



COLLECTION · COL-02

EXTREME COLD

Liquid nitrogen, millikelvin fridges, a tunnel built for -40 °F, a city carved from river ice, Everest's death zone, a glacier that bleeds, a nuclear icebreaker built for 2.8 m of ice, a nebula at 1 K, snowflakes that never quite match, glacier ice that glows blue, emperor penguin dads who fast all winter, polar bears that swim between floes, Mercury's frozen nights and the tundra's permafrost.



INSIDE

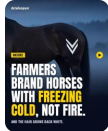
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ABOUT THIS COLLECTION

31 case files where extreme cold does the work. Freeze-branding irons are copper or brass and are chilled in liquid nitrogen (-196 °C / -320 °F) or a dry ice and alcohol bath. **DD-006** A superconducting quantum chip sits on the bottom plate of a dilution refrigerator at around 10–15 millikelvin, more than 180 times colder than deep space. **DD-012**

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Cosmic Freezer

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No Perfect Crystallizations

DD-288 · Nature / Science · Every snowflake writes its own flight log.

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Iceberg Blue

DD-299 · Nature / Science · Dense glacier ice glows blue.

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Emperor Penguins

DD-115 · Nature · Emperor penguin fathers fast for about four months.

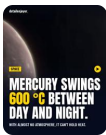
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DD-119 · Nature · Polar bears are classified as marine mammals.

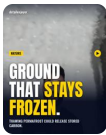
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DD-133 · Space · Mercury swings by about 600 °C between day and night.

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Earth's Harshest Biome

DD-212 · Nature / Science · Tundra soil stays frozen year-round just below the surface.

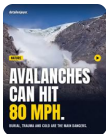
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DD-264 · Nature / Science · Brinicles are tubes of ice that grow down from sea ice.

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DD-273 · Nature / Locations · Avalanches can reach 80 mph within seconds.

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DD-316 · Nature / Locations · Meltwater can pour off a glacier's edge as a waterfall.

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DD-318 · Tech / Locations · Icebreakers ride up onto the ice and crush it with their weight.

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DD-326 · Science / Nature · In deep cold, a soap bubble can freeze into a crystal shell.

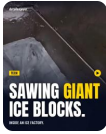
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ICECORE

DD-398 · Science / Nature · Ice cores hold air bubbles hundreds of thousands of years old.

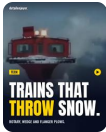
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nICE

DD-382 · Tech · Ice factories freeze huge blocks, then slice them with saws.

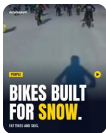
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Snowplower

DD-409 · Tech · Rotary plows can throw snow far from the tracks.

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Advanced Bicycle Riding II

DD-419 · People · Fat bikes ride snow on extra-wide tires.

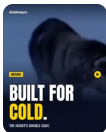
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FREEZING

DD-444 · Science · Ice floats because freezing water spreads out into an open lattice.

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Just a Chill Dog

DD-458 · Nature · A husky's double coat traps warm air against its skin.

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Immune to Cold

DD-467 · Nature · A husky's undercoat traps warm air next to its skin.

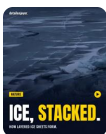
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How Water Freezes

DD-468 · Science · Freezing water locks into a six-sided lattice.

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Layer by Layer

DD-470 · Nature · Ice sheets can build up in visible layers.

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Frozen Gators

DD-491 · Nature · Alligators can poke their snouts through ice to breathe.

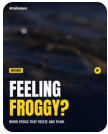
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The Plunge

DD-497 · Nature · Young penguins gather at the ice edge before their first swim.

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Feeling Froggy?

DD-758 · Nature / Science · Wood frogs can freeze solid in winter and thaw back to life.



Collection Quiz and Answer Key

62 questions from every case file

Every quick fact has a stable ID (for example DD-006-F01) and comes from a case file with its sources listed. Online edition with videos and slides: <https://detailenjoyer.com/collections/extreme-cold/>



DD-006 NATURE · 1 OF 31

CRYOBRANDING

Some horses are branded with $-196\text{ }^{\circ}\text{C}$ cold instead of fire, and the hair grows back snow-white in the brand's shape.

QUICK FACTS

DD-006-F01

Freeze branding marks horses with extreme cold instead of fire, and the hair grows back white in the brand's shape.

DD-006-F02

Freeze-branding irons are copper or brass and are chilled in liquid nitrogen ($-196\text{ }^{\circ}\text{C}$ / $-320\text{ }^{\circ}\text{F}$) or a dry ice and alcohol bath.

DD-006-F03

Freeze branding destroys the hair's pigment cells (melanocytes) but spares the growth follicle, so the hair grows back white.

DD-006-F04

A copper freeze-branding iron is typically held on a dark horse for 7 to 10 seconds, while cows need 25 to 30 seconds.

DD-006-F05

Holding a freeze-branding iron on a horse for 12 or more seconds stops the hair from growing, leaving a bald mark that shows up on light coats.

DD-006-F06

The new white hair from a freeze brand takes 2 to 3 months to grow in.

DD-006-F07

Freeze branding was invented in 1966 by Washington State University veterinarian R. Keith Farrell as a gentler alternative to hot irons.

DD-006-F08

In a 300-steer study, hot-iron-branded cattle kicked, fell and bellowed more than freeze-branded cattle.

DD-006-F09

Human skin is far thinner than horse or cow hide; one woman's 10-second freeze brand caused a deep burn that needed 6 months of wound care.

THE WRITE-UP

Liquid nitrogen: $-196\text{ }^{\circ}\text{C}$. Copper or brass irons are chilled in liquid nitrogen ($-320\text{ }^{\circ}\text{F}$) or a dry ice and alcohol bath.

It kills only the color. The cold destroys pigment cells (melanocytes) but spares the growth follicle, so the hair grows back white.

7 to 10 seconds. Typical copper-iron time on a dark horse. Cows need 25 to 30 seconds.

Bald on purpose. Hold it longer (12+ seconds on a horse) and the hair stops growing. That bald mark shows up on light coats.

2 to 3 months. That's how long the new white hair takes to grow in.

Invented in 1966. By Washington State University veterinarian R. Keith Farrell, as a gentler alternative to hot irons.

Gentler than fire. In a 300-steer study, hot-iron cattle kicked, fell and bellowed more than freeze-branded ones.

Not for humans. Our skin is far thinner. A 10-second freeze brand gave one woman a deep burn that needed 6 months of wound care.

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Permalink: <https://detailenjoyer.com/case/cryobranding/> · Last updated Oct 17, 2026



QUANTUM INFRASTRUCTURE

The gold 'chandelier' in photos of quantum computers is really a refrigerator. Superconducting qubits are so easily disturbed that the chip sits on the bottom plate of a dilution refrigerator. Each stage of the fridge is colder than the one above, and the bottom plate is held around 10–15 millikelvin by a mixture of helium-3 and helium-4. That is more than 180 times colder than the 2.7 K of deep space.

QUICK FACTS

DD-012-F01

A superconducting quantum chip sits on the bottom plate of a dilution refrigerator at around 10–15 millikelvin, more than 180 times colder than deep space.

DD-012-F02

Dilution refrigerators cool by pumping helium-3 across the boundary between two phases of a helium-3/helium-4 mixture, which only separates below about 0.87 K.

THE WRITE-UP

Fragile by design. Qubits must be almost perfectly isolated from heat, vibration and stray disturbances. Even then, they hold their quantum states for at most a few hundred microseconds before they 'decohere'.

The 'chandelier' is a fridge. The tiered gold structure is a dilution refrigerator. It has a stack of metal plates, each colder than the one above, with the top plate at room temperature.

Chip at the bottom. The quantum processor is mounted on the lowest and coldest plate, the mixing chamber. It sits inside a shielded package that blocks stray radiation and magnetic fields.

Helium-3 meets helium-4. Below about 0.87 K, a mixture of helium-3 and helium-4 separates into two phases. Pumping helium-3 across the boundary between them absorbs heat, like evaporation, and this provides continuous cooling.

About 10–15 thousandths of a degree. Commercial dilution refrigerators reach a base temperature of around 10 mK. IBM's fridges hold chips at about 10–15 mK.

Colder than deep space. Space is bathed in the 2.7 K cosmic microwave background. IBM says its fridges, at below 15 mK, are more than 180 times colder than deep space.

Getting bigger. In August 2026, IBM joined two cryogenic modules, each over 8 feet tall and wide, into one ultra-cold environment. The modules are designed to link hundreds of quantum chips.

REEL VS. RECORD

- **Confirmed:** the cryogenic stack protects qubits from heat, vibration and electromagnetic interference; the processor is mounted at the bottom; and the fridge cools with a He-3/He-4 mixture. [Bluefors; Oxford; PRX Quantum; Popular Science; MIT Tech Review]
- **Range check:** '10–20 mK' is fair. Base temperatures are typically ≤ 10 mK, with qubits operated around 10–15 mK. 'Colder than outer space' is correct (deep space is about 2.7 K). [PRX Quantum; Popular Science; IBM]
- **Nuance:** this applies to superconducting qubits, as the Reel says. Other kinds of quantum computers, such as trapped-ion and photonic, don't need a dilution refrigerator for the qubits themselves.

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Permalink: <https://detailenjoyer.com/case/quantum-cryogenics/> · Last updated Jun 13, 2026



DD-008 LOCATIONS / HISTORY · 3 OF 31

ONE ROOF TOWN

Most of Whittier, Alaska lives in a single 14-story building, and the only road into town is a tunnel that closes every night.

