GCE Chemistry – 3.2.5 Transition Metals

Learning about this topic is important because: The 3d block contains 10 elements, all of which are metals. Unlike the metals in Groups 1 and 2, the transition metals Ti to Cu form coloured compounds and compounds where the transition metal exists in different oxidation states. Some of these metals are familiar as catalysts. The properties of these elements are studied in this section with opportunities for a wide range of practical investigations.	
This builds on: 3.1.1 atomic structure, 3.1.3 Bonding, 3.2.3 Periodicity	
This leads to: 3.1.8 Thermodyamics	
We will learn: Transition metal characteristics of elements Ti–Cu arise from an incomplete d sub-level in atoms or ions. The characteristic properties include: complex formation, formation of coloured ions, variable oxidation state, catalytic activity. Transition metals can bond with ligands to form complexes. What are monodentate, bidentate and multidentate ligands? (Using examples outlined in the specification. Ligands can be exchanged in substitution reactions and this may affect the shape and charge of the complex. How haemoglobin is a complex with Fe(II) and how this can be affected by carbon monoxide. Transition metal complexes can exhibit both optical and cis-trans isomerism. Colour in transition metal complexes arises through the absorption of wavelengths of light by the movement of electrons from a ground state to an excited state. Changes in oxidation state, co-ordination number and	We will develop/practise skills including: Identify whether an element is a transition metal and be able to describe it's properties. Be able to draw a metal complex, including shape, bond angles and charge, with given information and for the ligands outlined in the specification Write equations for ligand substitution reactions. Explain the chelate effect in terms of entropy and enthalpy change Be able to identify and draw isomers of transitional metal complexes The energy difference between the ground state and the excited state of the d electrons is given by: $\Delta E = hv = hc/\lambda$ Determine the concentration of a coloured complex ion by colorimetry. How to carry out redox titrations.

GCE Chemistry – 3.2.5 Transition Metals

ligand can lead to a change in colour. A simple colorimeter can be used to determine the concentration of coloured ions in solution. Transition elements show variable oxidation states.Vanadium species in oxidation states IV, III and II are formed by the reduction of vanadate(V) ions by zinc in acidic solution. The redox potential for a transition metal ion changing from a higher to a lower oxidation state is influenced by pH and by the ligand. The reduction of $[Ag(NH3)2]^{+}$ (Tollens' reagent) to metallic silver is used to distinguish between aldehydes and ketones. The redox titrations of Fe^{2+} and $C2O4^{2-}$ with $MnO4^{-}$	
Some of the vocabulary that we will use includes: Ligand Complex Sub-level Co-ordination number monodentate Bidentate Multidentate Colorimetry Redox Oxidation state Cis-trans	You could learn more about this topic by: AQA Chemistry A-level Inorganic II Revision - PMT (physicsandmathstutor.com)
Your teacher will assess your knowledge & understanding throughout the topic by looking at your work, questioning, discussion and giving you feedback in lots of different ways. The key pieces of work in this topic are: End of topic test Whiteboard quizzes Assessed homework	

KS5 Chemistry – 3.1.8 Thermodynamics

Learning about this topic is important because:
The further study of thermodynamics builds on the Energetics section and is important in understanding the stability of compounds and why chemical reactions occur. Enthalpy change is linked with entropy change enabling the free-energy change to be calculated.

This builds on:
3.1.4 Energetics- Hess Cycle, Bond energy Calculations and Calorimetry.

This leads to:
3.1.9 Rate Equations

We will learn:

- What are the definitions for each of the enthalpy changes and lattice enthalpy?
- Construct a Born–Haber cycles to calculate lattice enthalpies using these enthalpy changes.
- Construct Born–Haber cycles to calculate one of the other enthalpy changes.
- Compare lattice enthalpies from Born–Haber cycles with those from calculations based on a perfect ionic model to provide evidence for covalent character in ionic compounds.
- Define the term enthalpy of hydration
- Perform calculations of an enthalpy change using these cycles.
- Calculate entropy changes from absolute entropy values
- Use the relationship $\Delta G = \Delta H - T\Delta S$ to determine how ΔG varies with temperature
- Use the relationship $\Delta G = \Delta H - T\Delta S$ to determine the temperature at which a reaction becomes feasible.

