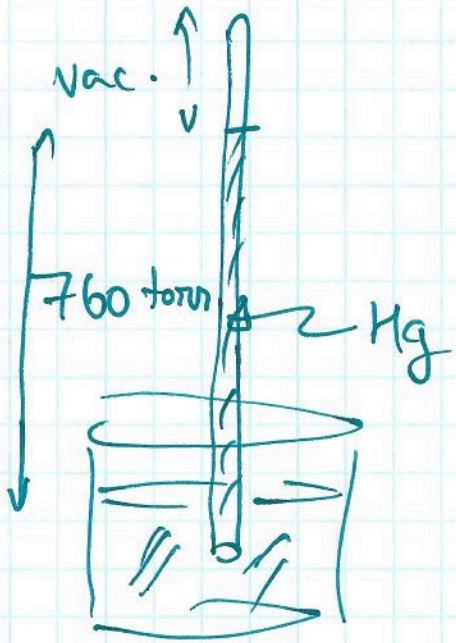
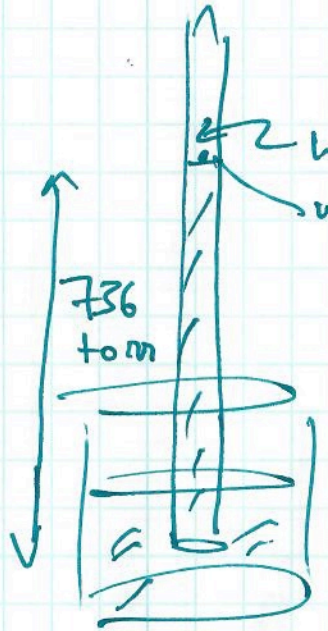
Class 8

Vapor pressure





Vapor pressure of water = (760 − 736) torr
= 24 torr at 25°C

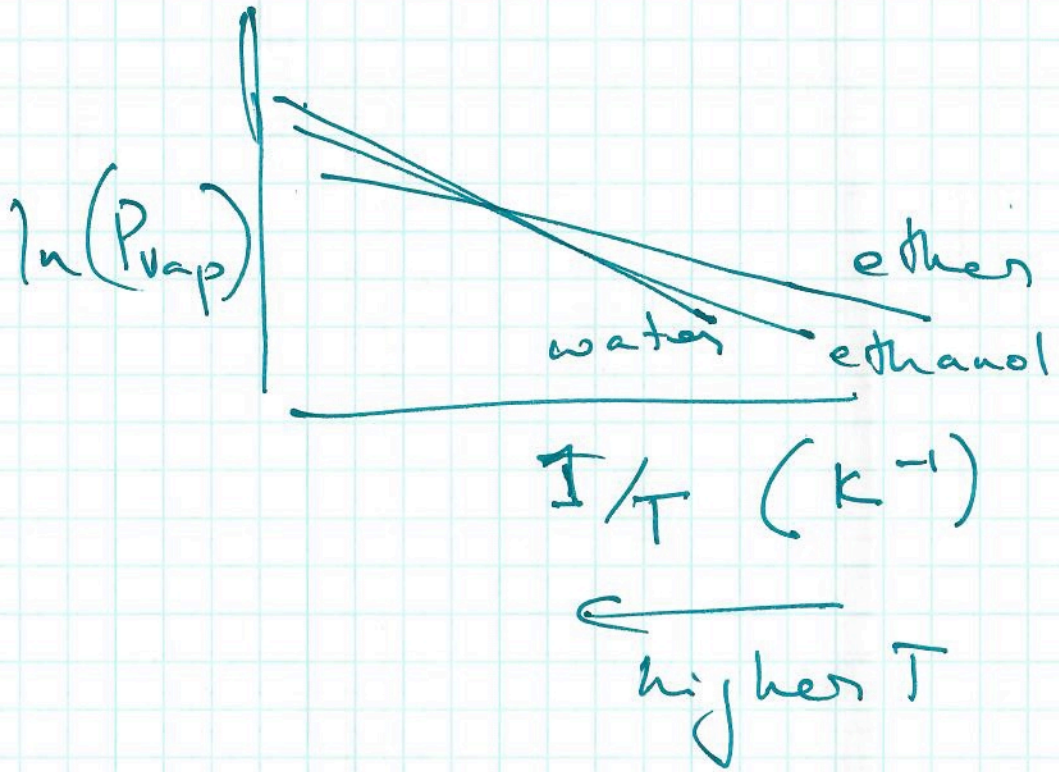
more volatile liquids (with lower boiling points) would result in an even greater vapor pressure

