	Statement	Guidance
6.1.U1	Species react as a result of collisions of sufficient energy and proper orientation	Description of the kinetic theory in terms of the movement of particles whose average kinetic energy is proportional to temperature in Kelvin
6.1.U2	The rate of reaction is expressed as the change in concentration of a particular reactant/product per unit time	Explanation of the effects of temperature, pressure/concentration and particle size on rate of reaction
6.1.U3	Concentration changes in a reaction can be followed indirectly by monitoring changes in mass, volume and colour.	Students should be familiar with the interpretation of graphs of changes in concentration, volume or mass against time.
6.1.U4	Activation energy (E_a) is the minimum energy that colliding molecules need in order to have successful collisions leading to a reaction.	Construction of Maxwell–Boltzmann energy distribution curves to account for the probability of successful collisions and factors affecting these, including the effect of a catalyst
6.1.U5	By decreasing E_a, a catalyst increases the rate of a chemical reaction, without itself being permanently chemically changed	Calculation of reaction rates from tangents of graphs of concentration, volume or mass against time should be covered
16.1.U6	Reactions may occur by more than one step and the slowest step determines the rate of reaction (rate determining step/RDS)	Use potential energy level profiles to illustrate multi-step reactions; showing the higher E_a in the rate-determining step in the profile
16.1.U7	The molecularity of an elementary step is the number of reactant particles taking part in that step	
16.1.U8	The order of a reaction can be either integer or fractional in nature. The order of a reaction can describe, with respect to a reactant, the number of particles taking part in the rate-determining step	Catalysts are involved in the rate-determining step. Reactions where the rate-determining step is not the first step should be considered
16.1.U9	Rate equations can only be determined experimentally	Deduction of the rate expression for an equation from experimental data and solving problems involving the rate expression
16.1.U10	The value of the rate constant (k) is affected by temperature and its units are determined from the overall order of the reaction.	
16.1.U11	Catalysts alter a reaction mechanism, introducing a step with lower activation energy	Sketching, identifying, and analysing graphical representations for zero, first and second order reactions
16.2.U12	The Arrhenius equation uses the temperature dependence of the rate constant to determine the activation energy. $$k = Ae^{-\frac{E_A}{RT}}$$	Use energy level diagrams to illustrate multi-step reactions showing the RDS in the diagram
16.2.U13	A graph of *1/T* against ln *k* is a linear plot with gradient $-E_a/R$ and intercept, ln*A*.	Consider various data sources in using the linear expression ln k = $-E_a/RT$ + ln A
16.2.U14	The frequency factor (or pre-exponential factor) (*A*) takes into account the frequency of collisions with proper orientations.	Describing the relationships between temperature and rate constant; frequency factor and complexity of molecules colliding.