QUICK FACTS

DD-008-F01

Most of Whittier, Alaska's roughly 300 year-round residents live in Begich Towers, a single 14-story building.

DD-008-F02

Begich Towers in Whittier, Alaska was built by the U.S. Army as Cold War barracks; locals moved in after the military left.

DD-008-F03

In Begich Towers, a grocery store, post office and a church are just an elevator ride away.

DD-008-F04

Kids in Whittier, Alaska can walk to school through a tunnel without ever stepping outside.

DD-008-F05

The only road into Whittier, Alaska is the 2.5-mile Anton Anderson Memorial Tunnel, the longest highway tunnel in North America.

DD-008-F06

The Anton Anderson Memorial Tunnel has a single lane that cars and trains take turns using, with computers making sure they're never inside at the same time.

DD-008-F07

The tunnel into Whittier, Alaska closes overnight; its winter hours are 7 AM to 11 PM.

DD-008-F08

The Anton Anderson Memorial Tunnel was the first tunnel designed for -40 °F cold and 150 mph winds.

THE WRITE-UP

Begich Towers. A 14-story tower in Whittier, Alaska that houses most of the town's ~300 year-round residents.

Built for soldiers. The U.S. Army built it as Cold War barracks. Locals moved in after the military left.

A town in a building. Grocery store, post office and a church are just an elevator ride away.

School by tunnel. Kids can walk to school through a tunnel without ever stepping outside.

2.5 miles. The only road in is the Anton Anderson Memorial Tunnel, the longest highway tunnel in North America.

One lane. Cars and trains.. They take turns. Computers make sure they're never inside at the same time.

Closed at night. The tunnel shuts overnight, cutting the town off until morning. Winter hours: 7 AM to 11 PM.

-40 °F and 150 mph. It was the first tunnel designed for that kind of cold and wind.

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Permalink: <https://detailenjoyer.com/case/whittier-one-roof/> · Last updated Oct 17, 2026



DD-034 LOCATIONS / PEOPLE · 4 OF 31

WINTER IN HARBIN

Harbin, the 'Ice City' of China's northeast, began its modern ice festival on January 5, 1985. Its roots go back to a 1963 ice-lantern show and Qing-dynasty lanterns made from blocks of river ice. Each December, workers saw blocks two to three feet thick out of the frozen Songhua River. Sculptors then turn them into palaces, landmark replicas and LED-lit castles. The centerpiece, Harbin Ice and Snow World, opened in 1999, is rebuilt from scratch every year, and holds a Guinness record as the world's largest ice-and-snow theme park.

QUICK FACTS

DD-034-F01

Harbin's ice palaces are cut from the frozen Songhua River in blocks two to three feet thick, and the whole Ice and Snow World is rebuilt every year.

DD-034-F02

Harbin Ice and Snow World holds a Guinness record as the world's largest ice-and-snow theme park.

THE WRITE-UP

From lanterns to palaces. In the Qing dynasty, people in Heilongjiang made ice lanterns by freezing water in buckets and putting a candle inside. Harbin's first government ice-lantern show opened on February 7, 1963, in Zhaolin Park and drew 250,000 visitors in six days.

The festival is born. The first Harbin Ice and Snow Festival opened on January 5, 1985, outside Zhaolin Park. It was China's first local festival built around ice and snow. In 2001 it merged with Heilongjiang's International Ski Festival under its current name.

Cut from the river. Each December, crews use swing saws to cut blocks two to three feet thick from the frozen Songhua River. In 2020 the sculptures used about 220,000 cubic meters of ice.

Ice and Snow World. The headline park opened in 1999 for the millennium and is rebuilt every year. Its 25th edition set a Guinness record as the world's largest ice-and-snow theme park, at 810,000 m² using 250,000 m³ of ice and snow. The 2025 edition covered about 1.2 million m².

In the global top four. The festival is usually ranked alongside Japan's Sapporo Snow Festival, Canada's Quebec Winter Carnival and Norway's Holmenkollen Ski Festival as one of the world's biggest winter events.

Snow, too. Harbin had plenty of ice but few snow sculptures until 1989, when a snow-sculpture fair on Sun Island added 60-plus works. It grew into the Sun Island International Snow Sculpture Art Expo.

REEL VS. RECORD

- **Confirmed from the frames:** the Reel is about the Harbin International Ice and Snow Sculpture Festival (captions at 0.8–2.6 s). [Wikipedia; Smithsonian]
- **Imprecise:** 'typically running from early January through February.' The festival officially opens January 5, but Ice and Snow World usually opens in late December and runs to late February. [Wikipedia; Smithsonian; Heilongjiang tourism]
- **Confirmed:** the ice comes from the Songhua River, in blocks two to three feet thick. [Wikipedia; Smithsonian]
- **Context:** 'one of the largest ... in the world' is fair. It's grouped with Sapporo, Quebec and Holmenkollen, and Ice and Snow World holds a Guinness 'largest ice-and-snow theme park' record. [Wikipedia; Heilongjiang tourism]
- **Footage note:** the Reel uses a lower-resolution source, so the cover is softer. The opening aerial shows Ice and Snow World with the Harbin skyline behind it. [visual observation]

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Permalink: <https://detailenjoyer.com/case/winter-in-harbin/> · Last updated Mar 10, 2026



FOREVEREST

More than 300 people have died in the Everest region in a century of climbing, and more than 200 bodies are thought to remain on the mountain. Above about 8,000 m, the so-called death zone, the air holds roughly a third of the oxygen at sea level, and summit temperatures average about -36 °C in January. Bringing someone down from there takes a large team, bottled oxygen and a short weather window, so many of the dead have stayed where they fell. Since 2019, Nepal-funded clean-up campaigns have started to bring some of them home: in 2024 a team of soldiers and Sherpa climbers recovered four bodies and a skeleton.

QUICK FACTS

DD-063-F01

More than 200 climbers' bodies are thought to remain on Everest, mostly because recovering them above 8,000 m is so dangerous and costly.

DD-063-F02

Nepal's clean-up campaigns since 2019 have brought 14 bodies down, including four bodies and a skeleton in 2024.

THE WRITE-UP

How many remain. More than 300 people have died in the Everest region over about a century of climbing. More than 200 bodies are believed to still be on the mountain, and some have become grim landmarks along the routes.

The death zone. Above about 8,000 m, the air holds roughly a third of the oxygen available at sea level. Climbers there are slowly weakened even with bottled oxygen, and that leaves little strength to carry anyone else.

Colder than the Reel says. Summit temperatures average about -36 °C in January and about -19 °C in July, and they can fall to about -60 °C. Winds can top 100 km/h.

What a recovery takes. Nepal set aside about Rs5 million (\$37,400) for each body in 2024. A single recovery can need around 12 people, each with several oxygen cylinders costing more than \$400 apiece, and one body took two days to cut out of the ice.

Bringing them home. Since 2019, government-funded clean-ups have removed tonnes of rubbish and 14 bodies. The 2024 campaign, a 54-day operation that ended June 5, recovered four bodies and a skeleton. Melting ice is now exposing more remains.

REEL VS. RECORD

- **Confirmed:** many of the dead do stay on Everest. More than 200 bodies are believed to remain, and the death zone is generally placed above about 8,000 m. [BBC; Phys.org]
- **Not always permanent:** Nepal-funded clean-ups since 2019 have recovered 14 bodies, including four and a skeleton in a 54-day 2024 operation that ended June 5. Melting ice is exposing more. [BBC; NPR; Phys.org]
- **Understated cold:** '-30 °C' is on the mild side. Summit temperatures average about -36 °C in January and can drop to about -60 °C; July averages about -19 °C. [Britannica]
- **Missing context:** 'expensive' means about Rs5 million (\$37,400) budgeted per body in 2024, with teams of about 12 and bottled oxygen at more than \$400 a cylinder. [BBC; NPR]
- **Footage note:** the Reel shows real human remains on the mountain. My cover and poster use a plain illustrated mountain instead of any frame from the video. [frames]

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Permalink: <https://detailenjoyer.com/case/foreverest/> · Last updated Jul 15, 2025



DD-725 NATURE / LOCATIONS · 6 OF 31

THE GLACIER THAT BLEEDS

Blood Falls is a sporadic outflow of brine at the snout of Taylor Glacier in the McMurdo Dry Valleys, where the glacier ends at ice-covered Lake Bonney. Griffith Taylor found it in 1911, and its color was first blamed on red algae. The source is ancient seawater, concentrated by freezing and sealed beneath the glacier. Estimates range from about 1.5 million years of isolation (for the microbes living in it) to a Pliocene origin about 5 million years ago. The brine is salty, iron-rich and has no detectable oxygen. When it reaches the air, dissolved ferrous iron oxidizes into iron-rich nanospheres that stain the ice red as the brine drops 60 to 80 feet to the lake shore. A 2017 radar survey traced a brine pathway more than 300 feet long inside the glacier, making Taylor the coldest known glacier with persistently flowing water.

QUICK FACTS

DD-725-F01

Blood Falls is red because iron-rich, oxygen-free brine from beneath Taylor Glacier oxidizes the moment it meets the air.

DD-725-F02

The brine stays liquid inside a glacier whose mean temperature is about -17°C , because salt lowers its freezing point and freezing releases heat.

THE WRITE-UP

Where it is. Blood Falls is at the snout of Taylor Glacier, an outlet of the East Antarctic Ice Sheet that ends in Lake Bonney in the McMurdo Dry Valleys. The red brine drops 60 to 80 feet to the shore of the frozen lake.

Not algae. Griffith Taylor discovered it in 1911, and the color was first attributed to red algae. It actually comes from iron in brine that reacts on contact with air.

