

Study guide for AP test on TOPIC 1 Matter & Measurement

The following list is a **GUIDE** to what you should study in order to be prepared for the AP test on TOPIC 1

In order to be fully prepared you should seek help if required, refer to the relevant chapter in the **textbook** and review **ALL** relevant notes, homeworks, worksheets, classwork and other materials

ALL students should;

- Recall a definition of chemistry
- Understand the process and stages of scientific (logical) problem solving
- Recall the three states of matter, their general properties and the methods for their interconversion
- Understand and recall definitions for physical and chemical change
- Know the difference between elements, mixtures and compounds including the difference between heterogeneous and homogeneous mixtures
- Understand and be able to use scientific notation (standard form)
- Recall and use SI units and prefixes
- Be able to convert between units
- Understand the concept of derived units and use relationships relating to density
- Recall the meaning of uncertainty and understand and be able to use the rules for determining significant figures and rounding off
- Understand the differences between, and be able to apply, the concepts of accuracy and precision
- Learn, and be able to use, formulae for the conversion of the three different temperature units studied in TOPIC 1

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Study guide for AP test on TOPIC 2 Atoms, Ions & Nomenclature

The following list is a **GUIDE** to what you should study in order to be prepared for the AP test on TOPIC 2

In order to be fully prepared you should seek help if required, refer to the relevant chapter in the **textbook** and review **ALL** relevant notes, homeworks, worksheets, classwork and other materials

ALL students should;

- Recall a very brief history of Atomic Theory
- Know and understand the five main aspects of Dalton's Atomic Theory
- Recall some of the experiments that led to the identification of sub-atomic particles
- Know the three particles that make up the atom and their relative charges, masses and positions in the atom
- Be able to use the Atomic # and Mass # of an isotope to calculate the numbers of protons, neutrons and electrons present
- Know what the term isotope means and be able to perform simple calculations relating to isotopic data
- Understand the phenomenon of radioactivity and the properties of radioactive particles
- Be able to write nuclear equations
- Understand the concept of half-life and be able to perform calculations related to it
- Recall some uses of radioactivity
- Understand the term mass deficit
- Be able to use neutron:proton ratio to make predictions about stability
- Understand the terms nuclear fission and fusion

- Understand, that in very general terms, radioactivity involves the rearrangement of the nucleus and chemical reactions involve the rearrangement of electrons
- Know the approximate locations of metals, non-metals and metalloids on the periodic table
- Understand the meaning of the terms Molecule and Ion
- Learn the lists of common anions and cations (including polyatomic ions) studied in TOPIC 2
- Know how to combine those anions and cations in the correct proportions to form ionic compounds with no net charge
- Be able to name binary ionic compounds of a metal and a non-metal
- Be able to name binary molecular compounds of two non-metals
- Be able to name simple binary acids
- Be able to name ionic compounds containing polyatomic anions
- Be able to name oxoacids and compounds containing oxoanions
- Be able to name hydrated salts

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Study guide for AP test on TOPIC 3 Electronic Configuration

The following list is a **GUIDE** to what you should study in order to be prepared for the AP test on TOPIC 3

In order to be fully prepared you should seek help if required, refer to the relevant chapter in the **textbook** and review **ALL** relevant notes, homeworks, worksheets, classwork and other materials

ALL students should;

- Understand the Bohr model of the atom
- Understand how line emission spectra are formed
- Appreciate that the electron can be considered to have wave like properties as well as particle type properties
- Understand and use equations that relate the Energy, frequency, speed and wavelength of waves including the Rydberg equation
- Understand the concept of electrons in shells and the use of quantum numbers
- Understand the use of the terms s, p, d and f and their use in orbital notation
- Recall and understand the rules for filling orbitals and determining electronic configuration, including the Pauli exclusion principle, Hund's rule of maximum multiplicity and notable exceptions
- Be able to construct the electronic configuration of the elements using the s, p and d and f notation
- Be able to construct the electronic configuration of the elements using the noble gas core and s, p, d and f notation
- Be able to construct the electronic configuration of simple ions (including d block ions)
- Recall the shapes of the s, p and d orbitals
- Recall that orbitals are electron probability maps
- Be able to describe electronic configurations using the electrons in boxes notation
- Recall the meanings of the terms paramagnetic, diamagnetic and isoelectronic