We will develop/practise skills including:

- Constructing Born-Haber cycles to calculate missing values from known enthalpy changes.
- Placing known enthalpy values with the correct enthalpy change on a Born-Haber cycle.
- Calculating entropy changes from absolute entropy values.
- Explaining the difference between theoretical and experimental values for lattice formation and what this means in terms of covalent character.
- Rearranging the equation $\Delta G = \Delta H - T\Delta S$ to find unknown values.
- Determining ΔS and ΔH from a graph of ΔG versus T.

Some of the vocabulary that we will use includes:

Enthalpy, Entropy, Born-Haber, Gibbs Free Energy

You could learn more about this topic by:
Videos - Topic 1.08 Thermodynamics - AQA Chemistry A-level - PMT
1.8. Thermodynamics.pdf (physicsandmathstutor.com)
Flashcards - AQA Chemistry A-level Topic 1.8 Thermodynamics - PMT

Your teacher will assess your knowledge & understanding throughout the topic by looking at your work, questioning, discussion and giving you feedback in lots of different ways. The key pieces of work in this topic are:
End of topic assessed questions, retrieval questions, mini whiteboards, exercise questions.

KS5 Chemistry – 3.1.9 Rate Equations

West Kirby Grammar School

Learning about this topic is important because:
In rate equations, the mathematical relationship between rate of reaction and concentration gives information about the mechanism of a reaction that may occur in several steps.

This builds on:
3.1.5 Kinetics- Collision Theory and Factors which affect rate.

This leads to:
3.1.10 Equilibrium constant Kp for homogeneous systems

We will learn:

- Define the terms order of reaction and rate constant
- Perform calculations using the rate equation
- Explain the qualitative effect of changes in temperature on the rate constant k
- Perform calculations using the equation $k = Ae^{-Ea/RT}$
- Understand that the equation $k = Ae^{-Ea/RT}$ can be rearranged into the form $\ln k = -Ea/RT + \ln A$ and know how to use this rearranged equation with experimental data to plot a straight-line graph with slope $-Ea/R$
- Use concentration–time graphs to deduce the rate of a reaction
- Use initial concentration–time data to deduce the initial rate of a reaction
- Use rate–concentration data or graphs to deduce the order (0, 1 or 2) with respect to a reactant
- Derive the rate equation for a reaction from the orders with respect to each of the reactants
- Use the orders with respect to reactants to provide information about the rate determining/limiting step of a reaction.

We will develop/practise skills including:

- Students use given rate data and deduce a rate equation, then use some of the data to calculate the rate constant including units.
- Students use a graph of concentration–time and calculate the rate constant of a zero-order reaction by determination of the gradient.
- Students could determine the order of reaction for a reactant in the iodine clock reaction.
- Students could be given data to plot and interpret in terms of order with respect to a reactant. Alternatively, students could just be given appropriate graphs and asked to derive order(s).
- Students calculate the rate constant of a zero-order reaction by determining the gradient of a concentration–time graph.
- Students plot concentration–time graphs from collected or supplied data and draw an appropriate best-fit curve. Students draw tangents to such curves to deduce rates at different times.
- Required practical 7 Measuring the rate of reaction:
  - by an initial rate method
  - by a continuous monitoring method

Some of the vocabulary that we will use includes:
Rate Constant
Rate Equation
Order of Reaction
Rate Determining Step

You could learn more about this topic by:
1.09. Rate Equations.pdf (physicsandmathstutor.com)
Flashcards - AQA Chemistry A-level Topic 1.9 Rate Equations - PMT (physicsandmathstutor.com)
Videos - Topic 1.09 Rate Equations - AQA Chemistry A-level - PMT (physicsandmathstutor.com)

KS5 Chemistry – 3.1.9 Rate Equations

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End of topic assessed questions, retrieval questions, mini whiteboards, exercise questions.