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Presents

Organic Chemistry Made Simple for IGCSE

2026 Edition

Cambridge IGCSE Chemistry | Complete Study Guide

Designed to make every concept clear, every reaction memorable, and every exam achievable.

Welcome to Organic Chemistry — IGCSE 2026

Organic chemistry is one of the most exciting and relevant areas of IGCSE Chemistry. It is the study of carbon-containing compounds — a field that underpins medicine, materials science, fuel production, food technology, and so much more. From the petrol in a car's engine to the plastics in everyday objects, and from the alcohol in hand sanitiser to the fats in the food we eat, organic chemistry is everywhere.

This guide, prepared by Eclassopedia for the 2026 IGCSE examination cycle, takes a structured, student-friendly approach. Every major topic is broken down into digestible sections with clear explanations, helpful memory aids, worked examples, and exam-focused tips. Whether you are just starting organic chemistry or consolidating your revision, this resource will help you understand the 'why' behind every reaction, not just the 'what'.

How to Use This Guide

Work through each section in order for the first time. During revision, use the key term tables and summary boxes to quickly refresh your memory. Pay attention to the Exam Tips throughout — they reflect the most commonly tested ideas in Cambridge IGCSE Chemistry papers.

1. Introduction to Organic Chemistry

Carbon is extraordinary. With four bonds available, it can link to other carbon atoms in chains, rings, and branched structures of almost unlimited variety. This versatility gives rise to millions of organic compounds, each with unique properties and uses.

1.1 Why Carbon is Special

Unlike most other elements, carbon can form stable bonds with itself repeatedly, creating long chains and complex ring structures. This property, called catenation, is the foundation of organic chemistry. Carbon also bonds readily with hydrogen, oxygen, nitrogen, sulfur, and the halogens, giving rise to an enormous diversity of functional groups and compound types.

- Carbon forms 4 covalent bonds — no more, no less.
- It can bond to other carbon atoms to form chains (aliphatic compounds) or rings (cyclic compounds).
- Organic compounds always contain carbon; most also contain hydrogen.
- Compounds containing only carbon and hydrogen are called hydrocarbons.

1.2 Representing Organic Molecules

There are several ways to represent organic molecules, each offering different levels of detail. Understanding all of these is important for IGCSE Chemistry.

Molecular Formula	Shows the exact number of each type of atom (e.g. C ₂ H ₆ for ethane).
Structural Formula	Shows how atoms are grouped and connected (e.g. CH ₃ CH ₃ for ethane).
Displayed Formula	Shows every bond and every atom explicitly, drawn out in full.
Skeletal Formula	A simplified line diagram where each vertex and end represents a carbon atom (used in A-level; awareness helpful at IGCSE).

1.3 Homologous Series

A homologous series is a family of organic compounds that share the same general formula, the same functional group, similar chemical properties, and show a gradual change in physical properties as the chain length increases.

Key Properties of a Homologous Series

1. Each member differs from the next by CH₂ (a methylene group).
2. All members share the same general formula.
3. Physical properties (boiling point, melting point, viscosity) change gradually.
4. Chemical properties are similar because the functional group is the same.

2. Alkanes — The Saturated Hydrocarbons

Alkanes are the simplest family of organic compounds. They contain only carbon and hydrogen atoms, and all bonds between carbon atoms are single bonds. Because they have no double bonds, alkanes are said to be saturated.

2.1 General Formula and Naming

The general formula for alkanes is $C_nH_{(2n+2)}$, where n is the number of carbon atoms. Naming follows a simple pattern based on the number of carbon atoms:

Name	Formula	Boiling Point (°C)	State at 25°C	Main Use
Methane	CH ₄	-162	Gas	Natural gas fuel
Ethane	C ₂ H ₆	-89	Gas	Fuel, cracking feedstock
Propane	C ₃ H ₈	-42	Gas	LPG, heating
Butane	C ₄ H ₁₀	-1	Gas	Lighter fuel, LPG
Pentane	C ₅ H ₁₂	36	Liquid	Solvent, petrol blend
Octane	C ₈ H ₁₈	126	Liquid	Petrol/gasoline

2.2 Physical Properties and Trends

As the chain length increases in alkanes, the boiling point rises steadily. This is because longer molecules have greater surface area, leading to stronger London dispersion forces (van der Waals forces) between molecules. More energy is needed to overcome these forces, hence a higher boiling point.

