students to know what crude oil consists of and how it is made. By the end of the lesson students shown know the general formula of alkanes and use this to predict the number of carbon/ hydrogen atoms. Students should be able to draw and name the first four alkanes.

**Lesson 2 Properties of hydrocarbons** to know how the volatility, viscosity, and flammability of hydrocarbons are affected by the size of their molecule.

**Lesson 3 Fractional distillation** to know how to separate crude oil into fractions to explain the separation of crude oil by fractional distillation.

Students should be able to describe in detail the process of fractional distillation and discuss the uses of the different fractions.

**Lesson 4 Burning hydrocarbons** to identify the product when you burn hydrocarbons in a good supply of air.

Students should know how to test for the products of complete combustion.

To know what is meant by incomplete combustion and products formed.

To write balanced equations of complete combustion with a given formula (H)

**Lesson 5 Cracking hydrocarbons** to know how and why larger less useful hydrocarbons molecules are cracked to form smaller ones.

To identify the products of cracking. To compare alkanes and alkenes. To use bromine water to identify alkanes and alkenes.

To balance chemical equations as examples of cracking given the formulae.

**Assessment: low stakes testing. Homework (google form)**

### Sequence 2:

**Lesson 6 Assessment**

**Lesson 7** Reflection and Improvement

**Assessment: Low stakes testing. Homework (google form) EOU exam.**

### Big picture

This unit has several opportunities for practical work, extended writing in response to exam style questions and the embedding of mathematic skills.

This unit builds on basic knowledge from KS3 whereby students are familiar with simple techniques for separating mixtures such as distillation, some examples of combustion and thermal decomposition and the structure and bonding of some simple molecular substances.

The topic develops further to show fractional distillation is used to separate the fractions in crude oil, the products of complete and in complete combustion of fuels from crude oil, the use of thermal decomposition in the cracking of hydrocarbons, drawings of displayed formula of alkanes.

### Developing Cultural Capital:

This unit provides s opportunities for students to develop their self-knowledge, self-esteem and self-confidence through group and paired work and develop their knowledge of how scientists have shaped understanding of the world taking initiative on wide and environmental issues and establish ways they can help on an individual, local, national, and global scale. They will also be able to relate science topics to career pathways such as in Medicine, Pharmacy, Beauty therapists and Chemical engineering and Energy industries.

### Reinforcement and retrieval practice

- All learning sequences are consolidated through a homework, which is reviewed in the next sequence to Space Learning.
- 'Memory joggers' are formally completed as they Do Now, these will be evidenced in the student's books.
- AfL is used regularly to evidence gaps in knowledge and inform planning so that learning is consolidated before being moved on.
- Regular questioning is embedded in all lessons and should be a key feature on learning walks.
- End of unit assessment will be cumulative involving questions from previous units.

### Progression Model:

- Students will build on and develop practical skills within this topic that will link into further units within science as well as an understanding of the fundamental building block of Chemistry that allow the higher-level learning to occur later in the GCSE.
- The learning will be revisited throughout the KS4 course through cumulative assessments and memory joggers.
- Also, their metacognitive skills will improve as they use self-assessment, low stakes testing, memory joggers and responding to teacher's feedback to take control of their own learning.



## KS4 Chemistry of the Earth's atmosphere

### **KS4 Curriculum Intent:**

This unit includes the history of our atmosphere including how it is evolving, greenhouse gases and climate change and atmospheric pollution.

### **Sequence 1:**

**Lesson 1: The history of our atmosphere** to state the composition of the gases in the atmosphere today.

Students to explain how the early atmosphere formed and discuss the scientific theories for how the atmosphere has developed over time.

**Lesson 2 Atmospheric pollutants**

To describe a variety of pollutants from fossil fuels when they are burned in different conditions.

Students to state the environmental impact of these gases.

*This is also taught in B2 Human impact*

**Lesson 3 Greenhouse gases and Climate change** to describe the greenhouse effect.

To recall human activities that increase the greenhouse gases and describe the effects of global warming.

*This is also taught in B2 Human impact*

**Lesson 4 Assessment**

**Lesson 5 Reflection and improvement**

**Assessment: Low stakes testing. Homework (google form) EOU exam.**

### **Big picture**

This unit has several opportunities for practical work, extended writing in response to exam style questions and the embedding of mathematic skills.

This unit builds on basic knowledge from KS3 whereby students are familiar with the composition of the air, the production of carbon dioxide by human activity and its impact on climate.

The topic develops further how the atmosphere developed over the Earth's history before arriving at its present composition, how climate change is caused by increasing levels of greenhouse gases and how the issue needs to be addressed, other atmospheric pollutants.

### **Developing Cultural Capital:**

This unit provides opportunities for students to develop their self-knowledge, self-esteem and self-confidence through group and paired work and develop their knowledge of how scientists have shaped understanding of the world taking initiative on wide and environmental issues and establish ways they can help on an individual, local, national, and global scale. They will also be able to relate science topics to career pathways such as in Medicine, Pharmacy, Beauty therapists and Chemical engineering and Environmental careers.

