

Discovered in 1784
by John Smith

by the Hon. John D. O.

Constitution

The work will contain 16
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& v. elegant binding

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Fixed Stars
 Why so called
 - places important
 - Magnitudes
 - Some from every part of
 the heavens
 - ~~objection~~
 - Constellations - 48 ancient
 Catalogues
 Hipp: 150 B.C. 1022
 Ptolemy 130 A.D. 1026
 Tycho Brahe
 Hevelius 3000
 Flamsteed 30000
 Herschel
 Changes in the Stars
 - Cloudy Stars
 - New Stars
 - Checks regulated
 - Not more than 1000 seen
 at once - Exp. of the tube
 no annual Par^a

Division of time.

- Days
- Months - moon - years
- years - periods
- + Division of the Zodiac
- Constell. but little resemble the objects
- weeks - uncertain
- Days of the weeks names

Astrology -

Sun - Venus - Mercury
 Moon - Saturn - Jup^r
 Mars -

Sun	Sunday
Moon	Monday
Mars	Tuesday
Mercury	Wednesday
Jupiter	Thursday
Venus	Friday
Saturn	Saturday

Books

- Divisions - Martin
- Bonnyeastle of horoscopes
- Vichon - works
- Puysson
- Pictor astr.

Venus	3	18 aft.
Mars	4	20 m
Jup:	12	4 10 m
Sat:	5	20 aft.
Georgian Sat:	2	40 m

Sum Enten Cap. 21° & more

Distances

M.	4	37
V.	7	69
E.	10	95
M.	15	145
J.	57	495
S.	95	908

Now the comparative Distances
are found, by these and the ^{radii} dist.
of any one planet all the rest may
easily be found by proportion.

Inclination of Planets

Mars	7°	+ in the year 1750 by Meyer
Venus	3 20	
Earth	5	
Mars	1 50	
Jup:	1 20	
Sat	2 20	

Now these are found

Rotations of

Sun	25.6
Mercury	88
Venus	224
Earth	24
Mars	24.48
Jupiter	10

Pluto
 Lengths of Day and night
 The sun and planets viewed
 with good telescopes appear not
 equally bright. ~~Orbit's~~ spots
 appear first on the eastern limb
 Name of app: and Disapp: the
 same adhere to the sun's
 surface - Above the sun to be
 a globe - Cavities - Spots
 in the sun sometimes seen
 with the naked eye - 5 or 6
 times the surface of the earth
 5 or 6 diameters. On 10 July 1777
 I saw a spot with the naked eye -

Planets

Periods Months	Rotations D H M
M = 3	Jun: 25.6 = 27.12
V = 7	Venus: 23.40
J = 12	Earth: 24
M. 1 3/4 y ^r	Mars: 24.48
J. near 2 -	Jupr: 9.56
J. near 30 -	
G.S. 82	

M
 11) Swinging machine
 12) E pul
 13) Steam machine

Distances

<i>Comp.</i>	<i>Real</i>	
$M = 4$	$\equiv 37$	} Million of English Miles —
$V = 7$	$\equiv 69$	
$E = 10$	$— 95$	
$M = 15$	$— 145$	
$L = 52$	$— 495$	
$S = 95$	$— 902$	
$G.S. = 180$	$— 1800$	

*Cannon ball would
reach*

M in 9 years	} at the rate of 1 mile $\frac{1}{60}$ Minute
$V = 16$	
$E = 23$	
$M = 34$	
$L = 118$	
$S = 216$	
$G.S. = 400$	

Comets

Phenomena

3. Phenomena concerning Comets
1. Motion in the Atmosphere
2. Solid bodies moving in right lines from one side of the heavens to the other & returning
3. A sort of planets moving round the sun in very eccentric ellipses - Newton.

Comets move in all directions
in very eccentric orbits -
Sun in one focus -

Of twenty Comets observed
in our System the periods
of three only are known

Lectures

in

Geography

for the use of the
Young Gent^l

of

1751

at 1751

Secondary planets —

~~Moon~~

Moon moves round the earth
which she supports as her earth

— Moons Periodical R: $27^{\circ} 7' 49''$
 — Sy. R: $29 12$

x Moon's orbit Elliptical — Earth is
placed in one focus —

Moon's mean distance $240,000$ miles
or 30 Diameters of the earth —

x Cause of the difference between
the periodical and Synodical
revolution of the moon —

— Watch hands — Had the
earth no annual motion the
Periodical and Synod. would
be the same. — Similar too

what takes place from the
diurnal motion of the earth and
transit of the sun over the Meridian

The moon turns round her axis in the same time she revolves round the earth -
proved by her keeping always the same side towards the earth - illuminated by the ^{sun} ball and candle - back hemisphere
- Moon's Phases shown on the Orrery -

