Robert Bell

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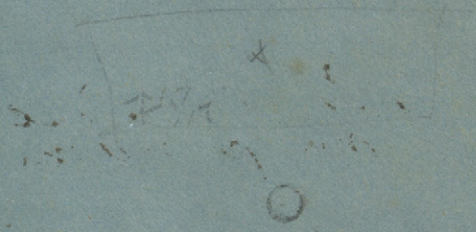
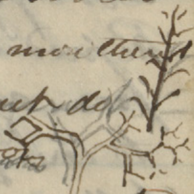
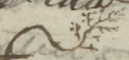
Mon petit ami
H et Sensible



1 Botany Lecture 1. Principal Dawson
Thursday December 2d. 1858
Buds are undeveloped branches
In the stem are nodes & internodes
The internodes alone increase in length
Adventitious buds exist in parts of
the wood where there are no leaves
& are to be found in the wood
Accessary buds are where more than 1
A simple stem  excurrent do
Deliquescent do deciduous 
Indefinite growth is when the bud
does not contain the whole stem
undeveloped. Definite is when
the bud contains the whole
stem undeveloped.
Herbaceous just strong enough to live
Suffrutescent woody under {a year the
size of a shrub 25 or 30 feet
is the highest shrubs

Culm is a hollow stem as straw. The Decumbent stems



procumbent

Repent

Stolon

Runner as Strawberry. Corm

As the crocus whose stem is on the same principle as the palm.

Zoology. Friday December 3rd.

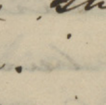
Reproduction. Animals are all from eggs. The ovum belongs to the female. Spermatozoa to the male. Nature of the ovum in all animals is the same. The germ is a small spot in the yolk which is a store of nutriment. When the ovum is complete in growth it is ready to receive the spermatozoa which is endowed with a kind of

Life to penetrate the ovum.
The cell of the male does not
differ much from the female
by the insertion of this a
number of cells spring up
the yolk of the egg is enclosed
to the two ends of it 
Lecture of Monday Dec 6th
Zoology.
Classification of Animals
1st their forms 2d the internal structure
form & structure are to be observed
in a two fold aspect 1st
in regard to form & size 2d as to
use. In looking at natural
objects we have 1st the idea
of Type & Plan - Adaptation
Homologous Analogous
Affinity
Animals may 1st be divided

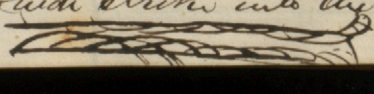
into four great types.
Classification. A species. Of
Colour of an animal is not
always an essential characteristic.
Unity of form is an essential
Character of species. The
skeleton does not vary
much in the same species. Habits and instincts
Not only its mental but
its historical habits as to
migration, time of breeding
&c &c &c. Cuvier's definition of a species was that
all the members came from a common
stock. A species continues
its kind the same from gen-
eration to generation.
Botany lecture of Tuesday
Dec. 7th
Internal structure of the

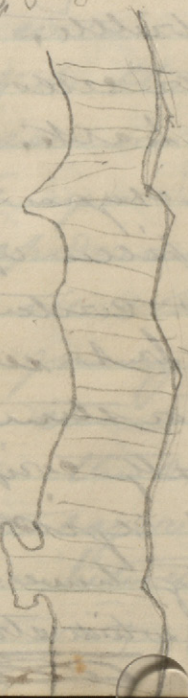
stem. The horizontal and vertical tissue. The exogen commences with cellular tissue out of which vascular and woody tissues are to be developed Exogen medullar rays begin to develope thus  and these gradually become filled up by the insertion of more wedges. The pith is not all equally thus  , and these bridges remain full of juice after the rest has dried up. The medullary rays were one the same as the pith itself but became softened by the continual insertion of wedges. Immediately surrounding these wedges is the sheath or endoplasm, which

the inner bark of the
tree, or liber. which are
elongated cells. The next
or mesophlum is green.
The next or outer bark is
the corky layer like the
common cork which is
an extraordinary development
of this, in a certain species.
Birch bark is the corky
layer. It is essentially a cork
but as split up. Next
comes the epidermis or
outer coat of all which is
to be found in young shoots.
Growth of the stem.
At first, in the exogen,
this is on the outer ends
of the wedges. between the
bark & the wood



until these meet when the annual growth goes clear round. The growth takes place in the cambium which is between the bark & the wood. In bass wood this is filled with leg fibres but in the beech it is quite brittle. This bass matter or cells exists in most bark. In the inner wood of exogens the cells have become filled up with woody matter & contains little or no life but serves to strengthen the tree or stem. The endogens are mostly confined to the tropical regions. Instead of wedges they have bundles of woody matter [illegible] which strike into the tree on again.





French, Exercise 102.

~~Exercise 169~~

Ai-je eu raison d'ecrir a mon
frere. Vous n'avez pas eu tort
[2] (d'ecrir) [1] (a lui.) Avez vous eu
mal au droit. J'ai eu mal
au l'oeil. Avez vous eu quelque
chose de bon. Je n'ai rien eu de
mauvais. Le bal a-t-il eu lieu
hier. Il n'a pas eu lieu. A-t-il
lieu aujourd'hui

Botany Lecture of Thursday
Dec. 9th.

