Vol. 2d

Notes

on

Davy's Lectures

Royal Institn.

18th Dec 1809

at 8 p.m.

Notes on Davy's
Lectures at the Royal
Institution —

Introductory Lecture
10th December 1809.
at 8 in the Even.g —

— at 8 p. m. —

Monday 18th December 1809

Electro-chemical Science Lect 1st

Introduction. General view of the subject. Origin and progress of chemical Science. —

W. D. began by adverting to the many discoveries made in his last Evening Lecture 1806. — (Decomposition of ~~a~~ many bodies formerly thought simple bodies — His apparatus last morning cannot consist of 1000 Leyden now it is 2000. Experiments of the present course will be performed on this.

History of Elect.y — Amber — Gilbert — Franklin Identity of Elect.y Galvani — Frog laid on a plate of Zinc supported by the hand

and the circuit formed by a silver wire — Galvani's Hypothesis — that Galvanism was a fluid origin[al] belonging to the nerves and muscles of animals, put in motion by metals &c. &c. — Phenomena observed before Galvani's Experiment — silver to the under and zinc on the upper part of the tongue — Porter out of a pewter pot — and a Gold or Silver tip — Iron nails this copper plates in sheathing ships — Snuff from a tin box and a horn — W. D[?] [illegible] this. — Volta first asserted the identity of Galvanism and Electricity — showed by Experiment that the Elect.^y is produced from the metals — copper and Zinc in contact in air — in water produce Elect.^y —

Description of Volta's pile —

— English ready to encourage new discoveries but they get tired of them. About 50 years after Newton, mathematical sciences began to decline in England, where they have been cultivated abroad to such lengths that few Englishmen can now read the late writers on the continent —

— To Black, Cavendish and Priestley Pneumatic Chemistry owes its existence. The French have improved it, but the materials are of British manufacture. — What use! —

London 1st Jan 1810

Mr Davy's 2 Lecture on Electro-chemical Science. Progressive improvements of the Voltaic Instrument; Construction and agencies of the great apparatus. Investigation of the mode of Operation Reference to the laws of Elect: Attraction, conduction and non conduction, Distinctions between. Experiments on the various classes of Electrical agents

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— Voltaic pile — common construction — Cruickshanks trough — Wilkinsons improvement — Dr Babbington's last recommended troughs of Wedgewood

Davy – Apparatus of the Royal Institution – 500 Series made use of in the lectures – Laws of Electrical action friction – common Electrical machine – Attraction, repulsion shewn by Gold leaf – Pith balls &c – Two cylinders of paper covered with Gold leaf hung on the tops of two rods or wire on the positive and negative conductors. — Attraction by the voltaic Instruments Spark from both. –
– Negative & positive – Franklin Theory. Whether two electric fluids – Whether Elect. be a fluid – undetermined.

Exp. on the Elect. machine – Elect attraction and repulsion – Insulation – Common conduct. Leyden Jar charged and discharged cannot be discharged by a non-conductor — Lightening – Identity of Elect. and Lightening – Great Ancient Safest and most dangerous situations during a thunderstorm – Dangerous under a tree Abundance of wood the conductor the human body a better conductor than a vegetable.

– On the French attempt to Decompose the diamond. It is a non-conductor therefore cannot be decomposed by Electricity

+ D. divides all bodies into conductors, imperfect conductors &

non conductors – enumerated
the principal of each class –
– Changes which some bodies un-
dergo with regard to their conduct-
ing powers – wood charcoal –
air, cold and heated –
– Luminous conductor. Large
gold leaf Electrometer
+ lect. this Evening 1½ hours.
++ Mr B. a little elevated. —
+ The French still make use of
the piles which they say is
superior to the troughs. The wood
of the latter, they alledge con-
ducts the Electric matter. —

Royal Inst.: 8. Lond. 1810
Mr Davy's 3 Lect. El: C. &
Laws of the excitation of
Electricity by heat by friction
by Contact. Electricity by Indn.
Application to the explanation
of the phenomena of the Voltaic
battery, and to appearances
in Nature.

- Positive and Negative Elect.
Excitation by contact - Copper
and Zinc, when separated
after contact, the Copper is
negative, the Zinc positive
The same, but in descending de-
gree with iron Silver Gold &c.
and Zinc - Glass and
Mercury. Positive and Nega-
tive - Amalgam of Mercury
and Zinc is Pos. negative, Glass
positive. Hence the action

of the Electrical Machine,
the simple contact of the
amalgam on the Rubber and
the cylinder produces positive
Elect^y: on the glass by the motion of the cyl^r
produces a rapid succession
of contacts. — Water is one
of the imperfect conductors
— Voltaic Electricity by contact.
Slip of Copper and Zinc in
water. Evolution not the
cause but the effect Voltaic
action
— This last experiment, M^r
D thinks irreconcilable to
D^r Franklin's Hypothesis.

— Elect^y produced by evaporation
Common experiment described —
This experiment is in M^r D's
opinion much in favour of Franklin's
System, the most so of any. —
— A small Elect^l machine
in a glass receiver made to
act in Carbonic acid gas in
oxygen gas, and in rarified air
In the former more powerful
than in atmospheric air,
In oxygen gas the same as
in at. air — In rarified air
very little action, because
there is a conductor. —

— Mr Davy adopts the Hy-
pothesis that heat is not a
fluid, but produced by the mo-
tion and actions of bodies on
each other — Black smith
hammers a piece of cold iron
till it be hot — Iron on a
dry Grindery Stone — Air in
a syringe violently compressd
lights amadou (fungus).

