

ALCOHOL

History and etymology

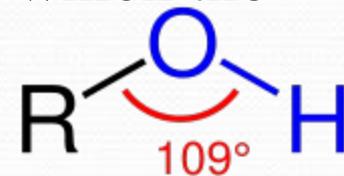
The word *alcohol* appears in English as a term for a very fine powder in the 16th century. It was borrowed from French, which took it from medical **Latin**.

The first alcohol (today known as **ethyl alcohol**) was discovered by the tenth-century Persian alchemist **al-Razi**. The current Arabic name for alcohol (**ethanol**) is ألكحول al-ġawl – properly meaning "spirit" or "demon" – with the sense "the thing that gives the wine its headiness" (in the Qur'an **sura 37** verse 47).

The term *ethanol* was invented 1838, modeled on the German word *äthyl* (Liebig), which is in turn based on Greek *aither* **ether** and *hyle* "stuff."¹

Ultimately the word is from the Arabic **كحل** (*al-kuḥl*, "kohl, a powder used as an eyeliner"). **Al-** is the Arabic **definitive article**, equivalent to *the* in English;

In **chemistry**, an **alcohol** is an **organic compound** in which the **hydroxyl functional group** (-OH) is bound to a **carbon** atom.



In particular, this carbon center should be **saturated**, having single bonds to three other atoms.

An important class of alcohols are the simple **acyclic** alcohols, the general formula for which is $C_nH_{2n+1}OH$. Of those, **ethanol** (C_2H_5OH) is the type of alcohol found in **alcoholic beverages**, and in common speech the word ***alcohol*** refers specifically to ethanol.

Other alcohols are usually described with a clarifying adjective, as in **isopropyl alcohol** (*propan-2-ol*) or *wood alcohol* (*methyl alcohol*, or **methanol**).

Systematic names

- Alcohols are classified into 0° , primary (1°), secondary (2° ; also italic abbreviated *sec-* or just *s-*), and tertiary (3° ; also italic abbreviated *tert-* or just *t-*), based upon the number of carbon atoms connected to the carbon atom that bears the **hydroxyl (OH) functional group**. The primary alcohols have general formulas RCH_2OH ; secondary ones are $RR'CHOH$; and tertiary ones are $RR'R''COH$, where R, R', and R'' stand for alkyl groups. Methanol (CH_3OH or CH_4O) is a 0° alcohol. Some sources include **methanol** as a primary alcohol, including the 1911 edition of the **Encyclopædia Britannica**.

Physical and chemical properties

- Alcohols have an odor that is often described as “biting” and as “hanging” in the nasal passages. Ethanol has a slightly sweeter (or more fruit-like) odor than the other alcohols.
- Two opposing solubility trends in alcohols are: the tendency of the polar OH to promote solubility in water, and the tendency of the carbon chain to resist it. Thus, methanol, ethanol, and propanol are miscible in water because the hydroxyl group wins out over the short carbon chain. **Butanol**, with a four-carbon chain, is moderately soluble because of a balance between the two trends. Alcohols of five or more carbons (**pentanol** and higher) are effectively insoluble in water because of the hydrocarbon chain's dominance. All simple alcohols are miscible in organic solvents.
- Because of **hydrogen bonding**, alcohols tend to have higher boiling points than comparable **hydrocarbons** and **ethers**. The boiling point of the alcohol ethanol is 78.29 °C, compared to 69 °C for the hydrocarbon **hexane** (a common constituent of **gasoline**), and 34.6 °C for **diethyl ether**.

● Applications

● Alcohol has a long history of several uses worldwide. It is found in beverages for adults, as fuel, and also has many scientific, medical, and industrial uses. The term **alcohol-free** is often used to describe a product that does not contain alcohol. Some consumers of some commercially prepared products may view alcohol as an undesirable ingredient, particularly in products intended for children.

● Alcoholic beverages

● **Alcoholic beverages**, typically containing <1% to 40% **ethanol** by volume, have been produced and consumed by humans since pre-historic times.

● Antifreeze

● A 50% **v/v** (by volume) solution of **ethylene glycol** in water is commonly used as an **antifreeze**.

● Antiseptics

● Ethanol can be used as an **antiseptic** to disinfect the skin before injections are given, often along with **iodine**. Ethanol-based **soaps** are becoming common in restaurants and are convenient because they do not require drying due to the volatility of the compound. Alcohol based gels have become common as **hand sanitizers**.