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Study guide for AP test on TOPIC 4 Stoichiometry

The following list is a **GUIDE** to what you should study in order to be prepared for the AP test on TOPIC 4

In order to be fully prepared you should seek help if required, refer to the relevant chapter in the **textbook** and review **ALL** relevant notes, homeworks, worksheets, classwork and other materials

ALL students should;

- Be able to write chemical equations in words
- Be able to write chemical equations using chemical formulae and chemical symbols (this requires knowledge, and correct use of, chemical nomenclature)
- Understand, and be able to use, state symbols as part of chemical equation writing
- Be able to balance chemical equations
- Understand why balancing chemical equations is important
- Understand the concept of percentage by mass
- Be able to calculate empirical formulae from percentage by mass data
- Be able to convert empirical formulae to molecular formulae by using Molar Mass data
- Understand and be able to apply the concept of the mole in chemical calculations (including the application of Avogadro's number)
- Be able to use combustion data to calculate empirical formulae of compounds
- Understand the importance of, and be able to apply, the concept of stoichiometric coefficients relating to reacting ratios
- Know how to calculate the number of moles of a solid substance present in a reaction from data
- Be able to perform calculations relating to molarity
- Understand and be able to perform calculations relating to the Beer-Lambert law
- Be able to perform calculations relating to dilution
- Be able to perform calculations relating to molality
- Be able to calculate the formulae of hydrated salts from experimental data
- Understand, and be able to apply, the concept of a limiting reactant
- Understand, and be able to apply, the concept of percentage yield

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Study guide for AP test on TOPIC 5 Qualitative & Quantitative Chemistry

The following list is a **GUIDE** to what you should study in order to be prepared for the AP test on TOPIC 5

In order to be fully prepared you should seek help if required, refer to the relevant chapter in the **textbook** and review **ALL** relevant notes, homeworks, worksheets, classwork and other materials

ALL students should;

- Understand that a reaction in aqueous solution is one that is carried out in water
- Understand the terms electrolyte, weak electrolyte and non-electrolyte and be able to predict which compounds fall into which category
- Be able to calculate the individual ion concentrations when ionic compounds are dissolved in water
- Understand the difference between, and be able to write, full, ionic and net ionic equations
- Learn and be able to apply solubility rules
- Recall that an acid is a hydrogen ion donor
- Recall that a base is a hydrogen ion acceptor
- Understand how the degree of ionization/dissociation determines the strength of an acid and a base
- Understand that in a neutralization reaction an acid and base react to form a salt and water

- Learn some reactions that produce gases as products and the chemical tests for those gases
- Understand that oxidation and reduction can be described in terms of loss and gain of electrons respectively
- Be able to find the oxidation number of an element within a compound
- Become familiar with some common oxidizing and reducing agents and the half-equations that represent their action
- Understand and be able to recognize the different types of REDOX reaction. Namely synthesis (combination), decomposition, combustion, single and double displacement (replacement) including metal displacement, hydrogen displacement from water and acids and halogen displacement
- Learn and be able to use the reactivity series as a tool for predicting displacement reactions
- Understand the concept of disproportionation
- Recall and understand the technique of titration
- Be able to carry out simple quantitative moles calculations relating to REDOX titration data

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Study guide for AP test on TOPIC 6 Gases

The following list is a **GUIDE** to what you should study in order to be prepared for the AP test on TOPIC 6

In order to be fully prepared you should seek help if required, refer to the relevant chapter in the **textbook** and review **ALL** relevant notes, homeworks, worksheets, classwork and other materials

