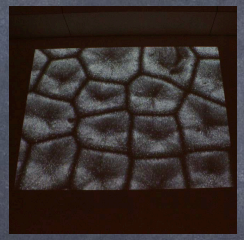
PHY117 HS2023

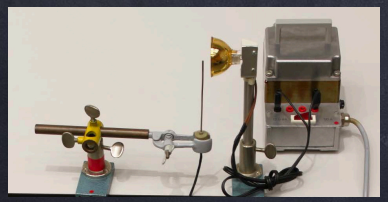
Week 7, Lecture 1
Oct. 29th, 2024
Prof. Ben Kilminster

Note: 1 cal = 4.184 J
1 Cal = 1 kcal = 4.184 kJ

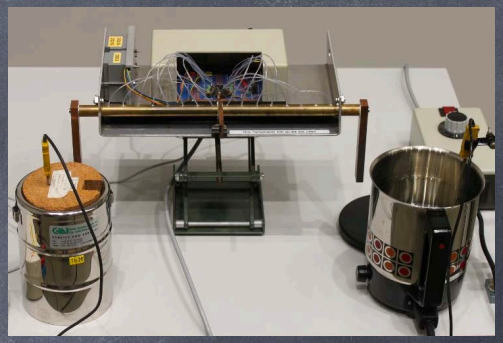
Transfer of thermal energy is done by 3 main processes:

1) convection
2) radiation
3) conduction





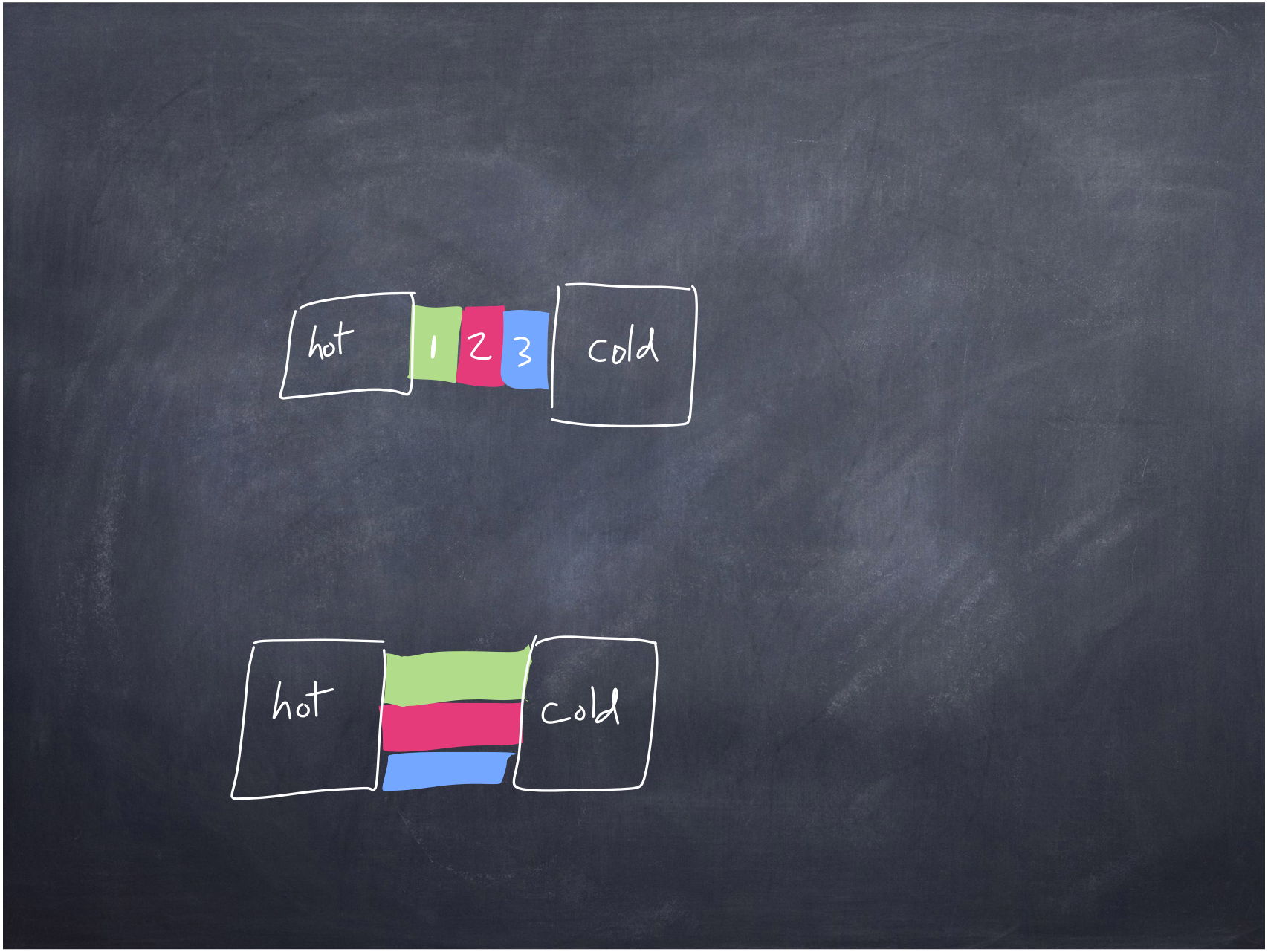
3) Conduction: thermal energy transferred by interaction between atoms, molecules.