● Fuels

● Some alcohols, mainly **ethanol** and **methanol**, can be used as an **alcohol fuel**. Fuel performance can be increased in **forced induction internal combustion engines** by injecting alcohol into the air intake after the **turbocharger** or **supercharger** has pressurized the air. This cools the pressurized air, providing a denser air charge, which allows for more fuel, and therefore more power.

● Preservative

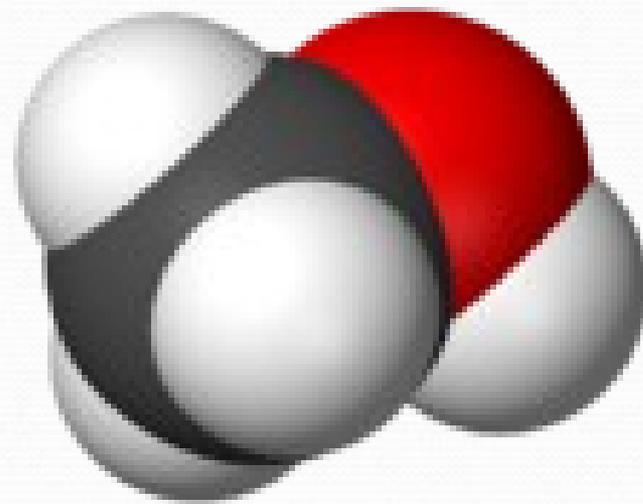
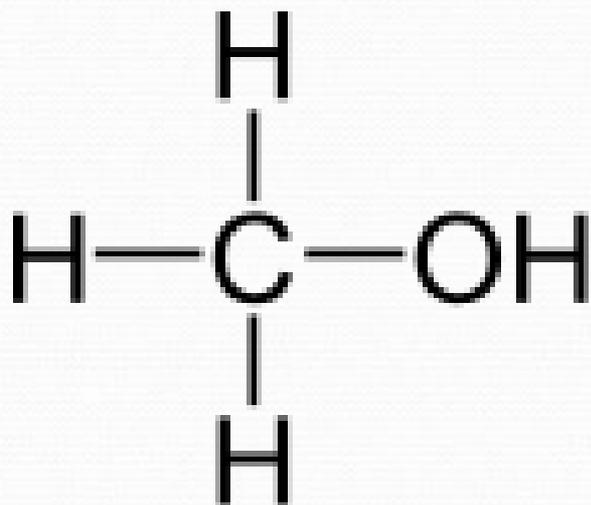
● Alcohol is often used as a **preservative** for **specimens** in the fields of science and medicine.

Solvents

- Hydroxyl groups (-OH), found in alcohols, are **polar** and therefore **hydrophilic** (water loving) but their carbon chain portion is **non-polar** which make them **hydrophobic**. The molecule increasingly becomes overall more nonpolar and therefore less soluble in the polar water as the carbon chain becomes longer. Methanol have the shortest carbon chain of all alcohols (one carbon atom) followed by ethanol (two carbon atoms.)
- Alcohols have applications in industry and science as reagents or **solvents**. Because of its relatively low toxicity compared with other alcohols and ability to dissolve **non-polar** substances, ethanol can be used as a solvent in medical drugs, **perfumes**, and vegetable essences such as **vanilla**. In **organic synthesis**, alcohols serve as versatile intermediates.

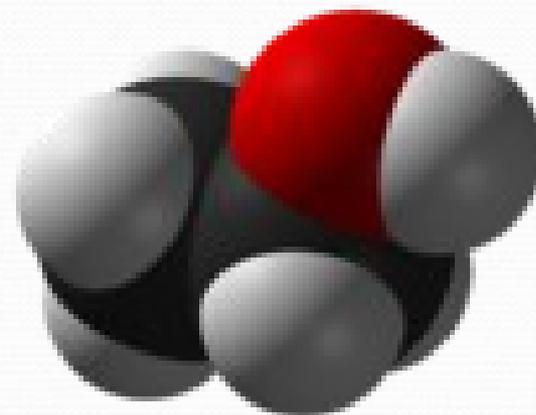
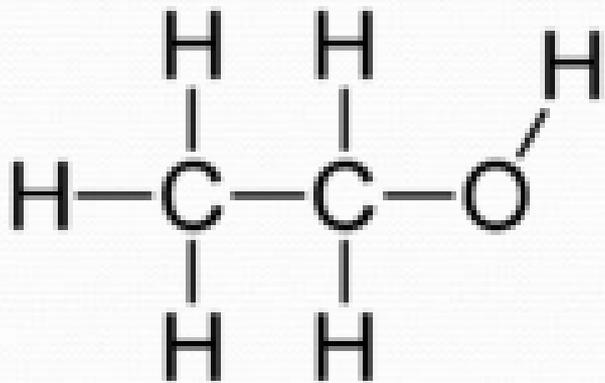
Methanol