ALL students should;

- Be able to convert between different units of pressure
- Be able to convert between different units of temperature
- Recall and be able to use Boyle's law in calculations
- Recall and be able to use Charles's law in calculations
- Recall and be able to use Avogadro's law in calculations
- Recall and be able to use the Combined gas law and the General gas law in calculations
- Recall and be able to use the Ideal gas law in calculations
- Understand and be able to use the van der Waals equation (modified ideal gas law) in calculations
- Recall and be able to use Dalton's law of partial pressures in calculations
- Recall the conditions that are used as standard in calculations
- Be able to use molar gas volume in calculations
- Understand the Kinetic theory as applied to gases
- Understand the concept of, and be able to perform calculations involving, the root-mean-square-speed of gases
- Understand the terms effusion and diffusion and be able to perform calculations relating to those concepts

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Study guide for AP test on TOPIC 7 Periodicity

The following list is a **GUIDE** to what you should study in order to be prepared for the AP test on TOPIC 7

In order to be fully prepared you should seek help if required, refer to the relevant chapter in the **textbook** and review **ALL** relevant notes, homeworks, worksheets, classwork and other materials

ALL students should;

- Understand that regular, repeatable patterns occur across periods and within groups on the periodic table
- Appreciate that these patterns sometimes have notable exceptions
- Recall and understand that the noble gases have full outer shells that represent stable electronic configurations
- Recall how, and understand why, group I, II, VI and VII elements achieve pseudo noble gas electronic configurations
- Recall the definition of ionization energy
- Recall the definition of electron affinity
- Recall and understand the variation in ionization energy and electron affinity when moving about the periodic table
- Be able to predict the group an element is in from ionization energy data
- Understand and be able to apply the terms diamagnetic and paramagnetic
- Recall how and why atomic and ionic size vary when moving about the periodic table
- Understand how many physical properties change gradually when moving about the periodic table
- Understand and recall the change in the specific chemical properties mentioned in TOPIC 7

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Study guide for AP test on TOPIC 8 Bonding

The following list is a **GUIDE** to what you should study in order to be prepared for the AP test on TOPIC 8

In order to be fully prepared you should seek help if required, refer to the relevant chapter in the **textbook** and review **ALL** relevant notes, homeworks, worksheets, classwork and other materials

ALL students should;

- Understand that when forming chemical bonds atoms are attempting to form more stable electronic configurations
- Understand the essential difference between intra and inter bonding
- Understand the concept of ionic bonding and the nature of the ionic bond
- Understand the concept of covalent bonding and nature of the covalent bond
- Be able to draw Lewis structures
- Understand the concept of resonance related to Lewis structures
- Understand the concept of formal charge related to Lewis structures
- Be able to predict the shape of, and bond angles in, simple molecules and ions using VSEPR theory
- Understand the concept of the dative (co-ordinate) bond related to Lewis structures
- Understand that ionic bonding and covalent bonding are at two ends of a sliding scale of bond type
- Understand the concept of electronegativity
- Understand that polarization caused by small highly charged cations leads to ionic compounds exhibiting some covalent character
- Understand that differences in electronegativity in covalent molecules causes dipoles and some ionic character in covalent compounds
- Understand when molecules exhibit polarity
- Be able to predict the shapes of simple molecules and ions using Lewis structures
- Understand the occurrence, relative strength and nature of dipole-dipole interactions, London dispersion forces and hydrogen bonds

- Understand how solid structure influences properties
- Understand the nature of liquids
- Understand the nature of sigma and pi bonds
- Understand and be able to identify different types of orbital hybridization

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Study guide for AP test on TOPIC 9 Thermochemistry

The following list is a **GUIDE** to what you should study in order to be prepared for the AP test on TOPIC 9

In order to be fully prepared you should seek help if required, refer to the relevant chapter in the **textbook** and review **ALL** relevant notes, homeworks, worksheets, classwork and other materials