Dr Stukely's theory of Earth-
quakes, Mr D thinks the best,
to this may be added the pro-
duction of Elect.y from Metallic
Strata. —

— Aurora borealis, Mr D. thinks
an Electrical phenomenon
and satisfactorily accounted for
— Ice is a perfect non conductor
hence the Elect.y of the Atmosphere
in the Northern regions cannot
return to the earth thro' the
ice. —

Royal Institution 15th Jan.
Mr. Davy's 4th Lect. Ch. Science
of the Difference between
Voltaic and common Elect.
Experiments on a battery
composed of large plates;
comparison of their power
with those of smaller combi-
nations. General agencies
of the Voltaic Apparatus.
Experiment of Ignition

Common Electricity produces
products Elect. but
of greater intensity than the
Voltaic apparatus. Some theory
of Elect. thrown over a large
surface is less intense — Exp.
charge of a Quart jar thrown

into a Rarefied one — Battery with a small charge has the same effect as the Voltaic Pile would when loaded with it &c —

— Indeed that shewn by some small conductor the ends positive and negative alternately — also by the Common wooden Royal Institution —

— M. Berthollet says that Electricity comes wire by the separation of the fluids and the application of charge — M. Davy proves that this is not true by the following elegant experiment Platina wire was kept red hot in by the Voltaic battery in an exhausted receiver for an hour. The more perfect the vacuum the more red the wire metal appeared, but M. D. then was nothing to carry off the heat —

— M. Davy believes light to be the result of the combination of bodies, as Bacon and Newton, and that Electricity is the consequence of certain attractions and repulsions. He thinks the appearance of the flame with the Coal in both sides is agreeable to his theory but contrary to that of his worthy Colleague M. Dalton. For was it matter which made the heat the Coal would be found only on the anode.

— I could not hear distinctly M. D.'s account of it —

Monday 22^d Jan^y 1810

M^r Davy's 5^th Lecture Ele. C. 1.

Battery of transfer. Connection of the Electrical Phenomena with Chemical changes in the Battery. Experiments on this subject. Excitation of Electrical power by chemical agents. Historic views of the progress of Elect^y.

— Could not attend this Lecture. — —

Royal Institution

Monday 29th Jan, 1810

Electro-chemical Science.

Lect: 6 - Chemical agency of Electricity. Early modes of applying Elect to an agent of decomposition. Experiments on the decomposition by the voltaic battery. General principles of this department of the Science. —

— Could not attend —

Royal Inst. Feb 5 – 1810

Electro Chemical Decomposition 7 —— Mr Davy

Decomposition of Acids & Alkalies by Electricity. —

Energies and properties of the new substances obtained Potassium. Sodium

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The same experiments were exhibited in this lecture as on the same subject last season. In this session he only described the process made of decomposing Potash, in this former lecture he shewed the experiments and ~~he~~ replied to some objections of Mr Dalton against the decomposition of Mr Davy of there being only two proportions of hydrogen and Oxigen and Bi-oxide. but as I did not hear Mr Dalton, I did not perfectly understand Mr Davy when I also could not distinctly hear. ——

Monday 12 Feb. 1810

Electro Chemical Science

Lect: 8

Decomposition of the Earths

Metals of the Alkaline earths and earths. General relations of salifiable bases. Probable agencies of the metals of the earth. Volcanoes. Meteo-ric stones.

History of opinions respect the earths being metalic oxides – no direct experiments to prove this. Merely a ~~theory~~ conjecture given up several years before Davy made the discovery of decomposing the Alkalies

History of Mr. D–s first ex-periments and failures –

– Berzelius's mode by making an amalgam of the new

metals and mercury, which
is done by electrifying the mercury
with the negative power — of
of forty pair of metals. This
is sufficient to show the fact
tho' not so convenient for pre-
paring the metal for experiments
Mercury may be afterwards
evaporated — tho' some difficulty
— Then the decomposition of the
alkaline earths, and earths
only described — Silex con-
tains more oxygen than any
other body —
— In the preparation of pyro-
phorus potassium is found
which takes fire when exposed
to the air — Potassium acts
on platina, from this Dr. Woll-
aston conceived a mode of pro-
curing potassium by this means

— New discoveries likely to be
of use in the arts — In the
conversion of cast into mal-
leable iron — Iron forms with
a substance in the process —
a kind of glass. —
— Geology improved by the
new discoveries —
Dr. Maskelyne and Mr. Caven-
dish have shown that the mean
density of the earth is more than
twice that of bodies on the surface.
Hence the interior parts of the earth
are probably metallic — water
falling on these must occasion
explosions — volcanos
— Experiment a small cup
in a glass, in the cup a bit
of potassium, water poured
into the glass caused the
potassium to explode — represents
a volcano. —

— Meteoric Stones, probably
masses of new matter which
take fire in our Atmosphere
cannot be formed in the at-
mosphere for even this the cor-
they would fall spontaneously
W. D. does not pretend to say
from whence they come —
— Expt. a bit of protoxyum in
a wine glass a little water
poured on it, thrown upon
it bounds and hot like a
meteoric stone, and the liquid
has the same action. —

Royal Inst.n Monday
the 19th Feb. Electro. Chem.
Lect. 9th

Experiments on the decomposition
of the fluoric and boracic acids.
Experiments on the Muriatic
acid. Decomposition of Phosphorus
and Sulphur. Experiments on
Carbonaceous matter. Metallization
of ammonia. General view of the
Chemical arrangements of matter.
On the probable advancements of
Chemistry. Conclusion of this Course

