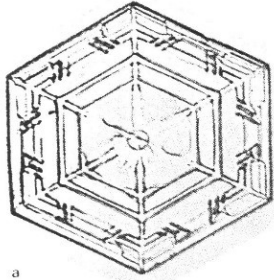
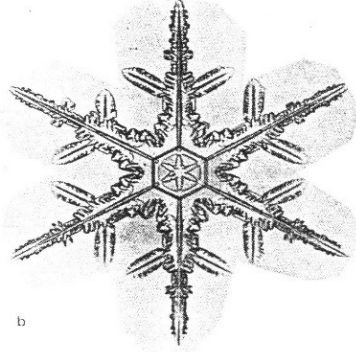


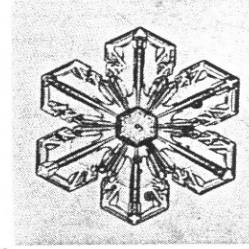
# Ice Crystal Growth



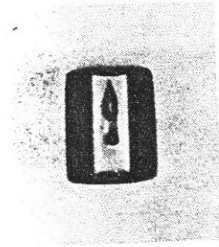
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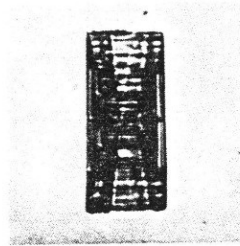
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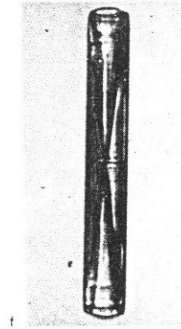
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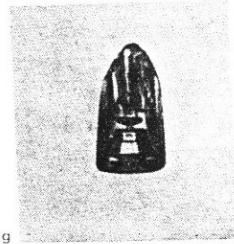
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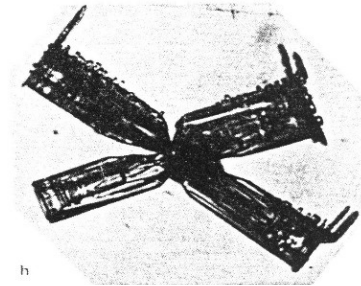
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f



















































