The growth of the woody fibre takes place from above downwards not from the root upwards. The woody tissue comes from the stalk of each leaf.

The arrangement of leaves on the stem is called Phylotaxis

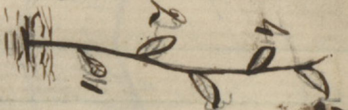
Leaves may be, a. alternate

b, opposite or

c, verticillate

Alternate leaves

Distichous or two ranked



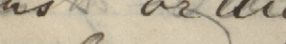
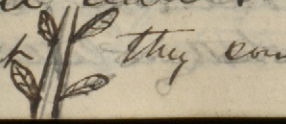
Represented by the figure 1/2

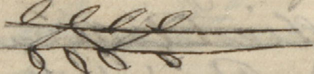
all grasses wheat corn &c are thus arrayed. In the arrangement of 1/3 this is

called

Tristicus

Pentastichous or 5 ranked ar-
rangement

represented by 2/5 nearly all
exogens & Dicotyledonous
are so leaved. Requiring to
go twice round the stem to
get to the 6th leaf. The two
first placed in endogens
& the last in exogens
the 8 ranked

represented by 3/8 Requiring to go
round 3 times & the 9th leaf
is over the first. The number
of wholes increases by adding the
numerators & denominators of the
first & second & so on
$\frac{1}{2} + \frac{1}{3} + \frac{2}{5} + \frac{3}{8} + \frac{5}{13}$ all this applies
to alternate leaves. Now
opposite leaves. Decussate
arrangement

they sometimes have

Agrean Stems as in number-
but after this comes double
sets instead of single as before

so by leaving
out one of each pair its
just the same.

Chemistry Lecture of Thursday
Dec. 9th No. 1
Generally bodies dont act on
each other till dissolved in liquid.
Sugar disolved in water is
affinity but not properly so
high in the scale as when
two liquids produce a solid.
or two solids produce a
liquid, Cloride of Barium
(Barytes) which a little sul-

furic acid in water forms a deposit of terra ponderosa, By so throwing down one substance & then another an analysis is obtained of the whole.
Sulfate of magnesium, which means sulfuric acid & magnesium & Chloride of Barium mixed form a white liquid & deposits chloride of magnesium. Bichloride of mercury which means 2 of Chorine & 1 of Mercury & iodide of potassium mixed produces Biniodide of mercury.
Acetate of lead, sweet lead with Iodide of potassium forms a yellow liquid with a yelow deposit which is acitate of potassium.

Prussian blue is made of sulfuric acid sulfate of iron &

Iron has two oxides. Protoxide of iron is acid and not be com to be chemically an acid. Sulfate of Coppa is blue vitrol.

Light heat & galvinism affect affinities. Anatropism means difference in condition

Zoology Lecture of Friday
Dec. 10th " 1858
Variation is an exception
Cats originally came from
Asia where they are all the
same colour. Mummies of cats
are preserved in tombs in Egypt
which are just the same as
the domestic cats of our day
1 Species - Felis Catus
2 Genus - Felis
3 Family - Felidae
4 Order - Carnaria
5 - Class - Mamalia
6 Province - Vertebrata sub kingdom or Branch
Cuvier's Arrangement of the
animals is now adopted
Many systems of animals
may be made if we take
any one organ as Hunter did
the heart Owen the nerves &

Aristotle and Linnaeus
& the blood.

Chemistry Friday Dec. 10th 58
The sources of heat are. the
sun combustion friction
electricity animals. Light
moves at 192000 miles a
minute ~~—~~ 1.100 sun
When the air is cold it is
heavy. Dense bodies trans-
mit sound faster than air.
When light is passed through
glass it is bent but
it goes out in the same
direction as it enters. Some
kinds of wood transmit
sound 17 or 18 times faster
than air. The prismatic
colours are called the [illegible].

Spectral, Actinism is the Chemical influence of the sun The red has the longest wave or vibration & the violet the shortest. The wave of heat is longer than the wave of light. The polariser To obtain the specific gravity of a substance it must be weighed in air & then in water. The temprature of the water used should be 60°

Geology Lecture of Monday Dec. 13th 1858

vertebrata. They are characterized by having a brain at the end of the vertical column. We always have the 5 senses The heart is complex always

having more than one lobe. Nerves built on the vertebral column types always separate.
Locomotive organs consist of one pair at least.
Invertebrata are altogether different having no true red blood
Molluscs are sometimes di- & sometimes mo- necious: that is have the sex in the same or dif. individ
Radiates. The greater portion of these are Monecious.
Numerical distribution.
20,000 species of Vertebrates
15,000 " " Molluscs
100,000 " " Articulates
10,000 " " Radiates
Typical examples from the lowest to the highest.
Radiates lowest & simplest.
2 Groups

& 2
alics'
Spiral' Protozoa small & simple
" 2 H
" 3
" 4 Aster
" 5 Estr

Class 1: Protozoa
Order 1 Rhizopoda
Calcareous chambered shells or Foraminifera belong to this order, and other similar animals having siliceous coverings.

