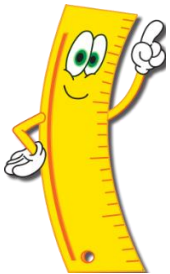


Terms & Definitions

you must know !!

It is absolutely essential that you know these terms and definitions. They form the vocabulary of the Grade 12 Physical Sciences without which it is impossible to pass the final exam. The majority of simple recall and / or comprehension questions test your knowledge of these important terms / laws – if you know them well, you already have the 30% needed to pass the final exam. But please don't limit yourself! Aim high. There is no reason you can't do well (get 70% +) in the Physical Sciences. It's not rocket science!!

Govan Mbeki Mathematics Development Centre
empowering young minds

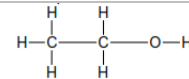
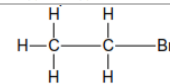
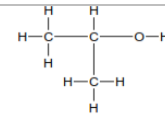
Grade 12: Paper 2 (Chemistry)

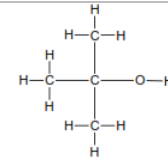
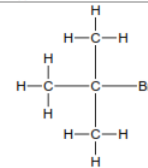
Table of Contents: Terms and Important Points relevant to …. *Page*

Matter and Materials: Organic Molecules	
addition reaction	A reaction in which a double bond in the starting material is broken and elements are added to it.
addition polymer	A polymer formed when monomers (usually containing a double bond) combine through an addition reaction.
addition polymerisation	A reaction in which small molecules join to form very large molecules by adding on double bonds.
alcohol	An organic compound in which H atoms in an alkane have been substituted with hydroxyl groups (–OH groups). General formula: $C_nH_{2n+1}OH$
aldehydes	Organic compounds having the general structure RCHO where R = H or alkyl. General formula: RCHO (R = alkyl group)
alkane	An organic compound containing only C–H and C–C single bonds. General formula: C_nH_{2n+2}
alkene	A compound of carbon and hydrogen that contains a carbon–carbon double bond. General formula: C_nH_{2n}
alkyl group	A group formed by removing one H atom from an alkane.
alkyne	A compound of carbon and hydrogen that contains a carbon–carbon triple bond.
boiling point	The temperature at which the vapour pressure of a liquid equals atmospheric pressure.
carbonyl group	Functional group of ketones (>C=O)
carboxyl group	Functional group of carboxylic acids (–COOH)
carboxylic acid	An organic compound containing a carboxyl group (–COOH group). General formula:

	$C_nH_{2n+1}COOH$ (or RCOOH)
chain isomers	Compounds with the same molecular formula, but different types of chains.
condensation polymer	A polymer formed by two monomers with different functional groups that are linked together in a condensation reaction in which a small molecule, usually water, is lost.
condensation polymerisation	Molecules of two monomers with different functional groups undergo condensation reactions with the loss of small molecules, usually water.
condensed structural formula	A formula that shows the way in which atoms are bonded together in the molecule, but does not show all bond lines.
cracking	The chemical process in which longer chain hydrocarbon molecules are broken down to shorter more useful molecules.
dehydration	Elimination of water from a compound usually such as an alcohol.
dehydrohalogenation	The elimination of hydrogen and a halogen from a haloalkane.
dipole–dipole force	Intermolecular forces found between polar molecules i.e. molecules in which there is an uneven distribution of charge so that the molecule has a positive and a negative side.
elimination reaction	A reaction in which elements of the starting material are "lost" and a double bond is formed.
esterification	The preparation of an ester from the reaction of a carboxylic acid with an alcohol.
functional group	A bond or an atom or a group of atoms that determine(s) the physical and chemical properties of a group of organic compounds.
functional isomers	Compounds with the same molecular formula, but different functional groups.
haloalkane (alkyl	An organic compound in which one or more H atoms in an alkane have been replaced with

halide)	halogen atoms. General formula: $C_nH_{2n+1}X$ (X = F, Cℓ, Br or I)
halogenation	The reaction of a halogen (Br, $C\ell_2$) with a compound.
homologous series	A series of organic compounds that can be described by the same general formula. A series of organic compounds in which one member differs from the next with a CH_2 group.
hydration	The addition of water to a compound.
hydrocarbon	Organic compounds that consist of hydrogen and carbon only.
hydrogenation	The addition of hydrogen to an alkene.
hydrogen bond	A strong intermolecular force found between molecules in which an H atom is covalently bonded to wither an N, O or F atom.
hydrohalogenation	The addition of a hydrogen halide to an alkene.
hydrolysis	The reaction of a compound with water.
intermolecular force	Forces between molecules that determine physical properties of compounds.
IUPAC name	A chemical nomenclature (set of rules) created and developed by the International Union of Pure and Applied Chemistry (IUPAC) to generate systematic names for chemical compounds.
London force	A weak intermolecular force between non–polar molecules.
macromolecule	A molecule that consists of a large number of atoms.
melting point	The temperature at which the solid and liquid phases of a substance are at equilibrium.
molecular formula	A chemical formula that indicates the type of atoms and the correct number of each in a molecule, e.g. CH_4
monomer	Small organic molecules that can be covalently bonded to each other in a repeating pattern.