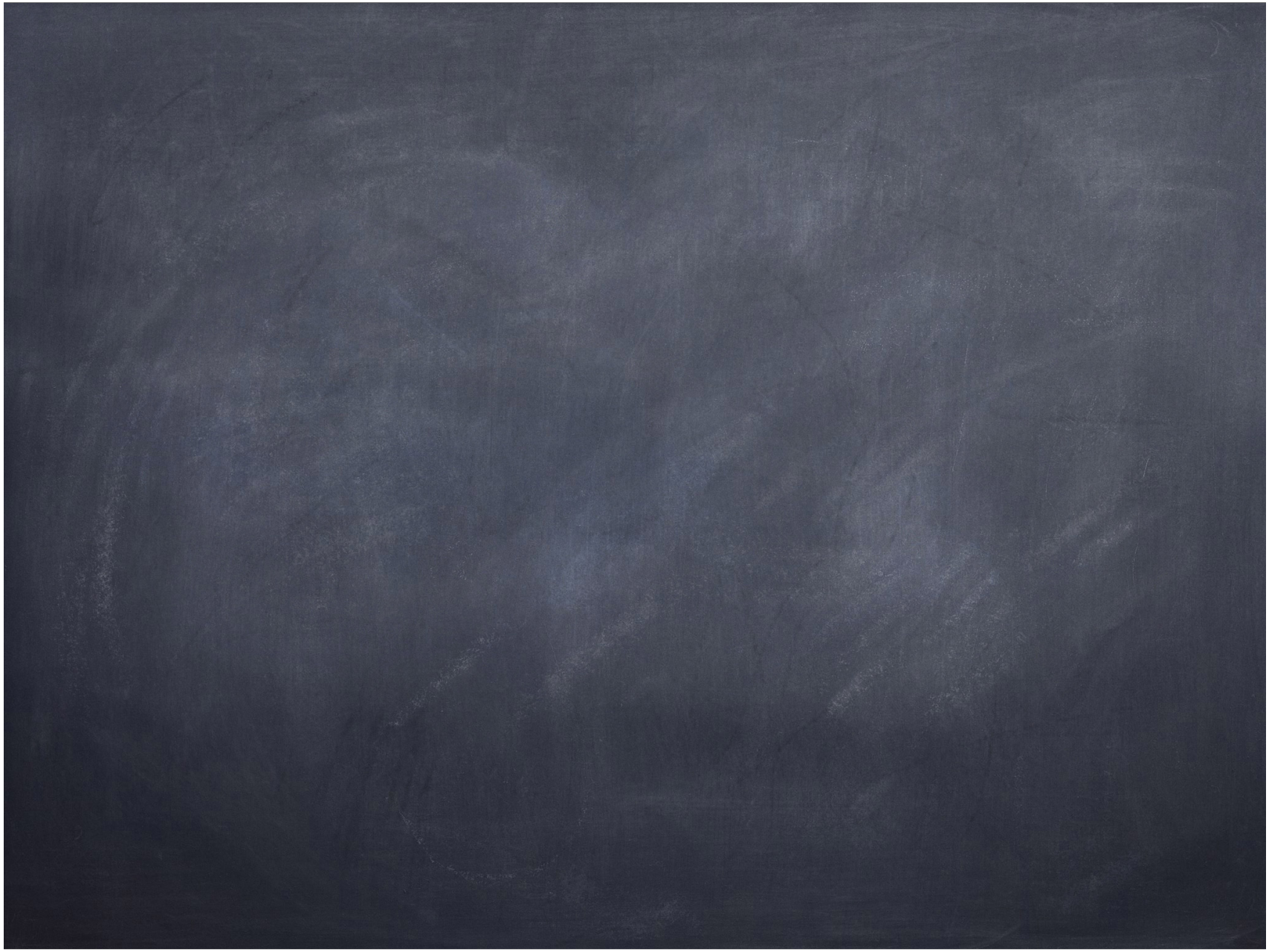


coefficient of thermal conductivity, k

materials	k
air	0.026
ice	0.592
copper	401
wood	0.11 - 0.15
glass	~0.8
aluminum	237

