

The Anomalies of Water: Beyond Freezing and Boiling

**Infinity Turbine
LLC**

[TEL] 1-608-238-6001

[Email] greg@infinityturbine.com

<https://infinityturbine.com/infinity-turbine-water-anomalies.html>

Explore the unusual physical properties of water beyond its freezing and boiling points, including density maximum at 4°C, supercooling, compressibility changes, and other key anomalies.



This webpage QR code

PDF Version of the webpage (maximum 10 pages)

The Anomalies of Water

4°C (39,2 °F)	Density Maximum Water is densest at 4°C
30C (86°F)	Minimum Viscosity Water’s viscosity is lowest near 30°C
46C (114,8°F)	Compressibility Minima Compressibility is minimal around 46°C
74C (165°F)	Speed of Sound Maximum Speed of sound in water is maximal near 74°C
−38C (−36,4°F)	Supercooling Water can remain liquid below 0°C
374C (705,2°F)	Critical Point Above 374°C, there is no distinction between liquid and vapor
0,01°C (32,02°F)	Triple Point Solid, liquid, and vapor coexist
121°C (249,8°F)	Boiling Point Shift Boiling point under pressure exceeds 100°C

The Anomalies of Water: Beyond Freezing and Boiling

Water is one of the most studied substances on Earth, yet it continues to surprise scientists with behaviors that defy the patterns of most liquids. While the freezing point at 0°C (32°F) and the boiling point at 100°C (212°F) are well-known, water has a range of lesser-known anomaly points where its physical properties behave in unusual ways.

1. Density Maximum at 4°C (39.2°F)

Unlike most substances that become denser as they cool, pure water reaches its maximum density at 4°C. Cooling it further causes it to expand, which is why ice floats. This anomaly plays a critical role in aquatic life survival, as lakes and rivers freeze from the top down.

2. Minimum Viscosity at ~30°C (86°F)

Water's viscosity decreases with rising temperature until about 30°C, after which it follows a more typical liquid behavior. This property influences biological fluid flow and industrial processes.

3. Compressibility Minima Around 46°C

Isothermal compressibility, a measure of how much volume changes under pressure, reaches an unusual minimum at about 46°C. Above and below this temperature, water becomes more compressible.

4. Speed of Sound Maximum (~74°C / 165°F)

The speed of sound in water is highest at around 74°C at normal atmospheric pressure. This is due to changes in molecular structure and hydrogen bonding as temperature increases.

5. Thermal Expansion Coefficient Shift

From 0°C to 4°C, water has a negative thermal expansion coefficient, meaning it contracts when heated. Above 4°C, it follows the typical pattern of expansion with heat.

6. Supercooling to -38°C

In extremely pure and undisturbed conditions, water can remain liquid well below its normal freezing point, supercooling to about -38°C before spontaneously freezing.

7. Critical Point at 374°C and 218 atm

At the critical point, the distinction between liquid and vapor disappears. Above 374°C and 218 atmospheres of pressure, water becomes a supercritical fluid with unique solvating properties.

8. Triple Point at 0.01°C and 611.657 Pa

At this precise temperature and pressure, water exists simultaneously as a solid, liquid, and gas in equilibrium.

9. Boiling Point Shift Under Pressure

The Anomalies of Water: Beyond Freezing and Boiling

Water is one of the most studied substances on Earth, yet it continues to surprise scientists with behaviors that defy the patterns of most liquids. While the freezing point at 0°C (32°F) and the boiling point at 100°C (212°F) are well-known, water has a range of lesser-known anomaly points where its physical properties behave in unusual ways.

1. Density Maximum at 4°C (39.2°F)

Unlike most substances that become denser as they cool, pure water reaches its maximum density at 4°C. Cooling it further causes it to expand, which is why ice floats. This anomaly plays a critical role in aquatic life survival, as lakes and rivers freeze from the top down.

2. Minimum Viscosity at ~30°C (86°F)

Water's viscosity decreases with rising temperature until about 30°C, after which it follows a more typical liquid behavior. This property influences biological fluid flow and industrial processes.

