IX. *Tables of* specific Gravities, *extracted from various Authors, with some observations upon the same; communicated in a Letter to* Martin Folkes *Esq;* President *of the* Royal Society, *by* Richard Davies *M.D.*

Presented Feb. 18. 1747.

THE manifold applications which may be made, for the purposes of Natural Philosophy, of the relations which Bodies bear to each other, by their respective Specific Gravities, engaged me some years since to collect all the experiments of this sort I could meet with in the course of my studies, and also to make several new ones of my own with the same design.

When my collection began to be somewhat considerable, I disposed the several bodies in Tables according to their species, which I found to be the most convenient method, as my tables were by this means capable of receiving additions in any part, without destroying the form of the whole: and as they were thereby easy and ready to be consulted, and well disposed for the forming of immediate comparisons between the several bodies of the same species.

But having now no farther opportunities of enlarging my collection, I hereby beg leave to recommend the prosecution of my design to others, as a subject well deserving the attention of some of the members of the *Royal Society*, to whom I therefore present these my tables: wishing they may prove of

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ſome uſe and ſervice to the inquiſitive and philoſophical part of the world. As I perſuade myſelf they really will, when they ſhall be further rectified, by the omiſſion of the erroneous or uncertain experiments; when they ſhall be enlarged by the addition of ſuch others, as may ſtill be found in good authors, or which yet remain unpubliſhed in the cloſets of the curious: and eſpecially if ſome ſuch gentlemen as have skill, leiſure, and opportunities, ſhall pleaſe to ſupply their remaining defects, by the communication of their own obſervations, made upon thoſe bodies, whoſe ſpecific gravities have not as yet been carefully recorded.

Denique cur alias aliis præſtare videmus
Pondere res rebus, nihilo majore figura?
Nam, ſi tantundem eſt in Lanæ glomere, quantum
Corporis in Plumbo'ſt, tantundum pendere par eſt.
Lucret.

A ſhort account of the Authors, from whoſe writings and experiments, the following Tables have been collected, with ſome remarks upon the experiments themſelves, and the manner in which they appear to have been made.

THE antients have left but few particulars concerning the different ſpecific gravities of bodies, tho' it is plain they were in the general ſufficiently acquainted with them. It was by the knowledge of the various weights of gold and ſilver, that *Archimedes* is recorded to have detected the famous fraud committed in *Hiero*'s crown, as *Vitruvius* has at large related in his *Architecture*, l. ix. c. 13. and it is from the ſame great philoſopher, that we have derived the demonſtration of thoſe hydroſtatical rules, by which the proportions are beſt to be known, of the ſeveral weights or denſities of different bodies, having the ſame bulk or magnitude: as may be ſeen in his tract *De inſidentibus humido*, loſt in the *Greek* original, but retrieved in great meaſure, as it is ſaid, from an *Arabic* tranſlation. It was publiſhed in *Latin*, with a commentary by *Federicus Commandinus* at *Bononia* 1565, 4°, and the ſubſtance of it by Dr. *Barrow* in his *Archimedes*, printed likewiſe in 4° at *London* 1675.

Pliny, in the xviii. book of his *Natural Hiſtory*, has ſet down the proportional weights of ſome ſorts of grain, among which he ſays that barley is the lighteſt. *Leviſſimum ex his hordeum, raro excedit, [in ſingulos nimirum modios]* xv *libras, et faba* xxii.

Ponderoſius

Ponderosius far, magisque etiamnum triticum. And a little further on, *ex his generibus* [*frumenti scilicet*] *quæ Romam invehuntur, levissimum est Gallicum, atque e Chersoneso advectum: quippe non excedunt in modium vicenas libras, si quis granum ipsum ponderet. Adjicit Sardum selibras, Alexandrinum et trientes: hoc et Siculi pondus. Bœoticum totam libram addit: Africum et dodrantes. In Transpadanâ Italiâ scio vicenas quinas libras farris modios pendere: circa Clusium et senas.* And the same author in his xxxiii. book, speaking of quicksilver, observes that it is the heaviest of all substances, gold only excepted. *Omnia ei innatant, præter aurum: id unum ad se trahit.* Which *Vitruvius* had also taken notice of, and had mentioned besides the weight of a known measure of it, that of four *Roman Sextarii. Eæ autem* [*guttæ nempe argenti vivi quæ inter se congruunt et una confunduntur*] *cum sint quatuor sextariorum mensuræ, cum expenduntur, inveniuntur esse pondo centum. Cum in aliquo vase est confusum, si supra id lapidis centenarii pondus imponitur, natat in summo: neque eum liquorem potest onere suo premere, nec elidere, nec dissipare: centenario sublato, si ibi auri scrupulum imponatur, non natabit, sed ad imum per se deprimetur, Ita non amplitudine ponderis, sed genere singularum rerum gravitatem esse, non est negandum. Archit.* l. vii. c. 8.

Again, *Q. Rhemnius Fannius Palæmon*, in his fragment *De ponderibus et mensuris*, has given us an observation, of the proportional gravities of Water, Oil, and Honey.

——*Libræ*

——Libræ, ut memorant, bessem sextarius addet,
Seu puros pendas latices, seu dona Lyæi,
Addunt semissem Libræ labentis Olivi,
Selibramque ferunt mellis superesse bilibri.

That is to say, that the *Sextarius* of either water or wine weighed 20 ounces, the same measure of oil 18, and of honey 30. Their specific weights were therefore in proportion as 1.0, 0.9, and 1.5, exactly agreeable to what *Villalpandus* determined about the beginning of the last century: Yet was this author himself sensible that these were not to be look'd upon as very nice experiments.

Hæc tamen assensu facili sunt credita nobis.
Namque nec errantes undis labentibus amnes,
Nec mersi puteis latices, aut fonte perenni
Manantes, par pondus habent: non denique vina,
Quæ campi aut colles nuperve aut ante tulere,
Quod tibi mechanica promptum est depromere Musa.

After which he proceeds to describe a good pretty instrument for the ready finding of the different specific gravities of fluids, and shews how those of solids also may be hydrostatically discovered. And so much shall suffice for what I had to mention from the antients relating to this subject: I now come to those who have written within these last hundred and fifty years.

Francis

Francis Bacon, Lord Verulam &c. in his *Historia densi et rari*, printed in the second volume of his works in *folio*, *London* 1741. *p.* 69. has given a table, which he calls, *Tabula coitionis et expansionis materiæ per spatia in tangibilibus (quæ scilicet dotantur pondere) cum supputatione rationum in corporibus diversis.* This tract does not appear to have been published till after his death, which happened in the year 1626, but was probably written several years before; and the experiments were even as he tells us made long before that. *Hanc Tabulam multis abhinc annis confeci, atque ut memini, bona usus diligentia.* I therefore apprehend it to be the oldest table of Specific Gravities now extant. The experiments therein mentioned were not made hydrostatically, but with a cube of an ounce weight of pure Gold, as he says, to which he caused cubes of other materials to be made equal in size: as he did also two hollow ones of silver, and of equal weights, the one to be weighed empty, and the other filled with such liquid as he wanted to examine. He was himself sensible that his experiments of this sort were, notwithstanding his care, very defective, *possit proculdubio tabula multo exactior componi, videlicet tum ex pluribus, tum ex ampliore mensura: id quod ad exactas rationes plurimum facit, et omnino paranda est, cum res sit ex fundamentalibus.* From among these, notwithstanding their imperfection, as they appear to have been some of the first experiments of the sort regularly digested, and as they were besides made by so great a man, I have extracted the specific gravities of the fixed metals, which I have inserted as examples in the following tables: after reducing them to the common form, upon the suppofition that pure gold was, according to *Ghetaldus*, juft 19 times as heavy as water. And this I have rather chofen to do, than to make ufe of his Lordfhip's own weight of water given in the table, which in the manner he took it could not be very exact, and which befides would not have brought out the fpecific gravity of pure gold more than 18 times as much; and that of the other metals in proportion. This table contains in all 78 articles.

There are alfo in the third volume of the fame edition of his works, *p.* 223, *Certain experiments made by the Lord Bacon about weight in air and water.* Thefe are truly *hydroftatical*, but very imperfect, I have not therefore inferted any of them in the following collection.

Marinus Ghetaldus, a nobleman of *Ragufa*, publifhed in *quarto* at *Rome*, in 1603, his treatife entitled, *Promotus Archimedes, feu de variis corporum generibus gravitate et magnitudine comparatis*, wherein he has given a comparifon between the fpecific gravities of water and eleven other different fubftances, from his own hydroftatical experiments made with care and exactnefs. Thefe I have inferted: expreffing the numbers as they ftand in his own book, but I have afterwards alfo for uniformity reduced them to the decimal form. I have befides at the end tranfcribed at large the two tables of this author, in which every one of the twelve forts of bodies he treats about is fucceffively compared with all the others, both in weight and magnitude.

Father

Father *Johannes Baptiſta Villalpandus*, a Jeſuit of *Cordoua* in *Spain*, in his *Apparatus Urbis et Templi Hieroſolymitani*, printed in *folio* at *Rome* in 1604, exhibited a table of the proportional weights of the ſeven metals and ſome other ſubſtances, from his own experiments, made with great care as he tells us, by the means of ſix equal ſolid cubes of the fixed metals, and a hollow cubical veſſel 8 times as large, for the comparing Mercury, Honey, Water, and Oil with the ſame. His numbers, which are inſerted under his name in the following tables, were alſo again publiſhed afterwards by *Joh. Henr. Alſtedius* in his *Encyclopædia univerſa*, printed in 2 vols. in *folio* at *Herborn* 1630, and by *Henry Van Etten*, in his *Mathematical recreations*, from whence they have been often tranſcribed into other books. *Villalpandus*'s book, which is only the third volume of a work begun to be publiſhed ſeveral years before, was itſelf printed ſo ſoon after *Ghetaldus*'s, that it is probable he either never ſaw that author, or not at leaſt till after his own experiments were made.

Mr. *Edmund Gunter*, in his *Deſcription and Uſe of the Sector*, printed after his death by Mr. *Samuel Foſter* in 1626, having occaſion to make mention of the ſpecific weights of the ſeveral fixed metals, quoted *Ghetaldus*, and made uſe of his proportions, and ſo did alſo Mr. *William Oughtred*, in his *Circles of Proportion*, firſt publiſhed in *quarto* 1633, with this only difference, as to the form, that he changed *Ghetaldus*'s unit into 210, whereby he expreſſed all his relations in whole numbers. It is likewiſe probable that *D. Henrion* took from the

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ſame place the numbers he applied in his *Uſage du Compas de Proportion*, printed at *Paris* in 1631, 8°. although he has not given them all with exactneſs, for the ſake as it ſeems of uſing ſimpler vulgar fractions.

Father *Marinus Merſennus*, a *French* Minim, in his *Cogitata Phyſico Mathematica*, printed at *Paris* in 1644. 4°, has given from the obſervations of his accurate friend *Petrus Petitus*, a table of the ſpecific gravities of the metals and ſome other bodies, making Gold 100, Water $5\frac{1}{3}$, and the reſt in proportion. Theſe I have reduced to the common form, and inſerted under his name in the following tables. The ſame were afterwards made uſe of by Father *Francis Milliet de Chales*, Jeſuit, in his *Curſus Mathematicus*, Monſieur *Ozanam*, Profeſſor *Wolfius*, and ſeveral others. I have not ſeen *Petitus*'s own book, but it was entitled *L' Uſage ou le moyen de pratiquer par une Regle toutes les Operations du Compas de Proportion—augmentées des Tables de la Pesanteur et Grandeur des Metaux* &c. had a privilege dated in 1625. tho' it is ſaid not to have been printed till ſome years after. The ſame Father *Merſennus* has alſo taken notice, in his general preface, of a table of 20 ſpecific gravities, ſome time before publiſhed by Monſ. *Aleaume*, which he there ſets down, but which he alſo obſerves to be very incorrect. I have not therefore inſerted any of them in this collection.

Mr. *Smethwick*, one of the earlieſt members of the *Royal Society*, communicated to the ſame in *July* 1670, the weights of a cubic inch of ſeveral different ſubſtances;

ſubſtances; ſaid to have been formerly taken by Mr. *Reynolds* in the *Tower* of *London*. This gentleman was the ſame who compoſed ſeveral tables relating to the price of Gold and Silver, which were publiſhed in a book entitled *The Secrets of the Goldſmith's Art*, at *London* 1676, *in octavo*. Theſe weights are expreſſed in decimals of an *Averdupois* Pound, are carried to 8 places of figures, and ſeem to have been carefully and accurately collected. I have therefore in the following tables reduced them to the common form, in order to give them their proper authority with the reſt. I am ignorant whether theſe weights were ever before printed or not, neither can I give any account, after what particular manner the experiments were made, from which they were taken. They were communicated to me from the regiſter-books of the *Royal Society*; and I ſhall only obſerve, that the abſolute weight here aſſigned of a cubic inch of common water does not differ more than a ſmall fraction of a grain, from the weight of the ſame afterwards determined by Mr. *Ward* of *Cheſter*.

The *Philoſophical Society*, meeting at *Oxford*, directed ſeveral experiments to be made hydroſtatically by their members, concerning the ſpecific gravities of various bodies; which being digeſted into a table, were by Dr. *Muſgrave* communicated to the *Royal Society* the 21st day of *March* 1684. ſoon after which they were printed in the 169th number of the *Philoſophical Tranſactions*. Theſe experiments were, according to Dr. *Muſgrave*, made by Mr. *Caſwell* and Mr. *Walker*: they are all originals,

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and eſteemed ſome of the moſt accurate that are extant.

