Vol I

Royal Institute

Notes

20th Century

1909

Royal Institution

20th Dec.r 1809 – Mr. Pond

Astronomy Lect.r 1st Introductor.

Nature and Object of the

Science. Of the apparent

Diurnal motion of the Sphere.

Nutation of the Axis of the Sphere

Mr P – said that the present

course would differ from the last

Physical Astronomy – Mechanical

– Astr.y not the advantage of

striking experiments as in the

other branches of the philosophical

sciences. Curiosity is here rather

interested. Grandeur of the Uni-

verse – Two methods of Learning

Studying Nature. Analysis, Synthesis

— M. P. prefers the former for sub.
— History of the ~~Phenomena~~ Diurnal
phenomena — Sphere — fixed Stars
rise and set — some pass over our
heads, some to northward others to
the southward. Pole — Earth an
extended plane — Whence do the
stars come from at their rising
and whither do they go after their
setting? a difficult question. Star
on the Equator the same time above
as below the horizon. On the surface
of the earth the sensible horizon very
small. On a hill much larger. On
a balloon a whole city may be
seen, still higher a county — a King-
dom — half the globe — Hence it is
inferred that the stars are at a
very great distance from us — Sea sur-
rounds the Earth — Heavenly bodies
were supposed to rise from, and plung
into the ocean —

Thursday 21st Dec. 1809

On Natural Theology by Mr. Dalton — Lecture I. — Introduction Brief outline of the Course. New and important doctrine in some branches adverted to. Properties of Matter. Bodies at rest considered and elucidated by the mechanical powers. —

Mr. D. set out with observing that no encomium on or recommendation of Nat. Theology was necessary — Plan of the Course number of Lectures on each branch. On the whole 20 Lectures. — much new matter — Forces as the squares of the velocities. This from Mr. Ewart of Manchester M.D. has often much commended adopted this opinion.

— Properties of Matter —

Extension — Divisibility, not infinite
There must be original particles of
bodies — Great divisibility of matter
shown by chemical solutions
— Impenetrability only exists in
the original ~~bodies~~ atoms. — Attraction
Gravitation — Cohesion — Magnetism
Electric attraction shown afterwards
Inertia — Rest or rest — a
figure — Three powers —

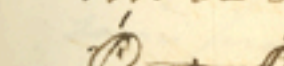
— Mechanical Powers —

— Lever — Arms equal needs no
demonstration — Unequal, the
Marks M'Laurin demonstrates
the best — Compound lever
— Wheel and axle — Inclined plane
Pulley — Screw — In these no-
thing new — / M'D mentioned the
1st Vol. of a work on Chemistry,
which he was publishing — The 2. vol
to be published next 4 years. —

Saturday 23 Dec. 1809

M'Dalton 2 Section

Laws of motion. Newton's 3
has generally misunderstood
Power in motion considered.
Force of bodies in motion.
Momentarily as the mass
multiplied by the square of the
velocity, illustrated by cases of
collision of elastic and inelastic
bodies.

M'D — by a variety of Diagrams
 and
others showed that the forces
must be estimated from the
squares of the times — Composition
and resolution of motion by
threads and weights, and a general
Algebraic figure —

The Law of bodies descendency by Gravity shewn on Atwoods machine — Space as the square of the time — In the composition of motion, no power is lost this is contrary to the common opinion.

Thursday 26th Dec. 1805
Nat: Phil: Lect 3 — Mr Dalton
Experiments of Collision continued. No moving power lost in the Collision of Elastic bodies, a part always lost in the Collision of inelastic bodies, which is spent in changing the figure of these bodies. Composition of motion Composition of moving powers. Vimes proposition concerning the same quantity of motion being requisite to produce the same progressive motion, with a contrary rotatory motion. considered and explained with by an appropriate machine

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In this lecture the subject of Collision was illustrated by Ivory balls — Exp. 3rd and seven

no experiments on instantaneous Velocities described by Diagram
— an elastic body striking a larger elastic body, communicates more motion than it has — this is the common doctrine cannot be true —
W. D — Mentioned Mutton's mode of explaining the subject as very unsatisfactory. Estimating by the squares of the velocities all appears right —
— Mr Ewart's thread machine for the composition of motion, highly praised by Mr Dalton. —
— Mr Vince's machine did not answer. More than a quarter of an hour was spent on it, but without being able to perform the Experiment.

Thursday 28th Dec. 1809

Nat. Ph. & Letters W. Dalton

Pneumatics. ~~Action of a mixture of different elastic fluids.~~

Of the atmosphere. Its density at different heights. Weight & pressure of the air considered and illustrated by a variety of Exps.

— Elastic and inelastic fluids explained by two figures. In the first the particles are at a great distance by heat. In the latter they are near to & touch each other, and have only little, tho' some elasticity.

— Water of the same density in every part. Vessel filled at the top and bottom of a ~~[illegible]~~ Vessel of the same weight, not so with the atmosphere.

— Decrease in density in geom: ::
to the Altitude taken in Arith: ::
shewn by a Hyperbola, and
a paper full of dots, thicker at
bottom — Altitude of the Atm:
uncertain. — Mr D. thinks it not
so much as commonly supposed
— must have its limits
— How high in the Atmosphere can
Animals breathe? It is found
by experiments that animals
can live in air of ⅓ the den: ::
at the surface of the earth, hence
the height may be known. ::
— Description of the Air-pump
and its action — not satisfac-
tory to such as are unacquainted
with the subject. —

Experiments.

1. Receiver on the pump plate
2. Bladder broken
3. Hand on the hand glass.
4. Bladder full of Air, exhausted
5. Lost in a receiver, blown up.
6. Hemisphere —
7. Torricellian Exper. —
8. Wind mills —
9. (Double transferring plates
10. Small cistern and jet
Air a lifting Paper. —

Saturday 30th Oct. 1809

Mr. Dalton's 5th Section — Pneumatics. Action of a mixture of different Elastic fluids. Mechanical action of air on water condensation of air. Various experiments on condensed air

Different airs unite mechanically not chemically — Equilibrium of pressure of air on water. — Diagram — Particles of water large and conical — Of air small & at times the distance of those of water. He referred to a publication of his on this subject.