In this Lecture the process
by which the new substances
were obtained with the properties
of Fluorine &c will be explained
in an oral course of Chemistry.
The Gases with which I intend
to decompose the boracic and
Muriatic acid (so called) in sub-
jected

jected to the Voltaic Practice
for platina will be rendered
a Black or brownish substance
but in small quantities, because
the boracic acid is a remarkable
It cannot therefore be distinguished
by Voltaic Test like the Tellurium
and other bodies already treated of
— Potassium produced with Boracic
acid an important matter
— See Barons Lecture
Philosophical transactions
for 1809 part 1st — for an
account of attempts to decom-
pose the Boracic, Fluoric &
Muriatic acids —
— M. D. found that he could
not decompose Muriatic acid
& water by oxygenating or
the acid by alone — But by
uniting it with potassium
Phosphorus & Sulphur —

Mr Davy concluded his
Lecture with intimating his
intention of commencing a
set of experiments on Charcoal
and the Diamond and that if
he succeeded in burning diamonds
he would present them to the
Ladies who had been present
with this evening's Lecture.

Saturday 3 March 1810

On the advantages that may be derived from improving the Royal Institution, and rendering it permanent as a great public establishment. With views of the progress of experimental science and arts in Britain; and of the means which may assist their advancement. — By desire of the managers.

See the printed papers on this subject. —

at 2 p.m.

Royal Institution 1810

Saturday 10th March —

Mr Davys 1st Lecture on

Chemical Philosophy —

— Particular views illustrated by

experiments. Chemistry of the

Arabians. Alchemy. Experiments

of the early Philosophical Che-

mists. Researches of Paracelsus

Boyle, Hook and Mayow. Foun-

dations of Chemical Philosophy

Three methods of acquiring a

knowledge of bodies, Chemistry,

Analogy and Experiment

Example - a plant in water

Exposed to the same rays - Oxy-

gen &c. —

— Chemistry of the ancients consists

in the working of some Metals.

and Dyeing certain Colours.
— Dioscorides dissolved Cleopatra Pearl in vinegar — supposed to have been the discoverer of the Art of distilling — Neither Hippocrates nor Galen make any mention of chemical experiments, we may hence conclude that chemistry was but little known in their days. — Arabians — Alchemy of their Chemists — European Alchemists Agricola, Raymond Lully, Basil Valentine — Van Helmont Paracelsus &c. —

— Cause of failure in the process of making gold was generally an explosion understood to be by accident when particles of gold were found scattered about —

— Mr D— thinks that this was effected by Aurum fulminans —

+ Experiment some A. F. — on paper over a ~~lam~~ spirit lamp!

exploded very feebly — Experiment with a retort — retort broke — there another where the experiment had succeeded, particles of gold on the inside

— Exp: solution of Sulphate of Copper rubbed on a plate of Iron, as there was but little difference between the colour of the iron and copper, this experiment was not near so striking as when polished iron or steel is made use of.

+ Experiments were observed by Bacon, Boyle, Hook, Mayow ~~and~~ Priestley &c. —

— Small part of atmospheric air employed in supporting life and combustion — Experiment of breathing air in a jar inverted in water, through a bent

tube – candle extinguished –
animal killed in this air. –
– condensed air supports flame
longer than common Atmospheric air – Proved by a candle
burning for a long time in
the charged condenser.
– Becher and Stahl laid the
foundations of true Chemistry
– Inflamm.ble earth – Phlogiston

Saturday 17th March
Chem: Phil.l Lect 2 (Davy
Discoveries of Glauber, Glazer
and Homberg. Chemical
views of Newton. Attraction
its nature. Progress of
Pneumatic Chemistry.
Pneumatic processes illustrated
by Experiments. Different airs.
Discoveries of Cavendish, of
Priestley.

Glauber discovered that acids
and alkali neutralize each
other Exp. Sulphuric acid and
Sol. of soda, tried the test paper
but experiment did not succeed.
– Points and Cones. — Glazer
published the first book on Chemistry – Physician to Louis 14th
and preceptor to the duke of Orleans

– Hamburg – Phosphorus Expt.' –
was not very striking –

X – Academy del cimento – Royal Society of England, and Royal Academy of Science at Paris established.

– D.r Hales – fixations air –

– Dr. Black's discovery of fixed air and its properties Expt.' – Fixed air made –
Nature of fixed air in earths and alkalies under them mild – alcaline caustic – Lime lime water

+ Dr. Black's discoveries the foundation of Pneumatic Chemistry –

– Mr. Cavendish's discoveries, in this Volume, were numerous and important –
Here an Eloge on Cavendish concluded by saying "no death was so much lamented by men of science, since that of Newton."

– Doctor Priestley's Discoveries very numerous, and very important –
Character of Priestley – was no Chemist – Letter of his to Mr. D – says he began his Pneumatical Studies with — almost no apparatus, or knowledge of Chemistry — He was a great & excellent Enthusiast, and an ingenious experimenter, but an indifferent reasoner — He, Mr. D, said, he might be permitted, as a chemist to regret that Dr. P. had confined his attention to so much drawn off from pursuits of such importance, to those of a more transitory and perishable nature. –

— In this lecture Mr. D. Exhib.
the Pneumato-chemical appa-
ratus, and the method of ma-
king and preserving the gases
Several Experiments —
— Taper extinguished by car-
bonic acid two ways
— Candela Photosophi-
ca — flame thro' a very
small bore. Common phial.
— Oil of turpentine inflam.
by Nitrous acid — Brithi-
en's Experiment.
— Charcoal in Oxigen Gas
— Steel wire — watch spring
in ditto
— The piece of charcoal was much too
large, effect not very remark-
able —

