

# 'Quæstiones quædam Philosophiæ' ('Certain Philosophical Questions')

**Author:** Isaac Newton

**Source:** MS Add. 3996, Cambridge University Library, Cambridge, UK

**Published online:** October 2003

---

<88r>

Amicus Plato amicus Aristoteles magis amica veritas.

## Questiones quædam Philosophiæ

### Off the first mater

Whither it be mathematicall points: or Mathematicall points & parts: or a simple entity before division indistinct: or individualls i.e. Attomes{.}

1 Not of Mathematicall points since what wants dimentions cannot constitute a body in their conjunction because they will sinke into the same point. An infinite number of mathematicall points sink into one being added together & that being still a mathematicall point is indivisible but a body is divisible.

Not of parts & Math: points; for such a point is either something or nothing. if something tis a part & so added between 2 parts will make a line of 3 parts. if nothing, then added betwixt two parts there is still nothing betwixt the 2 parts & consequently the line consists of nothing still but 2 parts. &

Not of simple entity before division indistinct. for this must be an union of the parts into which a body is divisible since those parts may again be united & become one body as they were before at the creation. Now the nature of union (being but a modall ens) is to depend on its parts (which are absolute entities) therefore it cannot be the terme of creation, or first matter for tis a contradiction to say the first matter depends on some other subject since that implies some former matter on which it must depende.

<88v>

The latter will be in its due place be proved impossible

3 Those things which can exist being actually {seperate} are really distinct, but such are the parts of mater.

4 Suppose the first matter one uniforme mass without parts how should that body be divided into parts as we see now it is without admission of a vacuum. Suppose it be divided into two what will be between those two parts not body since it is all in the two halves. But if it be said that it was first divided into smaller parts we ask how came it so without less parts than those into which it was at first divided or els vacuum to succeed in their room as they came a peices. Suppose the first matter were divided as small as sand then divide one of those sands a third sand cannot succeed twixt 'em before they be at some distance unless there might be some smaller matter to run in & keepe out vacuum but to affirme this is to say the first matter had very little parts in

it before it was divided. But againe if now matter is divided two parts of matter of the least size. were seperateing & distant one from another the space & halfe

<89r>

### **Of Attomes.**

It remaines therefore that the first matter must be attomes. And that Matter may be so small as to be indiscerpible the excellent D<sup>r</sup> Moore in his booke of the soules imortality hath proved beyond all controversie yet I shall use one argument to shew that it cannot be divisible in infinitum & that is this: Nothing can be divided into more parts than it can possibly be constituted of. But matter (i.e. finite) cannot be constituted of infinite parts. The Major is true for looke into how many parts a thing is divided those parts added agane make that same whole that they were before; & so if any finite quantity were divided into infinite parts (& certainly it may if it be so far divisible) those infinite parts added would make the same finite quantity they were before which is again the Minor; & It is plaine from hence that an infinite number of extendid parts & the least parts of quantity must be extended make a thing infinitely extended this cannot be denyed if I can prove that things infinitely extended have fine parts Now vacuum is infinitely extended & so may matter be fansied to be. but if the world were removed & vacuum came into the roome of it that very vacuum would not be infinite we can conceive of interspersed vacuities amongst matter but they are not infinite (though an infinite number of them would be so) we see the parts of matter are finite. & an infinite number of finite unites cannot be finite. To helpe that conception of the nature of these leasts, how they are indivisible how extended of what figure &c I shall all along draw a similitude from numbers, comparing Math: points to ciphers, indivisible extension, to unites: divisibility, or compound quantity, to number: i.e. a multitude of attomes, to a multitude of unites. Suppose then a number of Mathematicall points were indued with such a power as that they could not touch nor be in one place (for if they touch they will touch all over, & bee in one place) Then ad thees as close in a line as they can stand together every point added must make some extension to the lenght because it cannot sinke into the formers place or touch it so here will be a line which hath partes extra partes; another of these points cannot bee added into the midst of this line, for that implys that the former points did not lie so close but that they might lye closer. The distance then twixt each point is the least that can be & so little may an attome be & no lesse: now that this distance is indivisible (& therefore the matter contained in it) is thus made plaine: Wherever

<89v>

### **Of a Vacuum & Attomes. pag 2**

halfe theire diameter Vacuum will then come betwixt if nothing else can, & no matter will come betwixt since the diameter of the least particle will be as big againe as that space. As thus suppose two globes were to come together they must pas through all the intermediate degrees of distance before they can be joyned suppose they then be distant but halfe the breadth of the least particle of matter there can be no matter betwixt them since all matter is too big to interpose it self. Neither can the two globes touch for that implyes that semidiameter of the least attome hath no breadth but had it not breadth the diameter could have none & so the least particles of matter would be Mathematicall points. therefore A vacuum must interpose. Vnles you say those attomes are as far divided as they ar divisible that there are least parts of matter is proved in the chapter of attomes.

\* i.e. so little that theire can not be a place too little for them to creepe into & then you will grant what I pleade for i.e. indivisible particles. & you must grant too that Attom{es} were either created so or divided by meanes of a Vacuum

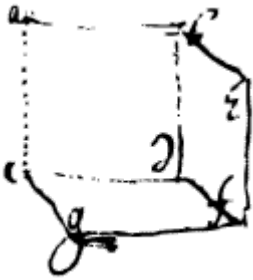
<90r>

### **Of Quantity**

As finite lines added in an infinite number to finite lines, make an infinite line: so points added twixt points infinitely, are equivalent to a finite line.

All superficies beare the same proportion to a line yet one superficies may bee greater than another (thesame may be said of bodys in respect of surfaces) which happens by reason that a surface is infinit in respect of a line, soe though all infinite extensions beare thesame proportion to a finite one yet one infinite extension may be greater than another soe one angle of contact may exceed another, yet they are all equal when compared to a rectilinear angle viz which is infinitely greater Thus  $\frac{2}{0}$  is double to  $\frac{1}{0}$  &  $\frac{0}{1}$  is double to  $\frac{0}{2}$ , for multiply the 2 first & divide the 2<sup>ds</sup> by 0, & there results  $\frac{2}{1} : \frac{1}{1}$  &  $\frac{1}{1} : \frac{1}{2}$ . yet if  $\frac{2}{0}$  &  $\frac{1}{0}$  have respect to 1 they beare the same relation to it that is  $1 : \frac{2}{0} :: 1 : \frac{1}{0}$ . & ought therefore to bee considered equall in respect of a unite.

The angle of contact is to another angle, as a point to a line, for the crookednes in one circle amounts to 4 right angles & that crookedness may bee conceived to consist of an infinite number of angles of contact, as a line doth of infinite points.



As the point a to the line a b so the line a c to the pgr a b c d:: pgr d b e f: the parralelipedon b g.

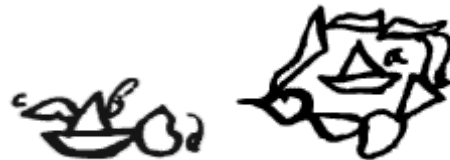
Tis indefinite (that is undetermined) how greate a {sphær} may be made how greate a number may be reckoned, how far mattar is divisible, how much time or extension wee {c}an fancy but all the extension that is, Eternity,  $\frac{\infty}{0}$  are infinite {&} exceeds all number & is soe greate that there can bee noe greater, but (finite) number is called indefinite in respect of a greater.

<90v>

### Conjunction of bodys.

Whither the conjunction of bodys be from rest: Neg: For then sand by rest might be united sooner than by a furnace &c

Whither it be from the close crouding of all the matter in the world affirmatur. For the aire (though its pressure bee but little in respect of that, performed by the purer matter of the vortex (twixt ☉ & us) receding from the center) by its pressure to the center & consequently crouding all thing close together betwixt which there is not aire to keepe them asunder it maketh them stick together, as the 2 polished sides of 2 marbles the {Lots} of water &c but this juncture cannot be very firme by reason that the pressure of the aire is not verry strong as appeares by the experiments of Esquire Boyle. but the pressure of all the matter made by reason of its indevor from ☉. twixt ☉ & us being farr greater (& it may be some other power by which matter is kept close together&c) when 2 or 3 or more littell bodys once touch so as to admitt noe other matter betwixt them they must be held very fast together al the matter about them pressing them together but nothing striving to parte them. And when 2 of the least particles meete whos sides with which they touch one another are pretty broad & fitted to touch close every where, those two may move together as one body & so may increase by haveing others joyned to them in the same manner. but if the circumstant particles chanch to be held of from



pressing them together by some accident as those about (a) or be variously pressed as at (b) by the bodys c & d they may be againe severed. yet in more compound bodys there is no danger for the least particles are so wedged together that neither of these two chanches could undo them as for the first it cannot to a whole body but onely in some littell parte of it as some attome of a mans hand may chanch not to be touched by the water into which hee puts it. But this cannot happ to his <91r> whole hand.

so that those particles which are pressed together may holde a particle wedged as it were amongst them so that it cannot fall away from them though it chanch not to be pressed to them. the second can happen at all for the neighbouring matter can onely scarce press two touching particles toward the center or it may be a little awry but not from the body to which they adhere but let the wors hapen that can the particle may be wedged

in amongst the rest. But it may be that the particles of compound matter were created bigger than those which serve for other offices.

<91v>

### Of Place

Extension is related to places, as time to days yeares &c Place is the principium individuationis of streight lines & of equall & like figures the surfaces of two bodys becoming but one when they are contiguous becaus but in one place.

<92r>

### Of time & Eternity

#### The representation of a clock to goe by water or sand.

##### Probleme



1. By a line of tangents upon a square ruler & a plummet to know at one view whither the stile of a diall bee true & thereby to erect a stile.
2. the stile erected, by a plumb line let fall from the stile to find the meridian line.
3. By the said ruler to find the substilar & draw the other hower lines. Note that this may be done though the wal bee not eaven &c.

To make metalline Globular dust for the said clock instead of sand. Daube the hollow cone B with pitch &c on the inside, fire it. through which fire (by the helpe of the tunnell A) cast the filings of brasse or pewter &c which molten into a globular forme may fall into the bason of water C.

<92v>

### Of Motion

That it may be knowne how motion is swifter or slower consider i That there is a least distance, a least progression in motion & a least degree of time. as lay two globes together so close that they cannot come any nigher with out touching that is the least distance, let them be moved together that is the least degree of motion & tis performed in the least part of time. There are so many parts in a line as there can stand Mathematicall points in a row with out touching (i.e. falling into) one another in it & soe many degrees of motion along that time. as there can be stops & stays. & there are soe many least parts of time in an hower as there can be Tò vùn 'ç. This proposition is proved as I proved a least part in Matter. 2 These leasts have no parts for that implys that they are yet divisible. neither prius nor posterius 1 not least distance since it is passed over in an indivisible part of time & ther cannot be a different time ascribed to the entrance of a thing into that part of space & the leaving of it. 2 not the least degree of motion because too that is performed in an indivisible parte of time & is no sooner begun than done 3 not the least moment of time because first & last imply severall parts of time. 3 The least degree of motion is equal to the least distance & time 1 distance & not to more: because a thing moves in passing over but one of them. Nor to less, because the least motion is over some distance. 2 Tis æquall to the least moment in time, not to more, because in each degree of time wherein a thing moves there will be motion or else in all those degrees put together there will be none: not to lesse becaus no motion is done in an instant or intervall of time. But againe should two parts in motion be but equall to one in space or time &c contra: that one would be liable to have a prius accor{ding} to the firt of the two parts a midle according to the



<93r>

### Of the Celestiall matter & orbes.

Whither Cartes his first element can turne about the vortex & yet drive the matter of it continually from the ☉ to produce light. & spend most of its motion in filling up the chinkes betwix the Globuli. Whither the least globuli can continue always next the ☉ & yet come always from it to cause light & whither when the ☉ is obscured the motion of the first Element must cease (& so whither by his hypothesis the ☉ can be obscured) & whither upon the ceasing of the first elements motion the Vortex must move slower. Whither some of the first Element comeing (as he confesseth that hee might find out a way to turne the Globuli about their one axis to grate the 3<sup>d</sup> El{ement} into wrathes like screws or cockle shells) immediately from the poles & other vortexes into all the parts of our vortex would not impel the Globuli so as to cause a light from the poles & those places from whence they come.