- Moon resembles the earth
1. In her globular form - proved from her phases - were the moon a thin flat surface she she could not be visible to the earth before the end of her first or ^{after the} beginning of her fourth quarter, she could appear and disappear almost instantaneously

2. Moon is an opaque body, and receives all her light from the sun - Manifest from her phases - Had she light she would appear full at all times - She would however appear more luminous in opposition than at other times -

3. Has Day and night - this a consequence of her rotation - has one Day and night in our month - each 15 Days.

4. Irregularities on her surface - Light and shade - Mountains and Valleys - Lunar Mt. best observed in the first and last quarters - line bounding the enlightened part is not regular - not circular -

— Lunar mountains measured
by comparing the distance at
which they are first observed
from the common horizon with
— some of them found 3 miles high

5. Lunar year the same as
ours. — Sun's apparent
annual motion nearly the
same to a lunar year as to
us.

6. Our earth is a moon to the
moon — Phases of the earth
— 1/2 time larger — motion
on its axis — Stationary
in the heavens — Longitude
— Dial for the moon —

Moon differs from the Earth

1. Has almost no variety of
seasons or lengths of days
— Because her axis is nearly
perpendicular to the plane
of her orbit — $2^{\circ} 10'$ —
— Sun always rises and
sets and crosses the mer.
within $2^{\circ} 10'$ of the same place
^{4^h 29}
2. Moon has no atmosphere
— This is proved by the
occultation of the stars
and by her surface always
appearing bright —
— It is argued to this that the
moon's atmosphere if it
proportion to ours would not
exceed the 6th of a mile —

The atmosphere would be of
little use -

3. Moon has no sea -
- If the dark parts were water
the moon would appear in dif-
ferent situations of different
colours - reflective of the sun.
- They are only darker parts
of the surface of the earth.
- are lower than the bright
parts - shadows -

Consequences -

1. Neither rain nor winds -
2. Inhabitants deaf and dumb
3. No vegetables -
4. No fire - or Electricity -
5. No twilight -
6. Sun seen at midday
7. No thunder and lightning

8. No rainbow or spectrum.
9. Quick transition from dark-
ness to light blinding
to most animals
10. Volcanic appearance
in the moon -
- 11.

Moon

- Moon round the earth
phases - proofs - a globe
- Light from the Sun -

Exp^t: ivory ball -

Period: Revol: = 27.7.43

Synodical - 29.12

How determined - both obs^d

Orbit Elliptical - Moon in face

inclⁿ of orbit $\angle 5\frac{1}{4}$ -

Nodes - Retro: m^o: 19 years

- Chaldean Names - Melon

Plinian period - very
ancient -

- Merides direct in 9 years

Days and Nights - Seasons

year -

- Some side to Earth -

cause unknown -

- Libⁿ in Long: & Lat

+ D^o: Musset. m^o: equal

Moon - Ages - Difference
the earth -

Mountains how measured
Volcano -

Sun's Atmosphere -

Eclipses

Shadows of the Earth & Moon

Dimensions how ascertained

Extent Sun and Moon

Why not every month

Why not at the same time
of the year -

Moon's shadow seldom reaches
the earth -

Partial - total - Annular -

D.'s vel. same quantity to
all places where visible -

It varies much - greatest
space observed 200 miles - this
is passed in 4 - consequence

Measure - (Digits) - about
 $12 = + D'$ Dist. from Cen. of the Earth

Calculations - Ancient

uses - Chron. - preferable
to any other Chronometric

Projection of an object

to

W

171

Thales 540 A.C.

First Greek Phil. - Eclipse

Pythagoras - Motion ^{as}

Globular figure - 490

Socrates - - - 400

Plato of Acropolis Secret; 348

imagined in

Aristotle - - - 332

many theories

- Mechanics - properties

(demonstrated) as now -

- Chrysaline Cubes -

denied the motion of the

earth which brought it

into contempt -

- Dialectics or Logic he

was the inventor of Syllo-

- Motion - Mechanical

powers -

Euclid A.C.
of Alexandria 270
Elements 15 books
Original work 2000 years
Euclid the Collector - A
Several ages to invent
- How few properties in-
vented by the Moderns?
All the figures named by
the Ancients

Works

15 Books of Elements
1 of Data

2 Treatises on Music

- Phenomena

- Optics and Catoptrics
Mirrors Convex Concave
Perspective - Vision

- 1 Book on the Division
of Superficies

A.C.
Archimedes 208
Geometrical Works
1. Sphere and Cylinder
2. Spiral Lines
3. Spheroid and Conoid
4. Mechanis - Equilib. Cent.
of Gravity &c
5. Squares the Circle 7. 22
6. Hydrostatics -
7. Aranas - first Astron.
8. Lemmata

- Hero's Crown. Vitruvius
- Spiral pump - Athenaeus
- Screw by which he raised
- Hero's Great Shop - Atheneus
- Warlike Engines - Catop-
- trical. Scorp. 1200 w.
x - Polyb. and others -
x Iron hand lifted ships

Polyperaspon or System
of pulleys by which he
lifted enormous weights

+ Burning Spunta
by Zebzes and Galen
- not by Polybius or Plutarch

Pneumatic and Hydraulic
Engines with treatise on
them - by Claudius

Sphere - by Claudius

Morphology

- Ptolemy - 130 A.C.