Ancient seawater. The brine's chemistry matches seawater concentrated by freezing. It's thought to be a remnant of a Pliocene marine incursion about 5 million years ago, and its microbes have been isolated for an estimated 1.5 million years.

No oxygen. At its source the outflow is iron-rich (3.8 mM total iron) and has no detectable oxygen. Microbes inside it survive by cycling iron and sulfur compounds.

Why red. A 2023 analysis found no strong evidence of crystalline rust minerals. Instead, the color comes from amorphous, iron-rich nanospheres that form as dissolved iron oxidizes in air.

Liquid inside a cold glacier. Radar traced a brine pathway more than 300 feet long inside the glacier. The brine stays liquid because salt lowers its freezing point and freezing releases latent heat, making Taylor the coldest known glacier with persistently flowing water.

REEL VS. RECORD

- **Confirmed from the frames:** the Reel is about Blood Falls at Taylor Glacier (captions at 0.8–4.0 s). Iron-rich, hypersaline, oxygen-free brine emerges and turns red on contact with air. [Mikucki & Priscu 2007; UAF]
- **Missing detail:** it doesn't flow constantly. Blood Falls releases brine sporadically, and the red stain persists between releases. [Badgeley et al. 2017; Cambridge]
- **Refined:** it isn't simply 'rust'. A 2023 study found no strong evidence of crystalline iron oxide; the red comes from amorphous iron-rich nanospheres that form as the dissolved iron oxidizes. [Frontiers 2023; Johns Hopkins]
- **Roughly right:** 'trapped for millions of years.' Estimates range from about 1.5 million years of isolation to a seawater origin about 5 million years ago, and UAF says 'more than 1 million years'. [NASA Astrobiology; Mikucki & Priscu 2007; UAF]
- **Footage note:** the wide shots of a towering ice wall and branching red veins across a frozen plain appear dramatized and may be AI-generated or heavily edited. The real feature is a rust-red stain where brine drops 60 to 80 feet to the shore of Lake Bonney. [frames; Cambridge]

SOURCES

1. Badgeley et al., An englacial hydrologic system of brine within a cold glacier: Blood Falls (Journal of Glaciology, 2017): <https://doaj.org/article/bd333f16254645f5a2ec94cda8d7d1f4>
2. Researchers solve the century-old mystery of Blood Falls (University of Alaska Fairbanks): <https://www.uaf.edu/news/archives/news-archives-2010-2021/researchers-solve-the-100-year-old-mystery-of-blood-falls.php>
3. Mikucki & Priscu, Bacterial Diversity Associated with Blood Falls (Applied and Environmental Microbiology, 2007): <https://journals.asm.org/doi/full/10.1128/aem.01396-06>
4. Sheffer et al., A Multi-Technique Analysis of Surface Materials From Blood Falls (Frontiers in Astronomy and Space Sciences, 2023): <https://www.frontiersin.org/journals/astronomy-and-space-sciences/articles/10.3389/fspas.2022.843174/full>
5. Seeing red: Researchers uncover the century-old mystery of Blood Falls (Johns Hopkins Hub, 2023): <https://hub.jhu.edu/2023/06/26/blood-falls-mystery/>
6. Life at Blood Falls (NASA Astrobiology, 2009): <https://astrobiology.nasa.gov/news/life-at-blood-falls/>
7. Solving the mystery of Antarctica's 'Blood Falls' (Cambridge Core Blog, 2017): <https://www.cambridge.org/core/blog/2017/05/04/solving-the-mystery-of-antarcticas-blood-falls/>

Permalink: <https://detailenjoyer.com/case/the-glacier-that-bleeds/> · Last updated Jul 1, 2026



DD-579 TECH · 7 OF 31

URANIUM URAL

Ural is a Project 22220 nuclear-powered icebreaker, the third ship of the class after Arktika and Sibir. It's operated by Atomflot, part of Russia's state nuclear corporation Rosatom, and registered in Murmansk. Baltic Shipyard in Saint Petersburg laid its keel on July 25, 2016, and it was launched on May 25, 2019. Its reactors had already been lifted aboard while it was on the slipway. Delivery was planned for 2020 but slipped to 2022 because of delays with its domestically made steam turbines. After sea trials in October 2022, its flag was raised on November 22, 2022, and on December 2 it left Murmansk on its first icebreaking mission, to the Kara Sea. The ship is 172.7 m long and 34 m wide. Two 175-megawatt RITM-200 pressurized-water reactors, fueled with uranium-235 enriched to up to 20%, make steam for two turbogenerators. Their electricity drives three 20-megawatt motors, each turning a 6.2 m four-bladed propeller, for 60 megawatts in total. At full power in deep water, the design calls for breaking level ice 2.8 m thick at a steady 1.5 to 2 knots. By taking on or pumping out ballast water, the crew can vary the draft between about 9 m and 10.5 m. That lets the same ship work the deep Northern Sea Route and the shallow estuaries of Siberian rivers such as the Yenisei. The name had been chosen once before, for the last Arktika-class icebreaker in 1989, which was renamed 50 Let Pobedy during construction. The footage shows Ural's red, white and blue superstructure and dark-blue hull, marked 'УРАЛ' and 'РОСАТОМФЛОТ', moving through snow-covered ice at dusk.

QUICK FACTS

DD-579-F01

Ural's two RITM-200 reactors power three 20-megawatt propeller motors.

DD-579-F02

Ural is designed to break level ice 2.8 m thick.

THE WRITE-UP

Third of its class. Ural is the third Project 22220 icebreaker, built at Baltic Shipyard and run by Rosatom's Atomflot.

2019 to 2022. It was launched on May 25, 2019, and entered service on November 22, 2022, after turbine delays.

Reactors to propellers. Two RITM-200 reactors make steam for generators that power three 20 MW propeller motors.

2.8 m of ice. At full power, it's designed to break level ice 2.8 m thick at 1.5 to 2 knots.

Two drafts. Ballast lets it ride at about 9 m for river estuaries or 10.5 m for the open Arctic.

REEL VS. RECORD

- **Note:** 'Launched in 2019 and commissioned in 2022': correct. It was launched on May 25, 2019, and its flag was raised on November 22, 2022. Delivery was two years late because of steam-turbine delays.
- **Note:** 'Cut through ice up to 2.8 m thick': that's the design figure for level ice at a steady 1.5 to 2 knots, at full power in deep water.
- **Note:** 'Keep the Northern Sea Route navigable year-round': that's the class's purpose, as part of a larger fleet. One ship alone doesn't keep the whole route open.
- **Note:** 'From 9 to 10.5 m': correct for the working range. The official minimum draft is a little lower, about 8.65 m.
- **Missing:** the reactors run on uranium-235 enriched to up to 20%. They make steam for two turbogenerators, and the electricity drives three 20 MW motors.

SOURCES

1. Wikipedia: Ural (icebreaker): [https://en.wikipedia.org/wiki/Ural_\(icebreaker\)](https://en.wikipedia.org/wiki/Ural_(icebreaker))
2. Rosatomflot (in Russian): Project 22220 universal nuclear icebreaker Ural launched (May 25, 2019): <https://www.rosatomflot.ru/press-centr/novosti-predpriyatiya/2019/05/25/11252-universalnyy-atomnyy-ledokol-ural-proekta-22220-spushen-na-vodu/>
3. PortNews: Nuclear-powered icebreaker Ural of Project 22220 leaves Murmansk for the first operational voyage (December 2, 2022): <https://en.portnews.ru/news/339556/>
4. Wikipedia: Project 22220 icebreaker: https://en.wikipedia.org/wiki/Project_22220_icebreaker

Permalink: <https://detailenjoyer.com/case/uranium-ural/> · Last updated May 24, 2025



DD-752 SPACE · 8 OF 31

COSMIC FREEZER

The coldest place in the universe isn't the void between galaxies. It's a dying star's breath, 5,000 light-years away, at 1 K (-272 °C).

QUICK FACTS

DD-752-F01

The Boomerang Nebula: A cloud of gas blown off by a dying star, about 5,000 light-years away in Centaurus.

DD-752-F02

1 Kelvin: That's -272 °C / -458 °F. Just one degree above absolute zero.

DD-752-F03

Colder than space: The Big Bang's afterglow keeps empty space at about 2.7 K. The Boomerang is colder.

DD-752-F04

The only one: It's the only known natural object colder than the cosmic background.

DD-752-F05

Found in 1995: Sahai and Nyman measured it with the 15-metre SEST radio telescope in Chile.

DD-752-F06

164 km per second: Its star blasts gas outward at over 500,000 km/h.

DD-752-F07

1/1,000 of a Sun: That's how much mass it sheds every year, for at least 1,500 years.

DD-752-F08

A cosmic fridge: The gas expands so fast it chills itself. Same trick as your refrigerator.

THE WRITE-UP

The Boomerang Nebula. A cloud of gas blown off by a dying star, about 5,000 light-years away in Centaurus.

1 Kelvin. That's -272 °C / -458 °F. Just one degree above absolute zero.

Colder than space. The Big Bang's afterglow keeps empty space at about 2.7 K. The Boomerang is colder.

The only one. It's the only known natural object colder than the cosmic background.

Found in 1995. Sahai and Nyman measured it with the 15-metre SEST radio telescope in Chile.

164 km per second. Its star blasts gas outward at over 500,000 km/h.

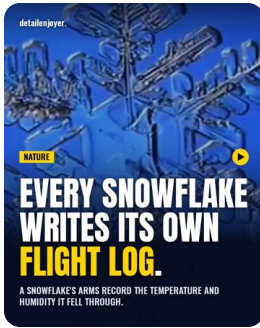
1/1,000 of a Sun. That's how much mass it sheds every year, for at least 1,500 years.