ALL students should;

- Learn definitions that describe the systems studied in thermochemistry
- Understand, be able to quote a definition and write suitable equations for standard enthalpy of formation
- Understand, be able to quote a definition and write suitable equations for standard enthalpy of combustion
- Understand and be able to use a Hess's law cycle or algebraic methods to calculate a given enthalpy change
- Understand and be able to use in calculations, average bond energy terms
- Understand the meaning of the terms exothermic and endothermic
- Understand and be able to apply the concept of entropy both in descriptive and calculation contexts
- Understand and be able to apply the concept of Gibbs Free Energy both in descriptive and calculation contexts
- Understand and be able to apply the energetics of the ionic bond as described by the Born-Haber cycle and associated calculations
- Understand the role of charge density in determining some physical properties of ionic compounds

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Study guide for AP test on TOPIC 10 Transition Metal Basics

The following list is a **GUIDE** to what you should study in order to be prepared for the AP test on TOPIC 10

In order to be fully prepared you should seek help if required, refer to the relevant chapter in the **textbook** and review **ALL** relevant notes, homeworks, worksheets, classwork and other materials

ALL students should;

- Understand and be able to write electronic configurations of transition metals and their ions
- Recall some colors of transition metals and understand when color occurs
- Be able to recognize and name complex ions
- Understand and be able to write equations for complex ion reactions (Ligand exchange & Decomposition)

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Study guide for AP test on TOPIC 11 Organic Basics

The following list is a **GUIDE** to what you should study in order to be prepared for the AP test on TOPIC 11

In order to be fully prepared you should seek help if required, refer to the relevant chapter in the **textbook** and review **ALL** relevant notes, homeworks, worksheets, classwork and other materials

ALL students should;

- Be able to name some simple aliphatic organic compounds
- Understand and be able to write equations for some organic reactions (Combustion, Substitution, Acid Base, Addition & Esterification)

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Study guide for AP test on TOPIC 12 Equation Writing

The following list is a **GUIDE** to what you should study in order to be prepared for the AP test on TOPIC 12

In order to be fully prepared you should seek help if required, refer to the relevant chapter in the **textbook** and review **ALL** relevant notes, homeworks, worksheets, classwork and other materials

ALL students should;

- Be able to write and balance net ionic equations for Double Replacement Reactions
- Be able to write and balance net ionic equations for Simple REDOX Reactions
- Be able to write and balance net ionic equations for Non-Simple REDOX Reactions
- Be able to write and balance net ionic equations for Hydrolysis Reactions
- Be able to write and balance net ionic equations for Complex Ion (Transition Metal) Reactions
- Be able to write and balance net ionic equations for Organic Reactions
- Be able to answer simple questions associated with the reactions in TOPIC 12

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Study guide for AP test on TOPIC 13 Equilibrium

The following list is a **GUIDE** to what you should study in order to be prepared for the AP test on TOPIC 13

In order to be fully prepared you should seek help if required, refer to the relevant chapter in the **textbook** and review **ALL** relevant notes, homeworks, worksheets, classwork and other materials

ALL students should;

- Understand the concept of dynamic equilibrium
- Be able to write an expression in terms of concentrations for the equilibrium constant K_c given a chemical equation
- Understand that equilibria take a finite time to be achieved
- Be able to calculate values for K_c and associated data from initial concentrations
- Be able to write an expression in terms of partial pressures for the equilibrium constant K_p given a chemical equation
- Be able to calculate values for K_p and associated data from pressure data
- Recall and understand Le Chatelier's Principle

- Understand the application of Le Chatelier's Principle and be able to predict the shift in position of equilibria and optimum conditions in reactions
- Understand and be able to apply the relationship of K_c to K_p , the different formats of K_c (reciprocals and roots) and the relationships in simultaneous equilibria
- Understand and be able to apply to calculations, the concept of solubility product
- Understand and be able to apply to calculations, the concept of common ion effect
- Understand and be able to interpret phase diagrams
- Understand and be able to interpret heating and cooling curves