units $\left[\frac{W}{m \cdot K}\right]$

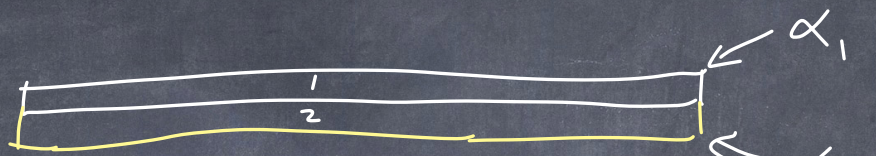

hot
1
2
3
cold
hot
cold



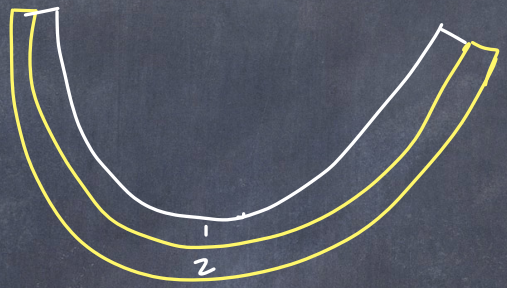
Material	$\alpha \left[\frac{1}{K}\right]$
Aluminium	24 E-6
Steel	11 E-6
copper	17E-6
brass	19E-6
ice	51 E-6
water (20°C)	0.207 E-3
alcohol	1.1 E-3

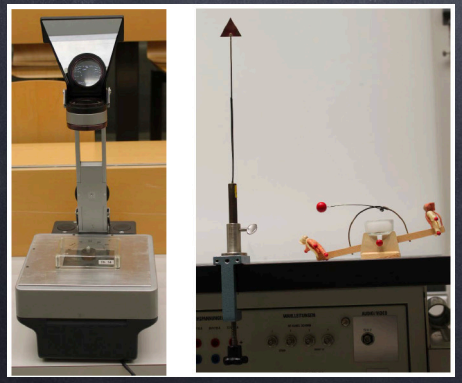
we can turn this into a thermometer.

