

Vol. 10

Accompanying  
Illustrations

1810

London 12 Jan 1810

This Even<sup>g</sup>: Mr Singer began  
his lectures for the season

— Upon 3 courses of 14 Lect<sup>rs</sup>  
each.

— First course consists of  
States, Pyrostatics, Pyroaerics,  
Pneumatics, Optics, Natural  
Chemistry, and Mineralogy.

— Second course

Electricity

— Third course Electro Ch<sup>em</sup>istry

For all 42 Lect<sup>rs</sup>: sub<sup>scr</sup>

to whole 2 Guineas

to one hour 1 Guineas

to single lectures 2/6

Lect<sup>rs</sup> on Sundays & Free 4/4.

Scientific Inst. 12 Dec. 1811  
Introductory Lecture Importance  
of the subject and best mode  
to be followed both by the lecturer  
and the student. This oc-  
cupied three quarters of the  
Lecture. The subject and man-  
ner well interesting. —  
We then considered the prop-  
erty of matter — Extension, Divis-  
ibility — Infinite Divisibility,  
Mathematical Demons<sup>tration</sup> of  
Solidity. — inertia. Glass of  
water drawn on a brass car-  
riage with three wheels to show  
the tendency of a body to con-  
tinue in its present state —  
better shown by the motion  
of a basin of water by the  
hand on the table.

The Double fly wheel in the Re-  
of the air pumps, was set again  
on the table to show the effect  
of resistance to motion — Another  
Experiment to the same purpose  
Different weights made to Descend  
by turning a wheel and axle  
having weights inversely pro-  
portional to the Diam<sup>eters</sup>, all  
these were intended to show that  
friction and the resistance of the  
air being the motion of all  
bodies to an end. Hence it  
is deduced that a body in mo-  
tion would move for ever if every  
obstacle was removed.

<sup>th</sup>  
M. Singer's 13<sup>th</sup> Lecture 1810  
Friday 23 Feb. - 1810

- Chemical properties of air
- Differences between Mechanical and Chemical properties -
- That an animal without a supply of fresh air will die in an old atmosphere - Light extinguished -
- History of the Chemical discovery regarding atmospheric air - Boyle, Mayo, Rømer, Priestley, Cavendish, Lavoisier &c.
- Atmospheric air composed of two different gases, Oxygen and Azote - Former supports life and flame the latter extinguishes both
- Experiments with a lamp - In Az. Gas extinguished, in Oxygen Gas lighted in a mixture of 80: and 20: in the proportion of about four Az: to 1 O<sub>2</sub>:  
Ours as in Atmospheric air

Eudiometry - Tube with foot drawn  
into cubic inches - Experiment with  
with Nitrous gas - A retort with  
a long neck divided into cubic  
inches - held perpendicular in  
the system of water, the surface of  
which was at a certain degree  
on the neck. A small bit of  
Phosphorus put into the body  
in upper part of the retort,  
and set on fire by a candle  
held below - The diminution of  
the air in the retort was shown  
by the divisions on the neck  
This N.S. thinks the best mode  
of ascertaining the quantity of at-  
mospheric air. Davy's Eudiometer  
Atmospheric Air is found to con-  
tain at all times, and in all  
situations nearly the same quantity  
of oxygen gas - Insatubility of  
atmospheric air in some places  
very, N.S. supposes, to a quantity

of Carbonic acid Gas, which has been  
found sometimes to the amount of 5  
I think - He thinks <sup>this</sup> cause has not  
been noticed before by Philosophers.

- Origin has from a Gas holder  
sent up the inner tube of a piston  
pump, did not produce any remarkable  
effect, nor when blown on the flame  
of a candle. -

- In this lecture N.S. explained the  
action of the lungs - Lungs of glass. -  
Effect of breathing - Heat - red colour  
of the blood.

+ J. Priestley, said N.S. invented  
many useful experiments, but  
he adapted those experiments to  
a preconceived theory instead of  
deducing his theory from the experi-  
ments. - Mr. Singer broke  
a large air pump receiver by  
burning phosphorus in Oxygen Gas.  
The same last year.

Tuesday 27<sup>th</sup> Feb<sup>r</sup> 1816  
M. Singer's 14<sup>th</sup> Last Lecture  
of his 1<sup>st</sup> Course. —

- Short recapitulation of the former Lectures - Respiration
- Animal heat, in proportion to the size of the lungs
- Table of animals - hot and cold blooded - Quadrupeds, Birds down to frogs, worms
- Lungs - Gills - small holes in different parts of the body for breathing.
- Caloric - expands bodies not by its repulsion, but by its attractive power
- Conductors of heat very different - Exp. a brass wire and glass rod of the same thickness with each a piece of sealing

- in one end of both were held  
 over the sand lamp at about  
 an inch from the wax. That on the  
 side melted much sooner than the  
 other - Request colored clothes  
 - Animals of cold countries, wool  
 fine &c.  
 - M. S. condenses the steam  
 from made of heating rooms  
 by grate - Says that near  
 we sit to the fire the colder we  
 are  
 - Different modes of heating room  
 Steam does not answer - best  
 flues with hot air below the floor  
 - Hydrogen and Oxygen form water  
 Decomposition shown afterwards  
 Composition - Inflame air blow  
 from a bladder through a  
 small pipe set on fire and  
 burned under a receiver placed  
 in water vessel - Explosion of  
 a mixture of Oxygen and Hydrogen

- water decomposed by vegetable  
 exposed to the light of the sun  
 The Hydrogen enters the plant  
 and the oxygen is set free.  
 - A quart of oxygen of the atmosphere  
 by the breathing of one man and  
 the burning of one candle -  
 Atmospheric renewed principally  
 by the vegetable things decom-  
 posed by the air.  
 - Oxygen not destroyed, but only  
 changed its state - No body ani-  
 hilated. When deprived of its ca-  
 loric, oxygen is reduced to its solid  
 state.  
 - Springs caused not by capillary  
 attraction of water from the sea,  
 this could not take place to such  
 a distance as the sources of the  
 Nile and other great rivers  
 - Springs owing to the great quan-  
 tity of rain that falls on mountains  
 - Intermitting Springs have been

explained by Ferguson and others by supposing a sypho-  
like passage to the water from  
the cavity or reservoir -

Dalton's account is that when the  
cavity has a chalky bottom  
it fills and runs over - When  
a sandy or gritty bottom  
the water will seep through &  
and the stream be constant.

Why then more rain in a  
mountainous ~~see~~ than in a  
plaine country.

Myromentis - was over sign  
of rain - poultry, cats washing  
behind her ears &c -

Marble floors in the lower  
parts of houses moist.

First Hygrometer a cord over  
a pulley by W. Boyle - raised a  
weight of  $\frac{1}{2}$  pounds -

Around of the water out, several  
other vegetable substances

- Shale bone, Myromentis hair -  
Sponge or many <sup>pieces</sup> of paper  
on a balance -

- Glass of cold water from a  
well when brought into a  
warm room condenses the water  
on out side of the glass

Mr. Dalton recommends this  
as the best Hygrometer for  
indicating rain. If the Differ-  
ence between the temperature of the  
cold water <sup>and the air</sup> be only a Degree or  
two then rain may be soon ex-  
pected; but if ten degrees, then  
it cannot rain that day. In  
winter the water must be cooled  
artificially to occasion moisture  
on the outside of the glass.