Also known as methyl alcohol, wood alcohol, wood naphtha or wood spirits, is a chemical with the formula CH_3OH (often abbreviated MeOH). Methanol acquired the name "wood alcohol" because it was once produced chiefly as a byproduct of the destructive distillation of wood. Modern methanol is produced in a catalytic industrial process directly from carbon monoxide, carbon dioxide, and hydrogen. It can lead to blindness or death.



ETHANOL C_2H_5OH

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- In everyday life "alcohol" without qualification usually refers to ethanol, or a beverage based on ethanol
- Alcoholic beverages, typically containing <math><1\%</math> to 40% ethanol by volume
- Reasons for drinking alcoholic beverages vary and include:
 - Being part of a standard diet
 - Medical purposes
 - Relaxant effects
 - Euphoric effects
 - Recreational purposes
 - Artistic inspiration
 - Putative aphrodisiac effects
 - Happiness



- An **alcoholic beverage** is a drink that contains ethanol. Alcoholic beverages are divided into three general classes for taxation and regulation of production:
beers, wines, and spirits (distilled beverages).
- They are legally consumed in most countries around the world. More than 100 countries have laws regulating their production, sale, and consumption Beer is the third most popular drink in the world, after water and tea.
- Alcoholic beverages have been consumed by humans since the Neolithic era; the earliest evidence of alcohol was discovered in Jiahu, dating from 7000–6600 BCE.
- Alcoholic beverages are a source of **food energy**. Each gram of alcohol provides 7.1 kcal, and each millilitre provides 5.6 kcal.

Distilled beverages

- A **distilled beverage**, **spirit**, or **liquor** is an alcoholic beverage produced by distilling (i.e., concentrating by distillation) ethanol produced by means of fermenting grain, fruit, or vegetables. Unsweetened, distilled, alcoholic beverages that have an alcohol content of at least 20% ABV are called spirits. For the most common distilled beverages, such as whiskey and vodka, the alcohol content is around 40%



- The term **hard liquor** is used in North America to distinguish distilled beverages from undistilled ones (implicitly weaker). Vodka, gin, baijiu, tequila, whiskey, brandy, and soju are examples of distilled beverages.

Fermented beverages



- In general, a beverage fermented from a grain mash will be called a beer.
- Beer is made from barley or a blend of several grains.
- If the fermented mash is distilled, then the beverage is a spirit.
- Wine and brandy are usually made from grapes but when they are made from another kind of fruit, they are distinguished as fruit wine or fruit brandy. The kind of fruit must be specified, such as "cherry brandy" or "plum wine."
- Whiskey (or whisky) is made from grain or a blend of several grains. The type of whiskey (scotch, rye, bourbon, or corn) is determined by the primary grain.
- Vodka: Vodka is distilled from fermented grain. It is highly distilled so that it will contain less of the flavor of its base material. Gin is a similar distillate but it is flavored by juniper berries and sometimes by other herbs as well. Applejack is sometimes made by means of freeze distillation.
- Cider: In the United States and Canada, *cider* often means unfermented apple juice (sometimes called *sweet cider*), and fermented apple juice is called hard cider.

Fortified beverages

- Fortified wine: Fortified wine is wine with an added distilled beverage (usually brandy). Fortified wine is distinguished from spirits made from wine in that spirits are produced by means of distillation, while fortified wine is simply wine that has had a spirit added to it. Many different styles of fortified wine have been developed, including Port, Sherry, Madeira, Marsala, Commandaria wine and the aromatized wine Vermouth



Mixed drinks:

Mixed drinks include alcoholic mixed drinks



(cocktails, flaming beverages, fortified wines, mixed drink shooters and drink shots) and non-alcoholic mixed drinks (including punches). Blending and caffeinated alcoholic drinks may also be called mixed drinks