Celestial Astronomer

Catalogue of the first 1100

Instruments for observⁿ

- Longitude Latitude

Vitruvius . . . 40 A.C.

Celestial Architect -

- Mechanic - much corrupted

- Example - Moving tower

- Bathing room -

Ptolemy - 140 A.C.

Almagest - 7th century

contains all the Astrono-
mical knowledge of the Anc^{ts}

- System of the world -

Copernicus ¹⁵⁴³

- System from the ancient
Greeks - few known before
- Great opposition -
- + Objections - Phases of Venus
and Mars -
- Stone thrown perpen-
dicularly -

Galileo

Removed both the Claps
of Objections

- 1. Motion - relative
and Absolute -
- 2. Descent of bodies by Gravity
- 3. Parabola - Gunnery
- 4. Telescope -
with which
1. Phases of the Planets
2. Sat: of Jupiter
3. Spots on the sun -
Astronomy -

Kepler

1. Elliptical orbits
2. Areas :: Times
3. $P^2 :: Dist^3$

Fond of Analogies

- 3 Things he wondered &
1. Why the planets were
six in number - 2. Why
the planets are such
as they are - 3. What are
the laws of their motion
- 5 Planetic bodies

Des Cartes

- Vortices - Arch. Biqua-
dra Equations in Algebra
- Huygens - Cassini
- Flamsteed - Catalogue
of more than 3000 Stars
- Bacon - Experimental
Philosophy -

Otto Guericke

- Air pump - Electric
machine -

- Boyle Double barreled
air pump -

X Barometer by Torricelli

X Mercurial Chap 14 Cont.

- Newton born in 1643.
works

1. Mathematical principles
of Natural philosophy

2. Optics - Light and Colours

3. Fluxions -

• Discoveries

1. Gravitation - Projectile

2. Prismatic colours

3. Fluxions -

4. Chemical Attraction

5. Thermometer

6. Reflecting Telescope

Wally

- Return of Comets
- Distances of the Planets
- by the Transit of Venus
- Astronomical Tables
-

Nicebancow

Electricity

Theophrastus

Gilbert - Gray

Lichtenberg

Lightning

Achromatic Telescope

Dividing Engines

Rules of Philoso^y?

1. No more causes of natural things ought to be admitted than are true and sufficient to explain the phenomena —
2. And consequently effects of the same kind are produced from the same cause —
3. Those qualities of bodies which can neither be increased nor diminished and which are found in all bodies on which experiments can be made ought to be admitted as qualities of all bodies in general —

How long it
 years multiply fast
 cycles - number in year
 1 Lunar Cycle - time in
 Golden number - Metro -
 shows how many years
 since Moon changed day
 day -

$$\begin{array}{r}
 1759 \\
 19 \overline{) 1751} \quad 93 \\
 \underline{-14} \quad 9 \quad 2
 \end{array}$$

2. Solar Cycle - Period 285.52
 + 1 - hence the year always
 the day of the week it begins -
 New Year Day moves forward
 Day every year Exple
 - Period in 7 years but
 half year shifts 2 Days
 - Period in 25 years

$$\begin{array}{r}
 1759 \\
 25 \overline{) 1729} \quad 69 \\
 \underline{-25}
 \end{array}$$

Solar Cycle

3. Dominical Letter —
 - Steps backwards with
 the Solar Cycle — two
 letters in Leap year

$$\begin{array}{r} 1750 \\ 445 \\ \hline 7 \overline{) 1335} \quad 7 \\ \underline{190} \quad \underline{5} \end{array} \text{ to } A$$

4. Indiction 15 years
 - has no reference to

1780

$$\begin{array}{r} 15 \overline{) 1780} \quad 118 \\ \underline{15} \end{array} \text{ Indiction}$$

$$19 \times 25 \times 15 = 7950$$

Shale

- Vegetable earth

Gravel

Sand - shells - rocks

- Horizontal - Dipper

often oblique

- seen in great rivers

- Layers sometimes broken
 in thin intervals

- filled with extraneous

matter - Empty - frequent

caverns, chasms

- Interruptions of the Shale

- vast convulsions

- Layers have been torn apart
 in many places

Shells found in the layers
mixed frequently with other
substances - Frequently in
tracing - Shells found
in the spaces between the
stratified masses -

