Subject	Year	Term
Chemistry	12	3

Topic

3.2.2 Rates and 3.2.3 Equilibrium

Content (Intent)

Prior Learning (Topic) 10C6 Rate and extent of chemical change/11C2 Electrolysis, energy changes and equilibria

Simple collision theory

(a) the effect of concentration, including the pressure of gases, on the rate of a reaction, in terms of frequency of collisions

(b) calculation of reaction rate from the gradients of graphs measuring how a physical quantity changes with time

Catalysts

(c) explanation of the role of a catalyst:

(i) in increasing reaction rate without being used up by the overall reaction

(ii) in allowing a reaction to proceed via a different route with lower activation energy, as shown by enthalpy profile diagrams

(d) (i) explanation of the terms homogeneous and heterogeneous catalysts

(ii) explanation that catalysts have great economic importance and benefits for increased sustainability by lowering temperatures and reducing energy demand from combustion of fossil fuels with resulting reduction in CO_2 emissions

(e) the techniques and procedures used to investigate reaction rates including the measurement of mass, gas volumes and time

The Boltzmann distribution

(f) qualitative explanation of the Boltzmann distribution and its relationship with activation energy **(see also 3.2.1 c)**

(g) explanation, using Boltzmann distributions, of the qualitative effect on the proportion of molecules exceeding the activation energy and hence the reaction rate, for:

(i) temperature changes

(ii) catalytic behaviour **(see also 3.2.2 c).**

Dynamic equilibrium and le Chatelier's principle

(a) explanation that a dynamic equilibrium exists in a closed system when the rate of the forward reaction is equal to the rate of the reverse reaction and the concentrations of reactants and products do not change

(b) le Chatelier's principle and its application for homogeneous equilibria to deduce qualitatively the effect of a change in temperature, pressure or concentration on the position of equilibrium

(c) explanation that a catalyst increases the rate of both forward and reverse reactions in an equilibrium by the same amount resulting in an unchanged position of equilibrium

(d) the techniques and procedures used to investigate changes to the position of equilibrium for changes in concentration and temperature.

(e) explanation of the importance to the chemical industry of a compromise between chemical equilibrium and reaction rate in deciding the operational conditions

The equilibrium constant, Kc

(f) expressions for the equilibrium constant, Kc, for homogeneous reactions and calculations of the equilibrium constant, Kc , from provided equilibrium concentrations

(g) estimation of the position of equilibrium from the magnitude of Kc

Future Learning (Topic) Y13 5.1.1 How Fast? / Y13 5.1.2 How Far?

How will knowledge and skills be taught? (Implementation)	How will your understanding be assessed & recorded (Impact)
Practical work - rates Experiment to determine initial rates Experiment to determine effects of a catalyst *Written - rates* Plan a practical to determine the initial rate of a reaction Calculating the rate from a tangent Use Boltzmann distribution to explain the effects of temperature and catalysts *Practical work – Equilibria* Effect of concentration on equilibrium Effect of changing H^+ ion concentration (pH) on equilibrium position *Written - Equilibria* Explain effect of temperature, pressure, concentration and catalysts on the position of equilibrium Kc expressions for different reactions	- exam questions in lessons - 1 x homework of exam style questions - 1 x standard homework (grade given. Written and oral feedback.) For rates and equilibria

How can parents help at home?

Look at the topic specific resources on the VLE
Use appropriate websites: MaChemGuy, Allery Chemistry, Chemistry World – by Royal Society of Chemistry, ChemGuide.
Take an interest! Ask your children what they have learnt and be curious about their learning.

Helpful further reading/discussion

Reading	Vocabulary Lists	Careers Links
The Science of Everyday Life by Marty Jopson Why Chemical Reactions Happen by Keeler and Wothers Chapter 10 of A level chemistry for OCR	Collision theory Activation energy Initial rate Tangent Catalysts Energy profile diagrams Homogeneous Heterogeneous Boltzman distribution Le Chatelier's principle Equilibrium law	Analytical chemist Chemical engineer Clinical biochemist Forensic scientist Pharmacologist Process chemist Quality control analyst Research scientist Science writer Site chemist Teacher or lecturer Degrees; Chemistry Biochemistry Biomedical science Biological sciences Medicine Research chemist Veterinary medicine