<93v>

### Of the Sunn Stars & Plannets & Comets

Whither ☉ move the vortex about, as Des-Cartes {will} by his beames. pag 54 Principia Philos: partis 3<sup>a</sup>  
 Whither the vortex can carry a Comet towards the poles &c Whence tis that the ☉ is turned about upon his axis Whither Cartes his reflexion will unriddle the mistery of a Comets bird.

Heb 1 chap: vers 2 by God made the worlds by his son τούς αιωνας The ☉s spots are coloured sometimes like the rainebow.

October 16 1618 in Scorpio appeared a comet the tayle being extended twixt Spica virginis & Arcturus toward the north pole it passed into libra moveing from the Ecliptick to the Tropick of cancer from east to west or Northerly

On Saturday at 30<sup>min</sup> past 4 of the clock in the morning December 17<sup>th</sup> 1664 A Comet appeared Whose distance from Sirius was 30<sup>d</sup>, 0'. from procion 38<sup>d</sup>, 45'. There was little or noe difference twixt the time of its & Sirius his self its setting about 2' after him Soe that its Right ascension was about 126<sup>d</sup>, 32'. & its declinacon Southward 31<sup>d</sup>. The length & its tayle was about 34<sup>d</sup> or 35<sup>d</sup> & pointed below toward procion or almost to the North pole, cutting the horizon at an angle of about 35 or 40<sup>d</sup> & the Ecliptick at 47<sup>d</sup>.

[1]

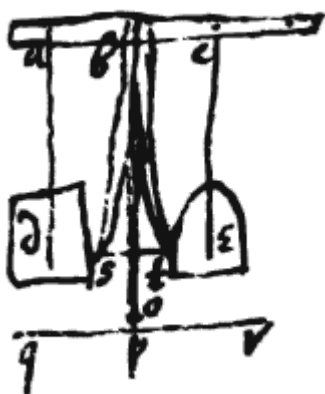
<94r>



### Of Rarity & Density. Rarefaction & Condensation.

Corke may be pressed into 40 times less roome than it naturally requireth & yet swim in water. By my tryall 48 times.

#### two bodys given to find which is more dense



Vpon the Threds da & ce hang the bodys d & e. & exactly twixt them hang the spring sbt by a thred soe that it have liberty to move any way. then compresse the spring bs to bt by the thred st. Then cutting | clipping the thred st the spring shall cast both the body d & e from it & they receve alike swiftnes from the spring if there be the same quantity of body in both otherwise the body bo (being fastened to the spring) will move towards the body which hath less body in it. which motion may be observed by compareing the motion of the point (o) to the point p & other points in the resting body qv.

<94v>

### Of Perspicuity & Opacity

Why though both a dry bladder & water are perspicuous yet a wet blader is not. though oyle bee les diaphaneous than water yet it makes a paper more diaphaneous than it.

Perspicuity is not effected the same way in glass, christall water  
bladders paper

&c that it is in aire, Aether,

Why water is clearer than Vapors

<95r>

### **Of Fluidity Stability humidity Siccity**

<95v>

### **Of Softnesse hardnes Flexibility Ductility Tractility**

Why flints doe breake upon a soft thing sooner than a hard one.

Whither hard bodys stick together by branchy particles foulded together. Cartes.

Why the Adamant dust is harder than adamant.

<96r>

### **Of Figure Subtility hebetude smothnes asperity**

<96v>

### **Of heate & cold**

Whither things congeale for want of agitation from the ethereall mater. Cartes.

Whither doth air moved by light cause heate or light itselke &c Why is a coale hotter than flame but flame heates farther Why doth warme breath proceede out of an open mouth but cold out of a contracted mouth.

Why is breath or sweate seene in winter more than in summer

Fire heates by heating the aire because wind by blowing the aire blows heate to a man

To make a crucible to endure halfe a yeare a very strong fire lute it on the outside (thick at the bottom & thinner towards the top) with a mixture of tobaccopipe clay & salt of Tartar ( or Tartar may bee made use of but not with so good successe) I think there must bee an equall quantity of each.

Whither may not water bee frozen by drawing the warme aire from it out of M<sup>r</sup> Boyls Receiver.

Snow put in a glasse & Salt or any quick dissolvent put into it & well mixed with it will cause vapors to settle on the outside of the glase & to freeze nay warme water or heated sand powered into the snow & well shaken together will condense vapors on the outside & perhaps congeale them. M<sup>r</sup> Boyle

Cold ( because bodys condensed therewith moves down wards) tends farthest downwards as heat upwards.

Tis best to freze liquors at the bottome for fear of breaking the Glasse.

An frozen Egg will thaw much faster when immersed in water than when in the ayre, & will freze the water by its thawing, soe will frozen me~~illeg~~ chese meate, Glasse

Why does water freeze first & most next the Aire

<97r>

### **Of Gravity & Levity**

The matter causing gravity must pass through all the pores of a body. it must ascend againe. i for else the bowells of the earth must have had large cavitys & inantys to conteine it in, 2 or else the matter must swell it. 3 the matter that hath so forcibly borne {down} the earth & all other bodys to the center (unles you will have it growne to as gross a consistence as the Earth is, & hardly then) cannot if added to gether be of a bulke so little as the earth, for it must descend exceding fast & swift as appeares by the falling of bodys, & exceeding weighty pressure to the Earth. It must ascend in another forme than it descendeth or else it would have a like force to beare bodys {illeg} that it hath to press them downe & so there would bee no gravity It must ascend in a grosser consistence than it descends because it may be slower & not strike boddys with so greate a force to impell them upward 2 that it may onely force the outside of a body & not sinke into every pore & then its densness will little availe it because it will yeild from the superficies of a body with ease to run in an easier channell as though it never strove against them. if it should ascend thinner it can have onely this advantage that it would not hit bodys with so weighty a force but then it would hit more parts of the body & would have more parts to hit with & hit with a smarter force: & so cause ascension with more force than the others could do descension. Wee know no body that {} not sinke into the pores of bodys finer than aire & it will sink into most if it be forcibly crouded in the stream descending will lay some hould on the streame ascending & so press it closer & make it denser & therefore twill rise the slower. the streame descending will grow thicker as it comes nigher to the earth but will not loose its swiftnesse untill it find a much opposition as it hath helpe from the following flood behind it. but when the streames meete on all sides in the midst of the Earth they must needs be coercted into a narrow roome & closely press together & find very much opposition one from another so as either to turne back the same way that they came or croud through one<sup>[2]</sup>

<97v>

### Of Heate & Cold.

Apples, Eggs, Cheeses, Men &c: frozen are vitiated by freezing but not soe much when thawed by water or snow as by fire. Frost will breake stones, crack trees, make the Humor chrystall looke white.

A man cannot feelee where hee is frozen & though frozen all over feeles onely a prickling in his recovery, hee may bee recovered being dipped in water or rubbed over with snow, but not by a Stove. Nay any frozen part is lost which is thawed in a Stove. & the fier pains us in warming our cold fingers. Frozen meate layd to thaw & roast by the fire will bee raw in the midst after many Howers.

Though frost change & destroy bodys (espetially in the thawing) yet cold preserves them.

Ice (to which noe fresh aire in the Frezing could come the botome of the water being first frozen &c) is full of bubbles great as sands, shott, & pease, which bubbles are fewer & lesse if the water bee first purged of aire by the receiver. And those bubbes in thawing shrink againe perhaps into as little rome as at first.

Cold shrinkes liquors, Oyle shrinke in frezing, water scarce shrinkes before frezing, but swells before & in frezing, & Ice is about one ninth or tenth parte greater than water

Water & aire shut up in a glasse egg with a shank. the aire being in the shanke was crouded into 19 times lesse rome by the freezing of the water till it broke the glasse.

Cold will penetrate through Boyles Vacuum, Oyle of Turpentine, & a little through strong bryan & perhaps through hot mediums to freze water.

<98r>

### Of violent Motion

Violent motion is continued either by the aire or by force imprest. or by the naturall gravity in the body moved. Not by the aire since the aire crowds more uppon the thing projected before, than behind, as must



therefore rather hinder it for you may

observe in water that a thing moved in it doth



carry the same water behind it along with it as in a cone or at least the water is moved from behind it with but a small force as you may observe by the motes in the water suppose (a) to be the body moved: (b. d. e. f) to be the water moving behind (a) to give it place. (r) the water behind (a) following it & going along with it. The {n} if the water at (f) ran so violently against the backside of (a) it would beat away the water at (r) with violence but that water is moved very slowly from behind a. if it be moved away: as you may perceive by the motes in the water. the like must happen in air if you say no I answer must then move (a) forwards in water. So if hot lead drop into water that part which is behind will be pointed the fore part round which would be otherwise if the air pressed as much on it behind as before. thirdly how can the air continue the motion of a globe on its axis. Fourthly <98v> in the former figure the air is supposed to have the same propensity to motion which the ball (a) is supposed to have that is will move no longer than it is propelled on. then I say the water at (r) cannot move the ball unless the ball do at the same time move (b) that (b) may (g) & (h) & (g) may move (d) & (d) move (i) & (i) move (f) & f move r & force it to rush upon the ball & consequently at the same instant (r) must the ball, & the ball move (r) which cannot be. But suppose the air & the ball were detained from motion by some outward agent, & yet kept the same respect to one-another in situation as they did in their flight: then as soon as they were both let loose again the air would have as much power to move the ball as it had when they were in their former flight: If it be answered that the air will be more compressed at (f) than at (b) & consequently when let loose again it will dilate itself & so begin a new motion. I answer how comes the air to be more crowded behind the ball then before since (a) will communicate as much force on (b) as it receives from r & the fore part of the air will crowd no more on the latter parts than the ball will crowd on it. Again whence is it that a piece of lead will move farther & with more force than a piece of wood of the same bigness since the air will have the same influence on both.

<99r>

### Of Reflection undulation & refraction.

Why refraction is less in hot water than cold

If a piece of silver be boyled (that is be first brushed & then decocted with salt & tartar & perhaps other ingredients it will look very white, but burnish it with a piece of steele & it will be a perfect speculum.

Whither the backside of a cleare glas reflect light in vacuo

Since there is refraction in vacuo as in the air it follows that the same subtle matter in the air & in vacuo causeth refraction

Try Whither Glasse hath the same refraction in M<sup>r</sup> Boyles Receiver, the air being drawn out, which it hath in the open air.

How long a pendulum will undulate in M<sup>r</sup> Boyls Receiver? &c.

<99v>

### Of Fier



Whither flame will descend in Tor: vacuo or not. & what other Phænomena (as dilatacion & transparency) hath it.

<100r>

### Of Aer

Whither the parts of air be les than them of light or no.

Whither it consist of branchy bodys not foulded together but lying upon one another {illeg} Cartes

The height of the Atmosphere may bee known from Torricellius his experiment.

What is the utmost naturall dilatacon of the aire may be known by Torricellius his Experiment

The velocity of air, wind, or water may be known by the resistance which a moveing body hath in standing air or water.