Chemistry Monday Dec. 13th

Catalysis is allied to affinity. It means that a substance is present in a compound but does not take part in the change in it. Platina and hydrogen gas makes the former

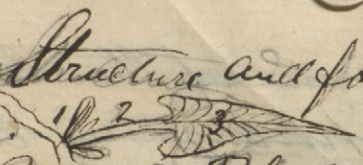
red hot & produces water by uniting with oxygen.
Boiling starch and sulfuric acid — the starch will disappear & is converted into sugar.
Sugar by fermentation may be converted into alcohol by the use of yeast.
The old Alchemists had three principles, salt, sulphur, and mercury.
64 or 65 is the number of the elements now-a-days
14 or 15 are of common occurrence & form the chief part of the earth.
These elements are divided into Metalic and Non-metalic. And some of them are called metaloids. which

have not been agreed to
which division they belong
Mercury & bromine are liquids
5- are gases, oxygen, hydrogen, fluorine
nitrogen &c. The rest are
solids. The composition of
all compounds is invariable,
never varying.
In making an analysis
100 parts are always taken.
Water contains 11.10 parts Hydrogen &
88.90 Oxygen. 1 by the
rule of three.
By passing hydrogen over
oxide of copper water is
produced and leaves metallic
copper. Substances unite in
more than one proportion
known by the name of

the law of multiples.
proportion of nitrogen is
equivalent,
suppose a body is composed
of the weight quantity of
each this [illegible] say the
6 and the other Constituent
of the compound may be 16 &
the compound will be 22
parts. Chlorohydric acid is
clorine and hydrogen and
the combining quantities
of each of these added
will give the number of
parts in the Compound.

Botany Tuesday
Dec 14th. 1858.
Arrangements of the leaves in
the bud which is called

Venation. Structure and forms of the leaf.



1 stipules 2 Petioles 3 Blade

The upper side is hard and varnished over but the under side has an epidermis more soft than the upper & contains cells. These cells are arrayed thus

In moist weather they swell and open thus but in dry they close

Called stomata

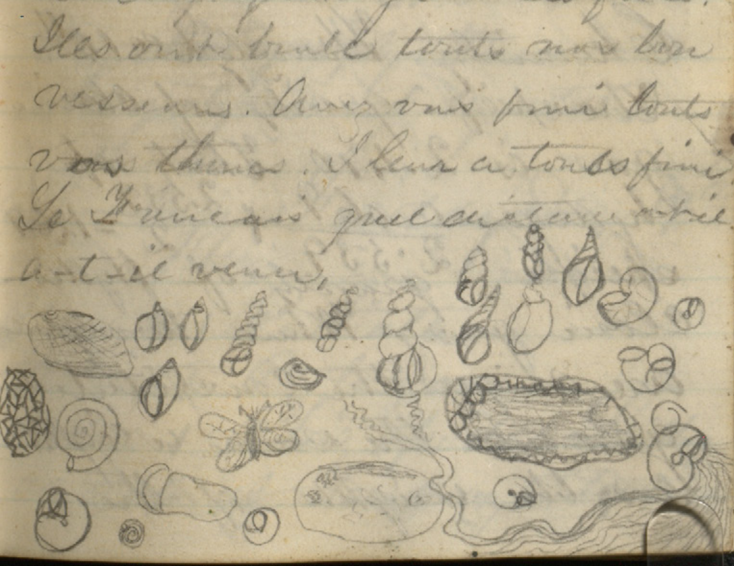
some swamp plants have open stomata and appear dry while those that grow in dry places as Cactus which have closed stomata and retain the moisture ap-

pearance. Development of the leaf.

Form of the leaf is of importance in determining plants. Parallel veined leaves are chiefly to be found in endogenous plants. In exogens they are reticulated, the former being more or less linear plants & the latter dicotyledonous. Smooth edged leaves are called entire. Emarginate leaf means that the margin is cut in.

Chemistry Lecture
Tuesday Dec. 14th 185
Wednesday Dec 15th

~~Qui me cherche? Votre père.~~
~~vous~~ 122
Votre frere est-il deja allé
en Espagne. Il n'y est pas encore
allé. Avez vous voyagé en
Espagne. J'y ai voyagé. Quand
partez vous. Je pars demain.
A quelle heure. A cinq heures du
matin. Avez vous usé toutes
vos souliers. Je les ai toutes usé
Les Espagnol qu'ont-ils faits.
Ils ont brulé toutes nos beau
vaisseaux. Avez vous fini toutes
vos themes. Je les ai touts fini.
Les Français quel auteur est-il
a-t-il venu,



Platycarcinus irroratus

Botany Lecture of Thursday Dec. 16th

Compound Leaf

Duration of leaves

Fugacious leaves are those which do not last a whole season as seed leaves & the round leaves at the bottom of the hair bell.

Chemistry Thursday Dec 16th

The specific gravity of Clorine gas is 2.470 That of hydrogen $\frac{0.069}{2.539} + \frac{2.539}{2} = 1269$ Specific gravity of Hydro-cloric gas. When two gases are mixed the constituted gas is the same weight as the weights of the

Constitutents added together
(Spermaceti) (ammoniacal gas, nolabene)
Some gases require three volume to unite with one volume of another, others two &c.
& 1 vol. of one gas mixed with 1 of another & divided by two will give 1 vol. of the compound
Water is 2 vols. of Hydrogen & 1 of oxygen & may be written thus H^2O
Crystalography. There are 6 systems of crystals

Zoology Friday Dec. 17th.