- Methane to butane are gases at room temperature.
- Pentane to hexadecane (C₁₆H₃₄) are liquids at room temperature.
- Longer chain alkanes are waxy solids.
- Alkanes are non-polar and do not mix with water (immiscible).
- Alkanes dissolve readily in non-polar solvents like hexane.

2.3 Chemical Reactions of Alkanes

Combustion

Alkanes burn in oxygen. Complete combustion occurs when there is excess oxygen, producing carbon dioxide and water. Incomplete combustion, when oxygen is limited, produces carbon monoxide and carbon (soot), which are toxic and polluting.

Complete Combustion of Methane

$\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$ This reaction is exothermic and releases a large amount of energy — which is why methane (natural gas) is an important fuel.

Incomplete Combustion

When oxygen is insufficient:
 $2\text{CH}_4 + 3\text{O}_2 \rightarrow 2\text{CO} + 4\text{H}_2\text{O}$ (carbon monoxide produced)
 $\text{CH}_4 + \text{O}_2 \rightarrow \text{C} + 2\text{H}_2\text{O}$ (carbon soot produced)
Carbon monoxide is dangerous as it binds to haemoglobin, preventing oxygen transport in the blood.

Substitution Reactions with Halogens

Alkanes react with chlorine or bromine in the presence of ultraviolet (UV) light in a substitution reaction. One hydrogen atom is replaced by a halogen atom. This reaction is also called a free radical substitution.

Chlorination of Methane

$\text{CH}_4 + \text{Cl}_2 \rightarrow \text{CH}_3\text{Cl} + \text{HCl}$ (UV light required)
 CH_3Cl is chloromethane. The reaction can continue:
 $\text{CH}_3\text{Cl} + \text{Cl}_2 \rightarrow \text{CH}_2\text{Cl}_2 + \text{HCl}$, and so on. This produces a mixture of products.

3. Alkenes — The Unsaturated Hydrocarbons

Alkenes are hydrocarbons that contain at least one carbon-carbon double bond (C=C). Because of this double bond, alkenes are described as unsaturated. The presence of the double bond makes alkenes far more reactive than alkanes.

3.1 General Formula and Structure

The general formula for alkenes is $C_nH_{(2n)}$. The simplest alkene is ethene (C_2H_4), which consists of two carbon atoms joined by a double bond, with two hydrogen atoms on each carbon.

Ethene	C_2H_4 — two carbons, one double bond. Used in making poly(ethene).
Propene	C_3H_6 — three carbons, one double bond. Used in making poly(propene).
Butene	C_4H_8 — four carbons, one double bond. Has structural isomers (but-1-ene, but-2-ene).

3.2 The Carbon-Carbon Double Bond

The double bond in alkenes consists of two components: a sigma bond (strong, formed by direct overlap of orbitals) and a pi bond (weaker, formed by side-on overlap). At IGCSE level, you need to understand that the double bond is a region of high electron density that makes alkenes reactive — it attracts electron-seeking species called electrophiles.

Testing for Unsaturation

Bromine water (orange/brown) is used to test for C=C double bonds. When an alkene is added to bromine water, the solution decolourises (goes colourless) immediately. Alkanes do not decolourise bromine water in the dark.

3.3 Addition Reactions of Alkenes

The most important reactions of alkenes are addition reactions. In an addition reaction, two molecules react together to form one product. The double bond opens up and atoms are added across it.

Hydrogenation (Addition of H₂)

Alkenes react with hydrogen gas in the presence of a nickel catalyst at 150°C. The double bond breaks and hydrogen atoms are added, converting the alkene into an alkane. This process is used in the food industry to harden vegetable oils into margarine.

Hydrogenation of Ethene

$C_2H_4 + H_2 \rightarrow C_2H_6$ (Nickel catalyst, 150°C) Ethene becomes ethane. The product is saturated and no longer reacts with bromine water.

Hydration (Addition of H₂O)

Alkenes react with steam (water vapour) in the presence of a phosphoric acid catalyst at high temperature and pressure to form alcohols. This is an important industrial process for manufacturing ethanol.

Hydration of Ethene

$C_2H_4 + H_2O \rightarrow C_2H_5OH$ (H₃PO₄ catalyst, 300°C, 60 atm) This produces ethanol. This is one of the two main methods of making ethanol — the other being fermentation.

Addition of Halogens

Halogens such as bromine and chlorine add directly across the double bond of alkenes without a catalyst. The halogen molecule splits apart and each atom adds to one of the carbon atoms of the double bond.