3. Compressibility Minima Around 46°C

Isothermal compressibility, a measure of how much volume changes under pressure, reaches an unusual minimum at about 46°C. Above and below this temperature, water becomes more compressible.

4. Speed of Sound Maximum (~74°C / 165°F)

The speed of sound in water is highest at around 74°C at normal atmospheric pressure. This is due to changes in molecular structure and hydrogen bonding as temperature increases.

5. Thermal Expansion Coefficient Shift

From 0°C to 4°C, water has a negative thermal expansion coefficient, meaning it contracts when heated. Above 4°C, it follows the typical pattern of expansion with heat.

6. Supercooling to -38°C

In extremely pure and undisturbed conditions, water can remain liquid well below its normal freezing point, supercooling to about -38°C before spontaneously freezing.

7. Critical Point at 374°C and 218 atm

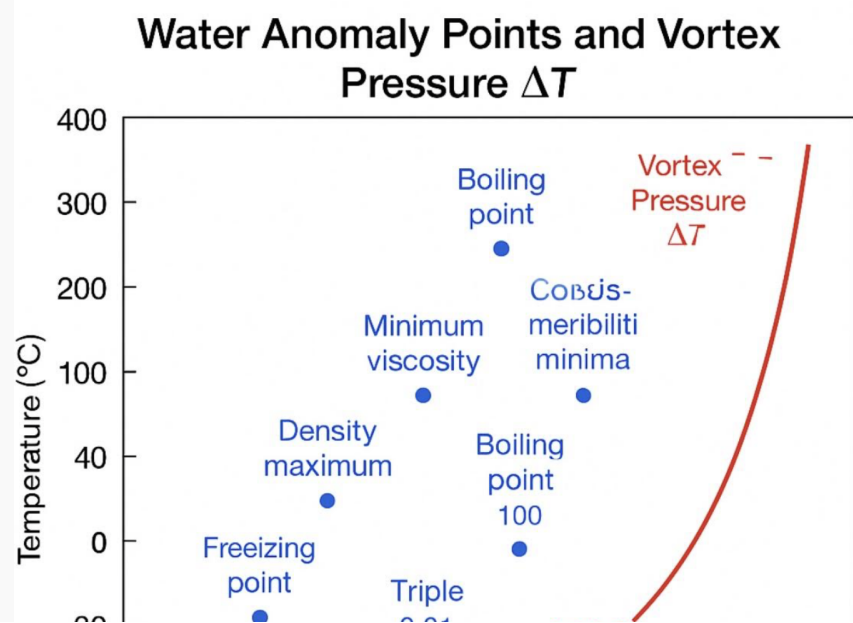
At the critical point, the distinction between liquid and vapor disappears. Above 374°C and 218 atmospheres of pressure, water becomes a supercritical fluid with unique solvating properties.

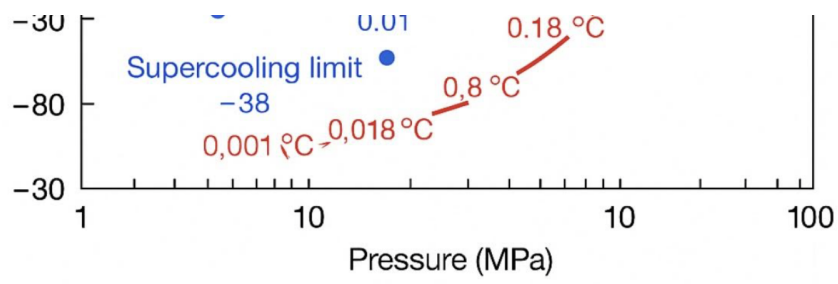
8. Triple Point at 0.01°C and 611.657 Pa

At this precise temperature and pressure, water exists simultaneously as a solid, liquid, and gas in equilibrium.

9. Boiling Point Shift Under Pressure

Due to strong hydrogen bonding, water's boiling point decreases slightly with pressure. For example, at 0 atmospheres it boils at about 101°C, and at the critical pressure it reaches 374°C.





Copyright 9/28/202 Infinity Turbine LLC