Province 1 Radiata
Class 1 Protozoa
Order 1 Rhizopoda. Limbes consist of temporary extentions,

of the body. Foraminifera.
on account of the little
holes or Foramens which are
in them. Genus Oculina or
Miliolina. Polimorphina
Pollestomella.  the most
common at this place.
Order 2d: Porifera. It
is now pretty certainly as-
certained to be an animal.
Sponge of commerce is composed
of horny fibers
The sponges of our sea have
both horny fibers and
& silicious spicules
The young sponge is like this  .
& moves about till it finds
a good place to settle in

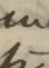
Fresh water sponges are generally greenish and sometimes they are nearly white. Halicondria is the name of the genus of sponges which inhabit our seas. The sponges of commerce are the genus Spongia. Spongilla is our fresh water sponges.
3^d Order. Infusoria. It includes the many Animalcules. They are so named from being produced in great numbers in infusions of vegetable substances.
Chemistry Friday Dec. 17th 1858
Language of Chemistry. Letters are generally applied to acids. O is next. Per oxides. Deutoxides double of protoxide.
Acids & bases unite to form

salts. Per as a prefix is
the highest. Per oxid & sesqui
oxid are the same thing.
Difference of affinity & cohesion
the former is exercised between
two different substances & cohesion
~~is the~~ between particles of the
same substance. System of
notation or symbols is the
representation of a word
by a letter, & a simple
letter means but 1 equivalent.

Chemistry Monday Dec. 20th.
Crystollography 20th.
One substance may have two
forms of crystallization (isosm)
as calc spar. Axis of
a crystal is the line
through it around which the

particles are symmetrically
grouped (Regularly)
System 1 regular
Cubic or Hexahedral
from having 6 sides. Tesseral
system also called. A prism
is a solid body whether three
cornered square or otherwise
Octohedron ⊕ belongs to this
system. The rombic
dodochohedron or twelve
sided crystal has equal
& parallel sides. Tetrahedron
hemioctohedron
or 4 sided figure △△△ is a
primitive form of this system
Mode of increase & diminution
Transforms crystals from
one form to another thus
by cutting off the angles
of a cube we get an

octohedron 
The rombic dodecahedron or
12 sided may be formed by
increase thus  
The crystals of this system
are not doubly refracting
by zinc copper gold iron
lead Diamond fluorspar chloride
of sodium Iodide of
potassium. Alum

Second or Square prism
system has 1 of the axis
is shorter than the others
or unequal, this is the
principal axis. This system is
characterised by having three unequal
axis.
  . The planes or
sides instead of being [illegible]

equilateral triangles as in
the regular system are isosceles
triangles, 
Calamite by ... as a
merry & ...
symmetries of the ...
quadratic & ... dimetric,

Chemistry Tuesday Dec 21st "

Crystallography continued

3d Rombohedral or Rombic
system Characterized by 4 axis
3 of which cut each other at
an angle of 60 & are equal
& the other different.
Rombohedron or romboid belongs
to this system. A 6 sided
prism or cylinder is a good
representative of this system
& also the double six

sided pyramid & so has
12 sides & is a dodecahedron
& also the dihexahedron 
or 24 sided prism. The
number of planes is doubled
by each angle being replaced by a
plane. Carbonate of lime
crystalizes in this shape & so do
quartz crystals, the prism
here comes to a point 
Antimony, arsenic,
platinum, ice, cinabar,
Calc spar (carbonate of lime)
Lime dolomite &c crystalize
in this system.
4th The Right rombic or
right prismatic system.
has 1 axis of double refraction.
It has 3 rectangular axis
all of unequal lengths.

2 triangular prisms put together
sidenays forms this crystal.
This with polarized light yields
two rings of colour.
These substances crystalize in it
Iodine sulfur
corrosive sublimate
Carbonate of lead. (Lime
called aragonite nitrate
of silver. Tartar emetic
5th
oblique prismatic system.
Two axis cut each other
at oblique angles &
the third cuts them at
right angles. These substances
crystalize in this system.
Sulphur Carbonate of soda
sulf sulf. of
lime borax sugar candy.

6th Or last Triclinate or biclinate is very irregular. Its axis are all oblique to each other. and unequal. Substances of this system Sulfate of copper Gallic acid.

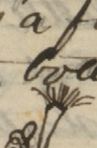
Dimorphism & Isomorphism When a substance crystallizes in more than 1 form it is called Dimorphism but when 2 different substances crystalize in the same form it is called Isomorphism. These different shapes of 1 & the same substance affect its hardness and solubility. The composition of oil of turpentine, oil of lemons & oil of orange is identically the same.

