**Selectividad syllabus**

Content not covered by the IB is highlighted in red

**1. Basic concepts** (equivalent to IB Topic 1)

* Basic concepts such as atoms, molecules, moles, element, % (richness) by mass, gas laws, Avogadro's number etc. Conversion of mmHg to atm 🡪 760 mmHg = 1 atm and use of R=0.082 not 8.314 when used with pressure in atm.
* Scientific development and use of these concepts and the fundamentals.

**2. The structure of matter** (equivalent to IB Topics 2, 12, 3, 13, 4 and 14)

* Atomic structure and the periodic table - know the fundamental particles that make up atoms, as well as the concepts of atomic and mass numbers.
* The basic ideas developed on Bohr´s atomic model and the quantization of the energy of atoms i.e. atomic emission and absorption spectra of hydrogen and their relation to Planck´s equation 🡪 E = hν (h = Planck´s constant and ν = frequency).
* An introduction to the contribution of wave mechanics in the evolution of the concept of the atom as well as the types of orbitals and their relationships with quantum numbers (n, l, m, s).
* Knowledge of wave-particle duality, Heisenberg´s Uncertainty Principle and the concept of orbitals.
* Using knowledge of periodicity for the explanation of the variation of the properties such as ionization energies, electron affinity (covered in IB Topic 5) or electronegativity. Labelling of groups from 1-18 (IB is from 1-8 ignoring the d-block)
* Relating chemical bonds with the outer electronic configuration of atoms.
* The foundations and properties of covalent bonds (Lewis Theories and valence bond), ionic bonding (lattice energy), metallic bonding (electron cloud model) intermolecular forces and their effect on solubility, melting point, boiling point, electrical conductivity and hardness.
* Pi(π) and sigma(σ) bonding, hybridisation and using them to justify structures of organic and inorganic molecules. Concepts and types of isomerism (must know terms: positional isomerism, functional group isomerism, chain isomerism).
* Molecular geometry (only up to molecules with AX4 structure NOT ions or delocalised structures)
* Deduce polarity in a molecule by understanding the polarity in its bonds.

**3. Thermodynamics** (equivalent to IB Topics 5 and 15)

* The first law of thermodynamics - the variation in internal energy of a system is equal to the sum of the heat interchange (between the system and surroundings) plus the work done by or on the system. ∆U = Q + W.
* Concepts of heat (Q), work (W) and internal energy (∆U). The formulae that relate these entities under different conditions such as isothermal, adiabatic and isobaric conditions.
* Endo- and exothermic reactions.
* Calculating the enthalpy change of reactions using ∆Hformation or bond enthalpy information using Hess´s Law.
* Lattice enthalpy (*energía reticular)* calculations with Born-Haber cycles.
* The second law of thermodynamics – Entropy in an isolated system will always tend to increase. Entropy and spontaneity of reactions (Gibbs free energy).

**4. Kinetics and chemical equilibrium** (equivalent to IB Topics 6, 16, 7 and 17)

* Rate of reaction (*velocidad*) and rate expressions and calculations.
* Collision theory and factors that affect rate of reaction – concentration, physical state, Ea, nature of reactants and catalysts.
* Activation energy (including the Arrhenius equation) and the use of catalysts.
* The concept of reaction quotient (the same as the equilibrium constant but when the reaction is not at equilibrium) and the law of mass action (calculation the equilibrium constant).
* The relationship between equilibrium constants and their relation with Gibbs free energy at standard conditions.
* The features of a dynamic equilibrium.
* Calculation of Kc and Kp in homogenous and heterogeneous equilibria and calculation of concentrations of species and the degree of dissociation (α).
* Le Chatelier´s principle and its use with changing conditions.
* The concept of solubility, calculating Ksp, the common ion effect and how this can influence pH.

**5. Proton transfer** (equivalent to IB Topics 8 and 18 – acids and bases)

* Arrhenius theory of acids and bases (dissociation to H+ or OH- ions) and examples.
* Bronsted-Lowry theory of acids, bases and amphoteric substances.
* Indicating corresponding conjugate acids or bases.
* Defining strong acids and bases and calculating Ka, Kb, degree of dissociation (α).
* Ionic product of water, Kw, its value at 25oC and the calculation of pH and pOH.
* Justifying the neutrality, acidity or basicity of salt solutions depending on the origin of the cation and anion of the salt.
* Indicate equivalence points in titrations (only strong acids and bases) and suitable indicators.
* Defining a buffer solution and where there are important in biological processes.

**6. Electron transfer** (equivalent to IB Topics 9 and 19 – redox)

* Identification and calculation of redox reactions using oxidation numbers (Roman numerals).
* Adjusting redox reactions in acidic or basic media using the ion-electron method.
* Understanding standard electrode potentials and the relative strength of oxidants or reductants by comparison with a reference electrode.
* Calculating whether a reaction will be spontaneous or not at standard conditions.
* Calculating the E.M.F for a given cell.
* Faraday´s Law and its application (calculations).
* Understand electrolysis and its use in the prevention of corrosion of metals.

**6. Carbon chemistry** (equivalent to IB Topics 10 and 20 – organic chemistry)

* The concept of functional groups and homologous series.
* Formulation and naming (IUPAC) of alcohols, phenols, ethers, aldehydes, ketones, carboxylic acids, esters, alkyl and aryl halides, amines, amides and nitriles.
* Isomerism – chain, functional group, position, geometric and optical.
* Substitution reactions (nucleophilic)
* Addition reactions of hydrogen, halogens, hydrogen halides and water to a C to C double bond.
* Elimination reactions of water and hydrogen halides.
* Esterification reactions.

(*You do NOT need to know any mechanisms*)

**Knowledge from lab sessions**

* You need to know how to prepare a solution using a solute and solvent or by diluting liquids.
* Carry out calculations using titration data.