4

Saturday 24 March 1810
Chemical Philosophy Lect 3 – Davy.
Discoveries by of Ochre, illustrated by Experiments. Composition of the Atmosphere. Its renovation respiration. Later discoveries of Cavendish. Nitrous acid. Composition of Water. Generalizations of Lavoisier. Experimental illustrations

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+ I was too late for this Lecture and obliged to take a seat as far from Front that I could not hear ——

– when I entered the Theatre Mr. D– was passing Nitrous with Oxygen Gas – Combustion – red vapours – oxygen discovered by Dr. Priestly and Mr. Scheele, without any knowledge of each other's discovery

— Jupar in Oxygen Gas. —
— Phosphorus in Ditto — just before
— candle extinguished in Nitrous
Gas —
— Discovery of the Component
parts of the Atmosphere, Oxygen
and Nitrogen — Priestly — Cavendish.
— Euchiometry discovered by Priestly
Eudiometers — D. Hossen &c. —
— Observations on the purity of
the atmosphere —
— Respiration — Lavoisier shows
— Composition
— Formation of Water —
History of the discovery —
Warltire — Priestly — Watt Cavendish — the last the real discoverer.
— Lavoisier, who had heard
of this, publishes the discovery as his own.

Wednesday 28th March 1810

Chem: Phil: Lect: 4th — ~~Nitrous~~

— Nitrous oxide, its properties; Experiments on its respiration.
History of the discovery of the Gas
absorbable by water. Muriatic acid
gas. Oxymuriatic acid Gas. Experiments ~~discovered by Priestly~~ demonstrating the nature of their bodies.
Fluoric acid ~~Gas~~ discovered
by Scheel. Experiments upon it.
Its decomposition. ——

Nitrous oxide discovered by Dr.
Priestley. He calls it Dephlogisticated
Nitrous air — Candle burns in it
with an enlarged flame. Sulphur
if weakly lighted, is extinguished
in this air; but if strongly lighted
it burns with a large greenish
blue flame — Surprizing effects
on the nervous system.

sensations sometimes pleasurable – at others the contrary – resembles vinous intoxication – Mr. D. breathed it till he began to experience its effects – He made a small quantity of it in a glass retort over a patent lamp. –

– Muriatic acid gas – oxymuriatic gas – Discovered by Priestley. The latter contains less oxygen than the former. Oxy. M. a. gas has never been decomposed, the other gas has been decomposed. – Extremely difficult to free the muriatic acid from water, when this is nearly done, the air loses its property of reddening test paper when the paper is well dryed. A quantity of the air in this state produced no difference in the test paper but when water was afterwards thrown in the air at ready on the paper it instantly turned red. ——

– Fluoric acid discovered by Scheel – Engraving on glass – Decomposition by Potassium – Experiment performed in a glass bent tube –

– Lavoisier's brilliant discovery of oxygen; being the acidifying principle not universally true – Example – we know two acids which contain no oxygen, the fluoric and Muriatic

– Mr. Davy has succeeded in decomposing muriate of soda by iron thinks this may probably be done to advantage on a large scale.

Wednesday 4th April 1810

Chemical Phil.y Lect.s Sir H. Davy.

- Discoveries of Phosphuretted and Sulphuretted Hydrogene Gas, and on their properties. Discovery of the Hydrocarbonates. Of the economical applications of Gas from coal. Gaseous oxide of carbon. Discoveries concerning the diamond and Carbonaceous substances. ———

- Lectures employed on the history of the discovery, and the discoverers of the above Gases. —

- I did not hear distinctly, being in a back seat

- Olefiant coal gas made to contain ~~—~~ water — This gas contains three different kinds of gases 1 Olefiant 2 Carbonic oxide 3 Hydro-carbonate The last is by far the greatest in qu.y

— to a bill is now before Par-
liament Mr Davy would not
give any opinion on the sub-
ject, but in what ever way
it may be determined it ought
to be remembered that Gas
lights are originally of Bri-
tish manufacture. —

— History of Experiments on the
combustion of the diamond
— Cosmo Duke of Tus-
cany first burned the dia-
Mr Macquer, Guyton De Morveau
found it a pure Charcoal —

— To make a diamond it
will first be necessary to
fuse carbon and plumbago
which has not yet been done
— This however may possibly
be done by a Voltaic battery
of 2000 pairs, some 500 being
sufficient to decompose some very
refractory bodies ——

— Experiments on Sulphuretted
Hydrogen — Phosphuretted Hydr.
from a retort, took fire in the
atmosphere more readily than
common —

— Phosphat of lime — burnt on
the outside and at the bottom
when sulphuric acid was pour-
ed on it by a glass funnel reaching
to the bottom of the glass

Wednesday 11 April 1810

Chemical Chair Lect: by Mr Davy

— History of the discoveries made concerning heat; with experimental elucidations. Hooke's experiments on the radiation of heat. Pictet's experiments on the radiation of cold. D. Blanks experiments. Combustion. Comparison of the theories of Cavendish and Lavoisier.

— Two opinions concerning heat
1st Material 2 a property of bodies
— 1st Effect of heat known was its expanding all bodies, solid, fluid and aeriform
1st Experiment. The end of the tube of a retort was plunged into water and a spirit lamp applied to the bottom. The atmospheric air in the retort was partly

expelled from the vial &c. —

2. A quantity of Ether in a small retort was entirely expelled from the retort by pouring hot water on it. When cooled it returned and filled the retort as before.

3. Cold ^coloured^ water in a wide tube, on the application of a spirit lamp rose in the tube.

4. Thermometer tube. History —

5. Radiation of heat — Two mirrors placed on stands perpendicular to the horizon. No experiment with these — Other two placed parallel to the horizon, one on the floor, the other on a high support. The radiation of heat shown by the explosion of fulminating mercury laid on a piece of paper on the side of the lower mirror.

