Boiling point and pressure

Physics · Class 9 Matter in Our Surroundings; Class 11 Physics: Thermal Properties of Matter

The trap

✗ Most students think

~~Water always boils at 100 °C, and a bigger flame makes boiling water hotter, so food cooks faster.~~

✓ Actually

Water boils when its **vapour pressure equals the outside pressure**. In Leh (≈ 0.65 atm) that is **≈ 88 °C**, and once it boils, extra heat only makes steam.

The concept in 5 lines

1. A liquid boils when its **vapour pressure = the pressure above it**; "100 °C" is true only at 1 atm (sea level).
2. Higher up the air pressure is lower, so water boils sooner: about **1 °C lower per 300 m** (Leh ≈ 88 °C, Everest ≈ 70 °C).
3. While water boils its temperature **stays fixed**; extra heat becomes **latent heat** of vaporisation (≈ 2,260 J/g).
4. A **pressure cooker** traps steam and raises the pressure (≈ 2 atm at sea level), so water boils at **≈ 120 °C**.
5. Cooking is chemistry: the rate roughly **doubles per 10 °C**, so the cooker cooks several times faster.

Remember

boils when: vapour pressure = outside pressure

Why it matters

Vapour pressure and boiling point return in Class 12 Chemistry *Solutions*, which carried **3 NEET questions in 2025**.

Previous-year question, solved

AIEEE 2003 (now JEE Main)

A pressure cooker reduces cooking time for food because

(A) heat is more evenly distributed in the cooking space

(B) boiling point of water involved in cooking is increased

(C) the higher pressure inside the cooker crushes the food material

(D) cooking involves chemical changes helped by a rise in temperature

Answer: (B) the boiling point of water is increased

1. Steam cannot escape the sealed cooker, so the pressure inside rises to about **2 atm** (at sea level).
2. Water boils only when its vapour pressure equals that pressure, so it must reach **≈ 120 °C** first.
3. Food in hotter water cooks faster. (A) and (C) are not the reason; (D) is true of cooking in general, but what the cooker changes is the **boiling point**.

Option letters differ between sources; match the answer by its wording.

Practice: try each one before you check the answers

Q1 Class 9 Water boils at 100 °C in Chennai but at a lower temperature in Leh. The main reason is: (a) less oxygen (b) lower air pressure (c) colder weather (d) harder water

Q2 Class 9–11 While water is boiling on a stove, you double the flame. What happens to the water's temperature?

Q3 Class 11 Using "about 1 °C lower per 300 m", estimate the boiling point at a hill station 2,400 m high.

Q4 NEET / JEE A reaction's rate doubles for every 10 °C rise. By what factor does it speed up when the temperature goes from 70 °C to 100 °C?

Q5 JEE The latent heat of vaporisation of water is about 2,260 J/g. How much heat is needed to boil away 500 g of water that is already at its boiling point?

Answers

1. **(b) lower air pressure.** Boiling happens when the vapour pressure equals the outside pressure, and that is reached at a lower temperature when the outside pressure is lower.
2. It stays the same (at its boiling point). The extra heat goes into latent heat, converting more water into steam, so it only boils away faster.
3. 2,400 ÷ 300 = 8, so about **100 − 8 = 92 °C**.
4. 30 °C = 3 steps, so 2^3 = **8 times** faster.
5. Q = mL = 500 × 2,260 = **1,130,000 J ≈ 1.13 MJ**. Notice that none of it raises the temperature.

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