This Hygrometer exhibits the  
real fact - real rain is occasioned  
in the same manner by conden-  
sation, as the outside of the glass.



- Mineral water -
- Exp<sup>ts</sup> com<sup>on</sup> Salt in water  
by Petrol of Silver -
- Iron by precipitate of Alkali
- Copper by Ammonia -

At the conclusion of the  
lectures M. S. read from  
the comb<sup>o</sup> the advantages of living  
in a Garret - high salubrity  
& there was, I think, ill done

Tuesday 6 March 1840 -  
1 Lecture of M. S. in 2  
courses - Electricity -  
M. S. has printed outlines  
to every lecture -

Introductory - Nature of Electro-  
cal Science - Its utility and im-  
portance - Sources derived from  
its cultivation - Plan of the present  
lectures - Sketch of the early stages  
of Electrical discovery, with experi-  
mental illustrations - Invention  
and subsequent improvement of  
Electrical machines -

History - Amber by Thales - Lin-  
næus by Theophrastus -  
Gilbert in 1600 his treatise of  
the Magnet - Discovered a  
number of Electricities - Tried their  
effects with a small brass needle  
balanced on a point, like a mag-

netic needle, having two small  
circular pieces of paper at the  
extremities - This attracted by excited  
amber, sealing wax, glass tube  
resin and c. - Other circum-  
stances mentioned see T. P. Waller's  
History

- Boyle - Dry objects more attracted  
moisture & conductors &c. -

- Otto Guericke's experiments with  
Mr. Boyle's - first Electrical  
machines, globe of sulphur.

- MacKubin's Expts. and book

- Gray's discovery of the Elec.  
division of bodies into conductors &  
non conductors &c. &c. -

- Newton's Experiments with the  
glass plate -

- Du Fay's discoveries - Neg-  
ative and positive Elec. &c. - Some  
Expts. - papers given in to the  
Royal Academy of Sciences -

- Improvement of Elect. machines  
- Glass globe with one neck placed  
horizontally - when filled with  
atmospheric air, the Elect. Light  
is on the out side, when exhausted  
on the inside. -

- Cylinder Machines - Nairne's  
Improvement. -

- Plate Machines by Ingenhousz  
not approved at first - Improved  
by Cuthbertson -

- M<sup>r</sup>. Cuthbertson and Singer are  
now engaged in a series of Experi-  
ments to ascertain the comparative  
power of the cylinder and plate  
machines. Nothing conclusive has  
yet taken place - The two seem  
to be exactly the same power  
when put in action in the  
vacuum room. Plate is mounted  
so as not to produce negative St.  
This a great disadvantage.

## Experiments

1. Amber rubbed on the arm attracts small slips of paper
2. Stick of sealing wax ditto
3. Glass tube - ditto
4. Ditto and feather - same size to the tube
5. Newtons Expt. Glass supports at the two ends on two books about an inch from the table small bits of paper below.
6. A quarter of a sheet of writing paper, first warmed and then rubbed strongly with a bit of Louis green, attracts the salt on which it was rubbed strongly and adheres to the wall of the room - laid on the upper <sup>metal</sup> plate of the Electrophorus, a spark may be taken from the other or under side of the metal - insulated

7. A piece of Brown paper well (waxed and) folded to about 2 or 3 inches in breadth, if thin be rubbed hard between the arm and tube it gives sparks of electricity. (The only number).

8. When the small globe machine was rubbed by a piece of Silk with smaltum on it, held in the hand behind the globe, coils of Electricity appeared on the outside - when the globe was surrounded of air, then no coils on the outside, but the light appeared in the inside.

9. The Glass tube first attracts a feather, then repels it.

W. S. does not admit of Electricity repulsion. He thinks that in this experiment, the feather is attracted by the air -

10. When a glass tube with a cork in its <sup>open end</sup> is cauled, the cork attracts light bodies as well as the tube — The same thing takes place at the end of a long wire stuck into the cork

n.b. These <sup>two</sup> were the first of a long series of Experiments by Mr Gray which ended in the discovery of conductors and non conductors of Electricity. —

11. A rap heap with threads tied to it, placed with the globe machine ~~with~~ it. on working the machine the threads attracted towards the centre of the globe. —

Friday 9<sup>th</sup> March 1810

Songin 2 Lect: Electricity  
~~Resapitulation of part of~~  
- Execution of Electricity  
considered — Circumstances of  
essential to this phenomenon —  
appearances by which it is  
attended — Best means of pro-  
ducing them — Management  
of the Apparatus — Causes of  
Electric appearances, and Nature  
of Electric action, illustrated by  
numerous experiments

Resapitulation of part of last  
Lecture — De la Rive's Discoveries  
Vitium and various Elec.

Gray on conductors and noncon-  
ductors —

+ F. Franklin's Hypothesis —

- Capacities of bodies -  
Sugar on hot, and cold water  
Sulphuric acid and water &c.
- Electrical capacities - When  
one body contains more and  
another less, the two are brought  
into contact and quantity of Elec  
is given out when separated -
- Positive and negative Electricity,  
always produced at the same  
time - Expt. a bit of fur on  
cat skin fold covered a rod of  
glass and rubbed with a stick  
of sealing wax, the wax is found  
to be negative and the skin posi-  
tive - Expt. made with the  
glass tube, the tube is pos-  
itive and the skin negative
- This was shown by two feathers  
suspended by silk threads from  
the extremities of a glass rod sup-  
ported horizontally on an insulat-  
ed block of glass.

- It was long the opinion that  
the Electricity was produced from  
the cylinders, that no conductors  
have no electricity - It appears  
however, says M. S. that conductors  
have all the Electricity, and non  
conductors possess no Electricity
- Excitation on the Galvani  
Machine - The simple con-  
tact of the unarranged  
rubber with the cylinder produ-  
ces Electricity along the line of  
contact, when by the turning  
of the cylinder this line is  
removed the Elec<sup>n</sup> becomes sen-  
sible, this is followed by another  
&c till the accumulation be-  
comes great.
- Arrangement, M. S. thinks best -  
None on the best - None laid on  
- after applied, a little tallow or  
oil on the hand applied to the  
cylinder, will greatly reduce the Elec<sup>n</sup>

- A new theory of Electricity,  
has been published, which  
asserts that there are two  
electricities, one composed of  
Caloric and Oxygen Gas, the  
other of Caloric and Nitrogen  
The former produces positive  
the latter negative Electricity  
This Hypothesis is overturned  
by Mr. Davy's Experiments  
- In oxygen Gas the Electrical  
Machine acted scarcely better  
than in Atmospheric air  
in Carbonic acid Gas, the  
machine acted much more  
promptly than in Oxygen Gas  
or Atmospheric Air - Carb:  
acid Gas contains no azote. -

- Attractions alone will account  
for Electric phenomena  
- Withinoni's figure for Daniell's  
his own - Negative, not satisfactory  
- Volta's, & his own Explanations  
not satisfactory -  
- Comparative advantage  
of a wheel

Tuesday 13<sup>th</sup> March 1810  
3 Lect. Electricity

— General consideration of  
Electric phenomena —  
Incontestable proofs of the  
Compound nature of Electricity —  
Emission of Electric light,  
and its varieties of appearance  
— Electric illuminations, com-  
prising a very brilliant series  
of illustrations.

