LEAVING CERTIFICATE CHEMISTRY

REVISION CHECKLIST

The Periodic Table and Atomic Structure

Periodic Table:

- ❑ I can name the first 36 elements from their symbols
- ❑ I know the contribution of the Greeks, Boyle, Davy and Mosley to the discovery of elements.
- ❑ I know that the periodic table is designed to show the trends in the physical and chemical properties of elements.
- ❑ I know the contribution of **Dobereiner, Newlands**, Mendeleev and **Mosley** to the development of the periodic table.
- ❑ I can list 4 differences between the modern periodic table and Mendeleev's.
- ❑ I can name groups I, II, VII and VIII on the periodic table and know their characteristic properties

Atomic Structure:

- ❑ I know that all matter is composed of particles which may be atoms, molecules or ions.
- ❑ I know how small atoms are
- ❑ I can state 3 things about Daltons atomic theory
- ❑ **I understand how Crookes worked with vacuum tubes and discovered cathode rays**
- ❑ I know that Thompson discovered the electron by working with cathode rays
- ❑ I can draw Thompson's model of an atom
- ❑ **I know that Thompson calculated the charge : mass ratio of an electron**
- ❑ **I know that the name electron was proposed by George Stoney.**
- ❑ **I know that Milikan calculated the charge on the electron using the oil drop experiment. (details not required)**
- ❑ I can state the law of conservation of mass
- ❑ I know that Rutherford discovered the nucleus using the α-particle scattering experiment (Gold leaf experiment)
- ❑ **I know how Rutherford discovered the proton**
- ❑ **I know how Chadwick discovered the Neutron**
- ❑ I can draw Bohr's model of an atom
- ❑ I can fill in a table of properties of electrons, protons and neutrons (mass, charge, location)
- ❑ I can identify the mass number (A) and the atomic number (Z) of an atom of an element from the periodic table
- ❑ I know what an isotope is **and can calculate relative atomic masses from the abundances of isotopes of given mass number.**
- ❑ I know that the relative atomic mass is based on the mass of a ^{12}C atom.

- ❑ I know that a mass spectrometer is used to determine relative atomic mass
- ❑ **I know that there are 5 processes that occur in a mass spectrometer and can name and explain them. (not including mathematical treatment)**

Electronic Structure of Atoms

- ❑ I know what an energy level is
- ❑ I know why Bohr's model works for the first 20 elements in the periodic table. (no. of electrons in each main energy level)
- ❑ I can classify the first 20 elements in the periodic table on the basis of the number of electrons in their outermost shell
- ❑ **I know what an emission spectrum is**
- ❑ **I know what an absorption spectrum is**
- ❑ **I know that the Balmer series is the visible light section of energy emission**
- ❑ I know that different metals give rise to different coloured flames, eg fireworks, sodium street lights
- ❑ **I know that line spectra give evidence for energy levels and how.**
- ❑ **I know that energy levels have sub levels**
- ❑ **I can state Heisenberg's uncertainty principle.**
- ❑ **I know that electrons have a wave nature.**
- ❑ **I can define Orbital**
- ❑ **I can draw S and P orbitals**
- ❑ **I can state the Aufbau principle**
- ❑ **I can state Hund's Rule**
- ❑ **I can state the Pauli Exclusion principle**
- ❑ **I can draw the full s,p,d electronic configurations of the first 36 elements.**
- ❑ **I am familiar with the Flame tests experiment**

Trends in the Periodic table:

- ❑ I can define atomic radii
- ❑ I can account for the trends in atomic radii down a group
- ❑ I can account for the trends in atomic radii across a period.
- ❑ **I can define First ionisation energy**
- ❑ **I can account for the trends in ionisation energy down a group**
- ❑ **I can account for the trends in ionisation energy across a period**
- ❑ **I can account for the exceptions to the trends in ionisation energy across a period**
- ❑ **I can define second and successive ionisation energies**
- ❑ **I can explain how successive ionisation energies give evidence for the existence of energy levels.**
- ❑ I can explain how electronic structure influences the chemical properties of an element

- ❑ I can explain in terms of atomic radius, screening effect and nuclear charge, the general trends in properties of elements in groups I and VII.

Radioactivity:

- ❑ I know that Henri Becquerel discovered radioactivity and how.
- ❑ I know that Marie and Pierre Curie worked on Uranium salts to discover polonium and radium
- ❑ I know that radioactivity is all around us
- ❑ I know the nature and penetrating ability of alpha, beta and gamma radiation and I can give one example of each
- ❑ **I know the difference between chemical reactions and nuclear reactions**
- ❑ **I can complete simple nuclear equations for alpha and beta particles.**
- ❑ I know what a radioisotope is
- ❑ I can give three uses of radioisotopes
- ❑ I can define half life
- ❑ I know how half life is used in ^{14}C dating.
- ❑ I can explain the use of ^{60}Co radiation in cancer treatment.