organic chemistry	Chemistry of carbon compounds.
polymer	A large molecule composed of smaller monomer units covalently bonded to each other in a repeating pattern.
polymerisation	A chemical reaction in which monomer molecules join to form a polymer.
positional isomer	Compounds with the same molecular formula, but different positions of the side chain, substituents or functional groups on the parent chain.
primary alcohol	One C atom is bonded to the C atom bonded to hydroxyl group. 
primary haloalkane	One C atom is bonded to the C atom bonded to the halogen. 
saturated compounds	Compounds in which there are no multiple bonds between C atoms in their hydrocarbon chains. Compounds with only single bonds between C atoms in their hydrocarbon chains.
secondary alcohol	Two C atoms bonded to the C atom that is bonded to hydroxyl group. 
secondary haloalkane	Two C atoms bonded to the C atom bonded to the halogen.
structural formula	A structural formula of a compound shows which atoms are attached to which within the

	molecule. Atoms are represented by their chemical symbols and lines are used to represent ALL the bonds that hold the atoms together.
structural isomer	Organic molecules with the same molecular formula, but different structural formulae.
substituent (branch)	A group or branch attached to the longest continuous chain of C atoms in an organic compound.
substitution reaction	A reaction in which an atom or a group of atoms in a molecule is replaced by another atom or group of atoms
tertiary alcohol	Three C atoms bonded to carbon that is bonded to hydroxyl group. 
tertiary haloalkane	Three C atoms bonded to the C atom bonded to the halogen. 
unsaturated compounds	Compounds in which there are multiple bonds (double or triple bonds) between C atoms in their hydrocarbon chains
Van der Waals forces	A combined name used for the different types of intermolecular forces.

vapour pressure	The pressure exerted by a vapour at equilibrium with its liquid in a closed system.
Chemical Change: Quantitative Aspects of Chemical Change	
mole	One mole of a substance is the amount of substance having the same number of particles as there are atoms in 12 g carbon–12.
molar gas volume at STP	The volume of one mole of a gas. 1 mole of any gas occupies 22,4 dm^3 at 0 °C (273 K) and 1 atm (atmosphere) (101,3 kPa).
molar mass	The mass of one mole of a substance. Symbol: M; Unit: $g \cdot mol^{-1}$
Avogadro's Law	Under the same conditions of temperature and pressure, the same number of moles of all gases occupy the same volume.
concentration	The amount of solute per litre/cubic decimetre of solution. $c = n / V$; Unit: $mol \cdot dm^{-3}$
empirical formula	The simplest positive integer ratio of atoms present in a compound.
percentage yield	Yield is the amount of product obtained from a reaction. Percentage (or percent) yield = actual mass obtained / calculated mass × 100
percentage purity	percentage purity = mass of pure chemical / total mass of sample × 100
percentage composition	The percentage of each of the components in a substance. Percentage of component = mass contributed by component / mass of all components × 100
limiting reagents	The substance that is totally consumed when the chemical reaction is complete.

Chemical Change: Energy and Change	
heat of reaction (ΔH)	The energy absorbed or released in a chemical reaction.
exothermic reactions	Reactions that release energy. ($\Delta H < 0$)
endothermic reactions	Reactions that absorb energy. ($\Delta H > 0$)
activation energy	The minimum energy needed for a reaction to take place.
activated complex	The unstable transition state from reactants to products.
Chemical Change: Rate of Reaction	
reaction rate	The change in concentration of reactants or products per unit time. Rate = $\Delta c / \Delta t$ Unit: $mol \cdot dm^{-3} \cdot s^{-1}$
collision theory	A model that explains reaction rate as the result of particles colliding with a certain minimum energy.
catalyst	A substance that increases the rate of a chemical reaction without itself undergoing a permanent change. (A catalyst increases the rate of a reaction by providing an alternative path of lower activation energy. It therefore decreases the net/total activation energy.)
factors that affect reaction rate	Nature of reacting substances, surface area, concentration (pressure for gases), temperature and the presence of a catalyst.