Negative and positive  
Electricity — Effects of sealing  
wax and small spark glass  
Small brass conductor  
with two pith balls hanging  
from one end — sealing wax  
brought near one end, the  
balls diverge at the other

The former end is positive, the  
batter <sup>negative</sup> positive. While the wax  
remains the positive side the  
battery, though the conductor with  
the finger and the battery will  
collapse, remove the finger and  
wax at the same instant by  
the battery will again diverge. —  
Two, and three small conductors  
were made use of in these experi-  
ments, the wax of a length  
about 14 or 15 inches long and  
an inch in diameter, with balls  
on the ends.

Induced Electricity!

M. J. showed at the com-  
mencement of the lecture, the  
figure on the board for his  
demonstrations that attraction  
will account for the divergence  
of balls negatively electrified

M. J. says that there  
is no use for repetition in  
any part of Nature —





# Experiments -

1. New - footed measuring.
2. An three downy feathers -  
- in the darkness
3. Points positive, and nega-  
tive - Star - pencil -
4. From the positive ball to the  
negative - to ascertain the  
direction of the electric fluid
5. Short open glass tube, blue glass
6. Tube longer white glass.
7. Tube, white and green tinges  
Diamond and Emerald
8. Tube - Diamond and Ruby
9. Spangled 3 feet long, all  
the whole length.
10. Gale way
11. Ornament for the corners of  
a room

12. Light, acted well.
13. Singer - this acted badly
14. Spirit round a large eye -  
Lindens jar - was too long  
the whole did not act.
- 15 - <sup>15</sup>Platinum - Glass plate  
The tube diameter - on this  
a brass hoop was supported by  
three glass feet, at about  $2\frac{1}{2}$  inches  
above the plate - on this <sup>plate</sup>  
ball of glass 2 to 3 inch <sup>in</sup>  
rolled round ~~within~~ the brass  
hoop which hoop was connected  
with the conductor of the machine

- In the course of the Lecture  
Mr. S. mentioned an opinion  
of a Mr. that some  
bodies might conduct the positive

Electricity and intercept the re-  
gative, and vice versa. ~~It has~~  
The one Electricity might pass  
through the other! —

+ To prove that Electricity  
is material

16. A little sealing wax  
was struck on a wire in-  
serted in the condenser. The  
wax was blown in very fine  
threads, on a paper held  
at more than a foot distance  
from the wax.

17. Pouchet and capillary tubes  
in the bottom, shewn by  
drops in the inside

N.B. The Experiments noted  
above are not always in the  
order in which they were per-  
formed

Friday 14<sup>th</sup> March 1910.

Act: 4 - Electricity M. S. J. G.  
Consideration of the Electric  
spark and its Diversities;  
Sound, Direction, Form and Light.  
- Influence of different surfaces  
and shapes, on the spark -  
action of balls and points -  
Theory of Electric light - Effects  
of the spark on various sub-  
stances

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Expt.

1. Jet of water from a small fountain Electrified
2. Taper placed between two balls  
the one on the negative, the other  
on the positive conductor. The  
flame seemed to incline most  
to the negative conductor. The

ball connected with the 2000-  
line conductor grew hot the  
other remained cold - This shown  
by a piece of wax put on each  
each. - In this Experiment the  
paper was always placed near  
the negative ball - It ought to  
have been in the middle. -

- Effect of different sized balls in  
taking sparks

- Zig zag form. Length regulated  
by the size of the ball - The  
largest ball about 5 inches &  
other down to a point

- A large brass and a still larger  
tin foil conductor. The former on  
a glass support, the latter sus-  
pended from the ceiling by silk  
cords - A great many sparks  
taken from them in different  
ways

- Points throw off by draw off  
the electric matter at 2 greater  
distance than round or flat  
surfaces.

- Exp balls assuming sparks from  
the conductor, a point at a greater  
distance presents the sparks

- Points take in proportion  
to their length - Richard's Expe-  
the points carried off much  
less than one projecting  
much farther from the body on  
which they were placed.

- Voltaic 5 Inch ball and point  
were grasping through it - sparks  
taken with the point projecting  
to different distances from the  
surface of the surface of the ball

+ Spark taken with a point  
within a glass tube, strong  
and the sound loud as on a ball.

also zig zag form  
+ Point on a spindle like the same.

+ Ferguson's five paper models  
all acted very well. —

— M. S. says that it is com-  
monly said that the air in  
contact with the conductor is  
in a contrary state to that of the  
conductor, but he maintains  
that they are in the same state.  
His theory of points is this.

The conductor is surrounded  
by atmospheric air electrified in  
the same state as the conductor.  
The air being a bad conductor  
of heat prevents the electricity  
of the conductor from escaping.  
When a pointed wire is at-  
tached to the conductor it pro-  
jects beyond that part of the  
electrified atmosphere next the  
conductor into a more distant  
part less electrified, the air in the  
first attracts the electricity from

the point, and consequently from  
the conductor in a constant  
stream.

— M. S. takes the comparison that  
has been made between points  
and tubes. It is true the action  
is similar, but very differently  
modified. In tubes the longer the  
diameter, more water is dischar-  
ged; the reverse is the case with  
electrified points. Also the longer  
the tube, less water is discharged  
which is not the case in electricity.  
+ Hence I think the compari-  
son improper, as it does not  
hold in the principal result,  
the quantity of matter discharged.

Tuesday 20<sup>th</sup> March 1810

Electricity Lect: 5 - Singer

- History of the discovery of the Leyden Jar - Experimental Demonstration of its effects - Theory of its action - Cause of the vast accumulation of power in the Leyden Jar. Accordance of its phenomena with other electric appearances. -

- Von Kleist was the inventor of the Electric Charge - He used a glass phial with a wire in it - Muschenbroek repeated the experiment with water in the phial, and received a strong shock. great surprise &c &c

- Improvements of Dr. Watson and Dr. Bevis. The former used an outside coating of sheet lead and that for the inside. The latter

coated both inside and out  
with gold, silver, lead or tin foil  
- Charge - Elect. attracted by  
conductors <sup>from the insulator</sup> - Glass has ~~no~~ more  
Electricity than charged than  
when in its natural state.

+ The act of charging may be explained  
thus. The glass attracts the Elect.  
from the conductor on one side  
and part of its natural share of  
Electricity is attracted from the  
the other side by conducting  
bodies.

- Two plates of wood covered with  
Zinifer, both insulated, if the  
under one be electrified by  
a spark from a charged jar  
the plates both connected with  
it will diverge. If now the other  
plate held by its insulating  
handle, be brought near, but not  
in contact with the under plate  
the plates both converge, and so

the plates and they diverge. This  
was explained by saying that  
two metallic plates when brought  
near each other have a greater  
capacity for Electricity than when  
separate -

- All the Electric jars were  
cylinders, equally wide throughout.  
jar charged, spontaneous discharge  
by two turns of the wheel.

{ Discharge by the discharging rod  
- One jar charged at the out side  
of another - Different Discharges

- Some affirm that in charging  
the electric matter penetrates the  
glass - This Mr. S. says is absurd.

- His explanation of the great  
accumulation of the Electricity  
in the Leyden jar, I think not  
satisfactory.

