PHYSICAL REFERENCE · CHEAT SHEET

Standard temperature *reference*.

Freezing and boiling points of common substances, comfort and cooking temperatures, body temperatures, weather extremes — **everything on one chart**, in Fahrenheit and Celsius.

The chart

TEMPERATURE (°F)	TEMPERATURE (°C)	REFERENCE POINT
−459.67 °F	−273.15 °C	**Absolute zero** — no thermal motion. Defined exactly.
−320.5 °F	−195.8 °C	Liquid nitrogen boiling point (at 1 atm)
−109.3 °F	−78.5 °C	Dry ice (solid CO_2) sublimation
−40 °F	−40 °C	**F and C meet** — the only point where Fahrenheit equals Celsius
−128.6 °F	−89.2 °C	Coldest natural temperature on Earth (Vostok Station, Antarctica, 1983)
−4 °F	−20 °C	Home freezer (typical)
0 °F	−17.8 °C	Original Fahrenheit zero (saturated salt water)
−37.9 °F	−38.83 °C	Mercury freezes
14 °F	−10 °C	Standard freezer temperature
32 °F	0 °C	**Water freezes** (1 atm)
34-38 °F	1-3 °C	Refrigerator (recommended 1-4 °C / 34-40 °F)

TEMPERATURE (°F)	TEMPERATURE (°C)	REFERENCE POINT
40 °F	4 °C	Refrigerator typical / cold air mass
50 °F	10 °C	Cool autumn day
59 °F	15 °C	Standard temperature for thermodynamics (ISO 13443)
68 °F	20 °C	**Room temperature** (common reference, ASHRAE comfort range)
72 °F	22 °C	Indoor comfort
77 °F	25 °C	STP (semiconductor industry), warm room
86 °F	30 °C	Hot summer day
98.6 °F	37 °C	**Human body temperature** (oral, healthy)
100.4 °F	38 °C	Low-grade fever threshold
104 °F	40 °C	High fever; hot tub max
113 °F	45 °C	Hot day in Death Valley / Persian Gulf
134 °F	56.7 °C	Highest recorded air temperature on Earth (Death Valley, 1913 – WMO official record)
140 °F	60 °C	Hot water supply (max) / safe holding temperature for food
165 °F	74 °C	Safe minimum internal temperature for poultry (USDA)
180-205 °F	82-96 °C	Coffee brewing (drip / pour-over range)
212 °F	100 °C	**Water boils** (1 atm)
350 °F	175 °C	Standard baking (gas mark 4)
375 °F	190 °C	Hot frying oil
400-450 °F	200-230 °C	Pizza, breads (gas mark 6-8)

TEMPERATURE (°F)	TEMPERATURE (°C)	REFERENCE POINT
572 °F	300 °C	Auto-ignition temperature of paper
621 °F	327.5 °C	Lead melts
1220 °F	660 °C	Aluminum melts
1984 °F	1084.6 °C	Copper melts
2192 °F	1200 °C	Industrial brazing (silver)
2730 °F	1500 °C	Steel melts (varies by alloy)
6192 °F	3422 °C	Tungsten melts (highest melting metal)
6692 °F	3700 °C	Carbon arc temperature
~10,000 °F	~5500 °C	Surface of the sun

About 'standard temperatures'. Different fields use different reference temperatures: *0 °C / 32 °F* for ice point; *20 °C / 68 °F* for ASHRAE 'room temperature'; *25 °C / 77 °F* for semiconductor 'STP'; *15 °C / 59 °F* for natural gas STP (ISO 13443); *20 °C and 100 kPa* for IUPAC STP since 1982. Always check which 'standard' your reference document means.

