PiXL Partners in excellence

Personalised Learning Checklist

	Student 1
AQA A Level Chemistry	
Unit CHEM 4	
1. Kinetics and equilibria	
Understand, derive and use rate equations in the form: rate = $k[A]^m[B]^n$	
Explain qualitatively the effect of temperature change on the rate constant and rate of reaction	
Understand that the orders of the reaction can be used to find the rate determining step	
Define and calculate K_c	
Deduce, for homogeneous reactions, expressions for K_c	
Predict the effect of chnaging temperature on the equilibrium constant	
Understand that K_c is unaffected by changes in concentration or by catalysts	
2. Acids and bases	
Describe acids, bases and acid-base equilibriain terms of protons	
define pH; $pH = -\log[H^+]$; $[H^+] = 10^{-pH}$	
Convert concentration into pH and visa versa	
State water is weakly dissociated	
State $K_w = [H^+][OH^-]$	
Calculate pH strong base from concentration	
State the level of dissociation for weak acids and bases	
Deduce K_a for weak acids	
State $pKa = -\log_{10}K_a$	
Calculate K_a for a weak acid given data	
Understand the shapes of acid-base titration pH curves	
Use pH curves to select appropriate indicator	
Carry out titration calculations for titrations	

Explain qualitatively the action of acidic and basic buffers	
State applications of buffere solutions	
Calculate the pH of acidic buffer solutions	
3. Isomerism in organic chemistry	
Know and understand the meaning of the term structural isomerism	
Know that E-Z and optical isomerism are forms of stereoisomerism	
Know that an asymetric carbon atom is chiral giving rise to optical isomers	
Understand the meaning of the terms enantiomer and racemate	
Understand why racemates are formed	
Draw structural and displayed formulae of isomers	
Understand the impact of isomerism on drug action	
4. Compounds containing the carbonyl group	
Understand the basis of simple test to distinguish between aldehydes and ketones	
Appreciate the hazards of synthesis using HCN/KCN	
Know that aldehydes and ketones can be reduced to form alcohols including mechanisms	
Understand the mechanism of the reaction of carbonyl compounds with HCN	
Know that carboxylic acids are weak but react with carbonates forming carbon dioxide	
Know that carboxylic acids react with alcohols to form esters	
Know the common uses of esters and that esters can have pleasant smells	
Know that vegetable oils and animal fats are esters of propane-1,2,3-triol (glycerol)	
Know that esters can be hydrolysed e.g. to form soap	
Know the composition of biodiesels and how vegetable oils can be converted into biodiesel	
Know the reaction between primary amines and ammonia	
Know the reactions of water, alcohols, ammonia and primary amines with acyl chlorides & acid anhydrides	
Understand the mechanism of nucleophilic addition of the above	
Understand the advantages of ethanoic anhydride over ethanoyl chloride in the manufacture of aspirin	
5. Aromatic chemistry	
Understand the nature of the bonding in a benzene ring	
Understand how delocalisation affects stability and use evidence to illustrate the principle	

Understand electrophilic substitution in arenes	
Understand the importance and the mechanism of nitration in synthesis e.g. dyestuffs and explosives	
Undertsand the importance of Friedel-Crafts acylation reactions	
Understand the mechanism of acylation using $AlCl_3$ as a catalyst	
Explain the difference in base strength between ammonia, primary aliphatic & primary aromatic amines	
Understand the nucleophilic substitution of ammonia and amines (including mechanisms)	
Know aliphatic amines can be prepared from haloalkanes and the reduction of nitriles	
Know aromatic amines are prepared by the reduction of nitro compounds	
Undertstand amino acids form zwitterions and have acidic and basic properties	
Understand the structure of proteins	
Understand how amino acids can be formed from proteins	
Know that mixtures of amino acids can be separtaed by chromotography	
Understand the importance of hydrogen bonding in proteins	
6. Polymers	
Draw the repeating unit of addition polymers from monomer structures and visa versa	
Understand how condensation polymers may be formed	
Know the linkage of the repeating units of polyesters and polyamides	
Understand why polyalkenes are non-biodegradable	
Understand why polyesters and polyamides are biodegradable	
State the advantages and disadvantages of different methods of disposal of polymers including recycling	
Deduce how to synthesis organic compounds using the reactions in the specification	
Identify organic functional groups using the reactions in the specification	
7. Structure determination	
Use data from all analytical techniques in specification to determine the structure of compounds	
Understand the fragmentation of a molecular ion gives rise to a chrarcteristic relative abundance spectrum	
Know the more stable X^+ species give higher peaks	
Use infrared spectrscopy to identify functional groups	
Understand NMR gives information about the position of ^{13}C or ^{1}H atoms in a molecule	
Understand that ^{13}C gives a simpler spectrum than ^{1}H	

Know and use the δ scale for recording chemical shift	
Understand the chemical shift depends on the molecular environment	
Understand how integrated spectra indicate the relative numbers of ^{1}H	
Understand that ^{1}H n.m.r spectra are obtained using samples dissolved in proton-free solvents	
Understand why tetramethylsilane is used as a standard	
Deduce the spin-spin splitting patterns of adjacent, non-equivalent protons (n + 1 rule)	
Know gas chromatography can be used to separate mixtures of volatile liquids	
Know separation by column chromatography depends on balance between solubility and retention	