T_0

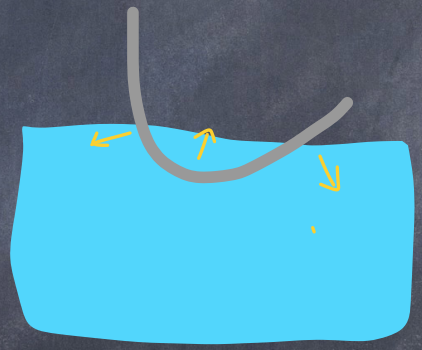


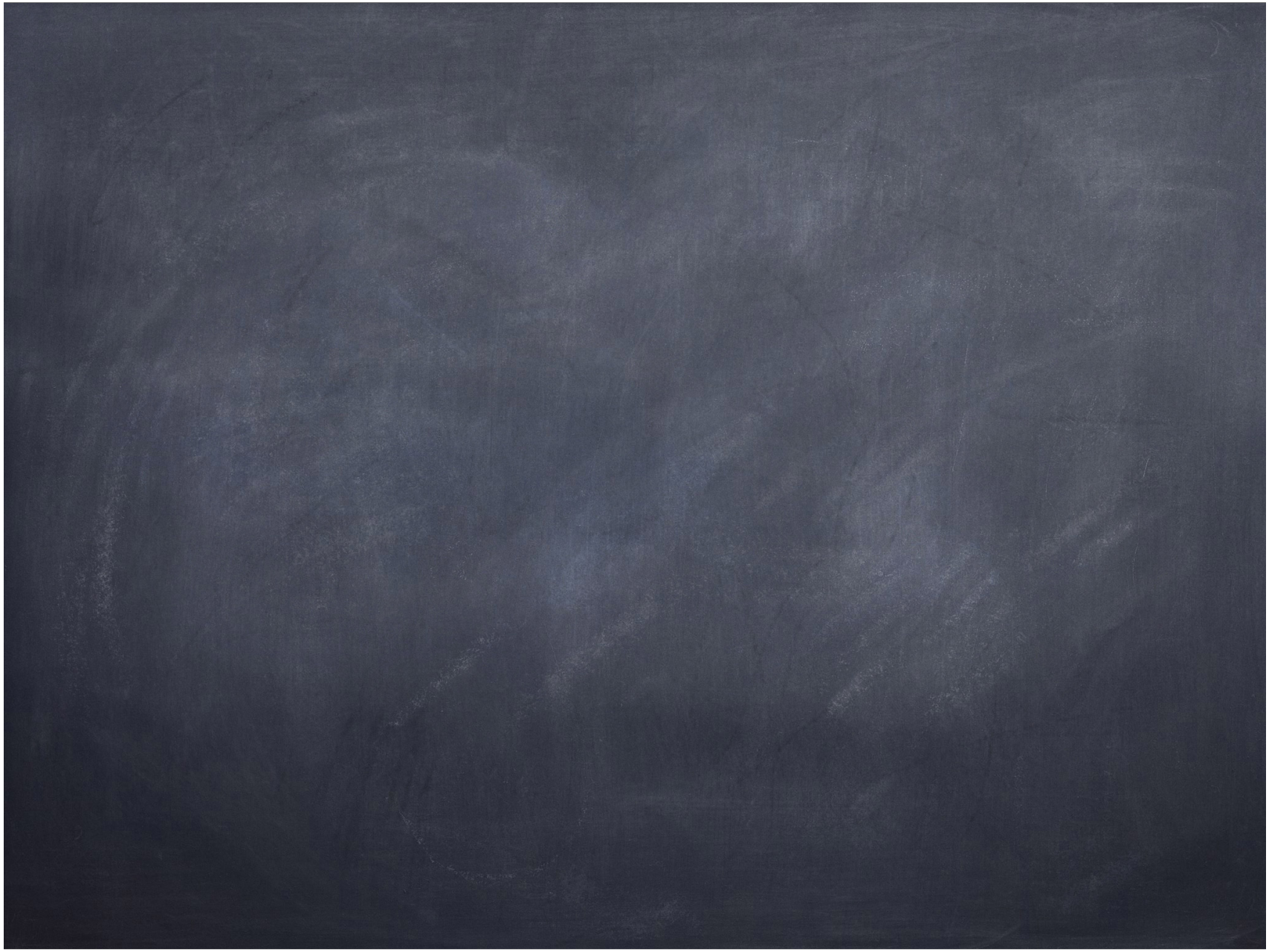
$\alpha_2 > \alpha_1$





material	Y $\left[\frac{GN}{m^2}\right]$
steel	200
lead	16
gold	8

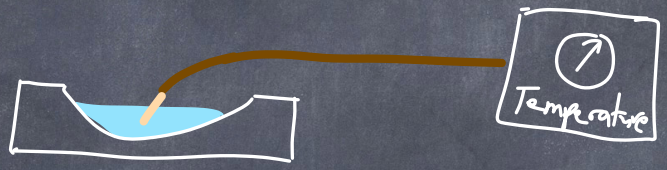


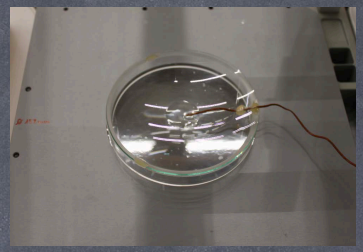


	Melting point [K]	latent heat of fusion L_f $\left[\frac{kJ}{kg}\right]$	Boiling point [K]	latent heat of vaporization L_v $\left[\frac{kJ}{kg}\right]$	specific heat C $\left[\frac{kJ}{kg \cdot K}\right]$
Gold	1336	62.8	3081	1701	0.126
water	–	333.5	373.15	2257	4.18
lead	600	24.7	2023	858	0.128
alcohol	159	109	351	879	2.4
ice	273.15	333.5	–	–	2.05

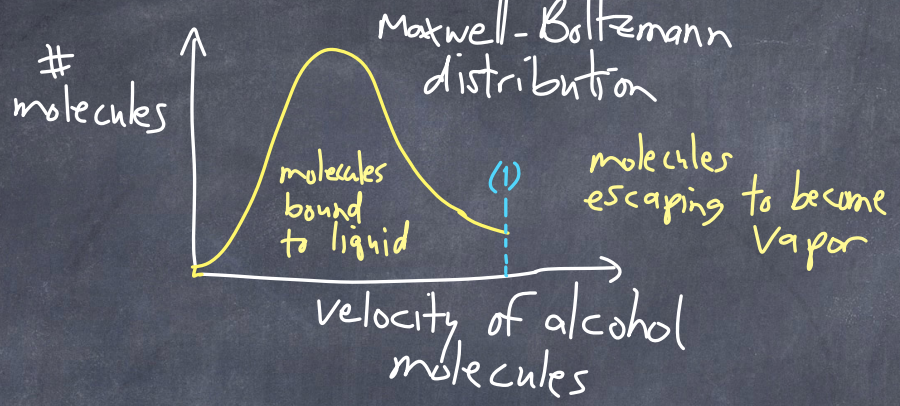
During evaporation, a liquid loses heat and decreases in temperature.

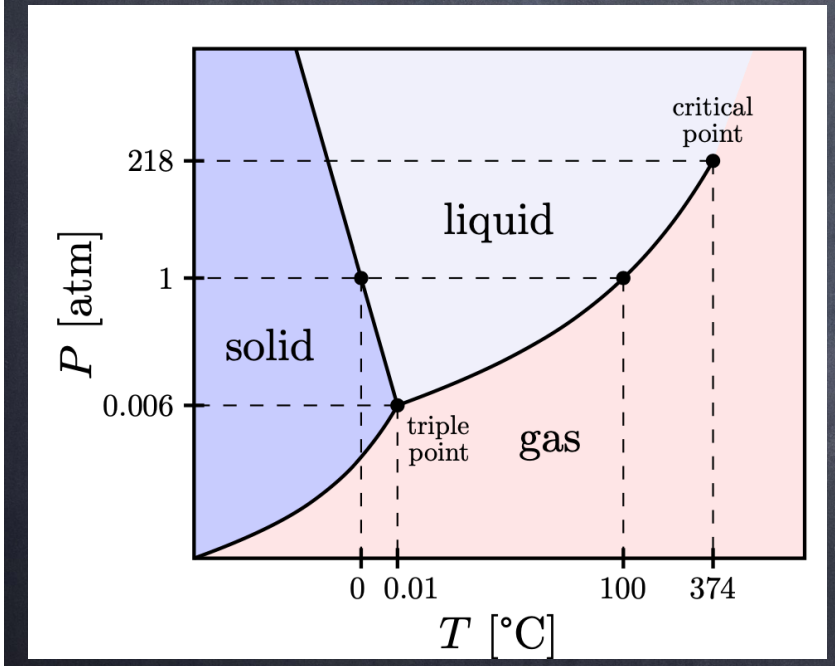
Experiment.