6. Radiation of Cold — Ice held in the focus of the lower mirror, and Leslie's Photometer on a large scale, placed in the focus of the other — It was not much affected — No necessity for supposing cold a positive body ———

— W. D. gave the history of Dr Black's discoveries — Latent heat — improvement by Irving — Dr Crawford on animal heat — Theories of Combustion — Stahl's Cavendish's Lavoisier's. —

+ Conductors of heat, + Glass metals, wood, fur, hair, clothes discussed in the usual manner, also temperature of the human body same in all climates

– American bear has a temperature of 80 – a dead body soon acquires the temperature of the surrounding atmosphere. Not so a living body – Blagden on Fordyce's experiments in a heated room. –

Saturday 5th May 1810

– Connexion between heat, light and electricity. New experiments on the radiation of heat in Saussure. Chemical powers of Electricity. History of Dr Herschel's experiments on the Solar Spectrum and the conclusions arising from them. Last 7 Chemical Philosophy –

The radiation of heat is much affected by the colour of the body. Dark coloured bodies radiate heat more than white bodies. Exp. a tin globe with hot water in it, one side painted black and the other remaining bright. The black side affects Leslie's differential Thermometer much more than the metallic bright side – Dr Franklin's experiments

of pieces of different coloured cloths laid on snow. The black sunk deepest, the white had scarcely any effect —
— Tubes in conveying heated air or steam through a room, if it is the object to heat the room, the tubes should be black or dark coloured. — if the heat is wanted to act not in the room but at a distance, the tubes should be bright. —

— Mr Leslie has endeavoured to shew that heat is not in reality radiated, but is propagated with the velocity of sound by undulation or pulses —
In refutation of this ~~answer~~ ~~to this~~ Mr Davy proved by experiment that heat radiates in vacuo.

— The Voltaic Battery was employed in shewing the production of light and radiation of heat first in a receiver full of air, then exhausted when the light was ~~not~~ as brilliant as in air, charcoal was used —

— Condensation of bodies produces heat — rubbing the hand hard on the sleeve of the coat —
— ~~by~~ hammering a piece of soft cold iron till it will light a match — Condensing air — Condensing Syringe shewn —

— Mr Davy asserts that heat is only a quality, this he calls the Newtonian doctrine, altho' Newton mentions it only in the queries to his optics. He does not think that Dr Herschels late experiments

afford any unanswerable objection to this fact as a proof and produced by motion, or vibration —

— Condensation produces heat — rarefaction produces cold —

— A question has been frequently asked does the temperature of the Earth continue the same in all ages? If not whether does it increase or decrease? Various opinions have been entertained on this subject. Some maintain that the temperature increases and bring as a proof that Germany is now much warmer than in the time of the Romans. This is owing to the cutting down of the Great Forests — Mr Leslie thinks the temperature is increasing but at the very slow rate of two degrees in years.

— Those who maintain that the heat of the earth is diminishing bring their argument from the sun which they say must be diminishing, and from the radiation of the earth.

Saturday 12. May 1810

Chemical Phil.y Lect.o 11

History of the discoveries which connect Electricity with Chemistry. Construction of the Voltaic Apparatus. Experiments on its general powers.

— Amber — Lincuinum, which must either have been the Topaz or the Tourmalin both which are electrical. — Dr. Gilbert the first Electrical Philosopher. Which Bacon was pointing out the true road to philosophy, when Galileo was investigating the laws of motion, D. Gilbert was establishing two new Sciences Magnetism and Electricity —

– Otto Guericke constructed the first Elect.l Machine, a globe of Sulphur &c – This was by Mr Hauksbee exchanged for a Globe of Glass. Mr Stephen Gray's great discovery, Conductors non Conductors Du Fay – Vitreous, resinous Elect.y These imperceptible Effluvia were found by Positive and negative –

+ Discovery of the Leyden jar. Exp.t a friend took a spark of him in it, gave Mr D– a stronger shock than he intended –

– Next great discovery, and the great Mr Franklin's, is the identity of Electricity and Lightning by Franklin – Eloge on Franklin. –

× Ancients thought Amber and the Loadstone were Animated

Exp.ts on this subject

– Attraction and repulsion as much – Negative and positive – by dashing wax &c –

– Electricity of the outside Reg: and first Exp: two Cylinders of tin foil supported, one on the conductor the other on the outside, attract each other, when both on the same support they repel each other –

– Three small conductors placed in a line with intervals of air between each, every conductor furnished with three pair of pith balls, one pair on the middle and one at each end. The conductor next to the prime conductor is placed at about a foot from distant from it –

– When the machine is turned

— The pith ball on the end of the first small conductor next to the prime conductor diverge with ~~fear~~ negative Elect.y those on the opposite end of the same conductor diverge with positive El — while the middle point is neutral. The same fact take place, and in the same order there the other two small conductors.

— Davy applied this experiment to the explanation of the phenomena of the Leyden jar —

— A person insulated — sparks Electricity drawn from the earth. —

— Heating of dissimilar in Galvanism — Davy &c on same —

— Galvani's theory — Animal Elect.y — Volta's theory — The Electric matter produced by the metals.

