**Nucleation**, the initial process that occurs in the [formation of a crystal](https://www.britannica.com/science/crystallization) from a solution, a [liquid](https://www.britannica.com/science/liquid-state-of-matter), or a vapour, in which a small number of ions, atoms, or molecules become arranged in a pattern characteristic of a crystalline solid, forming a site upon which additional particles are deposited as the crystal grows.

Nucleation processes are classed as [heterogeneous](https://www.britannica.com/science/heterogeneous-nucleation) or [homogeneous](https://www.britannica.com/science/homogeneous-nucleation). In the former, the surface of some different substance, such as a dust particle or the wall of the container, acts as the centre upon which the first atoms, ions, or molecules of the crystal become properly oriented; in the latter, a few particles come into correct [juxtaposition](https://www.merriam-webster.com/dictionary/juxtaposition) in the course of their random movement through the bulk of the medium. [Heterogeneous](https://www.merriam-webster.com/dictionary/Heterogeneous) nucleation is more common, but the [homogeneous](https://www.merriam-webster.com/dictionary/homogeneous) mechanism becomes more likely as the degree of supersaturation or supercooling increases. Substances differ widely in the likelihood that they will crystallize under conditions in which the crystalline state is the inherently stable one; [glycerol](https://www.britannica.com/science/glycerol) is a well-known example of a [compound](https://www.merriam-webster.com/dictionary/compound) prone to supercooling.

[**Nucleation**](https://www.britannica.com/science/nucleation)**of ice crystals**

Before ice can form, water must supercool and ice crystals nucleate. [Homogeneous nucleation](https://www.britannica.com/science/homogeneous-nucleation) (without the influence of foreign particles) occurs well below the freezing point, at temperatures that are not observed in water bodies. The temperature of [heterogeneous nucleation](https://www.britannica.com/science/heterogeneous-nucleation) (nucleation beginning at the surface of foreign particles) depends on the nature of the particles, but it is generally several degrees below the freezing point. Again, supercooling of this magnitude is not observed in most naturally occurring waters, although some researchers argue that a thin surface layer of water may achieve such supercooling under high rates of heat loss. Nucleation beginning on an ice particle, however, can take place upon only slight supercooling, and it is generally believed that ice particles originating from above the water surface are responsible for the initial onset of ice on the surface of a lake. Once ice is present, further formation is governed by the rate at which the crystal can grow. This can be very fast: on a cold, still night, when lake water has been cooled to its freezing point and then slightly supercooled on the surface, it is possible to see ice crystals [propagating](https://www.merriam-webster.com/dictionary/propagating) rapidly across the surface. Typically, this form of initial ice formation is such that the crystal *c*-axes are vertically oriented—in contrast to the usual horizontal orientation of the *c*-axis associated with later thickening. Under ideal conditions these first crystals may have dimensions of one metre or more. An ice cover composed of such crystals will appear black and very transparent.