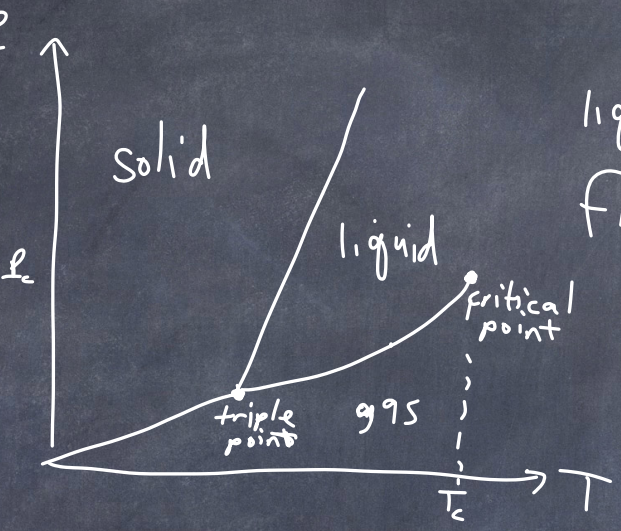
Microscopic scale:

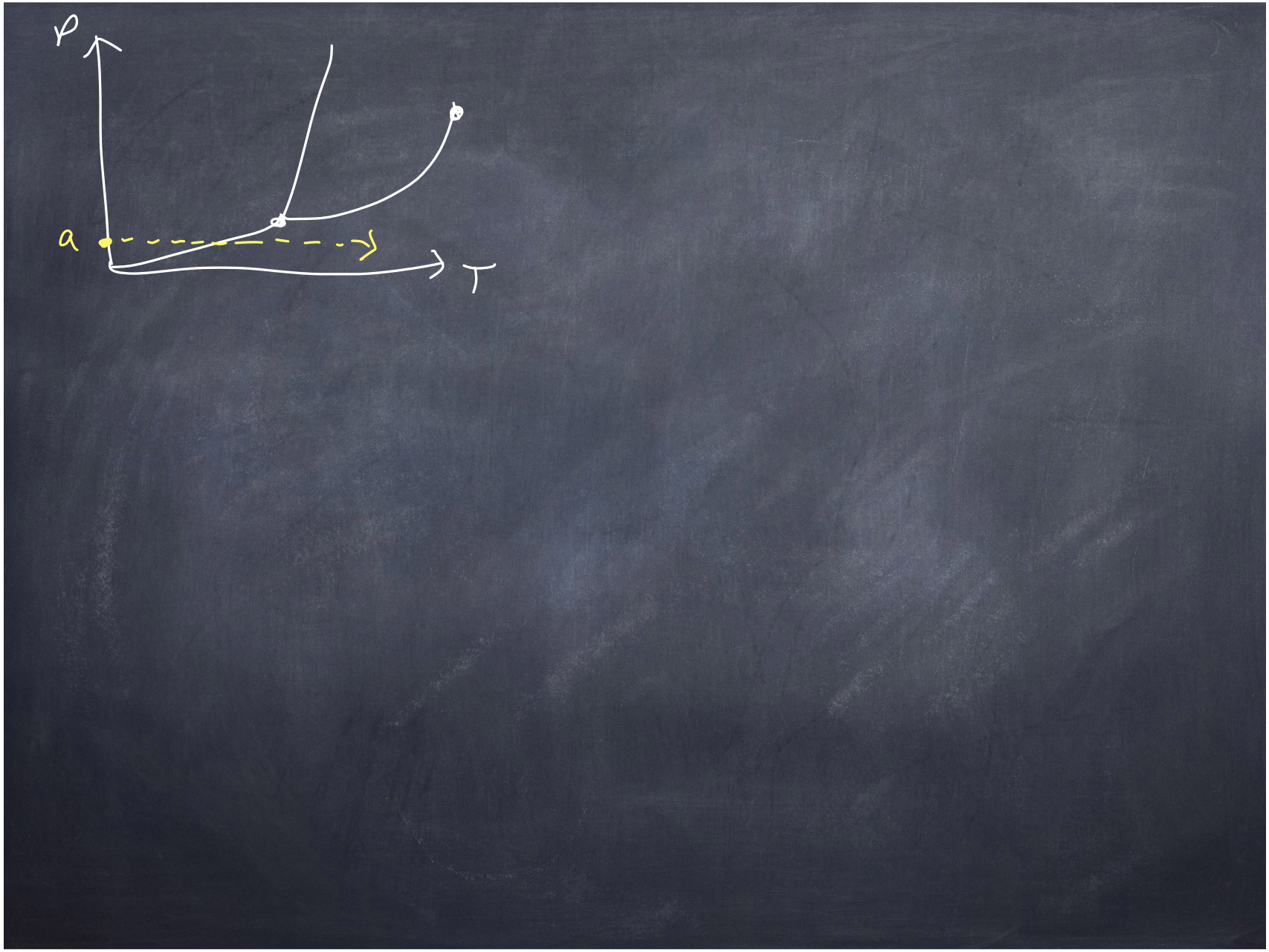


