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Methane - Thermophysical Properties

Chemical, Physical and Thermal Properties of Methane - CH_4 . Phase diagram included.

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Methane, CH_4 , is a colorless odorless gas. It is also known as marsh gas or methyl hydride. The vapors are lighter than air.

Methane is easily ignited. Under prolonged exposure to fire or intense heat the containers may rupture violently and rocket.

Methane is used as feed stock to chemical industry and is the main constituent of the fuel *natural gas*.

Methane phase diagram

Chemical, physical and thermal properties of methane:

Values are given for gas phase at 25 °C /77 °F / 298 K and 1 atm., if not other phase, temperature or pressure given.

Property	Value	Unit	Value	Unit	Value	Unit	Value	Unit
Autoignition temperature	810	K	537	°C	999	°F		
Boiling Point	111.51	K	-161.6	°C	-259.0	°F		
Critical density	10.139	mol/dm ³	162.7	kg/m ³	0.3156	slug/ft ³	10.15	lb/ft ³
Critical Pressure	4.5992	MPa=MN/m ²	45.99	bar	45.39	atm	667.1	psi=lb _f /in ²
Critical Temperature	190.56	K	-82.59	°C	-116.66	°F		
Critical Volume	98.63	cm ³ /mol	0.00615	m ³ /kg	3.169	ft ³ /slug	0.0985	ft ³ /lb
Density, gas	41.0	mol/m ³	0.657	kg/m ³	0.00127	slug/ft ³	0.0410	lb/ft ³
Density, gas at STP; 32°F/0°C 1 atm	44.7	mol/m ³	0.7168	kg/m ³	0.00139	slug/ft ³	0.0447	lb/ft ³
Density, liquid at -260 °F/-162°C	26429	mol/m ³	422.6	kg/m ³	0.820	slug/ft ³	26.38	lb/ft ³
Flammable, gas and liquid	yes							
Flash point	85	K	-188	°C	-306	°F		
Gas constant - R	518.28	J/kg K	0.1440	Wh/(kg K)	3099	[ft lbf/slug °R]	96.329	[ft lbf/lb °R]

Property	Value	Unit	Value	Unit	Value	Unit	Value	Unit
Gibbs free energy of formation	-51	kJ/mol	-3179	kJ/kg	-1367	Btu/lb		
Heat (latent) of vaporation	8.19	kJ/mol	511	kJ/kg	219.48	Btu/lb		
Specific heat, Cp	35.8	J/mol K	2.232	kJ/kg K	0.533	Btu/lb°F or cal/g K		
Specific Heat, Cv	27.4	J/mol K	1.709	kJ/kg K	0.408	Btu/lb°F or cal/g K		
Heat of combustion	-890.8	kJ/mol	-55528	kJ/kg	-23.9	Btu/lb		
Heat(enthalpy) of formation	-75.00	kJ/mol	-4675	kJ/kg	-2010	Btu/lb		
log KOW (Octanol/Water Partition Coefficient)	1.09							
Melting point	90.55	K	-182.6	°C	-296.7	°F		
Molecular Weight	16.042	g/mol			0.03537	lb/mol		
Solubility in water	0.022	mg/ml						
Sound velocity	446	m/s						
Specific Gravity (density relativ to air), 0°C/32°F	0.554							
Specific Heat Ratio - Cp/Cv	1.31							
Specific Volume	0.0244	m ³ /mol	1.52	m ³ /kg	784.44	ft ³ /slug	24.38	ft ³ /lb
Standard molar entropy, S°	186	J/mol K	11.59	kJ/kg K	2.77	Btu/lb °F		
Surface tension at -161 °C / -258 °F	14	dynes/cm	0.014	N/m				
Thermal Conductivity	0.0339	W/m°C	0.019587	Btu/hr ft °F				
Triple point pressure	0.011696	MPa=MN/m ²	0.117	bar	0.115	atm	1.70	psi=lb/in ²
Triple point temperature	90.69	K	-182.456	°C	-296.42	°F		
Vapor (saturation) pressure	62.12	MPa=MN/m ²	466000	mm Hg	613.07	atm	9010	psi=lb/in ²
Vapor (saturation) pressure at 38 °C /100 °F	34.47	MPa=MN/m ²	258574	mm Hg	340.18	atm	4999	psi=lb/in ²
Viscosity, dynamic (absolute)	0.01107	cP	7.44	[lb _m /ft s*10 ⁻⁶]	0.23	[lb _f s/ft ² *10 ⁻⁶]		
Viscosity, kinematic	17.08	cSt	183.8	[ft ² /s*10 ⁻⁶]				

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Follow the links below to get values for the listed **properties of methane** at varying **pressure** and **temperature**:

