THE

PHILOSOPHICAL TRANSACTIONS

(*From the Year* 1700, *to the Year* 1720.)

ABRIDG'D,

AND

Diſpos'd under GENERAL HEADS.

In Two VOLUMES.

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VOL. IV. Containing

Part I. The MATHEMATICAL Papers.

Part II. The PHYSIOLOGICAL Papers.

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The Philosophical Transactions

ABRIDG'D.

PART II.

Containing the

PHYSIOLOGICAL PAPERS.

CHAP. I.

Physiology. Meteorology. Pneumatics.

A Scale of the Degrees of Heat, by ... n.270. p.824.

0		I. THE Heat of Winter Air, when Water begins to freeze. This Heat is known by rightly placing the Thermometer in Snow pressed together, at what Time it begins to thaw.
0, 1, 2.		The Heat of Winter Air.
2, 3, 4.		The Heat of the Air in Spring and Autumn.
4, 5, 6.		The Heat of the Air in Summer.
6.		The Heat of the Air at Noon, about the Month of *July*.
12.	1	The greatest Heat that the Thermometer receives by the Contact of a Human Body. This Heat is much the same as that of a Bird sitting upon her Eggs.
$14\frac{3}{11}$	$1\frac{1}{4}$	The Heat of a Bath, which is almost the greatest that any one can endure long, with his Hand agitated and immersed in it. The same almost is the Heat of Blood just let out.
17	$1\frac{1}{2}$	The greatest Heat of a Bath that any one can endure long, his Hand being immersed and at rest in it.
$20\frac{2}{11}$	$1\frac{3}{4}$	The Heat of a Bath in which Wax swimming and melting, by moving about grows hard and loses its Transparency.
24	2	The Heat of a Bath in which Wax swimming grows liquid by the Heat, and is preserved in continual Flux without Ebullition.
$28\frac{6}{11}$	$2\frac{1}{4}$	The intermediate Heat between the Degrees in which the Wax melts and the Water boils.
34	$2\frac{1}{2}$	The Heat by which Water boils violently, and a Mixture of two Parts of Lead, of three Parts of Pewter, and

		and of five Parts of Biſmuth grows ſtiff in cooling. Water begins to boil by a Heat of 33 Parts, and in boiling conceives a Heat of more than 34$\frac{1}{2}$ Parts. But Iron with a Heat of 35 or 36 Parts ceaſes to excite an Ebullition, when hot Water is dropt upon it; and of 37 Parts, when cold Water does the ſame.
40$\frac{1}{3}$	2$\frac{3}{4}$	The leaſt Heat by which a Mixture of one Part Lead, of four Parts Pewter, and of five Parts Biſmuth, grows hot and melts, and is preſerved in a continual Flux.
48	3	The leaſt Heat by which a Mixture of equal Parts of Pewter and Biſmuth melts. This Mixture cools and coagulates by a Heat of 47 Degrees.
57	3$\frac{1}{4}$	A Heat by which a Mixture of two Parts of Pewter, and one Part of Biſmuth is melted, as alſo a Mixture of three Parts of Pewter, and two Parts of Lead. But a Mixture of five Parts of Pewter, and of two Parts of Biſmuth, cools and grows ſtiff with this Heat. And a Mixture of equal Parts of Lead and Biſmuth does the ſame.
68	3$\frac{1}{2}$	The leaſt Heat by which a Mixture of one Part of Biſmuth, and eight Parts of Pewter is melted. Pewter alone is melted with a Heat of 72 Parts, and cools and grows ſtiff by a Heat of 70 Parts.
81	3$\frac{3}{4}$	The Heat by which Biſmuth is melted, as alſo a Mixture of four Parts of Lead, and one Part of Pewter. But a Mixture of five Parts of Lead, and one Part of Pewter, grows ſtiff when melted, and cools in this Heat.
96	4	The leaſt Heat by which Lead is melted. Lead grows hot and melts in a Heat of 96 or 97 Parts, and cools and grows ſtiff in a Heat of 95 Parts.
114	4$\frac{1}{4}$	The Heat by which Bodies heated in the Fire by cooling quite leave off to ſhine in the Darkneſs of the Night, and again by growing hot begin to ſhine in the ſame Darkneſs, but with a very faint Light which can hardly be perceived. In this Heat a Mixture of equal Parts of Pewter and Regulus Martis will melt; but a Mixture of ſeven Parts of Biſmuth, and four Parts of the ſame Regulus Martis, will cool and grow ſtiff.
136	4$\frac{1}{2}$	The Heat by which Bodies heated in the Fire grow red hot, but not ſo in the Twilight. By this Heat a Mixture of two Parts of Regulus Martis, and of one Part of Biſmuth, as alſo a Mixture of five Parts of Regulus Martis, and one Part of Pewter, by cooling grows ſtiff. The Regulus by itſelf grows ſtiff with a Heat of 146 Degrees.

161	4½	The Heat by which Bodies heated in the Fire plainly grow red hot in the Twilight, juſt before the Riſing or Setting of the Sun, but not ſo in open Day-light, or but very obſcurely.
192	5	The Heat of burning Coals in a ſmall Kitchen Fire, made of bituminous foſſile Coals, and without blowing with Bellows. The ſame is the Heat of Iron in ſuch a Fire, that grows red hot as much as it can. The Heat of a ſmall Culinary Fire made of Wood is ſomething greater, perhaps of 200 or 210 Degrees. But the Heat of a large Fire is ſomething greater ſtill, eſpecially if provoked by the Uſe of Bellows.