A cosmic fridge. The gas expands so fast it chills itself. Same trick as your refrigerator.

SOURCES

1. [jpl.nasa.gov: https://www.jpl.nasa.gov/news/boomerang-nebula-boasts-the-coolest-spot-in-the-universe/](https://www.jpl.nasa.gov/news/boomerang-nebula-boasts-the-coolest-spot-in-the-universe/)
2. [esa.int: https://www.esa.int/Science_Exploration/Space_Science/Extreme_space/Coldest_place_in_the_Universe](https://www.esa.int/Science_Exploration/Space_Science/Extreme_space/Coldest_place_in_the_Universe)
3. [iopscience.iop.org: https://iopscience.iop.org/article/10.1086/310897](https://iopscience.iop.org/article/10.1086/310897)
4. [almaobservatory.org: https://www.almaobservatory.org/en/press-releases/alma-reveals-ghostly-shape-of-coldest-place-in-the-universe/](https://www.almaobservatory.org/en/press-releases/alma-reveals-ghostly-shape-of-coldest-place-in-the-universe/)
5. [science.nasa.gov: https://science.nasa.gov/missions/hubble/boomerang-nebula/](https://science.nasa.gov/missions/hubble/boomerang-nebula/)

Permalink: <https://detailenjoyer.com/case/coldest-place-universe-v2/> · Last updated Oct 17, 2026



NO PERFECT CRYSTALLIZATIONS

A snow crystal starts when supercooled cloud droplets freeze onto a tiny particle such as dust or pollen, and then grows as water vapor deposits directly onto the ice. Ice's crystal structure gives it six-fold symmetry, so crystals grow as hexagonal plates, columns or branching stars. Which shape wins depends on temperature and humidity, so as a crystal tumbles through changing conditions, each stage leaves its mark on its arms. Caltech physicist Kenneth Libbrecht, who grows snow crystals in the lab, explains that complex flakes are almost certainly never identical because of the huge number of possible growth paths, though very simple crystals can look alike, and researchers have grown 'identical-twin' crystals side by side under matched conditions. The footage shows a time-lapse of a crystal growing branches.

QUICK FACTS

DD-288-F01

Snowflakes have six-fold symmetry from ice's crystal structure.

DD-288-F02

Temperature and humidity shape each growth stage.

THE WRITE-UP

A seed particle. Snow crystals start on a tiny particle such as dust or pollen.

Growth from vapor. They grow as water vapor deposits directly onto the ice.

Six-fold symmetry. Ice's crystal structure gives snowflakes hexagonal symmetry.

Weather shapes it. Temperature and humidity decide which shapes grow at each stage.

Never quite twins. Complex flakes are almost never identical, though simple ones can look alike.

REEL VS. RECORD

- **Note:** 'No two snowflakes are exactly alike': I'd soften this a little. It's true for complex flakes, but tiny simple crystals can look alike, and researchers have grown near-identical twins in the lab.
- **Note:** 'Water vapor freezes onto a particle': close. In clouds a supercooled droplet usually freezes on the particle first, and vapor then deposits onto the ice.

SOURCES

1. Kenneth G. Libbrecht, Caltech: SnowCrystals.com: <https://www.its.caltech.edu/~atomic/snowcrystals/>
2. Wikipedia: Snowflake: <https://en.wikipedia.org/wiki/Snowflake>

Permalink: <https://detailenjoyer.com/case/no-perfect-crystallizations/> · Last updated Aug 3, 2024



DD-299 NATURE / SCIENCE · 10 OF 31

ICEBERG BLUE

Glacier ice forms as snow is buried and compressed over years, squeezing out air bubbles. Ice and water absorb a little more red light than blue, so over long paths through clear ice, red is removed and the light that comes back looks blue. Snow and bubbly ice look white because countless surfaces scatter all colors before much is absorbed. So deep, dense, bubble-free ice in a glacier or iceberg looks the most blue. The footage shows a glacier front calving blue ice into the sea.

QUICK FACTS

DD-299-F01

Ice absorbs slightly more red light than blue.

DD-299-F02

Bubbles make ice look white.

THE WRITE-UP

Compressed snow. Glacier ice forms as buried snow is compressed and air is squeezed out.

Red is absorbed. Ice absorbs slightly more red light than blue.

Long light paths. Over long paths through clear ice, the remaining light looks blue.

Why snow is white. Bubbles and grain surfaces scatter all colors, so snow looks white.

Deepest blue. Dense, bubble-free ice looks the most blue.

REEL VS. RECORD

- **Note:** 'Scatters the shorter wavelengths': I'd put the emphasis on absorption. The blue comes mainly from red being absorbed along long paths through clear ice; scattering by bubbles makes ice look white, not blue.

SOURCES

1. Wikipedia: Blue ice (glacial): [https://en.wikipedia.org/wiki/Blue_ice_\(glacial\)](https://en.wikipedia.org/wiki/Blue_ice_(glacial))
2. Wikipedia: Color of water: https://en.wikipedia.org/wiki/Color_of_water

Permalink: <https://detailenjoyer.com/case/iceberg-blue/> · Last updated Aug 14, 2024



DD-115 NATURE · 11 OF 31

EMPEROR PENGUINS

Emperor penguins (*Aptenodytes forsteri*) breed during the Antarctic winter, when temperatures can fall below -40°C , which is also -40°F . The female lays a single egg and passes it to the male, then heads to sea to feed. The male balances the egg on his feet under a fold of skin, the brood pouch, for about two months, huddling with other males against winds of up to 200 km/h. It's the only penguin species where the male alone incubates. By the time the egg hatches he will have fasted for around 120 days since arriving at the colony. The female returns to take over the chick. The footage shows emperor penguins, eggs and chicks on the ice.

QUICK FACTS

DD-115-F01

They breed through the Antarctic winter.

DD-115-F02

The female passes the single egg to the male.

THE WRITE-UP

Winter breeders. They breed through the Antarctic winter.

Egg handoff. The female passes the single egg to the male.

Brood pouch. The male keeps the egg on his feet under a skin fold.

Huddles. Males huddle against winds of up to 200 km/h.

120-day fast. Males fast for around 120 days.

REEL VS. RECORD

- **Note:** None needed. I added that the male's total fast is about 120 days, longer than the two-month incubation.

SOURCES

1. Wikipedia: Emperor penguin: https://en.wikipedia.org/wiki/Emperor_penguin

Permalink: <https://detailenjoyer.com/case/emperor-penguins/> · Last updated Dec 11, 2023



DD-119 NATURE · 12 OF 31

POLAR

Polar bears (*Ursus maritimus*) are strong swimmers and are classed as marine mammals because they spend much of their lives on sea ice and in the sea. Their name means 'maritime bear'. They hunt mainly seals from the ice and can swim long distances between floes, paddling with their large front paws. As sea ice shrinks, some bears have been tracked making very long swims. The footage shows polar bears on ice and in water, with the presenter.

QUICK FACTS

DD-119-F01

Polar bears are classed as marine mammals.

DD-119-F02

Ursus maritimus means 'maritime bear'.

THE WRITE-UP

Marine mammals. Polar bears are classed as marine mammals.

Sea bear. *Ursus maritimus* means 'maritime bear'.

Seal hunters. They hunt mainly seals from the ice.

Front paws. They paddle with their large front paws.

Long swims. They can swim long distances between ice floes.

REEL VS. RECORD

- **Note:** None needed.

SOURCES

1. Wikipedia: Polar bear: https://en.wikipedia.org/wiki/Polar_bear

Permalink: <https://detailenjoyer.com/case/polar/> · Last updated Dec 13, 2023



DD-133 SPACE · 13 OF 31

MERCURY

Mercury, the closest planet to the Sun, has almost no atmosphere (only a thin exosphere) to trap heat. Its daytime surface reaches about 430 °C (800 °F), hot enough to melt lead, while nights fall to about -180 °C (-290 °F). That is the largest day-night swing of any planet. Its slow rotation also stretches each day: a solar day lasts about 176 Earth days. Despite the heat, radar and the MESSENGER spacecraft found water ice in permanently shadowed craters near the poles. The footage shows images of Mercury and the Sun, with the presenter.

QUICK FACTS

DD-133-F01

Mercury has only a thin exosphere.

DD-133-F02

Days reach about 430 °C.

THE WRITE-UP

No atmosphere. Mercury has only a thin exosphere.

430 °C days. Days reach about 430 °C.

-180 °C nights. Nights fall to about -180 °C.

Long solar day. A solar day lasts about 176 Earth days.

Polar ice. Shadowed polar craters hold water ice.

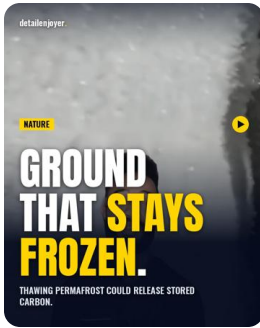
REEL VS. RECORD

- **Note:** 'Temperatures plummet to approximately 290 degrees Fahrenheit': it should be -290 °F; the caption drops the minus sign but the voiceover says 'negative'.