PiXL Partners in excellence

Personalised Learning Checklist

	Student 1
AQA A Level Chemistry	
Unit CHEM 5	
1. Thermodynamics	
Define and apply: enthalpy of formation, ionisation enthalpy, enthalpy of atomisation	
Define and apply: bond dissociation enthalpy, electron affinity, lattice enthalpy	
Define and apply: enthalpy of hydration, enthalpy of solution	
Construct Born-Haber cycles to calculate lattice enthalpies	
Compare lattice enthapies from Born-Haber cycles with calculations from a perfect ionic model	
Calculate enthalpies of solution for ionic compounds	
Use mean bond enthapies to calculate an approximate value of ΔH for other reactions	
Explain why values form mean bond enthalpy calculations differ from enthalpy cycles	
Understand ΔH is not sufficient to explain spontaneous change	
Understand ΔS (entropy change) accounts for the above deficiency	
Calculate entropy changes from absolute entropy values	
Understand the balance between entropy and enthalpy ΔG = ΔH - TΔS	
Determine how ΔG varies with temperature and the temperature at which a reaction is feasible	
2. Periodicity	
Describe trends in the reactions of the elements with water (Na & Mg)	
Describe trends in the reactions of the elements with oxygen (Na, Mg, Al, Si, P, S)	
Explain in terms of structure and bonding the link between physical properties of the highest oxides of Na-S	
Describe the reactions of oxides of elements Na-S with water	
Know the change in pH of resulting solutions across period	
Explain the trends in these properties in terms of the type of bond present	
Write equations for the reactions which occur between oxides and given simple acids and bases	
3. Redox equilibria	

Apply the electron transfer model of redoc to d-block elements	
Know IUPAC convention for writing half equations for electrode reactions	
Know and use the conventional representaion of cells	
Understand how cells are used to measure electrode potentials by reference to the standard hydrogen electrode	
Know the importance of the conditions when measuring the electrode potential E	
Know the conditions for standard electrode potential E^{θ}	
Know that standard electrode potentials can be listed as an electrochemical series	
Use E^{θ} values to predict the direction of simple redox reactions and calculate e.m.f of a cell	
Appreciate the uses and chargeability of fuel cells	
Use electrode data to deduce the reactions in cells and deduce the e.m.f	
Understand the electrode reactions of a hydrogen-oxygen fuel cell	
Appreciate the benefits and risks to society associated with the use of fuel cells	
4. Transition metals	
Know the link between d sub-level atoms or ions and the characteristics of Ti-Cu	
Know the chracteristics of Ti-Cu	
Define the term ligand	
Know coordinate bonding is involved in complex formation and understand the structure of a complex	
Know the meaning of coordination number	
Understand ligands can be unidentate, bidentate or multidentate	
Know that ham is an iron(II) complex with a multidentate ligand	
Know transitional metals commonly form octahedral complexes with small ligands	
Know transitional metals commonly form tetrahedral complexes with larger ligands	
Know square planar complexes are also formed	
Know Ag+ commonly forms the linear complex used in Tollens' reagent	
Know transition metal ions can be identified by their colour	
Know colour changes arise from changes in oxidation state, coordination number and ligand	
Know colour arises from electronic trasitions from the ground state to excited states: $\Delta E = hv$	
Appreciate absorption of visible light is used in spectrmetry to determine the concentration of coloured ions	
Know transition elements show variable oxidation states	

Know Cr^{3+} and Cr^{2+} are formed by reduction of $Cr_2O_7^{2-}$ by zinc in acid solution	
Know the redox titration of Fe^{2+} with MnO_4^- and $Cr_2O_7^{2-}$ in acid solution	
Carry out titration calculations for the above and others when reductant and its oxidation product are given	
Know the oxidation of Co^{2+} by air in ammoniacal solution	
Know the oxidation in alkaline solution of Co^{2+} and Cr^{3+} by H_2O_2	
Know that transition metals and their compounds can act as heterogeneous and homogeneous catalysts	
Know the meaning of the terms heterogeneous and homogeneous in terms of catalysis	
Understand the use of a support medium in terms of surface area and cost	
Undersand how V_2O_6 acts as a catalyst in the Contact Process	
Know that Cr_2O_3 is used in the manufacture of methanol	
Know Fe is used as a catalyst in the Haber process	
Know how impurities impact on the efficiency of catalysts	
Understand the importance of variable oxidation states in catalysis	
Understand the role of Fe(II) in haemoglobin	
Know the role of Pt(II) complex as a cancer drug; appreciate the risks and benefits of this drug	
Understand $[Ag(NH_3)_2]^+$ is used in Tollens' reagent to distinguish between aldehydes and ketones	
5. Reactions of inorganic compounds in aqueous solution	
Know the definitions of a Lewis acid and a Lewis base	
Understand the importance of lone pair electrons in coordinate bond formation	
Know metal-aqua ions are formed in aqueous solution	
Understand equilibria to show generation of acidic solutions with M^{3+} and very weak acidic solutions with M^{2+}	
Understand the activity of $[M(H_2O)_6]^{2+}$ is greater than $[M(H_2O)_6]^{2+}$	
Describe and explain the simple test tube reactions of M^{2+} and M^{3+} (aq) ions	
Know that MCO_3 is formed but $M_2(CO_3)_3$ is not formed	
Know some metal hydroxides show amphoteric character	
Know the equilibrium reaction between: CrO_4^{2-} and H^+	
Understand that ligands H_2O and NH_3 are similar in size and are uncharged; no change in coordination number	

Know substitution may be incomplete	
Understand that Cl^- ligand is larger than these uncharged ligands; can involve change in coordination number	
Know substitution of unidentate ligand with a bidentate or multidentate leads to a more stable complex	
Understand this chelate effect in terms of positive entropy change	