

	Statement	Guidance
10.1.U1	A homologous series is a series of compounds of the same family, with the same general formula, which differ from each other by a common structural unit	Skeletal formulas should be discussed in the course
10.1.U2	Structural formulas can be represented in full and condensed format.	The general formulas (eg C_nH_{2n+2}) of alkanes, alkenes, alkynes, ketones, alcohols, aldehydes and carboxylic acids should be known
10.1.U3	Structural isomers are compounds with the same molecular formula but different arrangements of atoms	
10.1.U4	Functional groups are the reactive parts of molecules	The distinction between class names and functional group names needs to be made. Eg for OH, hydroxyl is the functional group whereas alcohol is the class name
10.1.U5	Saturated compounds contain single bonds only and unsaturated compounds contain double or triple bonds	
10.1.U6	Benzene is an aromatic, unsaturated hydrocarbon	The following nomenclature should be covered: <ul style="list-style-type: none"> – non-cyclic alkanes and halogenoalkanes up to halohexanes. – alkenes up to hexene and alkynes up to hexyne. – compounds up to six carbon atoms (in the basic chain for nomenclature purposes) containing only one of the functional groups: hydroxyl, ether, carbonyl (from aldehydes or ketones), ester and carboxyl.
10.2.U7	Alkanes have low reactivity and undergo free-radical substitution reactions	Reference should be made to initiation, propagation and termination steps in free-radical substitution reactions. Free radicals should be represented by a single dot
10.2.U8	Alkenes are more reactive than alkanes and undergo addition reactions. Bromine water can be used to distinguish between alkenes and alkanes.	
10.2.U9	Alcohols undergo esterification (or condensation) reactions with acids and some undergo oxidation reactions	
10.2.U10	Halogenoalkanes are more reactive than alkanes. They can undergo (nucleophilic) substitution reactions. A nucleophile is an electron-rich species containing a lone pair that it donates to an electron-deficient carbon	
10.2.U11	Addition polymers consist of a wide range of monomers and form the basis of the plastics industry.	
10.2.U12	Benzene does not readily undergo addition reactions but does undergo electrophilic substitution reactions.	
20.1.U13	<p>Nucleophilic Substitution Reactions:</p> <ul style="list-style-type: none"> • S_N1 represents a nucleophilic unimolecular substitution reaction and S_N2 represents a nucleophilic bimolecular substitution reaction. S_N1 involves a carbocation intermediate. S_N2 involves a concerted reaction with a transition state • For tertiary halogenoalkanes the predominant mechanism is S_N1 and for primary halogenoalkanes it is S_N2. Both mechanisms occur for secondary halogenoalkanes • The rate determining step (slow step) in an S_N1 reaction depends only on the concentration of the halogenoalkane, rate = $k[\text{halogenoalkane}]$. For S_N2, rate = $k[\text{halogenoalkane}][\text{nucleophile}]$. S_N2 is stereospecific with an inversion of configuration at the 	Reference should be made to heterolytic fission for S_N1 reactions. The difference between homolytic and heterolytic fission should be understood

	<p>carbon.</p> <ul style="list-style-type: none"> • S_N2 reactions are best conducted using aprotic, non-polar solvents and S_N1 reactions are best conducted using protic, polar solvents. 	
20.1.U14	<p>Electrophilic Addition Reactions:</p> <ul style="list-style-type: none"> • An electrophile is an electron-deficient species that can accept electron pairs from a nucleophile. Electrophiles are Lewis acids. • Markovnikov's rule can be applied to predict the major product in electrophilic addition reactions of unsymmetrical alkenes with hydrogen halides and interhalogens. The formation of the major product can be explained in terms of the relative stability of possible carbocations in the reaction mechanism 	The difference between curly arrows and fish-hooks in reaction mechanisms should be emphasized.
20.1.U15	<p>Electrophilic Substitution Reactions:</p> <ul style="list-style-type: none"> • Benzene is the simplest aromatic hydrocarbon compound (or arene) and has a delocalized structure of bonds around its ring. Each carbon to carbon bond has a bond order of 1.5. Benzene is susceptible to attack by electrophiles. 	Use of partial charges and wedge-dash three-dimensional representations (using tapered bonds as shown below) should be encouraged where appropriate in explaining reaction mechanisms.
20.1.U16	<p>Reduction Reactions:</p> <ul style="list-style-type: none"> • Carboxylic acids can be reduced to primary alcohols (via the aldehyde). Ketones can be reduced to secondary alcohols. Typical reducing agents are lithium aluminium hydride (used to reduce carboxylic acids) and sodium borohydride. 	Typical conditions and reagents of all reactions should be known (eg catalysts, reducing agents, reflux etc.). However, more precise details such as specific temperatures need not be included.
20.2.U17	The synthesis of an organic compound stems from a readily available starting material via a series of discrete steps. Functional group interconversions are the basis of such synthetic routes	Conversions with more than four stages will not be assessed in synthetic routes
20.2.U18	Retro-synthesis of organic compounds.	Reaction types can cover any of the reactions covered in topic 10 and sub-topic 20.1
20.3.U19	Stereoisomers are subdivided into two classes—conformational isomers, which interconvert only by breaking and reforming a bond.	
20.3.U20	Configurational isomers are further subdivided into cis-trans and E/Z isomers and optical isomers.	
20.3.U21	Cis-trans isomers can occur in alkenes or cycloalkanes (or heteroanalogues) and differ in the positions of atoms (or groups) relative to a reference plane. According to IUPAC, E/Z isomers refer to alkenes of the form $R_1R_2C=CR_3R_4$	In the E/Z system, the group of highest Cahn–Ingold–Prelog priority attached to one of the terminal doubly bonded atoms of the alkene (ie R_1 or R_2) is compared with the group of highest precedence attached to the other (ie R_3 or R_4). The stereoisomer is Z if the groups lie on the same side of a reference plane passing through the double bond and perpendicular to the plane containing the bonds linking the groups to the double-bonded atoms; the other stereoisomer is designated as E.
20.3.U22	A chiral carbon is a carbon joined to four different atoms or groups.	
20.3.U23	An optically active compound can rotate the plane of polarized light as it passes through a solution of the compound. Optical isomers are enantiomers. Enantiomers are non-superimposable mirror images of each other. Diastereomers are not mirror images of each other	Wedge-dash type representations involving tapered bonds should be used for representations of optical isomers
20.3.U24	A racemic mixture (or racemate) is a mixture of two enantiomers in equal amounts and is optically inactive	