In the firſt Column of this Table we have the Degrees of Heat in Arithmetical Progreſſion, beginning the Computation from that Degree in which Water begins to freeze, as it were from the loweſt Degree of Heat, or the common Limit of Heat and Cold, and making the external Heat of a Human Body to be 12 Degrees. In the ſecond Column are had the Degrees of Heat in Geometrical Progreſſion, ſo that the ſecond Degree is as great again as the firſt, the third as great again as the ſecond, and ſo on; and the firſt is the external Heat of the Body of a Man adequate to Senſe. Now it appears from this Table, that the Heat of boiling Water is almoſt three Times greater than the Heat of the Human Body, and that the Heat of melted Pewter is ſix Times greater, and the Heat of melted Lead is eight Times greater, and the Heat of melted Regulus is twelve Times greater, and that the ordinary Heat of a Culinary Fire is 16 or 17 Times greater, than the ſame Heat of a Human Body.

This Table was conſtructed by the help of a Thermometer and a piece of red hot Iron. By the Thermometer I found the Meaſure of all the Degrees of Heat, till I came to the Heat with which Pewter is melted, and by the red hot Iron I found the Meaſure of the reſt. For the Heat which red hot Iron communicates to cold Bodies which are contiguous to it, in a given time, that is, the Heat which the Iron loſes in a given time, is as the whole Heat of the Iron. Therefore if the Times of cooling are taken equal, the Heats will be in a Geometrical Ratio, and therefore are eaſily found by a Table of Logarithms.

Therefore firſt I found, by a Thermometer conſtructed with Linſeed Oyl, that when the Thermometer was put into melting Snow, the Oyl took up a Space of 10000 Parts. The ſame Oyl rarified by a Heat of the firſt Degree, or by that of a human Body, took up the Space 10256; and by the Heat of Water juſt beginning to boil, it took up the Space 10705, and by the Heat of Water boiling vehemently it took up the Space 10725, and by the Heat of melted Pewter cooling, when it began to be ſtiff and put on the Conſiſtence of an Amalgama, it took up the Space 11516, and the Space 11496 when it was quite ſtiff. Therefore the rarified Oyl was to the dilated in the

Ratio

Ratio of 40 to 39, by the Heat of the human Body; in the Ratio of 15 to 14 by the Heat of boiling Water; in the Ratio of 15 to 13 by the Heat of cooling Pewter, when it began to grow ſtiff and coagulate; and in the Ratio of 23 to 20 by the Heat by which cooling Pewter grows quite ſtiff. The Rarefaction of Air with equal Heat was ten times greater than the Rarefaction of Oyl, and the Rarefaction of Oyl was about 15 times greater than the Rarefaction of Spirit of Wine. And from what is here found, by ſuppoſing the Heat of the Oyl proportional to its Rarefaction, and for the Heat of the human Body writing 12 Degrees, the Heat of Water when it begins to boil will come out 33 Degrees, and when it boils vehemently 34 Degrees; and the Heat of Pewter either when it melts, or when it begins to cool and becomes of the Conſiſtency of an Amalgama, will be of 72 Degrees, and when it cools and grows hard, of 70 Degrees.

Theſe things being known, that I might find the reſt, I heated a thick piece of Iron till it was red hot, and taking it out of the Fire with a hot pair of Pincers, I immediately put it in a cold Place, where the Wind blew conſtantly; and putting upon it little Particles of different Kinds of Metals, and other Bodies that would melt, I obſerved the Times of Cooling, till all the Particles grow ſtiff and loſt their Fluidity, and the Heat of the Iron was equal to the Heat of the human Body. Then ſuppoſing that the Exceſſes of the Heat of the Iron and the rigid Particles above the Heat of the Atmoſphere found by the Thermometer, are in Geometrical Progreſſion when the Times are in Arithmetical Progreſſion, all the Degrees of Heat became known. I placed the Iron in a Wind blowing uniformly, and not in a quiet Air, that the Air heated by the Iron might always be carry'd away by the Wind, and the cool Air might ſucceed in its Place with an uniform Motion. For thus equal Parts of the Air would be made hot in equal Times, and would conceive a Heat proportional to the Heat of the Iron.

Now the Heats thus found will have the ſame Proportion to one another with the Heats found by the Thermometer, and therefore we have rightly aſſumed, that the Rarefactions of the Oyl are proportional to its Heat.

An Account of Dr. Hook's *Marine Barometer, by Mr.* E. Halley, n. 269. p. 791.

II. Dr. *Hook*, who has made many Attempts to improve the *Barometer*, and to render the minute Diviſions on the Scale thereof more ſenſible, judging that it might be of great Uſe at Sea, contrived ſeveral Ways to make it ſerviceable on Board a Ship; one of which he explained to the *Royal Society* at their weekly Meeting in *Greſham-College*, *January* 2. 166$\frac{7}{8}$. ſince which Time he hath further cultivated the Invention, and ſome Years ago produced before the ſaid *Society*, the Inſtrument I am now to deſcribe.

The Mercurial Barometer requiring a perpendicular Poſture, and the Quickſilver vibrating therein with great Violence upon any Agitation, is therefore uncapable of being uſed at Sea, (though it hath lately

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