

The scenario

Subject (field/title)	Thermal properties of matter / Freezing of liquid nitrogen (under reduced pressure)
Length of movie	3:43
Main Goals	Changes in the state of matter
Detailed Goals	Changes in phase transition temperature due to changes in pressure
Structure and description of the experiments	
1. Introduction	Explanation: This video shows the existence of liquid nitrogen in three states of matter simultaneously.
2. Main topic	Description: Changes in phase transition temperature due to pressure change.
Part 1	<p>Tools: Beaker, liquid nitrogen, vacuum bell, vacuum pump, manometer, sponge (heat insulator).</p> <p>Description: When we pour liquid nitrogen into a beaker, we see condensed water vapour. Nitrogen boils in a beaker, which looks like boiling water. Nitrogen at atmospheric pressure boils at -195.8°C. The beaker is closed under a vacuum bell, and the pressure is reduced. After a while, the nitrogen stops boiling and a layer of solidified nitrogen forms on its surface. By lowering the pressure further, between the solid and liquid nitrogen, gaseous nitrogen appears. When its pressure is high enough, the solidified nitrogen layer is lifted, and gaseous nitrogen is released.</p> <p>The moment when a substance exists in three states of aggregation at the same temperature and pressure (three phases are in thermodynamic equilibrium) we call the triple point.</p> <p>Questions: Can other substances exist in three states of aggregation simultaneously?</p> <p>Conclusions: We can change the state of aggregation of a substance without changing its temperature because the state of aggregation of a given substance also depends on the pressure in which it is located.</p>
3. Summary and notes	<p>Point out to students that boiling, melting or evaporation takes place at a given temperature. However, it can change depending on the pressure around it.</p> <p>Level: secondary school</p>