Experiments —

1. Mercury in a glass tube of the $\frac{1}{20}$ of an inch bore to show that the spring of the air is equal to its pressure. 23 Inches of Mercury.
2. Mercurial shower — Common Effect
3. ~~Experiment~~ Bad Experiment —
4. Bell rung in vacuo, always heard — by the spring apparatus
5. Light and heavy body weighed in vacuo — Glass Globe and Wt. Globe about 2 Inches in D.
4 Air weighed — Glass Globe 8 or 9 inches in D. —

— Condenser described

5. Bladder full of air condensed in a receiver. —
6. Bladder just emptily screwed to the receiver of the condenser, filled, but could not be burst — A Second time, also without success.
7. Air exhausted from ber. —

— Experiment repeated. —

Wed.y 3d Janry 1810

Nat.l Phil.y Lect: 6th Mr Dalton

Hydrostatics — Nature and properties of inelastic fluids. Specific gravities of bodies.

Nature of Elastic fluids shewn by the two diagrams formerly used. — Def.s of Hydrostatics, Hydraulics, and Hydrodynamics.

— fluids arrange themselves agreeable to their specific gravity — Exp: a phial filled with 4 fluids, Mercury, water, oil and air shaken, they all resume the former situations. —

— Surface of water level. This a necessary consequence of the equality of pressure

— Pressure of water in proportion to the perpendicular ~~[illegible]~~ depth — 3 Diagrams of vessels — one cylindrical and two conical — particles of water large — Explanation of the equality of the pressure in all the three — Hydrostatic bellows, did not act well.

— Pressure upwards. Exp. brass plate —

— A body swimming displaces a quantity of water equal in weight to the whole body Exp. cork in water.

Water rises to the same level Exp. Glass tube connected by a bladder to the bottom of a large Jar of water.

24

Glass of water inverted on a
paper over its mouth, proof
of the upward pressure of water
24 — Syphon — sucking pump.
the latter would act when the
air over the water is removed
by the air pump —
— Velocity of water from an
aperture in a vessel. Different
opinions — facts correspond
best with the new theory —
— Spouting machine three jets
— Maximum velocity of a shot
is not $\frac{1}{3}$ of the water, but
$\frac{1}{2}$ — Smeaton investigated
of this subject. Hutton is
more agreable to the new
theory.

Thursday 4th Dec. 1810

Royal Inst. Art. 2d Lect.

Investigation of the apparent motion of the Sun. &c. the Instr. employed for that purpose by the Ancients and Modern Astrs.

Sun's apparent motion either respects the earth or the heavens both respect to the earth

Sun at the Equinox, rises in the east and sets in the west half a revolution above, the other half below the horizon like a fixed star as mentioned in last Lecture. Rises at six and sets at six. In the course of a few days he rises a little S. eastwards and to the Northward of the East point and sets to the North of

the west. A kind of Spiral motion to the Common Sphere when he appears Stationary for some days. Then returns towards the Equator again and moves from thence to the Winter's Solstice — Various modes of accounting for these Phenomena by Ancients — At length the Ecliptic was discovered — both regard to appearances in the Heavens it was found that the fixed Stars (Constellations) to the East ward of the sun appear to meet the sun last in his Way — Heliacal rising — of great importance in Ancient Astronomy, year and festival events (denoted by the Heliacal risings and settings of particular Stars — Rising of the Nile, Dog Star &c. —

+ First problem is to find to ascertain the obliquity of the ecliptic — Then the Gnomon (denoted by a Model. — — Altitudes of the sun at the Solstice — Great accuracy not to be expected from such an instrument. — Caspani Gnomon. —

Friday 5th Jan.y 1810

Mr Dalton's 7th Lecture

Natural Philosophy —

Steam Engine. Nature of Steam

Its force or pressure at various

temperatures. Law of variation

illustrated by the Logarithmic

curve. Relation of the force of

Steam to the heat necessary to

produce it.

— First application of Steam

to raise water was by the Marquis

of Worcester about a century

and a half ago & who saw he

had done it — But the first who

is known to have carried it into

effect is Capt. Savery in

— A rough drawing of his

contrivance shewn.

But the first Engine on the present plan, was that of Mr. Newcomen – this described by a drawing. In this Engine a man was employed in opening and shutting the cocks. The next improvement was by Mr.

The Engine was made to open and shut the cocks it self. In 1763, Mr. Watt made the great improvement of condensing the steam in a separate vessel, by which $\frac{2}{3}$ of the fuel was, also the Engine being more powerfull, was made of a lesser size. —

Properties of Steam

– Occupies about 1800 times the space of the water from which it is produced. Particles of water in Steam kept at a great distance from each other by atmospheres of Caloric – represented by a drawing, water below and steam above – Bubbles which rise in boiling, are it is generally thought, composed of steam. Mr D. thinks that they contain atmospheric air – If the air be extracted from the water it will not boil, but heave so as to be thrown out of the vessel – Action of Steam in the Geometrical proportion of the heat – illustrated by the Hyperbola – Sagacity, and Experiments

with thermometer of different
divided scales - consequent division
respect divisions larger. - Expt
with two barometer tubes,
mercury and air in one &
mercury and Ether in the other
condensation of air and of
steam - Watt Hammer.

- In Savery Engine the steam
is thrown from the boiler
on the surface of the water in
the reservoir. Why is not
always condensed? - The
water is a bad conductor
of heat, by Count Rumford's
experiments, while the upper
surface of the water is
heated to the boiling point,
the lower surface is still
cold.