What angle ought a Wind mill saile to make with the wind. &c. in the resolution of this must be considered the ordinary velocity of the wind & of the saile (the quantity of the wind hitting the saile i: e:) the perpendicular breadth of the saile to the wind, & the obliquity of the saile to the wind.



<100v>

Whither is salt or fresh water easlier {moved} & more pellucid. refracts more & easlier frozen.

### Of Water & Salt

Whither fresh water consist of long bending parts & salt of stiffe & long ones. the first is false because it could never bee frozen. they would twist about one another so as they would not be fluid but onely soft. 3 they would ly too close together to admit light through them for being pliable they would fill up every corner & hence they would bee exceeding heavy. they would not refract light so well, for they would bee soft & so not firmly resist the pure matter as Glass doth & Cartes would have that matter to passe swiftlier where it findes strongest resistance & refraction to be from hence that the matter passeth swiftliest which therefore should bee in water. 5 & if it seporate it by laping about it then when it hath seperated as much as it can of one kind of Salt it could seporate no more of another which is false 6 The aire being a stubborne body (because of branchy parts) would instantly quell there circular motion when they are rarefied. Why water is clearer than vapors.

Whither burning waters & hot spirits be of small sphericall & ovall figured parts & have many such globuli as fire is of they are 1 because such are easliest seperated in distillations 2 because they are easliest agitated & so heate & enliven men 3 they must have many small & sollid attomes in them because so easily fired.

Why doth hot water first contract it selfe (viz in cooleing) & then dilate it selfe before & as it freezeth.

Why doth salt & snow freese other water. & why is heated water sooner frozen than raw water.

Whither be ther more vapors when the aire is clearest.

How salt hinders corruption. but fresh water helps it.

Why (though salt bee heavier yet) it will mix with water. & gather into graines at the top of it

Whither water be salter at the equater than the poles becaus tis there exhaled but may fall againe at the poles. Cartes

Why sea water is not so apt to quench fier & why it will sparkle in the night but not if kept long in a vassell. why the superficies of water is lesse divisible than tis within = vid pag 47

**Of Earth**

Its conflagration testified 2 Peter 3<sup>d</sup>, vers 6, 7, 10, 11, 12. The wiked (probably) to be punished thereby 2 Pet: 3 chap: vers 7.

The succession of worlds, probable from Pet 3<sup>c</sup>. 13<sup>v</sup>. in which text an emphasis upon the word wee is not countenanced by the Originall. Rev 21<sup>c</sup>. 1<sup>v</sup>. Isa: 65<sup>c</sup>, 17<sup>v</sup>. 66<sup>c</sup>, 22<sup>v</sup>. Days & nights after the judgment Rev 20<sup>c</sup>, 10<sup>v</sup>.

**Philosophy**

The nature of things is more securely & naturally deduced from their operations one upon another than upon our senses. And when by the former Experiments we have found the nature of bodys, by the latter wee may more clearly find the nature of our senses. But so long as wee are ignorant of the nature of both soule & body wee cannot clearly distinguish how far an act of sensation proceeds from the soule & how far from the body &c.

**Atraction Magneticall**

1 The motion of any magneticall ray may bee knowne by attracting a needle in a corke on water.

2 Whither a magneticall pendulum is perpendicular to the Horizon or not, & whither iron is heaviest when



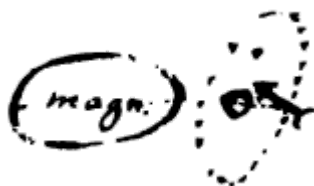
impregnated, or when the north pole or southpole is upmost. Coroll. A perpetuall motion .

3 Whither magneticall rays will blow a candle move a red hot copper or iron needle, or passe through a red hot plate of copper or iron



4 A perpetuall motion .

5 Whither a loadestone will not turne around a red hot iron fashioned like wind mill sailes as the wind doth them. Perhaps cold iron may reflect the magn: rays with that pole which shuns the lodestone.



6. A perpet: Motion

. Or,

**Vegetables.**

Suppose a b the pore of a Vegetable filled with fluid mater & that the Globule c doth hitt away the particle b, then the rest of subtile matter in the pores riseth from a towards b. & by this meanes juices leaving dreggs in the pores & then wanting passage stretch the pores to make them as wide as before they were clogged. which



makes the plant bigger untill the pores are too narrow for the juice to arise through the pores & then the plant ceaseth to grow any more.

<103r>

### Attraction Electricall & Filtration.

Whither filtration be thus caused. The aire being a stubborne body if it be next little pores into which it can enter it will be pressed into them (unles they be filled by something else) yet it will have some reluctance out wards like a peice of bended whale bone crouded into a hole with its middle parte forwards. if then water whose (parts are loose & pliable) have opportunity to enter that hole the aire will draw it in by strivei{ng} it selfe to get out. The aire too being continually shaken & moved in its smallest parts by vaporous particles every where tossed up & downe in it as appeares by its heate, it must needs strive to get out of all such cavity which doe hinder its agitation: & this may be the cheife reason sponges draw up water. But in paper ropes hempe threds fiddle-strings betwixt whose particles there is noe aire or but a little & it so pend up that it can scarce get out the cause may be this. that the parts of those bodys are crushed closer together than there nature will well permit & as it were bended like the laths of crosbows so that they have some reluctancy against that position & strive to get liberty which they cannot fully doe unless some oth{er} bodys come betweene them as aire or water but where aire cannot enter water will (as appeares in that it will get through a bladder which aire cannot doe &c) wherefore when opportunity offers it selfe by striving to get assunder they draw in the parts of water betwixt them

<103v>

### Of light see pag 82

Why light passeth easlier through white than black paper. & yet more efficaciously reflected from it.

How light is conveyed from the Sun or fire without stops.

Light is easlier admitted into black than reflected from it, for hold a paper twixt you & light with a black spot in it & it is blacker when towards you, than when to the light.

Light cannot be by pression for then wee should see in the night as wel or better than in the day we should see a bright light about us becaus we are pressed downewards . The sun would be long nay far greater. ther could be no refraction since the same matter cannot presse 2 ways, the \* sun could not be quite eclipsed the Moone & planetts would shine like sunns. A man goeing or running, would see in the night. When a fire or candle is extinguish we lookeing another way should see a light. The whole East would shine in the day time & the west in the night by reason of the flood which carrys our. Vortex a light would shine from the Earth since the subtill matter tends from the center. a \* little body interposed could not hinder us from seing pression could not render shapes so distinct. There is the greatest pression on that side of the earth from the ☉ or else it would not move about in equilibrio but from the ☉, therefore the nights should be lightest. Also the Vortex is Ellipticall therefore light cannot {illeg} come from the sone directly &c

Whither the rays of light may not move a body as wind doth a mill saile.

To know how swift light is. Set a broad well pollisd looking glasse on a high steeple soe that with a Telescope 1, 2, 3, 10, or 20 miles of you may see your selfe in it & having by you a great candle in the night cover it & uncover it & observe how long tis before you see the

<104r>

### Of Sensation

The senses of divers men are diversly affected by the same objects according to the diversity of their constitution To them of Java pepper is cold.

If the orifice of the stomach be wounded it sooner dispatches a man than if the head: the former having greate sympathy with the heart deads it & stops it motion & so sence ceaseth: the latter though it take away sence

yet the hearts motion is not impeded thereby.

The Common sensorium is either 1 the Whole body 2 the Orifice of the Stomack 3 the heart 4 the brain 5 the membranes 6 the septum lucidum 7 Some very small and perfectly solid particle in the body 8 the Conarion 9 the Concourse of nerves about the 4<sup>th</sup> ventricle of the braine. 10 The animall spirits in that 4<sup>th</sup> ventricle.

A ligature being tied sence & motion will be twixt the ligature & the head but not downwards. A frogs brain being peirced it looseth both sence & motion but it will leape & have its sence though its bowells bee taken out.

Phisitions find the causes of lethargies Apoplexies Epilepsies &c diseases that seiz on the Animall functions in the head.

Vnles the braine be peirced so deepe as to reach the ventricles the wound will not take away sence & motion

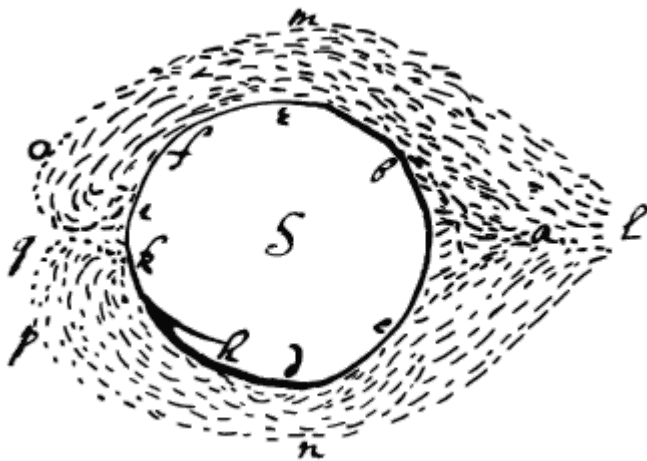
A man cannot see through the hole which a trepan makes in his head. Stones have beene found in the glandular pinealis & it is invironed with a net of veines & arteries.

A Vertigo must be from the turning round of the spirits

The least weight upon a mans brain when hee is trepanned maketh him wholly devoyd of sensation & motion

<104v>

### Of Species visible



S the Globulus of light a b c a cone of subtile matter which it carrys before it the better to cut the ether, which serves also to reflect it from other bodys.

m l n the parting of the matter which lieth so much the closer by how much it is nigher the globulus. f, h, the matter pressing on the backsid & consequently helping it forwards

qk, oqi, the matter returning to communicate the motion to the globules which it had before received of it. When it is reflected from i, k, i. e. when it hath given the ball its motion againe tis either reflected toward i, k, by the matter comeing from o & p

towards q &c Or else it serves to swell the matter at oqp & so is left in the same condition that the globulus found it in.

<105r>

### Of Vision

There is required some permanency in the object to perfect vison thus a coale whirled round is not like a coale but fiery circle or who can se a bullet pass by him. yet if the eye keep motion with the thing moved it sees it right One eye shutting or being perst the pupill of the other open both the eyes being opened together, dilate, & contract, & dilate. Vppon passion these spirits ebb & flow. Dymnesse may come from the deficiency of these spirits, & the Optick nerve obstructed

Rays from the same point in an object strikeing upon both the eyes do make the object seeme two as when an aye is deprest viz: then theire two axes respect not the same point, in that object. Things of the darker colour are easliest burned i.e. have loosest parts. A mans Eye struck sparkeleth.

The Eys being distorted a man may see the same parte of the same object, in two divers places with both eys at once or successively with one eye after another, & also hee may see two divers objects in the same place

successively (without varying the posture of his eyes or of the object, but onely by covering the one eye first & then the the other, or by being intent with one eye first & then with the other. which is an argument either that the image in the braine is painted on a superficies, or else that the Optick nerves at their meeting before they enter the braine doe sort their capilamenta uniting there each capilamentum of the one eye to its fellow capilamentum of the other eye. Soe that when the eyes conspire not towards the same object but have divers pictures painted upon the correspondent capillamenta the stronger picture at the meeting of those capillamen{ta} drownes the weaker &c:

Quære: whither fantasy as well as sight is not done in plano? That whither wee can imagine two like things to bee one behind another as we can do them one beside another. Resp: Noe but wee can understand them so.

Quære: why doth the forcible turning of the eye one way with the finger make the object seeme to move the other way but not the voluntary turning of it.

