I lecture

Production of low temps.

1. Lagado: condensing air into a dry tangible substance

2. Paris's a/c. of F's liquefn. Cl_2: soon after CO_2 & other gases

(5 F's expt-): (D. Cl_2, CO_2, other bulbs)

3. Explosions: it was from one of my tubes & was so powerful as to drive pieces of glass like pistol shot through the window. However I am getting better & hope to see as well as ever

4. Connection betw liquefied gases & low temp.

   CO_2 snow : Happy boy : $-78^\circ C$

   CO_2 + ether : 1/26 atm. $-110^\circ C$.

5. Permanent gases: not liquefiable under 3000 atm

6. not surprising. Andrews' work: E

   (D. Crit. temp. CO_2)

7. Liquefn. of per. gases prize problem

   Spurious claims Perkins.

8. 1877. Dramatic announcement by C + P.

   (a) C's letter to D. Correspondg member did not wish to prejudice the decision by a sensational announcement.

   (b) P's. though claimed cascade same as C's

   (D. Corona expt-)

9. Tho' imp. as breaking the record can hardly be said to have solved the problem of liquefn. Boiling quietly in a test tube Wroblewski + Olszewski.

(δ – Cascade)

10. H_2 could not be liquefied.

11. Digression: why easier to produce heat

(D. carrom men expt.)

~~12.~~ can pick + arrange: M's demon.

12. Looks as tho' liquefn. impossible: true, total disorder can not be diminished. 2 kinds etc.

13. Another view: faster ones have escaped same objective as in M's expt.

14. Another way: Principle of Kapitza's wide He.

15. Joule Thomson ^ Dewar. H_2. Thermos flask
Historically K. Onnes He from H_2.

~~16.~~ Kelvin scale: O_2 90°, H_2 20°, He 4.2

16. ~~Study~~ (D. Liquid air expts)

a) Spheroidal state:

(b) ^ Melting: grapes: rubber

(c) charcoal burning in vessel

(d) Cotton wool.

I wish I could show liquid He. Boils at

17. (Slides F, Cail, P., Dew., Onnes.)

~~18 Many properties: (a) Supra-cond. McLennan's expt. (b) He II.~~

18 diffus. pumps. in series
~~18~~. 1921 K. Onnes ^ 80 litres per sec. ·013 mm. 0·82 K

1932 Keesom 2 pumps.
675 litres/sec. ·0036 0·71°

no ~~gas~~ ^ substance of lower boil. pt. ~~Second b[?]~~

20. ~~another quest.~~ (Sl. V. pres. of He.)

19. many properties showed
(a) Super conductivity
(b) He II
(c) 1/T law
wh shows the magnets free

20) Deby Giau method ·005°

21) (a) lowest pres. (b) lowest temps. Records
(c) Ferromagnetism

22) what sets the lower limit
freedom.
~~[illegible]~~ ~~[illegible]~~ two stage

23) too much of a good thing
Relax time.

Great advance to recognise $E \sim kT$

Greater with increase of T many disorder

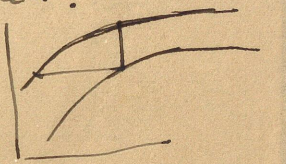
gas - liquid - solid.

<u>why difficult to cool.</u>

If disorder depended only on temp no cooling

Fortunately other parameters :

Gas : vol : Compression.



In terms of entropy :

"Entropy squeezers"

4.2° K

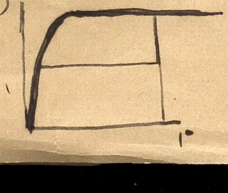
18 pumps 80 litres/sec. .013 mm 0.82°

675 .0036 0.71°

T	p mm
.5	2.5×10^{-5}
.3	7×10^{-10}
.1	3×10^{-31}
.05	4×10^{-62}
.03	6×10^{-103}

~~Cool~~ Some property wh will change rapidly with temp. $S = \int_0^H \left(\frac{\partial\sigma}{\partial T}\right)_H dH$

Curie law. Gd Mn Fe



$$T_f/T_i = \frac{k\Theta}{g\beta H}$$

Fe^{+++} .06

Mn^{++} .1

method

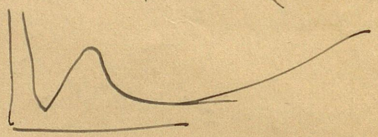
method of calculating Θ's.

~~Sp~~ Heat Cap. $C = T\left(\frac{\partial S}{\partial T}\right)_{H=0}$

Max. of Sp. heat.

Verified experimentally. (Gd ·1.)

2nd Max.



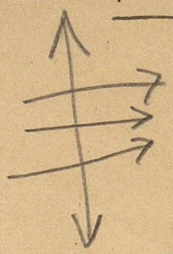
Low temp. reached with lower Θ
or higher H. } differ.

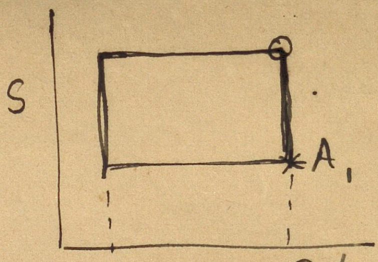
Measurement: Gas thermo. not operative.

T^*

$\Delta Q = T \Delta S$.

1st method





$Q_1/T_1 = -Q_2/T_2$

To produce same change in S   Q req'd $\propto T$

2nd method

Temp °K	p mm. Hg
1·0	·15
·7	·0032
·5	$2·5 \times 10^{-5}$
·3	7×10^{-10}
·1	3×10^{-31}
·05	4×10^{-62}
·03	6×10^{-103}

14·0	·056 sec
1·0	·03
·1	1·60
·05	34·00
~~·04~~	2 min
·03	31 "
·02	97 hrs
·01	30,000 yrs.