The honourable *Robert Boyle*, at the end of his *Medicina hydroſtatica*, firſt publiſhed at *London* in 1690, 8°. ſubjoined a table of the ſpecific gravities of ſeveral bodies, accurately taken from his own hydroſtatical experiments. Beſides which, there are alſo in the ſame tract, and in other parts of his works, ſeveral experiments of this excellent author's, which he has given occaſionally, together with the uſes reſulting from them. To ſuch of theſe in the following collection, as were taken from the table juſt mentioned, I have barely annexed his name, but to ſuch of the others as occurred, I have alſo added the volume, page, and column, of the late *folio* edition of his works in 1744, where the ſame are to be found. It may be noted, that in the firſt edition of the *Medicina hydroſtatica*, there were ſeveral errors of the preſs. Such of them as I could diſcover by calculation, I have corrected in the following pages.

There is a table publiſhed under the name of *J. C.* in the 199th number of the *Philoſophical Tranſactions*, A°. 1693: and this is evidently a ſupplement to that above-mentioned of the *Philoſophical Society* meeting at *Oxford*. The experiments were, according to the initials *J. C.* made by the ſame curious perſon Mr. *John Caſwell*, and are therefore of the ſame eſtimation as the others.

M. *Homberg*, of the *Royal Academy of Sciences* at *Paris*, read a memoir in 1699, wherein he took no

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tice of the expanſion of all ſubſtances by heat, and the contraction of the ſame by cold: from whence it muſt follow, that the ſpecific gravities of the ſame bodies would conſtantly be found leſs in the ſummer and greater in the winter. And this he ſhew'd from the experiments he had made upon ſeveral fluids, both in the ſummer and the winter-ſeaſons, by means of an inſtrument he had contrived and called an *Aræometer*, being a large phial, to which he had adjuſted a long and ſlender ſtem, whereby he could to good exactneſs determine, when it was filled with equal bulks or quantities of the ſeveral fluids he propoſed to examine. The reſult of his trials with this inſtrument he digeſted into a ſhort table, which was printed in the memoirs of the *Academy* for the ſame year 1699. This table *John Caſpar Eiſenſchmid* afterwards republiſhed with ſeveral additions, in his tract *De Ponderibus et Menſuris*, printed at *Strasburg* in 1708, 8°. changing it to a more convenient form for his purpoſe, by reducing the different fluids therein named to the known bulk of a cubical *Paris* inch. So much of this table as I thought might be of ſervice, I have here ſubjoined to the others in the following collection, but I have alſo made an alteration in the form, the better to fit it for general uſe, by omitting the abſolute weights of the ſeveral bodies in ſummer and winter, and placing inſtead of them, after the name of each body a decimal number, expreſſing the proportion of its weight in winter to its weight in ſummer, ſuppoſed to be every-where repreſented by unity.

Sir

Sir *Iſaac Newton* Kn[t]. in his *Opticks* printed in 4°. at *London* 1704, gave a table of the ſpecific gravities of ſeveral *diaphanous* bodies. The experiments were made by him with a view chiefly to optical enquiries, and to enable him to compare their denſities with their ſeveral refractive powers: we may therefore be well aſſured that they were made by the great author with the moſt ſcrupulous care and exactneſs. The table conſiſts of 22 articles.

John Harris D.D. in his *Lexicon Technicum*, firſt printed at *London* in 1704, *fol.* republiſhed at large the ſeveral tables of ſpecific gravities of the *Oxford Society* and *I. C.* from the *Philoſophical Tranſactions*, and that of the honourable *Robert Boyle* from his *Medicina hydroſtatica*, to which laſt he alſo added ſome experiments of his own, made as it ſeems with good accuracy. Theſe are here extracted, and placed under his name in the following tables.

Mr. *John Ward* of *Cheſter*, in his *Young Mathematician's Guide*, firſt printed, as I take it in 1706, acquaints us, that he had himſelf for his own ſatiſfaction, made ſeveral experiments upon the different ſpecific gravities of various bodies; and that he was of opinion, that he had obtained the proportion of the weight that one body bears to another of the ſame bulk and magnitude, as nicely as the nature of ſuch matter, as might be contracted or brought into a leſſer body (*viz.* either by drying, hammering, or otherwiſe) would admit of. And he has accordingly given us in the ſaid book the weight of a cubic inch of 24 different ſubſtances, both in *Troy* and *Averdupois* ounces and decimal parts of an ounce; which he further aſſures us requir'd more charge, care, and trouble, to find out nicely, than he was at firſt aware of. This table appears to have been well-eſteem'd, and to have had the ſanction of Mr. *Cotes*'s approbation, by his taking it, when reduced to the common form, into that collection which he drew up for his own hydroſtatical lectures.

Roger Cotes M A. and *Plumian Profeſſor of Aſtronomy and experimental Philoſophy* at *Cambridge*, firſt giving about the year 1707 a *Courſe of Hydroſtatical and Pneumatical Experiments*, in conjunction with Mr. *Whiſton* in that Univerſity, drew up, for the uſe of that courſe, a very accurate Table of Specific Gravities, collecting from ſeveral places ſuch experiments as he took to be moſt exact, and the beſt to be depended upon. And as the judgment of ſo great a man cannot but give a general reputation to ſuch experiments as he had ſo ſelected, I have thought proper, in the following tables, to diſtinguiſh all ſuch by the addition of the letter *C*, after the names of ſuch perſons from whom they firſt appear to have been taken, adding alſo the name of *Cotes* at length, to ſuch others as I have not met with elſewhere, and which I therefore take to have been tranſcribed from the *memoranda* of his own experiments. This table of Mr. *Cotes*'s uſed firſt to be given in *M.S.* to thoſe who attended his lectures; but it was afterwards printed in a ſingle ſheet, relating to a *Courſe of Experiments* at *Cambridge* in 1720, and ſince in Mr. *Cotes's Hydroſtatical and Pneumatical Lectures*, when they were publiſhed at large in 8°. by his ſucceſſor Dr. *Smith*, now the worthy Maſter of *Trinity College*. In theſe printed Lectures were inſerted the gravities of Human Blood, its *Serum*, &c. from Dr. *Jurin*, inſtead of thoſe that had before been made uſe of from Mr. *Boyle*.

Mr. *Francis Hauksbee*, now Clerk to the *Royal Society*, did, about the year 1710, begin, in conjunction with Mr. *Whiſton*, who had then newly left the Univerſity, to give hydroſtatical lectures *&c.* in *London*; for the purpoſe of which he reprinted in a thin volume in 4°, in which are the ſchemes of his experiments, Mr. *Cotes*'s table of Specific Gravities above-mentioned. To which he added, from tryals of his own, the weights of Steel, ſoft, hard, and temper'd, which are printed with his name in the following Tables, as are alſo ſome other experiments, which he has ſince occaſionally made, and communicated to me. Mr. *Cotes*'s table, with the above-mention'd additions of Mr. *Hauksbee*, was afterwards again publiſhed by Dr. *Shaw*, in his *Abridgment* of Mr. *Boyle*'s *Philoſophical Works*, at *London*, 1725, 4°. vol. ii. p. 345.

John Freind M. D. at the end of his *Prælectiones Chymicæ*, printed at *London* in 1709, 8°. has publiſhed ſome new tables of the Specific Gravities both of ſolid and fluid bodies, entirely taken from his own original experiments. And as theſe tables contain an account of a very uſeful ſet of bodies, upon which few or no other experiments have been made: it is great

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pity that this truly learned and elegant writer was not more accurate in his tryals than he appears to have been. Many of his experiments having indeed been made in so lax and improper a manner, and so many errors having been committed in them, that one can not with security depend upon these tables, tho' containing otherwise facts one would so much desire to be truly informed about. I have however here inserted the several particulars of his two last tables, which immediately concern Specific Gravities, after correcting such errors in calculation as I could certainly come at: And I hope that I shall be excused for this free censure upon part of the works of a gentleman, who has so well deserved of the learned world, and acquired so just a reputation in it.

James Jurin, M. D. and several years Secretary of the *Royal Society*, gave, in N°. 361 of the *Philosophical Transactions*, A°. 1719, some original and very accurate experiments made by himself, upon the Specific Gravity of Human Blood, at several times during the six preceding years. These were accompanied with a very curious discourse, which has since been translated by himself, into *Latin*, and reprinted in his *Dissertationes Physico Mathematicæ*, *Lond.* 1732. 8°.

This gentleman has also, in N°. 369 of the same *Transactions*, obliged us with some very judicious and useful remarks, relating to the *caution to be used in examining the specific gravity of solids, by weighing them in water*; for want of attending to which, several sorts of bodies, such as human *Cal-*

culi, the ſubſtance of all woods, *&c.* have appeared, from their pores and ſmall cavities filled up with air, to be conſiderably lighter than they really are.

John Woodward M. D. and Profeſſor of Phyſic in *Greſham College*, had, as he acquaints us in ſeveral places of his works, made a great number of experiments upon the ſpecific weights, of mineral and other foſſil bodies, but which being probably contained in thoſe of his papers which he ordered to be ſuppreſſed at his death, are thereby loſt to the world, to which they would without all doubt have been very acceptable. All I have been able to pick up are a very few mentioned in the *Catalogue of the Engliſh Foſſils in his Collection*, publiſhed ſince his deceaſe, in 8°. at *London* 1729.

Mr. *Gabriel Fahrenheit* F. R. S. communicated, in N°. 383. of the *Philoſophical Tranſactions*, *A Table of the Specific Gravities of* 28 *ſeveral ſubſtances*, from hydroſtatical experiments of his own, made with great care and exactneſs; to which he ſubjoined ſome obſervations upon the manner in which his trials were performed, together with a deſcription of the inſtruments in particular which he made uſe of to examine the gravities of Fluids. To ſome of his experiments which he thought required a greater nicety, he has affixed an aſteriſk in his table, ſignifying ſuch to have been adjuſted to the temperature of the air, when his Thermometers ſtood at the height of 48 degrees. This gentleman, who is well known by the reputation of his Mercurial Thermometers, which he made with great

great curiofity, and which are now generally ufed, was in *England* in the year 1724.

Profeffor *Peter van Mufschenbroek*, of *Utrecht*, publifhed in his *Elementa Phyficæ* at *Leyden* in 8°. 1734. a large table of Specific Gravities, which he afterwards yet fomewhat further enlarged in his *Effai de Phyfique* in *French*, at *Leyden* 1739. 4°. This table contains almoft all the preceding ones, but without the names of the authors from whom they were collected. I have among thofe which follow inferted, under this author's name, fuch experiments as I had not before met with elfewhere: making ufe of the *Latin* edition as the more correct, except in fuch articles which are only to be found in the *French*.

Mr. *John Ellicott* F. R. S. having an opportunity in the year 1745. to examine the weight of fome large Diamonds, he accordingly, with the utmoft care, and with exquifite affay-fcales which very fenfibly turned with the 200th part of a grain, took the fpecific gravities of 14 of thofe Diamonds, 4 of which came from the *Brafils*, and the other 10 from the *Eaft Indies*. Thefe experiments he communicated to the Prefident of the Royal Society, who caufed them to be read at one of their meetings, and afterwards publifhed them in N°. 476. of the *Philofophical Tranfactions*. Among thefe *Brafilian* Diamonds, one was of the abfolute weight of 92,425, another of 88,21; and among the *Eaft-Indian* ones, one of 29,525 *Troy* grains. And as the fize of thefe ftones made them much

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fitter for these enquiries, than any others which had probably ever before been used for the same purpose, so the known accuracy of the author, the goodness of his instruments, and the consistency of all his experiments, sufficiently shew the specific gravities he has delivered in his paper, may entirely be depended upon.

The same curious person also communicated the Specific Gravities of fine and standard Gold, published under his name in the following tables, and which were deduced from experiments he was so kind as to make on purpose at my request.

As I have just had occasion to mention Diamonds, it may possibly not be foreign to the purpose here to take some notice of the Diamond Carat weight, used among jewellers, which weight was originally the Carat or 144th part of the *Venetian* ounce, equal to 3,2 *Troy* Grains, but which is now, for want of an acknowledged standard, somewhat degenerated from its first weight. I have myself found it, upon a medium of several experiments, equal to 3,17 *Troy* Grains; and I have the rather taken notice of this weight here, because there happens to be a mistake about it, both in Dr. *Arbuthnot*'s and Mr. *Dodson*'s tables, who have set down as it seems the number of Diamond Carats in a *Troy* Ounce, instead of the weight of the Diamond Carat itself. This Carat is again divided into four of its own Grains, and those into halves and quarters, commonly called the eighths and sixteenths of a Carat: and thus the largest of the Diamonds just above-mentioned, weighed, in the jewellers phrase, better than 29 Carats and almost half a Grain.

 Mr.

Mr *James Dodſon*, in his book called *The Calculator*, printed in 8°. at *London* in 1747, has inſerted a uſeful table of Specific Gravities, in which he has by the firſt initial letter of their names diſtinguiſhed the ſeveral authors he has quoted: and amongſt theſe are ſeveral new experiments marked with an *L*, which I am told were communicated from his own trials, by Mr. *Charles Labelye*, engineer, and which concern particularly the weights of ſeveral ſorts of ſtone and other materials uſed in building. Theſe I have alſo diſtinguiſhed by an *L*. as they ſtand in Mr. *Dodſon's* book.

Mr. *Geo. Graham*, F.R.S. made for me, at the requeſt of a friend, ſome accurate trials upon the weight, of Gold and Silver, both when reported fine, and when reduced to the *Engliſh* Standard: all which I have inſerted under his name in the following tables. Wherein I have beſides reported ſome other ſingle Experiments which I occaſionally met with, from *Frederick Slare* M.D. *John Keill* of *Oxford*, M.D. *Stephen Hales* D.D. and *Edward Bayley* of *Havant* in *Hampſhire*, M.D.

Richard Davies M.D. I have laſtly to this Collection of Experiments added ſome of my own, which I endeavoured to make with as much accuracy, as the inſtruments I was provided with would allow of. My hydroſtatical Balance was one conſtructed ſeveral years ſince by Mr. *Francis Hauksbee*, which I have conſtantly found to turn ſenſibly with half a grain: and the bodies upon which I made moſt of my trials, were taken from a collection of the *Materia Medica* formerly made by Signor

Signor *Vigani*, and ſtill preſerved in the library of *Queen's College* in *Cambridge*.

TABLE I.

Of Metals.