<105v>

### Of Colours.

That darke colours seeme further of than light ones may be from hence that the beames loose little of their force in reflecting from a white body because they are powerfully resisted thereby but a darke body by reason of the loosenes of its parts give some admission to the light & reflects it but weakly & so the reflection from whitenes will be sooner at the eye. or else because the whit sends beams with more force to the eye & givs it a feircer knock.

Coulors arise either from shaddows intermixed with light, or stronger & weaker reflection or [arts of the body mixed with & carried away by light.

From some of these ariseth splendor & dullnesse

A shining colour though black reflecteth an Objects rayes perfecter than dull white one as black horne black polished leather &c better than white paper. & contrarywise. But polished black shineth best

A window lying open to the south will bee tinted with the colour of the curtane. A paper written on put twixt the eye & the light the letters towards the light looke dim the light being refracted in the paper after its' past the inke: but the letters on this side looke perfect the light comeing streight to the eye without any refraction

Why are coles black and ashes white.

No colour will arise out of the mixture of pure black & white for then pictures drawne with inke would be coloured or printed would seeme coloured at a distance & the verges of shadows would be coloured. & lamb black & spanish whiteing would produce colours whence they cannot arise from more or lesse reflection of light or shadows mixed with light.

<106r>

### Of Sounds

A man may heare the beatings of his owne pulse.

In every sound the eight above it but not below it seemes to bee heard. (for there is some more subtile, some more grosse matter in the aire, & the subtilest matter is prone to quickest vibrations, though the motion of both proceede from the same cause, as the vibration of a string or pipe thus twiggs vibrate ofter than branches. Also these motions doe least check one the other & are most congruous to the string or pipes motion when the ones vibrations are double in number to the others. Hence a sound & its eight are never separte. The greatest & grossest part of the matter in the aire doth comply with the strings motion for one string struck by the mediation of the air moves an unison string of another instrument better than that which is an Eight above or below it & the string is easliest moved by the air when its motion can be most conformable to the motion of the greatest parte of the aire. Nor can any considerable quantity of matter move slower than the string because it gives way to the strings motion & were there, yet its motion being 4 times

slower than that of the subtlest matter can scarce bee perceptible. Hence each sound hath its concomitant 8<sup>th</sup>, & perhaps 15<sup>th</sup> & 22<sup>th</sup> to a good eare, above but not below it. Hence 8<sup>ths</sup> seeme to bee unisons. And violenter breathing raiseth the sound & sight or 15<sup>th</sup> not a 12<sup>th</sup>, or but seldom to a twelft.

Quære, In what proportion the sound decreaseth in its progresse from the fountaine. viz: If the sound bee (a) at the distance (b) it shall be ( $\frac{a}{x} \frac{b}{x}$ ) at the distance x.

Why doth the sound of a Bell quaver or shake like a mans voyce? Because the Bell vibrates sometimes directly somtimes obliquely towards a man

How swiftly doe sounds move, & whither are acute or grave sounds the swifter?

Sounds, are much fainter in the exhausted receiver then in the open Aire. Boyle Exper 27.

<106v>

### Of Odours & Savors

<107r>

### Of Touching

A man hath beene deprived of his feeling. Sir K. Digby

<107v>

### Of Generation & Corruption

In winter expose the liquor of decocted hearbes to the cold aire & in the morning under the ice, there will appeare the figure & colour of the plant which was taken from it may be the ice keep those attomes from avolition.

There is an artificiall resurrection of plants from their ashes. dissolved salt upon its fixation returnes to its affected cubes. Figures of mineralls are regular: as Christall Hexagonall: the Fairy stone hemisphæricall. the stone Asteria of a stellar figure. the Misselto, & mosse grows upon other tress. A worme may turne to a Butterfly Tadpoles grow to frogs fly's eggs to be wormes & then flys againe

<108r>

### Of Memory

Messala Corvinus forgot his owne name. One by a blow with a stone forgot all his learning. Another by a fall from a horse forgot his mothers name & kinsfolkes. A young student of Montpelier by a wound lost his memory so that he was faine to be taught the letters of the Alphabet againe. The like befell a Franciscan frier after a fever Thucidides writes of some who after their recovery from the greate pestilence at Athens forgot the names & persons of their freinds & themselves too not knowing who they were or by what names they were called.

Atque etiam quosdam cepisse obliviam rerum  
Cunctarum, neque se possent cognoscere ut ipsi. lucretius

D<sup>r</sup> Mores immortal:

Things out of mind are remembred sometimes by meeting with other things of like nature: as dreames never thought upon in that morning at the time of awakeing are remembred by some actions of the like nature met withall in the day time.

Forgetfullnesse ariseth sometimes out of the want of thinking of things. Things seene & words heard at the same distance are distinctly remembred. So are distance & widenes or extension & bignesse. So are things

which enter not the senses as meditations, thoughts, dreames, & that a man hath remembred.

Meditations reminde a man of actions, & actions of meditatio. Colours, actions, sounds loud softly, high & low, Time as that 2 things were done together or so long after one another reconing how long since such a thing done by counting the time from one action to another untill the præsent time.

A man cannot remember what hee never thought uppon as a blow or prick or noise in his sleepe the things & sounds which hee heares & sees but minds not.

Objects from either eye or eare affect the memory alike. The same thing seene or heard from divers places or distances acte alike on the memor{y}

Things done in the same time helpe the memory of one another If memory bee done by characters in the braine yet the soule remembers too, for shee must remember those characters.

<109r>

### **[3]Imagination. & Phantasie & invention**

We can fancie the thing wee see in a right posture with the heeles upward. Phantasie is helped by good aire fasting moderate wine.

but spoiled by drunkenesse, Gluttony, too much study, (whence & from extreame passion cometh madnesse), dizzinesse commotions of the spirits

Meditation heates the brain in some to distraction in others to an akeing & dizzinesse

The boyling blood of youth puts the spirits upon too much motion or else causeth too many spirits. but could age make the brain either too dry to move roundly through or else is defective of Spirits yet their memory is bad.

A man by heitning his fansie & imagination may bind anothers to thinke what hee thinks as in the story of the Oxford scollar in Glanvill Van of Dogmatizing.

When I had looked upon the Sun all light coloured bodys appeared red & darke coloured bodys appeared blew. <sup>2</sup> If I looked on white paper with my bare eye it looked red, but if I looked on it through a very little hole so that but a little light could come to my eye from the paper it looked greene

<sup>3</sup> after the motion of the spirits in my eye were almost decayed that I could see all thing with their natural colours I shut it & could see noe colour or image till I heightned my fantasie of seeing ☉ & then began to appeare a blew spot which grew lighter by degrees in the midst untill it was white & bright in the midst next to which were circles of red, yellow, greene, blew purple, all which were sometimes encompassed with a darke greene or red. Sometimes the whole spot would turne very blew sometimes most of it red. After I opened my eye againe, white bodys looked red & darke ones blew as if I had newly looked on the Sunne whence

<109v>

### **Sympathy & Antipathie**

To one pallate that is sweete which is bitter to another

The same thing smells gratefully to one displeasinly to another

Objects of sight move not some but cast others into an extasie

Musical aires are not heard by all with alike pleasure. The like of touching.

<110r>

## Of Oyly bodys

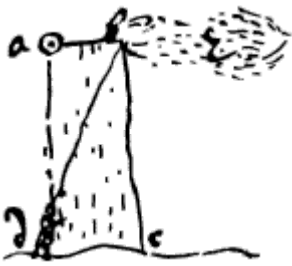
Whither they consist of branchlike particles onely touching superficially & foulded together. Cartes.

That oyle (though thicker yet) mixeth sooner with most bodys than water & spreades quicklier when dropt upon bodys, may proceede from its branches taking hold like briars on all adjacent bodys whereas water dropt is kept round by the aire & crouded together unless the pores of bodys lye open for its particles to drop into them &c

<110v>

## Of Meteors.

Whither fierce winds dry bodys by beating out the moisture from other bodys Cartes Met:



To measure the height of the clouds. Suppose (E) the cloud (b) the edge of it casting the shaddow c. (d) the man measuring it & a the Sunne. then  $\angle adb = \angle dbc$  may bee found & likewise dc its sine, whence the radius db or the distance of the cloude from the man is easly found. Feb 19 166 $\frac{4}{5}$  at night I observed a Halo about the  $\odot$  22<sup>d</sup> 35" distant from the {illeg} it was Ellipticall & its long diameter perpendicular to the Horizon varying below farthest from the  $\odot$ . neare the moone {illeg} were two rainbow the diameter of the 1<sup>st</sup> was 3<sup>d</sup> 0' of the 2<sup>d</sup>, 5<sup>degr</sup> 30'. the order of the colours from the Moone were white, blewish green red, yellow;

blewish greene, red, yellow.

<111r>

[4]

## Of Water & Salt flux & reflux of the Sea

insomuch that what will swim in its surface will sinke in it

Why is salt of a square figure haveing a hollow & broade top & a narrow base. & why graines of salt will crack in the fire but not if they be rubed first asunder.

Whither the pleasant smell of white salt & the colour of black salt proceed from some other mixture. Cartes.

Whither salt is melted by suddaine heate because there is water in it & not by a gentle fire because that exhales the water out by degrees Cartes

How oyle or spirits of salt (so sharpe that they will dissolve gold) is extracted out of salt. Cartes Met: of Salt.

Tides cannot be from the  $\odot$ s influence for there they would be lest at new moones.

Whither water may be drawne out of a receiver like aire or not. This may bee the best way empty the receiver

To try whither the Moone pressing the Atmosphære cause the flux & reflux of the sea. Take a tube of above 30 inches filled with quicksilver, or else take a tube filled with water which is soe much longer than 30 inches as the quicksilver is weightier than water & the top being stopped the liquor will sinke 3 or 4 inches below it leaving a vacuum (perhaps) then as the aire is more or lesse pressed without by  $\odot$  so will the water rise or fall as it doth in a witherglasse by heate or cold. The same may be done by compareing the motions of the water of 2 weather glasses one wherof is with in a vassell of water the other not.

Observe if the sea water rise not in days & fall at nights by reason of the earth pressing from  $\odot$  uppon the night water &c. Try also whither the water is higher in mornings or evenings to know whither  $\ominus$  or its vortex press forward most in its annuall motion

<111v>



## Of Mineralls

Why doth quicksilver sinke so readily into mettalls & into nothing else.

Foure ounces of copper, & one ounce of Tinglasse melted together compose a body coloured like Gold.

Brasse is Compounded of Copper & lapis Calaminariæ or fire-stones for ☉ {locks}, melted together

Pewter of tin & brasse.

Bell mettall of Tin one ounce & 3 ounces of Copp{er}

Mettall for reflections may bee thus made: Melt throughly 3 pounds of Copper then take 4 ounces of white Arsnick 6 ounces of Tartar & 3 ounces of Saltpeeter finely poudered together & put them into the melted copper & stirr them well together with a rodd of iron until they have done smoaking (but beware of the pernicious fume for the Arsnick is poyson) Then after a little blowing the fire to make it as hot as before put in 6 ounces of Tin-gla{ss} 2 ounces of Regulus of Antimony & after another blast or two put in a pound of Tin & stirr it a very little & immediately cast it The Tinglasse makes the mettall tough, & the Antimony makes it fine & of a steele colour two much of will make it bleaw. The Saltpeeter opens the poores of the mettall to let the filth evaporate & the Tartar helpeth to carry it away. If this mettall must bee cast smo{oth} line the sand mold with the smoake of a linke.

If there be mettalls of equall weight there proportions are tin = 10000 Iron = 9250, copper 8222, Silver = 7161, leade = 6435, quicksilver = 5453 gold = 3895. Or if they bee equall the weight of gold is {10000} of quicksilver 7143, Of leade 6053, Of silver 5438, of copper 4737 of iron 4210, of tin 3895.

