

Hydrobatus

J.
Hydrobatus
~~Prussicus~~

Pressure of fluids

1. In Cylindrical vessels

- Press equal - Press \therefore height

- height equal \therefore Press

2. Upon the equal bases the
pressures \therefore press² height with
regard to the quantity - Parol

3. Equal in all directions

4. Quantity Discharged in
proportion to the \sqrt{h}

Examples

Observations

— Same body weighed in different fluids — w. lost \therefore Sp. G.
If the body swims the part im-
mersed in different fluids \therefore Sp. G.

Specific Gravities

1. Body loses weight in fluids
2. Every body is pressed more upward than downwards — reason —
3. Weight lost in a fluid is in proportion to its surface — without regard to its matter or form —
4. Weights lost in different bodies are in proportion to the surface — hence an easy method of det. the surface of different bodies
5. Weight lost com. to the fluid —
6. Greater Sp. G. sinks, equal ~~to~~ ^{to} ~~the~~ ^{the} ~~rest~~ ^{rest} anywhere —
7. When a body swims a quantity of fluid equal to the part ^{by} immersed is equal to the weight of the whole body

Examples

1. Cubic foot of cork -
 .240 ounces
 1000 lost in water
 .760 upwards

2. Bucket which hold a cubic foot of water -
 water was over

* lost in water 1000 - Therefore the full bucket in water is the same weight as the empty one. It is not because the w. is destroyed but because it is supported by fluids. Do not grade in fluids, but because the gr. is supported by an equal over contrary pressure -

3. Press 2000 ounces
 water 1000
 Quicksilver 4000 ounces

- Hydrometer -

1. Wt. of spirits more: or their strength -
2. More spirits $\frac{1}{4}$ lighter than water -
3. Common Hydrometer -
 - construction -
 - water - few spirit
 - a thin stem bent -
 - Ball only useful to give it
 - made of glass - Ivory Metal
 - best best -

- Brown Hydrometer

- How made -
- Advantages -
- Exp. -

Examples

Gold and Copper

— Specific Gravity = 12 required
the quantity of each — Gold. 17 lbs.

$A : 7 :: 9 : C.$

$$\begin{array}{r} 19 \ 0 \\ \hline 76 \ 56 \end{array}$$

+ Levelling +
True and Apparent —
In m $8 = 1. \ 32 = 2 = 19. \text{ Dist.}$
+ Mountain Measure —
+ Pipes — Aqueducts —

small shot - Sand - Water -
Salt -

Density - rarity - relative
terms, do not express the abso-
lute number of partucles - but
∴ in two bodies of equal bulk -
height a measure of the Density
- formula

$$L \quad \therefore \quad M D$$

$$M \quad \therefore \quad \frac{L}{D}$$

$$D \quad \therefore \quad \frac{L}{M}$$

Extension — The expansion
 property of space — Surfaces
 — Solids — Lines — points —
 Divisibility — Matter is
 divisible by art to a great length
 — Microscopic animals —
 — Particles of light — Candle
 seen at 2 miles. — Musk —
 Chemical experiments — Pound
 of silver fused with 1 Grain of
 Gold — 1 Grain of this mixture
 which contains by the 57600 ft.
 of a Grain of Gold, when dissolved in
 aquafortis — Gold falls to the bottom
 1 Grain of Gold, a leaf of 50
 square Inches — 50 Million th

part of a Grain visible by the Microscope
 120,000 to make an inch —
 Matter divisible in infinitum
 Demonstration —



+ Three indivisible
 particles when laid tog.
 may be bisected —

Mobility — Inaction
— Vis inertia —

Space — Vacuum. Matter
fills a vacuum — proofs —
— Body annihilated — place
empty.

Time — we acquire our
Idea of time from a suc-
cession of events — Beats
of a watch —

Analogy between our Ideas
of time and space —
same epithets apply
to both. — Musgrave.