### **Reinforcement and retrieval practice**

- All learning sequences are consolidated through a homework, which is reviewed in the next sequence to Space Learning.
- 'Memory joggers' are formally completed as the Do Now, these will be evidenced in the student's books.
- AfL is used regularly to evidence gaps in knowledge and inform planning so that learning is consolidated before being moved on.
- Regular questioning is embedded in all lessons and should be a key feature on learning walks.
- End of unit assessment will be cumulative involving questions from previous units.

### **Progression Model:**

- Students will build on and develop practical skills within this topic that will link into further units within science as well as an understanding of the fundamental building block of Chemistry that allow the higher-level learning to occur later in the GCSE.
- The learning will be revisited throughout the KS4 course through cumulative assessments and memory joggers.
- Also, their metacognitive skills will improve as they use self-assessment, low stakes testing, memory joggers and responding to teacher's feedback to take control of their own learning.



## KS4 Analysis and the Earths resources

### KS4 Curriculum Intent:

This unit includes, pure substances and mixtures, analysing chromatograms, testing for gases, finite and renewable resources, water safe to drink, treating wastewater, extracting metals from their ores, life cycle assessments, reuse, reduce and recycle.

### Sequence 1:

**Lesson 1: Pure substances and mixtures** to use melting point data to distinguish between pure and impure substances to define a pure substance, mixture formulation to identify formulations from information.

**Lesson 2 Analysing chromatograms** to describe how chromatograms can be used to distinguish pure substances from impure substances. Students to recall how chromatography separates mixtures, interpret chromatograms, and calculate Rf values.

**Lesson 3 Testing for gases** to describe the tests and the positive results for hydrogen -oxygen -carbon dioxide-chlorine.

**Assessment: low stakes testing. Homework (google form)**

### Sequence 2:

#### **Lesson 4 Water safe to drink**

To describe the processes to make drinking water safe. Students to safely distill salty water.

**Lesson 5 Required practical: Analysis and purification of water samples from different sources, including pH, dissolved solids, and distillation.**

**Lesson 6 Treating wastewater** to explain why wastewater should be treated before it is released into the environment.

To create a flow chart to describe the main processes in sewage treatment.

**Lesson 7 -Consolidation lesson-** students to complete google form checkpoint. Opportunity to address misconceptions.

**Assessment: low stakes testing. Homework (google form)**

### Sequence 3:

**Lesson 8 Finite and renewable substances** to distinguish between finite and renewable substances given information.

To extract and interpret information about resources from charts, graphs, and tables.

**Lesson 9 Extracting metals from ores (H)** To describe the ways that copper can be extracted to describe the processes of phytomining and bioleaching. To evaluate the different methods of copper extracting

**Lesson 10 Life cycle assessments** to carry out simple comparative LCAs for shopping bags made from plastic and paper.

To know that some products can be reused and recycled.

**Lesson 11 Assessment**

**Lesson 12 Reflection and improvement**

**Assessment: Low stakes testing. Homework (google form) EOU exam.**

### Big picture

This unit has several opportunities for practical work, extended writing in response to exam style questions and the embedding of mathematic skills.

This unit builds on basic knowledge from KS3 whereby students are introduced to separating mixtures and using chromatography, test for hydrogen, about the Earth as a source of limited resources and recycling.

The topic develops further to analyse chromatograms and calculating Rf values, a wider range of chemical tests to identify unknown gases, analysis of data on diminishing finite resources including order of magnitude estimations, life cycle assessments, extraction of metals using biological methods.

### Developing Cultural Capital:

This unit provides opportunities for students to develop their self-knowledge, self-esteem and self-confidence through group and paired work and develop their knowledge of how scientists have shaped understanding of the world taking initiative on wide and environmental issues and establish ways they can help on an individual, local, national, and global scale. They will also be able to relate science topics to career pathways such as in Medicine, Pharmacy, Beauty therapists and Chemical engineering and Energy industries and Laboratory work.

### Reinforcement and retrieval practice

1. All learning sequences are consolidated through a homework, which is reviewed in the next sequence to Space Learning.
2. 'Memory joggers' are formally completed as the Do Now, these will be evidenced in the student's books.
3. AfL is used regularly to evidence gaps in knowledge and inform planning so that learning is consolidated before being moved on.
4. Regular questioning is embedded in all lessons and should be a key feature on learning walks.
5. End of unit assessment will be cumulative involving questions from previous units.

### Progression Model:

Students will build on and develop practical skills within this topic that will link into further units within science as well as an understanding of the fundamental building block of Chemistry that allow the higher-level learning to occur later in the GCSE.

The learning will be revisited throughout the KS4 course through cumulative assessments and memory joggers.

Also, their metacognitive skills will improve as they use self-assessment, low stakes testing, memory joggers and responding to teacher's feedback to take control of their own learning.



# KS4 Forces in Action

## KS4 Curriculum Intent:

This unit includes, vectors and scalars, Forces between objects, resultant forces, centre of mass, speed and distance time graphs, velocity and acceleration, velocity-time graphs, analysing motion graphs, forces and acceleration, weight and terminal velocity, forces and braking, forces, and elasticity.