Chemical Change: Chemical Equilibrium	
open system	A system which continuously interacts with the environment – it exchanges matter and energy with its environment.
closed system	A system that only exchanges energy with its surroundings, but it does not exchange matter with its surroundings.
isolated system	A system that does not exchange matter or energy with its environment.
reversible reaction	A reaction is reversible when products can be converted back to reactants.
chemical equilibrium	Dynamic equilibrium when the rate of the forward reaction equals the rate of the reverse reaction.
factors that influence the equilibrium position	Pressure (gases only), concentration and temperature.
Le Chatelier's principle	When the equilibrium in a closed system is disturbed, the system will reinstate a new equilibrium by favouring the reaction that will oppose the disturbance.
Chemical Change: Acids and Bases	
acid–base indicator	A dye used to distinguish between acidic and basic solutions by means of the colour changes it undergoes in these solutions.
amphiprotic	A substance that can act as either an acid or a base.

substance / ampholyte	
Arrhenius theory	An acid is a substance that produces hydrogen ions (H^+)/ hydronium ions (H_3O^+) when it dissolves in water. A base is a substance that produces hydroxide ions (OH^-) when it dissolves in water.
auto–ionisation of water	A reaction in which water reacts with itself to form ions (hydronium ions and hydroxide ions).
concentrated acids / bases	Contain a large amount (number of moles) of acid/base in proportion to the volume of water.
conjugate acid and base	A pair of compounds or ions that differ by the presence of one H+ ion, e.g. CO_3^{2-} and HCO_3^-
dilute acids / bases	Contain a small amount (number of moles) of acid/base in proportion to the volume of water.
diprotic acid	An acid that can donate two protons. Example: H_2SO_4
dissociation	The process in which ionic compounds split into ions.
endpoint	The point in a titration where the indicator changes colour.
equivalence point	The point in a reaction where equivalent amounts of acid and base have reacted completely.
hydrolysis	The reaction of a salt with water. The reaction of an ion with water to produce the conjugate acid and a hydroxide ion or the conjugate base and a hydronium ion.
ionisation	The process in which ions are formed during a chemical reaction.

ion product of water	The product of the ions formed during auto-ionisation of water i.e. $[H_3O^+][OH^-]$ at 25 °C.
ionisation constant of water (K_w)	The equilibrium value of the ion product $[H_3O^+][OH^-]$ at 25 °C.
K_a value	Ionisation constant for an acid.
K_b value	Dissociation or ionisation constant for a base.
Lowry-Brønsted theory	An acid is a proton (H+ ion) donor. A base is a proton (H+ ion) acceptor.
monoprotic acid	An acid that can donate one proton, e.g. HCl
neutralisation	The reaction of an acid with a base to form a salt (ionic compound) and water.
pH	The negative of the logarithm of the hydronium ion concentration in $mol \cdot dm^{-3}$. In symbols: $pH = -\log[H_3O^+]$ Unit: None
pH scale	A scale from 0 – 14 used as a measure of the acidity and basicity of solutions where pH = 7 is neutral, pH > 7 is basic and pH < 7 is acidic.
salt	The ionic compound that is the product of a neutralisation reaction.
standard solution	A solution of precisely known concentration.
strong bases	Dissociate completely in water to form a high concentration of OH^- ions. Examples: sodium hydroxide (NaOH) and potassium hydroxide (KOH).
strong acids	Ionise completely in water to form a high concentration of H_3O^+ ions. Examples: hydrochloric acid (HCℓ), sulphuric acid (H_2SO_4) and nitric acid (HNO_3).
titration	The procedure for determining the amount of acid (or base) in a solution by determining the

	volume of base (or acid) of known concentration that will completely react with it.
weak acids	Ionise incompletely in water to form a low concentration of H_3O^+ ions. Examples: ethanoic acid (CH_3COOH) and oxalic acid $(COOH)_2$
weak bases	Dissociate/ionise incompletely in water to form a low concentration of OH^- ions. Examples: ammonia (NH_3), sodium hydrogen carbonate ($NaHCO_3$), sodium carbonate(Na_2CO_3), potassium carbonate (K_2CO_3), calcium carbonate ($CaCO_3$)
Chemical Change: Electrochemical Reactions	
galvanic cell	A cell in which chemical energy is converted into electrical energy. A galvanic (voltaic) cell has self-sustaining electrode reactions.
electrolytic cell	A cell in which electrical energy is converted into chemical energy.
redox reaction	A reaction in which an electron transfer takes place.
oxidation	A loss of electrons. An increase in oxidation number.
reduction	A gain of electrons. A decrease in oxidation number.
oxidising agent	A substance that is reduced/gains electrons/whose oxidation number decreases.
reducing agent	A substance that is oxidised/loses electrons/whose oxidation number increases.
anode	The electrode where oxidation takes place.
cathode	The electrode where reduction takes place.
electrolyte	A solution that conducts electricity through the movement of ions.
electrolysis	The chemical process in which electrical energy is converted to chemical energy,