Expt. Two plates, copper and zinc brought into contact on both electrified, the zinc positive the copper negative — This was discovered by Volta by means of his condensing Electrometer. Expt did not succeed well with Mr — who used Cuthbertson's small condensing plates attached to the Gold leaf Electrometer. —

— Voltaic apparatus — Pile — Trough — Wedgwood's porcelain troughs — Expt. with 1000 pairs charcoal ~~lead~~ zinc — metals in wires and foil —

— Mr Davy promises to exhibit the whole battery of 2000 series at the conclusion of the course

+ Oil in a bent glass tube was decomposed by Common Elect.ʸ from the prime conductor

— Also ~~Gate~~ Voltaic Elect.ʸ this Gas in the copper part of a glass tube was converted into

Saturday 19ᵗʰ May.

Lect. 9ᵗʰ Chem: Philosophy

Decomposition of Neutral Salts Alkalies and earths, by Electricity, with Experimental illustrations and historical details —

+ For the particulars of this lecture see Mr Davy's Bakerian Lectures — Parkinson's and Murray's compends ~~&c~~

— Mr Davy gave a short and neat history of discoveries by the Voltaic machine —

Experiments were exhibited to prove all the new discovered properties and effects of Voltaic Electricity

— In the Exp.ᵗ Two insulating Stands with a plate of platina

on each were used. The wire from the large battery was connected by the universal Discharger. —

— In decomposing Potash & Soda by a small battery was used on one of the platina plates connected with the negative plate of the Battery while the positive wire was brought in to contact with the upper surface of the small limpid a violent action takes place particularly at the junction, and small globules having the appearance of mercury separate at the under or negative side. These either explode or are soon covered with a crust of pot ash, by attracting oxygen from the atmosphere. This metal is best preserved in Naptha thoroughly distilled. —

— Potassium decomposes carbonic acid in a glass retort. —

— Sulphat of Soda decomposed, the acid and alkali shewn by test paper —

— Borgstein made of decomposing boden by amalgamation with mercury — Mr Davy's improvement of this method. —

— Effect of Potassium on steam or water

— Silver and zinc in dilute sulphuric acid the zinc only is acted but being them in contact, and the silver is also acidated.

Mr Davy remarked that the many facts seemed to prove that chemical affinity was the result of Electrical agency, yet it was too soon to attempt a explanation at this moment a satisfactory Theory of Chemical Phenomena

+ A little liquid sulphat of Potash in both platina cups or plates which were connected by asbestus, after a few minutes, the cup connected with the negative end of the battery was found to contain a solution of potash, the other dilute sulphuric acid.

+ With water in the positive and sulphat of soda in the negative — result the positive Sulphuric acid, the negative, soda

In the joint of these experiments, the acid and alkali move in contrary directions, passing each other in contrary directions, along the moistened Asbestus, a Amianthus.

+ Take three cups in the 1st sulphat of potash-negative. In the middle, 2nd — In the 3 water-Positive In about 5 minutes (15 grains of Sulph.) acid was found collecting round the wire in the water; it had therefore passed thro' the ammonia without being arrested by its strong affinity to that substance.

+ When the disposition was reversed Pot. positive, water negative and an acid in the middle; the alkali was conveyed thro' the acid and collected in the distilled water.

It is very remarkable that in their transfer, the acids and alkalies lose their effects & contrast powers connected with the electricity, exerting their influence only at the positive and negative wire. —

— M. Davy in their investigations in the Laboratory, made use of cups of Gold, platina, Agate, also sulphat of Lime and the compound bases. and always found the acid in the cup connected with the positive end and the alkaline earth, in the cup connected with the negative side of the battery. —

Saturday 26 May 1810

Ch. Philosophy Lect 10

Decomposition of Airs by voltaic Elect^y, and by Ch. process. Decomposition of Boracic acid. Decomposition of fluoric acid. Metallization of Ammonia. General View concerning the nature of bodies and concerning elementary matter.

In this Lecture M. D. decomposed the boracic and fluoric acid by potassium in a small retort as last year - the residue was a yellowish brown matter.

–Ammonia with Mercury amalgam. Now the basis of ammonia amalgamates with mercury it is therefore a metal – Only the $\frac{1}{12000}$ part of the mercury!! Whence is this metallic substance derived? a very difficult subject – application to Geology –

Dr. Maskelyne's observations and Mr. Cavendish's experiments show that the mean density of the earth is double that of the bodies on its surface – It is probable that the interior parts are composed of metals which on exposure to the air or water become oxidated Hence perhaps the origin of volcanoes and earthquakes –

– Meteoric stones may be metals which become oxide in the atmosphere.

– Cast iron converted into wrought by heating the mass in charcoal, and hammering it. A matter flies off which is

– Mr. D– offers these opinions merely as conjectures – The science is too young for a complete theory.

Should be 11

Chemical Phil" Lect: 12

- Exhibition of the power of the whole Voltaic Apparatus consisting of 2000 plates

Experiments of recent and Analysis with this combination which has not before been put into action

Conclusion of the course

W. D- commenced by informing us that as he intended at this lecture to exhibit experiments with the whole Voltaic battery of 2000 plates, it was unnecessary to make use of any previous explanations. —

He first tried the power of 500 on two pieces of charcoal on the universal discharger, and after that

burned a platoon fires. —

2 — The same Expt with 1000 on the whole of the old plates The effect to all appearance was about double of that of the former. —

3 500 new plates simultaneously equal to the 1000 old plates

4. 1000 new plates double not well, some defect in the connection. The whole was then just in action. It did not do W.D — went into the trough several times, the Batteries gun became too powerful for the Audience, several left the room when at length Mr Davy was advised to adjourn the Lecture till Saturday next. —

Saturday 9th June 1810. —

Mr Davy exhibited Deflon the grand Voltaic apparatus which was placed below and conducting wires passed up thro the floor into the Lecture room. The Experiments were performed with the whole battery of 2000 plates and all succeeded — ...