- Passage of the Electric light  
shown by a charged jar -  
by the Aurora borealis flash,  
and the luminous conductors,  
presented both to the positive  
and negative conductor of the  
machine. -

- Electrometers - quadrant Elec.  
small and very large jar same  
to 45° - the discharges. very  
different. -

Friday 20 March 1810

- Elec. L. 6" M. L. L. L.  
- Further consideration of the  
Leyden Jar - Charge of a plate  
of air - Effect of Size of deposit,  
thickness - Correspondence of the  
effects with the Theory - Appli-  
cation of the power of the jar  
to experiment - Method of forming  
a circuit - Nature of Electric-  
meters and dischargers - Influen-  
ce of the charge on fluid soft  
and brittle bodies. -

- Recapitulation of the mode  
of charging Jar and plates.  
Theory -

- Plate of air charged - Two  
circular plates of wood about  
three feet in diameter covered



with insulat. In the centre  
of the lower plate is fixed a  
pillar of Solid Glass. In the  
centre of the upper plate there  
is a wooden socket through  
which the glass pillar passes  
and to which it may be made  
fast by a wooden socket screw  
in the upper part of the socket  
above the upper plate. By this  
simple contrivance, the plates  
can be readily fixed at any distance  
from, and parallel to each other.  
This is a great improvement  
on Breguet's construction of  
the upper instrument.

Exp<sup>n</sup> on this, first charging the  
plate of air between, when the lower  
plate is connected with the ground  
a shock, when the whole is insu-  
lated, no shock but large spark

— Exp<sup>n</sup> with charged Jars —  
+ 2 small jars charged, Discharge  
different ways  
(Discharging rod — with the  
arm — Electric shock —

1<sup>o</sup> Methods of preserving Electric  
Jars — of fixing the wires in  
them — three modes, covered,  
open & unshaded, the last best —

— W. J. mode. two pieces  
of wood one at bottom the  
other over the top of the coating,  
a tin tube between them. —

3. Electrostatic Quadrant by  
W. Henry — Invented by W. Smeaton.

Probes — Both between the best  
— Jars discharged by it (see C<sup>o</sup> Exp<sup>n</sup>)

4. Experiments with jars of different  
thicknesses. Through highest charge —

Experiments

5. To determine the direction of the electric matter in the discharge of a jar - N.B. a very large jar was made use of in this and the following experiments -  
- A wax taper placed between the balls of the conventional discharge, on the discharge, the flame was thrown towards the negative side.
6. A cork ball supported on two sticks of sealing wax on the U. discharge, was blown towards the negative ball.
7. The rarification of the air in a small wooden jar threw a cork or wooden ball to some distance.
8. Ditto - with when a few drops of water were put into the jar & became too to have a solid ball of G. Laps the water in diameter, by exploding

- a small quantity of water in its centre.
9. Ditto with a needle set in the jar - Proton.
10. Sheet of paper in the U. discharge torn to pieces and the fragments thrown into a considerable height above the table.
11. Paper Ditto
12. Piece of wood splintered
13. Shown round the room
14. Spirits found at the opposite end from the jar

Spirits found in the same manner by sending the shock through the water of the Thames by Mr Canton - other Expts of his -

Thursday 27<sup>th</sup> - March 1810

Elect. Lect. 7<sup>th</sup> - M. Singer

- Effects of the charge continued  
(Destruction of cohesion, aggragation and composition - Inflammation of Hydrogen Gas, resin, Phosphorus, Gun powder, Metals &c.  
Explanation of these effects, a wire melted without burning a bread in contact with it

Exp.

1. Cotton with resin fired
2. Ditto on a slip of paper
3. Candle with resin lighted
4. Resin <sup>on</sup> the surface of water fired
5. Hydrogen gas in a bladder with a slip cork fired by a spark from the condenser - by Cannon - In a strong glass vessel - by the balls of the

universal discharger, the tube of  
the bladder six or eight inches below  
the bladder. This Exp<sup>t</sup> has a good effect

6. A mixture of Oxygen and Hydro-  
gen gas fired different ways

7. Two inches of wire <sup>thick</sup> burned ~~and~~  
by a middle sized jar, in

8. Great experiment, when breathed  
into, burnt four inches of the  
same wire. In these experi-  
ments Cuthbertson's discharging  
instrument was used.

9. Great jar diffused eight in-  
ches of wire, without opening  
a thread in contact with it.

10. Different metals struck onto  
glass. Only one slip of glass  
used, on which the foil was  
laid.

11. Sparks fired at both ends  
of the room at once.

Elect<sup>r</sup> according to Singer has  
neither light nor heat - It only  
elicits light and heat from the  
bodies through which it passes, and  
from which it meets with re-  
sistance - The more resistance the  
more heat and light. All bodies  
contain both light and heat, say  
W. S. and Electricity remain

+ a bit of Phosphorus was fired  
by a spark -

Friday 30<sup>th</sup> March 1810 —

Electricity Sect: 8<sup>th</sup> - W. Senger

Effects of accumulated Electricity.

Power of a large Electric Battery —  
Eight feet of Steel wire melted at  
one Explosion. Gold, Platinum,  
Silver, Copper, Iron, tin and lead  
melted and beautiful figures produced  
on paper by their action. —

— Two batteries of 15 Jars each  
were employed in burning eight  
feet of Steel wire — The batteries  
were the same as Cuthbertson's  
each contained about 17 square  
feet of coated surface — The Leyden  
and plate machine were both used  
in this experiment. One of the  
batteries would have produced the same  
effect, but it is best to have a large

coated surface and not a high  
charge, by this a spontaneous  
discharge and breaking jar are  
avoided -

- The different <sup>metals</sup> ~~some~~ mentioned  
above were in series of different  
lengths some  $\frac{1}{2}$  inch of one  
inch some more other less -  
In length from 4 to 5 inches  
struck on two pins about  
a quarter of an inch distant  
from a piece of paper on which  
the oxide appeared, beautifully  
variegated - Some were struck  
on a single slip of glass.  
When there are two pieces they  
are generally broken by the  
discharge. Cuthbertson's Dis-  
charging any Electrometer was  
used in all these Experiments.  
- W.S. saw he could burn a

wire in water, and this was a  
proof that Electricity had no  
heat, but that the heat was  
elicited from <sup>the</sup> wire. - This I think  
doubtful. -

+ see Cuthbertson's Expts  
in his late work on Elect-

- The increase of the charge by  
breathing into the jar was  
shown - Charge about double.