☉ GOLD, fine. *Ward*, *C.*	19.640
A Medal eſteemed to be near fine Gold *J. C.*	19.636
Or d'eſſai, ou de Coupelle. *Muſschenbr.*	19.238
Fine Gold hammer'd. *Ellicot.* . .	19.207
D°. an ingot ſo accounted, and again refined with Antimony. *Ellicot.* .	19.184
D°. the ingot itſelf juſt mention'd. *Ellicot.*	19.161
A Medal of the Royal Society, reported fine Gold. *Graham.* . .	19.158
A gold medal of Qu. Eliz. *J. C.* . .	19.125
D°. of Qu. Mary. *J. C.* . .	19,100
Aurum. *Fahrenheit.* . . .	19.081
Id. *Ghetaldus.* Aurum purum. *Bacon* (ex hyp.)	19.000
A gold Coin of Alexander's. *J. C.* .	18.893
Gold. *Reynolds.* . . .	18.806
Aurum. *Villalpandus.* *Petitus.* .	18.750
Standard Gold (by which is underſtood Gold of 22 Carats, or ſuch of which our Guineas are intended to be coined). *J. C.* *Ward.* *C.*	18.888
An old Jacobus. I ſuppoſe the ſcepter'd broad piece. *Harris.* . .	18.375
A Mentz gold Ducat. *J. C.* . . .	18.261

Aureus

Aureus Ludovicus. *Muſchenbr.* .	18.166
A five Guinea piece of K. James II. 1687. with an Elephant. *Graham.* . . .	17.933
A Portuga piece of 3l. 12s. 1731. ſuppoſed to be nearly the ſame as Standard. *Graham.*	17.854
Guineas, ten weighed together. *Davies.*	17.800
D°. on a mean of 7 trials upon thoſe of different reigns. *Ellicot.*	17.726
A piece of Gold Coin of the Commonwealth. *Harris.*	17.625
Guineas two new ones. *Hauksbee.* .	17.414
A Grain of Scotch Gold, ſuch as Nature had made it. *Boyle* V. 30. *b.* . . $12\frac{2}{7}$	12.286
Electrum, a Britiſh Coin. *J. C.* . . .	12.071
☿ QUICKSILVER. Mercurius crudus. *Freind.*	14.117
Mercury Spaniſh. *Boyle* V. 10. *b.* Mercure ſublimé 511 fois. *Muſchenb.*	14.110
Quickſilver. *Oxford Soc.*	14.019
D°. *Ward. C.* revived from the Ore. *Boyle.*	14.000
Fine Mercury. *L.*	13.943
Quickſilver, another Parcel. *Oxf. Soc.*	13.593
Mercure amalgamé avec de l'Argent, affiné et ſublimé 100 fois. *Muſchenb.*	13.580
Mercurius. *Fahrenheit.*	13.575*
Argentum vivum. *Ghetaldus.* $13\frac{4}{7}$.	13.571
Mercure amalgamé avec de l'Or affiné, et ſublimé 100 fois; le même meſlé avec du Plomb, enſuite converti en poudre et revivifié. *Muſch.*	13.550

Coarſe Mercury. *L.*	13.512
Mercurius. *Petitus.*	13.406
Quickſilver. *Reynolds.*	13.147
♄ LEAD. *Reynolds.*	11.856
Plumbum. *Villalpand.*	11.650
Id. *Ghetaldus* $11\frac{1}{2}$.	11.500
Id. *Bacon.*	11.459
Lead. *Harris.*	11.420
Hardeſt Lead. *L.*	11.356
Plumbum. *Fahrenheit.*	11.350
Lead. *Oxford Soc. Ward.*	11.345
Plumbum. *Petitus.*	11.343
Lead. *Harris.* (an ordinary Piece)	11.330
D°. *Cotes.*	11.325
Plumbum Germanicum. *Muſchenb*	11.310
Caſt Lead. *L.*	11.260
☾ SILVER, fine. *Ward. C.*	11.091
A Medal of the Royal Society, reported fine Silver. *Graham.*	10.484
Argentum. *Fahrenheit.*	10.481
Silver. *Reynolds.*	10.432
Argentum. *Villalpandus.*	10.400
Id. *Ghetaldus.* $10\frac{1}{3}$.	10.333
Id. *Bacon.*	10.331
Id. *Petitus.*	10.219
Sterling or Standard Silver (that is, Silver 11 oz. 2 dwt. in the pound fine) A half crown of K. William's Coin. *Harris.*	10.750
D°. ſtruck into money. *L.*	10.629
D°. *J. C. Ward. C.*	10.535
D°. Caſt. *L.*	10.520

A

A new Crown-piece. 1746. LIMA under the head. *Graham*.	10.284
♀ COPPER. *Reynolds*. . .	9.127
Cuprum. *Villalpandus*. . .	9.100
Æs. *Ghetaldus*. Rose Copper. *Ward*. *C*. Fine Copper. *L*. An old Copper Halfpeny, Charles II's Coin. *Harris*.	9.000
Copper in Half-pence. *L*. . .	8.915
Æs; Cuivre. *Petitus*. . . .	8.875
Cuprum. *Bacon*.	8.866
Copper. *Oxf. Soc*. . .	8.843
Cuprum Suecicum. *Fahrenheit*. .	8.834
Id. Japonense. *Fahrenheit*. . .	8.799
Id. Suecicum. *Musschenbr*. .	8.784
Common Copper. *L*. . . .	8.478
BRASS. An old brass gold weight marked XXXIII. *Harris*. . . .	8.830
Aurichalcum. *Bacon*. . . .	8.747
A Piece of hammer'd Brass. *Harris*.	8.660
Æs, Airin, Calaminæ mixtum. *Petitus*.	8.437
Aurichalcum. *Fahrenheit*. . . .	8.412
Brass hammer'd. *J. C*. Plate Brass. *Ward*.	8.349
Wrought Brass. *J. C*. . . .	8.280
Cast Brass. *L*.	8.208
D°. *J. C. Ward*. . .	8.100
D°. *Cotes*.	8.000
Brass hammer'd. *Reynolds*. . .	7.950
D°. Cast. *Reynolds*. . . .	7.905
A Piece of cast Brass. *Harris*. .	7.666

♂ IRON. Ferrum. *Villalpandus.*	8.086
Id. *Ghetaldus.*	8.000
Iron, forged. *Reynolds.*	7.906
Ferrum. *Petitus.*	7.875
Id. *Bacon.*	7.837
Spaniſh bar Iron. *L.*	7.827
Swediſh D°. *L.*	7.818
Ferrum. *Fahrenheit.*	7.817
Iron. *Cotes.*	7.645
D°. of a key. *J.C.* Common Iron. *Ward.*	7.643
A piece of hammer'd Iron, perhaps part Steel. *Harris.*	7.600
Iron caſt. *Reynolds.*	7.520
D°. caſt. *L.*	7.135
Softeſt caſt Iron or Dutch Plates. *L.*	6.960
STEEL. *J. C. Ward.*	7.852
D°. *Cotes.*	7.850
D°. Spring Temper. *Hauksbee.*	7.809
D°. Nealed ſoft. *L.*	7.792
D°. Soft. *Hauksbee.*	7.738
D°. Hard. *Hauksbee.*	7.704
D°. Harden'd. *L.*	7.696
♃ TIN. *Reynolds.*	7.617
Stannum. *Bacon.*	7.520
Id. *Villalpandus. Freind.*	7.500
Etain d'Angleterre. *Muſschenbr.*	7.471
Stannum. *Ghetaldus.* $7\frac{2}{5}$	7.400
Id. Provinciæ Indiæ Or. Malacca. *Fahren.*	7.364
Block Tin. *Oxf. Soc. Ward. C.*	7.321
Stannum Anglicanum. *Fahrenheit.*	7.313

Id. commune. *Petitus.*	. . .	7.312
Id. purum. *Petitus.*	. . .	7.170
Block or Grain Tin. *L.*	. .	7.156

Notes and Obſervations.

As I thought the uſes that might be made of theſe Tables, either in buſineſs or in philoſophy, would beſt be illuſtrated by a few ſhort notes, I have therefore here occaſionally inſerted ſuch obſervations as occurred to me, whilſt I was reviſing them for the preſs: and as many of theſe related chiefly to the preſent defects of my tables, thoſe I thought would probably be of ſervice, to ſuch as might hereafter take the trouble of improving or correcting them.

As the particulars contained in the Tables were extracted from different books, at different times, and at firſt only intended for my own private uſe, I was not ſolicitous to preſerve one uniform language, but generally ſet down every experiment in my common-place, in the words of the author I took it from: and as I have ſince found, that by a tranſlation I might ſometimes happen not ſo juſtly to repreſent the body intended, I have upon the whole judged it beſt, here alſo to tranſcribe them in the ſame languages in which they were at firſt delivered.

To make experiments of this ſort with a ſufficient degree of accuracy requires a pretty deal of care and pains: and as in ſuch as I have made myſelf, I have found great conveniency in the uſe of decimal weights, preferably to thoſe of the common form, I would alſo recommend the uſe of ſuch to others, who ſhall pleaſe to employ themſelves in the like enquiries. Thoſe I have provided for myſelf have a *Troy* Ounce for their *integer*, and my leaſt weight is the thouſandth part of that quantity, differing conſequently from the half of a *Troy* Grain only as 24 does from 25, which is inconſiderable ſo far as thoſe ſmall weights are concerned. My four ſmalleſt are reſpectively of 1, 2, 3 and 4 of thoſe thouſandth parts, and together make 10, or an unit of the next denomination, that of the 100th part of an ounce. I then have four others, making 1, 2, 3 and 4 100ths, and together the unit of of the next denomination, or one tenth of an ounce, and ſo on. By theſe I ſave the trouble of reducing the common weights to their loweſt denomination in every experiment, and ſometimes perhaps avoid making miſtakes in that very trifling work.

Whenever two or more original writers nearly concur in their experiments upon any ſubject, the Gravity ſo deduced may be well depended upon. But where they differ remarkably it muſt either be imputed to the unequal gravity of the ſubject itſelf, or to ſome error in the tryals, which may eaſily happen in matters that depend on the obſervation of ſo many minute particulars. All thoſe caſes that ſo ſenſibly differ would well deſerve to be re-examined.

The firſt Table above, that of Metals, as it is compoſed of the moſt perfect and uniform bodies in nature, ſeems capable of being adjuſted with the greateſt preciſion, both with relation to the pure Metals

Metals themſelves, and to the ſeveral degrees of their mixtures one with another, if experiments in all theſe caſes were but made with a ſufficient degree of accuracy.

Gold, in the experiments I have made myſelf, I could never find to come up to the weight aſſigned it in ſome of the former tables, and particularly thoſe I have made upon our own coin, and ſome others have always remarkably fallen ſhort of the weight aſſigned to the Standard in thoſe ſame tables. I have inſerted that trial in which I found Guineas to come out beſt; and I may venture to affirm, that that experiment, in particular, was made with as much accuracy as my inſtrument was capable of, the Pieces were all waſhed in ſoap and water, cleaned with a bruſh, and the air-bubbles well freed and the like. That experiment is beſides abundantly confirmed ſince, by the exact trials lately made by Mr. *Graham* and Mr. *Ellicot*, which were performed with the greateſt care; and the fine Gold alſo mentioned by the laſt was choſen and prepared with the greateſt curioſity.

It may be obſerved, that the gold medals of Q. *Eliz.* and Q. *Mary*, quoted by *J.C.* were, without doubt, the large Sovereigns of thoſe Queens, which were of the old Standard of *England*, or of gold appointed to be 23 carats, 3 grains and a half fine: That the *Mentz* Ducat, mentioned by the ſame, if it was one of thoſe *ad Legem Imperii*, which are always in their own mints affirmed to be fine, come out conſiderably too light: and that the gold coin of the Commonwealth, and the piſtoles of *France*, were like our preſent gold money of the goodneſs of 22 carats.

Mercury

Mercury is placed in this table among the Metals, by reaſon of its near agreement with thoſe bodies in its ſpecific gravity; tho' it otherwiſe ſo widely differs from them in moſt of its properties.

Braſs is conſiderably condenſed by hammering; whether Gold, Silver, and the other Metals are alſo condenſed in like manner, hardly appears yet to have been ſufficiently tried.

Of the mixed Metals, hardly any except Braſs, appear to have had their ſpecific gravities very carefully aſcertained: bell-metal, princes metal, however, and ſome others, might deſerve to be examined in that particular.

It might poſſibly be queried alſo, whether ſeveral mixed Metals do not either rarifie or condenſe upon mixture, ſo as thereby to acquire a different ſpecific gravity, than the natural law of their compoſition, at firſt ſeems to require.

It may laſtly be obſerved, that the ſpecific gravities of all the known Metals are ſuch, as that none of them come up to 20 times the weight of common water, or fall ſenſibly below 7 times the ſame weight.

TABLE II.

Of Minerals, Semimetals, Ores, Preparations and Recrements of Metals, &c.