— Fire is the great Instrument for converting Solids into fluids and fluids into elastic fluids — some bodies have hitherto resisted the action of the strongest heat that has been excited —

— Experiments —

— Charcoal burned at two inches distance

— Platina, Iridium, Osmium, Rhodium, Zircon, Silex, Alumine &c were all melted by the battery,

with the addition, in some of the
instances, of a Steam of Oxygen
Gas. Alumine boiled and then
crop'd out the best crystals, some
of the others did the same. —
— To ascertain which the metals are simple
bodies several were burned in va-
cuo, Gold, silver &c, and some dark
Steel was certainly produced two
instance.
— An attempt to melt charcoal, d
not succeed. Mr D, however in-
tends to repeat the experiments i
private
— Mercury, in the barometer tube,
was acted on for some time wit
any change
— Plumbago suffers some change,
could not be found
Mr D. performed three experiments o
— Charcoal and plumbago with a
to Draw light on the diamond
if the Carbon could be found, it m
probably chrystallize in cooling
and form some kind of diamond.
— Substances acted on in these
experiments were put into small
cavities in a thick piece of Charcoal
fixed on the conductor discharged
with three brilliant experiments
Mr Davy concluded his lecture for
the season.

London 19th Jan.y 1811

Saturday 19th Jan.y at 2 o'Clk

M. Davy

Chemical Philosophy – Lect. I –

Introductory. Objects of this course of Lectures. Of the powers and arrangements of Matter. New views on the Chemical agents; their arrangements in Nature; their uses in art. On the combinations of substances, and of the proportions in which they combine. Reasons why this branch of knowledge ought to be cultivated, promoted and encouraged. –

– Study of Chemistry needs no recommendation –

– ~~Objects~~ Objects of Chemistry have been lately much enlarged. It is about three years since the Alkalies were decomposed, and

new metals were discovered
The French Chemists maintained that these metals were compounds, Hydrats. About 5 month ago they retracted their opinion and allowed that they are simple bodies.

— Some bodies unite, and as it were, absorb each other. Exp. Sugar, or salt in water, alkalies in acids, metals in acids. The power by which this is effected is called attraction. This attraction is very different in different bodies. The French Chemists say that it is affected by the mass or quantity of matter — Mr. D— said he adopted this opinion, but he now thinks it unfounded — were this doctrine true, the Atmosphere & the sea would swallow up every thing.

Atomic Philosophy first taught in Greece by Moschus before the Trojan War; but was first reduced to system & taught by Epicurus. —

An attempt has been made lately by a very ingenious Philosopher to revive it. I shall have occasion to consider this and object to the doctrine. We know nothing of the form or magnitude of the original particles of matter.

Different bodies — metals the principal —

Supporters of combustion.

Saturday 26th Oct. 1811

Chem: 1st Phil: 2d Lect: M. Davy

Of attraction and its laws, illustrated by 4 Lectures. Views of the French School of Chemistry combated. Attractive powers as well as combinations specific. Of the connections of Magnetic, Electrical and Chemical attraction

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One of the most important Phenomena in Nature is attraction - A Stone falls to the ground - water descends in the Atmosphere - The planets are all attracted by the sun. These phenomena are said to be owing to the attraction of Gravitation.

— Attraction also takes pl
between the minute particl
of matter and at insens
distances from each other.
In this case, when the bod
are homogeneous it is
called attraction of Cohesi
when the bodies are hetero
geneous it is called Che
mical attraction. —

Exp. Two pieces of smo
marble adhere to each oth
so as to require a considera
force to separate them. This
is an instance of the Att. of
Cohesion, or adhesion as it is
sometimes called. This exp.
succeeds equally well in va
cuo, therefore the presence of
the atmosphere is not nec

between the heterogeneous.

— Exp. Illustrations of Chemi
cal attraction —

— 1st Fact is that when two bodies
are united by Chem. attraction
their properties are changed.
The product possesses properties
very different from either of
the component parts E.G. Acid
and Alkali = Neutral Salt. —
— Oil and water mix
but soon separate — Acid
solution of Pot ash + form
Soap. Mordants in dyeing

— 2. Same bodies always unite
in one fixed proportion.

Exp. Nitrous Gas and Oxy
gen Gas form Nitric Acid
the proportion is Oxygen
2 Nit. Gas 1.

Eg: Muriatic and gas or Ammoniacal Gas form a solid, or muriate of Ammonia. The proportion is Muriatic gas 1 Amm gas 1.

The Earlier Chemists were of opinion that no action took place between two bodies unless one of them at least was fluid "Corpora non agunt nisi fluida". This is generally tho' not universally true. E.g. Muriate of lime and soda, two solids act very powerfully on each other. best freezing mixture. Amalgam of Mercury or lead, and an amalgam of mercury and bismuth rubbed together in a mortar become fluid.

Part. The attractive powers in different bodies. E.G. if two bodies attract each other with a force sufficient to cause them unite, and a third body be presented to the two which has a more powerful attraction to one of them than the two have for each other, the two will separate, and the third body will unite with that for which it has the most powerful attr and form a new compound. On this principle Tables of Elective Attr or Affinity are called were first formed by Geoffroi in 1719. Newton first gave elements the principle of attr to account for Chemical Phenomena.