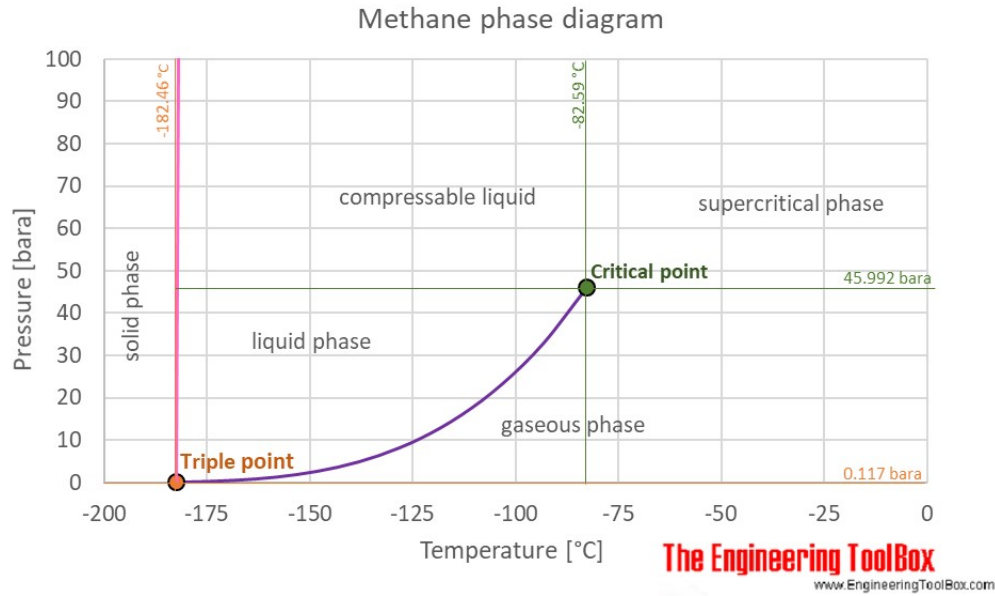
- [Density and specific weight](#)
- [Dynamic and kinematic viscosity](#)
- [Prandtl number](#)
- [Specific heat \(heat capacity\)](#)
- [Thermal conductivity](#)

See also [more about atmospheric pressure](#) , and [STP - Standard Temperature and Pressure & NTP - Normal Temperature and Pressure](#) , as well as **Thermophysical properties** of: [Acetone](#) , [Acetylene](#) , [Air](#) , [Ammonia](#) , [Argon](#) , [Benzene](#) , [Butane](#) , [Carbon dioxide](#) , [Carbon monoxide](#) , [Ethane](#) , [Ethanol](#) , [Ethylene](#) , [Helium](#) , [Hydrogen](#) , [Hydrogen sulfide](#) , [Methanol](#) , [Nitrogen](#) , [Oxygen](#) , [Pentane](#) , [Propane](#) , [Toluene](#) , [Water](#) and [Heavy water, D₂O](#) .

Methane is a *gas* at standard conditions. However, at low temperature and/or high pressures the gas becomes a liquid or a solid.

The methane phase diagram shows the phase behavior with changes in temperature and pressure. The curve between the critical point and the triple point shows the methane boiling point with

changes in pressure.



At the **critical point** there is no change of state when pressure is increased or if heat is added.

The **triple point** of a substance is the temperature and pressure at which the three phases (gas, liquid, and solid) of that substance coexist in thermodynamic equilibrium.

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Related Topics

- **Material Properties** - Material properties of gases, fluids and solids - densities, specific heats, viscosities and more.
- **Fluid Mechanics** - The study of fluids - liquids and gases. Involving velocity, pressure, density and temperature as functions of space and time.

- **Thermodynamics** - Work, heat and energy systems.

Related Documents

- **Acetone - Thermophysical Properties** - Chemical, physical and thermal properties of acetone, also called 2-propanone, dimethyl ketone and pyroacetic acid. Phase diagram included.
- **Air - Thermophysical Properties** - Thermal properties of air at different temperatures - density, viscosity, critical temperature and pressure, triple point, enthalpi and entropi, thermal conductivity and diffusivity and more.
- **Ammonia - Thermophysical Properties** - Chemical, Physical and Thermal Properties of Ammonia. Phase diagram included.
- **Benzene - Thermophysical properties** - Chemical, physical and thermal properties of benzene, also called benzol. Phase diagram included.
- **Carbon Dioxide - Thermophysical Properties** - Chemical, physical and thermal properties of carbon dioxide. Phase diagram included.
- **Combustion Heat** - Heat of combustion (energy content) for som common substances - with examples how to calculate heat of combustion.
- **Cryogenic Fluids and Liquefied Gas Properties** - Cryogenic properties as density, boiling points and heat of evaporation for fluids like hydrogen, methane, oxygen, nitrogen, fluorine and helium.
- **Ethane - Thermophysical Properties** - Chemical, Physical and Thermal Properties of Ethane - C_2H_6 .
- **Ethylene - Thermophysical Properties** - Chemical, physical and thermal properties of ethylene, also called ethene, acetene and olefiant gas. Phase diagram included.
- **Fuel Gases - Heating Values** - Combustion heat values for gases like acetylene, blast furnace gas, ethane, biogas and more - Gross and Net values.
- **Fuels - Higher and Lower Calorific Values** - Higher and lower calorific values (heating values) for fuels like coke, oil, wood, hydrogen and others.
- **Gases - Densities** - Densities and molecular weights of common gases like acetylene, air, methane, nitrogen, oxygen and others.
- **Gases - Dynamic Viscosities** - Absolute (dynamic) viscosities of some common gases.
- **Gases - Explosion and Flammability Concentration Limits** - Flame and explosion limits for gases like propane, methane, butane, acetylene and more.
- **Gases - Ratios of Specific Heat** - Ratios of specific heat for gases with constant pressure and volume processes.
- **Heavy Water - Thermophysical Properties** - Thermodynamic properties of heavy water (D_2O) like density, melting temperature, boiling temperature, latent heat of fusion, latent heat of evaporation, critical temperature and more.
- **Methane - Dynamic and Kinematic Viscosity vs. Temperature and Pressure** - Online calculator, figures and tables showing dynamic and kinematic viscosity of methane, CH_4 , at varying temperature and pressure - Imperial and SI Units.
- **Methane - Density and Specific Weight vs. Temperature and Pressure** - Online calculator, figures and tables showing density and specific weight of methane, CH_4 , at temperatures ranging from -160 to 725 °C (-260 to 1300 °F) at atmospheric and higher pressure - Imperial and SI Units.
- **Methane - Liquid vs. Gaseous Units** - Convert between liquid and gaseous LNG and

Methane units.

- **[Methane - Prandtl number vs. Temperature](#)** - Figures and table showing changes in Prandtl number for methane with changes in temperature and pressure.
- **[Methane - Thermal Conductivity vs. Temperature and Pressure](#)** - Online calculator, figures and table showing thermal conductivity of methane, CH₄, at temperatures ranging from -160 to 725 °C (-260 to 1300 °F) at atmospheric and higher pressure - Imperial and SI Units.
- **[Methane Gas - Specific Heat vs. Temperature](#)** - Specific heat of Methane Gas - CH₄ - at temperatures ranging 200 - 1100 K.
- **[Methanol - Thermophysical Properties](#)** - Chemical, physical and thermal properties of methanol, CH₃OH (also called carbinol, wood alcohol, hydroxy methyl and methyl alcohol). Phase diagram included.
- **[Molecular Weight of Substances](#)** - Definition and molecular weight (molar mass) of some common substances.
- **[Pentane - Thermophysical Properties](#)** - Chemical, physical and thermal properties of pentane, also called n-pentane. Phase diagram included.
- **[Solubility of Gases in Water vs. Temperature](#)** - Solubility of Ammonia, Argon, Carbon Dioxide, Carbon Monoxide, Chlorine, Ethane, Ethylene, Helium, Hydrogen, Hydrogen Sulfide, Methane, Nitrogen, Oxygen and Sulfur Dioxide in water.
- **[Stoichiometric Combustion](#)** - Stoichiometric combustion and excess air.
- **[Water - Thermophysical Properties](#)** - Thermal properties of water at different temperatures like density, freezing temperature, boiling temperature, latent heat of melting, latent heat of evaporation, critical temperature and more.

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Unit Converter

Temperature

0.0

°C

°F

Convert!

Length

1.0

- m*
- km*
- in*
- ft*
- yards*
- miles*
- naut miles*

Convert!

Area

1.0

- m²*
- km²*
- in²*
- ft²*
- miles²*
- acres*

Convert!

Volume

1.0

- m³*
- liters*
- in³*
- ft³*
- us gal*

Convert!

Weight

1.0

- kg_f*
- N*
- lb_f*

Convert!

Velocity

1.0

- m/s*
- km/h*
- ft/min*
- ft/s*
- mph*
- knots*

Convert!

Pressure

1.0

- Pa (N/m²)*
- bar*
- mm H₂O*
- kg/cm²*
- psi*
- inches H₂O*

Convert!

Flow

1.0

- m³/s*
- m³/h*
- US gpm*
- cfm*

Convert!

Scientific Online Calculator



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