[illegible] is [illegible] of a [illegible]
but [illegible] because
their [illegible] [illegible] are
different,

Zoology Jan 10th 1859

Radiata. 2d Class Hydrozoa
They are sarcodous polyps, having
very small vestiges of muscular fibres.
The genus Hydra is a good example

They are very small & attach them-
selves to submerged objects.
The Tubularia is a family of Polyps
that live in the bottom of the sea



Campanularia
Next family Sertularia are all
small & look like sea weeds
The polyps which live in the cells
on each side of the stalk are
not unlike the Hydra. The cells

or the cells connect with the main tube in the centre & whatever nutriment one polyp may catch goes to nourish all & if there is any surplus nutriment it goes to form new cells & orifices in which the young are deposited. Zoophytes is the name given to all animals of this form & mean Plant Animals Corallines are plants which are jointed calcareous tubes the little plants have the power of accumulating calcareous matter around them Madipore is supposed to be of the same kind.

Chemistry Monday Jan. 10th.

Oxygen may be obtained from Nitrate of Potassa or saltpetre. It may also be obtained from fresh green leaves placed under a bell glass & exposed to the sun. Smoke of anything is carbonic acid and hydrogen or water. Steel burns in oxygen. A light may be made to burn much more brilliantly if oxygen is supplied to it by a tube conducting it to the centre of the flame.

Botany. Tuesday Jan 11th. 1858

Examination

Chemistry " " 11th.

Heat is caused by very rapid combination of two bodies. When iron & oxygen unite it is so slow that the heat is

not perceptible.
Hydrogen gas is always combined with something else. It is a constituent of all organic bodies. It may be obtained by decomposing water. Some metals by putting them into water decompose it. or by heat. by passing steam of water over hot iron which absorbs the oxygen & hydrogen pass out pure. This may be done by a gun barrel. 
Hydrogen is highly inflamable. It has no odour. It is exceedingly light.
2/3 Hydrogen & 1/3 oxygen makes the best compound for detonating explosion. Soap bubbles or balloons filled with this rise fast.

$2a + b - 3c + 4d - 5f + 6g$

6 5 4 3 2 1

$12a + 5b - 12c + 12d - 10f + 6g$

$12 + 6 = 12 + 12 \quad 10 + 6$

$ab + 5b - 4de + 5fg$

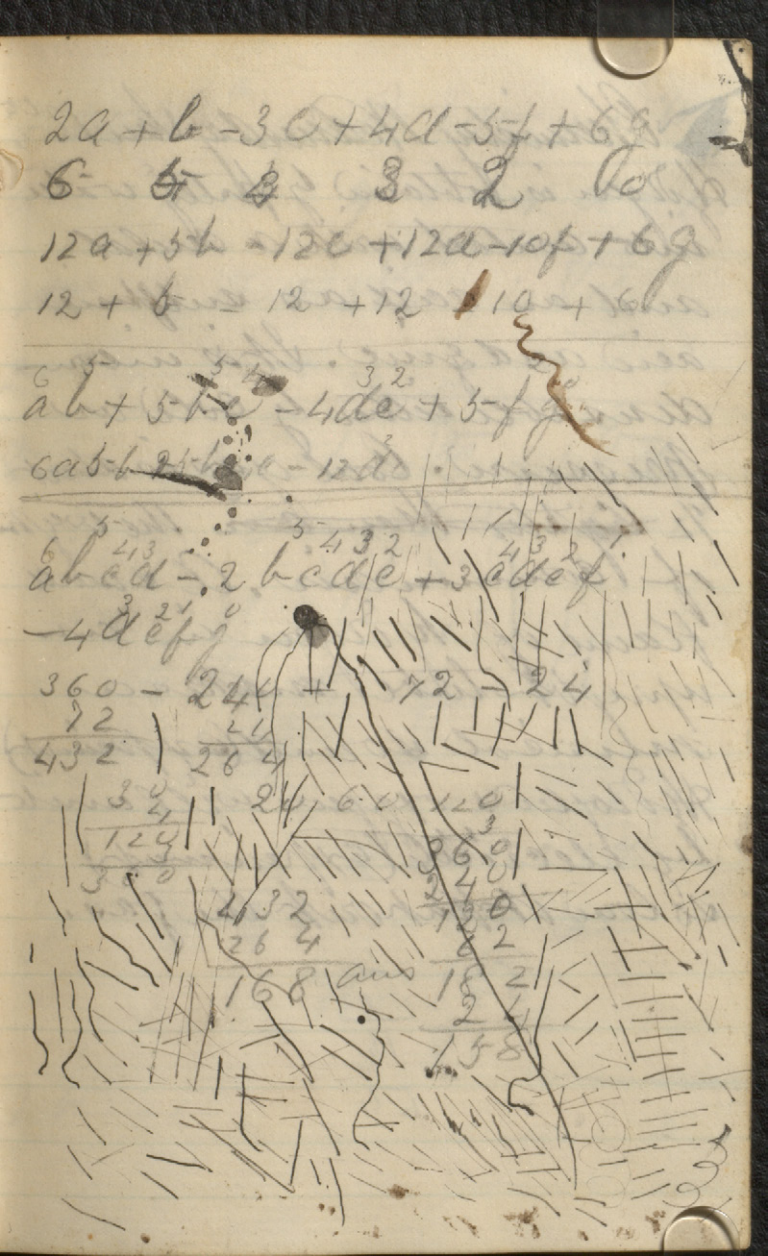
$6ab - 12c$

$abcd - 2bcde + 3cdef$

$-4defg$

$360 - 24 \quad 72 - 24$

$432 \quad 264$



Chemistry Wednesday Jan 12th 04

Hydrogen is obtained by putting water into contact with a metal and an acid as sulphuric acid and zinc. It is incondensable either by cold or pressure. Coal gas is about ½ ~~lighter than air~~ the weight of common air. A small flame of hydrogen in an upright tube it makes a musical sound (experiment) Hydrogen & oxygen will unite by electricity (experiment) so loud it shook the gas.