### Sequence 1:

**Lesson 1 Scalar and vector** to describe the difference between scalar and vector quantities and give examples. Students to draw, interpret and use scaled diagrams to represent vectors.

**Lesson 2 Gravity and weight** to use formula to calculate weight and know the link between mass and weight-know this is a non-contact force.

**Lesson 3 Centre of mass** to identify the approximate centre of mass of regular and irregular shapes.

**Lesson 4 Resultant forces** to describe what is meant by resultant force to be able to interpret and represent several forces acting on an object. To describe Newtons First Law of motion.

**Lesson 5 Parallelogram of forces(H)** To state what the parallelogram of forces is and what it is used for. To identify what is needed to draw a scale diagram of parallelogram of forces. To explain how to use the parallelogram of forces to find the resultant of two forces.

**Assessment: low stakes testing. Homework (google form)**

### Sequence 2:

**Lesson 6 Resolution of forces (H)** To know what is meant by resolution of force to resolve a force.

To use a force diagram to work out if an object is in equilibrium.

**Lesson 7 Work done** to define work done and apply the formula to calculate work done.

**Lesson 8 Speed and distance/time graphs** to use and rearrange the speed equation to interpret and draw distance/time graphs.

To calculate speed from distance time graph

**Lesson 9 Velocity and acceleration** to state the difference between speed and velocity to calculate acceleration from formula to know the difference between acceleration and deceleration.

**Lesson 10 Velocity –time graphs** to calculate distance from a velocity time graph (H) To calculate acceleration from a velocity time graph - where speed is constant - where speed is changing(H)

**Assessment: low stakes testing. Homework (google form)**

### Sequence 3:

**Lesson 11 Force and acceleration** to know how the acceleration of an object depends on the size of the resultant force.

To know how mass effects acceleration to calculate resultant force from mass and acceleration to state what is meant by inertia of an object H.

**Lesson 12 Required practical Investigate the effect of varying the force on the acceleration of an object of constant mass, and the effect of varying the mass of an object on the acceleration produced by a constant force** Depending on the ability of the class two lessons may be needed.

**Lesson 13 Forces and braking** to know the forces that oppose the driving force of a vehicle to describe what the stopping distance of a vehicle depends on to describe what can increase the stopping distance of a vehicle to calculate the braking force of a vehicle.

**Lesson 14 Weight and terminal velocity** to know difference between mass and weight to understand the forces acting on falling objects in a to state what is meant by terminal velocity to analyse the (H)velocity-time graph for a skydiver and explain what is happening at each stage of the jump.

**Lesson 15 Momentum (H)** To define and calculate momentum. To explain what is meant by a closed system. To explain what is meant by conservation of momentum. To carry out conservation of momentum calculations. To apply conservation of momentum when two objects collide/explode.

**Assessment: low stakes testing. Homework (google form)**

### Sequence 4:

**Lesson 16 RP Forces and elasticity** to define elastic and inelastic deformation to investigate the relationship between force and extension **Required practical: Investigate the relationship between force and extension for a spring.**

**Lesson 17 Hooke's Law** To calculate and rearrange formula to calculate the work done in stretching or compressing a spring. To identify the limit of proportionality on a graph

**Lesson 18 Assessment Lesson 19 Reflection** and improvement

**Assessment: Low stakes testing. Homework (google form) EOU exam.**

## Big picture

This unit has several opportunities for practical work and the embedding of mathematic skills such as calculating the component of a force using scale diagrams and ratios.

This unit builds on basic knowledge from KS3 whereby students are introduced to measuring forces with a newton meter, balanced and unbalanced forces, calculating weight of an object, calculating speed, effect of drag force and resistance, investigating springs.

The topic develops further understanding, vectors and scalars and how to represent scalar, to calculate resultant force and how to resolve a force into perpendicular components, interpreting velocity time graphs, calculating the distance, calculating acceleration using graphs and formula, terminal velocity in fluids, calculating spring constant, conservation of momentum, investigating Hooke's law.

## Developing Cultural Capital:

This unit provides opportunities for students to develop their self-knowledge, self-esteem and self-confidence through group and paired work and develop their knowledge of how scientists have shaped understanding of the world taking initiative on wide and environmental issues and establish ways they can help on an individual, local, national, and global scale. They will also be able to relate science topics to career pathways such as Engineering and Energy industries Mechanics.

## Reinforcement and retrieval practice

- All learning sequences are consolidated through a homework, which is reviewed in the next sequence to Space Learning.
- 'Memory joggers' are formally completed as the Do Now, these will be evidenced in the student's books.
- AfL is used regularly to evidence gaps in knowledge and inform planning so that learning is consolidated before being moved on.
- Regular questioning is embedded in all lessons and should be a key feature on learning walks.
- End of unit assessment will be cumulative involving questions from previous units.

## Progression Model:

- Students will build on and develop practical skills within this topic that will link into further units within science as well as an understanding of the fundamental building block of Physics that allow the higher-level learning to occur later in the GCSE.
- The learning will be revisited throughout the KS4 course through cumulative assessments and memory joggers.
- Also, their metacognitive skills will improve as they use self-assessment, low stakes testing, memory joggers and responding to teacher's feedback to take control of their own learning.