▶ Video explanation (YouTube Short)

Why Is Ice Slippery?

Everyone slips on ice, yet scientists still debate exactly why. Three ideas have been proposed.

1. Pressure melting (the old idea)

Pressure lowers the melting point of ice, so the idea was that your weight melts the ice under your feet.

Why it fails: the melting point falls by only about **0.0074 °C per atmosphere**. Even under a thin skate blade, a person's weight lowers it by only a fraction of a degree, yet ice stays slippery far below 0 °C (around −30 °C).

Solved example. A pressure of 100 atm lowers the melting point by 0.0074 × 100 ≈ 0.74 °C: far too little to melt ice at −30 °C.

2. Frictional melting

When a skate or shoe slides, **friction** turns kinetic energy into heat, which melts a very thin water film that lubricates the motion (Bowden and Hughes, 1939). This works well for a **moving** skater but cannot explain why ice is slippery the moment you step on it.

3. Premelting: the surface layer

Michael Faraday (1850s) proposed that a very thin **liquid-like layer** covers ice even below 0 °C. This **premelting** layer has been confirmed by surface experiments; it gets thicker as the temperature approaches 0 °C.

Surface molecules have fewer neighbours than molecules inside, so they are held less tightly and can move.

4. What is still debated

Recent experiments (for example Weber, Bonn and co-workers, 2018) found loosely bound, mobile water molecules at the surface that may roll like tiny **ball bearings**. How much each mechanism contributes at different temperatures and speeds is still being researched.

Idea	Status
Pressure melting	Too small to explain it
Frictional melting	True for sliding
Premelting surface layer	Confirmed; explains slipping when still
Exact molecular picture	Still debated

Key takeaways

- Not your weight: pressure melting is far too weak.
- Friction melts a film under moving skates.
- A liquid-like premelting layer exists below 0 °C (Faraday).
- Science still has open questions.

Practice questions

1. (MCQ) Pressure lowers ice's melting point by about: (a) 1 °C per atm (b) 0.0074 °C per atm (c) 10 °C per atm (d) it raises it
2. (MCQ) Who proposed a liquid-like layer on ice? (a) Newton (b) Faraday (c) Joule (d) Kelvin
3. (Very short) What is premelting?
4. (Short) Why can't pressure melting explain slipping at −30 °C?
5. (Numerical) By how much do 50 atm lower the melting point of ice?
6. (Application) Why does a skater glide better once moving?

Answer key

1. (b).
2. (b) Faraday.
3. A thin liquid-like layer on the surface of ice below its melting point.
4. Our weight lowers the melting point by only a fraction of a degree, nowhere near 30 °C.
5. 0.0074 × 50 ≈ 0.37 °C.
6. Friction while sliding heats the surface and melts a thin water film that lubricates the blade.

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