Oxidation and Reduction:

- ❑ I can give three simple examples of oxidation and reduction reactions
- ❑ I can explain the rusting of iron in terms of oxidation
- ❑ I can define oxidation and reduction in terms of loss or gain of electrons
- ❑ I can name three common oxidising agents and three common reducing agents including bleach as both an oxidising and a reducing agent.
- ❑ I can explain how oxidation and reduction is used in the treatment of swimming pool water
- ❑ I can build up an electrochemical series based on how easily metals are oxidised. (displacement reactions)
- ❑ I can use scrap iron to extract copper
- ❑ I can explain the electrolysis of copper sulfate solution with copper electrodes **and give the half equations.**
- ❑ I can explain the electrolysis of acidified water with inert electrodes **and give the half equations.**
- ❑ I can give practical uses of electrolysis such as electroplating, purification of copper and chrome and nickel plating and cutlery.

Oxidation Numbers:

- ❑ **I know 7 rules for assigning oxidation numbers**
- ❑ **I can assign oxidation numbers according to those rules.**
- ❑ **I can work out the oxidation numbers of transition metals in their compounds**
- ❑ **I can define oxidation and reduction in terms of oxidation numbers.**

1) I can carry out the following experiment: Redox reactions of group VII elements – halogens as oxidising agents (reactions with bromides, iodides $^{Fe+}$and sulphites. Dissplacement reactions of metals (Zn with Cu^{2+}, Mg with Cu^{2+}.)

Chemical Bonding

Chemical compounds:

- ❑ I can construct simple chemical formulas
- ❑ I know why noble gases are so unreactive
- ❑ I can give a use of helium and/or argon related to their unreactivity
- ❑ I can define valency
- ❑ I can predict bonding based on attainment of a stable structure
- ❑ I can state the octet rule and know its limitations.
- ❑ I know the structure and valency of the following anions: hydroxides, carbonates, **nitrates, hydrogencarbonates, sulfites and sulfates**.
- ❑ I know that transition elements have variable valency and can explain why in relation to Cu, Fe, Cr, and Mn.

Ionic Bonding:

- ❑ I know that there are positive and negative ions
- ❑ I can predict the type of ion an atom of an element is likely to form
- ❑ I can define an ionic bond
- ❑ I can represent ionic bonds using dot and cross diagrams
- ❑ I know the structure of a sodium chloride crystal and how ionic bonding is responsible
- ❑ I know the properties of ionic substances such as hardness, melting and boiling points, and the ability to conduct electricity.
- ❑ I can give the uses of two everyday ionic substances.
- ❑ I can carry out tests for anions

Covalent Bonding:

- ❑ I can define covalent bonding
- ❑ I know about single double and triple bonds and how they form
- ❑ **I can distinguish between sigma and pi bonding.**
- ❑ I can draw covalent bonds using dot and cross diagrams
- ❑ I know the difference between polar and non-polar bonding
- ❑ I can test for polarity in liquids using a charged plastic rod
- ❑ I can give two examples of polar and non-polar materials in everyday life
- ❑ I know the properties of covalent substances such as hardness, melting and boiling points, and the ability to conduct electricity.

Electronegativity:

- ❑ I can define electronegativity
- ❑ I can explain trends in electronegativity down a group on the periodic table
- ❑ I can explain trends in electronegativity across a period on the periodic table

- ❑ I can use electronegativity differences to predict ionic, polar covalent, or non-polar covalent bonding.

Shapes of Molecules and Intermolecular Forces:

- ❑ I can use the electron pair repulsion theory to explain the shape of molecules of type AB_n for up to 4 pairs of electrons around a central atom. (refer to bond angle)
- ❑ I know the difference between intramolecular bonding and intermolecular forces
- ❑ I can define ven der Waals forces and explain their occurrence
- ❑ I can define dipole-dipole forces and explain their occurrence
- ❑ I can define Hydrogen bonding and explain its occurrence
- ❑ I can explain the effect of intermolecular forces on the boiling forces of a covalent substance and use it to explain differences in boiling points of various substances.

STOICHIOMETRY, FORMULAS and EQUATIONS.