BISMUTH. *J. C.*	9.859
D°. *Cotes*	9.700
D°. or Tinglaſs. *Boyle.* . .	9.550

Tynglaſs,

Tynglass. *Reynolds* . . . 7.951
Marcasita alba. *Fahrenheit.* . . 9.850
Mineral, Cornish, shining like a Marcasite. *Boyle.* 9.06
Calx of Lead. *Boyle.* . . . 8.940
Spelter Solder. *J. C.* . . . 8.362
Spelter. *J. C.* . . . 7.065
Cinnabar common. *Boyle.* . . 8.020
Cinnabaris factitia. *Muschenb.* (if not a mistake for the last experiment) 8.200
Cinnabar native, breaking in polish'd surfaces like Talc. *Davies.* . . 7.710
D°. Persian, breaking rough. *Davies.* 7.600
D°. native. *Boyle.* . . . 7.576
Cinnabaris nativa. *Muschenb.* . . 7.300
Cinnabar native, very sparkling. *Boyle.* 7.060
D°. native from Guinea. *Davies.* 6.280
Cinnabar of Antimony. *Harris.* . . 7.060
D°. another piece. *Harris.* . . 7.043
D°. *Boyle.* 7.030
Cinnabar Antimonii. *Freind.* . . 6.666
Cinnabre d'Antimoine. *Muschenb.* . 6.044
Lead Ore, rich, from Cumberland. *Boyle.* 7.540
D°. *Boyle.* 7.140
The reputed Silver Ore of *Wales.* *J. C.* . 7.464
The Metal thence extracted. *J. C.* 11.087.
Regulus Antimonii. Item Martis et Veneris. *Freind.* 7.500
Id. *Fahrenheit.* . . . 6.622
Id. *Harris.* . . . 6.600
Id. per se. *Davies.* . . . 4.500
Silver Ore, choice. *Boyle.* . . 7.000

D°

D°. another piece from Saxony. *Boyle.*	4.970
Lithargyrus Argenti. *Freind.* . .	6.666
Lithargyrium Argenti. *Muſchenb.* .	6.044
Id. Auri. *Freind.* . . .	6.316
Id. Auri. *Muſchenb.* . . .	6.000
Minera Antimonii. *Davies.* . .	5.810
Cuprum calcinatum. *Freind.* . .	5.454
Glaſs of Antimony. *Newton.* *C.* .	5.280
Vitrum Antimonii. *Freind.* . .	5.000
Id. per ſe. *Boyle.* . . .	4.760
Tin Ore, choice. *Boyle.* . .	5.000
D°. black, rich. *Boyle.* . .	4.180
New Engliſh Tin Ore, Mr. Hubert's. *Boyle.*	4.080
Tutty, a piece. *Boyle.* . . .	5.000
Tutia. *Muſchenb.* . . .	4.615
Lapis Calaminaris. *Freind.* Lapis cæruleus Namurcenſis. *Muſchenb.* . .	5.000
Id. *Boyle.* . . .	4.920
Loadſtone. *Boyle* V. 6. *b.* . .	4.930
Magnes. *Petitus.* . .	4.875
A good Loadſtone. *Harris.* . .	4.750
Marcaſites, one more ſhining than ordinary. *Boyle.*	4.780
A Golden Marcaſite. *J. C.* . .	4.589
Marcaſites, from Stalbridge. *Boyle.* .	4.500
D°. *Boyle.*	4.450
Antimonium Hungaricum. *Muſchenbr.*	4.700
Antimony, good, and ſuppoſed to be Hungarian. *Boyle.*	4.070
D°. crude, which ſeemed to be very good. *Harris.*	4.058

Antimonium

Antimonium crudum. *Freind.* . .	4.000
Id. *Davies.*	3.960
Black Sand, commonly uſed on writing. *Boyle.* V. 33. *b.* . . .	4.600
Crocus Metallorum. *Muſchenb.* . .	4.500
Id. *Freind.*	4.444
Hæmatites. *Muſchenbr.* . .	4.360
Id. *Boyle.* V. 6. *a.* . . .	4.150
D°. Engliſh. *Boyle.* . . .	3.760
Copper Ore, rich. *Boyle.* . . .	4.170
D°. *Boyle.*	4.150
Copper-ſtone. *Boyle.* . .	4.090
Emeri. *Boyle.* V. 26. *b.* . .	4.000
Manganeſe. *Boyle.* . . .	3.530
A blew Slate with ſhining particles. *J. C.*	3.500
Iron Ore, a piece burnt or roaſted. *Harris.*	3.333
Ceruſſa. *Item* Chalybs cum Sulphure. pp. *Freind.*	3.158
Lapis Lazuli. *J. C.* . . .	3.054
D°. *Boyle.* V. 6. *b* . .	3.000
D°. *Boyle.*	2.980
Gold Ore. *Boyle.* V. 29. *b.* . .	2.910
D°. not rich, brought from the Eaſt Indies. *Boyle.*	2.652
Another Lump of the ſame. *Boyle.* .	2.634
A Mineral Stone, yielding 1 part in 160 Metal. *J. C.* . . .	2.650
The Metal thence extracted. *J. C.* 8.500.	
Pyrites homogenea. *Fahrenheit.* . .	2.584
Black Lead. *Boyle.* V. 27. *a.* . .	1.860
Æs viride. *Freind.*	1.714
Plumbum uſtum. *Freind.* . . .	1.666

The ſecond Table is compoſed of ſubjects no way ſtrictly allied to each other, either by their gravities, or their other eſſential properties; and perhaps they might better, on that account, have been divided into different tables.

The bodies themſelves are chiefly of an uncertain and heterogeneous nature; being ſo far as appears compoſed of different elements, and thoſe alſo combined in various proportions, ſuch as Sulphur and Arſenic, joined with Stone, Metal, and the like: and from theſe ſeveral degrees of mixture it muſt follow, that moſt of theſe kinds of bodies, tho ſo far ſimilar as to be called by the ſame names, yet muſt neceſſarily admit of a conſiderable latitude in their ſpecific gravities. Many uſeful deductions may nevertheleſs be drawn from thoſe conſiderations, relating to the comparative goodneſs &c. of ſuch bodies.

Cinnabar native appears to be a compound of Mercury and Sulphur, with a portion of earthy or ſtony matter; and that which is heavieſt muſt abound moſt with the Mercury. The different appearances which this body makes, would alſo give us a ſuſpicion that there are other varieties in its compoſition, beſides thoſe juſt taken notice of: ſome ſorts of Cinnabar, ſuch as the *Hungarian*, breaking into poliſhed planes and ſquares like Talc, whilſt others, like the *Perſian* of this table, break rough and with ſhining *granulæ* or *micæ*; and that without any conſiderable difference in their gravities.

By the factitious Cinnabar it may be determined, what proportion of Mercury will ſo incorporate with Sulphur, as to make up an uniform body.

Antimony

Antimony may in like manner be conſidered as a compoſition of its Regulus and Sulphur.

The black ſand uſed on writing is ſaid by Mr. *Boyle* to be a rich Iron Ore: he alſo ſays that Emeri, Loadſtone, and all ſuch ponderous ſtones, contain ſome kind of metal, which he had himſelf ſeparated from them. IV. 120. *a*.

The great variety of Ores of all kinds well deſerve to be accurately examined, for the ſake of the many concluſions that may be drawn from thence, concerning the natures of concrete bodies, and for many other purpoſes in Metallurgy. But I have as yet met with a very ſmall number of experiments upon theſe ſubſtances. Dr. *Woodward* has indeed mentioned a great many obſervations of this ſort which he had made, and kept exact regiſters of: but as they were probably among thoſe papers which he order'd to be deſtroy'd at his death, we muſt look upon them as now loſt to the world.

The Marcaſites and Pyrites are very uncertain and ſtrange kinds of bodies, their gravities are often very great: a Marcaſite here taken from *Fahrenheit* was found nearly to equal the heavieſt mineral Biſmuth itſelf; and yet it is very ſeldom that any Metal or ſemimetal can be obtained in any quantity from theſe ſubſtances, all that is in them being uſually deſtroyed, and carried away by their ſulphur.

Black Lead is alſo a very odd kind of Mineral, having all the appearance of a Semimetal, and yet falling ſhort even of the weight of common earth.

The Semimetals generally exceed in their ſpecific gravity even the baſer Metals themſelves.

It may be obſerved, that it appears by this table, that the ſpecific gravities of ores, including the metallic ſtones, are uſually found to lie between 7 and 3 times the weight of water. Lead and Silver ores are the heavieſt, thoſe of Copper, Tin and Iron being conſiderably lighter. The Gold Ore we have an account of muſt be ſo poor as hardly to be worth taking any notice of: but we have in general too few of theſe experiments, to draw any certain concluſions from them.

TABLE III.

Of Gems, Chryſtals, Glaſs, and tranſparent Stones.

GRANATE, Bohemian. *Boyle.* . . .	4.360
Granate. *J. C.*	3.978
Granati minera. *Boyle.*	3.100
A Pſeudo-Topazius, being a natural pellucid, brittle, hairy ſtone, of a yellow colour. *Newton. C.*	4.270
Sapphires. *Davies.*	4.090
A Sapphire very perfect, but rather pale. *Hauksbee.*	4.068
Glaſs, blue in ſticks from Mr. Scale. *Hauksbee.*	3.885
D°. whiteſt, from Mr. Scale. *Hauksbee.*	3.380
D°. clear chryſtal. *Cotes.* . .	3.150
D°. blue plate, old. *Hauksbee.* .	3.102
D°. plate. *L.* .	2.942

D°

Do. old looking-glaſs plate of a light colour. *Hauksbee.* . .	2.888
Do. green. *Freind.* . . .	2.857
Do. green bottle. *Hauksbee.* . .	2.746
Do. of a bottle. *Oxf. Soc.* It. a blue paſte. *Hauksbee.* . . .	2.666
Do. common green. *Hauksbee.* . .	2.620
Do. deep green old. *Hauksbee.* .	2.587
Do. vulgar. *Newton. Ward.* . .	2.580
Vitrum Venetum. *Freind.* . .	1.791
An oriental Cat's-Eye, very perfect. *Hauksb.*	3.703
A Diamond, yellow, of a fine water, ſomewhat paler than the jonquille. *Hauksbee.*	3.666
D°. white of the ſecond water. eau celeſte. *Hauksbee.*	3.540
D°. Eaſt Indian, the heavieſt of many. *Ellicot.*	3.525
D°. the lighteſt of many. *Ellicot.* .	3.512
D°. Braſilian, the heavieſt of many. *Ellicot.*	3.521
D°. the lighteſt of many. *Ellicot.* .	3.501
D°. the mean of all his experiments. *Ellic.*	3.517
D°. *Newton. C.*	3.400
Diamond Bort, of a bluiſh black, with ſome little adhering foulneſs. *Hauksbee.*	3.495
A Jacinth of a fine colour, but ſomewhat foul. *Hauksbee.*	3.637
A Chryſolite. *Hauksbee.*	3.360
Chryſtal cubic, ſuppoſed to contain lead. *Woodward.*	3.100
Chryſtal from Caſtleton in Derbyſhire, having the double refraction. *Hauksbee.*	2.724
Chryſtal of Iſland. *Newton. C.* . . .	2.720

Chryſtallum diſdiaclaſticum. *J. C.*	2.704
Chryſtallus de Rupe. *Fahrenheit.*	2.669
Chryſtal rock. *J. C.* *Boyle* III. 229. *b.*	2.659
D°. a large ſhoot. *Hauksbee.*	2.658
D°. of the rock. *Newton.* C. Ir.	
Chryſtal in the lead-mines near Works-worth. *Woodward.*	2.650
D°. *Hauksbee.*	2.646
D°. pure pyramidal, ſuppoſed to contain Tin. *Woodward.* 2. 5 or	2.400
Chryſtallus. *Petitus.*	2.287
Chryſtal. *Boyle.*	2.210
Talc, Jamaican. *Boyle.*	3.000
D°. Venetian. *Boyle.*	2.730
D°. *J. C.*	2.657
D°. Engliſh. *Woodward.*	2.600
D°. a piece like Lapis Amianthus. *Boyle.*	2.280
A red paſte. *J. C.*	2.842
A Braſile pebble, foul and feather'd. *Hauksb.*	2.755
D°. a fragment uncut. *Hauksbee.*	2.676
D°. cut. *Hauksbee.*	2.591
Jaſper, ſpurious. *J. C.*	2.666
A Corniſh Diamond cut. *Hauksbee*s	2.658
A Water Topaz, very perfect, but ſaid not to be Oriental. *Hauksbee.*	2.653
Pebble pellucid. *J. C.*	2.641
Briſtol Stone. *Davies.*	2.640
Hyacinth, ſpurious. *J. C.*	2.631
Selenites. *J. C.*	2.322
D°. *Newton.*	2.252

As the mean gravity of Chryſtal appears, by the foregoing table, to be little more to that of water than

than as two and a half to one; it may well be ſuſpected, that the Granate, Pſeudo-Topazius, Sapphire, and ſuch other Gemms which greatly exceed Chryſtal in weight, do contain a conſiderable portion of ſome ſort of Metal in their compoſition: as was obſerved of theſe bodies by Dr. *Woodward*, in his Method of Foſſils, p. 24.

As to the white Sapphire, which is reputed by Dr. *Woodward* to be a ſpecies of Gemm intermediate between Chryſtals and the Diamond in hardneſs, I have not yet obtained any good account of its ſpecific gravity.

The weight of the Diamond is aſcertained in No. 476. of the *Philoſophical Tranſactions*, where it appears, that by experiments made with the greateſt care, by Mr. *John Ellicot* F. R. S. with moſt exact inſtruments, and upon 14 different Diamonds, ſome of them very large, brought from different places, and having the greateſt varieties of colour and ſhape poſſible; they were all found to agree in weight to a ſurpriſing degree of accuracy, being all ſomewhat above three times and a half the weight of common water.

This indeed differs very ſenſibly from what had been found in ſome former experiments, but it is hardly probable that thoſe had been made upon Diamonds of ſo large a ſize as theſe: Mr. *Boyle* who found their weight leſs than 3 times that of common water, has himſelf told us in the ſame place, V. 83. *b*. that the ſtone he made uſe of only weighed about 8 grains. And tho no doubt can be made of the exactneſs of Sir *Iſaac Newton*'s experiment,

riment, by which alſo the ſpecific weight of the Diamond came out leſs than Mr. *Ellicot's*, yet it may well be queſtion'd, whether Sir *Iſaac* had, at the time when he made his trials, either ſo many or ſo perfect and weighty ſtones, as a favourable opportunity offered to this laſt gentleman. I ſhall therefore only obſerve, that, admitting this laſt to be the true ſpecific weight of the Diamond, the refractive power of the ſame, in proportion to its denſity, ſhould in Sir *Iſaac Newton's* table be leſſened from 14556 to 14071; which would ſtill be greater than what is found in any other body; but is upon the whole more conformable to the general law of that table.