g



h

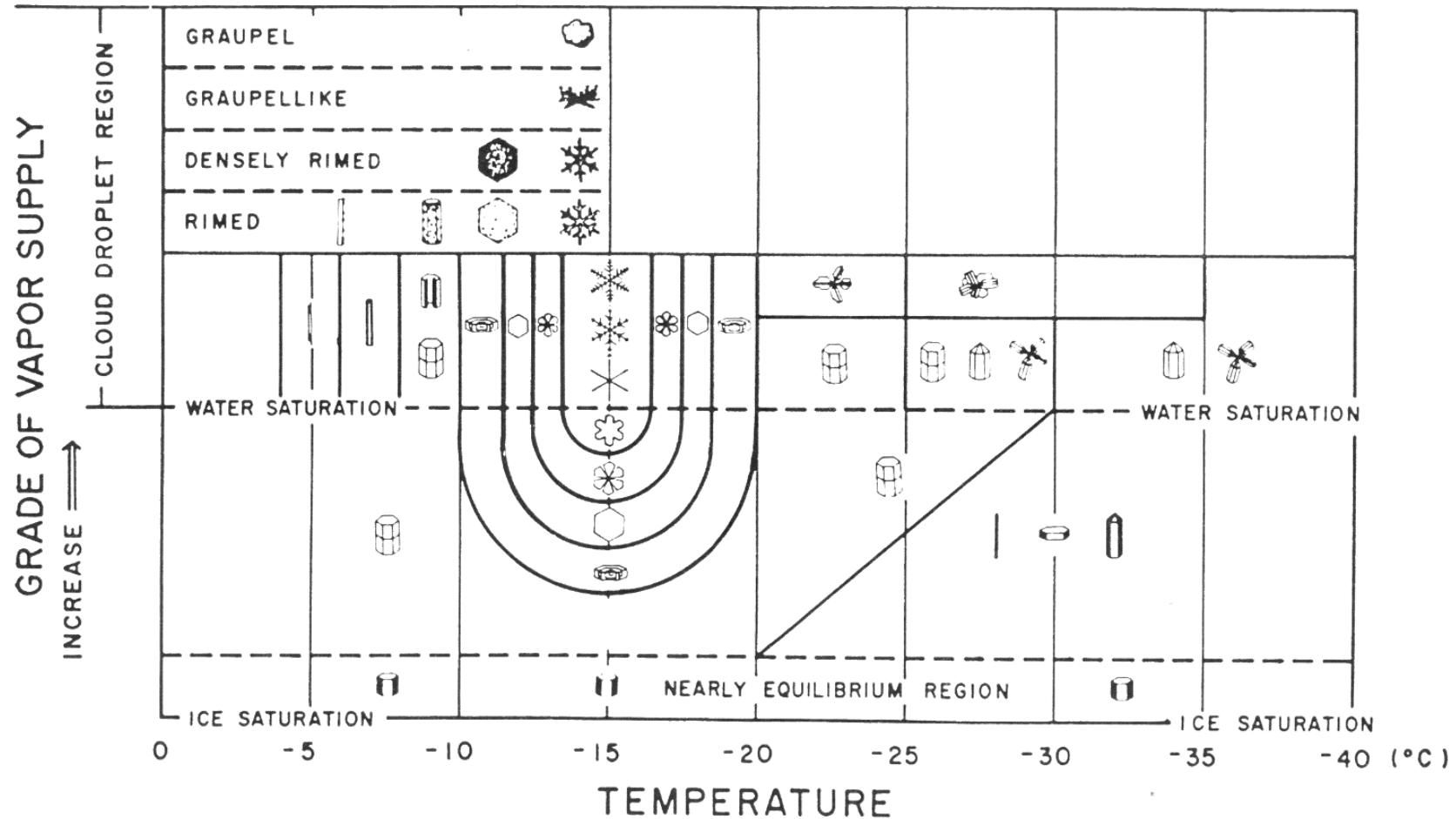
# Ice Crystal Classifications

	N1a Elementary needle		C1f Hollow column		P2b Stellar crystal with sectorlike ends
	N1b Bundle of elementary needles		C1g Solid thick plate		P2c Dendritic crystal with plates at ends
	N1c Elementary sheath		C1h Thick plate of skeleton form		P2d Dendritic crystal with sectorlike ends
	N1d Bundle of elementary sheaths		C1i Scroll		P2e Plate with simple extensions
	N1e Long solid column		C2a Combination of bullets		P2f Plate with sectorlike extensions
	N2a Combination of needles		C2b Combination of columns		P2g Plate with dendritic extensions
	N2b Combination of sheaths		P1a Hexagonal plate		P3a Two-branched crystal
	N2c Combination of long solid columns		P1b Crystal with sectorlike branches		P3b Three-branched crystal
	C1a Pyramid		P1c Crystal with broad branches		P3c Four-branched crystal
	C1b Cup		P1d Stellar crystal		P3a Broad branch crystal with 12 branches
	C1c Solid bullet		P1e Ordinary dendritic crystal		P3b Dendritic crystal with 12 branches
	C1d Hollow bullet		P1f Fernlike crystal		P3c Malformed crystal
	C1e Solid column		P2a Stellar crystal with plates at ends		P3a Plate with spatial plates

	P6b Plate with spatial dendrites		CP3d Plate with scrolls at ends		R3c Graupel-like snow with nonlined extensions
	P6c Stellar crystal with spatial plates		S1 Side planes		N4a Hexagonal graupel
	P6d Stellar crystal with spatial dendrites		S2 Scal-like side planes		N4b Lump graupel
	P7a Radiating assemblage of plates		S3 Combination of side planes, bullets and columns		N4c Conelike graupel
	P7b Radiating assemblage of dendrites		R1a Rimed needle crystal		I1 Ice particle
	CP1a Column with plates		R1b Rimed columnar crystal		I2 Rimed particle
	CP1b Column with dendrites		R1c Rimed plate or sector		I3a Broken branch
	CP1c Multiple capped column		R1d Rimed stellar crystal		I3b Rimed broken branch
	CP2a Bullet with plates		R2a Densely rimed plate or sector		I4 Miscellaneous
	CP2b Bullet with dendrites		R2b Densely rimed stellar crystal		G1 Minute column
	CP3a Stellar crystal with needles		R2c Stellar crystal with rimed spatial branches		G2 Germ of skeleton form
	CP3b Stellar crystal with columns		R3a Graupel-like snow of hexagonal type		G3 Minute hexagonal plate
	CP3c Stellar crystal with scrolls at ends		R3b Graupel-like snow of lump type		G4 Minute stellar crystal
					G5 Minute assemblage of plates
					G6 Irregular germ