Length of time estimated
from the No. of objects that
pass in review before the
mind — Time affected by
the quality as well as by
the quantity of the objects
while we are kept awake
with racking pain, or bleeding
over the melancholy remembrance
of a departed friend, how
slowly do the hours drag
along, but while we enjoy
health and spirits, a quiet
circumstance —

21^o December
Remark on the Imposs.
Creation possible —

When do we say a thing is
impossible? — obstacles
Imposs. to the Suppr:
being. — I cannot carry
a mountain &c —

Difficulty of any Operation
Involves from certain obstacles
None nothing opposes no obstacles
Therefore a creation implies neither
abundance nor Difficulty —

Divisibility of matter —
Great lengths to which it
goes —

Infinite Divisibility —
Objections — All infinites
are equal — a lesser body
equal to a greater —

Argument for the Non Ex.
— a Man &c. — father —
Revolutions of Saturn —
the Earth. —

Principles inadmissible —
Major and Minor of the Syll.
are not to be admitted. —

Some applied to the infinite
divisibility of matter —

Objekt supposes that Matter is
actually divided in inf^m that
all infinites are equal. ~~~

Motion —

— Cannot be defined

— Prismatic — Curvilinear —

Properties of motion — common
to both

* Time requisite —

Absolute — Relative —
Defualt apparent

Examples

Path — (Direction with position
of the path

Swift — Slow — Velocity

expresses the rate not the real
quantity of motion — like

Interest of money ~~~

Uniform — Accelerated

Retarded. —

Sophisms relating to motion

Perseverance of matter.
Laws of Matter or Nature

Proportions —
Direct — Inverse —
— Compound

In uniform motions —

$S :: TV$
 $T :: \frac{S}{V}$
 $V :: \frac{S}{T}$

} These formulae
suppose two
bodies —

Laws of Motion

I Bodies ^{independently} in
motion or rest

II Change of motion :: force
impressed ^{and} in the same direction

III Action and reaction -

softest Bodies resist — air —
Sponge — earth Does not
collapse into a point. —
*Two Bodies cannot fill the same Sp
Impenetrability. — We

receive this Idea from touch —
— Incompatible with Elasticity?
Compressibility

Particles of Matter not in
contact — Chemical mixture
— two Bodies occupy less
space when mixed — Heat &
Cold —

Same Body may contain
very different quantities of Mat.
Box filled with Cannon balls
will receive Musket balls —

Properties of Matter —

Matter is that substance of
all bodies are composed. — This
definition makes it no plainer
— some things cannot be defined
— some prop^s cannot be dem^d;
— the reason —

Essence of Matter — imp^{oss}.
to discover —

Distinguishing properties of matter —

Solidity — properly by
which it occupies its place
to the exclusion of all others —
This differs from the Geom^{et}.

Hydrostatics — properties of W.

— we assume the least weight of this
Element in the chert fountain — it
floats and even swims on the banks of
the peaceful lake — its rolling waves
melt in the fountain rill, its majestic
rapidity in the mighty river,
its modestly agitated motions
bellow in the stormy sea

— Dives into the bowels of the Earth
gather together the scattered Elements
of earth, stone and metals and
condenses them into form.

— rises from the surface in
vapours ascends into the at-
mosphere where it forms
clouds — descends in rain, hail
snow and dew, — accompanies the
growth of vegetation and affords
the most wholesome drink to animals.

Water

- fluid - Resin of a fluid

- Cause of fluidity

- Insoluble - salt

- Incompressible fluid -

- Florentine Experiment

+ Hammer

+ round particles

+ Mr. Canton

Hard water

1. Does not curdle Soap

2. Does not exhaust zinc

3. Iron column - heavy

4. Heavier than soft

5. Does not putrify so soon

6. Boiling renders it harder

7. Filtration softens it -

8. ~~Does~~ Not work - perme

a great stop to the Bleas

- and Brewer -

9. The cause of Stone Gout &c

10. Cause of R hardness

any of the acids -

11. To soften water -

- Act of carbon -

Salt water

1. Cause of salt. — such as
salt for in fresh or land
 2. Making salt — Evapⁿ.
— by fire — by sun —
 3. Dens^y of salt water fresh
 4. Salt water frozen into
ice — sea
 5. Rain for the sea fresh
 6. Dens^y the water decreases
— Baltic decreases 50 parts
in a century
- X From 30 to 40th part
Mauris —

Evaporation —

— wonder full — water suff.
is at — 1000 times

— what effects more evap.