Common applications

COOKING TEMPERATURE (°F)	(°C)	WHAT IT'S FOR
140 °F	60 °C	Steak: medium rare

COOKING TEMPERATURE (°F)	(°C)	WHAT IT'S FOR
145 °F	63 °C	USDA safe minimum: whole cuts of beef, pork, lamb
150 °F	65 °C	Steak: medium
160 °F	71 °C	Ground beef safe internal temperature (USDA)
160 °F	71 °C	Steak: medium well
165 °F	74 °C	Poultry safe internal temperature (USDA)
170 °F	77 °C	Coffee brewing minimum (some methods)
180 °F	82 °C	Drip coffee, tea (green tea)
190 °F	88 °C	Tea (oolong, white)
200 °F	93 °C	Tea (black, herbal); espresso brewing temperature
212 °F	100 °C	Boiling water (sea level)
350 °F	177 °C	Standard baking temperature
375 °F	190 °C	Hot oil for shallow frying
400 °F	204 °C	Roasting vegetables; bread
450 °F	232 °C	Pizza, hot-temperature roasting
500 °F	260 °C	Pizza stone, very hot

Common pitfalls

- **Boiling point depends on pressure.** Water boils at 100 °C at sea level (1 atm). At 5,280 ft elevation (Denver), water boils at about 95 °C / 203 °F. At the top of Mt. Everest, around 70 °C / 158 °F. This affects cooking times and is why pressure cookers work.
- **Body temperature isn't exactly 37 °C.** Healthy oral temperatures range from 36.1 to 37.2 °C (97-99 °F), with diurnal variation. Rectal temperatures run about 0.5 °C higher; axillary (armpit) about 0.5 °C lower. '98.6 °F' is an average, not a rigid number.
- **'Room temperature' isn't standardized.** ASHRAE comfort range is 68-76 °F (20-24 °C) depending on humidity, season, and activity. Scientific 'room temperature' is often 20 °C (68 °F) or 25 °C (77 °F) depending on the field.
- **Fan ovens run hotter than conventional.** A recipe at 180 °C (350 °F) conventional should be 160 °C (320 °F) on a fan-assisted oven — about 20 °C / 35 °F cooler.
- **USDA safe-food temperatures are higher than European equivalents.** The US specifies 165 °F (74 °C) for poultry; UK / EU often accepts 70 °C (158 °F) if held for time. Both produce safe food if held for the appropriate time, but US guidance is more conservative.

Common questions

Why does the Fahrenheit scale have 32° for freezing instead of 0°?

Fahrenheit's 1724 scale set 0°F to the freezing point of a brine (water + salt) — the coldest stable temperature he could reproduce. Then he set 96° to human body temperature (later refined to 98.6°F). Water freezing at 32°F and boiling at 212°F became fixed points after recalibration. The scale's only modern advantage: weather temperatures rarely go below 0°F.

What's absolute zero and why does it matter?

Absolute zero is -273.15°C / -459.67°F / 0 K — the temperature at which molecular motion stops. Below this is physically impossible. It matters because thermodynamic equations (gas laws, entropy) use absolute temperature. Tripling absolute temperature triples pressure or volume at constant conditions; tripling Celsius does not.

Why is human body temperature 98.6°F (37°C) and not 100°F?

Historical reasons. Fahrenheit originally set 96°F as 'blood-heat'. Later measurements with better instruments put healthy body temperature at 98.6°F (37°C). It's actually a range: 36.5-37.5°C is normal, and varies by time of day, individual, and measurement site.

How hot does a kitchen oven actually reach?

Residential ovens reach 260-290°C (500-550°F) on bake mode, up to 290-315°C (550-600°F) on broil. The actual temperature swings ±15°C around the set point as the heating element cycles. Older ovens drift more. For accurate baking, an oven thermometer reveals the truth — and the cycling is why baking time varies.

What's the hottest natural temperature on Earth's surface?

Officially: 56.7°C (134°F) at Furnace Creek, Death Valley, CA on July 10, 1913. Surface temperatures of dark surfaces in direct sun have been measured up to 80°C (176°F), but those aren't air temperatures. Higher claimed temperatures (58°C in Libya, 1922) were later invalidated by the World Meteorological Organization.

Sources

- **Absolute zero, water phase points:** Defined in ITS-90 (International Temperature Scale of 1990).
- **STP definitions:** IUPAC (100 kPa, 0 °C); NIST (101.325 kPa, 20 °C); ISO 13443 for natural gas (15 °C); semiconductor industry (25 °C).
- **Cooking safe temperatures:** USDA Food Safety and Inspection Service guidelines.
- **Comfort temperatures:** ASHRAE Standard 55 — Thermal Environmental Conditions for Human Occupancy.

Disclaimer. Cooking and food-safety temperatures should be verified against the most current USDA or local health-authority guidance. Industrial reference temperatures depend on the field — always confirm the relevant standard.