Meden School Curriculum Planning							
Subject	Chemistry	**Year Group**	10	**Sequence No.**	7	**Topic**	Rates of reaction (C6)

Retrieval	Core Knowledge	Student Thinking
What do teachers need **retrieve** from students before they start teaching **new content**?	What **specific ambitious knowledge** do teachers need teach students in this sequence of learning?	What real life examples can be applied to this sequence of learning to **development of our students thinking, encouraging them to see the inequalities around them** and 'do something about them!'
KS3 – Year 8- Applications of chemistry. Catalysts speed up the rate of a reaction. They do this by lowering the amount of energy that is needed for atoms to react, this is called the activation energy. Year 9 – Enzyme activity. Catalysts speed up chemical reactions, they are not used up or changed in the process. Enzymes are biological catalysts; they are proteins. Enzymes will either break a molecule or make a molecule, either way what is formed is called a product. An enzyme will not change or be used up in the process. Enzymes are present in every cell in the body, without them reactions would happen too slowly, and we would die.	**L1: Factors affecting rate** Factors which affect the rates of chemical reactions include: the **concentrations** of **reactants** in solution, the **pressure** of reacting gases, the surface area of solid reactants, the temperature, and the presence of **catalysts**. **L2: Collision theory** Collision theory explains how various factors affect rates of reactions. According to this theory, chemical reactions can occur only when reacting particles collide with each other and with sufficient energy. The minimum amount of energy that particles must have to react is called the **activation energy**. Increasing the **concentration** of reactants in solution, the **pressure** of reacting gases, and the surface area of solid reactants increases the **frequency of collisions** and so increases the rate of reaction. Increasing the temperature increases the frequency of collisions and makes the collisions more energetic, and so increases the rate of reaction. Students should be able to : • predict and explain using collision theory the effects of changing conditions of concentration, pressure and temperature on the rate of a reaction • predict and explain the effects of changes in the size of pieces of a reacting solid in terms of surface area to volume ratio • use simple ideas about proportionality when using collision theory to explain the effect of a factor on the rate of a reaction. **L3: Catalysts** Catalysts change the rate of chemical reactions but are not used up during the reaction. Different reactions need different catalysts.	

	Enzymes act as catalysts in biological systems. Catalysts increase the rate of reaction by providing a different pathway for the reaction that has a lower **activation energy**. Students should be able to identify catalysts in reactions from their effect on the rate of reaction and because they are not included in the chemical equation for the reaction. Students should be able to explain catalytic action in terms of activation energy. Students do not need to know the names of catalysts other than those specified in the subject content. **L4: Calculating rates** The rate of a chemical reaction can be found by measuring the quantity of a reactant used or the quantity of product formed overtime: $$mean\ rate\ of\ reaction = \frac{quantity\ of\ reactant\ used}{time\ taken}$$ $$mean\ rate\ of\ reaction = \frac{quantity\ of\ product\ formed}{time\ taken}$$ The quantity of reactant or product can be measured by the mass in grams or by a volume in cm^3. The units of rate of reaction may be given as g/s or cm^3/s. **(HT only)**: Students are also required to use quantity of reactants in terms of **moles** and units for rate of reaction in mol/s. Students should be able to: • calculate the mean rate of a reaction from given information about the quantity of a reactant used or the quantity of a product formed and the time taken • draw, and interpret, graphs showing the quantity of product formed or quantity of reactant used up against time • draw tangents to the curves on these graphs and use the slope of the tangent as a measure of the rate of reaction • (HT only) calculate the gradient of a tangent to the curve on these graphs as a measure of rate of reaction at a specific time. **L5 + 6: Measuring rates**	Mobile phones and electric cars use Lithium-ion batteries. In these batteries a reversible reaction happens. $LiC_6 + CoO_2 \rightleftharpoons C_6 + LiCoO_2$

	Required practical activity 11: investigate how changes in concentration affect the rates of reactions by a method involving measuring the volume of a gas produced and a method involving a change in colour or turbidity. **L7,8,9: Rate graphs:** Students should be able to: • Draw, and interpret, graphs showing the quantity of product formed or quantity of reactant used up against time • Draw **tangents** to the curves on these graphs and use the slope of the tangent as a measure of the rate of reaction • (**HT only**) calculate the **gradient** of a tangent to the curve on these graphs as a measure of rate of reaction at a specific time. **L10: Reversible reactions** In some chemical reactions, the products of the reaction can react to produce the original reactants. Such reactions are called reversible reactions and are represented: $A + B \rightleftharpoons C + D$ The direction of reversible reactions can be changed by changing the conditions. If a reversible reaction is **exothermic** in one direction, it is **endothermic** in the opposite direction. The same amount of energy is transferred in each case. **L11 + 12 Le Chatelier (HT)** When a reversible reaction occurs in apparatus which prevents the escape of reactants and products, equilibrium is reached when the forward and reverse reactions occur at exactly the same rate. The relative amounts of all the reactants and products at equilibrium depend on the conditions of the reaction. If a system is at equilibrium and a change is made to any of the conditions, then the system responds to counteract the change. The effects of changing conditions on a system at equilibrium can be predicted using Le Chatelier's Principle. If the concentration of one of the reactants or products is changed, the system is no longer at **equilibrium** and the concentrations of all the substances will change until equilibrium is reached again.	Haber cycle – the production of fertilisers. The haber process is a reversible reaction, which requires a high pressure to produce a high yield of ammonia. The ammonia is used in fertilisers which are in increasing demand with the increasing population. Higher pressure however requires more energy and expensive equipment.

	If the concentration of a reactant is increased, more products will be formed until equilibrium is reached again. If the concentration of a product is decreased, more reactants will react until equilibrium is reached again. If the temperature of a system at equilibrium is increased: • the relative amount of products at equilibrium increases for an endothermic reaction • the relative amount of products at equilibrium decreases for an exothermic reaction. If the temperature of a system at equilibrium is decreased: • the relative amount of products at equilibrium decreases for an endothermic reaction • the relative amount of products at equilibrium increases for an exothermic reaction. For gaseous reactions at equilibrium: • an increase in pressure causes the equilibrium position to shift towards the side with the smaller number of molecules as shown by the symbol equation for that reaction • a decrease in pressure causes the equilibrium position to shift towards the side with the larger number of molecules as shown by the symbol equation for that reaction.	