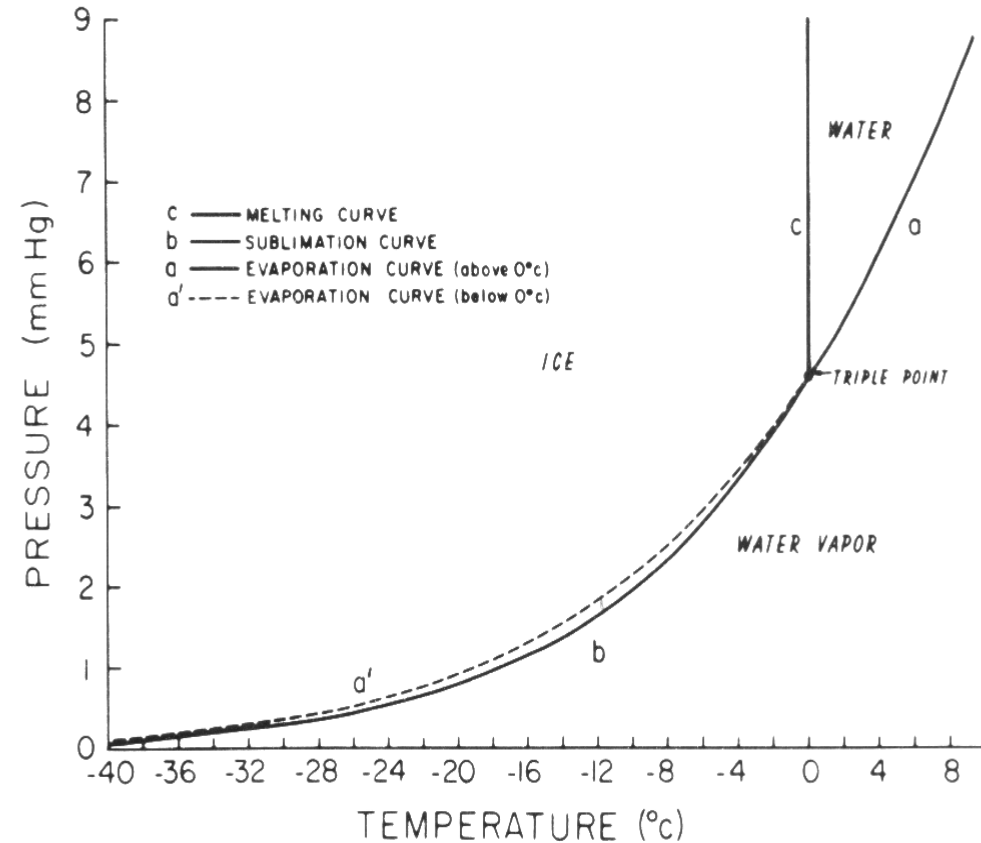
The Magono-Lee classification of natural snow crystals. (From Magono and Lee, 1966; by courtesy of J. Fac. Sci., Hokkaido University.)

# Crystal Habit Formation



# Clausius Clapeyron Equation

- Previous discussion related the vapor pressure in equilibrium with a pure, plane water (liquid) surface to temperature.
- If the water is frozen, however, the water molecules are held more securely to the surface and the amount of vapor in equilibrium with that surface is less.



# Difference Affects Growth Rates

High Vapor Pressure

Lower Vapor Pressure



Diffusion



# Mixed Cloud (Ice and Liquid)

- Ice crystals will grow rapidly.
- Water droplets will evaporate.
- Large fraction of the ice crystals falling as precipitation tend to be stellar types, even though they form in a very narrow region of the temperature/ humidity conditions possible in clouds.
- Also get a large number of plate types of crystals.