- When steam enters the bottom
of a vessel of cold water the
noise is thereby occasioned the
rapid succession of the strokes
of a large sledge hammer.
This gradually diminishes 'till
the water boil - This owing to
the instantaneous condensation
of the steam. When the water boils
there is no further condensation
and consequently no noise

- M. Watt's double Engine
more powerful than the single -
In this the steam is admitted
both above and below the piston

Saturday 4th Jan 1840

Mr Dalton's 8th Lecture

- Steam Engine -

Description of some of the best modern Steam Engines. Power of an Engine easily ascertained on the new principle of estimation by Prespace and Space. Observations on the progressive improvements of Steam Engines

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- Uses to which Engine is applied - Rain Water, and Well Engines for all sorts of purposes, such as grinding corn Spinning cotton &c - Goes 5 E. in Manchester Space in 10 days a Vessel which would reach to the Moon = 240,000 E. miles -

– First engines for raising water the beam ends inward. In N double engine, the piston rod must be fixed to the end of the beam – Parallel motion a beautiful contrivance –

– Governor for regulating the quantity of steam by its centrifugal force –

Instrument for ascertaining regulating the num of strokes the Engine given in a given time –

– Power = pressure and space or square of the velocity

– Many attempts have been made to convert the reciprocating into a rotative motion In the reciprocating, it is supposed that there is much power lost at the end of each stroke This Mr Dalton thinks is not so great as is commonly supposed. The parallel motion diminishes the loss.

– A rotative Engine is proposed by Mr Clegg of Manchester Mr D– thinks that Gent. is mistaken in his estimate of the loss of power in the reciprocating Engine – See Ph' Magazine for Dec. 1809.

Tuesday 9th Jan. 1810 —

Natural Phil. Lect 9th Elect:
Introduction. Electrical Phen:
attraction, repulsion, sparks
Bodies arranged as Conductors
and Non conductors. Leyden
Phial, or "Electric Jar. Electric
Shock. Electric Shock.

A very short history of Elect.
beginning with the Egyp. with
Amber and ending with the
Leyden phial — Conductors
non conductors — excitation
Construction of the Electrical
machine —. Franklins
hypothesis adopted by M
Dalton, as the least objectionable
— Attraction and Repulsion
Expt. Balls (set of three) Down
Feathers (Feather very small) — Head.

Dancing balls / Jar charged with
a wire from the conductor).
Points carry off the El. matter
at greater distances than balls
or flat surfaces Exp.
+ Negative Elect. — when the
rubber was insulated the spark
from the positive Conductor
nearly as strong as when the
rubber is connected with the
Table. —
— Leyden jar described — Differents
with regard to the charge on the
outside acting through the glass
and repelling the Elect. matter
from the out side.
+ Mr Battons Hypothesis is
Light, Heat and Electricity are
only different modifications of the
same substance. That the Light
of the Sun when it arrives at
our earth and uniting with
bodies of different qualities is
converted into Heat or Elect.
according to the nature of the
bodies — Mr D. adduces the fol-
lowing experiment in proof of
this — A mixture of Oxygen and
Hydrogen gas which explodes
with the smallest spark of Elec.
exploded even by the applica-
tion only of Light. —
— Electrophorus described —
The Instrument about 14 or
15 Inches in Diam. — acted
but weakly — Mr D. explained
the common one. He seems
to consider its length of time
in continuing to act. —
— The plate Electrics he consi-
ders as acting on a principle

Similar to the Electrophorus
— Drawing of the Great Machine
at Harlem, with its effect on
Gold leaf &c. ——

+ In comparing the Electric with
the Voltaic machine, he proceeds
with more intricacy, the
latter produces more Matter
This M. D. illustrated a Chart
Diagrams, one a deep pail
of water, narrow and deep, the
other vessel broad and shallow
with jets in the lower parts,
or bottoms of each. Now the
both vessels may contain the
same quantity of water, yet
the water will spout with
much more force from the
bottom of the deep vessel than
that of the shallow one
The former may represent
the common Electric machine
the latter the Voltaic Machine
— In taking sparks from the
conductor by a small wire
inclosed in a glass tube, the
sparks were large, bright and
in large rays. ——

— Experiment to shew that
the Electric charge of a jar
passes a short passage thro'
a bad conductor, in a long
one thro' a good conductor —

— Last Exp'r — To illustrate a
quality of a sheet of writing
paper by India Rubber, this
tried several times with dew

not moved — He applied the
paper to the chimney piece
said it should have mounted
towards the ceiling, but it
constantly fell to the ground
— Invented person Electrified
— Had struck thro' two
folds of paper — beer on both
sides — A proof as Mr Dalton
thinks of the Materiality of the
Electric fluid —

Wednesday 10th Jany 1810

at 8 in the Evening

Mr Dalton's 10th Lect on

Nat: Philoy ——— Electric

various Electrometers, Inflam:

of bodies by Electricity. Thunder

and Lightning. Electric battery

Luminous Experiments.

—Leyden Jar — charge in proport

to the coated surface. Also in

the inverse proportion of the

thickness of the Glass. — Electro

meters — Pith balls — quadrant —

Nodness and Cuthbertson Electr:

— experiments with the battery

wire burned — the battery not

one fourth charged. It consisted

of 15 Jars 5 by 3. — Cuthbertsons

Spirits fired at the plate
machine, frequently one pe
fire house - Thunder house
Electric cannon, two sorts -
one a glass tube the other
a brass cannon. - Lemmon
conductor - Royal Institute
Observations on Thunder -
- Distance at which Thund-
may be heard probably 10 o
12 miles - at which Light-
ning may be seen 40 or 100
miles - Noise explained -
Sudden Stroke - N.B. Shows
the lightning must in this
case move in a direct line
Phenomena of the effects of
Lightning - Earth Tri-

Thursday 11th Jan.y 1810

Art. Lect. 3 Mr. Dove

Continuation of the former subject. Practical Astron.y The Assistants. Comparison of their Instruments with some of modern construction

Gnomon — Armillary Sphere — Astronomical quadrant — Equatorial Instrument. Transit Telescope — Suspending a pendulum with a small weight which keeps it in motion for a few minutes — Mr Conway's clock — All these Instruments on the Table —

— To find the obliquity of the Ecliptic and the semi diameter from the equinoctial and two of the most important pro-

time of ancient as well as modern. — The obliquity of the Ecliptic was determined by taking the sun's altitude at the solstice and from his altitude at any other time, his distance from the equinoctial point was ascertained by Spherical Trigonometry.