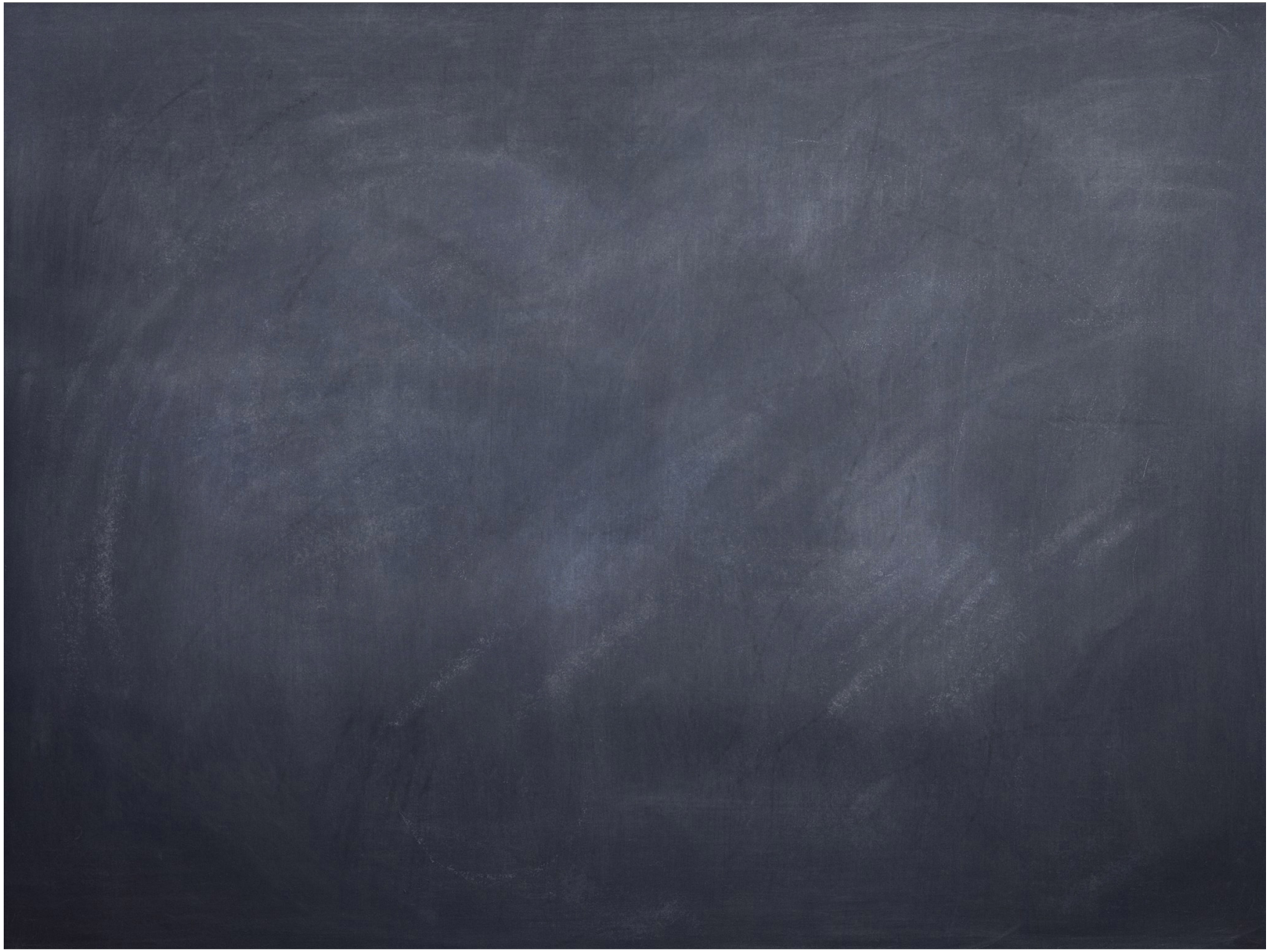

critical
point
218
liquid
1
solid
P [atm]
0.006
triple
point
gas
0
0.01
100
374
T [°C]