Bromination of Ethene

$C_2H_4 + Br_2 \rightarrow C_2H_4Br_2$ (1,2-dibromoethane) This reaction causes the decolourisation of bromine water — the standard test for alkenes.

Addition of Hydrogen Halides

Hydrogen halides (HCl, HBr) also undergo addition reactions with alkenes. The HX molecule adds across the double bond. With asymmetric alkenes, two products are possible (Markovnikov addition), but at IGCSE, the focus is on ethene (symmetric) so only one product forms.

4. Alcohols — The Hydroxyl Family

Alcohols are organic compounds that contain the hydroxyl functional group (-OH). The presence of this group gives alcohols distinctive physical properties and makes them versatile chemicals used in beverages, fuels, solvents, and medicines.

4.1 General Formula and Naming

The general formula for alcohols is $C_nH_{(2n+1)}OH$ or more generally ROH, where R is a carbon chain. The simplest members of this homologous series are:

Methanol	CH ₃ OH — highly toxic alcohol; used as industrial solvent and fuel.
Ethanol	C ₂ H ₅ OH — the alcohol in beverages; also widely used as biofuel and solvent.
Propanol	C ₃ H ₇ OH — solvent in cleaning products and cosmetics.
Butanol	C ₄ H ₉ OH — solvent; being explored as a biofuel.

4.2 Physical Properties of Alcohols

Alcohols have higher boiling points than alkanes of similar molecular mass. This is because alcohol molecules form hydrogen bonds between their -OH groups. Hydrogen bonds are much stronger than the London dispersion forces between alkane molecules, so more energy is required to break them.

- Short-chain alcohols (methanol, ethanol, propanol) are miscible with water — they mix completely.
- Boiling points increase as chain length increases (more London dispersion forces in addition to hydrogen bonding).
- Alcohols are colourless liquids at room temperature (for C₁-C₁₁ members).
- They have characteristic odours and are good solvents for organic compounds.

4.3 Reactions of Alcohols

Combustion

Alcohols burn in excess oxygen to produce carbon dioxide and water. They are used as fuels because of this exothermic reaction. Ethanol is particularly important as a biofuel — it can be produced renewably by fermentation and blended with petrol.

Combustion of Ethanol

$C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$ Ethanol burns with a pale blue flame and is a relatively clean fuel, producing no sulfur dioxide.

Oxidation

Alcohols can be oxidised using acidified potassium dichromate(VI) ($K_2Cr_2O_7$). Primary alcohols are oxidised first to aldehydes and then to carboxylic acids. The orange dichromate solution turns green as the chromium is reduced. At IGCSE, you need to know that ethanol is oxidised to ethanoic acid — this is what happens when wine turns into vinegar.

Oxidation of Ethanol

Ethanol \rightarrow Ethanoic acid (using acidified potassium dichromate) $C_2H_5OH + 2[O] \rightarrow CH_3COOH + H_2O$ The orange $K_2Cr_2O_7$ solution turns green. This is the chemical basis of a breathalyser test.

Dehydration

Alcohols can undergo dehydration — the removal of water — when heated with a concentrated acid catalyst (such as concentrated H_2SO_4 or over aluminium oxide at $300-400^\circ C$). This converts an alcohol into an alkene. The $-OH$ group and an adjacent H atom are eliminated, forming water and restoring a double bond.

Dehydration of Ethanol

$C_2H_5OH \rightarrow C_2H_4 + H_2O$ (concentrated H_2SO_4 , heat) Ethanol is dehydrated to ethene. This is an industrial route to ethene and is the reverse of the hydration reaction.

5. Carboxylic Acids — The Acidic Organic Compounds

Carboxylic acids contain the carboxyl functional group (-COOH). This group consists of both a carbonyl group (C=O) and a hydroxyl group (-OH) on the same carbon atom. Carboxylic acids are weak acids — they partially ionise in water.

5.1 The Carboxyl Group and Properties

The -COOH group gives carboxylic acids their characteristic acidic properties. In water, they donate a proton (H⁺) from the -COOH group, forming carboxylate ions. Because they only partially ionise, they are classified as weak acids, unlike strong acids such as hydrochloric acid which ionise completely.

Methanoic acid	HCOOH — found in ant stings and stinging nettles.
Ethanoic acid	CH ₃ COOH — found in vinegar; used widely as a food preservative.
Propanoic acid	C ₂ H ₅ COOH — used as a food preservative in baked goods.
Butanoic acid	C ₃ H ₇ COOH — gives rancid butter its unpleasant smell.