	or the use of electrical energy to produce a chemical change.
salt bridge	The connection between two half-cells needed to ensure electrical neutrality in the cell. A component used in a galvanic cell to complete the circuit.
electrodes	An electrical conductor used in a galvanic cell to make contact with a non-metallic part of the circuit e.g. the electrolyte.
cell notation	A short way to represent a galvanic cell. When writing cell notation, the following conventions apply: The $H_2\|H^+$ half-cell is treated just like any other half-cell. Cell terminals (electrodes) are written on the outside of the cell notation. Active electrodes: reducing agent | oxidised species || oxidising agent | reduced species Inert electrodes (usually Pt or C): Pt | reducing agent | oxidised species || oxidising agent | reduced species | Pt - example: Pt | $C\ell^-$(aq) $\|C\ell_2$(g) || F_2(g) | F(aq) | Pt
overall cell reaction	The reaction obtained by combining two half-reactions.
positive value of the standard emf	The reaction is spontaneous under standard conditions.
standard conditions for a galvanic cell	Temperature: 25 °C / 298 K; Concentration: 1 mol·dm^{-3}; Pressure (gases only): 101,3 kPa / 1 atm (atmosphere).
standard hydrogen electrode	The reference electrode used to compile the Table of Standard Reduction Potentials. The hydrogen half-cell was given a standard reduction potential of 0 V. Half-cell notation: Pt | H_2(g) | H(aq) Half-reaction: $2H^+ + 2e^- \rightleftharpoons H_2$

electroplating	The covering of an object with a metal by making it the cathode in an electrolytic cell.
bauxite	The ore from which aluminium is recovered.
cryolite	An aluminium compound in which aluminium oxide is dissolved to reduce the cost of the extraction of aluminium. Cryolite has a lower melting point than aluminium oxide.
Chemical Systems: Fertilisers	
non-mineral nutrients	C, H and O; obtained from the atmosphere (CO_2) and rain (H_2O)
primary nutrients	Nitrogen (N), phosphorous (P) and potassium (K); function: N: essential for plant growth, green leaves; P: development of roots, stems and seeds; K: resistance against diseases and production of flowers/fruits
NPK fertilisers	Fertilisers containing the three primary nutrients for plants. They contain ammonium nitrate (NH_4NO_3), ammonium phosphate [$(NH_4)_3PO_4$] and potassium chloride ($KC\ell$).
N:P:K ratio	The percentage nitrogen, phosphorous and potassium in a fertiliser.
fractional distillation of liquid air	Industrial preparation of nitrogen from air.
steam reforming	Preparation of hydrogen from earth gas (methane); reaction: $CH_4 + H_2O \rightarrow 3H_2 + CO$
Haber process	Industrial preparation of ammonia; reaction: $N_2 + 3H_2 \rightleftharpoons 2NH$ (using an iron catalyst)
Ostwald process	Industrial preparation of nitric acid; reactions: Catalytic oxidation of ammonia with catalyst Pt: $4NH_3 + 5O_2 \rightleftharpoons 4NO + 6H_2O$ $2NO + O_2 \rightarrow 2NO_2$

	$3NO_2 + H_2O \rightarrow 2HNO_3 + NO$ or $4NO_2 + 2H_2O \rightarrow 4HNO_3$
contact process	Industrial preparation of sulphuric acid; reactions: $S + O_2 \rightarrow SO_2$ $2SO_2 + O_2 \rightarrow 2SO_3$ (Contact catalyst: vanadium pentoxide (V_2O_5) $SO_3 + H_2SO_4 \rightarrow H_2S_2O_7$ $H_2S_2O_7$: fuming sulphuric acid or pyro sulphuric acid or oleum) $H_2S_2O_7 + H_2O \rightarrow 2H_2SO_4$
preparation of ammonium sulphate	ammonia + sulphuric acid → ammonium sulphate $2NH_3 + H_2SO_4 \rightarrow (NH_4)_2SO_4$
preparation of ammonium nitrate	ammonia + nitric acid → ammonium nitrate $NH_3 + HNO_3 \rightarrow NH_4NO_3$
eutrophication	The process by which an ecosystem, e.g. a river or dam, becomes enriched with inorganic plant nutrients, esp. phosphorus and nitrogen, resulting in excessive plant growth. As plant growth becomes excessive, the amount of dead and decaying plant material increases rapidly.