- ❑ **I know how particles move in solids, liquids and gases.**
- ❑ **I can define diffusion and know that NH_3 and HCl diffuse and form a visible solid ammonium chloride. I also know that ink diffuses in water and smoke diffuses in air.**
- ❑ **I can state Boyles law and understand how Boyles air pump works**
- ❑ **I can state Charles's law.**
- ❑ I can state Gay-Lussac's law of combining volumes.
- ❑ I can state avagadro's law
- ❑ **I can state the combined gas law**
- ❑ **I can do simple calculations using the combined gas law including correction of gas volumes to S.T.P. using the units: Pa; cm^3; K)**
- ❑ I can state the assumptions of the kinetic theory of gases.
- ❑ I know what an ideal gas is
- ❑ I know why an gases deviate from ideal gas behaviour
- ❑ I can write the equation of state for an ideal gas
- ❑ I can do calculations using the equation of state for an ideal gas (using the units: Pa; m^3; and K).
- ❑ I can convert cm^3 to m^3.
- ❑ I can carry out an experiment to determine the Relative molecular mass of a volatile liquid.
- ❑ **I can define and express numerically Avogadro's constant**
- ❑ **I can define and write numerically a mole.**
- ❑ **I can define and write numerically Standard Temperature and Pressure (s.t.p.)**

- ❑ **I can define molar volume and find the value on an exam paper**
- ❑ **I can define molar mass**
- ❑ **I can define relative atomic mass**
- ❑ **I can define relative molecular mass M_r)**
- ❑ **I can carry out calculations to find relative molecular mass from relative atomic masses**
- ❑ **I can convert moles into grams, litres and into number of particles.**
- ❑ **I can convert grams and litres into moles**
- ❑ I can convert number of particles into moles
- ❑ I can convert moles to number of atoms of a molecular species
- ❑ I know how a mass spectrometer is used to determine M_r and know about the structure of a mass spectrometer.
- ❑ **I can define an empirical formula**
- ❑ **I can define a molecular formula**
- ❑ **I can carry out calculations of empirical formulas given the % composition by mass**
- ❑ I can calculate empirical formulas given the masses of reactants and products
- ❑ **I can calculate molecular formulas given the empirical formula and the relative molecular mass (e.g. glucose and urea).**
- ❑ **I can define and calculate % composition by mass**
- ❑ **I can define structural formulas and draw simple ones**
- ❑ **I can balance chemical equations**
- ❑ I can balance redox equations (ionic equations only – ignore spectator ions)
- ❑ **I can carry out calculations in g or kg involving masses and volumes based on balanced equations using the mole concept.**
- ❑ I can carry out calculations involving an excess of one reactant
- ❑ I can calculate and define percentage yields

VOLUMETRIC ANALYSIS.

- ❑ **I can write the concentration of solutions in: mol l^{-1} (molarity); g l^{-1}; and in** % (W/V); **% (v/v) (and know its use in wine); and** % (w/w).
- ❑ **I can calculate molarity from concentration in grams per litre and vice versa.**
- ❑ **I can calculate the number of moles from molarity and volume**
- ❑ I can carry out simple calculations using percentage concentrations
- ❑ **I know that colour intensity is a function of concentration.**
- ❑ I can do calculations of the effect of dilution on concentration
- ❑ **I know what a primary standard and a secondary standard is**
- ❑ **I can define acids, bases and salts.**
- ❑ **I can define neutralisation**

- ❑ **I can give two examples of a household acid and two examples of a household base.**
- ❑ **I can give everyday examples of neutralisation such as indigestion tablets and lime in agriculture**
- ❑ **I know the Arrhenius theory of acids and bases for aqueous solutions**
- ❑ I know the Bronsted-Lowry theory of acids and bases for aqueous solutions
- ❑ I can define a conjugate acid-base pair and can identify the conjugate acid and the conjugate base of a range of substances.
- ❑ **I know what apparatus is used in titrations**
- ❑ **I can outline correct titrimetric procedure**
- ❑ **I can solve volumetric problems using the formula method**
- ❑ I can solve volumetric problems from first principles
- ❑ I can calculate the relative molecular mass of a compound by titration
- ❑ I can calculate the amount of water of water of crystallisation in a compound from titration data.
- ❑ I can do calculations based on acid/base and redox volumetric analysis experiments.
- ❑ I can carry out the following titration experiments
    - Prepare a Standard solution of Sodium Carbonate.
    - To standardise a solution of Hydrochloric acid
    - To standardise a solution of Sodium Hydroxide
    - The determine the concentration of ethanoic acid in vinegar
    - To determine the % water of crystallisation in washing soda crystals
    - To standardise Potassium Permanganate
    - To determine the % iron in Iron Tablets
    - To standardise a solution of Sodium Thiosulfate
    - To determine the % sodium hypochlorite in household bleach