5.2 Reactions of Carboxylic Acids

Reaction with Carbonates

Carboxylic acids react with metal carbonates and metal hydrogencarbonates to produce a salt, water, and carbon dioxide gas. The fizzing observed is due to CO₂ production. This is a characteristic test for carboxylic acids.

Ethanoic acid with Sodium Carbonate

$2\text{CH}_3\text{COOH} + \text{Na}_2\text{CO}_3 \rightarrow 2\text{CH}_3\text{COONa} + \text{H}_2\text{O} + \text{CO}_2$ Sodium ethanoate (a salt) is formed along with water and carbon dioxide gas.

Esterification — Formation of Esters

When a carboxylic acid reacts with an alcohol in the presence of a concentrated acid catalyst (usually H₂SO₄), an ester and water are formed. This reaction is called esterification and is a reversible reaction. Esters are pleasant-smelling compounds widely used in perfumes, food flavourings, and solvents.

Esterification of Ethanol with Ethanoic Acid

$\text{C}_2\text{H}_5\text{OH} + \text{CH}_3\text{COOH} \rightleftharpoons \text{CH}_3\text{COOC}_2\text{H}_5 + \text{H}_2\text{O}$
Product: ethyl ethanoate (a fruity-smelling ester used in nail varnish remover and food flavouring)
Catalyst: concentrated H_2SO_4 ; gentle heating applied.

The general rule for naming esters: the first part of the name comes from the alcohol (e.g. ethanol -> ethyl), and the second part comes from the acid (e.g. ethanoic acid -> ethanoate). So ethanol + propanoic acid forms ethyl propanoate.

6. Polymers — Giant Organic Molecules

Polymers are very long chain molecules made by joining together many small molecules called monomers. Polymers are essential materials in modern life — from the plastic bottles we use daily to the nylon in sportswear and the DNA in our cells.

6.1 Addition Polymerisation

Addition polymerisation occurs when unsaturated monomers (alkenes with C=C double bonds) join together. The double bonds break open and the monomers link up in a chain. No other product is formed — all the atoms from the monomers end up in the polymer.

Poly(ethene) from Ethene

$n(\text{C}_2\text{H}_4) \rightarrow (-\text{CH}_2-\text{CH}_2-)_n$ Ethene monomers link together to form poly(ethene) — commonly known as polythene. Used in plastic bags, bottles, and insulation.

Poly(ethene)	From ethene; used in plastic bags, bottles, and piping.
Poly(propene)	From propene; used in ropes, crates, and carpets.
Poly(chloroethene)	From chloroethene (vinyl chloride); PVC, used in pipes and window frames.
Poly(tetrafluoroethene)	From tetrafluoroethene; PTFE/Teflon, used in non-stick cookware.
Poly(styrene)	From styrene (phenylethene); used in packaging foam.

6.2 Condensation Polymerisation

Condensation polymerisation occurs when monomers with two functional groups react together, releasing a small molecule (usually water, H_2O , or HCl) each time a bond forms. Two different types of monomer are typically used. The resulting polymers are more complex than addition polymers and often have important properties.

Polyesters

Polyesters are formed when a diol (a molecule with two -OH groups) reacts with a dicarboxylic acid (a molecule with two -COOH groups). Water is eliminated at each bond. The most important polyester is PET (polyethylene terephthalate), used in plastic bottles and polyester clothing fibres.

Formation of a Polyester

Diol + Dicarboxylic acid \rightarrow Polyester + Water
For example, ethane-1,2-diol + benzene-1,4-dicarboxylic acid \rightarrow PET
Each ester bond formed releases one molecule of water.

Polyamides (Nylons)

Polyamides are formed when a diamine (two -NH₂ groups) reacts with a dicarboxylic acid. Amide bonds (-CONH-) form between the monomers, releasing water. Nylon-6,6 is the most common polyamide, used in clothing fibres, parachutes, ropes, and toothbrush bristles.

Formation of Nylon-6,6

Hexane-1,6-dioic acid + hexane-1,6-diamine \rightarrow Nylon-6,6 + water
Each amide bond (-CO-NH-) forms with the loss of one water molecule.
Nylon-6,6 has excellent strength and flexibility — ideal for fibres and engineering plastics.