— To calculate the distance of the moon from a star — Ancient method to find the distance of the sun from the moon and then that of the moon from the star. This made use far from being accurate — The modern method is most accurate and very easy Diff: of time of the stars passage over the meridian and noon — Measure of time — Pendulum, standard of its length

Cycloid — Then a description of Conway's clock (This afterwards for I shall see it at Mr Conways — French artists cannot devise Instruments equal to the English — Repeating circle described — When the telescope is pointed to a star to the southward the Instrument is then turned round to the opposite point of the heavens, and while in this situation, the circle being kept steady the telescope is moved again to the southward and pointed to star. It has now described an arch a double the former distance. This may be again repeated &c &c. —

Saturday 13 Jan. 1810.

Mr. Dalton's 11th Lect: Nat: Phil

Meteorology — General Theory of Winds. On Temperature. On Clouds; their formation, height, extent, and apparent Orbit &c.

— I could not attend this Lecture. —

Tuesday 16 Jan. 1810

Mr. Dalton's 12 Lecture —

Meteorology — On rain. Theory of it; is formed by the greatest condensation of the Atmosphere. Of Storms; why heavier in Winter than in Summer, and more abundant in mountainous countries. Evaporation. Dew. Dew point. Thunder and

and Lightning. Luminous Meteors
— could not attend this Lecture

Wed.^y 17^th Jan.^y 1810
Mr Dalton's 13^th Lect.
Astronomy. System of the universe. Solar Syst.
Optical Ph.^a of the planets explained.

Definition and object of the science — Fixed stars Different distance — No parallax + diurnal revolution Different magnitudes owing to different distances. —
— Solar System described
— 3 here nothing worth noting
— Drawings — Earth shadow. Sun less, equal to, or larger than the Earth
— Earth and Moon — Sun —
— Transit of Venus —
x The perpendicular planetarium Orbits ellipses
Mr Dalton apologized for lecturing on a Subject when he did not know there was another Lecturer who was much better acquainted with the present subject than he was — applause — He also gave a distant hint at his being an opponent in Electr.^n
— Planetarium has the orbits of various to shew their different inclinations. —

Thursday 18th Jan 1810

Mr. Pond's 4th Lecture

Continuation of practical Astr. Description of the Astronomical Quadrant and Transit Instrument and of the method of conducting observations in modern observatories

Snow quite enough prevented me from attending.

Saturday 20th Snow.

Astronomy Lect 14 Mr. Dalton — Theory of Gravitation. Laws of Motion of the Planets &c Tides.

Did not attend —

Tuesday 23d Jan. 1810

Natural Philos. Lect 15

Elect. Hypotheses concerning heat of Combustion and the Theory — New gradation proposed embracing some remarkable circumstances, relating to the expansion of Liquids the form of steam, the force of permanent elastic fluids, and the refrigeration of bodies. —

— could not attend —

Wednesday 26th Jan. 1870

Natural Phil. Lect 16.

Heat. On the Specific heat of bodies. Evolution and absorption of heat by combustion and other chemical agency. Ignition of bodies in the Galvanic & electric circuits explained. Natural Zero of temperature or absolute Std. Radiation of heat. ——

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Could not attend —

Thursday 25 Jan. 1870

Nat. Phil. Lect. 5 Mr. Pond —

Continuation of the former Lecture on practical Astronomy Description of some modern Instruments, and of the method of making observations with them

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— Could not attend —

Saturday 29th
~~Friday~~ 29 Jan.y 1810
Natural Philosophy
Lect. 17th - Chemical Elements
- Divisibility of matter.
Elastic fluids exhibit matter
in extreme division. Other bodies
constituted of Atoms as well as
Elastic fluids. All atoms of the
same matter alike in weight,
bulk &c. Atoms of different
kinds of matter unequal in
weight &c. Bodies deemed sim-
ple till they are decomposed.
Chemical Synthesis contrasted.
Tables of Arbitrary marks
representing the elements

— could not attend —

Thursday 30th Jan.y 1810
Natural Philosophy - Lecture
18th - Chemical Elements -
Combinations of Simple Atoms
constituting Compound Atoms.
Manner of finding the relative
weights of Atoms. Arrangement
of two or more Atoms forming
one compound. Of Water. Of
Ammonia. Of the various
compounds of Azote and
Oxygen — Mr Dalton

— could not attend —

Royal Instn. Wed. 31st Jan.

Natural Philosophy Lect 19 —

Chemical Elements —

Compounds of Charcoal and Oxygen. Carbonic Oxide. Carbonic Acid. Compounds of Charcoal and Hydrogen. Olefiant Gas. Sulphur, Phosphorus and their compounds. Earths. Metals Metallic Oxides and Sulphurets

— could not attend —

Thursday 1st Feb.y 1810

Astronomy. Lect: 6. M. Pond

Investigation of the nature of the Solar Orbit. Ancient Theories on this subject Ptolemaic by an Hypothesis. On the changes which have taken place in the position of the Solar orbit since the Creation of the world. —

— could not attend —

Saturday 3 Feb. 1810

Natural Philosophy —

Lect. 20 and last —

Chemical Elements.

Fluoric, Muriatic, ~~Oxy~~ oxymuriatic, Hyperoxymuriatic and Acetic acids.

Weights of the component parts of Neutral salts from theory and experiment.

Action of common Electricity on compound Gases and gaseous mixtures.

— Conclusion of the course

— Did not attend —

Thursday 8th Feb 1810

Feb? Lect 7th — N. Bond.

— Conclusion of the Course subject Magnitude and distance of the Sun. Solar Atmosphere. Zodiacal light. Equation of time.

— Did not attend —

Friday 7th Feb 1840

Mechanics Lecture 1st by Mr Allen.

Introductory. Use and importance of Mechanical Philosophy. Power of Matter. Objects of the course.

Phenomena of Nature most interesting to man. To account for these phenomena by investigation this was in the province of Mechanical Philosophy — Man endowed with powers adapted to the investigation of nature the subject of Natural knowledge. Language of science adapted to the common notions of men at the time.

Matter is the subject of which all bodies are composed.

Properties of Matter — Extension Solidity — Divisibility inertia Mobility — Attraction of Gravitation, aggregation or Cohesion. Combination or affinity — Electric and Magnetic Attraction — All these were illustrated by appropriate experiments made in the usual way.

Great divisibility of matter shown by Gold leaf. Chemical experiment, division of Matter by glass used in ascertaining the size of Microscopic objects — If all the matter in the universe were collected into

two Globes, they would instantly begin to move towards each other and meet at a point the distance of which from each body is inversely proportional to the quantity of matter in the bodies Gravitation decreases in the inverse proportion of the square of the distance. —
bodies fall towards the centre hence the Earth a Globe.
— Cohesion illustrated by two pieces of lead in the shape of a bread all handle - also by capillary tubes and two small plates of glass in a little trough to
the parabola - this shewn round to the company —

Mr Allen adopts Newton's opinion respecting the particles of matter - Hard and unchangeable - and Newton's account - Different degrees of solidity - Atoms at different distances - surrounded by Caloric probably also by Electricity - This represented by a figure - quantity of matter in a body determined by its weight, that is by the attraction of the earth.
— Particles cannot be forced into absolute contact - not even in as shewn by the Dyeings —
All bodies fall equally fast in vacuo - Guinea and feather. —
— Electric attraction shewn by a large stick of red sealing wax and two pith balls. —
— Magnetic attraction shewn by two large bars armed with

brass. One supported on a point like a needle, the other presented to it — Similar poles repel, and dissimilar poles attract each other — a body in a situation nearly perpendicular becomes Magnetic — a poker. ———

— ~~The~~ Rules of Philosophy with their explanation in Newton's own words ——

— reasoning by Induction —

Analogy — caution necessary here E.G. Nitric acid dissolves Copper Iron and many other metals, if from this we infer that it will dissolve all metals, we shall find our selves mistaken, for it will not dissolve Gold or Platina. ———

Thursday 15th Feby 1810

Astronomy Lect: 8th Mr. Pond

On the dimension and equation of time. Of the Phases of the moon. Investigation of the lunar Orbit.

———

— Did not attend —

Friday 16th Feb. 1810 —
Mechanical Philosophy
Lect: 2d Mr. Allen —
— Laws of Motion. Elasticity.
Percussion. Composition of
Motion. Gravitation. Accelerated
and retarded motion. —

Mr. A — divided Mechanics
in Rational and practical
mechanics — The first concerns
Motion, the other the construction
of machines — Motion. Definition
absolute and relative. Illustrated
in the usual manner — Laws
of motion, in Newton's own
words. — Uniform. Accelerated
Retarded motion. Momentum
— Dispute concerning forces.
Smeaton's pamphlet on wind &
water contains an ingenious
experiment with a spring, in

favour of the squares. Most decisive
experiment is by Mr.
of the Admiralty; a machine
was contrived for rolling out lead
plates by the motion of a large
heavy fly. When the fly was
made to move with double the velocity
four times the length of
lead plate was rolled out. —
The subject deserves further
investigation and will have it.
— Bodies perfectly hard, perfectly
elastic. Approximation only to
the two first — Elasticity exemplified
by an ivory ball on a block of
marble done over with black paint
or ink, laid gently on produces a
very small black spot on the ivory
ball, when struck with force the
spot is larger. Perpendicular — oblique
stroke — illustrated by a figure —
— Percussion — Collision Illustrated

by lead and ivory balls in the usual manner — Composition and resolution of forces by a figure (parall.m) by board with two weights balancing each other at a particular angle. This place ~~at a particular~~ perpendicular instead of horizontal its usual position. Compn of forces also shewn by exp.t Two ivory balls were made to fall at the same instant on the same ivory ball placed at the angle formed by two curves of wood. The ball went off in a line between the two directions
— Gravity — bodies descend to the earth by a motion uniformly accelerated &c —
— Path of a projectile a parabola — ~~a~~ This explained

on the several figures
— Atwood's machine ~~[illegible]~~ Treated but not firmly fix'd for the experiment
— Then at the begin.g of next lecture —

1810

Royal Institution Thursday the 22d Feb. Astron. — Mr. Pond Lect: 9th Construction of the Art. of the moon. Phenomena of Solar and Lunar Eclipses.

At the preceding lecture the moons phases were described — Inferences from these — The moon is a globe or nearly so — It is a dark body, and receives her light from the sun — In these she resembles our earth. Also in having mountains. As these mountains are of a conical form, or approaching towards pyramids at their bases, they are under the influence of Gravity, as on the earth. These, however are the only properties in which the moon resembles the earth.

On the surface of the moon are large extended plains, supposed to be sea, in the bright points supposed to be islands. Low these and other parts of the moons surface a number of more bright parts, like cracks in a mirror, extend in different directions. There is nothing resembling these on the earth — The moon has no atmosphere, at least nothing resembling an atmosphere has yet been observed. Not a cloud on her surface, constantly the same. In this differs from the other bodies in our System. Changes are observed on the face of the sun, Jupiter Saturn and others — Moons irregularities — Elliptical orbit — Evection ~~depends from that~~ no such in the motion of the earth — Moons apogeum ~~revolves~~ in 9 years Nodes retrograde in 18 years

near the Equinoctial points, and consequently the earth's orbit makes a revolution in about 25,000 years — In the first and third quarter the moon's motion is retarded, in the 2 and 4th accelerated — irregularities by her different distances from the Sun. —

— The moon's period is shorter now than in Ancient times — Ptolemy collected all the ancient observations particularly those of Babylon about 700 years before the Christian era — these when comp.d with the Arabian and also with Modern Observ. are found to give moon's shorter now than formerly — by Dr. Halley — This fact was not understood till La Place explained it very lately. see Motte's orbits. —

— Eclipses of the sun and moon. These were illustrated by the usual diagrams, which however are declared to be very imperfect — Orrery or Planetarium and Dials impossible — Mr. Orme has invented a Tellurian much more perfect than the common one —