64 4/4 16/64

1024 is 5th root 4 written $\sqrt[5]{1024}$

$a = 25$ $b = 9$ $c = 4$ $d = 1$

$\sqrt{a} + 2\sqrt{b} + 3\sqrt{c} + 4\sqrt[3]{d}$

~~25 + 0 + 12~~

$\sqrt[3]{5a} + 2\sqrt[3]{3b} - \sqrt[3]{2c} + 4\sqrt[3]{d}$

5 + 6 − 2 + 4 = 13

25
5
125

15
15
15
15
225

9
3
27 | 3 27

2
6 5 4

6
6
36

$a = 0$ $2\sqrt{a-b} + 3\sqrt{3a+2c-1}$

$b = 2$ $+ 4\sqrt{a+b+2c+d}$

$c = 4$

$d = 6$ 4 + 15 + 64 3|125

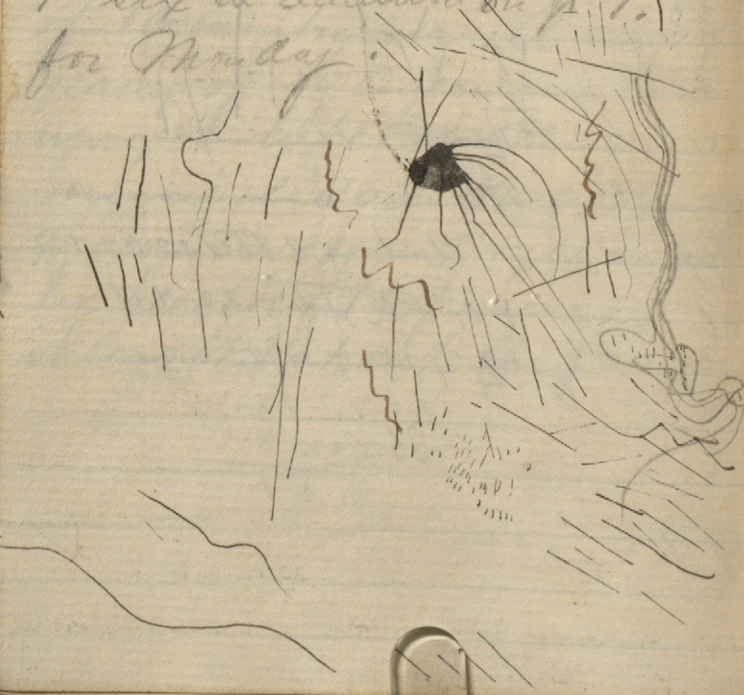
16 15
35 ans 2
81

$2b^2 + 2c^2$

$2c^2$
$-3c^2$
$-7c^2$
$10c^2$
$4c^2$
$16c^2$
12
$4c^2$

$2a + c + d$
$-b + a + e$
$c - d$
$-3a - a - f$
$-2c + 2d - 2e$
$4a - b + 2d - 2e - f$

10th on P. 4 2d 6th 7th of
1st six in addition on p. 7.
for Monday



Un officier français étant arrivé
à la cour de Vienne la impéra-
trice lui demanda s'il était vrai
que le journal dit. Quelle a été
la vieille ~~réellement~~ [être] le plus belle
~~créature~~ femme du monde. »
Comme on ~~disait~~ a dit. Madame
répliqua le officier je le pense
hier. Comment aimez-vous
ce vin de l'homme ~~bien~~ beaucoup bien
Ostarais je vous demanderai un
morceau de ce poisson. Si
vous avez la bonté de me passer
votre assiette je vous en servirai.
Avez-vous la bonté de me
verser à boire. Avec beaucoup
de plaisir. Ainsi voyant un
gendre qui était très petit venir
avec une longue épée au côté
dit. Qui est ce qui a attaché mon
gendre a cette épée.

~~Zoology Thursday Jan 13~~

Botany Thursday Jan 13th

endosmosis & exosmosis
is the force which sends sap
up the stem. When a tube
is filled with some thick
& immersed in a vessel of
clear water the tube being thin
and porous at the bottom pure
water will enter them the
thicker liquid go out.
Food of the plant & its compounds
Minerals found in plants are
Carbon, Oxygen, Hydrogen, Nitrogen
& cheifly the first three.
O. & H. the plant obtains from
water, the C. from the air,
It is soluable in water &
is found in rain water.

It is this that has produced all geological changes in the decay of rocks & formed the soil. The plants can also take in this gas by their leaves. The N. is obtained from ammonia which is composed of N. & Hydrogen. This is found in the air and brought down to the plant in the rain.