The vapor pressure increases with increasing temperature. When the vapor pressure reaches the external pressure (eg. 760 torr at the surface of the earth) then boiling takes place.

Liquids with lower boiling points have higher vapor pressure and are referred to as being volatile

The vapor pressure is related to the temperature through

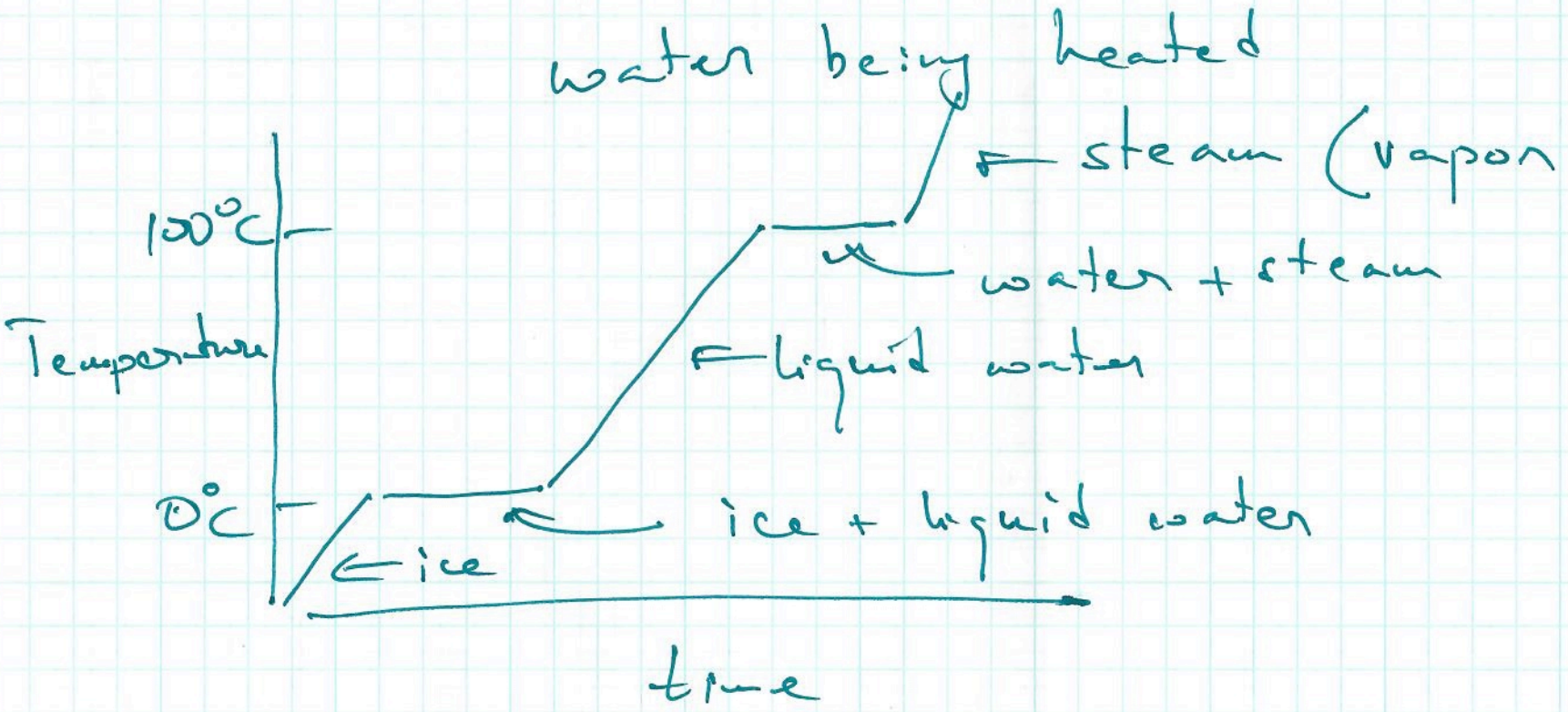
$$\ln(P_{vap}) = -\frac{\Delta H_{vap}}{R}\left(\frac{1}{T}\right) + C$$