— Eclipses are now rather matter of curiosity than of any use in Astronomy

— Friday 23 Feb. 1810 —

Royal Inst.n — Mechanical Philosophy Lect 3 — Mr. Allen

Centre of Gravity. Motion on inclined planes, and on portions of a curve. Doctrine of pendulums. Projectiles. Central Forces

— Experiments on Atwood's machine — succeeded very well. —

— Centre of Gravity. Irregular piece of wood, hung by two different points. Chalk lines from each perpendicular to the horizon. Centre of Gy. in the point of intersection. Centre of Gy. of the human body in the Actions of walking, running, standing, carrying a load before, bowing. Rising from a chair, — A body stands when the Centre of Gravity falls within the base, piece standing obliquely, add a small piece to it, and it falls. Tower at Pisa; —

— Descent of bodies on inclined planes.

- Rolling Shading down. — Double
- Motion down inclined plane
illustrated by the common figures
Times of descent in all the chords
of a circle the same as that through
the diameter (or pendulum).
This proved by experiment on an
apparatus, where two ivory balls
can let go at the same time, one down
the diameter (Pendulum), the other
along the chord. —
- Pendulum, illustrated by figures
in the usual manner — Point of
suspension — centre of oscillation
Great and small vibrations. —
Cycloid drawn by chalk on the
Table cloth - Counter piece of wood
rolled along a straight piece.
Ivory ball suspended by threads
from the centre of a wooden
cycloid with cheeks, vibrated in
a cycloid — This error of no use
in practice —
- Effects of heat and cold on pendu-
- Dead rods preferable to those of
metal. — Compound pendulum
shewn by a figure, two rods
of brass with two of steel. —
Law of inequality corrected thereby
- Three balls of Lead ivory and
cork, all of the same length, set
a vibrating together, lightest comes
to rest first, the heaviest last.

Thursday 1st March 1810

Astronomy Lect: 10 Mr Pond

Historical account of the experiments that have been made at different times to determine the Magnitude and figure of the earth. Description of the great Theodolite employed in the trigonometrical Survey of this kingdom and of some other instruments employed in similar operations. —

History of the various attempts to discover Degrees and Fractions of a degree to determine the magnitude of the earth. Celestial phenomena first suggested the rotundity of the earth — The disappearance of the lower objects on leaving port. Mr Pond thinks do not suggest the Globular figure of the earth. —

Eratosthenes first attempted this problem

Norwood first English measured the distance between London and York. —

Snellius Hounslow Heath

Principles explained by a figure 1st Measure a Base 2 Angles. 3 position of the line joining the extreme points with respect to the meridian or 4th azimuth and 4th the celestial arc between the parallels of latitude passing thro' the Northernmost and southernmost stations. —

Metal standard affected by heat and cold — English standard a brass rod, adjusted the temperature of 62° of Fahrenheit — Steel chain with Ivory tallies adjusted to the standard at the above temperature

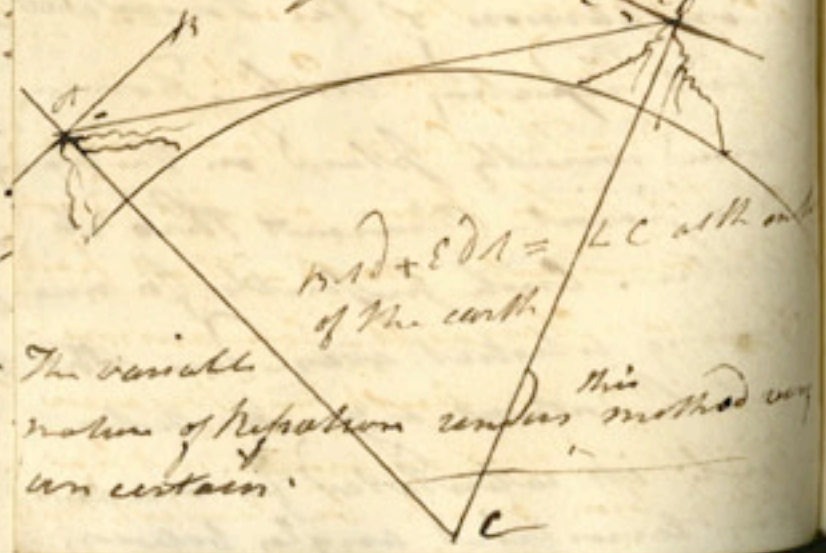
- Base measured with Iron Chain.
It was some time after wards measured with Glass rods, and the Difference did not exceed Three Inches in upwards of Five miles
2 Angles measured by the Theodolite in England, and by Borda's repeating circle in France. Description of both — Of the Great Theodolite made by Ramsden, and used in the English measurement by Genl. Roy. This Instrument belongs to the Royal society. —
- Stations taken horizontal — Shewn by a board with pins on threads — Horizontal measures are wanted.
+ all these Operations are entirely terrestrial. —

- To ascertain the situation of the System of Triangles with regard to the meridian and equator — This problem is performed by observing the azimuth of any side from one of the triangles by means of the Sun or a star when on the meridian.
4 — Operation is purely Astronomical — Zenith Sector.
+ Comparison of the Theodolite with the repeating circle — Former more exactly placed on the station point — Plummet thro' its centre. Circle preferable for measuring celestial arcs — does the whole without a Zenith Sector.
- Circle ill calculated for measuring terrestrial angles between

stations which have different altitudes above the horizon. Upon the whole the great Trigonometrical Problem is susceptible to the French repeating Circle

+ Base of verification.

- attempt to determine the magnitude of the earth by the intersection of the horizontal lines of two elevated objects at a distance from each other.



BAD + EDA = ACB the curvature of the earth

+ The variable nature of Refraction renders this method very uncertain.

Thursday 8th Nov. Mr. Pond

Investigation of the figure of the earth continued. Results of the different trigonometrical operations. Of the method of determining altitudes by Barometrical measurement. On Mountain Barometers.