Chemistry Jan 13th 1.
Symbol of water is H.O. oxyde of hydrogen. 620 is the specific gravity of vapour of water Sea water freezes at 28° & water 32°. By passing hydrogen through oxide of copper the oxygen and hydrogen unite & form vapour of water which

may be condensed. Take
17 cubic inches hydrogen
& 8.5-0 " " oxygen
they will form 25.5-0 cubic
inches of vapour which
if made to condense will
form only a very small
quantity of water, these
gases uniting in the pro-
portion of 2 to 1.

Botany — A soil may be barren
for a crop by wanting only one
constituent of the plant and
to remove the soil all that
is required is to find which
ingredient is wanting and to
add it and not put on
manure at random for
perhaps that which is put
on may not be required.

Zoology Huxley Jan 14th

3d Class. Acalephae. They are free swimming marine animals. are soft gelatinous & possess arms for benumbing their prey are mostly dioecious, pass through many forms before maturity. Are arranged in 3 groups or orders

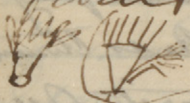
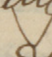
1st Siphonophora, body is floated by air cells & is transported by the wind

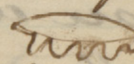
2d order Discophora

ordinary jelly fishes

Some are large a foot in diameter & others as the bean eye small 1/8 of an inch &c. The latter being produced by the tubularia & have the power of depositing ova. This & the clothed eye were classed in the old genus Medusae

The large purple jelly fish in the Gulf belong to this order The young medusa is like a polyp, having been reprodu from true ova 

 in this state they 

may remain a year & produ new medusa then  the upper one then drops off & reverses itself  this one ovum may produce a very great numbe These animals afford food for a great number of oceanic animals corallis large ones. The polyps in the bottom sticking on stones shells keep throwing off these little phosphorescent specks we see when they are disturbed.

3^d order Ctenophora
They have two very long appendages
they send out & withdraw their
~~several~~ ~~covered~~ cilia with perfect
ease although it would seem im-
possible to prevent them from
tangling

Algebra 1st 7 in Substraction
for Tuesday
2^d 5th 6th on P. 10
Read multiplication on Ps
13 & 14 examples & rules.

Zoology Monday Jan. 17th

Class 4 Anthozoa

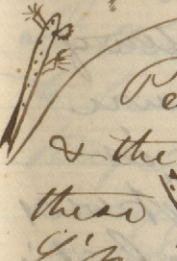
Fam. Actinidae. soft has
no skeleton, tentacles lead to a
stomach, it being separate from

the outer structure by a space & spines are [illegible] between the different cavities. This is the first division of this kind in our animal scale.  cross section of a sea anemone. The wide spaces between the rays are filled with ova & contain the reproductive organs. The stomach has no tubes leading from it but throughout the circumference by the mouth (in most part) by ciliated action. They are monœcious. They are very beautifully colored. If they swallow a large thing they cannot disgorge it but they force through the sides.

Fam. Veniidae

[redacted] Aleyonidae are horny & tubular & contains cup shaped. These are sponges & are often taken for sponges & are grossly classed with them.
In this genus the animals like the anemones with prickly rays are stuck into the outside of the tube.

Group a Family
Pennatulidae is beautiful & the animals stick out of them



Like a pen hence the name Pennatulidae & the stem into which the pen is stuck is planted in the mud & are often very common

Family Tubiporidae
(Coral) is composed of lime
& is made of cells.

& at a certain stage
all the cells send
out a floor &
join the cells so on
at intervals.
Also Fam. Alcyonidae.

Chemistry Monday Jan. 17th
Water is a bad conductor of
electricity if it is pure
but if a little salt is
added it conducts it well
It may be found by electricity
(experiment) at an elevation
of 20,000 feet above the
sea fish will not
live as the pressure

of the air is too light to keep a surplus of oxygen in it. (There is a surplus of oxygen in water at ordinary heights & kept there by the pressure of air) If the air pump be applied to the surface of water with a fish in it, it feels great inconveniences & if continued will die. In this country water ought to be kept evaporating to keep the Atmosphere moist enough or our throats & chests will become dry. 70,000 grs. is the weight of a gallon of water or 10 pounds so there be 7,000 grs. in one pound. Water is regarded as an oxyde as well as any

other mixture of oyster. Cracking of salt when put in fire, is owing to a small quantity of water being deposited between the laminae of the crystals, mechanically deposited. In making soda water a quantity of Carbonic acid gas is forced into the water & corked up. The brown colour of the Ottawa water is owing to vegetable substances. The St. Lawrence contains nearly 3 times as much mineral matter than the Ottawa. Sulphuric hydrogen gas is what we call sulphuretting gas and

may be tested by plunging
leaves of into them.
The Tuscarora Spring
near Brantford contains
a great amount of
sulphuric acid.

Philosophy Tuesday Jan. 18th
The earth is 13 miles shorter
from pole to pole than
through the equator
The angle made by the
line drawn to a star &
the horizon is called the
altitude of the star
Great circle
sailing is done this.