Sir *Iſaac Newton* conjectured a Diamond to be an unctuous ſubſtance coagulated, and found it to have its refractive power nearly in the ſame proportion to its denſity as thoſe of Camphire, Oyl-Olive, Lintſeed Oyl, Spirit of Turpentine and Amber, which are fat ſulphureous unctuous bodies: all which have their refractive powers two or three times greater in reſpect to their denſities than the refractive powers of other ſubſtances in reſpect of theirs. Yet muſt it be allowed that a Diamond ſuffers no change by heat in any degree, contrary to the known property of Sulphurs; and as it is moſt reaſonable in our Philoſophy to treat ſuch bodies as ſimple, in which we are not able to produce any change or ſeparation of parts, we muſt therefore on that account conſider a Diamond as a ſimple body and of the Chryſtalline kind.

Glaſs, which is a factitious concrete of Sand and Alkaline Salt, is nearly found to aſſume the mean gravity of Stones and Chryſtals.

If,

If there is no miſtake in the gravity of what Dr. *Freind* calls *Vitrum Venetum*, it differs very remarkably from all other kinds of Glaſs.

I do not know whether the Jaſper and Hyacinth ſpurious of *J.C.* are to be underſtood as natural or artificial Gemms.

TABLE IV.

Of Stones and Earths.

Sardachates. *J. C.*	3.598
Lapis ſciſſilis cæruleus. *Muſchenbr.* (qu. if not the ſame experiment mentioned before pag. 447. *a blew ſlate with ſhining particles. J. C.*)	3.500
Cornelian. *Boyle.*	3.290
D^o. *J. C.*	2.563
A Hone. *J. C.*	3.288
D^o. to ſet razors on. *Harris.*	2.960
Marmor. *Petitus.* (probably ſome miſtake in the experiment.) 3.937.	
Marble. *Reynolds.*	3.026
D^o. white. *Hauksbee.*	2.765
D^o. white Italian, of a cloſe texture viſibly.	2.718
D^o. white. *Boyle.* fine. *Ward. C.*	2.710
D^o. white Italian, tried twice. *Oxford Soc.*	2.707
D^o. black Italian. *Oxford. Soc.* veined. *L.*	2.704
D^o. black. *Hauksbee,*	2.683
D^o. Parian. *L.*	2.560
Lapis Amianthus, from Wales. *J. C.*	2.913
Turquoiſe, one of the old rock, very perfect. *Hauksbee.*	2.908
Turcoiſe Stone. *J. C.*	2.508

Lapis Nephriticus. *J. C.* . . .	2.894
Corallium rubrum. *Freind.* . .	2.857
Corall. *J. C.*	2.689
D°. red. *Boyle* V. 7. *a.* . . .	2.680
D°. *Boyle.*	2.630
D°. white, a fine piece. *Boyle.* .	2.570
D°. white, another piece. *Boyle.* .	2.540
Emeril Stone, a solid piece. *Hauksbee.* .	2.766
Paving Stone. *Reynolds.* . .	2.708
D°. a hard sort from about Blaiden. *Oxf. Soc.* . . .	2.460
A Whetstone, not fine, such as cutlers use. *Harris.*	2.740
Pellets, vulgarly called Alleys, which boys play withal. *Hauksbee.* . .	2.711
English Pebble. *L.* . . .	2.696
Lapis Judaicus. *Boyle.* . .	2.690
Id. *Freind.* . . .	2.500
Maidstone Rubble. *L.* . .	2.666
Marbles, vulgarly so called, which boys play withal. *Hauksbee.* . .	2.658
Morr Stone. *L.* . . .	2.656
Agate. *Boyle.* . . .	2.640
D°. German, for the lock of a gun. *Hauksbee.* . . .	2.628
D°. English. *J. C.* . . ,	2.512
Lapis, *Petitus.*	2.625
Flint, black, from the Thames. *Hauksbee.*	2.623
Flint Stone. *L.* . . .	2.621
A round pebble-stone within a flint. *Harris.* . . .	2.610
East Indian blackish. Item, an English one. *Boyle.* III. 243. *a.* . .	2.600

D°.

Do. *Oxford Soc.* . . .	2.542
Corallachates. *J. C.* . . .	2.605
Purbeck Stone. *L.* . .	2.601
Freeſtone. *Reynolds.* . .	2.584
Portland Stone. *L.* . .	2.570
Do. white for carving. *L.* .	2.312
Grammatias Lapis. *J. C.* . .	2.515
Onyx Stone. *J. C.* . . .	2.510
Slate Iriſh. *Boyle.* Lapis Hibernicus. *Davies.* . . .	2.490
Wood petrified in Lough Neagh. *J. C.*	2.341
Oſteocolla. *Boyle.* . . .	2.240
Heddington Stone. *L.* . .	2.204
Allom Stone. *Boyle.* . . .	2.180
Bolus Armena. *Freind.* . .	2.137
Hatton Stone. *L.* . . .	2.056
Burford Stone, an old dry piece. *Oxford Soc.* . . .	2.049
Heddington Stone, that of the ſoft lax kind. *Oxford Soc.* . .	2.029
Terra Lemnia. *Freind.* . .	2.000
Brick. *Cotes.* . .	2.000
Do. *Oxford Soc.* . .	1.979
A Gallypot. *J. C.* . .	1.928
Alabaſter. *Ward. C.* . :	1.874
Do. *Oxford Soc.* . .	1.872
A ſpotted factitious Marble. *J. C.* .	1.822
Stone Bottle. *Oxford Soc.* . .	1.777
A piece of a glaſs (perhaps glazed) coffee-diſh of a brown colour. *Harris.* .	1.766
Barrel Clay. *L.* . .	1.712
Lapis de Goa. *Davies.* . .	1.710
Lapis ruffus Bremenſis. *Muſchenb.* .	1.666

An Icicle broken from a Grotto (I suppose Stalactites) *Dr. Slare*, in *Harris*.	1.190
Chalk, as found by Dr. *Slare*. *Harris*.	1.079

The mean gravity of Stone appears to be to that of water as about two and a half to one, and many stones of great hardness, such as the Onyx, Turquoise, Agat, Marble, Flint *&c.* do not much exceed that weight. It may therefore well be doubted whether such Stones whose specific gravity comes up to near three times that of water, or even beyond it, owe their density to metalline additions; or whether they are really formed of a different species of matter, as the Diamond seems to be.

Coral by its density appears to be a stone, tho in a vegetating state: or it may possibly from some late observations, be of an animal nature.

What is called *Lapis Hibernicus,* is a soft stone containing Vitriol.

We have not many observations upon Earths: by those we have, it seems probable that they contain the same kind of matter in a lax form, of which Stones are a more solid and denser concretion.

Lapis de Goa is but a trifling composition, perhaps hardly worth retaining in the tables.

What species of body should *Alabaster* be accounted? which with a stone-like hardness, yet falls so much below other Stones, or even Earths, in gravity.

TABLE

TABLE V.

Of Sulphurs and Bitumens.

SULPHUR. *Petitus.* . .	2.344
D°. a piece of roll. *Hauksbee.* .	2.010
D°. vive. *Boyle.* . .	2.000
D°. German, very fine. *Boyle.* .	1.980
D°. transparent, Persian. *Davies.* .	1.950
Sulphur mineralis. *Freind.* . .	1.875
Brimstone, such as is commonly sold. *J. C.* . .	1.811
D°. *Cotes.* . .	1.800
Asphaltum. *Boyle.* III. 243. *a.* . .	1.400
Scotch Coal. *Boyle.* III. 243. *a.* . .	1.300
Coal, of Newcastle. *L.* . .	1.270
D°. Pit, of Staffordshire. *Oxford Soc.*	1.240
Jet. *J. C.* . . .	1.238
D°. *Davies.* . . .	1.160
D°. *Davies.* . . .	1.020
Succinum citrinum. *Davies.* . .	1.110
Id. pingue. *J. C.* . .	1.087
Id. flavum (by 2 experiments). *Davies.*	1.080
Id. pellucidum. *J. C.* . .	1.065
Id. album, item pingue. *Davies.* .	1.060
Amber. *Boyle. Newton. C.* .	1.040
Fine Gunpowder. *Reynolds.* . .	0.698

Sulphur is in gravity very nearly the same as Earth, so that its purity can hardly be ascertained by its weight, unless the matter it is associated with is of a stony density.

The

The ſemidiaphanous *Sulphur* is a beautiful kind which I have but ſeldom ſeen: it is in lumps of the ſize of a ſmall bean.

Coal, the ſorts here taken notice of are conſiderably lighter than *Sulphur*: but there are many other kinds, and of different weights.

I take the *Gagates* or *Jet* to differ very little from the *Channel Coal*.

The different ſorts of *Amber* may be obſerved not to differ conſiderably in their ſeveral gravities.

Sulphurs ſeem to be the lighteſt of all mineral bodies.

TABLE VI.

Of Gums, Reſins, &c.

GUM Arabic. *Freind.* . .	1.430
D°. *Newton. C.* . .	1.375
Opium. *Freind.* . .	1.360
Gum Tragacanth. *Freind.* . .	1.330
Myrrh. *Freind.* . . .	1.250
Gum Guaiac. *Freind.* . . .	1.224
Reſina Scammonii. *Freind.* . .	1.200
Aloes. *J. C.* (qu. whether the reſin or the wood). . .	1.177
Aſa fœtida, a very fine ſample. *Hauksbee.*	1.251
D°. from *Dr. John Keill's Introd. ad veram Phyſicam.* . .	1.143
Pitch. *Oxford Soc. C.* . . .	1.150
Thus. *Freind.* . . .	1.071
Camphire. *Newton. C.* . .	0.996
Bees-wax. *Cotes.* . .	0.955

Cera.

Cera. *Ghetaldus.* (ad aquam ut $95\frac{5}{11}$ ad 100).	0.954
Wax well freed from the honey. *Davies.*	0.938
Cera. *Petitus.* . . .	0.937
D°. the fame lump 2 years after. *Davies.*	0.942
Balfamus de Tolu. *Mufschenbr.* .	0.896
Maftic. *J. C.* (qu. whether the gum or the wood). . .	0.849

The bees wax in my own experiments was well freed from honey, by the boyling it in water, which probably made it lighter than it was fet down in Mr. *Cotes's* Table: and the fecond experiment which I made two years after the firft, if the difference was not owing to the difference of heat, is an inftance of what I take to be a pretty general truth, that bodies become more denfe and compact by reft, and that they would alfo be found heavier in the fcale, in thofe cafes where they do not lofe weight by the evaporation of humidity.

The weights of vegetable Gums nearly correfpond with thofe of the ligneous parts.

TABLE VII.

Of Woods, Barks &c.

COCO Shell. *Boyle.* . .	1.345
Bois de Gayac. *Mufschenbr.* . .	1.337
Lignum Guaiacum. *Freind.* . .	1.333
Lignum Vitæ. *Oxf. Soc.* . .	1.327
Speckled Wood of Virginia. *Oxf. Soc.* .	1.313
Cortex Guaiaci. *Freind.* . .	1.250

Lignum

Lignum Nephriticum. *Freind.*	1.200
Lignum Aſphaltum. *J. C.*	1.179
Ebony. *J. C. Item* Aloes. *J. C.*	1.177
Santalum rubrum. *J. C.*	1.128
Id. album. *J. C.*	1.041
Id. Citrinum. *J. C.*	0.809
Lignum Rhodium. *J. C.*	1.125
Radix Chinæ. *Freind.*	1.071
Dry Mahogany. *L.*	1.063
Gallæ. *Freind.*	1.034
Red wood. *Oxf. Soc.* It. Box wood. *Oxf. Soc. Ward. C.*	1.031
Log wood. *Oxf. Soc.*	0.913
Oak, dry, but of a very ſound cloſe texture. *Oxf. Soc.*	0.932
D°. tried another time. *Oxf. Soc.*	0.929
D°. ſound dry. *Ward.*	0.927
D°. dry. *Cotes.*	0.925
D°. dry, Engliſh. *L.*	0.905
Oak of the outſide ſappy part, fell'd a year ſince. *Oxf. Soc.*	0.870
D°. *Reynolds.*	0.801
D°. very dry, almoſt worm-eaten. *Oxf. Soc.*	0.753
Dry Wainſcot. *L.*	0.747
Beech meanly dry. *Oxf. Soc.*	0.854
Maſtic (qu. if the wood or gum). *J. C.*	0.849
Aſh dry about the heart. *Oxf. Soc.*	0.845
D°. dry. *Cotes.*	0.800
D°. meanly dry, and of the outſide lax part of the tree. *Oxf. Soc.*	0.734
Elm dry. *L.*	0.800
D°. *Reynolds.*	0.768

D°.

D°. *Oxf. Soc. C.* . . .	0.600
Rad. Gentianæ. *Freind.* . . .	0.300
Cortex Peruvianus. *Freind.* . .	0.734
Crabtree meanly dry. *Oxf. Soc.* .	0.765
Yew, of a knot or root 16 years old. *Oxf. Soc.*	0.760
Maple dry. *Oxf. Soc. C.* . .	0.755
Plumtree dry. *J. C.* . . .	0.663
Fir, dry yellow. *L.* . . .	0.657
Dry white Deal. *L.* . . .	0.569
Lignum Abietin. *Freind.* . .	0.555
Fir dry. *Cotes.*	0.550
D°. *Oxf. Soc.* . . .	0.546
Walnut tree dry. *Oxf. Soc.* . .	0.631
Cedar dry. *Oxf. Soc.* . . .	0.613
Juniper wood dry. *J. C.* . .	0.556
Saſſafras wood. *J. C.* . . .	0.482
Cork. *Cotes.*	0.240
D°. *J. C.*	0.237

Dr. *Jurin* has obſerved in the *Phil. Tranſ.* N°. 369. that the ſubſtance of all wood is ſpecifically heavier than water, ſo as to ſink in it, after the air is extracted from the pores and air-veſſels of the wood, by placing it in warm water under the receiver of an air-pump; or if an air-pump cannot be had, by letting the wood continue ſome time in boiling water over a fire. The ſeveral weights therefore above given muſt be looked upon as the weights of the concrete bodies, in the condition they were, before the Air was either forcibly got out, or the water driven into the ſmall hollows: and both theſe conſiderations may have their uſe as notwithſtanding that the ſpecific weights of the ſolid particles are truly heavier than water, we ſhall from the weights of the bodies as they are now compounded, be enabled to make ſome judgment of their poroſity, ſo far as they may be penetrable by water or other fluids.

TABLE VIII.

Of Animal Parts.

MANATI Lapis. *Boyle.* . .	2.860
D°. another. *Boyle.* . . .	2.330
D°. a fragment of. *Boyle.* . .	2.290
D°. *J. C.* another from Jamaica. *Boyle.*	2.270
Pearl, very fine Seed, oriental. *Boyle.* V. 12. *a.*	2.750
D°. a large one, weighing 206 grains. *Boyle* V. 7. *b.* . . .	2.510
Murex Shell. *J. C.* . . .	2.590
Crabs Eyes artificial. *Boyle.* . .	2.480
D°. native. *Boyle.* . . .	1.890
Os ovinum recens. *Freind.* . .	2.222
Oyſter Shell. *J. C.* . . .	2.092
Calculus humanus, juſt voided. *Davies.*	2.000
D°. *Boyle.* V. 7. *b.* . . .	1.760
D°. *Boyle.*	1.720
D°. *Cotes.*	1.700
D°. *Boyle.* V. 7. *b.* . .	1.690
D°. *J. C.*	1.664
D°. *Davies.*	1.650
D°. *Boyle.*	1.470

D°.

D°. *J. C.*	1.433
D°. *Davies.* . . .	1.330
D°. *J. C.*	1.240
Rhinoceros Horn. *Boyle.* . . .	1.990
The top part of one. *J. C.* . .	1.242
Ebur. *Freind.*	1.935
Ivory. *Boyle.* . . .	1.917
D°. dry. *Oxford Soc. C.* . .	1.826
D°. *Ward.*	1.823
Unicorn's Horn, a piece. *Boyle.* . .	1.910
Cornu Cervi. *Freind.* . . .	1.875
Ox's Horn, the top part of one. *J. C.* .	1.840
Blade bone of an Ox. *J. C.* . .	1.656
A ſtone of the Bezoar kind found with four others in the inteſtines of a mare. *Edw. Bailey M. D.* of *Havant* in *Hampſhire.* See Philoſoph. Tranſact. N°. 481.	1.700
Bezoar ſtone. *Boyle.* . . .	1.640
D°. a large one. *Davies.* . .	1.570
D°. being the kernel of another. *Boyle.* V. 8. *a.*	1.550
D°. a fine oriental one. *Boyle.* .	1.530
D°. two weigh'd ſeparately. *Davies.* .	1.504
D°. *Cotes.*	1.500
D°. *Boyle.*	1.480
D°. *Boyle.*	1.340
A ſtone from the Gall-bladder. *Hales.* .	1.220
Blood human, the globules of it. *Jurin by calculation.*	1.126
D°. the Craſſamentum of. *Jurin from Experiments.* . .	1.086
D°. *Davies.* . . .	1.084

Do. from another Experiment. *Jurin.*		1.082
Sanguinis humani cuticula alba. *Davies.*		1.056
Human blood when grown cold. *Jurin.*		1.055
The ſame as running immediately from the vein. *Jurin.*	. . .	1.053
The ſerum of human blood. *Jurin.*	.	1.030
Do. *Davies.*	. . . .	1.026
Ichthyocolla. *Freind.*	. . .	1.111
A Hen's Egg. *Davies.*	. . . .	1.090
Milk. *J. C. C.*	. . . .	1.031
Lac caprinum. *Muſschenbr.*	. .	1.009
Lac. *Freind.*	. . . . . .	0.960
Urine. *J. C. C.*	. . .	1.030
Id. *Freind.*	. . .	1.012

Manati Lapis is ſaid to be a ſtone, found in the head of the Manatee, or Sea-Cow of the *Weſt-Indies.* See *Ray's Synopſis methodica Animalium Quadrupedum &c. Lond.* 1693. 8o. Theſe Stones and Pearls are the heavieſt of all the animal productions we are acquainted with.

Dr. *Jurin* has obſerved, *Phil. Tranſ.* No. 369. that, in examining freſh Human *Calculi* whilſt they were ſtill impregnated with Urine, he had met ſuch as exceeded the weight of ſome ſorts of burnt earthen ware and alabaſter, and approached very near to that of brick, and the ſofter ſort of paving ſtone; which I have myſelf alſo found to be true. Whereas thoſe who have made their experiments upon ſuch *Calculi*, as had moſt probably been a conſiderable time taken out of the bladder, and had conſequently loſt much of their weight, by the evaporation of the urine, with which they had at firſt

firſt been ſaturated, have found thoſe Stones commonly to have been but about one half part, and ſome of them no more than a fourth part, heavier than an equal bulk of Water. From whence it has been too haſtily concluded, that theſe Stones have very improperly been called by that name, as not at all approaching to the Specific Gravity of even the lighteſt real ſtones that we have any account of.

The *Calculus Humanus* and *Animal Bezoar* approach nearly to each other in their Specific Gravity.

Mr. *Boyle* has taken notice of the great difference to be found between the gravity of the true and the factitious Crabs-eyes. It is ſtrange that the factitious ſhould be made of ſuch materials as can bring them ſo near to the mean gravity of true ſtones: and this conſideration may deſerve the attention of thoſe, who may think that any praticular dependence is to be had upon the uſe of theſe bodies in medicine.

Dr. *Jurin* was the firſt who carefully examined the Specific Gravities of the different parts which compoſe Human Blood; and his experiments were performed with the greateſt accuracy. It may be obſerved, that the Blood is, by an eaſy *analyſis* divided into *Serum* and *Craſſamentum*; and the *Craſſamentum* again into the Glutinous and the Red globular parts, whoſe Specific Gravities are the greateſt. It had before theſe experiments been the general received opinion, that the globules of the Blood were lighter than the Serum; and this indeed ſeemed to follow from Mr. *Boyle*'s Experiments in his Natural Hiſtory of *Human Blood*; from which he deduced the Specific Gravity of the maſs itſelf, to be to that of Water as 1040 to 1000, and that of the Serum alone to be to the ſame as 1190. And theſe numbers 1040 and 1190 had accordingly, till Dr. *Jurin* re-examined the affair, been conſtantly taken to repreſent the true gravities of Human Blood and its Serum reſpectively. See Dr. *Jurin*'s *diſſertation* in *Phil. Tranſ.* N°. 361.

Milk is made by Dr. *Freind* to fall more ſhort of the Gravity of Water, than it is made to exceed the ſame by *J. C.* Poſſibly this difference might ariſe from the Milk's being taken in one caſe warm from the cow, and in the other after it had ſtood ſome time.

TABLE IX.

Of Salts.

MERCURIUS dulcis bis ſublim. *Muſsch.*	12.353
Mercurius dulcis. *Freind.* . .	11.715
Id. ter ſublim. *Muſschenbr.* . .	9.882
Id. tertio ſublim. Item Panacea rubra. *Freind.*	9.372
Id. quater ſublim. *Muſschenbr.* Item Turpethum minerale. . .	8.235
Id. 4*to* ſublim. Item Turpeth mineral. *Freind.*	7.810
Sublimat. corroſiv. *Muſschenbr.* .	8.000
Id. *Freind.*	6.045
Cinis clavellatus, ſordibus ſaleque ſuo neutro quodam (quod fere ſemper magis vel minus in cinere illo reperitur) depurgatus. *Fahrenheit.*	3.112
Sal illud neutrum. *Fahrenheit.* .	2.642

Saccharum Saturni. Item ſal Nitri fix. *Muſschenbr.*	2.745
Eadem. *Freind.*	2.600
Magiſterium Coralli. Item Pulvis ſympatheticus. *Freind.*	2.231
Tartarum vitriolatum. *Muſschenbr.*	2.298
Id. *Freind.*	2.186
Sal mirabile Glauberi. *Muſschenbr.*	2.246
Id. *Freind.*	2.132
Tartarum emeticum. *Muſschenbr.*	2.246
Id. *Freind.*	2.077
Sal Gemmæ. *Newton. C.*	2.143
Nitrum. *Fahrenheit.*	2.150
Nitre. *Newton. C.*	1.900
Id. *Freind.*	1.671
Sal Guaiaci. Item Sal enixum. Item Sal prunellæ. Item S. Polychreſt. *Muſsch.*	2.148
Eadem omnia. *Freind.*	2.030
Sal maritimum. *Fahrenheit.*	2.125
Cremor Tartari. Item Vitriol. alb. Item Vitriol. rubefact. Item S. Vitriol. *Muſsch.*	1.900
Cremor Tart. Item Vitriol. alb. *Freind.*	1.796
Vitriol Engliſh, a very fine piece. *Boyle.*	1.880
D°. Dantzick. *Newton. C.*	1.715
Alumen. *Fahrenheit.*	1.738
Alum. *Newton.*	1.714
Sal chalybis. *Freind.*	1.733
Borax. *J. C.*	1.720
D°. *Newton. C.*	1.714
Vitriolum viride. Item Calcanth. rubefact. Item S. Vitriol. alb. *Freind.*	1.671
Saccharum albiſs. *Fahrenheit.*	$1.606\frac{1}{2}$
Mel. *Villalpandus.*	1.500
Id. *Ghetaldus* $1\frac{9}{20}$. Honey, *Cotes.*	1.450

Sal

Sal volatile Cornu Cervi. *Muſschenb.* . .	1.496
Id. *Freind.*	1.421
Sal Ammoniac. purum. Item Ens Martis ſemel ſublimat. *Muſschenb.* . .	1.453
Eadem. *Freind.* . . .	1.374
Ens Martis ter ſublimat. *Muſschenb.* .	1.269
Id. *Freind.*	1.233

Moſt of the experiments in the ninth table are taken from Dr. *Freind,* who weigh'd the Salts in Spirits of Wine, and regiſter'd the proportional gravity of the Salts to the Spirits. But the misfortune is, that the gravity of the Spirits of Wine he made uſe of is not regiſter'd: ſo that the experiments cannot with certainty be reduced to the common ſtandard of Water. He has deliver'd the gravity of Spirits of Wine to be 0.818, and that of Spirits of Wine rectified to be 0.78. I have ſuppoſed the Salts to be weighed in the laſt, as being the fitteſt for the purpoſe: but which he really uſed can only be conjectured.

There appears indeed to be a way to diſcover the weight of the Spirits of Wine, in which Dr. *Freind* weighed his Salts: for he weighed 60 Grains of Mercury, both in Water and in Spirits of Wine, and the loſs of its weight was reſpectively $4\frac{1}{4}$ Grains and $2\frac{2}{3}$. Now the gravities of theſe Fluids muſt be in the ſame proportion, and this would give for the weight of the Spirits of Wine 0.627, which is much too little for the weight of his own rectified Spirits tho even that is leſs than what is aſſigned by any other author. So that, upon the whole, nothing can really be concluded from this experiment; and it

muſt

must be allowed besides, that 60 Grains of Mercury take up too small a bulk in these Fluids, to have their gravities determined with any exactness thereby.

As Professor *Muschenbroek* has given in his table the specific weights of many of the same salts which are mentioned by Dr. *Freind*, but which differ considerably from the weights above set down, as resulting from the Doctor's experiments, I have also transcribed the Professor's numbers from his own table. These do not however appear to me to be derived from new or differing experiments, but from the very same related by Dr. *Freind*, only computed from the supposition of a heavier sort of Spirits of Wine, whose specific gravity is supposed to have been 0.823. The gravity of the *Sublimate corrosive*, set down 8.000, I take to be a mistake, made by the writing down its comparative weight to that of the Spirits themselves, instead of the water to which it should have been referred.

It requires great care and attention to take the Specific Gravities of Salts with sufficient accuracy. They dissolve in Water, and in some degree in all Fluids that partake of the nature of Water. If therefore Spirits of Wine are made use of for this purpose, they ought to be highly rectified, their own gravity accurately ascertained, and their degree of heat should be preserved uniform. For as this Fluid rarefies much faster than Water does, a small difference of heat would sensibly affect the gravities of the Salts to be determined by it. And perhaps Spirit of Turpentine were a more proper Fluid to be employed on these occasions.

It is remarkable, that *Tartar vitriolat. Sal Gem. Sal mirabile, Sal maritimum, Nitre, &c.* being Salts composed of different Acids and an Alkaline Salt, should so far exceed in gravity the Vitriolic Salts, composed of the most heavy Acid and a metallic Earth. Is not this owing to its forming less solid Chrystals, and to its containing large quantities of Air concealed in its Pores?

The great difference in the weight of the *Nitre*, in the several experiments of *Fahrenheit, Newton,* and *Freind*, may possibly be owing to the quantity of its concealed Air.

TAB. X.

Of Fluids.

MERCURY. *Ward. C.* (See Tab. I. among the Metals.)	14.000
Oleum Vitrioli. *Fahrenheit.* . .	1.8775*
Oyl of Vitriol. *Newton* C .	1.700
Spiritus Nitri Hermeticus. *Freind.* .	1.760
Id. *Muschenb.*	1.610
Lixivium cineris clavellati, sale quantum fieri potuit impregnatum. *Fahrenheit.*	1.5713*
Id. alio tempore præparatum. *Fahrenh.*	1.5634*
Oil of Tartar. *Cotes.* Ol. Tartari per deliquium. *Muschenb.* . . .	1.550
Spiritus Nitri, cum Ol. Vitrioli. *Freind.*	1.440
Id. *Muschenb.*	1.338
Spiritus Nitri communis. Item, Bezoardicus. *Freind.* . . .	1.410

Spirit

Spirit of Nitre. *Cotes.* Item Sp. Nit. Bezoardicus. *Muſchenb.* . .	1.315
Sp. Nitri. *Fahrenheit.* . .	1.2935*
Sp. Nitri dulcis. *Muſchenb.* . .	1.000
Aqua fortis melioris notæ. *Fahrenheit.*	1.409*
Eadem, duplex. *Freind.* . .	1.340
Aqua fortis. *Cotes.* . . .	1.300
Eadem, ſimplex. *Freind* . .	1.100
Solutio ſalis comm. in aqua ſaturata. *Davies.*	1.244
Eadem, 1 in aquæ 2,7 part. ponderis. *Davies.*	1.240
Eadem 1 in aquæ 3 part. *Davies.*	1.217
Eadem, 1 in aquæ 3 part. *Freind.* .	1.146
Eadem, 1 in aquæ 12 part. *Davies.*	1.060
Soap Lees the ſtrongeſt. *Jurin.* .	1.200
D°. Capital. *Jurin.* . . .	1.167
Spirit of Vitriol. *Freind.* . .	1.200
Spiritus Salis cum Ol. Vitriol. *Muſchenb.*	1.154
Idem, &c. *Freind.* . .	1.146
Spirit of Salt. *Cotes.* Sp. Salis marini. *Muſchenb.* . . .	1.130
Sp. Salis communis. *Freind.* . .	1.037
Sp. Salis dulcis. *Muſch.* . .	0.951
Id. *Freind.*	0.890
Sp. Salis Ammoniaci ſuccinat. Item, cum ciner. clavellat. *Freind.* . .	1.120
Sp. Salis Ammoniac. cum calce. *Muſch.*	0.952
Idem cum calce viva. *Freind.* .	0.890
Sp. Cornu Cervi non rectific. *Freind.* .	1.073
Sp. Serici. *Muſchenb.* . . .	1.145
Sp. Urinæ. *Cotes.*	1.120
Solutio Salis enixi, 1 in aquæ 5 part. *Freind.*	1.100

Oleum Sassafras. *Musschenb.* . .	1.094
Decoctio Gentianæ. *Freind.* . .	1.080
Sp. Tartari. *Freind. Musschenb.* .	1.073
Decoctio Bistortæ. *Freind.* . .	1.073
Decoctio Sarzæ. It. Chinæ. *Freind.*	1.049
Decoctio Ari. It. Sp. Salis comm. *Freind.*	1.037
Oleum Cinnamomi. *Musschenb.* . .	1.035
Ol. Caryophyllorum. *Musschenb.* .	1.034
Beer-Vinegar. *Oxf. Soc.* . .	1.034
Acetum Vini. *Musschenb.* . .	1.011
Id. distillatum. *Musschenb.* . .	0.994
Acetum. *Freind.* . . .	0.976
Sack. *Oxf. Soc.* . . .	1.033
Sp. Ambræ. *Musschenb.* . . .	1.031
Sea-Water. *Cotes.* . . .	1.030
D°. settled clear. *Oxf. Soc. Ward.* .	1.027
College plain Ale. *Oxf. Soc.* . .	1.028
Solutio Aluminis, 1 in aquæ 5.33 part. Item Solutio Sal. Amm. purif. 1, et vitriol. alb. 1, in aquæ 5 part. *Freind.*	1.024
Laudanum liquidum Sydenhami. It. Panacea Opii. *Freind.* . . .	1.024
Decoctio Cort. Peruv. Item, Granatorum. *Freind.*	1.024
Moil Cyder, not clear. *Oxf. Soc.* .	1.017
Aqua fluviatilis. *Musschenb.* . .	1.009
Tinctura Aloes cum aqua. Item, Decoctio Santali rubri. *Freind.* . . .	1.000
Rain Water. *Newton, Reynolds.* Common Water. *Cotes.* Common clear Water. *Ward.* Pump Water. *Oxf. Soc. J. C.* Aqua. *Ghetaldus.* Aqua pluviatilis. *Fahrenheit, Musschenb. &c.* . .	1.000

Aqua

Aqua vel Vinum. *Villalpandus.* .	1.000
Aqua putealis. *Muſschenb.* . .	0.999
Oleum Fœniculi. *Muſschenb.* . .	0.997
Oleum Anethi. *Muſschenb.* . .	0.994
Aqua diſtillata. *Muſschenb.* . .	0.993
Wine, Claret. *Oxf. Soc.* . .	0.993
D°. red. *Ward.* . . .	0.992
Vinum. *Petitus.* . . .	0.984
Id. *Ghetaldus.* (ad aquam ut $98\frac{1}{3}$ ad 100.)	0.983
Id. Burgundicum. *Muſschenb.* .	0.953
Oleum Sabinæ. It. Hyſſopi. *Muſschenb.*	0.986
Ol. Ambræ. It. Pulegii. *Muſschenb.* .	0.978
Ol. Menthæ. It. Cumini. *Muſschenb.* .	0.975
Decoctio Sabinæ. *Freind.* . .	0.960
Infuſio Marrhubii. It. Menthæ. It. Abſynth. *Freind.*	0.950
Ol. Nucis Moſchatæ. *Muſschenb.* .	0.948
Ol. Tanaceti. *Muſschenb.* . .	0.946
Ol. Origani. It. Carvi. *Muſschenb.* .	0.940
Elixir Propr. cum Sale volat. It. Infuſio Theæ. *Freind.* . . .	0.940
Ol. Spicæ. *Muſschenb.* . .	0.936
Ol. Roriſmarini. *Muſschenb.* . .	0.934
Linſeed Oyl. *Newton. C.* . .	0.932
D°. *Ward.*	0.931
Spirits of Wine proof, or Brandy. *Ward.*	0.927
Sp. of Wine well rectified. *Newton. C.*	0.866
Alcohol Vini. *Fahrenheit.* . .	0.826
Id. magis dephlegmatum. *Fahrenheit.*	0.825
Sp. Vini. *Freind.* . . .	0.818
Id. rectific. *Freind.* . .	0.781
Eſprit de Vin etherè. *Muſschenb.* .	0.732

Spiritus Croci. *Freind.*	0.925
Lamp Oyl. *Reynolds.*	0.924
Oleum. *Ghetaldus.* (ad aquam ut $91\frac{2}{3}$ ad 100.)	0.916
Oyl Olive. *Newton. C.*	0.913
D°. *Ward.*	0.912
Sallad Oyl. *Reynolds.*	0.904
Oleum. *Villalpandus.*	0.900
Id. *Petitus.*	0.891
Ol. Raparum. *Fahrenheit.*	0.913
Id. It. Tinct. Chalyb. Mynsicht. It. Tinct. Sulphur cum Sp. Terebynth. *Freind.* It. Huile de semences de navets. *Musch.*	0.853
Sp. Mellis. *Muschenb.*	0.895
Sp. Salis Ammoniaci cum calce viva.	0.890
Oleum Aurantiorum. *Muschenb.*	0.888
Spirit of Turpentine. *Newton. C.*	0.874
Tinct. Castorei. Item Sp. Vini camphorat. *Freind.*	0.870
Oyl of Turpentine. *Boyle* V. 22. *a.*	0.864
Ol. Terebynth. *Freind.*	0.793
Ol. Ceræ. *Muschenb.*	0.831
Tinctura Corallii. *Freind.*	0.828
Aqua cocta. *Freind.*	0.750
Air. *Newton. C.*	0.00125
Aer *Princip. Edit.* 3. *p.* 512. Aer juxta superficiem terræ occupat quasi spatium 850 partibus majus quam aqua ejusdem ponderis.	0.00118
The same, by an experiment made by the late Mr. Francis Hauksbee F.R.S. when the barometer stood at 29.7 inches. See *Physico Mathem. Exp. pag.* 74.	0.00113

As to the absolute weight of water with which all the other bodies are compared in these Tables, Mr. *Boyle* tells us in his *Medicina Hydrostatica*, printed in the new Edition of his Works, V. 19. *b.* that he had found by his own experiments, that a cubic inch of clear water weighed 256 *Troy* Grains. And Mr. *Ward* of *Chester*, who afterwards pursued this affair with great accuracy, determined that a cubic inch of common clear water did weigh by his tryals 253.18 like Troy Grains, or 0.527458 decimals of the *Troy Ounce*, or 0.578697 of the *Ounce Averdupois*, agreeable to what Mr. *Reynolds* had formerly deliver'd, who found the inch cubic of Rain Water to weigh by his experiments 0.579036 decimals of the same Averdupois ounce, differing from the other only 0.000339 parts.

But, as the accuracy of all the experiments in these tables depends upon the identity of the weight of Common Water, it may not be improper to ascertain that point by a Note taken from Mr. *Boyle's Medicina Hydrostatica*, V. 18. *b.* where he expresses himself in the following manner.

—" It speciously may, and probably will be " objected, that — there may be a great disparity " betwixt the liquors that are called, and that de- " servedly, *Common Water*. And some travellers " tell us from the press, that the water of a certain " eastern river, which if I mistake not is *Ganges*, " is by a fifth part lighter than our water. But— " having had upon several occasions the opportunity " as well as curiosity to examine the weight of " divers waters, some of them taken up in places very

" distant

" diſtant from one another. I found the difference " between their ſpecific gravities far leſs than almoſt " any body would expect. And if I be not much " deceived by my memory (which I muſt have " recourſe to, becauſe I have not by me the notes " I took of thoſe trials) the difference between " waters, where one would expect a notable diſpa- " rity, was but about the thouſandth part (and " ſometimes perchance very far leſs) of the weight " of either. Nor did I find any difference con- " ſiderable in reference to our queſtion, between " the weight of divers waters of different kinds, as " ſpring-water, river-water, rain-water, and ſnow- " water; though this laſt was ſomewhat lighter " than any of the reſt. And having had the curio- " ſity to procure ſome water brought into *England*, " if I much miſremember not, from the river " *Ganges* itſelf; I found it very little, if at all, " lighter than ſome of our common waters."

The heavieſt fluid we are acquainted with, next to *Mercury*, is *Oyl* of *Vitriol*, or water impregnated with the *Vitriolic Acid* in the higheſt degree we can obtain it, being almoſt double the weight of Water.

The next is probably the *ſaturated ſolution* of the *fix'd Salt of Vegetables*; being a ponderous Salt, and diſſolving freely in Water.

The next to this is *Spirit of Nitre*. *Spirit of Salt* is lighter, and inferior in weight to the *ſaturated ſolution* of *Salt* itſelf.

It is obſervable, that *marine* or *common Salt* and *Nitre* differ little in gravity, contrary to the nature of their *Spirits*.

The

The ſeveral *ſolutions* of *common Salt*, if accurately repeated, would ſhew in what proportion the gravities of fluids increaſe, upon the addition of Salt: and that *Sea-Water* does not contain one twenty-fourth part of Salt.

I have omitted in this table the three animal fluids, Milk, Serum of Blood, and Urine, as the ſame may be ſeen before in the 8*th* table, that of *animal parts*; but it may be noted in general that the ſpecific gravity of all theſe fluids is nearly the ſame as that of Sea Water.

There are in Dr. *Freind's* table ſeveral decoctions of Plants, which I have inſerted, altho' they are not I think of much uſe, nor greatly to be depended upon. Several of them are lighter than common Water, in contradiction to Dr. *Jurin's* obſervation, that *Vegetable Parts* are all heavier than Water: But it is probable theſe Experiments were made before the *Decoctions* were reduced to the temper of *Common Water*.

What is meant by the *Aqua cocta* of Dr. *Freind* in his table, I cannot imagine; not having any idea of ſuch a change by boiling or otherwiſe, as can deprive common water of a full fourth part of its weight.

Since the denſity of the Air is as the force by which it is compreſſed, it follows that the weight of any portion of Air muſt vary in the ſame proportion with the weight of the whole *Atmoſphere*: which in our climate is not leſs than one tenth of the whole weight, allowing the *Barometer* to vary from 28 to 31 Inches.

Again, by an experiment of the late Mr. *Hauksbee's* in his *Phyſ. Mechan. exp.* pag. 170. the denſity of the air varies one eighth part between the greateſt degree of Heat in Summer, and that of Cold in the Winter Seaſon. So that the Air, in a hard froſt when the *Mercury* ſtands at 31 inches, is near a fifth part ſpecifically heavier, than it is in a hot day when the *Mercury* ſtands at 28 inches.

TAB. XI.

From Monſ. Homberg *and* John Caſpar Eiſenſchmid, *of the proportion of the ſpecific weights of certain fluids in the Winter to the weights of the ſame in the Summer Seaſon.*

Mercurius	1.00479
Aqua pluvialis	1.00809
Aqua fluviatilis	1.00811
Aqua diſtillata	1.00815
Spirit. Vitriol.	1.01272
Lac bubulum	1.01316
Aqua marina	1.01351
Spir. Salis	1.01467
Acetum	1.01600
Ol. Vitrioli	1.02131
Ol. Terebynth.	1.02141
Aqua fortis	1.02637
Ol. Tartari	1.03013
Spir. Vini	1.03125
Spir. Nitri	1.04386

The

The Oyls of Olive and ſweet Almonds congealing with the cold, could not be examin'd by the *Aræometer* in the winter ſeaſon.

According to this table, the increaſe of the ſpecific weight of common water in the winter above its weight in the ſummer, is not more than about the one hundred and twenty-fourth part of the whole; which is little more than half of what Profeſſor *Muſschenbroek* has elſewhere accounted the ſame, *deſorte qu' un pied cubique Rhenan d'Eau, qui peſe environ 64 livres en Etè, ſe trouvera etre en Hiver de preſque 65 livres. Eſſai de Phyſique p. 424.* but ſure this difference is much too great.

Notwithſtanding that all fluids are condenſed by cold, it is only till ſuch time as they are ready to freeze; for upon the freezing they immediately expand again, ſo as for the ice to be lighter ſpecifically than the fluid of which it is formed, and to ſwim in it: *Muſschenbroek* gives the ſpecific weight of Ice to be to that of Water commonly as 8 to 9. *La peſanteur de la Glace eſt ordinairement a celle de l'Eau, comme 8 a 9.* pag, 441. I am not acquainted with any other accurate experiments upon this ſubject, and it is hard to get ice in which there are not large bubbles of air included.

The *Philoſophical Society* at *Oxford*, together with their Table of *Specific Gravity* already ſo often mentioned in the foregoing pages, communicated beſides at the ſame time, to the *Royal Society*, another Table of a groſſer nature indeed, but which being printed in the ſame Number 169. of the *Philoſophical Tranſactions*, and appearing to be of uſe for many purpoſes: I have thought

 the

ſthe ſame not improper to be here alſo tranſcribed.

Of the weight of a cubic foot of divers grains &c, tried in a veſſel of well-ſeaſon'd Oak, whoſe concave was an exact cubic foot.

The following bodies were poured gently into the veſſel, and thoſe in the firſt 12 experiments were weigh'd in ſcales turning with two ounces; but the laſt 7 were weighed in ſcales turning with one ounce. The pounds and ounces here mentioned are Averdupois weight.

	lb	oz
1. A foot of *Wheat* (worth 6 *s.* a buſhel).	47	8
2. *Wheat* of the beſt ſort (worth 6*s.* 4*d.* a buſhel). Both ſorts were red *Lammas Wheat* of laſt year. . . .	48	4
3. The ſame ſort of *Wheat* meaſured a ſecond time.	48	2
4. White *Oats* of the laſt year. . .	29	8
The beſt ſort of *Oats* were 2*d* in a buſhel better than theſe.		
5. Blew *Peaſe* (of the laſt year) and much worm-eaten.	49	12
6. White *Peaſe* of the laſt year but one	50	8
7. *Barley* of the laſt year (the beſt ſort ſells for 1 *s.* 6*d.* in a quarter more than this)	41	2
8. *Malt* of the laſt year's *Barley*, made 2 months before. . . .	30	4
9. Field *Beans* of the laſt year but one. .	50	8

	℔	℥
10. Wheaten *Meal* (unsifted). . . .	31	0
11. Rye *Meal* (unsifted). . .	28	4
12. Pump *Water*.	62	8
13. Bay *Salt*.	54	1
14. White Sea *Salt*. . . .	43	12
15. *Sand*.	85	4
16. Newcastle *Coal*.	67	12
17. Pit *Coal*, from *Wednesbury* 63; but this is very uncertain in the filling the interstices betwixt the greater pieces. .	63	0
18. *Gravel*.	109	5
19. Wood *Ashes*. . . .	58	5

Of the same nature is also the following account of *The difference of the weight of some Liquors upon the Tunn compared to Rain Water*, from the Experiments made formerly by Mr. *Reynolds* in the *Tower* of *London*, and communicated to the *Royal Society*, with his others before-mentioned, by Mr. *Smethwick*, *July* 7. 1670.

	℔	℥ *Averdup*.
Muscadine Wine was found heavier than Rain Water . .	11	2
Milk	8	4
Sherry	5	3
Ale	5	2
Canary Wine . . .	3	3
Small Beer . . .	1	3
White Wine was found lighter than Rain Water . . .	1	2

Rhenish

	℔	℥	*Averdup.*
Rhenish Wine . .	1	4	
Claret	1	6	
Sallet Oyl	21	6	

The proportion given by this Author as the true one of the *Averdupois* Pound to the *Troy* Pound is, that fourteen of the former are equal to seventeen of the latter.

From whence the *Averdupois* Pound would be found equal to 6994.285, and the *Ounce* to 437.143 *Troy Grains*; which is indeed a little less than the same have since been determined by others; for Mr. *Ward* of *Chester* gives from a very nice experiment as he calls it, of his own, that one pound Averdupois was equal to 14 ounces 11 penyweight and $15\frac{1}{2}$ *Troy Grains*, or to $6999\frac{1}{2}$, and consequently the ounce Averdupois to 437.47 of the same grains. And several Gentlemen of the *Royal Society*, who very carefully on 22 *April* 1743. examined the original standards of weights kept in the *Chamberlain's Office* of his MAJESTY's *Exchequer*, found, upon the medium of the several trials which they made with those standards, that the *Pound Averdupois* was equal to 7000.14, and the *Ounce Averdupois* to 437.51 *Troy Grains*. *Phil. Transf* N°. 470.

I shall conclude these papers with the two Tables from *Marinus Ghetaldus* mentioned in the beginning, which I here transcribe, with an account of some of their uses, in his own words.

Ad comparandum inter se duodecim corporum genera, gravitate, et magnitudine Tabella.

	Oleum	Cera	Vinum	Aqua	Mel	Stann.	Ferrum	Æs	Argent.	Plumb.	Arg. vivum	Aurum
Oleum	1	$1\frac{5}{121}$	$1\frac{4}{55}$	$1\frac{1}{11}$	$1\frac{32}{55}$	$8\frac{4}{55}$	$8\frac{8}{11}$	$9\frac{9}{11}$	$11\frac{3}{11}$	$12\frac{6}{11}$	$14\frac{62}{77}$	$20\frac{8}{11}$
Cera		1	$1\frac{13}{420}$	$1\frac{1}{21}$	$1\frac{109}{210}$	$7\frac{89}{105}$	$8\frac{8}{21}$	$9\frac{9}{21}$	$10\frac{52}{63}$	$12\frac{1}{21}$	$14\frac{32}{147}$	$19\frac{19}{21}$
Vinum			1	$1\frac{1}{59}$	$1\frac{28}{59}$	$7\frac{31}{59}$	$8\frac{8}{59}$	$9\frac{9}{59}$	10 [illegible]/59	$11\frac{41}{59}$	$13\frac{331}{413}$	$19\frac{19}{59}$
Aqua				1	$1\frac{9}{20}$	$7\frac{2}{5}$	8	9	$10\frac{1}{3}$	$11\frac{1}{2}$	$13\frac{4}{7}$	19
Mel					1	$5\frac{3}{29}$	$5\frac{15}{29}$	$6\frac{6}{29}$	$7\frac{11}{87}$	$7\frac{27}{29}$	$9\frac{73}{203}$	$13\frac{3}{29}$
Stannum						1	$1\frac{3}{37}$	$1\frac{8}{37}$	$1\frac{44}{111}$	$1\frac{41}{74}$	$1\frac{221}{259}$	$2\frac{21}{37}$
Ferrum							1	$1\frac{1}{8}$	$1\frac{7}{24}$	$1\frac{7}{16}$	$1\frac{39}{56}$	$2\frac{3}{8}$
Æs								1	$1\frac{4}{27}$	$1\frac{5}{18}$	$1\frac{32}{63}$	$2\frac{1}{9}$
Argentum									1	$1\frac{7}{62}$	$1\frac{68}{217}$	$1\frac{26}{31}$
Plumbum										1	$1\frac{29}{161}$	$1\frac{15}{23}$
Arg. viv.											1	$1\frac{38}{95}$
Aurum												1

Quæro,

Quæro, exempli gratia, quam habet rationem in gravitate plumbum ad aurum. Intelligatur plumbum, quoniam levius est auro, gravitatem habere 1, *et in linea plumbi, in prima columna nominata, sub titulo auri, quæratur auri gravitas, ea erit* $1\frac{15}{23}$. *Plumbum igitur ad aurum rationem habebit in gravitate ut* 1, *ad* $1\frac{15}{23}$. *Si enim sumantur duo corpora magnitudine æqualia, unum plumbeum alterum aureum, sit autem plumbei corporis gravitas* 1, *aurei erit* $1\frac{15}{23}$; *quare corpus plumbeum ad corpus aureum ejusdem magnitudinis rationem habebit in gravitate ut* 1, *ad* $1\frac{15}{23}$. *Comparantur autem inter se genera diversa gravitate, in corporibus magnitudine æqualibus.*

Rursus, quæro quam habet rationem in gravitate aqua ad argentum vivum. Intelligatur aqua, ut levior argento vivo gravitatem habere 1, *et in linea aquæ, sub titulo argenti vivi, quæratur argenti vivi gravitas, ea erit* $13\frac{4}{7}$; *aqua igitur ad argentum vivum rationem habebit in gravitate ut* 1, *ad* $13\frac{4}{7}$.

Contra, quæro quomodo se habent in magnitudine aurum et plumbum. Intelligatur aurum, quoniam gravius est plumbo, magnitudinem habere 1, *et in linea plumbi, sub titulo auri, quæratur plumbi magnitudo, ea erit* $1\frac{15}{23}$; *aurum igitur ad plumbum se habebit in magnitudine ut* 1, *ad* $1\frac{15}{23}$: *si enim sumantur duo corpora æque gravia, unum aureum, alterum plumbeum, sit autem corporis aurei magnitudo* 1, *plumbei erit* $1\frac{15}{23}$; *quare corpus aureum ad corpus plumbeum ejusdem gravitatis se habebit in magnitudine ut* 1, *ad* $1\frac{15}{23}$. *Comparantur autem inter se genera diversa magnitudine, in corporibus æque gravibus.*

Quæro

Quæro denique, quomodo ſe habent in magnitudine ferrum, et aqua, ponatur ferrum, ut gravius aqua, magnitudinem habere 1, *et in linea aquæ, ſub titulo ferri, quæratur aquæ magnitudo, ea erit* 8, *ferrum igitur ad aquam ſe habebit in magnitudine ut* 1, *ad* 8.

Altera,

Altera, ad comparandum inter se duodecim corporum genera, gravitate, et magnitudine, Tabella.

	Oleum	Cera	Vinum	Aqua	Mel	Stann.	Ferrum	Æs	Argent.	Plumb.	Arg. viv.	Aurum
Aurum	$4\frac{47}{57}$	$5\frac{5}{209}$	$5\frac{10}{57}$	$5\frac{5}{19}$	$7\frac{12}{95}$	$38\frac{18}{69}$	$42\frac{2}{19}$	$47\frac{7}{19}$	$54\frac{22}{57}$	$60\frac{10}{19}$	$71\frac{3}{7}$	100
Arg. viv.	$6\frac{43}{57}$	$7\frac{7}{209}$	$7\frac{14}{57}$	$7\frac{7}{19}$	$10\frac{13}{19}$	$54\frac{10}{19}$	$58\frac{18}{19}$	$66\frac{6}{19}$	$76\frac{8}{57}$	$84\frac{14}{19}$	100	
Plumbum	$7\frac{67}{69}$	$8\frac{76}{253}$	$8\frac{38}{69}$	$8\frac{16}{23}$	$12\frac{19}{23}$	$64\frac{8}{23}$	$69\frac{13}{23}$	$78\frac{6}{23}$	$89\frac{59}{69}$	100		
Argent.	$8\frac{27}{31}$	$9\frac{81}{341}$	$9\frac{16}{31}$	$9\frac{21}{31}$	$14\frac{11}{31}$	$71\frac{19}{31}$	$77\frac{13}{31}$	$87\frac{3}{31}$	100			
Æs	$10\frac{5}{27}$	$10\frac{26}{33}$	$10\frac{25}{27}$	$11\frac{1}{9}$	$16\frac{1}{9}$	$82\frac{2}{9}$	$88\frac{8}{9}$	100				
Ferrum	$11\frac{11}{24}$	$11\frac{41}{44}$	$12\frac{7}{24}$	$12\frac{1}{2}$	$18\frac{1}{8}$	$92\frac{1}{2}$	100					
Stannum	$12\frac{43}{111}$	$12\frac{366}{407}$	$13\frac{32}{111}$	$13\frac{19}{37}$	$19\frac{27}{37}$	100						
Mel	$63\frac{19}{87}$	$65\frac{265}{319}$	$67\frac{71}{87}$	$68\frac{28}{29}$	100							
Aqua	$91\frac{2}{3}$	$95\frac{5}{11}$	$98\frac{1}{3}$	100								
Vinum	$93\frac{13}{59}$	$97\frac{47}{649}$	100									
Cera	$96\frac{2}{63}$	100										
Oleum	100											

Quæro

Quæro exempli gratia, quænam ſit ratio in gravitate, auri ad argentum. Intelligatur aurum quoniam gravius eſt argento, gravitatem habere 100, *et in linea auri, ſub titulo argenti, reperietur argenti gravitas* $54\frac{22}{57}$, *aurum igitur ad argentum rationem habebit in gravitate ut* 100, *ad* $54\frac{22}{57}$. *Si enim ſumantur duo corpora, magnitudine æqualia, unum aureum, alterum argenteum, ſit autem aurei corporis gravitas* 100, *erit argentei* $54\frac{22}{57}$; *quare corpus aureum ad corpus argenteum ejuſdem magnitudinis, rationem habebit in gravitate, ut* 100, *ad* $54\frac{22}{57}$.

Quæro, quomodo ſe habet in gravitate aqua ad vinum; quoniam aqua gravior eſt vino, intelligatur ejus gravitas 100, *et quoniam in linea aquæ, ſub titulo vini, datur vini gravitas* $98\frac{1}{3}$, *aqua ad vinum ſe habebit in gravitate, ut* 100, *ad* $98\frac{1}{3}$.

Contra quæro quomodo ſe habent in magnitudine argentum, et aurum. Intelligatur argentum ut levius auro, magnitudinem habere 100, *et in linea auri, ſub titulo argenti, quæratur auri magnitudo, ea erit* $54\frac{22}{57}$, *argentum igitur ad aurum ſe habebit in magnitudine, ut* 100, *ad* $54\frac{22}{57}$. *Si enim ſumantur duo corpora æque gravia, unum argenteum, alterum aureum, ſit autem argentei corporis magnitudo* 100, *erit aurei* $54\frac{22}{57}$: *quare corpus argenteum, ad corpus aureum ejuſdem gravitatis, ſe habebit in magnitudine, ut* 100, *ad* $54\frac{22}{57}$.

Quæro denique, quomodo ſe habent in magnitudine aqua et argentum vivum. Quoniam aqua levior eſt argento vivo, intelligatur ejus magnitudo 100, *et in linea argenti vivi, ſub titulo aquæ, quæratur argenti vivi magnitudo, et reperietur* $7\frac{7}{19}$, *aqua igitur ad argentum vivum ſe habebit in magnitudine, ut* 100, *ad* $7\frac{7}{19}$.

F I N I S.