Berthollet has lately offered

a new view of this subject
He says Chemical attn is considerably affected by the mass that is, the third body in the experiment mentioned above may, in a certain proportion not be able to decompose the other two, yet if it be added in larger quantity, it will separate part of one of the others. Expt boil together Sulphat of Baryte and Pot ash, a quantity of Sulphat of pot ash will be produced. Had the pot ash in this Expt been pure, Mr D. says it would be conclusive in favour of Bertholets opinion; but he made use of Carbonate of Potash, and forgot that he himself first showed that pot ash was after heated ~~red~~ red hot, retains a quantity of water. —

Mr D. thinks that if Bertholets opinion were true, there would be no certainty or dependance on Chemical operations. —

In the experiment of mixing Nitrous and oxygen gas to form Nitric acid, the Oxygen and Nitrogen are Chemically combined, but in in forming Atmospheric air, they are only Mechanically united.

—Mr D. showed a new gas the name of which I could not hear. It serves to ascertain the quantity of moisture—water—in Atmospheric air—it is a very delicate ~~[illegible]~~ Hygrometer—(Fluoroboracic acid)

—Mr D. concluded the Lecture with just mentioning, Electric and Magnetic attraction. —

+ combination of three, four or more bodies may take place most remote from their mutual ingredients. —

— Double Elective attraction — Quiescent — Divelt powers, Mr. D thinks a very superior mode of expressing this subject — he does not know what the strength of the attractions are, how they can they be expressed by numbers. Mr. D — attempts to illustrate the subject by two persons, one with money in the funds wants to purchase an estate, the other has an estate to dispose of — this illustration did not appear very apropos. —

Royal Institution 2 Feb^{y} 1811

Chemical Philosophy Lect 3.

Of the powers opposed to attraction and first of heat. Thermometer. Excitation and communication of heat. New & permanent. Economical application. Equable expansion of Gases. Laws of their combinations. Operation of heat in Nature and Art.

When we consider the Element of fire in its empire and acts in its great activity to man and other animals, we need not be surprized that it was by some nations made the object of religious worship

The term heat is familiar

to every person. It has, how-
two significations, a sensa-
and the cause of that sensa-
It was to remove a sup-
posed ambiguity arising f-
this that the French Chemi-
introduced into their New
Nomenclature, the word Ca-
loric to signify the cause o-
the sensation of heat. This
appears to be quite unnecessa-
What man ever mistook the
sensation for the burning
coal which produces that sen-
sation? Who ever supposed
that iron was melted by a
sensation?. The use we h-
have, in the technical
terms of a science, from
common language, the nec-
essity will that science be
learned and the less ambi-
guity will there be in its
terms. Caloric is a theore-
tical term and consequent-
ly must be ever liable to
change. The French Nomen-
clature of 1780 will not ap-
ply, in several instances to
the present state of Chemistry
E.G. Oxygenous acid
was then supposed to con-
tain a great quantity of
Oxygen. It is now found not
to contain a single particle.
The French Calendar
was adapted only for France
Piemont, Savoy &c. —
not apply to India or
the Torrid Zone. —

— Heat effects an equal enlarge
+ Heat enlarges the dimensions of all bodies, and in this way it appears also
— Pyrometer shewn but not fitted for action — hedgewood Pyrometer ditto. The contrivance of the stay in the last instrument no exception to the general rule, water effected M. D— mentioned an Expt. with Magnesia as a proof of this, which I could not understand.

— Expansion of fluids shewn by Experiments with fluids in glass tubes as usual

— History and construction of all the different kinds of thermometers

— Common Fahrenheit air thermometer gave the hint to Leslie who greatly improved it in his Photometer or differential Therm.— This shewn — Rittenhouse first discovered the boiling and freezing points are fixed. — This contrivance for shewing the greatest and least heights of the Therm. during the night. Fluids for thermometers air, water, oils, Ether Alkohol, mercury. The last is upon the whole, the best.

Equal quantities of heat produce equal expansions in the thermometer — Expt. described any quantity of water at 100 mixed with an equal quantity at 50. The Therm. will shew

the Arithmetical mean between them 75. But this will not be the case if the fluids are of different kinds E. G. If a quantity of quicksilver at 150 be mixed with the same quantity of water at 100 the therm. will indicate not 125 the Arith.l mean but 120, so that the quicksilver has lost 30 and the water has gained only 20. Hence a larger quantity of heat is required to raise water through any given number of degrees of the scale, than quicksilver through the same. Water is therefore said to have a greater capacity for heat than quicksilver.

and in the proportion of 3 to 2. This last example is taken from Dr. Henry and differs from the proportion by other chemists who make it about 3. to 1.

— Solid, fluid, vapour. A change from the first to the second, and second to the third is always attended with absorption of heat — Latent heat. A change in the contrary order gives out heat This subject was illustrated in the usual manner.

— Mercury was frozen by Mixture of Lime and Snow — water was attempted to be frozen by Ether and

Experiment, but it did not succeed. As this experiment was attempted in the opposite side of the room, I could neither see nor hear.—

– Boiling described – Action shewn by putting some coloured water over clear water in a tube – The experiment failed by the breaking of the tube. Pease or barley in a pot shews this very well. –

— Power of bodies in conducting heat very different. Exp. described – Glass and metal rods – Metals the best conductors & differ in metals. Ascertained by covering rods of different metals and of the same dimensions, partly with wax and exposing the

(uncoated end.) to the same degree of heat – time of melting will be inversely as the conducting power –

– Exp. a piece of paper wrapt round a piece of metal will not be burned. Hartley's fire plates to secure houses from being burned.

– The hand bears about 140° in iron. 170 in water and above the boiling point

– Dr. Fordyce's Experiments in a heated room.–

– Conducting power of color. Hair, wool fur &c. —

Man as well as other animals preserves the same temperature in all climates

— Animal heat is supposed to be derived from the oxygen Gas of the atmosphere taken into the lungs in breathing — Some late Exp.ts of M.r Brodie seem to support this theory

— see Philosophical Trans.: