

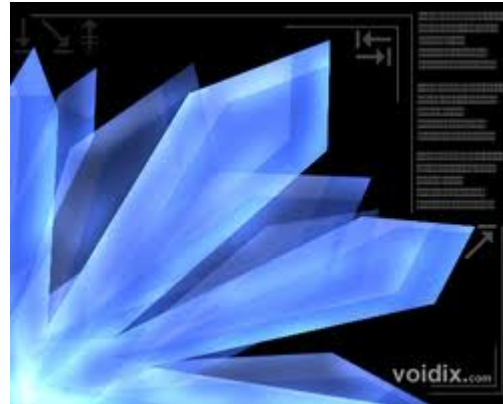
Dr. Nandini Devi
NCL



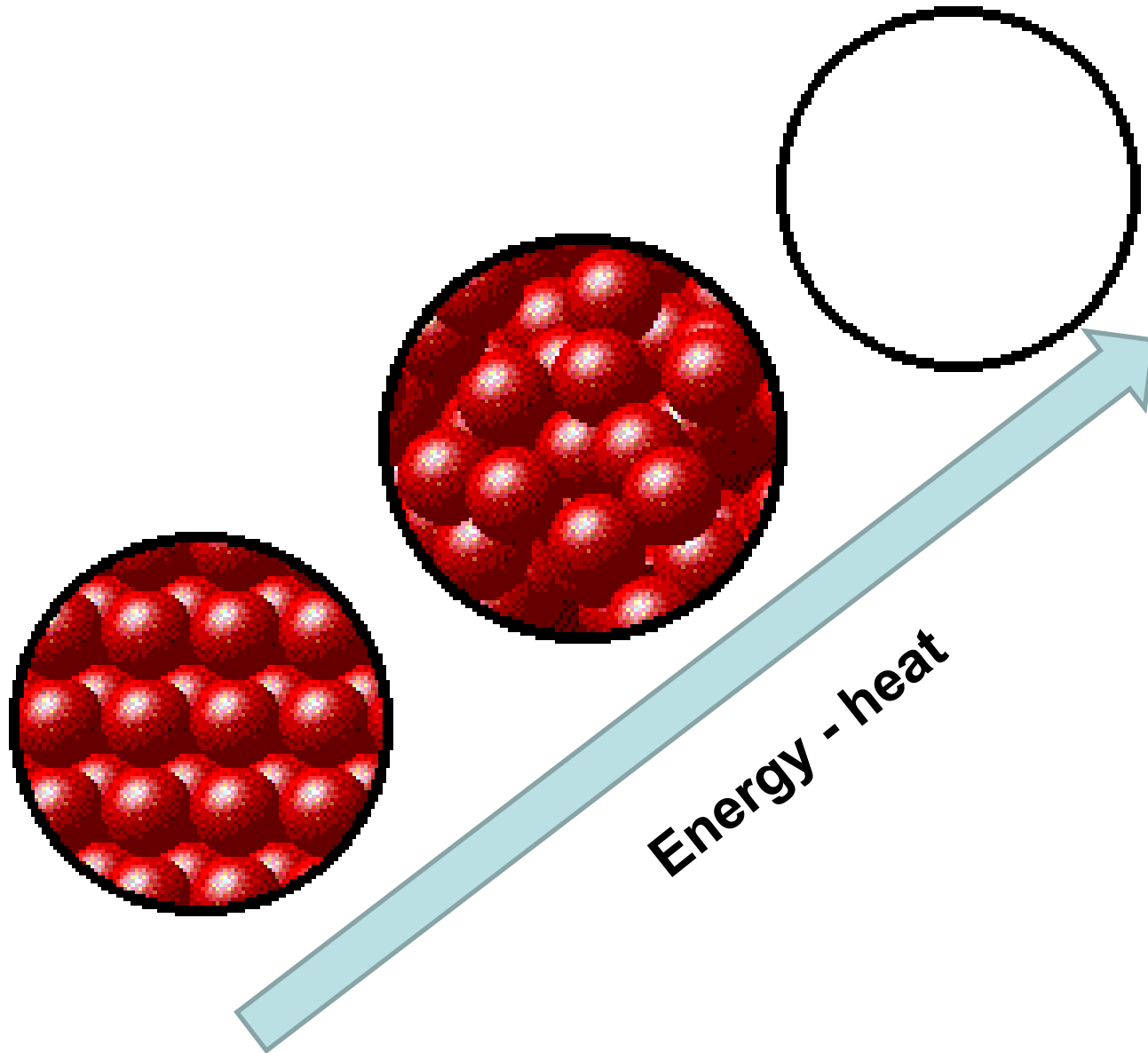
Anu Aga
and family



States of Matter & Crystal Growing



How are the molecules arranged in solids, liquids and gases?



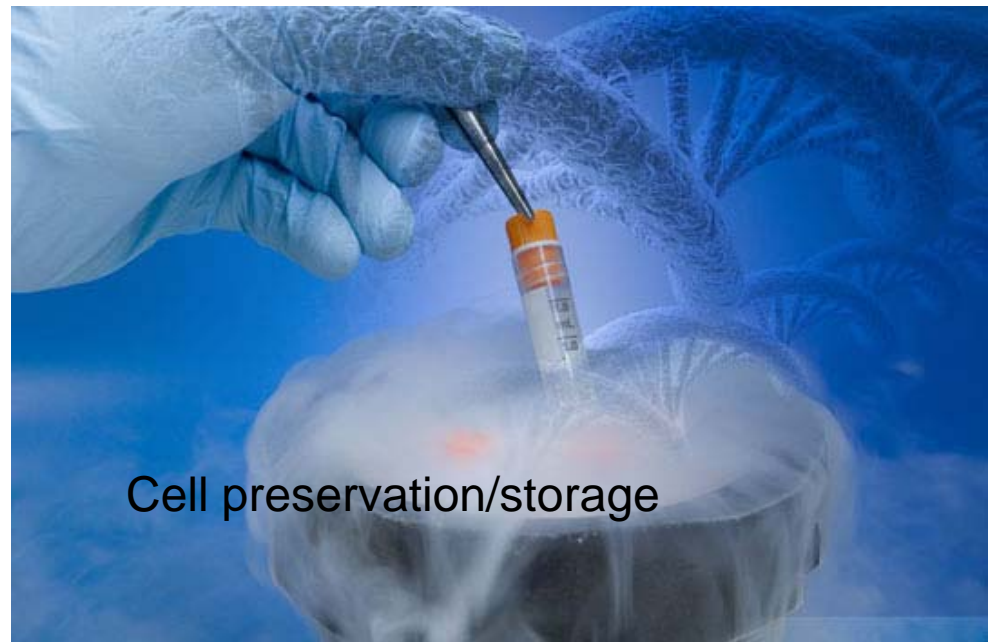
What are the components of air? Oxygen, Nitrogen, Argon, Carbon dioxide etc.

Nitrogen – N₂

How is liquid N₂ made?

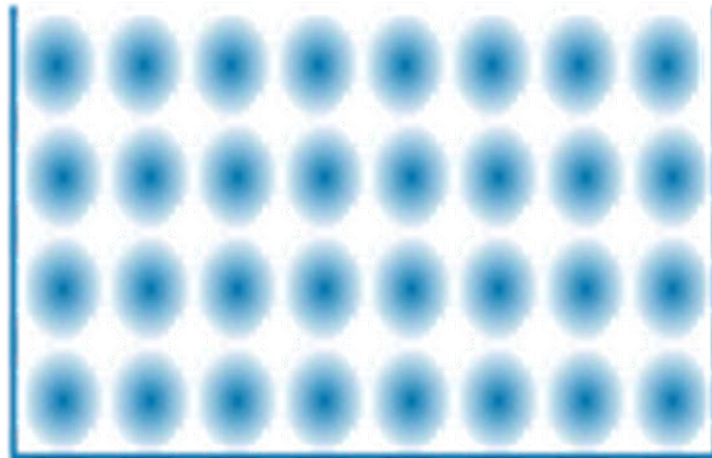
If the temperature is brought down to -196 °C!

Such processes are called **cryogenics**



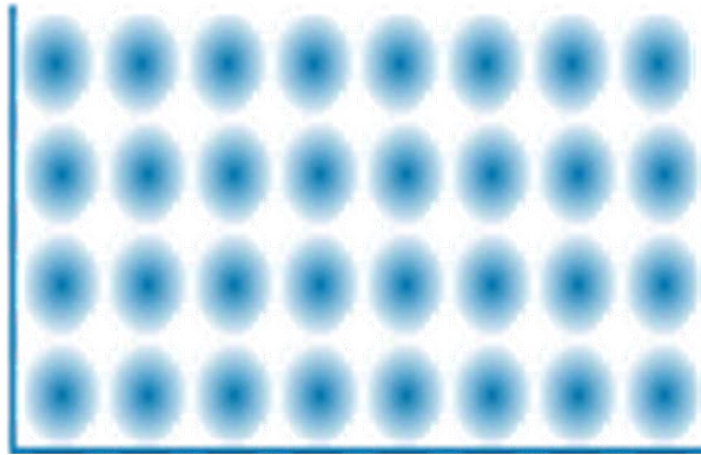
Vapourisation:

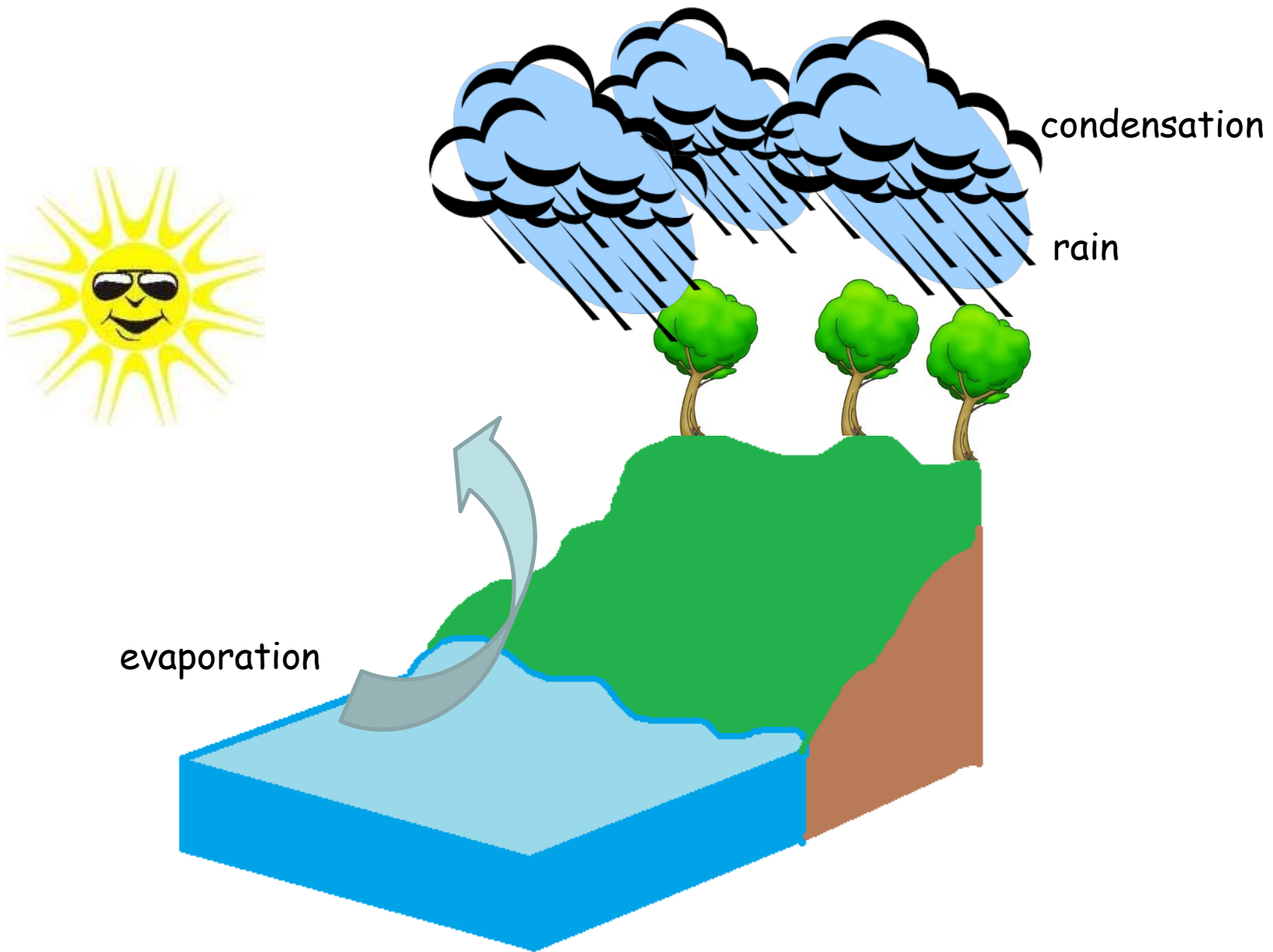
when the liquid becomes gas at its boiling point



Evaporation:

when the liquid becomes gas below its boiling point





Carbon dioxide – CO₂

How is solid CO₂ made? If the temperature is brought down to -78.5 °C!

Sublimation : when solid becomes gas directly

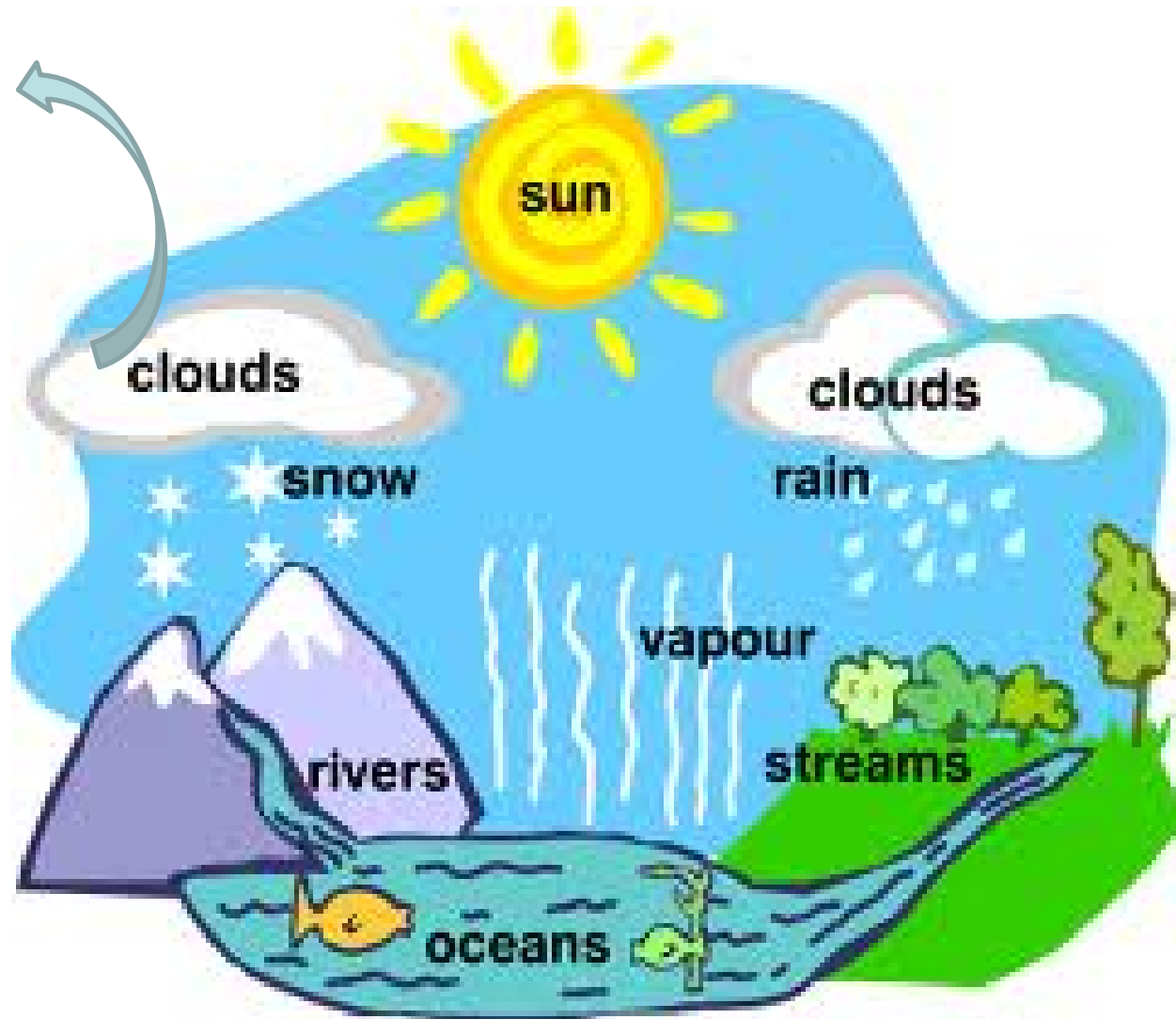


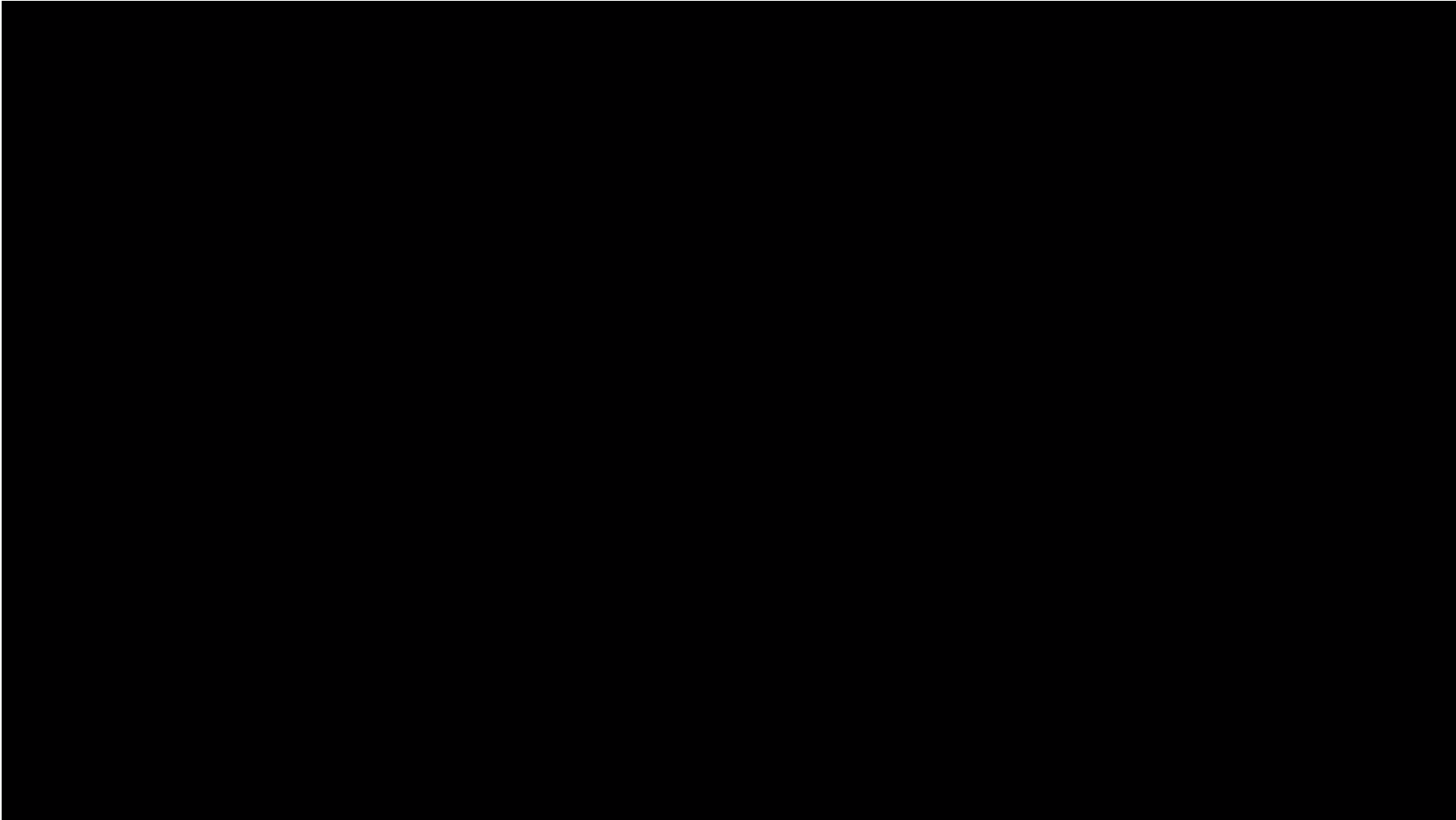
Frozen food transport



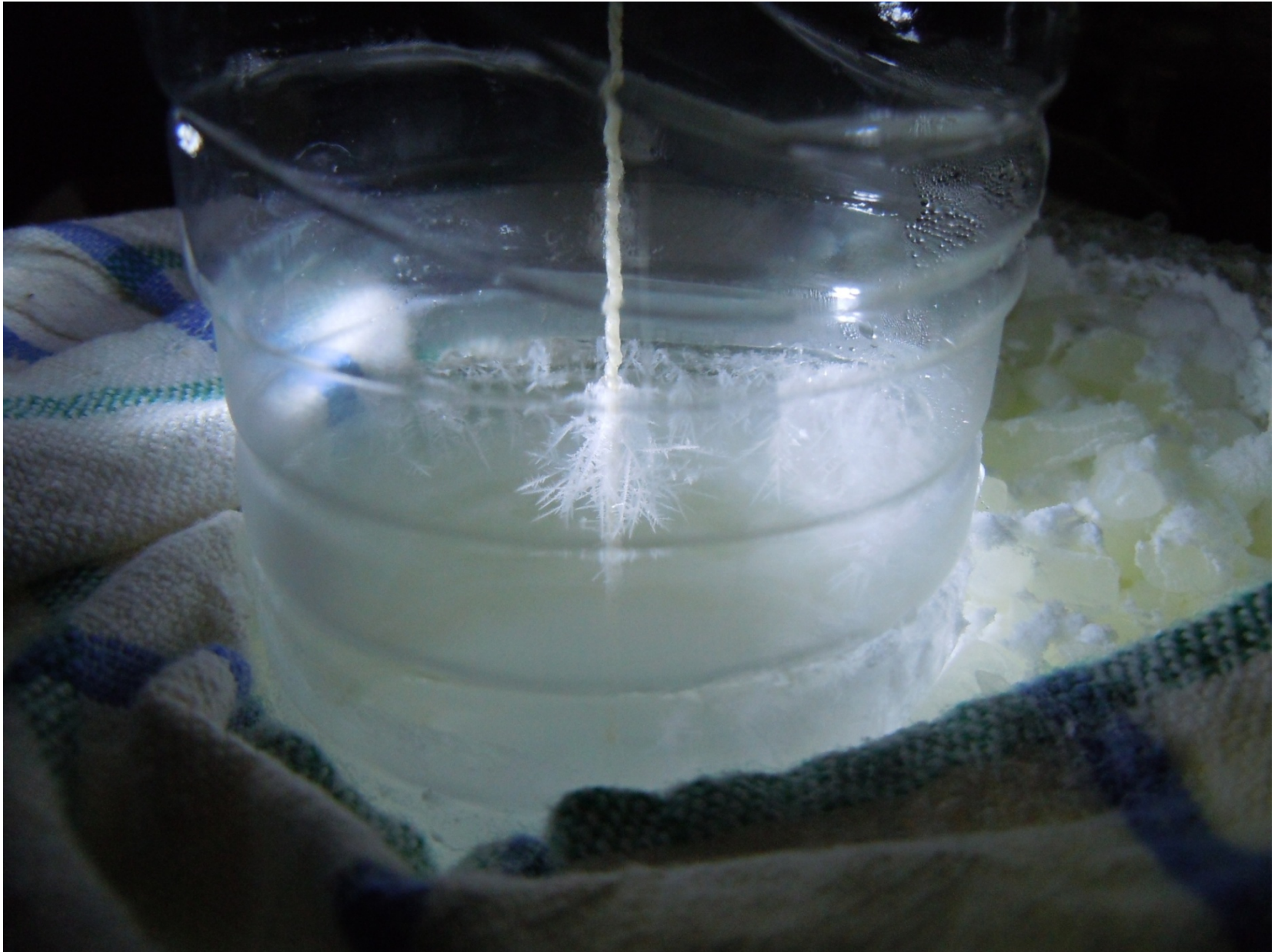
Organ transport

When the temperature is below freezing point of water, small crystals of ice form



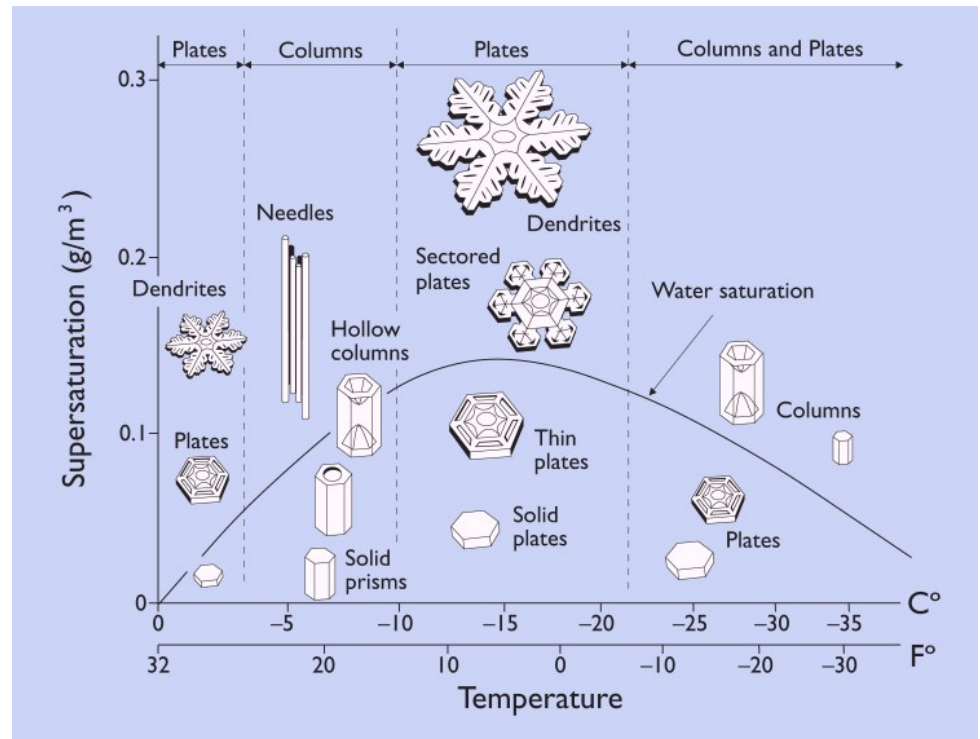
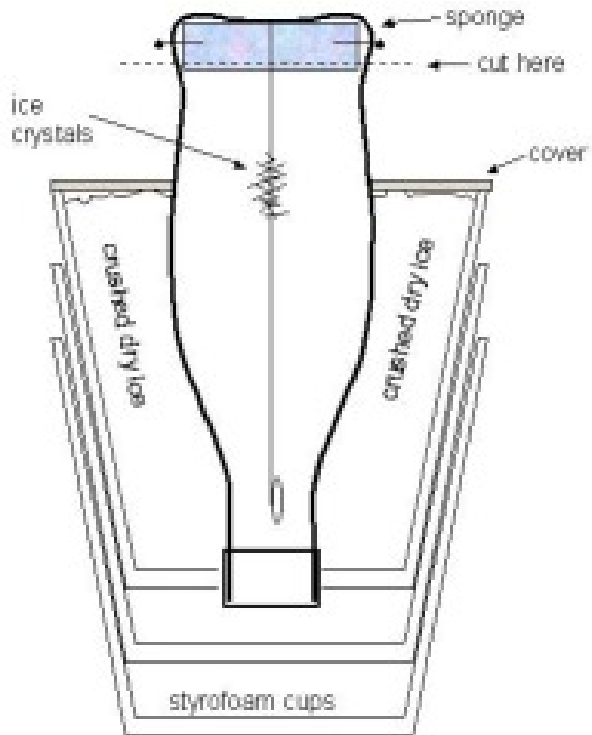


Let us make snow!!!





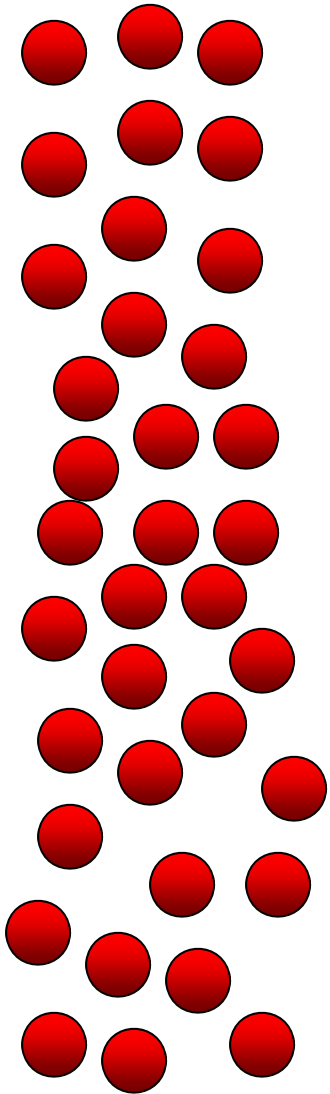
Dendritic snow crystals formed inside the bottle



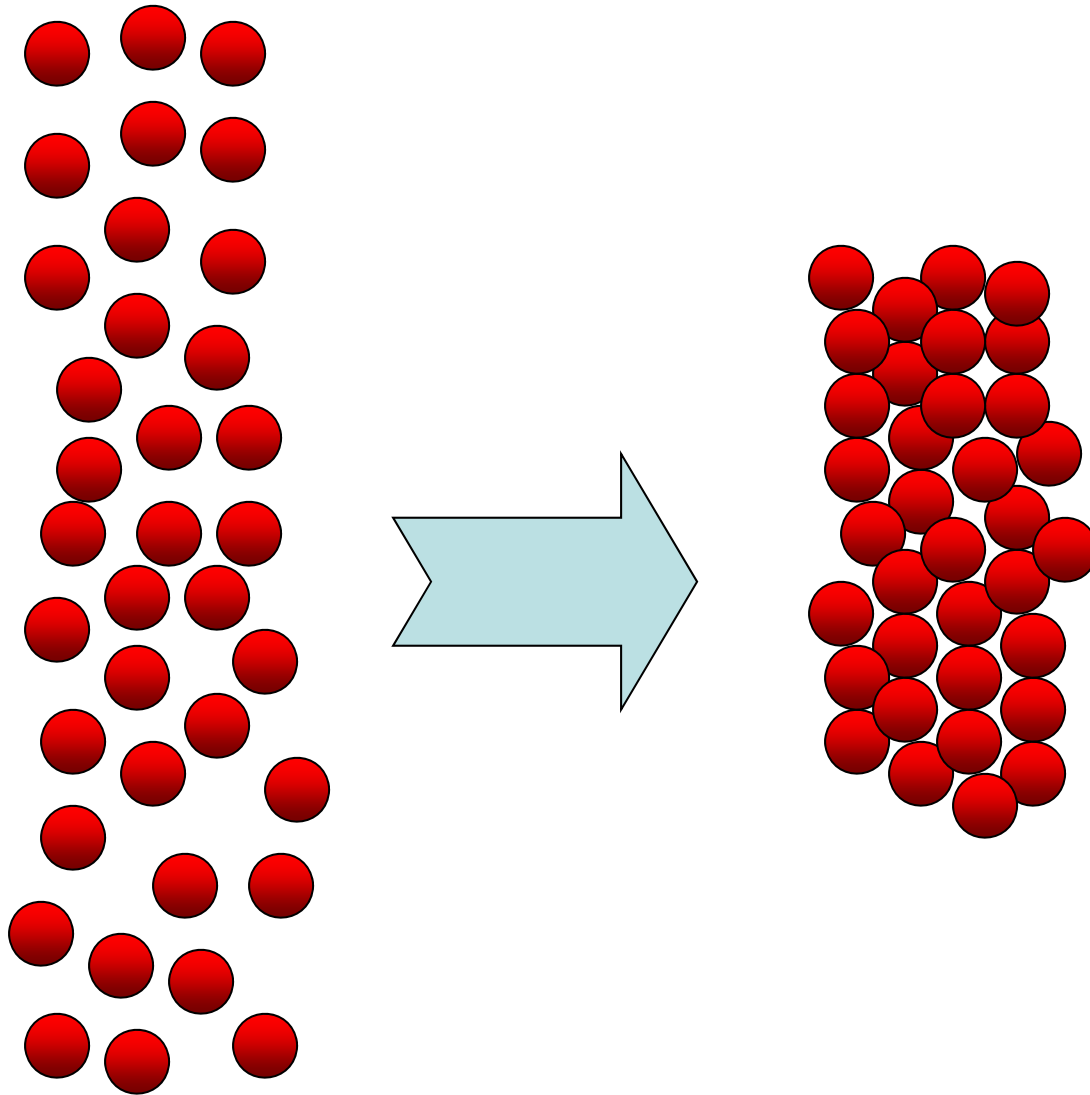
Natural snow crystal shapes - 6 sided hexagons



Water vapour forming snow – very ordered - crystalline



Solid but but no order - amorphous



Solids - crystalline and amorphous



quartz



sand

Both are chemically more or less same based on silica **SiO₂**

Solids - crystalline and amorphous



charcoal

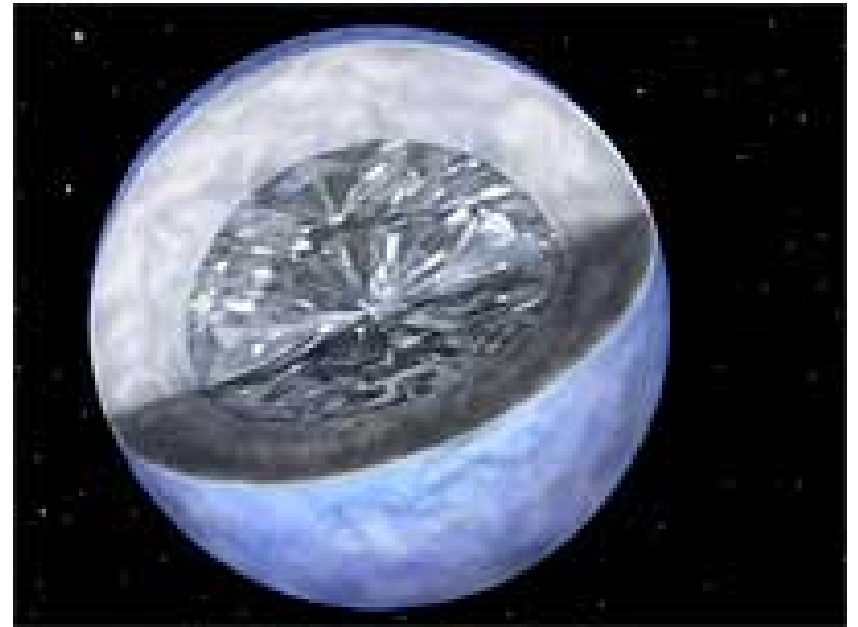


diamond

Both are chemically same based on carbon **C**



World's biggest diamond – golden jubilee diamond in Thailand mined From South Africa



Universe's biggest diamond – star Lucy
In constellation Centaurus, 50 light years from Earth!!!

Crystals!!!! Nature has made beautiful crystals

emerald



Fool's gold -pyrite



topaz



beryl



How did these beautiful crystals form in nature?

Geode – a natural pressure cooker!



Earth cooled from molten state

Took millions of years!!





Very very big crystals of gypsum (magnesium sulphate) in a cave in Mexico

Let's make some cool crystals - much faster than nature!!

Crystallisation from supersaturated solutions

Epsom salt, sodium carbonate, alum

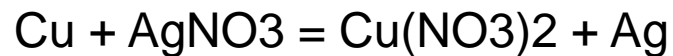


Alum

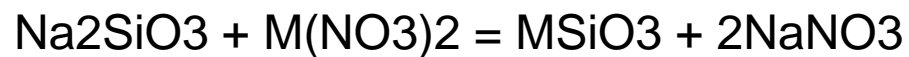
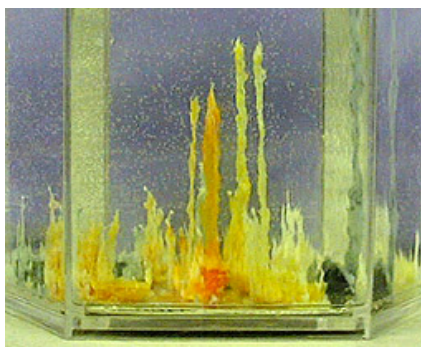
Aluminum sulphate

Crystallisation by reactions

Silver



Rock garden in a bowl!



Crystallisation from melt cooling
Thiosulphate



THANK YOU