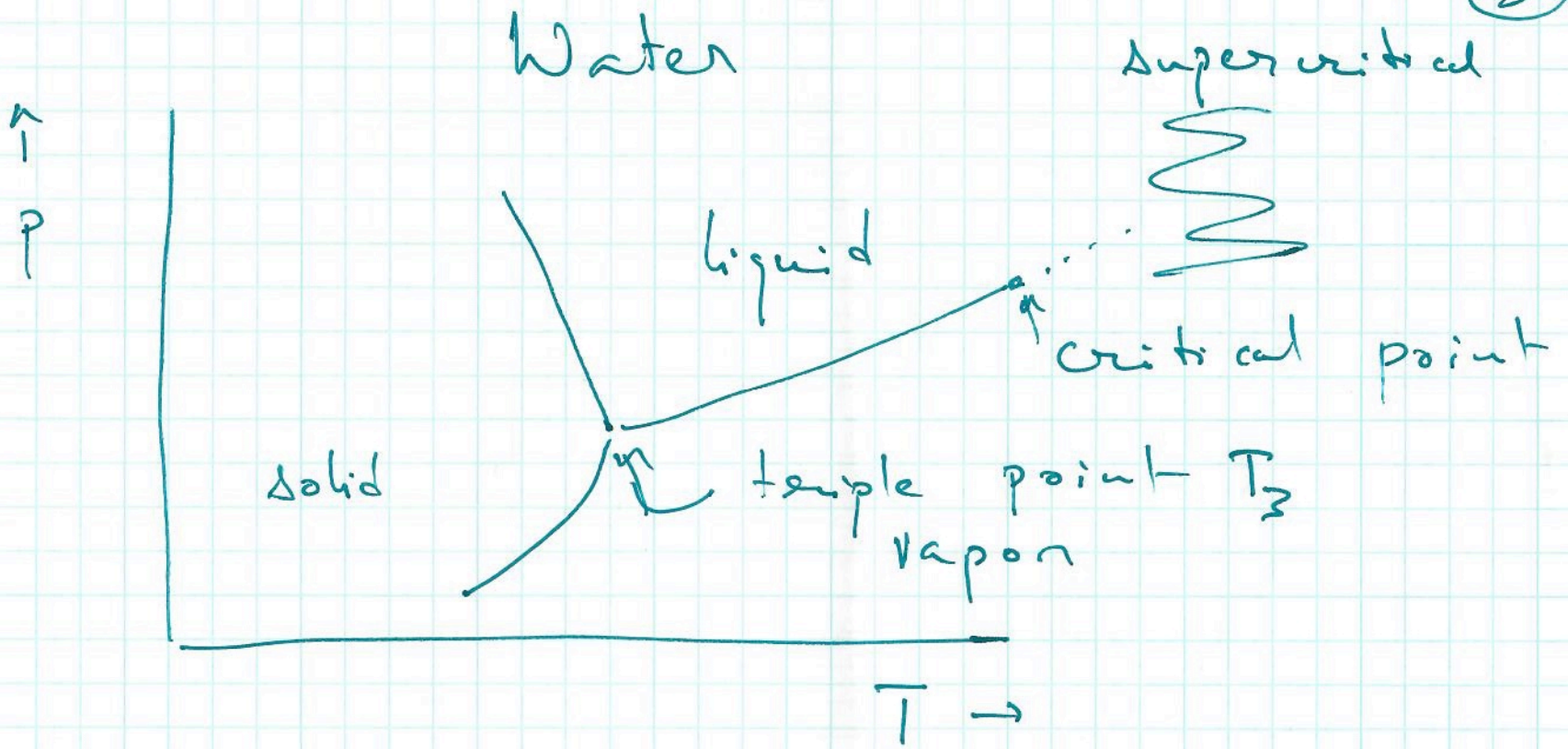


A ~~different~~ expression for the ~~pressure~~ ~~dependence~~ temperature-dependence of the vapor pressure is

$$\ln \frac{P_{vap}^{T_1}}{P_{vap}^{T_2}} = \frac{\Delta H_{vap}}{R} \left(\frac{1}{T_2} - \frac{1}{T_1} \right)$$