+ When the two Batteries were  
discharged through a wire eight  
foot in length there was very  
little sound on the discharge.  
But in the short wires the  
Explosion was very loud, tho'  
less so than when the discharge  
is spontaneous. W.S. did not  
assign any cause - Said that it  
could not be owing to the resist-

as commonly supposed. He  
thinks the more resolute the  
Lords would be the report. —

Tuesday 3 April 1810 —  
Electricity Lect 9<sup>th</sup> W. Singer

Electricity applied to explain  
the cause of Thunder — Franklin  
Experiments — Lightning drawn  
from the clouds — mode of defending  
buildings from Thunder, exempli-  
fied by metals, an obelisk, a house  
on fire, explosion of a powder  
mill, shop wreck &c. &c. —

M. S. began with a discourse  
on the utility of Science in gene-  
ral and of Electricity in particular  
— The importance of the subject,  
of this women's lecture, the phi-  
nomena of Thunder —

— M. Gray first compared the Elec-  
tric spark to lightning, tho' his  
spark was very small when compared  
to what we can now produce. —

Dr. Franklin - History of his  
Discovery of the identity of Elec.  
and lightning -

Experiments -

1. Effect of points first discovered  
in America - Balls and point  
presented to the conductor. -
2. Great Ice discharged thro'  
W. S. by a point -
3. Thunder house -
4. Obelisk -
5. Powder house -
6. Fun house -
7. Ship in a vessel of water

Series concluded with a  
grand Eloge on Franklin  
- as this was given after  
ten o'clock, several feet. went  
away in the middle of it. -



Friday 6<sup>th</sup> April. 1910.  
Electricity Lect: 10<sup>th</sup> - Mr. Singer -  
- Origin of Atmospheric Elec.  
Explanation of the nature and  
effects of thunder storms. Direction  
for security from danger &c. &c. -

Half an hour employed in recapitulating the former lecture.  
- Romer's dangerous experiment  
with the pile - Richmond of  
Petersburgh, killed. see Prouty's book:

- Exp<sup>o</sup> -

1. Zig Zag Sparks
2. wire made red hot }  $\frac{1}{150}$  inch
3. (Ditto melted) - }
4. Three bells with a pointed wire  
connected with them being at a  
great distance from the Machine

5. Evaporation of water produced  
Electricity - An earthen ware  
cruet placed on the Gold leaf  
Elect. a few water put in it  
and water thrown on it, the  
vapour highly electrified -

6. The same Experiment demon-  
strated - A metallic funnel  
of tin foil and Gold leaf work-  
in the tin, was placed over the  
cruet to receive the vapour  
as in the last experiment. The  
Electrometer touched the out-  
side of this artificial cloud  
It was strongly affected as in  
the last experiment. <sup>of the vapour</sup> Electricity, in both positive. The  
electrometer and cruet  
negative -

7. The two large plates formerly  
used for charging a plate of  
air - upper one connected with  
the conductor - flashes between them  
like some kinds of lightning.  
The flash generally passed along  
the stick of glass that joined the  
plates -

8. A jar coated on the inside as  
usual, but on the outside to  
only about an inch from the  
bottom, resemble ramified light-  
ning. -

9. Shock sent through a lump  
of Chalk, shattered it.

- W. L. thinks the atmosphere  
is furnished with Elec<sup>t</sup> by the  
evaporation of water by the  
heat of the Sun -

- His account of this, <sup>and</sup> ~~or~~  
of the figures of the flash, and  
noise of thunder is taken from  
Noyan - Dalton's opinion.

- The formation of clouds he did  
not pretend to account for. -

This is a very difficult subject

Friday 10<sup>th</sup> April. 1810

Elect<sup>y</sup> Sect 11. W. Senger

- Luminous appearance of the  
atmosphere - Nature of Northern  
lights, falling stars, Meteors &c.  
illustrated by a variety of beau-  
tiful Experiments. -

- Experiments to determine the  
best metals for conductors -  
Lead, <sup>and</sup> zinc burned with a great  
change - Copper the best for the  
part in the earth and zinc for  
the upper part. The former less af-  
fected by water, and the latter by  
lightning than any other metal.

- Short lightning - no thunder -

- Meteor - Aurora borealis, in the  
Upper regions of the atmosphere.

- Electric light more vivid in pro-  
portion to the resistance it meets  
with -

- Then the Exp<sup>t</sup> of the black lumi-  
nous conductor, and a very curious  
exhausted <sup>by</sup> on a good air pump -

This elegant experiment exhibited  
the Electric light in various form  
and colours in proportion to the  
degree of exhaustion and ~~resistance~~  
length of the electric spark -

- The air pump is on Smee's  
plan, with some alterations -

- M. S. does not admit of Davy's  
explanation of the Aurora Borealis

The Elect<sup>r</sup>? prevented from entering  
the earth in the northern regions

by the ice which M. S. says is  
a perfect non-conductor, and sup-  
poses the north-part of the earth  
to be in a different state from the

southern - This M. S. denies, she  
says the earth must be all electric  
fluid in the same way -

- Falling Stars - He has not yet  
been able to exhibit this pheno-  
menon by Electricity - he had some  
experiments on this subject -  
exhausted tubes small bore -

- Gas discharged along the surface  
of glass - water on the glass, and  
on Dills through a length of  
12 or 14 inches, the whole time  
transmission, but no resemblance to  
a falling star -

- Ignis fatuus - M. S. thinks it  
owing to brown moss insects -

G. Darwin denied the existence of  
such a phenomenon -

<sup>th</sup>  
Friday 13 - April 1810 -

<sup>th</sup>  
Lectur: Lecture 12 - M. Singer

Other luminous appearance  
of nature. Relation of Electricity  
to the phenomena of Phosphorescence  
- Brilliant luminous appearance  
produced by Electricity. Original  
Experiments on this subject.

M. S. began this lecture with  
repeating the experiment of the  
Aurora box; in the <sup>large</sup> exhausted vessel.  
- After this a falling star shown  
by sending the charge of a middle  
sized jar through the same re-  
ceiver partially exhausted - the  
charge descended in a dense, bright  
luminous ball - If there was, but  
a little air more or left in the  
receiver, the experiment did not suc-  
ceed. From this it was inferred that

The Aurora was formed in the upper regions of the atmosphere and the falling star in "lower strata". —

History of the Phosphoric acid  
(Du Fay, Bérard, Wilson, Canton.

— Experiments.

1. Thumb redned transparent.
2. Paper - shock sent over it.
3. Lump of chalk shattered into luminous pieces - Mr. Canton.
4. <sup>of Sugar</sup> Pills - more luminous. —
5. Custard, and Sulphat of Barytes - The latter a beautiful green.
6. Three solid acids, Benzoin, Rosin and Succinic - The latter the most beautiful.
7. Compound Salt - Carbonate of Pot ash - of Ammonia - Soda acetate of Pot ash &c - The last the

most beautiful of all this class.

8. Canton's Phosphorus. —  
A compound of Sulphur and Lime - This burns more than any of the former. — Sulphurated lime

— Both Sulphur and Lime exhibit Phosphoric light separately or at least but in a small degree. — This fact is worth attending to. —

9. Phosphorus always luminous - stick in the dark, light and smoke from it, particularly if moved.

10. Letters written with it on Black or Blue paper - When blown on, a dense smoke and the light diminished - Hence an is concerned in the production of Phosphoric light —

11<sup>th</sup> Phosphorus dissolved in Bit  
a little in the bottom of a phial  
when the cork is taken out light  
enters through the mouth of the  
phial, and descends slowly to the  
bottom. Stop the phial and the  
light soon disappears —

12 Three large jars filled with  
dyed coloured water, placed on  
three intervals of a step of lumber  
on a board. On the discharge  
of the large electric jar through  
the conductors they were all  
illuminated. —

13 four eggs between three rods of  
glass - large jar sent thro' them  
with very little noise - illumina-  
ted them. —

14 oranges - did not succeed - Dis-  
charge went over the surface.