Plaque cavern seldom
near than 200 feet
But was ¹⁰⁰ 1100 yard
7 vegetable earth
9 turf - 9 soft clay
5 sand - 4 earth
10 clay - 4 earth
10 sand - 2 clay 4 white sand
1 soft earth - 1 1/2 sand
5 clay mixed with sand
4 sea sand mixed with shells
102 soft clay - 31 feet of sand

Trade winds extend from
to or 30° of the Equ. —
Atlantic — Pacific and
Indian oceans —
N.E. and S.E. —

Cause of the trade winds
— Subsoons Indian ocean
— Sea and land breezes
— Double currents of air
— Bomb shell at Quebec
— Velocity of wind —
+ from 4 to 10° north — Colours
and humours.

Heat rarifies the air —
— Hot air is lighter than cold
— Hence air ascends in a warm
room — in a chimney —
— Steam of air along a
candle — Air rushes violent
by through the key hole —
— Double current in a door
— Semi heat rarifies the
— air — wind is the
consequence — If the heat
is confined to one place
the wind would blow in
every direction to that place
— But when it moves the
air will rush after the heat
— Hence the course of the trade
winds

Let 2. Monday 21

air invisible

Seldom found pure

+ Morphose - might

ascertain'd two ways

about 50 miles

Air compressible (D)

density - thickness of wood

Foot. three miles = alt

+ Altitudes in arith?

7 = 4. 14 = 16

General. bell. pressure

neither the air nor its

effects - But

Condensations - Baromet

air aquaria non povera

Equilibrium vertous -

Experiments

1. Hand Glass
 2. Bladder
 - + 3. Hemisphere
 4. Glass ball
 5. Trump
 6. Mineral cup
 7. Willow
 8. Bladder - small
 9. Bladder with weights
 10. Air Gun
 11. Egg
 12. Pen
 13. Warm water
 14. Candle
 15. Guinea and feather
-
- + Pitch fork

Sound - body striking
against air - causes sound
- Air the medium of sound
where there is no air or
no free circulation of air
no sound -

- Augmented in condensed
and diminished in rarefied
air -

- Propagated like waves
in water - a stone thrown
into water, waves increase
in circumference but
decrease in height -

- Distance greater or less -
- Ruds - wave broken -

+ In like manner sound
in a town - wood of
Hence the reason why
sounds are heard farther
at sea than at land - on
a plain than on a hilly
country - Great Bell of
Edin. not heard 100 yards
from the church -

+ Sounds move 1142 feet
in 1 second on an English
mile in 4.6 seconds -
- All sounds move equally
fast the gentlest whisper
as fast as the roar of a cannon
- the reason.

+ Audible and retarded
with and against the air
- Single pulses of sound
must succeed 13 in a second
to make continued sound
- Door rattling on its
hinges - Comb - Ratchet
machine -

+ All ears feel continued
sound at the same time
- Somewhat fast in vision
+ Reasons of both -
+ Rippled sounds
Echoes - 100 feet
Distance -
+ Same sound frequently
repeated object distant

- + Sir John Stewart's home
at Greenock - two Pavil
100 feet a pander
Sound frequently repeated
- Double the no of reflect
in the middle
- Echo in the deep boat
of Edin: which repeats
a tone of organ
- + Some figures circle an
oval greatly augment
sounds
- Whispering Gallery
of St Pauls
- + Side of Paisley
40. 30 20 - feet

- + In an oval room all
the sound in one focus
is directed to the other
- Concert hall at Edin:
- + A Concave Mirror
- Tube conveys sound
- + Speaking trumpet
but figure possible
- Whisper conveyed
where the sound at
large is impossible
- Speaking figure
Human Ear - Shape - Tongue
- + Sympathetic sounds
Paper on a string of a
violin - Glass pane
broken by an Organ

- + Two voices unison
- struggle with each other
- whistle during the ringing
- of a great bell - difficulty
- + Musicians glass water
- in waves - Deeper the
- more water - why -
- Vibration of strings
- wind and strings
- + Instruments -
- Octave in each
- Low German flute
- 120 vib. in a second
- Arabian harp -
- Different sounds on
- the same string -

- This can be proved by
- exp! stop all the strings
- + Scale of musician
- Two voices - one always
- the same sound -
- Consonance - Dissonance
- + Ear only judge of music
- written music
- Bass - Treble -
- Tenor how formed
- Position of the sounding
- body with regard to the ear -
- How does the ear determine this

Echos are caused by the reflection
of several other which reflect the sound
to the same point -

- Echo in the air not from a glass
but from - Madeira -

Two ... +
-

... +
-

... -
-

... -
-

... -
-

... -
-



21
16
D. C. / sac / 5

M

23. 49

11. 49