7. Crude Oil, Fractional Distillation, and Cracking

Crude oil is a complex mixture of hydrocarbons — mostly alkanes — formed from the remains of ancient marine organisms over millions of years. It is the primary source of the organic compounds used as fuels and as feedstocks for the chemical industry.

7.1 Fractional Distillation of Crude Oil

Because crude oil is a mixture, its components can be separated by fractional distillation. This process exploits the different boiling points of the hydrocarbons in crude oil. The crude oil is heated and vaporised, then fed into a fractionating column. As vapours rise up the column, they cool. Shorter chain hydrocarbons (lower boiling points) rise higher and condense at the top; longer chain hydrocarbons (higher boiling points) condense lower down.

Fraction	Chain Length	Boiling Point	Main Use
Refinery gases	C1-C4	-162 to -1°C	LPG, fuel gas
Petrol (gasoline)	C4-C12	40-200°C	Car fuel
Naphtha	C6-C12	60-180°C	Chemical feedstock
Kerosene	C10-C16	150-250°C	Jet fuel
Diesel	C14-C20	200-350°C	Lorries, buses
Fuel oil	C20-C50	300-400°C	Ship fuel, power stations
Bitumen	C50+	Above 400°C	Road surfacing, roofing

7.2 Cracking

Cracking is a process in which long-chain hydrocarbons are broken down into shorter, more useful molecules. There is high demand for short-chain hydrocarbons (petrol, chemicals for making plastics) but lower demand for long-chain fractions (heavy fuel oil). Cracking converts surplus heavy fractions into useful lighter products.

Thermal Cracking

Uses high temperature (400-900°C) and high pressure; produces alkenes and alkanes.

Catalytic Cracking

Uses a zeolite catalyst at moderate temperature (~450°C) and low pressure; more efficient.

Example of Cracking

$C_{10}H_{22} \rightarrow C_5H_{12} + C_5H_{10}$
Decane \rightarrow pentane + pentene
The alkane (pentane) can be used as fuel; the alkene (pentene) can be used as a monomer for making polymers.

8. Fermentation and Ethanol Production

Ethanol (C₂H₅OH) is one of the most important organic chemicals. It is produced by two main routes: fermentation and the hydration of ethene. Each method has advantages and disadvantages and suits different contexts.

8.1 Fermentation

Fermentation is the process by which yeast converts sugars (glucose) into ethanol and carbon dioxide under anaerobic (oxygen-free) conditions. This is the traditional method of producing alcoholic drinks, but is also used to make bioethanol — a renewable fuel.

Fermentation Equation

$C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$
Glucose → Ethanol + Carbon dioxide
Conditions: Yeast enzyme, 25-35°C, anaerobic conditions (no oxygen), aqueous solution.

- Temperature must be controlled: too cold and the yeast is inactive; too hot and the yeast is denatured.
- No oxygen must be present — fermentation is anaerobic. If oxygen enters, ethanol is oxidised to ethanoic acid (vinegar).
- The maximum ethanol concentration achievable is about 15% — above this, ethanol kills the yeast.
- To obtain pure ethanol from the fermented mixture, fractional distillation is used.

8.2 Comparison: Fermentation vs Hydration of Ethene

Factor	Fermentation	Hydration of Ethene
Raw material	Sugars / starch (renewable)	Ethene from crude oil (non-renewable)
Conditions	25-35°C, yeast, anaerobic	300°C, 60 atm, H ₃ PO ₄ catalyst
Rate	Slow (batch process)	Fast (continuous process)
Purity	Impure (requires distillation)	High purity product
Sustainability	Renewable and carbon-neutral	Uses finite fossil fuel resources

Scale	Can be small or large scale	Large-scale industrial
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9. Isomerism and Functional Group Summary

Isomers are compounds that have the same molecular formula but different structural arrangements. Understanding isomerism helps explain why different compounds with identical formulas can have very different properties and behaviours.

9.1 Structural Isomerism

In structural isomerism, molecules have the same molecular formula but atoms are connected in different ways. There are several types of structural isomerism:

- Chain isomerism: the carbon skeleton is arranged differently (e.g. straight chain vs branched chain).
- Position isomerism: the functional group is in a different position on the carbon chain.
- Functional group isomerism: the atoms are arranged to form completely different functional groups.

Example: Isomers of C₄H₁₀ (Butane)

Butane: CH₃CH₂CH₂CH₃ — a straight chain of 4 carbons. Methylpropane: CH₃CH(CH₃)CH₃ — a branched structure with 3 carbons in the main chain and one branch. Both have the formula C₄H₁₀ but are structurally different and have different boiling points.