Standard drinks

- A standard drink is a notional drink that contains a specified amount of pure **alcohol**. The standard drink is used in many countries to quantify alcohol intake. It is usually expressed as a measure of beer, wine, or spirits. One standard drink always contains the same amount of alcohol regardless of serving size or the type of alcoholic beverage.
- The standard drink varies significantly from country to country. For example, it is 7.62 ml (6 grams) of alcohol in **Austria**, but in **Japan** it is 25 ml (19.75 grams).
- In the **United Kingdom**, there is a system of **units of alcohol** which serves as a guideline for alcohol consumption. A single unit of alcohol is defined as 10 ml. The number of units present in a typical drink is sometimes printed on bottles. The system is intended as an aid to people who are regulating the amount of alcohol they drink; it is not used to determine serving sizes.
- In the **United States**, the standard drink contains 0.6 US fluid ounces (18 ml) of alcohol. This is approximately the amount of alcohol in a 12-US-fluid-ounce (350 ml) glass of beer, a 5-US-fluid-ounce (150 ml) glass of wine, or a 1.5-US-fluid-ounce (44 ml) glass of a 40% **ABV** (80 proof) spirit.

Serving sizes

- In the **United Kingdom**, serving size in **licensed premises** is regulated under the **Weights and Measures Act (1985)**. Spirits (gin, whisky, rum, and vodka) are sold in 25 ml or 35 ml quantities or multiples thereof. Beer is typically served in **pints** (568 ml), but is also served in half-pints or third-pints.
- In Ireland, the serving size of spirits is 35.5 ml or 71 ml. Beer is usually served in pints or half-pints ("glasses"). In the Netherlands and Belgium, standard servings are 250 and 500 ml for **pilsner**; 300 and 600 ml for **lager**.



Blood alcohol content

- **Blood alcohol content (BAC)**, also called **blood alcohol concentration**, **blood ethanol concentration**, or **blood alcohol level** is most commonly used as a metric of **alcohol intoxication** for legal or medical purposes.
- Blood alcohol content is usually expressed as a **percentage** of **alcohol** (generally in the sense of **ethanol**) in the **blood**. For instance, a BAC of 0.10 means that 0.10% (one tenth of one percent or one **permille**) of a person's blood, by volume (usually, but in some countries by mass), is alcohol.

Progressive Effects of Alcohol

Blood Alcohol Concentration	Changes in Feelings and Personality	Brain Regions Affected	Impaired Activities (continuum)
0.01–0.05	Relaxation Sense of well being Loss of inhibition	Cerebral cortex	Alertness Judgment
0.06–0.10	Pleasure Numbness of feelings Nausea, Sleepiness Emotional arousal	Cerebral cortex + forebrain	Coordination (especially fine motor skills) Visual tracking
0.11–0.20	Mood swings Anger Sadness Mania	Cerebral cortex + forebrain + cerebellum	Reasoning and depth perception Inappropriate social behavior (e.g., obnoxiousness)
0.21–0.30	Aggression Reduced sensations Depression Stupor	Cerebral cortex + forebrain + cerebellum + brain stem	Slurred speech Lack of balance Loss of temperature regulation
0.31–0.40	Unconsciousness Death possible Coma	Entire brain	Loss of bladder control Difficulty breathing
0.41 and greater	Death		Slowed heart rate

Ethanol

Red - generally "bad"
Green - generally "good"

Large consumption

Brain:

- Impaired development

- Wernicke-Korsakoff syndrome

* Vision changes

* Ataxia

* Impaired memory

- Psychological

* Cravings

* Irritability

* Antisociality

* Depression

* Anxiety

* Panic

* Psychosis

* Hallucinations

* Delusions

* Sleep disorders

Mouth, trachea and esophagus:

- Cancer

Blood:

- Anemia

Heart:

- Alcoholic cardiomyopathy

Liver:

- Cirrhosis

- Hepatitis

Stomach:

- Chronic gastritis

Pancreas:

- Pancreatitis

Peripheral tissues:

- Increased risk of diabetes type 2

Small to moderate consumption

Systemic:

- Increases insulin sensitivity

- Lower risk of diabetes

Brain:

- Reduce the number of silent infarcts

Blood:

- Increases HDL

- Decreases thrombosis

- Reduces fibrinogen

- Increases fibrinolysis

- Reduces artery spasm from stress

- Increases coronary blood flow

Skeletal:

- Higher bone mineral density

Effects linked with both small and large consumption

Joints:

- Reduced risk of rheumatoid arthritis

Gallbladder:

- Reduced the risk of developing gallstones

Kidney:

- Reduced risk of developing kidney stones