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Study guide for AP test on TOPIC 14 Acids & Bases

The following list is a **GUIDE** to what you should study in order to be prepared for the AP test on TOPIC 14

In order to be fully prepared you should seek help if required, refer to the relevant chapter in the **textbook** and review **ALL** relevant notes, homeworks, worksheets, classwork and other materials

ALL students should;

- Be able to recall the Bronsted Lowry, Arrhenius and Lewis definitions of an acids and bases
- Be able to identify acid base conjugate pairs
- Recall the difference between strong and weak acids in terms of ionization
- Be able to calculate pH of strong acids and strong bases
- Be able to calculate pH of weak acids and weak bases using K_a and K_b
- Recall a definition of K_w , the ionic product of water
- Recall the definition of a buffer
- Understand and how a buffer works
- Be able to identify and calculate the pH of a buffer solution
- Understand the techniques and procedures associated with titrations
- Be able to sketch titration curves and be able to suggest a suitable indicator for a particular titration
- Understand the hydrolysis of salts and the effect this has on pH
- Understand the meaning of the term 'equivalence point'
- Understand how indicators work

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Study guide for AP test on TOPIC 15 Kinetics

The following list is a **GUIDE** to what you should study in order to be prepared for the AP test on TOPIC 15

In order to be fully prepared you should seek help if required, refer to the relevant chapter in the **textbook** and review **ALL** relevant notes, homeworks, worksheets, classwork and other materials

ALL students should;

- Be able to recall AND understand Collision Theory
- Be able to recall AND understand how temperature, concentration, surface area and catalysts affect a rate of reaction
- Understand AND be able to interpret a Maxwell-Boltzman distribution plot
- Understand AND be able to interpret an energy profile plot
- Be able to deduce orders, rate equations and rate constants (including units) from initial rate data

- Understand the link between the rate determining (slow step) in a reaction mechanism and the rate equation
- Understand AND be able to interpret graphical data relating to rates

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Study guide for AP test on TOPIC 16 Electrochemistry

The following list is a **GUIDE** to what you should study in order to be prepared for the AP test on TOPIC 16

In order to be fully prepared you should seek help if required, refer to the relevant chapter in the **textbook** and review **ALL** relevant notes, homeworks, worksheets, classwork and other materials

ALL students should;

- Recall the definition of oxidation and reduction in terms of electrons
- Understand and recall the definition of standard electrode potential
- Understand and recall how to construct a cell diagram (line notation) and draw a diagram (picture) of the apparatus needed
- Recall the conditions that standard electrode potentials are measured under
- Understand the nature and purpose of a salt bridge
- Be able to predict the likelihood or otherwise of chemical reactions using standard electrode potentials and understand how those predictions may not prove to be accurate
- Understand and use the Nernst equation
- Understand the relationship between Gibbs free energy, equilibrium constants and E_{cell} , and be able to perform related calculations
- Understand electrolysis and be able to perform quantitative calculations relating to it

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Study guide for AP test on TOPIC 17 Colligative Properties

The following list is a **GUIDE** to what you should study in order to be prepared for the AP test on TOPIC 17

In order to be fully prepared you should seek help if required, refer to the relevant chapter in the **textbook** and review **ALL** relevant notes, homeworks, worksheets, classwork and other materials

ALL students should;

- Understand the concept of vapor pressure
- Be able to relate changes (both quantitative and qualitative) in vapor pressure to addition of non-volatile solutes to solvents (Raoult's Law)
- Understand and recall Raoult's Law in terms of ideal solutions of two volatile components AND deviations from ideal behavior
- Be able to recall and use equations relating to quantitative treatments of Boiling Point Elevation, Freezing Point Depression, Osmotic Pressure and the van't Hoff factor

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