<112r>

[5]

## Of the Flux & reflux of the sea earth water & vortices.

Note that the Earths diurnall motion is not helped by its vortex, for by the same force it would move the water & air along with it, or rather faster.

Try whither the Seas flux & reflux bee greater in Spring or Autume in winter or Sommer by reason of the ☾s Aphelion & perihelion.

Whither the Earth moved out of its Vortexes center by the Moones pression cause not a monethly Parallax in Mars &c

In the Island Berneray scituated betwixt the Islands Eust & Herris In the tract of Islands west to scotland called by the inhabitants the long Island (Berneray is 3 miles long from east to west, & more than one mile broade). foure days before & after the full moone the tide flood runs east & its ebb west (the spring tides riseing 14 or 15 foot upright). but foure days before & after the quarters (a southerly moone makeing there full sea) One flood & ebb runns east ward from about 9<sup>h</sup> 30' to 3<sup>h</sup> 30' in the day & in the other 12 night howers the flood & ebb run west ward in the summe  $\frac{1}{2}$  yeare when the ☉ hath northerne declin{e} but in winter it runs westward in the day eastward in the night.

The Danube runns swiftest at noone & midnight & slowest at six of the clock (as is perceived by the motion & noyse of the clackers in Mills) & yet there is noe ebb nor flow the water keeping at a constant height. Also another turbulent river which swimms into the Danube mixeth not with it, nor swim they like water & oyle one above (but besides) the other.

<113r>

[6]

## Of Violent motion

2 This motion is not continued by a force imprest because that force must be communicated from the mover into the moved either by Some corporeall efflux or incorporeall one or nothing. if by corporeall attomes we are still at a loss how those attomes must continue theire one motion. if by an incorporeall efflux it must be by either spirit or some quality if by a spirit how comes the spirit to be so easily united to the body & not to slip through it & when united to it how comes the spirits to cease so soone & the spirit to leave it & hence every little attome must have soules in store to cast away uppon every body they meete with. if a quality then qualitas transmigrat de subjecto in subjectum. & this quality cannot be the motion of the mover since it & the mover are seperated at once from the thing moved. In a word how can that give a power of moveing which it selfe hath not.

<113v>

Therefore it must be moved after its seperation from the mover by it one gravity. Which will be cleare by seing whither there can be motion in a vacuum & what that motion is & so compareing it with motion in pleno.

1 That there may be motion in vacuo let us suppose (a b) to be a body as a peice of Aire (c. d. e.) to be three globes, (f g h i) & all the space about the globes & that aire to be inane now in the chapter de vacuo wee have shewed that those



three globes would be really seperate & not touch one another. you will grant that halfe the globes are in places & consequently may move, suppose then that halfe of (r) in the aire move towards (d) we aske whither that part in vacuo would move along with it or stay behind & be seperated frome it if the first we have our desire if the last wee ask what should seperate it from it not the vacuum since that is accounted nothing. but you may say that it is not truly motion for the upper par<sup>te</sup> of r to be carried to (d) we answer that where there is action (for such is the passing of (r) to (d)) & where there are new respects acquired to the same bodys there must be motion, but the upper part of (r) hath neither the same respect to the aire nor to (d) which it had before it began to pass towards d. If this going of r to d be not motion I aske what it is. but this is onely to strive about termes & if it please you not to call it motion cal <114r> it what you will but it is that which we aimed to prove & there is but this difference twixt it & motion in pleno. that the one is environed with such mater as is impenitrable & consequently that mater must be crouded out of the moving bodys way before or rather at the same time that the body moves, it must needs impede the motion to be continually thrusting against & resisted by the body before it: but in vacuo it meetes with nothing impenitrable to stay it tis true God is as far as vacuum extends but he being a spirit & penetrating all matter can be no obstacle to the motion of matter noe more than if nothing were in its way Let mee aske why one should be motion more than another since in pleno motion is so stopped by one body rubbing uppon another & in vacuum it hath its liberty can the same thing (viz a being invironed with bodys) at the same give a being to motion & yet destroy it, wherefore to be in pleno cannot be essentiall to motion. & if it were things would be more properly sade to move where there is most body or they find most resistance to theire motion & so more properly in water than in aire &c. But it is objected by Aristotle that a Vacuum is uniforme & every where alike & a body hath the same respects to a vacuum in all places alike but there is no motion with some mutation of circumstances And so in Vacuo no motion I answer as to our senses the aire is uniforme And we judge a thing to be moved when we se it come nigher or goe farther from some thing which our senses can perceive & so we judge not a thing to be moved in respect of the aire but of the earth or some thing

<114v>

## Of Comets.

### The motion of a Comet

| Die mensis  | longitude |                 | latid<br>Austr |                  |                 |     |
|-------------|-----------|-----------------|----------------|------------------|-----------------|-----|
| Octob.      | 8         | 23 <sup>d</sup> | ♄              | 16'              | 13 <sup>d</sup> | 51' |
| At midnight | 9         | 26              |                | 17               | 12              | 48  |
|             | 10        | 29              |                | 13               | 11              | 44  |
|             | 11        | 2               | ♃              | 4                | 10              | 39  |
|             | 12        | 4               |                | 50               | 9               | 35  |
|             | 13        | 7               |                | 31               | 8               | 30  |
|             | 14        | 10              |                | 7                | 7               | 26  |
|             | 15        | 12              |                | 38               | 6               | 23  |
|             | 16        | 15              |                | 4                | 5               | 22  |
|             | 17        | 17              |                | 24 $\frac{1}{2}$ | 4               | 22  |
|             | 18        | 19              |                | 39               | 3               | 25  |
|             | 19        | 21              |                | 47               | 2               | 30  |
|             | 20        | 23              |                | 48               | 1               | 38  |
|             | 21        | 25              |                | 42               | 0               | 49  |
|             | 22        | 27              |                | 29               | 0               | 3   |

|        | longitud |                 | lat Septen: |                  |   |     |
|--------|----------|-----------------|-------------|------------------|---|-----|
| Die    | 23       | 29 <sup>d</sup> | 10'         | 0 <sup>d</sup>   |   | 40' |
| Octob. | 24       | {illeg}         | ♄           | 45               | 1 | 20  |
|        | 25       | 2               |             | 15               | 1 | 58  |
|        | 26       | 3               |             | 40               | 2 | 34  |
|        | 27       | 5               |             | 0                | 3 | 7   |
|        | 28       | 6               |             | 16               | 3 | 37  |
|        | 29       | 7               |             | 28               | 4 | 6   |
|        | 30       | 8               |             | 36               | 4 | 33  |
|        | 31       | 9               |             | 40 $\frac{1}{2}$ | 4 | 58  |
| Novem  | 1        | 10              |             | 42               | 5 | 21  |
|        | 2        | 11              |             | 40               | 5 | 43  |
|        | 3        | 12              |             | 35               | 6 | 3   |
|        | 4        | 13              |             | 27               | 6 | 22  |

|    |    |   |    |   |    |
|----|----|---|----|---|----|
| 5  | 14 |   | 16 | 6 | 39 |
| 6  | 15 |   | 22 | 6 | 54 |
| 7  | 15 |   | 45 | 7 | 7  |
| 8  | 16 |   | 25 | 7 | 18 |
| 9  | 17 |   | 2  | 7 | 28 |
| 10 | 17 | ♋ | 36 | 7 | 37 |

Its beard was round about it.

Octob 8<sup>th</sup> at 11<sup>h</sup> afternoone this comet was distant from the 3<sup>d</sup> star of ♎ 45<sup>d</sup> 16<sup>1</sup>/<sub>2</sub> {} 11<sup>h</sup> 10<sup>m</sup> from scapula Pegasi 33<sup>d</sup> 43' <sup>1</sup>/<sub>4</sub>. Therefor it longitude was 23<sup>d</sup> ♎ 9' 2". latitud 13<sup>d</sup>, 52', 9"

Anno 1618 A Comet appeared Stilo Gregor:

|  | longitudo                    | lat: Bor:                  |
|--|------------------------------|----------------------------|
| Decemb 13<br>hor: 4 <sup>1</sup> / <sub>2</sub> matu       | ≈ 17 <sup>d</sup> , 42', 5"  | 41 <sup>d</sup> , 47', 40" |
| Dec 14 <sup>d</sup> . 5 <sup>3</sup> / <sub>4</sub> h mat. | ≈ 15 <sup>d</sup> , 41', 15" | 46 4 24                    |
| Dec 24 <sup>d</sup> 4 <sup>1</sup> / <sub>2</sub> h mat:   | ♎ 20 <sup>d</sup> , 44 2     | 58 33 37                   |
| Dec 11 <sup>d</sup> , 6 <sup>1</sup> / <sub>2</sub> h mane | ≈ 23, 21, 0                  | 37, 3, 50                  |
| Dec 2 day. ho 6 <sup>1</sup> / <sub>2</sub> mat            | ♎ 8 <sup>d</sup> , 23' 43"   | 14, 12, 0                  |

### The motion of the comet

from 2<sup>day</sup> to 11<sup>th</sup> day 26<sup>d</sup> 31'. From 11<sup>th</sup> to 13<sup>th</sup>; 6<sup>d</sup> 34' from 13<sup>th</sup> to 14<sup>th</sup> 2<sup>d</sup> 35' 50". from 13<sup>th</sup> day to 24<sup>th</sup> it moved 23<sup>degr</sup> 45' 54". The 1<sup>st</sup> day the tayle was avers from ☉ exactly its tayle reached beyond | below the **{illeg}** <115r> lower wheeles in the Great Beares belly & was in a manner || to them. But it declined a little afterwards from ☉ toward ♀ upwards Sometimes the tayle declines from ☉ 20 or 30 <sup>degrees</sup> east or westward. The tayle of this last Comet was sometimes 25<sup>d</sup> in length. The beard of it was so raire as that starrs might be seene through it.

1664. Dec 9<sup>th</sup> old stile at 4 of the clock in the Morning the latitude southward of the Comet was 20<sup>d</sup>, its longit 182<sup>d</sup>. The length of its tayle 20<sup>d</sup>.

On fryday before midnight December 23<sup>d</sup> 1664 I observed a Comet whose rays were round her, yet her tayle extended it selfe a little towards the east parallell to the Ecliptick The \* it selfe was not seene onely it looked like a little cloude The altitude of Sirius at the time of observation was 16<sup>d</sup>, The comet was then entering into the whales mouth at the nether jaw being distant from Aldeboran 23<sup>d</sup> 21' & as much from Rigel. Therefore the longitude of it was 48<sup>d</sup> 4'. its latitude 22<sup>d</sup>, 3', 44". At about 9<sup>h</sup> 24' at night

December 24<sup>th</sup> it appeared as on the day before, being distant from Rigel 28<sup>d</sup>, 24'; from Aldeb: 24<sup>d</sup> 12{} Sirius being 20<sup>d</sup> high that is it was 10<sup>h</sup> 28' | 26' at night. whence its longitude was 44<sup>d</sup> 7' its latitude

southward  $18^d 23'$ .

Dec 27<sup>th</sup> before midnight Sirius being  $16^d$  high the distance of the Comet from Aldeboran was  $28^d 11'$ . from Rigel  $38^d 36' \frac{1}{2}$ . Its longitude was  $37^d. 4'. 13''$ . <115v> its longitude was  $37^d, 4', 13''$ . its latitude south  $10^d, 20', 4\{\text{illeg}\}\{\}$  at  $9^h 8'$  at night.