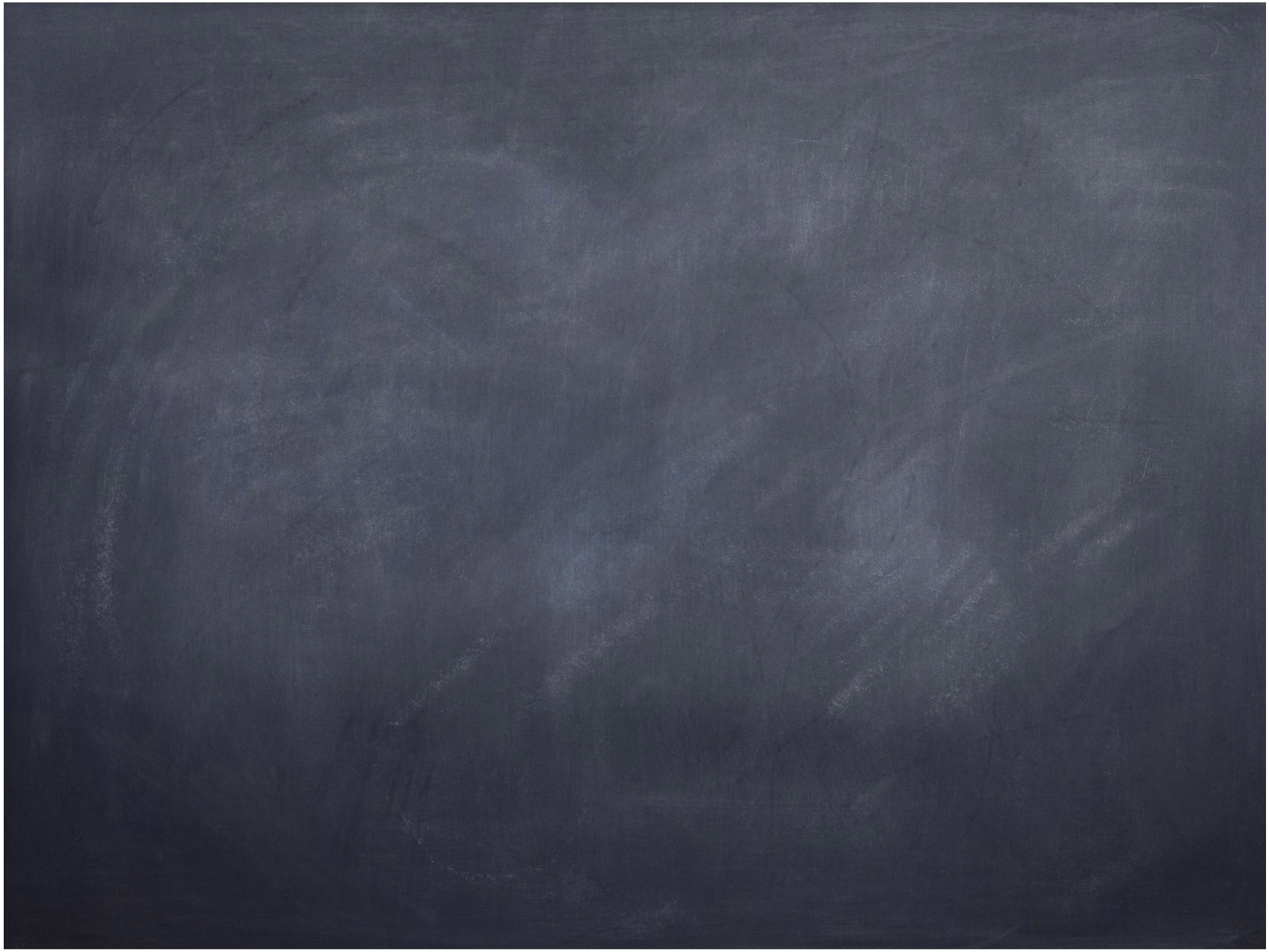
Expt: Boiling by vacuum.