— Fluids have all ascend

— but what is the cause

x Doctor Walling, Galvani

compound of air & film

of water

— object

Now distinct globe form

— If the air cannot ascend

of it self, how when stopped

with a velvety film —

— air will soon be reduced

to the same composition

Doctor O. Sargent's Sept

— water converted into vap.

— winter heat renders water

lighter, what will happen

in summer —

— Steam will even be

reduced to its usual state

x Mistake in the spec.

Gravity of steam, only

$\frac{1}{1400}$ times lighter than

water —

Solution

Decomposition

Account of solution
on the principles
attraction

Newton's Theory

Examples

x Satisfactory

Applied to Earth

Heat promotes

Condensation

Large Drops

Large and small

High low clouds

Snow - Mist - rain

(Dews

Dews ascent

8 Jan. 1777

Inequality of period time
of in winter than in summer.
Mag. and Dist. of the orbit
Mag. changes - four changes
Season changes - nodes make
a complete Rev. in about 19 years
from the first of. to change and
the 2^d of. to change she moves
further from orbit incl. 5^o proof
of this from Ellipse not happen
at every new & Change - to determine
the true inclination it is right 5^o to
find the place of the node.
Comp. 1. 5. 03. 2. 55. 18" the nodes
not uniform - of. equal of the nodes
about 2^o - incl. various - 18' in
all other incl. 5, 5'

Just" is of. when the line of the
nodes pass thro' the sun - &c. —
When the moon approach the
node the incl: is greater —
Halley's tables have not det. abn
16. Mayer's tables ascertain the
moon's place to a minute —

- Archimedes' spiral pump -
- Bucket Engine -
- Common Raising Forcing
Rope pumps -

Evaporation goes on faster
in Spring than in the hottest
season middle of Summer

- A Northwester with dry weather
sooner in Spring than in
Summer or any other time
of the year -

- From one pound of Nitre
Gall! of pure air can
be obtained -

- Mr. Bergman found that
92 parts of 100 of charcoal
was Phlogiston -

- Aerial Gum powder stronger
than common powder -

+ Elective attraction like a
Lady who has got a number
of admirers she lets go one
and takes to another —

— Common Salt made by
hanging a small retort
over a Salut lamp —

— Wine proved to consist of
spirit, water and the alkali
by which gives it the colour.
Distilled a glass of wine first
came over spirit, then water
and last of all the bottom was
found dry at the bottom —

— A small quantity of Gum
Benzoin laid on a retort
and covered with a receiver
in which is placed a sprig
of mint produces a fine
rose fruit —

The Poet represents the alms giving
as coming into the world with the
center of all: in this he said this
Poet is professed than Plato:
the alt: Dan not reside in a point
but diffused over the whole
of the De Meckelgren *Exp* is
a proof —

— In calm weather the wind blows
into a great city from every
side —

— Blank mice better in Phlogo-
on in common air — hence the
reason of that ~~quarantine~~ which
we find near great towns

— A plant precisely under the
same circumstances at London
and two miles distance the
former weighed one fifth more
than the latter —

Stomach produces pure air - the
process slow -
Evaporation a chemical process
Two vessels of the same figure
and size - equal quantities
of water - one under the receiver
of an Air pump the other
exposed to the air in the
room - quantity Evap.
Siphon fountain - Copper
Ball for the florentine Expt.
Specific gravities - Three
bodies one sinks the other
rises, a third lies indifferently
any where -
A body floating on a fluid
displaces a piece of matter
but undress into water
the same quantity above
as one were -
Bodies lose as much of their
weight in water &c. &c.