Thursday 17<sup>th</sup> April 1810  
- Lect. 13 - W. Singer -  
- The Electro-phorus and its effects -  
Importance of this Instrument  
with regard to Theory. - Unusual  
excursions and action of Elec. proved  
by the Condenser, Double Multi-  
plier and Springing Instrument by  
Mutual Electrical Energies illustrated  
by some curious experiments -

Electro-phorus about 12 Inches  
in Diam. - Exp. on it the same  
as usual - see Boyer, Cuthbertson  
and Volta, the inventor's original  
experiments - & The electro-pho-  
rus when insulated, had two galle-  
rises suspended from each plate



- Of the other instruments exhibited in the lecture, the small condenser, Cuthbertson's, is the best. It discovers very very minute quantities of Electricity. -

- Experiments with powder, placed under with the ball of a weakly charged jar a resinous plate - on a glass plate - with negative and positive Electricity, separately - both both on the same plate. The powder used was a mixture of red lead and Sulphur.

#  
Tuesday 24<sup>th</sup> April - 1810  
Lect. - Lect. 14<sup>th</sup> M. Senguer  
- Electric energies of metals, retention of discoverous in Galvanism.  
- Strong muscular action excited in the limbs of dead animals - Chewing, sucking and other functions of life excited in the head of an animal recently killed - general consideration of these phenomena - Conclusion of the course

- Early observations of the connection between Electricity and animal life - Breydon's observations -  
- L. Galvani's Discoveries on the Toad and Gymnotus Electricus - History of this discovery - M. Hunter's experiments - Galvani - Hist. of his Discoveries

- Fray, with Zinc and Silver - Exp.  
Did not succeed well - With  
two Batteries of 30 Series each  
fray laid on one pole was thrown

off -  
Galvani's Theory - Animal Electricity -  
Volta - Theory - The metallic plates

produce the Electricity - Experiment  
with two plates of Copper  
and Zinc, glass handles, condensing  
Electrometer - In this Experiment  
the Electricity was barely perceptible.

- Wilson's Experiment of Sealing,  
Copper filings through a Zinc  
sieve, on a plate of metal attached  
to the gold leaf Electrometer, the  
leaves opened readily with negative  
Electricity, and this without

the assistance of the condenser. Had  
the sieve been of Copper and the  
filings of Zinc, the Electricity would  
have been positive - This by far  
the most delicate test of Electricity,  
all condensers, Doublen and Mul-  
tiple, <sup>are</sup> wholly unresponsive -

+ Proofs of the identity of Galvanic  
and Common Electricity - Shock -  
Light - Burning of Metals -  
Exp. with a battery of 30  
plates of inches square, 9000  
each light would not fire gun-  
powder - it browned gold and silver  
leaf, instantly -

- Concluded the course with a  
Dissertation on the great utility of  
Muriatic Acid -  
- Will begin his next course on Thursday  
the 10 May - Monday and Wednesday

Thursday 10<sup>th</sup> May 1810

Ele<sup>th</sup> Chem: Lecture 1

- Introduction to the subject  
Objects of Chemical inquiry.  
Extent and utility of chemistry,  
its application. First prin-  
ciples of the Science. Nature of  
Chemical attraction illustrated  
by experiments.
- Three kinds of attraction  
Gravitation - Aggregation and  
affinity or chemical attr<sup>n</sup>
- This last principally illustrated  
on and illustrated by the usual  
experiments, of solutions, Precipi-  
tations, Colours &c
- Opinions respecting the cause

of Solution - needles and tubes  
or sheaths - Newton considers it  
as a species of the same power  
which retains the planets in  
their orbits -

- In chemical action one of the  
bodies <sup>at least</sup> must be fluid, or a fluid  
must be added. E. g. Nitre of  
Copper rolled in tin foil when dry  
does not act on the tin foil, but when  
moistened a little with water pro-  
duces smoke and flame. A mixture  
of sugar and oxy-muriatic of pot-  
ash exhibits no action, but if  
sulphuric acid be poured on the  
mixture, it bursts into flame.

- Ice and Salt act on each other  
which seems an exception to the  
general rule. This is only an app. <sup>to the</sup>

- Tables of affinity -

- Berzelius and Berzani's figures  
for simple and compound aff. -

Monday 14<sup>th</sup> May 1810

Mr. Lavoisier's 2 Lectures on E. C. Sci.

Of the different States assumed by various Bodies under different circumstances. Nature of Gases; their general properties shown by experiments.

Heat - Caloric - reason for this Term.

- Whether heat be composed, or the effect of motion or vibrations.

- Mr. L. adopts the former opinion.

Mr. Davy is the principal supporter of the old opinion.

- Heat always tends to an Equilibrium - illustrated in the usual manner.

- Expands all Bodies, whether solid fluid or aëiform, the three States in which Bodies are seen

Exp. on the Expansion  
of solids, the only described -  
Fluoridation, common, best in Diffusion  
Thermometer - Description of the  
common sort of Fahrenheit -  
Exp. of air and gases - Alkali  
Thermometer - small bubble of Air  
on a colored fluid in a glass flask,  
converted into gas by passing hot  
water on it, the colored fluid expelled  
from the mouth of the flask plunges  
into the water of the Celsius. -  
- Air made to boil in the ex-  
hausted receiver. When the receiver  
was removed from the pump, and  
a match applied to its mouth,  
it exploded with a deep blue &  
colored flame.  
+ Gases - Oxygen and Hydrogen  
gas prepared - Gun barrel with

Magnesium in the gas. Hydrogen  
gas in the common proof bottle  
Exp. Hydrogen gas in a large  
air-pump receiver open at top  
burst downwards - Hy. gas and  
atmospheric air exploded - Pop:  
much quieter with Oxygen gas. -  
Wine burnt in Oxygen gas,  
red globule sometimes turned  
round its axis!! as M.S. said  
Taper in a small jar of Oxygen  
gas. -

- Carbonic acid made in a  
balance. D. B. L. in Exp.

Thursday 17<sup>th</sup> May 1810

Urb. Ch. S. Lect 3. Mr. Snyg

Combination of Gases with other bodies, results of these combinations. Formations of acids, Acids &c. Recent discoveries relative to this class of substances

- Gases exist in bodies in a condensed or solid state.

This ponderable substance exists in bodies forms a Gas.

A gas therefore consists of two substances at least.

In converting a solid or liquid into Gas a great quantity of heat is consumed or becomes latent in the vapour or Gas.

Exp. Evaporation of Ether from the large bulb of a Thermometer in the tube of which was a

small quantity of coloured water - On the contrary Steam returned to water gives out a great quantity of heat, sufficient to make a large quantity of cold water boil at a considerable distance. It is applied economically in heating water in some manufactories

- Muriatic acid <sup>gas</sup> was attempted to be made in a retort and thrown into cold water in an air jar to heat it. This Experiment did not succeed with much time lost.

- Nitrous Gas made with copper filings - Eudiometer, small retort, divided into cubic inches held perpendicular in the water cistern, water raised to a particular division. A bit of Phosphorus in the belly of the

retort set on fire, the water rise  
in the neck of the retort and the  
divisions point out the Dimen-  
sions. This Mr. S. thinks the  
best Eudiometer — Eudiometry  
of little use in ascertaining the  
purity of the atmosphere —  
- Phosphorus burnt in oxygen gas  
produces Phosphoric acid —  
- Vitriolic acid — Sulphur burnt  
in O<sub>2</sub> gas, produces Sulphuric  
acid. Water in the plate tartar  
acid. — Charcoal burnt in oxygen  
gas — carbonic acid. Extinguished  
a taper, it should also have shown  
to be heavier than Atmospheric  
air —  
- Carbonic acid made in a  
common phial thro' the cork  
of which a glass tube passes,  
the outer end bent down ward  
into an air jar, all on the table  
without a water cistern or any other

apparatus. This is a convenient  
mode of making Carb. acid gas.

- Various metals burnt with  
oxygen gas. The metals were  
in coarse filings, they lay on  
a lump of charcoal acted on  
by a stream of oxygen gas from  
a Gasometer —

New nomenclature re- oxide in-  
stead of Calx a term highly im-  
proper when applied to metals.

- A combination of oxygen with  
different bases form the acids,  
some of which however have not  
yet been decomposed. —



Monday 21<sup>st</sup> May 1810

Et. Ch. Science Lect 4

Nature of Simple Bodies,  
Characters by which they are  
distinguished. Probable limit  
of their number. Recent investi-  
gation of their properties. Power-  
ful influence of chemical attri-  
bution. General results of combination

— did not attend —

Thursday 24<sup>th</sup> May 1810

Et. Ch. Science Lect 5. M. Sings

of Chemical analysis. Nature  
of the processes usually employ-  
ed to ascertain the constituent in-  
gredients of bodies. Decomposition  
by heat. By affinity. Theory of

these processes. Their advantages  
and ~~disadvantages~~ <sup>Imperfections</sup>. General con-  
sideration of the nature of chemical  
unions. Both composition and de-  
composition shown to depend on the  
Agency of Attraction.

In the first three Lectures.  
M. S. described the bodies supposed  
to be simple — He exhibited the  
decomposition of water, according  
to Lavoisier's method. Exp. viewed  
very well.

In the last or 5<sup>th</sup> Lecture —  
Analysis of wood by Distillation  
Products — Eff. of potash salt water &c.  
These only described — Reduction of  
lead, red lead and charcoal. Exp. —  
Wagon reduced by the flame of a candle

- Nitrous acid distilled with Wolff  
 apparatus, two intermediate bottles  
 Experiment on Colours - Acid and  
 Alkalies - Vegetable infusions - Litmus  
 Præbit - Red cabbage. Solution of  
 + iron with infusion of Gallic, with  
 Oxyd of Alkali, then last makes  
 a good Sympathetic ink, shown  
 in several experiments. M. S.  
 prefer this to the Sulphuric which  
 is seldom completely invisible -  
 Solution of Gold in N. M. and  
 precipitated by Ether, by Sal. Am.  
 - Silver from Protein and by Gua-  
 rick's acid. Deposition or refining  
 the metals for the coinage -

Monday 28 - May 1810  
 Dr. E. C. S. Lecture 6 M. S.

General considerations of the  
 nature of attraction. Evidence of the  
 existence of this property as arising  
 from different operations. Electric  
 attraction. Circumstances un-  
 der which this power is developed  
 Usual consequences of its action.  
 Illustrations by experiment.  
 Extent and singularity of the  
 Phenomena arising from Electric-  
 ity. Deductions naturally drawn  
 from the preceding facts.

- Attraction of cohesion - Brass plates  
 Leaden balls strongly adhere. Cork  
 balls floating on water rush together,  
 this experiment accounted for by  
 the French philosophers, from the

coke falling into the hollow by  
worn them - down an inclined  
plane. -

- Electric attractions - Feathers attracted  
by the conductor, then move from  
it not because it is repelled but  
because it is attracted by the  
moisture in the air. Says W.S.  
The phenomena of induced Elect  
by the three small conductors ex-  
plained in the same manner  
by an attractive power, without  
the aid of repulsion. I think the  
old theory is most satisfactory.
- Charging explained on the same  
principles - See Morgan and  
Withinson -

Thursday 31<sup>st</sup> May 1810

El. Soc. Science Lect. 7. Mr. Senger

Elect. employed as a Ch. Agent  
Researcher of the eastern Philosophical  
History of the applications of  
Electricity to the purpose of them:  
Inquiry, made prior to the year  
1800. Nature of the Apparatus em-  
ployed. Its imperfections. Circum-  
stances necessary to be attended  
to in similar experiments.  
Exhibition of some contrivances  
for this purpose &c. -

Precipitation of part of last  
Lecture - On principle, attraction,  
accounts for all the Electrical Phae-  
nomena. No necessity for repulsion  
Says W.S.

- Mr. Volta - G. Priestley &c -  
Their experiments to show the

Chemical effects of the Electro  
fluid -

- Iron wire melted - D. Prentley

battery of 80 square feet and  
refracted only 2 feet of wire

$\frac{1}{4}$  of an inch - M. S. - a battery

of 15 jars = 20 square feet burn

$\frac{1}{4}$  feet of the same wire. The

shows now much more power  
full -

- Decomposition <sup>and formation</sup> of water by  
Elect - M. Lewis into first of

exposed then by Elect - His appa-

rate for burning a mixture of

Hydrogen and Oxygen gases, con-

sisted of a strong glass tube of an

oval shape found on an air receiver

with a stop cock between. A wire

hermetically sealed passed thro

The top of the tube to near the

bottom where it approached near

another wire. The mixture of Hy-

and Oxygen gases was contained in

the large receiver. By opening the

stop cock, the tube became filled.

The stop cock was then shut and

the charge of a jar sent down the

wire, a flash took place, but no

explosion, this after being repeated

a number of times produced marks

in the upper part of tube -

- Alcohol in a small glass

tube bent at an obtuse angle

with a wire through each end

approaching near to each other

in the liquid at the bend of the

tube. A large brass ball was  
placed at about two inches from  
the ball connected with the Con-  
ductor. The bent glass tube with

The alcohol is brought in con-  
tact with the former when sparks  
of light are seen between the wires  
and bubbles of air rising through  
the Alcohol - Hydrogen Gas. -  
- In the same manner other  
oils and other fluids may be  
decomposed. When gases  
are to be acted on by Electricity  
a glass tube of  $1\frac{1}{2}$  or 2 inches  
in diameter having on end shut  
and at the other a stopcock to  
connect it to the air pump, and  
near the other shut end, two wires  
pass thro' the sides of the tube  
and approach within a quarter of  
an inch of each other. This tube  
is first exhausted of air then filled  
with the proper Gas and an Electric  
Shock or sparks sent through the  
wires. When this experiment is

performed with Ammoniacal Gas  
The Gas cracks into four or five  
times its bulk and is converted  
into Hydrogen and Nitrogen Gas,  
in the proportion of 20 of the former  
to 80 of the latter. This fact was  
discovered by Dr. Priestley -

Monday 4<sup>th</sup> June 1810

U. Ch. Surgeon Lect. O. W. Surgeon

- Discovery of the Voltaic Battery.  
- Details of its construction. Theory  
of its action. Exhibitions of the early  
experiments on its chemical  
agency. Discoveries of the British  
Philosophers. Chemical facts derived  
from their labours.

- Oxidation and reduction of  
metals by Electricity - Chain on  
paper - was stretched at a small  
distance from paper, by the ex-  
plosion of a battery, beautiful figure  
produced - Airs better conductor  
than water. Exp. Sulphuric  
acid on a long slip of glass  
and water on another, the bat-  
tery was discharged at double  
the distance thro' the air than thro'

thro' the water.  
- Gases of len and acid reduced  
by sending a charge of a large  
jar or small battery thro' them  
in a glass tube. - Metallic  
particles were evident after the  
discharge.

- Two plates, copper and zinc  
produce Heat - Nig: a powder.  
The condensing Electrode a very  
little effect - Copper wire and zinc  
foliages - It strongly affected (this  
is in my opinion the best exp<sup>t</sup>  
for discovering small quantities of  
Electricity).

+ Volta's enormous Decades  
- Pile Described  
- Cruickshanks's trough -  
- Wilkinson's improvement  
- G. Babin<sup>ton</sup> - Wedgewoods were  
troughs -

Galvanic Experiments -

- Water decomposed different ways.
- two small glass tubes in a wire glass - air in one found to be oxygen gas by lighting, a taper newly blown out, and the other hydrogen by burning.
- Sol.<sup>n</sup> of Acetate of Lead and Nitrate of Silver reduced by placing them in the Voltaic circuit - reducing by the negative wire - Lead and Silver tubes. -

M. S. finds that the <sup>Voltaic</sup> machine will act with pure water and for several weeks the not so powerfully as with acid -

Thursday 7<sup>th</sup> June 1810 -  
Elect. Chem. Lect 9<sup>th</sup> M. Sings  
Comparative action of ~~large~~  
~~and small~~ Voltaic batteries. Explanation of the action of large and small plates. Best disposition of an Apparatus for general experiments. Energy of a large Voltaic Apparatus. Its action on combustible bodies, and on metals. Description of the deflagration. Substance of the from charcoal. Experiments on this subject. -

M. Sings finds that a part of nitric acid added to Nitrous acid produces a greater effect than when either of the acids are used singly. -

June 1840

Lecture 10 Electro-Chemical Series

Account of the experiments which led to the discovery of the series and the experiments on the subject and the conclusions drawn from them. Electricity the cause of chemical attraction. Experiments in proof. Importance of this discovery.

1840. The above should have been the subject of the lecture this evening but Mr. Surgeon employed the time in following out the subjects of the last lecture.

Comparison of two Batteries each of 40 series each, the plates of one 2 inches square, those of the other 4 inches — Both charged with the same fluid.

Wire was burned by a small trough of, I think, 32 series. — This whole battery consisted of 300 series.

This burned the metals in wire as well as in foil, the latter is best burned by applying it to a flat

plate of metal, <sup>in a large bath</sup> charcoal burned with great brilliancy. Silver leaf gives a greenish yellow colour, but if a piece of charcoal is put on the end of the conducting wire the colour is white like that of the charcoal at self.

Green powder fired.



The small plates were fixed in the trough in the old plates the others in the new.

The shock was the same in both. So if any difference the small battery felt somewhat stronger than the large one

Cause of the Difference between the effects of large and small plates - Great plates produce more electricity, but smaller plates have more intensity. Bad conductors such as water, animal bodies &c do not carry off the whole electricity from great plates, metals carry off the whole, hence the reason, why <sup>metal</sup> ~~is~~ is so easily burned by great plates and charcoal so easily fixed

This illustrated by experiments in Common Elect<sup>n</sup> - Small spark

through a bad conductor - Elect<sup>n</sup> from one turn of the wheel thrown into a small phial gives a shock but into a large jar gives a less shock and into a battery a still less shock -

Cause of the electric light - it is from the body, not from the electric matter -

Electrical  
Large jar and Battery charged with the Voltaic Battery. A single contact however rapid charges to the utmost height which is that of the Voltaic Battery and says M. Singer would one of the extent of several acres in the same time. This I think very unlikely. -

Davy's Theory of Galvanism acted by Induction from jar to jar, M.S. objected to Davy one of his own - frequent renewal of the contact

between the <sup>Zinc</sup> metal and the acid  
by the falling of the oxide -

- But why is not the balance  
restored between the positive and  
negative plate - Because says Mr. D.  
there is a constant production of  
both Electricities - This insufficient to  
account for the fact.

Monday 14 June 11 Lectures  
This lecture thro' the 11<sup>th</sup> in  
number was really the 10<sup>th</sup>  
in subject - see the heads of  
last lecture

- Acids produced at the Pos.  
and Alkali at the ne-  
gative pole - History of all  
the Experiments on this sub-  
ject - Mr Davy's Discoveries  
He proved that the Acid and Alkali  
produced from the Metals were

were of in the experiments, were  
that from water is decomposed  
only into oxygen and hydrogen.

- Mr Davy proved that Acids  
and Alkali <sup>and gases</sup> formed at the positive end  
Alkali <sup>and inflamm</sup> round the negative end  
of the battery - Hence the Oxygen  
gas at the Zinc <sup>end</sup> and the Hydrogen  
gas at the copper <sup>end</sup> of the battery  
in the decomposition of water.

- Colours. - Infusion of red cab-  
brass in two glass tubes suspended  
from an insulated brass wire, and  
connected with moist cotton, the  
Zinc wire turned the one red, and the  
Copper wire turned the other green.

- Same experiment with two watch  
glasses - Also with test paper -

Monday 18<sup>th</sup> June - 1810 -  
M. S. begins 12<sup>th</sup> Lect. by M<sup>c</sup>, but  
it by heads as follow

- Influence of <sup>the present</sup> discovery on  
chemical science. - Improvement  
in the art of Analysis. Natural Elec-  
tricity of bodies. Instances of Decom-  
position by electric powers. Decom-  
position of Saline and earthy com-  
pounds, and of Natural Products com-  
binations. Geological Phenomena  
explained by these experiments

Head of Lecture 12<sup>th</sup>

- General application of the methods  
of Electro-chemical science Analysis  
Decomposition of acids by electricity.  
Nature of this class of bodies. Experi-  
ments on Acids, and on acid and  
metals combinations. Inferences  
drawn from these investigations.

M. S. Does not follow exactly the  
order of the printed prospectus

Experiments

- Transfer of Acids and Alkalies  
through bodies which have  
a powerful attraction for them -  
Wetted Glasses and Tubes as in  
last Lecture

- Acids and Alkalies produced on  
moist test paper laid on <sup>a bit of</sup> Sulphat  
of ~~sulphur~~ of Baryle. These  
by 50 thin inch plates. -

- A piece of flat silver in Sol. of  
Sulphat of Copper is not affected, but  
corrodes the silver with the magne-  
tism and it is acted on in the same  
manner as iron by the Sulphat of  
Copper. -

- A copper wire in a diluted nitric  
acid is acted on by the acid and bubbles  
of air escape - Touch it with the positive  
wire of the battery, and the action ceases.

- Sulphur and phosphorus burn  
in Oxygen Gas. - Sulphuric and  
Phosphoric acid produced. - As sulphur  
is positive why should the acid be  
negative? Owing to the oxygen. How  
also Phosphoric acid is more power-  
fully negative than Sulphuric acid,  
because it contains more oxygen.

- Test paper acted on by Elect<sup>n</sup> from  
the conductors of a small Electrical  
machine - All from the positive  
but not attracted from the negative  
conductors. - Malin's wire from  
through a finely pointed sealed in the  
ends of glass tubes.

- Insulated copper plates laid on  
powdered lime and applied to the  
condensing electrode, repeated several  
times, gold leaves dissolved with powder  
but with Boracic acid, with negative Elect<sup>n</sup>  
+ In the transfer of acids and attract<sup>n</sup>  
they produce no effect on test paper on  
this passage, - growth of the wire only.