9.2 Complete Functional Group Summary

Family	Functional Group	General Formula	Example	Key Test
Alkanes	None (C-C)	C _n H _(2n+2)	Ethane (C ₂ H ₆)	Burns; no bromine water reaction
Alkenes	C=C	C _n H _(2n)	Ethene (C ₂ H ₄)	Decolourises bromine water
Alcohols	-OH	C _n H _{(2n+1)OH}	Ethanol (C ₂ H ₅ OH)	Burns; oxidised by K ₂ Cr ₂ O ₇
Carboxylic Acids	-COOH	C _n H _{(2n+1)COOH}	Ethanoic acid (CH ₃ COOH)	Fizzes with Na ₂ CO ₃
Esters	-COO-	RCOOR'	Ethyl ethanoate	Fruity smell; hydrolysis

Amines	-NH ₂	RNH ₂	Methylamine (CH ₃ NH ₂)	Basic; reacts with acids
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10. Exam Tips, Common Mistakes, and Final Revision

This final section brings together the most important exam strategies and common pitfalls identified by experienced IGCSE Chemistry teachers. Use this section in the final weeks before your examination.

10.1 Top Exam Tips for Organic Chemistry

Tip 1: Always Write Full Equations

When asked for a chemical equation, always include state symbols if requested, balance the equation fully, and use the correct structural or molecular formula. Half-marks are often lost by missing a product (e.g. HCl in substitution reactions).

Tip 2: Know the Tests

Bromine water test (orange to colourless) = unsaturation (alkene). Acidified $K_2Cr_2O_7$ (orange to green) = alcohol present. Fizzing with Na_2CO_3 = carboxylic acid. These are frequently tested in multiple-choice and data-based questions.

Tip 3: Distinguish Addition from Substitution

Addition reactions: two molecules become one; the double bond opens. Substitution reactions: one atom replaces another; the carbon skeleton stays intact. Alkenes undergo addition; alkanes undergo substitution.

Tip 4: Remember Conditions

Reactions often earn marks for stating conditions correctly. UV light (not sunlight) for halogenation of alkanes. Nickel catalyst, $150^\circ C$ for hydrogenation. H_3PO_4 catalyst, $300^\circ C$, 60 atm for hydration. Yeast, $25-35^\circ C$, anaerobic for fermentation. Concentrated H_2SO_4 catalyst for esterification.

Tip 5: Understand Trends, Don't Just Memorise

If you understand that boiling point increases with chain length because of increasing London dispersion forces, you can answer any question about trends — even for compounds you haven't specifically memorised.

10.2 Most Common Mistakes

- Confusing saturated (alkanes) and unsaturated (alkenes) — always check for double bonds.
- Writing the wrong product for combustion — complete combustion gives CO₂ and H₂O, not CO.
- Forgetting that bromine water tests involve colour change from orange/brown to colourless, not from colourless to orange.
- Mixing up esterification and hydrolysis — they are reverse reactions of each other.
- Not writing the HCl by-product in alkane substitution reactions.
- Calling fermentation aerobic — it is strictly anaerobic (no oxygen).
- Forgetting the catalyst in addition reactions — hydration requires H₃PO₄; hydrogenation requires Ni.
- Confusing molecular formula with structural formula — always read the question carefully.

10.3 Final Summary Table — Reactions at a Glance

Reaction	Reactants	Conditions	Products	Type
Combustion (complete)	Alkane + O ₂	Heat	CO ₂ + H ₂ O	Oxidation
Substitution	Alkane + Cl ₂	UV light	Chloroalkane + HCl	Substitution
Hydrogenation	Alkene + H ₂	Ni, 150°C	Alkane	Addition
Hydration	Alkene + H ₂ O	H ₃ PO ₄ , 300°C	Alcohol	Addition
Bromination	Alkene + Br ₂	None	Dibromoalkane	Addition
Oxidation	Alcohol + [O]	Acid K ₂ Cr ₂ O ₇	Carboxylic acid	Oxidation
Dehydration	Alcohol	Conc H ₂ SO ₄	Alkene + H ₂ O	Elimination
Esterification	Acid + Alcohol	Conc H ₂ SO ₄	Ester + H ₂ O	Condensation
Fermentation	Glucose	Yeast, 25-35°C	Ethanol + CO ₂	Biological
Cracking	Long alkane	Heat or catalyst	Shorter alkane + alkene	Thermal/Catalytic

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