We cannot feel two pains
- Boy pulling a hair without
pain -
The motion of the heart and blood
are too important an office to
be left to our own will, but
the motion of the limbs ought
to be entirely in our power -
The Expt. by which it is at-
tempted to be proved that
inflam^d air burst in com-
mon air produces water is
very doubtful -
How extremely delicate must
be the auditory nerve?
- without that no inflated
air can be produced -
A bit of paper placed on
the string of a Violin will
not be affected by striking any
other thing except an unison

which will make the paper
come off. - particularly notes
effect Rays - ourselves - Particu-
lar tones will be a glass
or make it some of the
table - A note of a window
was agitated during the sound
of a particular note of an
organ, the organist imme-
diately observed that he
would soon silence it he
by dwelling on the proper
note with it -

- Solar Microscope - sections of
wood - grass growth - tree grown
most on the south side - Indians
know their way in the woods by
this they cut down a tree -
- As eye depicted small part
of the hind part thro' the Scler-
coat - candle inverted - cho-
roid removed - candle more
(distinct
- Sclerotic the only member of the
human body not clothed -
- Retina attached by one point
when immersed in clear w.
spreads out most beautifully
- Aqueous humor new pieces
- Show how shell work on the
sides has a good effect
- transparent view of Petersburg
painted on three glasses -
- Concave cylindrical mirror -
- Cataract upon the Crustall.
human hand about -
- Artificial eye - rough glass is

The best substance for receiving
the images of objects —

A cat has the longest
vision of her pupil perpen-
dicular because she has the
depth for vision in the upper
iris well as the under part of
the pupil. An Ox the contrary
as his vision is to look
for grass side wise —

Phosphorus — 1 Writing on
white paper. 2 A small bit
of Phosphorus in a small quantity
of water in a porous flask over
a lamp produces corrosion,
strange Phosphoric Ether a few
drops poured on a bit of sugar
and the sugar thrown into warm
water makes the water appear
luminous —

More rain falls at the bottom
than at the ~~surface~~ top of a slope

— Does dew ascend? experiment
seems to prove that in the "low"
the dew ascends —

— Evaporation solution of water
in air — across a meadow
the water seen rising —

— a sudden cold covers the at-
mosphere with clouds, heat
soon dissolves the more water
and it clears up —

— A syphon fountain

Ophias

Eye noble organ - as it was to
be the inlet to all our knowledge
of Creation we wonder that un-
common pains should be taken
to - hollow cube -

Figures - Two Eyes ^{rays} ~~coloured~~
Reflection figure - Experi.
Bowl - Solid cube of Glass
split in a black case -

Three specks put obliquely on
a plate appear straight in W.
Boys lose their lives from the
appearance of the bottom being
higher than it really -

x. A stick bent at an angle
equal to the refraction of water
put into the water at the pro-
per degree of inclination appears
straight -

Arthur Dianne -
- Sympathetic Inks some
with pine and a stone
wall
- Experiments on colours
- The length of the string
to vibrate the ~~the~~ notes in
the natural scale correspond
to the prismatic colours -
- Monochord divided by
the prism -

+ Lead riveted different ways
a wafer in a candle
red lead with Sherwood
in a Crucible -

The human body is nearly
of the same weight as water -
When putrefaction comes on
the body swells and floats
+ Machine watering Garden
+ Pumps to be wrought by the
motion of the ship -
Tide Machine -
Scale for the configurations of
Jupiter's satellites -

Colours

Ancient Phil. Laws of Light
uniform - that colour was

- Newtons Doctrine -

Prism separates the rays
differently - forms a long
spectrum - coloured
the rays most refracted violet
last -

These seven prismatic colours
when compounded make
a white - collected in

the focus of a convex

+ lens - Optical Exp -

Every body absorbs some
rays and reflects others
colour of a body

In whatever rays a body
is placed it appears of that
colour - In white its own
colour - + All other colours
formed of the seven prismatic
colours - Any two produce
the intermediate colour -
Yellow and Blue - Green
As green a prismatic colour
It is, + for the prismatic colours
no attraction on any prin-
ticular -
Red yellow blue will
produce a white on the top
and all other colours -

Heat of bodies affected
by their colour -
+ Black and white board
Handkerchief -
+ Garden wall - fruit -
Black body emits light
Black and white stockings
Black cloaths warmest in
summer &c -
Black body sooner war-
ms than a white -

h

Two boards of equal size
Black and white - exposed
equally to the sun's rays
the black is hottest. This
+ is insensible on the com-
mon hypothesis - Why is
not the black board burnt
up the accumulation of
the heat? + The sun's rays
are rays only of light -
+ Sun's rays do not heat
a transparent body -
+ pane of glass - Clear water
speculum's focus produces
no heat in water, and yet
+ Burns a piece of wood
below the surface -

Light and Colours

- Ancient opinion of colour -

- Newtonian -

- Light not uniform -

- consists of seven primitive
colours -

- Prism - Different refraction

- Spectrum oblong -

- Red least violet most ref -

- Rays when mixed make a
white - convex lens - Foc -

- Cause of Different Refraction is

Magnitude of the rays -

Red greatest - violet least
particles - Cells of rays

- Intermediate colours how prod?

- Primitive colours cannot be
altered.

Why bodies appear of this or that
colour - Reflect one set of rays
and absorb the rest -

White is a compound of all colours

- Black no colour -

+ Different heat of bodies -

- Black - White -

- Garden wall -

Candle lighted -

- Black body soon consumes.

+ Achromatic Glass -

+ Heat of the sun's rays col-
lected in the focus of a Convex
mirror or Double convex lens
is as the square of the diam.
orally and of the distance inversely

Speculum

Refractive $\frac{3}{4}$ Inch

Diameter . . . 3.11

Focal Dist: . . . 3.2

Cast iron Melt: in 16"

Fin - - - - - 3

Suspension in - - - - - 7 $\frac{1}{2}$

Half penny - - - - - 20

Iron calome in - - - - - 4

and Deliquesced. - - - - - 33

In this Sp. the heat was 200
times greater than white heat
iron -

+ Focus does not heat water nor
air. - burn wood under water -
- Sun's rays do not heat a
transparent body - Air receiv-
eth heat from the earth - Water
also -

~~Dalhousie's~~ —

— Air more dense on the level
than top of mountain hence
— Great cold —

— Black and white bodies
— ~~exposed~~ to the sun's rays
why ^{is} does not the black
body heat up? —

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Reflected rays
Plane Mirror
Rays are reflected from
a plane mirror as they fall
on it. Magnitude not
altered. If a plane mirror
is placed perpendicular to
the horizon and a person
sees his whole length in
it the mirror will be $\frac{1}{2}$ his
length.

Object appears as far be-
hind the mirror as it is
really on this side of it.
- ^{principle}
It is erect and similar to
the object.

If two plane mirrors are placed
to each other innumerable images
of one object will be seen - if
the mirrors are inclined 30° e.g.
there will be 12 images in both mirrors
that is $\frac{360}{30} = 12$

Concave Mirrors —
 Par. says falling on a
 concave mirror are reflected
 converging so as to meet
 in a point at the distance
 of half the radius of the
 concavity.

Objects Magnified by a con-
 cave mirror — as by a convex
 lens — The magnifying
 power is increased ~~as to~~ \therefore
 to the concavity, it is as
 the distance of the object from
 the center ~~to~~ the Dist. of
 the image from the center.
 If an object is farther from a
 mirror than its focus and
 the eye farther than the image
 a distinct inverted image appear

hanging in the air before the
 mirror —

A concave mirror held to the
 sun's rays will burn —

Vitelli's Experiment

Diameter $\frac{3}{4}$ in.
 Focal Dist. 3 2 inches

Cast iron melted in	16"
Iron	3
Steel pen	7 $\frac{1}{2}$
A half penny	20
Plate melted	3
Bone calcined	4
and vitrified	33

In this experiment the heat was
 about 500 times greater than
 common fire —

Concave Mirrors

Rays diverge - the object
 therefore diminished. As
 the Rays do not cross each
 other, the object always
 appears erect.

Optical Instruments

1. Diagonal point Machine
2. Opera Glass
3. Camera Obscura
4. Refracting Telescope

An image is formed in the
 focus of the object glass, it
 is this image and not the
 object which is seen - This
 image enlarges in proportion
 to the focal distance and in
 the inverse proportion of the
 distance of the eye from it
 the eye cannot view it more
 than the limits of distinct
 vision hence the use of the
 eye glass - Divide the one
 focal distance by the other gives
 the magnifying power.

To have distinct vision the rays from the image in the focus of the object glass must come parallel to the eye - This can be effected either by a convex or concave eye glass - But with this difference that with a convex eye glass the distance of the glasses must be equal to the sum of the focal distances; with the concave it must be a difference -

Now with a convex eye glass the telescope may be shorter by twice the focal dist. of the eye glass - with a convex eye glass the object is inverted - with a concave it is erect -

x The field depends on the eye glass - the brightness on the object glass - A concave eye glass gives a larger field -
Q. The mag. power the less the field

The addition of two or four eye glasses does not increase the magnifying power of the telescope -
Invention of the telescope
Janssen & Galileo 1600

Reflecting Telescope

The image is formed in the focus of the great mirror - which coincides with the focus of the lesser mirror. By the lesser mirror it is thrown down through the hole in the great mirror - and formed in the eye tube which consists of two glasses like a refracting telescope -

The magnifying power depends on the focal distances of the mirrors and of the eye glasses -

Rule - Divide the Eq. Sp. focal Dist. by the lesser Multi-ply this into the quot arising from the division of the lesser Sp. second focal distance and the eye glass the product is the Magnifying power -

Nature in three different
views

1. Subject of Metaphysics
2. Subject of art
3. Subject of Philosophy

Study of Nature into

N. Metaph. N. Theology
N. Philosophy

Business of Nat. N. to de-
scribe all the bodies in the
Infernal System and re-
late what happens to them
— to arrange them into great
classes or genera then
into lesser classes or species
and then last into indivi-
duals —

— Consider how things are
adjusted to each other ^{in the works of Nat.} examine
the ^{the} swarms and contumacy

The designs, we then view
nature as a work of art
admire the skill of the artist
and endeavour to discover
his intentions, To raise the
existence and attributes of the
Deity from Nature
examined in this way is the
business of Nat. Theology

+ D. But when the subject of
enquiry is not for what
purpose, but by what
means natural appearances
are produced, what are
the efficient causes
- subject of Philosophy

To explain the appearance
of Nature, by tracing them
to their causes and to app-
ear. &c

- + Of that beautiful &c
- Course of Experiments
- Proof of a ~~Deity~~ Prop-
ty exp. &c
- Chief object of the present
meeting is to explain the
materials and arrange
- + Syllabus - parts to relate
each other -
- Elementary course -
- x. Syllabus -

- Such are the materials
and such the arrang^g of
these materials -
Plainest and simplest
Dress - Technical terms
+ Two extremes avoided -
- Such a number of Experi:
as are sufficient to prove
+ Apparatus extensive -

- In all our enquiries into
nature - proceed in this
manner

Use

- Improvements of Arts.
- Enlargement of our Press -
- + Prejudice - when we show

Terms

- 12 Lectures 1 Guinea
- 12 Tickets - transferable
- Single tickets half a crown — every lecture
- Private parties 2/6 each not less than 12 -
- + Matten wheat tickets
- 6 Guineas 1 Guinea 12
- X Course 2 tickets in the week - Monday & Tuesday
- + one in 12 —