SOURCES

1. Wikipedia: Mercury (planet): https://en.wikipedia.org/wiki/Mercury_%28planet%29

Permalink: <https://detailenjoyer.com/case/mercury/> · Last updated Dec 21, 2023



EARTH'S HARSHHEST BIOME

Tundra is a treeless biome where cold temperatures and short growing seasons limit plant growth. Arctic tundra rings the far north, and alpine tundra occurs on high mountains; small areas of Antarctic tundra exist too. Below the surface lies permafrost, ground that stays frozen for at least two years in a row. Mosses, lichens, sedges and dwarf shrubs grow there, and animals include caribou, Arctic foxes and many migratory birds that breed in summer. Permafrost holds large amounts of organic carbon, and warming that thaws it can release carbon dioxide and methane. The footage shows tundra landscapes behind the presenter.

QUICK FACTS

DD-212-F01

Tundra is a treeless biome.

DD-212-F02

There's Arctic and alpine tundra.

THE WRITE-UP

Treeless. Tundra is a treeless biome.

Arctic and alpine. There's Arctic and alpine tundra.

Permafrost. Permafrost stays frozen for two years or more.

Life. Mosses, lichens, caribou and foxes live there.

Carbon. Thawing permafrost can release carbon.

REEL VS. RECORD

- **Note:** None needed. The caption says 'hearty vegetation'; the usual word is hardy.

SOURCES

1. Wikipedia: Tundra: <https://en.wikipedia.org/wiki/Tundra>
2. Wikipedia: Permafrost: <https://en.wikipedia.org/wiki/Permafrost>

Permalink: <https://detailenjoyer.com/case/earths-harshest-biome/> · Last updated Mar 25, 2024



THE FINGERS OF DEATH

A brinicle is a hollow tube of ice that grows downward from sea ice in polar waters. As seawater freezes, salt is expelled as very cold, dense brine, which sinks and freezes the less salty seawater around it, forming a tube. If it reaches the seabed, ice can spread across the bottom and trap slow-moving animals such as sea stars and sea urchins. A BBC crew filmed one forming in Antarctica in 2011 for the series Frozen Planet. The footage shows a brinicle growing and spreading, with the presenter.

QUICK FACTS

DD-264-F01

A brinicle is a hollow ice tube.

DD-264-F02

Cold dense brine sinks from sea ice.

THE WRITE-UP

Ice tube. A brinicle is a hollow ice tube.

Brine. Cold dense brine sinks from sea ice.

Freezing. It freezes surrounding seawater.

Seabed. It can trap animals on the seabed.

Filmed 2011. The BBC filmed one in 2011.

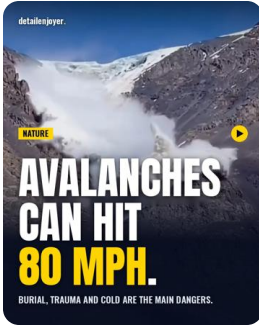
REEL VS. RECORD

- **Note:** None needed.

SOURCES

1. Wikipedia: Brinicle: <https://en.wikipedia.org/wiki/Brinicle>

Permalink: <https://detailenjoyer.com/case/the-fingers-of-death/> · Last updated Jul 5, 2024



WHAT ARE YOU WAITING FOR?

An avalanche is a mass of snow sliding rapidly down a slope. It can be triggered by heavy snowfall, temperature changes or people. The Reel says avalanches can reach 80 miles per hour; typical slab avalanches do, and large powder avalanches can be faster. An avalanche can bury people, destroy buildings and flatten forests. For people caught in one, the main dangers are burial, traumatic injury and hypothermia. The footage shows a large avalanche filmed from a rocky slope.

QUICK FACTS

DD-273-F01

An avalanche is a rapid flow of snow down a slope.

DD-273-F02

Snowfall, warming and people trigger them.

THE WRITE-UP

Definition. An avalanche is a rapid flow of snow down a slope.

Triggers. Snowfall, warming and people trigger them.

Speed. They can reach 80 mph or more.

Damage. They can flatten forests.

Dangers. Burial, trauma and hypothermia.

REEL VS. RECORD

- **Note:** The Reel gives 80 mph as a top speed; large powder avalanches can be faster.

SOURCES

1. Wikipedia: Avalanche: <https://en.wikipedia.org/wiki/Avalanche>

Permalink: <https://detailenjoyer.com/case/what-are-you-waiting-for/> · Last updated Jul 18, 2024



DD-316 NATURE / LOCATIONS · 17 OF 31

GLACIAL WATERFALLS

Glacial waterfalls form where meltwater from a glacier flows over a cliff or the ice edge. In warm seasons, faster melting makes the falls bigger. Meltwater carries fine ground rock, called rock flour, which gives it a milky look. The footage shows a meltwater river cutting across an ice sheet and pouring over an ice cliff.

QUICK FACTS

DD-316-F01

Melting ice feeds the falls.

DD-316-F02

Falls grow in warm seasons.

THE WRITE-UP

Meltwater. Melting ice feeds the falls.

Seasonal. Falls grow in warm seasons.

Rock flour. Rock flour makes water milky.

Ice cliffs. Water pours over ice edges.

Sediment. Meltwater carries sediment.

REEL VS. RECORD

- **Note:** None needed.

SOURCES

1. Wikipedia: Meltwater: <https://en.wikipedia.org/wiki/Meltwater>
2. Wikipedia: Rock flour: https://en.wikipedia.org/wiki/Rock_flour

Permalink: <https://detailenjoyer.com/case/glacial-waterfalls/> · Last updated Sep 2, 2024



DD-318 TECH / LOCATIONS · 18 OF 31

TO BREAK THE ICE

Icebreakers are ships built to clear paths through sea ice. Their sloped, reinforced bows let them ride up onto the ice so the ship's weight breaks it, and strengthened hulls protect them from damage. They keep polar shipping routes and research expeditions moving. The footage shows a red-hulled icebreaker pushing through pack ice.

QUICK FACTS

DD-318-F01

Icebreakers clear paths through ice.

DD-318-F02

Sloped bows ride up onto ice.

THE WRITE-UP

Purpose. Icebreakers clear paths through ice.

Bow. Sloped bows ride up onto ice.

Weight. The ship's weight breaks the ice.

Hull. Hulls are strengthened.

Polar. They support polar routes.

REEL VS. RECORD

- **Note:** The Reel calls the bow features 'icebreaker bulbs' or 'ice horns'; I could not confirm those terms. Icebreakers mainly rely on a sloped, reinforced bow.

SOURCES

1. Wikipedia: Icebreaker: <https://en.wikipedia.org/wiki/Icebreaker>

Permalink: <https://detailenjayer.com/case/to-break-the-ice/> · Last updated Sep 6, 2024



DD-326 SCIENCE / NATURE · 19 OF 31

PRESERVE YOUR BUBBLES

When a soap bubble is blown in air well below freezing, the thin water film begins to freeze. Ice crystals form and spread across the surface in branching patterns, swirled by currents in the film, until the bubble becomes a fragile frozen shell. Very low temperatures help the whole bubble freeze before it pops. The footage shows bubbles freezing outdoors on a snowy day.

QUICK FACTS

DD-326-F01

A bubble is a thin water film.

DD-326-F02

The film freezes in deep cold.

THE WRITE-UP

Film. A bubble is a thin water film.

Freezing. The film freezes in deep cold.

Crystals. Ice crystals spread across it.

Shell. It becomes a frozen shell.

Cold. Lower temperatures help.

REEL VS. RECORD

- **Note:** None needed.

SOURCES

1. Wikipedia: Soap bubble: https://en.wikipedia.org/wiki/Soap_bubble
2. Wikipedia: Ice crystal: https://en.wikipedia.org/wiki/Ice_crystal

Permalink: <https://detailenjoyer.com/case/preserve-your-bubbles/> · Last updated Sep 20, 2024



ICECORE

Ice cores are long cylinders drilled from glaciers and ice sheets, some from depths of more than 3,000 meters. Snow builds up in yearly layers, and air bubbles trapped in the ice preserve samples of the past atmosphere, including greenhouse gases. Antarctic cores extend back about 800,000 years and record past climate and volcanic eruptions. The footage shows a view down a borehole in the ice.

QUICK FACTS

DD-398-F01

Cores are drilled from ice sheets.

DD-398-F02

Some exceed 3,000 m.

THE WRITE-UP

Drilling. Cores are drilled from ice sheets.

Depth. Some exceed 3,000 m.

Layers. Snow forms annual layers.

Bubbles. Bubbles hold ancient air.

Age. Records reach about 800,000 years.

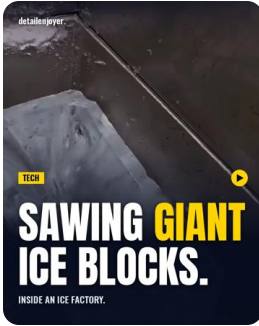
REEL VS. RECORD

- **Note:** None needed.

SOURCES

1. Wikipedia: Ice core: https://en.wikipedia.org/wiki/Ice_core

Permalink: <https://detailenjoyer.com/case/icecore/> · Last updated Nov 29, 2024



DD-382 TECH · 21 OF 31

NICE

Commercial ice plants freeze large blocks in molds, lift them out with cranes or conveyors, and cut them with industrial bandsaws or cutting machines into smaller blocks, cubes or crushed ice. Some blocks are shaped or carved to order. The ice is rinsed, packaged and kept in cold storage. The footage, credited to kuramoto_ice_global, shows blocks of ice being sawed.

QUICK FACTS

DD-382-F01

Ice freezes in molds.

DD-382-F02

Cranes lift blocks.

THE WRITE-UP

Molds. Ice freezes in molds.

Lifting. Cranes lift blocks.

Cutting. Bandsaws cut blocks.

Shapes. Cubes or crushed.

Storage. Cold storage.