Short recapitulation of the different methods employed for finding the figure and Magnitude of the Earth — Results — The Earth flatter at the poles than at the Equator — Measurements North — Mean height of Peru — Clairault — Condamine &c. — Error in the Southern Measurements. A new measurement has lately been made by Swedish Philo-

the results is considerably diff—
from the former. —
— various opinions respecting the
figure — Cassini ~~an oblate~~ prolate sphe-
roid — Newton an oblate spheroid
or higher at the Equator than at
the poles — suppose the Earth cov
with water — centrifugal force —
+ English measurements now
carrying on towards Scotland
make a degree in the South
of England greater than than
the degree next to the north — na
— tural figure of the earth still un-
determined —
++ The mode of measuring mount
by the barometer deferred till
next lecture. ———

Thursday 15th March 1810

Astronomy Sect: 12 Mr Pond

— Of the mountain barometer,
and on the method of ascertaining
the position of different points
on the earth's surface. Determi-
nation of the Lat: and Longitude
of places and their distance
from the center of the earth.

The method of determining
the Lat: of a place — the French
call the altitude of the pole
above the horizon, the Lat; or
the distance of the Zenith from
the Equator, which is equal to the
former, the Lat: — Circumpolar
Star — Half the sum of the meridian
altitudes is the height of the
pole = Latitude. — Another

method of finding the Lat: is by the meridian altitude of the sun or star, this with the Decl gives the altitude of the Equator Co-latitude.

Longitude. For finding the Longitude we must find the difference of time = 15.° to an hour — In the French and Trigonometrical surveys, the Explosion of Gunpowder was made use of, a good method for short distances on Land.

— Chronometer — This method described & Objections, chronometers have not yet been made to keep equal time.

— Eclipses of Jupiters Satellites

— Objections, Intransmission or instantaneous — Different power of Telescopes — Motion of the ship do not permit the use of telescopes at sea —

— Occultations of fixed stars by the moon. This is the most accurate mode of determining the Longitude — Instantaneous. It requires correct calculation on account of the moons parallaxes. —

— Moons distance from the sun or a star. This is the mode of determining the long: at sea. By the Nautical Almanac the calculation is rendered very easy, and it is practicable in every part of the Ocean.

+ An account of the irregularity in the Earth's figure, the latitudinal and longitudinal meridians will not always coincide — Two places may lie north and south of each, and yet be under the same parallel of Lat: and east and west of each other, and yet have different longitudes — This is a curious fact, and not generally known

+ Mountain barometer —

common barometer described.

– Portable barometer — Ramsden's floating gauge — Troughton's, Lowry by Sir Ch. Englefield —

+ Principle of measuring height by the barometer explained

Descent of the mercury, as the instrument ascends — proportion &c. —

– Equation or correction necessary the last, if I remember right, is for the distance from the centre of the earth ——

Friday 14th March 1010

Mechan. Phil. Lect 4 "

Projectiles. Centre of forces.

Mechanic powers.

Projectiles illustrated by a figure, and an experiment three jets at the bottom of a glass jar filled at 15°. 45'. 75° 4 shew the parabola &c. — Centre of forces — figure and whirling table —

+ Mechanical powers — Lever, wheel and axle, and pulley discussed, the other two deferred till next lecture. — Sundry means of velocity in the whirling machine and pair —

There was nothing remarkable in the lecture in this lecture. Several gentlemen left the room during the lecture. —

Thursday 22th March 1810

Astronomy Lect: 13th Mr Pond
– on the different bodies which com
from the Solar System. On the
Planetary Motions. Historical
Acc^t. of the Astronomy of the ~~ancien~~
planets. – (Did not attend

Friday 23 March 1810

– Mech^l: Philosophy Lect. 5th –
– Passive strength. Means of
increasing it in Metals.
Importance of attending to me-
chanical principles in the
application of Timber. Ropes.

– Inclined plane wedge. ~~screw~~
and screw explained in the usu-
al manner –

– Strength of timber – metals &c.

– Effect of hammering and wire drawing
metals, almost double their strength
gram. – Pieces of wood – joints of
timber dimensions – Hollow tubes
bats masts &c (here nothing
new). – Machine for ascertaining
the absolute strength of pieces of
wood. – – Ropes An Asian
plant called produce
ropes much stronger than hemp –
Tension of ropes. –

Thursday 29th March 1810

Astronomy Art 14 — Mr Pond —
— on the new planets, comets and
fallen meteors —

Views of Astronomy into the
new general and particular
Phenomena — Rom absolute
by a that view of the planets
primary and secondary — Satellites
of the Georgium many questions
Newton to the orbit — retrograde
motion —
— New planets Ceres &c — In the
great interval between Mars
and Jupiter a planet was
expected, but two planets at
the same distance from the
sun is contrary to the analogy
of the Solar System —

Mr P. adopts Dr Olbers
opinion that a planet has
been exploded or two to form
in the situation or orbit of
these new ~~moon~~ planets
Dr Olbers in consequence of
this theory suppose that
a new might be discovered at
those nodes when the mo-
tion of all the fragments
would agree — It was in
consequence of this that the
discovery of Juno planet
which he calls Vesta — This
is the only celestial body
that was ever discovered by
reasoning a priori —
— Comets about 700 have
been observed — little known
concerning them — different ap-
pearances — some have tails others

not. The orbits of comets are Ellipses — Newton discovered a method of calculating the orbits of comets. It is not known absolutely certain that the same has ever returned

Fallen Stones — In all ages stones have been found. Philosophers denied this fact — Now it is certain. — Composition is the same in all — Iron meteoric and Nickel. Both attracted by the magnet. From the most probable — Perhaps they may have the same origin as the new planets — Part of an exploded body. — Davy's opinion W.P. thinks most probable, that they are of the new planets, and again their heat in our atmosphere.

Friday 30th March 1810

Mech: Phil. Lect: 7. M. Allen

Friction or temporary retarding force in hard bodies. Its effect on stone wood and metal. Means of diminishing. Principle on which Wheel carriages should be constructed.