The length of its taylor was about  $11^d$  being extended towards Aldeboran or a little below it parallel to the Ecliptick. The taylor now perfectly manifested it selfe on that east side. It moved northward against the streame of the Vortex cutting it at an angle of about  $45^d$  or  $46^d$ . There was still a very bright beard | haire round about the Comet & it seemed to be nothing but bird raying from the center of it for I could not see the limits of the  $\ast$ .

Dec 28<sup>th</sup> the comet was distant from the bright  $p\ast$  in the jaw of the Whaile  $5^d 52'$ . from the {middle} star  $q\ast$  in the Whailes mouth  $3^d 43'$ . Covering the  $\ast$  twixt  $\ast e$  the  $3^d$  &  $5^t$  of the Goate with its haire but being rather above it as in the figure. Its taylor extending to the  $3^d$  &  $4^{\text{th}}$  stars in the section of the bull



Dec: 29<sup>th</sup> when 'twas in the meridian its altitude was  $44^d 13'$ . Therefore its declination was  $6^d 30'$  Northward.

Dec: 30<sup>th</sup>, 15<sup>min</sup> past  $7^h$  at night. The right ascension of the Comet was the same with the  $\ast c$  below the whailes eye its declination about  $28'$  most northern

<116r>

Ian 1<sup>st</sup> Sirius being  $20^d 50'$  high, or  $21^d$  high The comet had  $4'$  in Alinicanthers more than the  $\ast$  below the whailes eye,  $5'$  in Azimuths westward more than that in the hinder parte of the head. Its taylor being  $12^d$  in length & extending towards the 3  $\ast$ s below Suculae under Aldeboran.

Ian 2<sup>d</sup> Aldebor being Ian 2<sup>d</sup> Rigells Altitude being  $25^d 30'$  or lesse The Comet had the same Azimuth with the  $\ast$  in the hinder parte in the Whailes head, being perpendicularly over it & distant from it  $2^d 41'$ .

On Tuesday Ian 10<sup>th</sup> at 10 of the clock at night The comet was distant from the northerne  $\ast$  following the 1<sup>st</sup>  $\ast$  of  $\Upsilon$   $6^d 10'$ . from the midle & brighter  $\ast$  in the north knot of the fishes  $6^d 8'$ . Its taylor poynting towards the biggest of the 3  $\ast$ s in the taile of  $\Upsilon$  but being very weake & the star it selfe grown very dim.

On Munday Ian 23<sup>d</sup> at  $8^h$  at night The Comet was distant from the middle bright  $\ast$  in the North knot of the  $\text{H}$   $3^d 58'$ . & twixt that  $\ast$  & the  $\ast$  in the Rams neck exactly. its taylor being scarce discernable. This comets motion was swiftest & it nerest to us when it was in the belly of Sirius its right ascension being  $100^d$ .

<116v>

On Saturday Aprill 1<sup>st</sup> 1665 There appeared anothe{r} Comet which at 20' after 3 in the morning was distant from the Head of Andromeda  $3^d 29'$ . & From the  $\ast$  in the left knee of Pegasus  $16^d, 18'$ . being in or very neare the Tropick with longitude  $\Upsilon 4^d$  or thereabouts by the Globe.

On Tuesday morning at 20' after 3 Apr: 4<sup>th</sup> the Come{t} was distant from Andromeda's head, 8<sup>d</sup>, 26'. From the Star in Cassiopeas Brest called Schedir 28<sup>d</sup> 22'. Being on that side of them towards Perseus.

On wednesday apr 5<sup>th</sup> at 20<sup>m</sup> after 3<sup>h</sup> the Comet was distant from the head of Andromeda 10<sup>d</sup> 40'. 28<sup>d</sup>. 58' from Cassiopeas brest.

<117r>

[7]

### Of Motion.

the joyning & meeting of the two parts & posterius according to the latter of the two parts & so be still liable still to divisibility which contradicts the notion of an indivisible part. But to explaine how these leasts have no parts.

An Artist will play a lesson not minding a stroke & sing neither minding nor missing a note a man may walke without thinking of it. &c

In a wheele divided into 24 parts by the 24 letters. A cannot move before b nor b before c &c to z, then z will not move untill A hath nor A till z the reason is becaus a can have no place but b's nor that till b hath left it. If they move all together then in the instant that b leaves its place it is in't or not. if in't then a can't move into't in the same instant it leaves it if not in't then it had left it before. A less & greater  $\oplus$  in a wheele move equally swift {illeg} the ( or els a straight line drawne from the center to the cicumference would be in flected i. e. if some parts move faster than others) yet the greater circle passeth over more space.

A little wheele on the same axis with 2 large ones will pass over equall space with equall revolutions. Glanvill When a snaile creepes a gale of spirits circuit from her head downe her back to her taile & up her belly to her head againe. Cartes defines motion 2<sup>a</sup> parte Pr: Ph: to be The Translantion of one part of matter or one body from the vicinity of those bodys which immediatly touch it & seem to rest, to the vicinity of others.

The motion of the Stomack in vomiting (though wholly against our will & therefore merly mechanically) by the touch of a whale bone onely, doth much more illustrate the actions of brutes to bee mechanically & independent of soules, then Chartes his instance of winking at the shaking of a freinds hand by the eye.

How much longer will a pendulum move in the Receiver then in the free aire. Hence may bee conjecttured what bodys there bee in the receiver to hinder the motion of the pendulum.

<119r>

### [8]Of Attomes.

<119v>

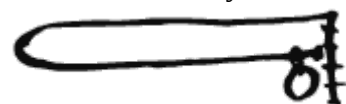
<120r>

What ever can be objected against indefinite divisibility in bodys may also bee objected against the same in quantity & number. but if the fraction  $\frac{10}{3}$  bee reduced to decimals it will be 3,33333333 &c infinitely. & what doth every figure signifie but a parte of the fraction  $\frac{10}{3}$  which therefore is divisible into infinite parts

<121r>

anothers streames with much difficulty, & pressure & so be compacted & the descending streame will keepe them so by continually pressing them to the Earth till they arise to the place from whence they came, & there they will attaine there former liberty.

The gravity of a body in divers places as at the top & bottome of a hill; in different latitudes &c: may bee measured by an instrument of this forme



The weight of water is to the weight of quicsilver as 1 to 14. Water is 400 (perhaps 2000) times heavier than aire & gold 19 times heavier than water.

Quæst: What proportion the weights of two bodys as gold & silver have in divers mediums as in vacuo aere aqua &c: which known the weight of the aire or water in vacuo or the quantity of gold to the silver is given &c: As if in aire the Gold (a) is equiponderant to the silver (z) the weight {a} it being called b. And in water the gold (a) is equiponderant to the silver (2z). let (c) bee the weight of so much water in the aire as is equall to the Gold a then is  $\frac{cz}{a}$  the weight of so much water as is equall to the silver  $\frac{a}{z}$ . Then the gold & silver weighed in water their weights are diminished by the weight of the water whose place they contene. Therefor b - c is the weight of the gold a in the water & b -  $\frac{cz}{a}$  is the weight of the silver (z) in it, & since b is equiponderant to 2z in it Therefore b - c = 2b -  $2\frac{cz}{a}$  or  $\frac{ab+ac}{2c} = z$ . that is 2c : b + c :: a : z. Or if (c) the weight of water in the aire is sought then  $\frac{ab}{zz-a} = c$ . Thus might the absolute weights of bodys i: e: their weights in vacuo bee found. as of air or the Bodys or fire in a hot furnace without flame {&c}

Try whither flame will descend in Torricellius vacuum

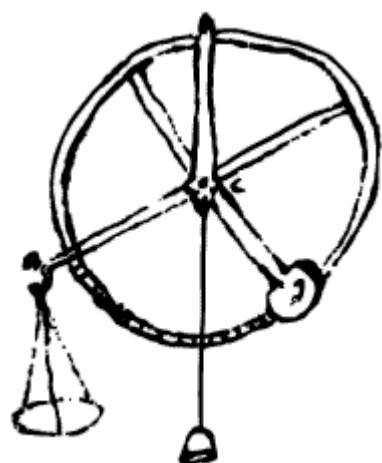
<121v>



In the descention of a body There is to be considered the force which it receives every moment from its gravity (which must be least in a swiftest body) & the opposition it receives from the aire (which increaseth in proportion to its swiftnesse). To make an experiment concerning this increase of motion When the Globe a is falne from e to f let the Globe b begin to move at g soe that both the globes fall together at h.

According to Galileus a iron ball or 100 Florentine (that is 78<sup>lb</sup> in London of Adverdupois weight) descends an 100 braces Florentine or cubits (or 49,01 Ells, perhaps 56 yds in 5" of an hower

By this {figure it will} appeare how to weigh without {illeg} the weight. And to tell exactly the weight of bodys {at} the first triall. But it will bee best to fix the wheele & make the armes cd & ac very long especially cd. This balance may bee of excellent use for finding the severall weights of allayed or mint bodys by their weight in severall mediums as in aire & water(as of gold & coppor,) or to compare the quantity of any two bodys (as gold & stone) by their difference of weight in divers mediums. to compare the weights of bodys, viz to find what proportion the weights of those bodys would have were they equall.



Try whither the weight of a body may be altered by heate or cold, by dilatation or condensation, beating, poudering, transferring to severall places or severall heights or placing a hot or heavy body over it or under it or by magnetisme whither leade or its dust spread abroad, whither a plate flat ways or edg ways in heaviest, whither the rays of gravity may bee stopped by refecting or refracting them, if so a perpetuall motion may bee made one of these two ways

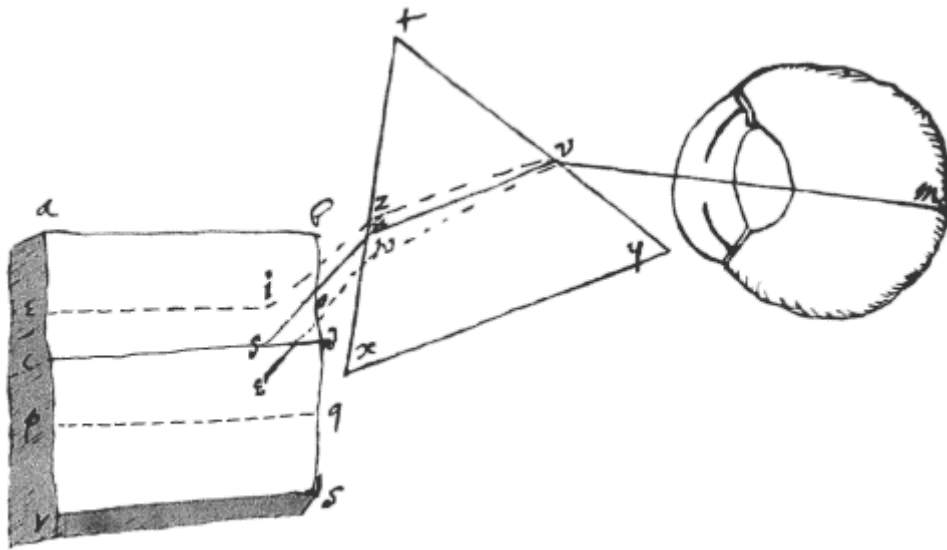


The gravity of bodys is as their solidity, because all body{s} descend equall spaces in equal {times} consideration being had to the Resistance of the aire &c

<122r>

## Of colours

Try if two Prismas the one casting blew upon the other's red doe not produce a white.



If abdc be white & cdsr black then eodc is red.

If abdc be black & edsr white then eodc is blew.