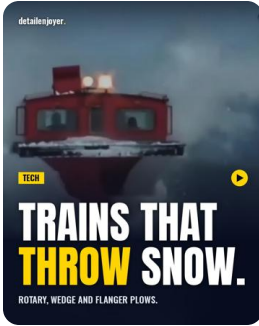
REEL VS. RECORD

- **Note:** None needed.

SOURCES

1. Wikipedia: Icemaker: <https://en.wikipedia.org/wiki/Icemaker>
2. Wikipedia: Ice: <https://en.wikipedia.org/wiki/Ice>

Permalink: <https://detailenjoyer.com/case/nice/> · Last updated Nov 20, 2024



DD-409 TECH · 22 OF 31

SNOWPLOWER

Railroads use several types of snow-clearing equipment. Wedge plows push snow to either side, rotary plows use a spinning bladed wheel to cut deep drifts and hurl snow away, and flangers clear snow and ice from the flangeways beside and between the rails. They keep lines open in heavy-snow regions. The footage shows a rotary plow throwing a plume of snow.

QUICK FACTS

DD-409-F01

Pushes snow aside.

DD-409-F02

Spinning blades throw snow.

THE WRITE-UP

Wedge. Pushes snow aside.

Rotary. Spinning blades throw snow.

Flanger. Clears between rails.

Regions. Heavy snowfall.

Purpose. Prevents blockages.

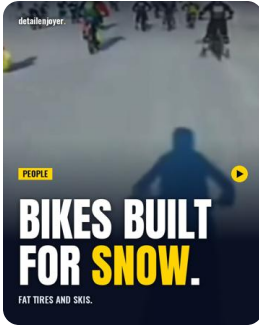
REEL VS. RECORD

- **Note:** None needed.

SOURCES

1. Wikipedia: Snowplow: <https://en.wikipedia.org/wiki/Snowplow>
2. Wikipedia: Rotary snowplow: https://en.wikipedia.org/wiki/Rotary_snowplow

Permalink: <https://detailenjoyer.com/case/snowplower/> · Last updated Dec 4, 2024



DD-419 PEOPLE · 23 OF 31

ADVANCED BICYCLE RIDING II

Snow biking covers riding bicycles on snow, mostly on fat bikes with tires about 4 to 5 inches wide run at low pressure for grip and flotation. Ski bikes or skibobs replace one or both wheels with skis and are ridden on slopes. Riders use groomed trails, backcountry routes and ski areas. The footage shows riders racing down a snowy slope.

QUICK FACTS

DD-419-F01

Very wide tires.

DD-419-F02

Low pressure for flotation.

THE WRITE-UP

Fat bikes. Very wide tires.

Pressure. Low pressure for flotation.

Ski bikes. Skis replace wheels.

Places. Trails and slopes.

Skills. Balance and strength.

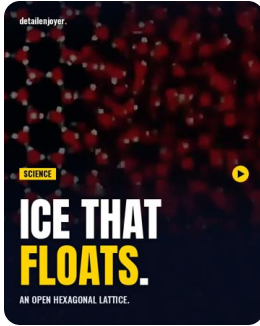
REEL VS. RECORD

- **Note:** None needed.

SOURCES

1. Wikipedia: Fat bike: https://en.wikipedia.org/wiki/Fat_bike
2. Wikipedia: Skibob: <https://en.wikipedia.org/wiki/Skibob>

Permalink: <https://detailenjoyer.com/case/advanced-bicycle-riding-ii/> · Last updated Dec 11, 2024



DD-444 SCIENCE · 24 OF 31

FREEZING

When water cools below 0 °C (32 °F), its molecules lock into a hexagonal crystal lattice held by hydrogen bonds, each molecule bonded to four neighbors. The lattice is more open than liquid water, so ice is about 9 percent less dense and floats, and water expands as it freezes. The footage shows an animation of water molecules forming ice.

QUICK FACTS

DD-444-F01

Hexagonal.

DD-444-F02

Hydrogen bonds.

THE WRITE-UP

Lattice. Hexagonal.

Bonds. Hydrogen bonds.

Neighbors. Four per molecule.

Density. About 9% less dense.

Expansion. Water expands on freezing.

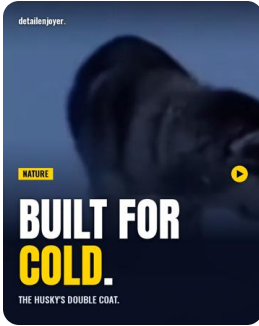
REEL VS. RECORD

- **Note:** None needed.

SOURCES

1. Wikipedia: Ice: <https://en.wikipedia.org/wiki/Ice>

Permalink: <https://detailenjoyer.com/case/freezing/> · Last updated Dec 31, 2024



DD-458 NATURE · 25 OF 31

JUST A CHILL DOG

Siberian Huskies cope with cold thanks to a thick double coat: water- and snow-repelling guard hairs over a dense, insulating undercoat. Furred paws with tough pads resist freezing and grip ice, and a countercurrent heat exchange in the limbs warms blood returning from the extremities, according to the Reel. The footage, credited to hackingtheuniverse, shows a husky resting in snow.

QUICK FACTS

DD-458-F01

Double coat.

DD-458-F02

Repel water and snow.

THE WRITE-UP

Coat. Double coat.

Guard hairs. Repel water and snow.

Undercoat. Traps warm air.

Paws. Furred, with pads.

Circulation. Countercurrent exchange, per the Reel.

REEL VS. RECORD

- **Note:** None needed.

SOURCES

1. Wikipedia: Siberian Husky: https://en.wikipedia.org/wiki/Siberian_Husky

Permalink: <https://detailenjoyer.com/case/just-a-chill-dog/> · Last updated Jan 13, 2025



DD-467 NATURE · 26 OF 31

IMMUNE TO COLD

Siberian Huskies tolerate cold through a double coat of water-repelling guard hairs and an insulating undercoat, furred paws with tough pads, and a countercurrent heat exchange that warms blood returning from the limbs, according to the Reel. The footage shows huskies in deep snow.

QUICK FACTS

DD-467-F01

Double coat.

DD-467-F02

Repel water and snow.

THE WRITE-UP

Coat. Double coat.

Guard hairs. Repel water and snow.

Undercoat. Traps warm air.

Paws. Furred, with pads.

Circulation. Countercurrent exchange, per the Reel.

REEL VS. RECORD

- **Note:** None needed.

SOURCES

1. Wikipedia: Siberian Husky: https://en.wikipedia.org/wiki/Siberian_Husky

Permalink: <https://detailenjoyer.com/case/immune-to-cold/> · Last updated Jan 24, 2025



DD-468 SCIENCE · 27 OF 31

HOW WATER FREEZES

As water cools below 0 °C (32 °F), hydrogen bonds lock each molecule to four neighbors in a hexagonal lattice. The open, spacious structure makes ice less dense than liquid water, so it floats, and causes water to expand as it freezes. The footage shows an animation of molecules linking into a honeycomb lattice.

QUICK FACTS

DD-468-F01

Hexagonal.

DD-468-F02

Hydrogen bonds.

THE WRITE-UP

Lattice. Hexagonal.

Bonds. Hydrogen bonds.

Neighbors. Four.

Density. Less than liquid.

Expansion. On freezing.

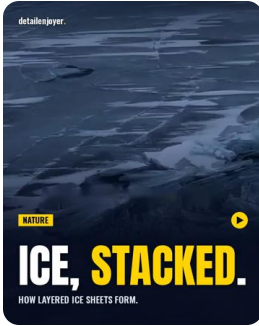
REEL VS. RECORD

- **Note:** None needed.

SOURCES

1. Wikipedia: Ice: <https://en.wikipedia.org/wiki/Ice>

Permalink: <https://detailenjoyer.com/case/how-water-freezes/> · Last updated Jan 24, 2025



DD-470 NATURE · 28 OF 31

LAYER BY LAYER

On frozen lakes, ice thickens in layers as cold spells come and go; temperature swings, wind and pressure crack and stack the sheets into ridges and shards. The Reel's captions describe ice sheets formed from layers of ice in cold temperatures, varying with the intensity of temperature fluctuations. The footage, credited to all.litvinova, shows layered, broken ice on a frozen lake.

QUICK FACTS

DD-470-F01

Layers of ice.

DD-470-F02

Cold temperatures.

THE WRITE-UP

Formation. Layers of ice.

Driver. Cold temperatures.

Variation. Temperature swings.

Cracks. Pressure and wind.

Setting. Frozen lake.

REEL VS. RECORD

- **Note:** None needed.

SOURCES

1. Wikipedia: Ice: <https://en.wikipedia.org/wiki/Ice>
2. Wikipedia: Lake Baikal: https://en.wikipedia.org/wiki/Lake_Baikal

Permalink: <https://detailenjoyer.com/case/layer-by-layer/> · Last updated Jan 26, 2025



DD-491 NATURE · 29 OF 31

FROZEN GATORS

When temperatures drop, American alligators (*Alligator mississippiensis*) enter brumation, a reptile dormancy in which metabolism slows sharply. In freezing water they may keep their nostrils above the surface as ice forms, letting them breathe while the rest of the body stays submerged and almost motionless. The footage, credited to AmazingNature, shows an alligator lying in icy water.

QUICK FACTS

DD-491-F01

Brumation.

DD-491-F02

Slows.

THE WRITE-UP

State. Brumation.

Metabolism. Slows.

Breathing. Snout above ice.

Body. Submerged.

Movement. Almost none.