Changes of state & phase diagrams

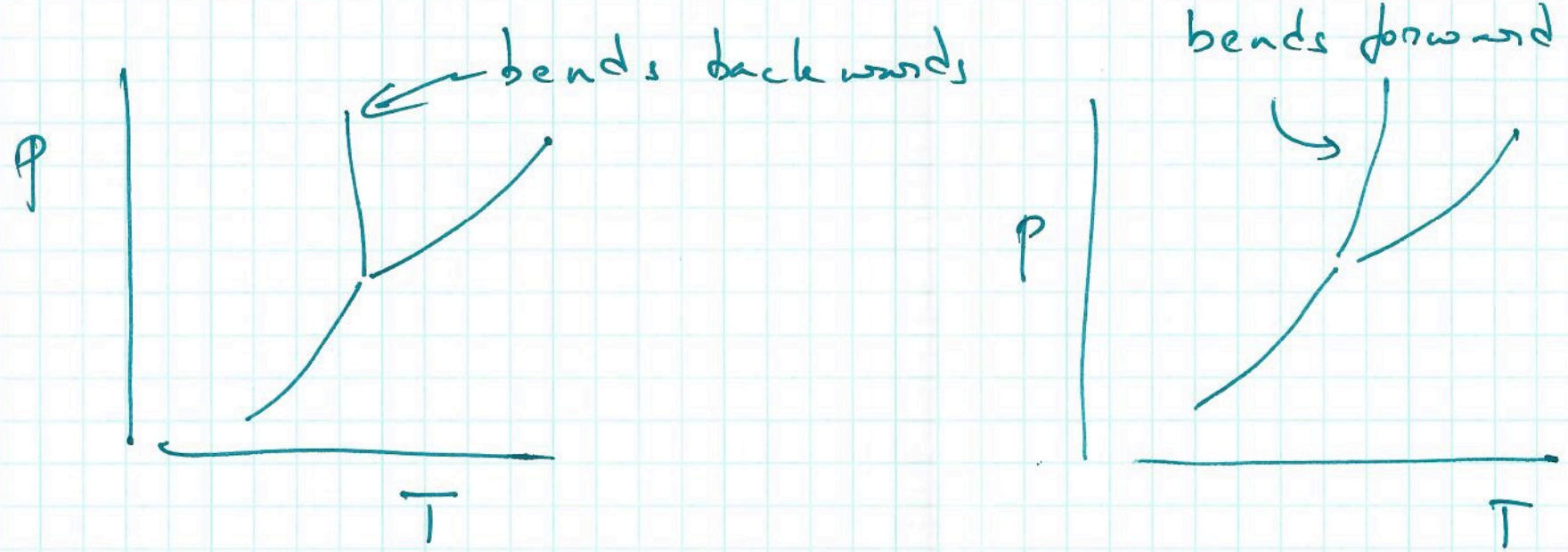




Water characteristics

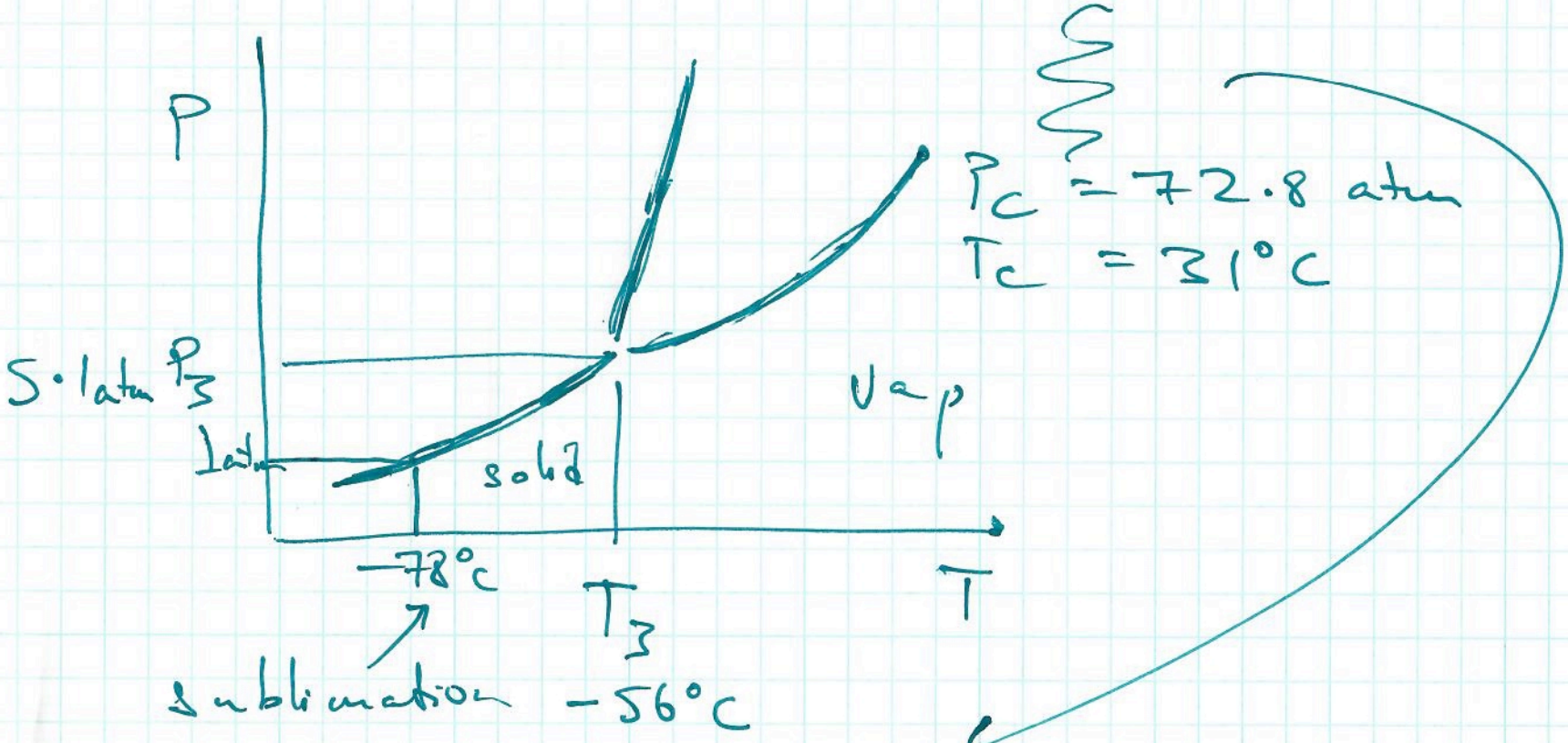
P (atm)	T_m	T_b	
1.00 atm	0°C	100°C	
0.006 atm	$T_3 = 0.0098$°C		(triple pt.)
218 atm	$T_c = 374$°C		(critical point)

Water vs not-water



water is anomalous because the liquid is more dense than the ice. Solid ice floats on liquid water and applying pressure can melt ice.

The supercritical state (best explored with (O_2))



In the supercritical state, there is no separation between the liquid and vapor states.