If abdc be blew & edsr white then eodc is blewer.

|       |       |                |
|-------|-------|----------------|
| white | blew  | Red.           |
| black | blew  | blewer.        |
| blew  | black | Greene, or Red |
| black | red   | blew.          |
| red   | black | redder.        |

If abdc be red & cdsr be white then eodc is blew.

|          |          |                     |
|----------|----------|---------------------|
| white    | red      | redder.             |
| white    | whiter   | blew.               |
| whiter   | white    | redd.               |
| black    | blackier | Greene or darke red |
| blackier | black    | blew.               |

The more uniformly the globuli move the optick nerves the more bodys seme to be coloured red yellow blew greene &c but the more variously they move them the more bodys appeare white black or Greys.

<122v>

1 Note that slowly moved rays are refracted more then swift ones

2<sup>d</sup>ly If adbc be shaddow & cdsr white then the slowly moved rays coming from cdqp will be refracted as if they had come from eodc soe that the slowly moved rays being seperated from the swift ones by refraction,



there arise 2 kinds of colours viz: from the slow ones blew, sky colour, & purples. from the swift ones red, yellow & from them which are neither moved very swift nor slow arise green but from the slow & swiftly moved rays mingled arise white grey & black. whence it is that cdqp will not appear red unless qsrp be darker because as many slow rays as come from cdqp & are refracted as if they came from eodc, so many slow rays come from qsrp & are refracted as if they came from dqpc unless qsrp be darker than dqpc

3<sup>dly</sup> That the rays which make blew are refracted more than the rays which make red appears from this experiment If one half of the thread abc be blew & the other red & a shade or black body be put behind it then looking on the thread through a prism one half of the thread shall appear higher than the other & not both in one direct line, by reason of unequal refractions in the 2 differing colours.

4 Hence redness yellowness &c are made in bodies by stopping the slowly moved rays without much hindering of the motion of the swifter rays. & blew green & purple by diminishing the motion of the swifter rays & not of the slower. Or in some bodies all these colours may arise by diminishing the motion of all the rays in greater or lesser geometrical proportion, for then there will be lesser difference in their motions than otherwise

<123r>

5 If the particles in a body have not so great an elastic power as to return back the whole motion of a ray. then that body may be lighter or darker colored according as the elastic virtue of that body's parts is more or lesser.

6 If there be loose particles in the pores of a body which by making them very narrow or by otherwise hindering the elastic power of the subtil matter whereby the motions of the rays are conserved that body may have some colour, &c

7 If a pore be too much straitened as at c e, so that the globulus must part the matter towards b from the matter towards d so that there be no subtil matter on either side towards c or e, when some of that narrow pore is behind it, there will be no matter on either side it to press it towards its hinder parts so much as it is pressed before likewise it is forced to croud before it all the matter in the pore so that its motion must needs be diminished if it had force to pass through but if it had not force enough to part the matter & get through then it would be reflected back without losing any considerable parts of its motion as rays passing out of glass, into the air when their force is too much diminished by their obliquity they are reflected by the air without any loss of their motion & bodies full of such straight passages in its pores must be of darker colours as blew glass whose pores may be straightened by loose & too great particles of the tincture lying within them. But if this pore were something bigger so as to let the slowly moved  $\circ$ s pass through with loss of most or all their motion, but letting the swift ones scape freelier then the colour will be red, yellow &c: as in glass it <123v> may be whose pores are full of smaller particles of the tincture than those pores of blew glass are,



8 Though 2 rays be equally swift yet if one ray be lesser than the other that ray shall have so much {illeg} lesser effect on the sensorium as it has lesser motion than the other &c.

Whence supposing that there are {loos} particles in the pores of a body bearing proportion to the greater rays, as 9 : 12: & the lesser globulus is in proportion to the greater as 2 : 9. the greater globulus by impinging on such a particle will lose a  $\frac{6}{7}$  parts of its motion the lesser glob: will lose  $\frac{2}{7}$  parts of its motion & the remaining motion of the glob: will have almost such a proportion to one another as {illeg} in quantity have. viz.  $\frac{5}{7} : \frac{1}{7} :: 9 : 1\frac{4}{5}$  which is almost 2 {the lesser} glob. & such a body may {prove blew} & {purple}

But if the particles on which the globuli reflect are equal to the lesser globulus it shall lose its motion & the greater glob: shall lose  $\frac{2}{11}$  parts of its motion & such a body may be red or yellow

9 If I press my eye on the left side (when I look towards my right hand) as at a, then I see a circle of red as at c but within the red is blew for the capillamenta are more pressed at n & o & round about the finger then at a towards the midst of the finger. that part of the apparition at q is more languid because the capillamenta at



o are duller & if the finger move towards e two much it vanisheth at q & appeareth semicircular but if I put my finger at e or {b} the apparition wholly vanisheth. By puting a brasse plate betwixt my eye & the bone nigher to the midst of the {tunica} than I could put my finger I mad a very vivid impression <124r> But of an ellipticall figue because the edge of the plate with which I prest my eye was long & not round like my finger If I was in the darke & the impression be very strong towards the outside appeared a broad circle of purple next blew then greene then yellow, red like flame, yellow, greene, blew, purple which growing from a very darke by degrees to a lighte blew ends in a greene in the midst. The colours I suppose next the flameing red looke something the darker by reason of its splendor. And if the experiment bee done in the light so that though my eyes were shut yet some rays got through my eye lids the outmost purple would appeare of a colour inclining to blacknes by reason I suppose of the bordering light. also if the pressure was not

very strong the greene & purple at a would not be preceived in the darke but it would be something lighter in the light than in other places of the eye as at v or w, & all the other outmost colours without strong pression bee but blew. but if the presion be strong in the light the apparition will but little vary from what it is in the darke. beyond all the colours as betweene o & e the light is stronger than in other places as at v or w, because the pressure helps the motion from without but is not strong enough to turne it to colour

10 Heate a peice of steele glowing hot, hold it over some water untill it turne from a white to a red heate then immediately quench it so far as you would harden for if it be quenched sooner it will bee too brittle if later too soft. Then makeing the end bright hold it over a candle that the end may be halfe an inch out of the flame, or lay it upon a hot iron, & these colours will follow one another towards the end of it; viz: bright yellow, deeper & reddish yellow or sanguine, a fainter blew; & a deeper blew, If it be quenched in tallow when tis yellow tis fit for gravers, drills &c: If when the light blew is on it it is fit for springs for watches If when the deepe blew is on it, it will bee very soft.

<124v>

11 The colours succede in order according to theire more or lesse reflection of light viz: white, redd, yellow, blew, purple greene, black. Red, & purple paint theire colours far more manifestly than blew, or greene.

Light reflected from a yellow to a blew body makes a greene

12 The sunne shineing through coloured paper or glasses as also the mixture of divers colours exhibits these colours viz yellow & blew make red

Yellow & red make Orange colour. Purple & red make scarle{t} Red & greene a darke orange Tauny. Red & blew make purple. Red & white by mixture make a Carnation

12 the yellow colour (made by a prisme) falling upon a blew makes a greene. blew falling upon red mak{es} a greene. It would be tried what colours the mixture of colours falling from 2 prismes would make.

13 Leade melted very hot & haveing the scum taken of represents these colours viz: Blew, yellow purple, blew; greene, purple, blew, yellow, red; purple blew, yellow & blew, yellow, blew, purple, Greene mix{ed} yellow, red, blew, greene, yellow, red, purple, greene.

14 Motes in the sunne in some positions appeare of divers colors.

15 Put as much common Sublimate into hot faire water as it can dissolve filter the solution through cap paper that it may be lympid. & into 2 spoonefulls of it, put about 5 drops of good limpid spirits of urine & it will be white like milke, to which if you put in some rectified Aqua=fortis it will be transparent. more fresh spirit of urine will make it looke white but not so white as before,

16 Make a strong Infusion of broken galls in faire water filter it into a cleane violl ad more of the same liquor to it till it be transparent. into it shake a convenient quantity of cleare but very strong solution of vitrioll & it will be black, then drop a little cleare & strong oyle of vitrioll into it shakeing the vessell well & the liquor will become transpar{ent} which againe will become black by the affusion of a smal{l} quantity of a strong solution of salt of tartar.

Note, the Corrosive liquors ( as oyle of Vitrioll) may clari{fy} a liquor seperating & dividing its parts. But precipitating liquors (as salt of tartar) by uniteing their parts make them conspicuous & the liquor coloured.

<125r>

### [9]Of Imagination

I gather that my Phantasie & the ☉ had the same operation uppon the spirits in my optick nerve & that the same motions are caused in my braines by both.

Opening my eye & lookeing in the darke upon the like imaginations there appeared the like phantasme as when I shut it

5 Lookeing uppon white paper there appeared (by meanes of a strong phantasie) first a spot something darker than the paper which grew blacker & blacker untill there seemed to be a dusky red spreading almost over all the paper {sometime} this spot would be red & sometime blew

6 lookeing on a bright cloude there appeared the same phantasm as when I looked on the white paper onely for the most part blacker untill at last I was able to make this spot glitter amidst the dusky red whither I looke on the paper or cloude like the ☉ in a cloude so bright that my eyes watered.

7 Imploying my selfe in other exercises for two or 3 howers an hower before ☉ set hee being wholly clouded, when I thought my eye was prety well restored I repeated all the former experiment adding this to them that though I shut the distemperd eye & opened that with which I looked not on the ☉ that I could see the ☉ pictured on the cloudes or other white objects almost as plaine as if I had looked with my distempered eye the other being shut & every where about ☉ appeared a dusky red & blacknesse. & with doeing thus I have made such impress on the optick nerve that let me looke with which eye I would ☉ offered itselfe to my vew unless I set my fantasie to worke on other things which with much difficulty I could doe

8 If after I had thus seene ☉s image with my left well eye I shut it & opened my right eye all objects would appeare coloured as when I had seene ☉ But I could not perceive any such motion in the spirits of my left eye for all objects appeared in their right colours to it unless <125v> when I fixed my eye on them for then appeared ☉

9 when the impresion of ☉ was not too strong upon my eye I could easily imagine severall shapes as if I saw them in the ☉s place, whence perhaps may be gathered that the tendere{st} sight argues the clearest fantasie of things visible. & hence something of the nature of madnesse & dreame{s} may be gathered

10 When I had beene thus affected 2 days the same white wall If I looked not over nigh it where it was shadowed looked blew, where it was lesse shadowed looked red inclining to white where it was lightest by the rays of the ☉ reflected from a wall uppon it it looked white, at that time I had beene in a darke rome for 2 or 3 howers & my eyes were made tender thereby so the motion made in them would be easlier conserved & consequently more uniforme.

<128r>

### Of God

Were men & beasts &c made by fortuitous jumbings of attomes there would be many parts uselesse in them here a lumpe of flesh there a member too much some kinds of beasts might have had but one eye some more

than two & the two eyes.

<128v>

### Of Light<sup>[10]</sup>

the candle in the glasse appears & disappare.

<129r>

### Of the Creation .

The word **ברא** which Gen i.i. is interpreted to create something out of nothing is used Gen the 1<sup>st</sup> v.21 where tis saide God created greate Whales &c, but the matter out of which they were created did exist before neither is it ment of creating the soule or forme of the whale, for that is not the whale alone. & there may be but one kind of irrationall soule which joyned with severall kinds of bodys make severall kinds of beasts, for setting aside the different shape of their body beasts differ from one another but in some qualitys which are called instincts of nature. now as in men whose soules are of one kind some love hate feare &c one thing some another & few men are of the same temper which diversity arises from their bodys (for all their soules are alike) so why may not the severall tempers or instincts of divers kinds of beasts arise from the different tempers & modes of their bodys they differing from one another more than one mans body from anothers.. To suppose then that God did create divers kind of soules for divers kinds of beasts is to suppose God did more than He needed How then can the soule of the whale be called the whalle since before it be joyned with the whale tis as much the soule of a horse & this creating then of whales & severall other creatures must be noe but modifying matter into the body of a whale & infusi{ng} an irrationall soule into it. Eccles: 33 ves 10 Adam was created of the earth.

Whither Moses his saying Gen the 1<sup>st</sup> that the evening & the morning were the first day &c do prove that God created time. Coll 1.16 or heb 1 ch 2 v τους αἰῶνας ἐποίησεν expounded, he made the worlds. prove that God created time

<130r>

### Of the soule

Were the soule nothing but modified matter & did memory consist in action (for it can thus consist in nothing else) wee could never call things into our memory for so long as that action continews we must thinke of & remember that phantasme & when that action ceaseth & not before then wee may cease to thinke & remember that phantasme but how shall we call this thing into memory the action being done & we haveing no principle with in us to begin such a motion againe within us. &c

If sence consisted in reaction we should perceive things double or we should never se any thing before us but there would be some apparition behind us for let this perceiving body be what it will suppose the conarion it cannot be so much pressed on one side by the spirits but it will press upon the spirits on the other side as consequently they will presse upon it &c.

Hobbs. part 4<sup>th</sup> chap 1<sup>st</sup>. Motion is never the weake{r} for the object being take away for then dreames would not be so cleare as sence. but to men wakeing things past appeare ob={scurer} then things present because the organs being moved by other present objects at the same time those phantasmes are lesse predominant. Resp: Then we should never forget any thing. 2 Phantasmes are prædominant from the strenght of the motion causing them if then but if the motion causing present & past phantasmes be alike strong the effect must be equall & so there would be no difference betwix sence & phantasie. all things which wee ever perceived would be alike in our phantasie & wee should thinke of an immense multitude of objects at once. &c

<130v>

### Of the soule

Memory is a faculty of the soule (in some measure for else how can divers sounds, or words excite her to divers thoughts or 3. 4. 5 or more words beget the same thought in her. Perhaps shee remembers by the helpe of characters in the Braine, but then how doth shee remember the signification of those characters.

Quaere. 1 Why Objects appeare not inverst, Resp: The mind or Soule cannot judge the image in the Braine to be inversed unlesse shee perceived externall things with which shee might compare that Image.

2. Why doe appeare to bee without our body? Resp: Because in the image of things delineated in the braine by sight, the bodys image is placed in the midst of the images of other things, is moved at our command {towars} & from those other images. &c :

3. But why are not these objects then judged to bee in the braine Resp: Because the image of the braine is not painted there, nor is the Braine perceived by the soule it not being in motion, & probably the soule perceives noe bodys but by the helpe of their motion. But were the Braine perceived together with those images in it wee should thinke wee saw a body like the braine encompassing & comprehending our selves the starrs & all other visible objects. &c

<131r>

### **Of Quantity**

If Extension is indefinite onely in greatness & not infinite then a point is but indefinitely little & yet we cannot comprehend any thing lesse. To say that extension is but indefinite (I meane all the extension which exists & not soe much onely as we can fancy) because we cannot perceive its limits, is as much as to say God is but indefinitely perfect because wee cannot apprehend His whole perfection

<132r>

### **Of Sleepe & Dreames &c**

How is it that the Soule so often remembers her dreames by chanch otherwise not knowing shee had dreamed, & thence whither shee by perpetually employed in sleepe. whither dreames are of the body or soule. Why are they patched up of many fragments & incoherent passages.

<133r>

### **Of colours vide pag 69**

17 Substances belonging to the vegetable or Animall Kingdome when lightly burned are black, when throughly burned are white. As Ivory being skilfully burnt affords painters one of the deepest blacks they have &c. But mineralls are to bee excepted from this rule, For Alabaster if never so much burnt will turne no darker then yellow. Leade being calcined with a strong fire turnes into minium which is red, & this minium by burning turnes darker but never to a white colour. Blew, but unsophisticated Vitriol when tis burnt a little by a slow heate to friability, is white being further burnt turnes Grey, Yellow, red, & when perustum it turnes to a purple.

18 Take Rectified oyle of Vitriol mixt by degrees with a convenient quantity of the essentiall oyle of wormewood (which was drawne over with stove of water in a limbec) & warily distill the mixture in a retort, there will bee left behind a greate quantity of dry & very black matter

Or becaus the essentiall oyle of Winter-savory is clearer than that of wormewood mix it by degrees with about an equall quantity of oyle of Vitrioll these two cleare liquors distilled as before leave a good quantity of black matter.

19 Gold & silver melted into a lumpe & dissolved by Aqua fortis the powder of gold falling to the bottome appeares not yellow but black though neither the gold silver nor Aquafortis be so, & silver rubbed on other bodys colours them black.

20 Most bodys precipitated from the liquor into which they were dissolved are white, but not all.

21 The scrapeings of black horne lookes white.

22 Sulphur adust is not the cause of blacknesse as Chimists hold, for common sulphur be either melted or sublimed turnes onely red or yellow. And the plant Camphire though very inflamable & consequently sulphureous by burning turnes to noe colour but white &c. But then what causeth blackness in sulphur adust.

23 A Candle looked on through blew glasse appeares greene.

24 Pouder of blew bise mixed with a greater quality of yellow orpiment makes a greene but the particles by a microscope are discovered to retaine their blewness & yellownesse.

25 The steame of clear Aq: Fortis, or spirit of niter is red, &c.

<133v>

26. A feather or black ribband put twixt my eye & the setting sunne makes glorious colours.

27 An Acid Spirit & juice & salts as Spirit of salt, or of Vinegar, or of Vitriol or Lemmon juice, or Oyle of Vitrioll, or Aqua fortis

being droped into diversly coloured liquors & especiall{y} blew ones (as syrrup of violets impregnated with the tincture of the flowers, juice of blew bottles or coneweede, juice of ripe privet berrys, ) it turnes them commnly to a red colour. But sulphureous salts which are either Vrinous & volatile salts of Animall substances (as Spirit of Hartshorne, of Urine, of blood, of Sal=Armoniack ) or Lixivate Vnctuous or Alcalizate & fixed Salts made by incineration (as the solution of Salt of Tartar, of pot ashes, of common wood ashes, of lime=water, Oyle of Tartar, ) doe change them to a Greene. as the red juice of bucthorne berrys

28 Yet either a Lixivious liquor, or urinous salt being poured on a solution of blew vitrioll in faire water makes it yellow & the precipitated corpuscles retained the yellow colour when they were false to the bottome.

29 A just quantity of Oyle of Tartar poured into a strong solution of french verdigrease turnes it from greene to blew; a Lixivium of pot ashes turnes it to a lighter blew, & spirit of Urin, or Harts-horne make other blews.

30 {One graine} of Cochineel dissolved in spirits of urin & then by degrees in faire water, imparted a discernable colour to 125000 graines of faire water.

31 Most of the Tinctures which chimists draw which abound with minerall or Vegetable Sulphur turne red; & both Acid & Alcalizate salts in most sulphureous or oily bodys produce a red. & blew is more commonly turned to red than red to blew

32 Fully satiate good common sublimate with water filter it through paper that it be cleare, put a spoonfull of it into a cleare glasse drop in 3 or 4 drops of oyle of tartar well filtred & it will be of an Orange colour. but 4 or 5 drops of oyle of Vitriol dispersed about the glasse by shaking it, makes the liquor pellucid againe

<134r>

32 Some tinctures (as that of Amber made with Spirits of wine) appeare red or yellow as the vessells they fill are slender or broad but cochineel dissolved as before, & other liquors never looke otherwise than Red or of a carnation &c.

33 White bodys are commonly sulphureous.

34 Oyle of Tartar generally precipitates Metalline bodys corroded with acid salts.

35 Tinge water with red rose leaves into which drop a little Minium dissolved in spirit of vinegar & it will be of a muddy greene, but drop in a little Oyle of Vitrioll which though an acid Menstruum yet it will

præcipitate the leade in the forme of a white powder to the bottome leaving the rest of the liquor above of a good red almost like a Rubie

36 Oyle or spirit of Turpentine will not mix with water & it & water shaken together apeare white.

37 Some very corrosive & acid liquors will præcipite some others, as oyle of Vitrioll præcipitates divers bodys dissolved in Aqua fortis or spirit of wine vinegar, which precipitated bodys are usually very white

38 Bodys will scarcely be precipitated by Alcalizate salts that are not first dissolved in acid Menstruums

39 A leafe of Gold held betwixt the eye & the light appeares blew.

40 Acid salts rather dilute yellow & white juice than turn them to red,

41 Gentle heates in chemicall operations rather produce rednesse than other colours in digested menstruums not onely sulphureous (as spirit of wine) vid: sec: 31. but saline as Spirit of Vinegar

42 Alcalizite salts are wont to precipitate what acid salts dissolve

43 An Acid salt doth seldom restore a Vegetable substance to the colour of which an Alcalazite deprived it.

44 The acidity of spirit of vinegar is destroyed by working on Minium, (or perhaps on Crabs claws)

45 Put some solution of Minium into a spoonefull of the fresh tincture of logwood to turne it deeply purple <134v> precipitate  $\frac{1}{2}$  the leade with spirit of sal=armonick which precipitation as well as the supernatant liquor looks purple (by reason of the predominance of the tinged particles over the white) then power in some spirit of salt warily & the precip{:} by Sal=Ar: is of a violet colour at the botome, the precip{:} by spirit of salt is white & carnacon in the midst, & the top yellow or red. vide sec 35

46 That the colour of a body bee altered by a cleare liquor tis commonly required that it have salt yet faire water powred on the grey & friable calix of powdred Vitriol melted by a gentle heate till it colour change & the liquor being set by in a close violl for some days it will tune to a vitriolate colour

47 Take Lignum Nephriticum (the infusion of which in faire water is good against the stone of the kidneys) put a handfull of thin slices of it into 3 or 4 pound of pure spring water after it hath infused there a night put the water into a cleare violl, & if you see the light through it it appeares of a golden colour (excepting sometimes a sky coloured circle at the top) but if the infusion was too strong the liquor will then appeare darke & reddish. But if your eye is twixt the liquor & light it appeares ceruleous: & Acid salts destroy the blew colour & sulphureous saltes restore it againe, without making any change in the golden colour. Which may bee usefull to the finding whither bodys abound more with acid or sulphureous Salts.

48 The same may be done by Sirrup of Violets impregnated with the tincture of the flowers. For an acid salt turnes it from blew to red but sulphureous one from blew to greene. vide sec 27.

49 Haveing found that a sulphureous salt is predominant in a body it may be knowne whither that salt be Vrinous (i. e. volatile salts of anim{al} <135r> or other substances which are contrary to acid ones) or Alcalizate in the 32<sup>d</sup> sec. that is into sublimate dissolved in faire water put an Alcaly & it turnes it to an Orange Tauny, but urinous (or salsuginous) salts turne it to a pure white

50 the same liquor viz oyle of Vitriol) powred into a lixivium in which crude antimony has beene newly boyled turnes it from a cleare to a yellow colour, which sec: 32 turned a yellow to a cleare one.

51 There be flat peices of a certaine kind of glase which exhibits the Phenominon of lignum Nephriticum.

[1] vide pag 54

[2] pag 67

[3] vid: pag: 75

[4] vide pag 26 & 49.

[5] vide pag 26 47

[6] vid pag 21

[7] vid pag 10

[8] vide pag 3.

[9] vide pag 43.

[10] see pag 32

---