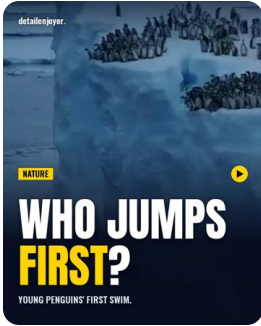
REEL VS. RECORD

- **Note:** None needed.

SOURCES

1. Wikipedia: American alligator: https://en.wikipedia.org/wiki/American_alligator
2. Wikipedia: Brumation: <https://en.wikipedia.org/wiki/Brumation>

Permalink: <https://detailenjoyer.com/case/frozen-gators/> · Last updated Feb 18, 2025



DD-497 NATURE · 30 OF 31

THE PLUNGE

When young penguins first go to sea, they gather at the water's edge and hesitate, partly because predators such as leopard seals and orcas may be waiting. Once one jumps, others quickly follow, and safety in numbers lowers each bird's risk, the Reel says, citing emperor penguins as an example. The footage, credited to natgeomagarab, shows a crowd of penguins at the edge of the ice.

QUICK FACTS

DD-497-F01

First plunge.

DD-497-F02

Hesitation.

THE WRITE-UP

Moment. First plunge.

Behavior. Hesitation.

Predators. Leopard seals, orcas.

Group. Follow the first.

Benefit. Safety in numbers.

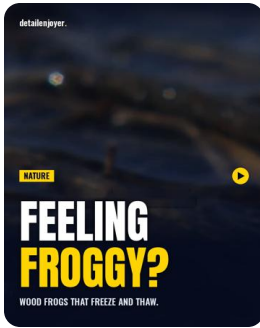
REEL VS. RECORD

- **Note:** None needed.

SOURCES

1. Wikipedia: Emperor penguin: https://en.wikipedia.org/wiki/Emperor_penguin

Permalink: <https://detailenjoyer.com/case/the-plunge/> · Last updated Feb 24, 2025



DD-758 NATURE / SCIENCE · 31 OF 31

FEELING FROGGY?

The wood frog (*Lithobates sylvaticus*), found across North America from the American Midwest and southern Canada to Interior Alaska, can survive with about 65-70% of its body water frozen. While frozen it shows no heartbeat, breathing or circulation. It builds up urea before winter and floods its tissues with glucose from the liver when ice starts to form; both act as cryoprotectants that limit ice formation and cell shrinkage. When temperatures rise in spring, the frog thaws, its heart starts beating again, and normal functions resume. The footage, credited to Nat Geo Animals, shows wood frogs in water and a close-up of a frog's eye.

QUICK FACTS

DD-758-F01

Lithobates sylvaticus.

DD-758-F02

North America, to Interior Alaska.

THE WRITE-UP

Species. *Lithobates sylvaticus*.

Range. North America, to Interior Alaska.

Frozen water. Up to about 65-70%.

Vital signs. None while frozen.

Protectants. Glucose and urea.

REEL VS. RECORD

- **Note:** The Reel calls glucose and urea 'cytoprotectants'; the standard term is cryoprotectants. I kept the Reel's wording in the transcript.

SOURCES

1. Wikipedia: Wood frog: https://en.wikipedia.org/wiki/Wood_frog

Permalink: <https://detailenjoyer.com/case/feeling-froggy/> · Last updated Oct 25, 2026

COLLECTION QUIZ

Test Your Knowledge: 62 questions from Extreme Cold. Answers are on the next page.

1. Freeze-branding irons are chilled in liquid nitrogen. How cold is it? (DD-006 · CryoBranding)

- A. -18 °C
- B. -60 °C
- C. -196 °C
- D. -273 °C

2. Why does freeze-branded hair grow back white? (DD-006 · CryoBranding)

- A. The cold destroys pigment cells but spares the growth follicle
- B. The iron leaves white dye in the skin
- C. The cold bleaches the hair shaft
- D. The follicle dies and is replaced by scar hair

3. What is the gold 'chandelier' seen in photos of quantum computers? (DD-012 · Quantum Infrastructure)

- A. A dilution refrigerator
- B. A cooling fan array
- C. The quantum processor itself
- D. A power supply

4. Where in the fridge does the quantum chip sit? (DD-012 · Quantum Infrastructure)

- A. At the top, at room temperature
- B. In the middle
- C. At the bottom, on the coldest plate
- D. Outside the fridge

5. How many stories tall is Begich Towers, home to most of Whittier, Alaska? (DD-008 · One Roof Town)

- A. 4
- B. 14
- C. 40
- D. 104

6. What was Begich Towers originally built as? (DD-008 · One Roof Town)

- A. A luxury hotel
- B. A hospital
- C. Cold War Army barracks
- D. A prison

7. Which river supplies the ice for Harbin's festival? (DD-034 · Winter in Harbin)

- A. Yangtze
- B. Yellow River
- C. Songhua River
- D. Amur

8. When did the modern Harbin Ice and Snow Festival begin? (DD-034 · Winter in Harbin)

- A. 1963
- B. 1985
- C. 1999
- D. 2008

9. About how many bodies are thought to remain on Everest? (DD-063 · Foreverest)

- A. About 20
- B. More than 200
- C. More than 2,000
- D. None

10. Above what altitude does the 'death zone' begin? (DD-063 · Foreverest)

- A. 5,000 m
- B. 6,500 m
- C. About 8,000 m
- D. 8,849 m

11. Which glacier is Blood Falls on? (DD-725 · The Glacier That Bleeds)

- A. Thwaites
- B. Taylor
- C. Beardmore
- D. Lambert

12. What was the red color first blamed on? (DD-725 · The Glacier That Bleeds)

- A. Volcanic ash
- B. Red algae
- C. Blood from seals
- D. Paint

13. How many nuclear reactors does Ural have? (DD-579 · Uranium Ural)

- A. Two
- B. One
- C. Four
- D. Six

14. How many propellers does Ural have? (DD-579 · Uranium Ural)

- A. Three
- B. One
- C. Two
- D. Four

15. About how cold is the Boomerang Nebula? (DD-752 · Cosmic Freezer)

- A. 1 K
- B. 2.7 K
- C. 10 K
- D. 77 K

16. What keeps empty space at about 2.7 K? (DD-752 · Cosmic Freezer)

- A. Starlight from the Milky Way
- B. The Big Bang's afterglow
- C. Cosmic rays
- D. Dark matter

17. What do snow crystals form on? (DD-288 · No Perfect Crystallizations)

- A. A tiny particle like dust or pollen
- B. A raindrop's surface
- C. Lightning
- D. Nothing at all

18. How do snow crystals grow? (DD-288 · No Perfect Crystallizations)

- A. Water vapor deposits onto the ice
- B. Raindrops stick together
- C. They melt and refreeze
- D. Wind sculpts them

19. How does glacier ice form? (DD-299 · Iceberg Blue)

- A. Snow is buried and compressed
- B. Seawater freezes
- C. Rain freezes on contact
- D. Hail piles up

20. Which light does ice absorb more? (DD-299 · Iceberg Blue)

- A. Red
- B. Blue
- C. Green only
- D. None

21. When do emperor penguins breed? (DD-115 · Emperor Penguins)

- A. In the Antarctic winter
- B. In summer only
- C. Never on ice
- D. In spring rain

22. Who incubates the egg? (DD-115 · Emperor Penguins)

- A. The male
- B. The female
- C. Both in turns
- D. Neither

23. How are polar bears classified? (DD-119 · Polar)

- A. Marine mammals
- B. Fish
- C. Reptiles
- D. Amphibians

24. What does *Ursus maritimus* mean? (DD-119 · Polar)

- A. Maritime bear
- B. Snow cat
- C. Ice wolf
- D. White giant

25. Why can't Mercury hold heat? (DD-133 · Mercury)

- A. It has almost no atmosphere
- B. It's too far out
- C. It has oceans
- D. It's cloudy

26. How hot do days get? (DD-133 · Mercury)

- A. About 430 °C
- B. About 43 °C
- C. About 4,300 °C
- D. 0 °C

27. What defines tundra? (DD-212 · Earth's Harshesht Biome)

- A. Treeless, cold land
- B. Rainforest
- C. Desert dunes
- D. Coral reef

28. Where is alpine tundra? (DD-212 · Earth's Harshest Biome)

- A. On high mountains
- B. In oceans
- C. In caves
- D. At the equator's coast

29. What is a brinicle? (DD-264 · The Fingers of Death)

- A. A hollow ice tube
- B. A fish
- C. An iceberg
- D. A volcano

30. What sinks to form it? (DD-264 · The Fingers of Death)

- A. Cold dense brine
- B. Fresh water
- C. Warm water
- D. Sand

31. What is an avalanche? (DD-273 · What Are You Waiting For?)

- A. Snow sliding rapidly downhill
- B. A rockfall only
- C. A flood
- D. A storm

32. What can trigger one? (DD-273 · What Are You Waiting For?)

- A. Heavy snowfall
- B. Sunlight only
- C. Birds
- D. Nothing

33. What feeds a glacial waterfall? (DD-316 · Glacial Waterfalls)

- A. Meltwater
- B. Rain only
- C. Seawater
- D. Groundwater only

34. When are they biggest? (DD-316 · Glacial Waterfalls)

- A. In warm seasons
- B. In midwinter
- C. At night only
- D. Never

35. How do icebreakers break ice? (DD-318 · To Break the Ice)

- A. Riding up and using their weight
- B. Lasers
- C. Explosives
- D. Heating the sea