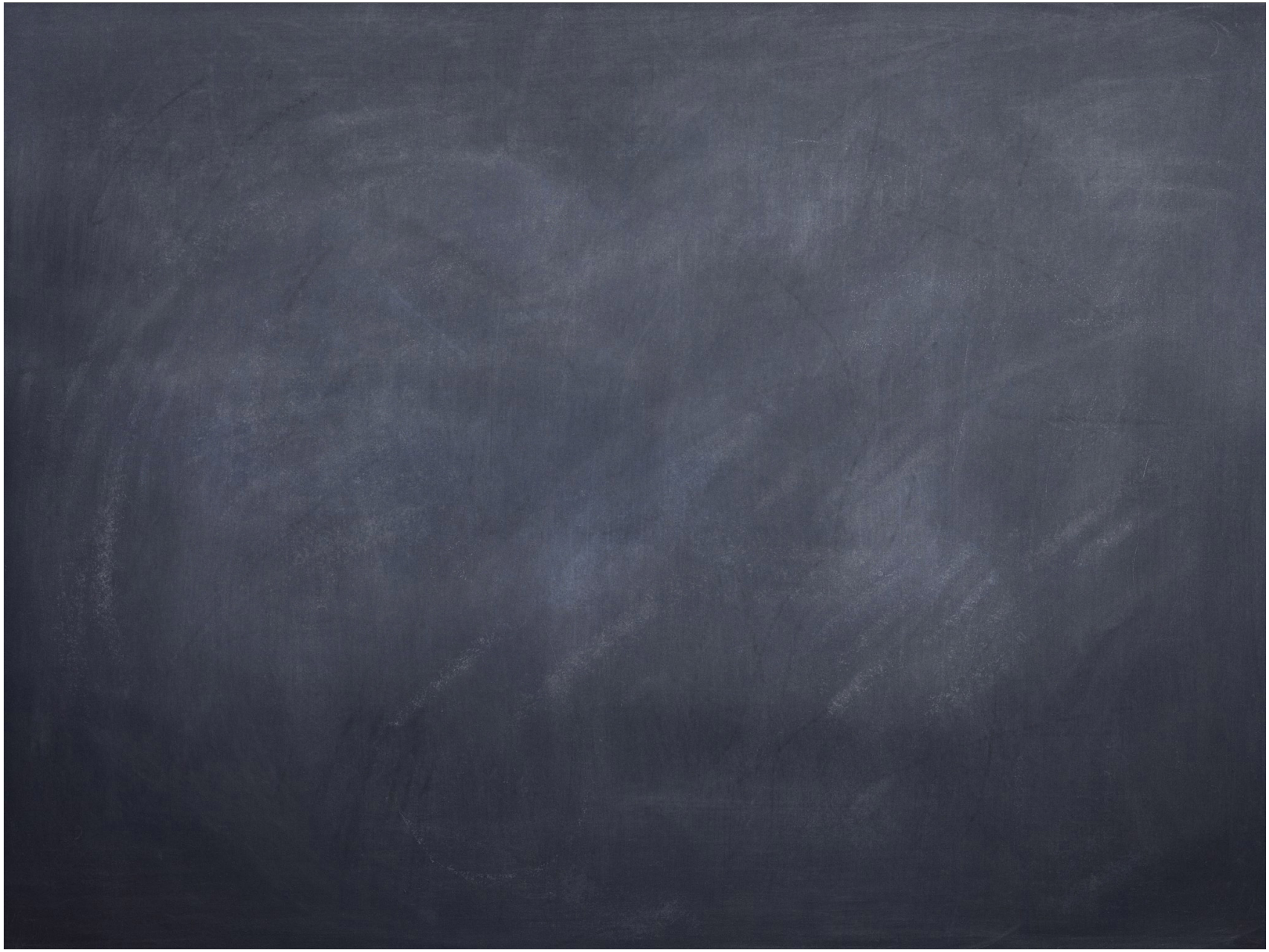
phase diagram for water.

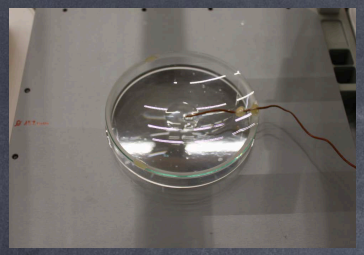



p
a
T

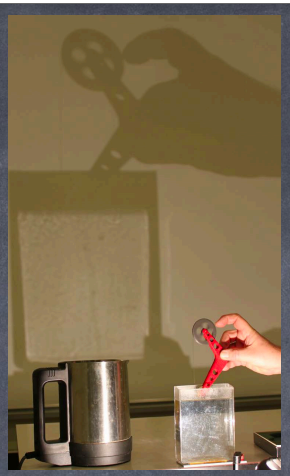






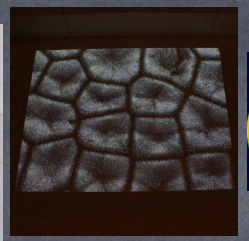


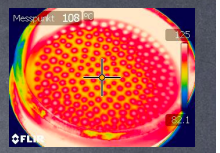
Th81



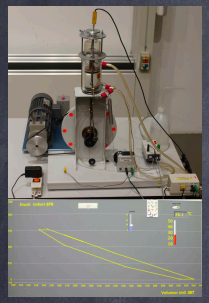
Th34

Th55



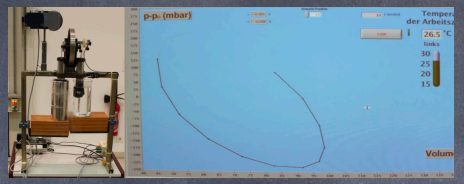


Th35



Th70

Th77



Th68

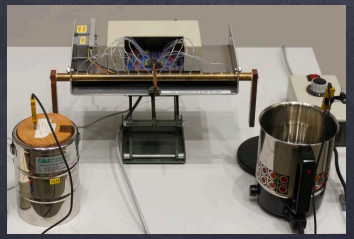
Th20

E12

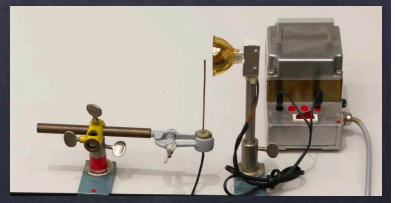
Th19

Th14

Th2



Th22



Th48