In this Lecture the quantity of friction was ascertained by experiments on sliding, and rolling bodies on horizontal and inclined planes — Wheel carriages — great and small wheels compared. Distinguished and Narrow wheels — Waggons — Carts — Cylindrical — Conical circumferences —

— In this Lecture there was nothing new.

Thursday 5th April 1810
Astr. Lect. 15th — Mr Pond.
— On the nature of the fixed stars and construction of the heavens. Binary combination of stars, and various spheres of Nebulæ. Particular motions of the fixed stars. Changes that have taken place in the appearance of the heavens, since the earliest history of Astronomy.
Did not attend —

Friday 13th April 1810
— Royal Institution —
Dr. Smith's first lecture on the Philosophy of Natural History — Introductory lecture. Design of the course. Of the three kingdoms of Nature. Of the Animal Kingdom. Of the vital principle. Nervous System, Sensation, Voluntary and involuntary motions, not originally distinct. Of the Intellectual faculty. Of Cruelty to animals. —

— Importance and utility of the Study of Natural History — Early division into the Animal, the Vegetable and Mineral Kingdoms — Still retained.

— Distinctions between animals and vegetables, and of the vital principle (see Dr. Smith's introduction

to Botany Chapter first) —
and Smellie's Phil.y of N.H.y
Chapter 1st —
— Ani.l and Veget. divided into Cortex
and medullary substance — the latter
contains the nerves, immediate inst.s of
sensation, the former all the other
parts. Voluntary motion — Perhaps
all animal motion is voluntary
effect at the command of the will —
(Mind produces motion on matter
even the action of the lungs and
heart is under the direction of the
will tho' not always attended to
a person learning to play on the
Harpsichord is obliged to attend to
every key the finger touches, but af-
terwards can go on by looking at the
notes without ever thinking of the
keys. —
— intellectual faculty gives man
a great advantage over all other ani-
mals —

Thursday 12th April 1810

Astronomy Lect. 16 Mr. Pond
— On the different Astronomical
Systems, the Egyptian, Ptolemaic
Tychonic and Copernican Systems
Discoveries of Kepler. State of
Astronomy previous to the intro-
duction of the Newtonian Philosophy
— conclusion of Prospective Astronomy
(did not attend —

Friday 13th April 1810

Mech.l Phil.a Lect: 8th — Mr. Allen
The principles on which a road
should be formed. Effects of wheel
carriages. Imperfections of the present
system. Hints for improving it
(did not attend —

Saturday 14th April 1810
Phil: of N. H. Lect: 2 - Dr. Smith
Of the classification and scientific distinctions of animals, especially of the class Mammalia

Two modes of classification - one begins with the most simple and ends with the most complex -
The other which is that of Linnaeus proceeds in the contrary order as follow
1 Mam: - 2 Birds - 3 Amph - 4 ~~Fish~~ - 5 Ins - 6 Worms
a few distinguishing character of each - Man at the head of all
Different opinions respecting the classification of man - Monkey -
- Mammalia - Skin - hair, small pointed towards the point. Exp: of rolling a hair between the finger and thumb, hair moves towards the root end. -
- This property of great use in the manufactory of cloth and hats. - serves to unite the fibres more firmly by the operation of felting
- Teeth - incisores - molares - canine - Ox has incisores only in the lower jaw, this more convenient for cutting the grass. Canine teeth or tusks evidently intended for tearing animal substances. -
Tusks of the wild boar of Sumatra bent back into a semicircular form can be of no use in tearing its prey - Mr. Home thinks that they are intended to preserve they eyes from being injured by the brush wood in which the wild hog is generally found

— eyes — pupil in the human eye round. In many quadrupeds such cats, it contracts, by the action of a strong light into, almost, a line, perpendicularly. Others contract horizontally, &c —
— Membrana Nictitans — birds —
— Human Stature about 6 feet — nearly the same in all ages —
— Pygmies said to exist formerly — L. Monboddo's account of men (with tails) this not named by D. S. who refers us to the book —
— D. Smith might have said ... that ... believed to exist in ancient times

Thursday 17th April. 1810 —
Phil: of Nat. Hist: Lect: 3d Dr. Smith
Characters and history of the several orders of Mammalia

This lecture was employed on the first and second orders of the Class Mammalia — namely the Orders Primates and Bruta — these distinctions depend on the teeth — four genera of the Primates, Homo, Simia, Lemur, Vespertilio — several anecdotes of the Monkey — great affection for their young — fight in troops. In cold countries the monkeys die of consumptions &c. &c. —
— Bruta order contains seven genera viz. Rhinoceros, Elephas, Trichechus, Bradypus, Myrmicophaga, Manis and Dasypus — these have no fore teeth in either jaw —
— Anecdotes of the Elephant. —

Thursday 19th April 1810
Mechanical Phil. and Exp. applicable to
Physical Art Sect. 1 – Mr. Pond

– Newtonian Philosophy founded on the discoveries of Kepler. Elementary principles of Mechanics. Motion, Force, Velocity. Force proportionate to Velocity. Of the different kinds of Force, which will become the subject of these lectures.

– Discoveries of Kepler –

1. Orbits of the planets elliptic –
2. Equal areas in equal times
3. Squares of the periodic times proportional to the cubes of the distances

— Motion – no definition necessary – Every person has a clear idea of it – relative and absolute – we are only acquainted with the former – No body perhaps at rest – Equable or uniform Motion accelerated, retarded motion. –

– On Atwood's machine —

– velocity – not swiftness, but rate of motion
– in uniform motion. –

$V = \frac{S}{T}$
$S = VT$
$T = \frac{S}{V}$

Illustrated by a person walking 12 miles at the rate of three miles an hour. –

M. P. explained this in a manner perfectly intelligible to any lady in the room – He touched very lightly on the measure of forces – said forces were known only from their effects &c. – Kepler's problem cannot be strictly solved. It may rank first with the squaring of the circle, the duplication of the cube and the trisection of an angle. It may however, like all the rest, be approximated and frequently use for useful purposes, the chief of which is to find the future of a planet.