36. What protects the hull? (DD-318 · To Break the Ice)

- A. Reinforcement
- B. Paint only
- C. Rubber
- D. Nothing

37. What is a bubble's skin? (DD-326 · Preserve Your Bubbles)

- A. A thin soapy water film
- B. Plastic
- C. Glass
- D. Ice from the start

38. What forms on it in the cold? (DD-326 · Preserve Your Bubbles)

- A. Ice crystals
- B. Salt
- C. Sand
- D. Mold

39. What do bubbles preserve? (DD-398 · ICECORE)

- A. Ancient air
- B. Water
- C. Fish
- D. Dust only

40. How far back do Antarctic cores go? (DD-398 · ICECORE)

- A. About 800,000 years
- B. 100 years
- C. 10 million years
- D. 1,000 years

41. What cuts the blocks? (DD-382 · nICE)

- A. Bandsaws
- B. Knives only
- C. Lasers only
- D. Fire

42. Where is ice frozen? (DD-382 · nICE)

- A. In molds
- B. In rivers
- C. Outdoors
- D. In bags

43. Which plow throws snow far? (DD-409 · Snowplower)

- A. Rotary
- B. Wedge
- C. Flanger
- D. Shovel

44. What does a wedge plow do? (DD-409 · Snowplower)

- A. Pushes snow aside
- B. Melts it
- C. Packs it
- D. Lifts rails

45. What bikes are used on snow? (DD-419 · Advanced Bicycle Riding II)

- A. Fat bikes
- B. Road bikes
- C. BMX only
- D. Unicycles

46. Why low tire pressure? (DD-419 · Advanced Bicycle Riding II)

- A. Flotation and grip
- B. Speed
- C. Looks
- D. Noise

47. What shape is the ice lattice? (DD-444 · FREEZING)

- A. Hexagonal
- B. Cubic only
- C. Round
- D. Random

48. What bonds hold it? (DD-444 · FREEZING)

- A. Hydrogen bonds
- B. Ionic bonds
- C. Metal bonds
- D. Glue

49. What coat type? (DD-458 · Just a Chill Dog)

- A. Double
- B. Single
- C. None
- D. Wool

50. What does the undercoat trap? (DD-458 · Just a Chill Dog)

- A. Warm air
- B. Water
- C. Snow
- D. Dirt

51. Coat type? (DD-467 · Immune to Cold)

- A. Double
- B. Single
- C. None
- D. Wool

52. Undercoat traps? (DD-467 · Immune to Cold)

- A. Warm air
- B. Water
- C. Snow
- D. Dirt

53. Lattice shape? (DD-468 · How Water Freezes)

- A. Hexagonal
- B. Square
- C. Round
- D. Random

54. Which bonds? (DD-468 · How Water Freezes)

- A. Hydrogen
- B. Ionic
- C. Metallic
- D. Nuclear

55. What builds the sheets? (DD-470 · Layer by Layer)

- A. Layers of ice
- B. Sand
- C. Snow only
- D. Salt

56. What drives variation? (DD-470 · Layer by Layer)

- A. Temperature swings
- B. Moonlight
- C. Fish
- D. Boats

57. Dormancy term? (DD-491 · Frozen Gators)

- A. Brumation
- B. Hibernation only
- C. Molting
- D. Estivation

58. How do they breathe? (DD-491 · Frozen Gators)

- A. Snout above ice
- B. Gills
- C. Skin
- D. They don't

59. Why hesitate? (DD-497 · The Plunge)

- A. Predators
- B. Cold air
- C. Hunger
- D. Noise

60. A predator? (DD-497 · The Plunge)

- A. Leopard seal
- B. Polar bear
- C. Shark only
- D. Eagle

61. How much body water can freeze? (DD-758 · Feeling Froggy?)

- A. About 65%
- B. 5%
- C. 100%
- D. 20%

62. Heart while frozen? (DD-758 · Feeling Froggy?)

- A. Stops
- B. Speeds up
- C. Unchanged
- D. Doubles

ANSWER KEY

1. **C. -196 °C** Now You Know: Liquid nitrogen is -196 °C (-320 °F). (DD-006)
2. **A. The cold destroys pigment cells but spares the growth follicle** Now You Know: The cold destroys the pigment cells (melanocytes) but spares the follicle, so the hair grows back colorless. (DD-006)
3. **A. A dilution refrigerator** Now You Know: It's a multi-stage dilution refrigerator, and each plate down is colder. (DD-012)
4. **C. At the bottom, on the coldest plate** Now You Know: The processor is mounted on the mixing-chamber plate, the coldest stage, at the bottom. (DD-012)
5. **B. 14** Now You Know: Begich Towers is a 14-story tower housing most of Whittier's ~300 year-round residents. (DD-008)
6. **C. Cold War Army barracks** Now You Know: The U.S. Army built it as Cold War barracks. Locals moved in after the military left. (DD-008)
7. **C. Songhua River** Now You Know: Crews cut blocks two to three feet thick from the frozen Songhua every December. (DD-034)
8. **B. 1985** Now You Know: It opened on January 5, 1985. The 1963 event was an ice-lantern show. (DD-034)
9. **B. More than 200** Now You Know: More than 300 people have died in the region over a century. (DD-063)
10. **C. About 8,000 m** Now You Know: The air there holds about a third of sea-level oxygen. (DD-063)
11. **B. Taylor** Now You Know: It's in the McMurdo Dry Valleys, ending at Lake Bonney. (DD-725)
12. **B. Red algae** Now You Know: Griffith Taylor found the falls in 1911. (DD-725)
13. **A. Two** Now You Know: Two RITM-200 reactors. (DD-579)
14. **A. Three** Now You Know: Each is driven by a 20 MW electric motor. (DD-579)
15. **A. 1 K** Now You Know: About 1 Kelvin, or -272 °C / -458 °F, one degree above absolute zero. (DD-752)
16. **B. The Big Bang's afterglow** Now You Know: The Big Bang's afterglow keeps space at about 2.7 K, and the Boomerang is colder than that. (DD-752)
17. **A. A tiny particle like dust or pollen** Now You Know: It's called nucleation. (DD-288)
18. **A. Water vapor deposits onto the ice** Now You Know: The vapor skips the liquid stage. (DD-288)
19. **A. Snow is buried and compressed** Now You Know: Air bubbles are squeezed out. (DD-299)
20. **A. Red** Now You Know: The difference is small but adds up. (DD-299)
21. **A. In the Antarctic winter** Now You Know: In extreme cold. (DD-115)
22. **A. The male** Now You Know: Only emperors do this. (DD-115)
23. **A. Marine mammals** Now You Know: They live on sea ice. (DD-119)
24. **A. Maritime bear** Now You Know: Sea bear. (DD-119)
25. **A. It has almost no atmosphere** Now You Know: Only a thin exosphere. (DD-133)

26. **A. About 430 °C** Now You Know: Hot enough to melt lead. *(DD-133)*
27. **A. Treeless, cold land** Now You Know: Short growing seasons. *(DD-212)*
28. **A. On high mountains** Now You Know: Also Arctic tundra. *(DD-212)*
29. **A. A hollow ice tube** Now You Know: Under sea ice. *(DD-264)*
30. **A. Cold dense brine** Now You Know: Expelled salt. *(DD-264)*
31. **A. Snow sliding rapidly downhill** Now You Know: A mass of snow. *(DD-273)*
32. **A. Heavy snowfall** Now You Know: Also people. *(DD-273)*
33. **A. Meltwater** Now You Know: Melting ice. *(DD-316)*
34. **A. In warm seasons** Now You Know: More melting. *(DD-316)*
35. **A. Riding up and using their weight** Now You Know: Sloped bows. *(DD-318)*
36. **A. Reinforcement** Now You Know: Thick steel. *(DD-318)*
37. **A. A thin soapy water film** Now You Know: Very thin. *(DD-326)*
38. **A. Ice crystals** Now You Know: Branching. *(DD-326)*
39. **A. Ancient air** Now You Know: Atmosphere. *(DD-398)*
40. **A. About 800,000 years** Now You Know: Long record. *(DD-398)*
41. **A. Bandsaws** Now You Know: Industrial. *(DD-382)*
42. **A. In molds** Now You Know: Blocks. *(DD-382)*
43. **A. Rotary** Now You Know: Spinning. *(DD-409)*
44. **A. Pushes snow aside** Now You Know: Sides. *(DD-409)*
45. **A. Fat bikes** Now You Know: Wide tires. *(DD-419)*
46. **A. Flotation and grip** Now You Know: Snow. *(DD-419)*
47. **A. Hexagonal** Now You Know: Six-sided. *(DD-444)*
48. **A. Hydrogen bonds** Now You Know: Water. *(DD-444)*
49. **A. Double** Now You Know: Two layers. *(DD-458)*
50. **A. Warm air** Now You Know: Insulation. *(DD-458)*
51. **A. Double** Now You Know: Layers. *(DD-467)*
52. **A. Warm air** Now You Know: Insulation. *(DD-467)*
53. **A. Hexagonal** Now You Know: Six sides. *(DD-468)*
54. **A. Hydrogen** Now You Know: Water. *(DD-468)*
55. **A. Layers of ice** Now You Know: Stacking. *(DD-470)*
56. **A. Temperature swings** Now You Know: Weather. *(DD-470)*
57. **A. Brumation** Now You Know: Reptiles. *(DD-491)*

58. **A. Snout above ice** Now You Know: Nostrils. *(DD-491)*

59. **A. Predators** Now You Know: Risk. *(DD-497)*

60. **A. Leopard seal** Now You Know: Antarctic. *(DD-497)*

61. **A. About 65%** Now You Know: Up to 65-70%. *(DD-758)*

62. **A. Stops** Now You Know: No heartbeat. *(DD-758)*

NOW YOU KNOW!