Parisitism of plants
The equator is supposed

plane at right angles
to the axis the ends
of which is the equator.
Meridians are graduated on
the equator & and to find
the Longitude of a place on
the globe go to the equator
& measure the no. of degs
easterly west from the
first meridian then
draw a line perpendicular
to the equator or draw a
line to the pole from it.
Circles are said to cut
each other at right angles
when their tangents cut
at right angles +
Latitude of a place is its
angular distance from
the equator.

Longitude cant be
more than 180 as it
counts both ways.
Longitude is the no. of degrees
a place is from the 1st Meridian
measured on the equator.
Botany Tuesday Jan. 18th "

The nutrition of the plant may
be considered as consisting
chiefly of water & carbonic
acid gas. The large amount
of silica in wheat & other
plants must be brought
up into it mixed with
an alcali; this is in the
case of wheat is potash.
The potash is sent up &
down charged with silica
& the woody part consists

and deposits the earthy
salts in the plants.
Plants do not cause
exertion to accumulate
about its roots so that the
exhaustion of soil by
the same crop over
not owing to this but
what is taken from it.
in an inorganic shape.
In Canadian soils there
is not enough of sulphuric
acid and it may be
added cheaply in the
form of gypsum.
Phosphoric acid may be add
in guano potash in
common ashes.

Chemistry Tuesday Jan. 18th 77

Water is called Deutoxyde of Hyd. is written HO^2. BaF is Fluride of Barium. Deutoxyde of Barium thus BaO^2. Ozone is a substance found in the atmosphere ~~which~~ by electric agencies It is a peculiar kind of oxygen in a highly active state — much more so than common oxygen Ozone is capable of overcoming certain affinities and so decomposing substances It seems to produce influenza and ~~other~~ diseases of the mucous membranes — the nose throat bowels &c.

Nitrogen and sometimes called azot. It forms 4/5 of the atmosphere. & is found in many nitrogen—indigo Blue It composes most of the air in fishes swimming bladders. Phosphorous has an affinity for oxygen May be obtained from Ammonia.

Cloride of Ammonium is written NH^4Cl

~~If fresh flesh be exposed~~

It is represented by N.

It is tasteless colorless smelless. Harmless Does not support flame does not burn. In the latter two qualities it

is the same as Carbonic
acid gas but the latter
may be tested by putting
some pure lime water
into a flask of this
gas & shaking it, it will
become milk which does
not take place with nitrogen
atmosphere is about 45
miles in height. Is highly
elastic the upper strata
pressing down & making
heavier the lower &
causing water to rise
34 feet in a closed tube
It is 11,000 times lighter than
mercury (exactly) & by multiply-
ing the height of the mercury
tube (30 inches) by this it
would give about 5 miles
but as you rise above
the sea it will not suppress

It is such a height. At 2 miles it is only 15 inches just 1/2. At the level of the sea it is 30 inches

at 3 miles	——	15 inches
6 "	——	7.50 "
9 "	——	3.75 "
12 "	——	1.875 "
15 "	——	0.937
30 "	——	0.029.

Chemistry Wednesday Jan 19

At 2 7/10 miles above the sea the half of the atmosphere is passed that is in weight & at 6 miles it is a half of that & at 9 that is half again & at 12 again & so on supposing the first half to be 3 miles in round

numbers. There are tides in the atmosphere as in the sea & this accounts for the weather in relation to the moon. Ordinary barometers

De L'Hire's pump has water both above & below so that you pump water by both the ascending and descending stroak, the one by the ordinary pressure of 34 feet & the other on the principle of the force pump

To find the superficies of a spherical vessel square its diameter & multiply by 3.1416. (Air pump experiments)

Composition of the atmosphere

Ox. 20.90 } 100 parts.
N. 79.10 }

Astronomy Thursday Jan 20th

If a pendulum takes (23.56 h. minutes sidereal) is the time the earth revolves) to revolve at the poles & does not revolve at all at the equator, how far will it revolve in an hour at Lat 45 or Montreal

Exercise Page 153

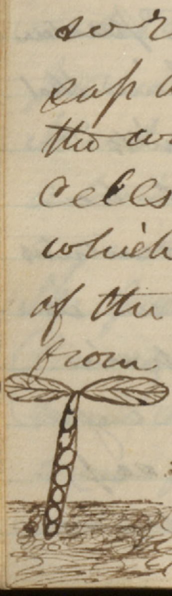
A quoi passez vous le temps. Je passe le temps a etudier. Votre frere a quoi passe-t-il le temps. Il passe le temps a etudier et a jouer. Cet homme passe-t-il le temps a travailler. Il est un vaurien; il passe le temps a boire et a jouer. Vos enfants a quoi passent-t-ils le temps Ils passent le temps a apprendre Pouvez vous me payer ce que vous me devez. Je ne peux pas vous payer car le marchand a manqué de m'apporter l'argent

Pour quoi avez vous déjeuner sans moi. Vous manquiez de venir a neuf heure, de sorte que nous avons déjeuné sans vous. Scaley sea cucumber belongs to the genus Psolus & the smooth kind are of the genus Cucumaria

Botany Thursday Jan 20th.
Bone dust is good to restore pasture land, as it is Phosphate of Lime that is taken from pasture by milk & the bones of animals that have fed on it. In winter the nutriment laid up in the wood of trees is starch & the acidity sap in spring converts it into sugar to form leaves &c. The sap ascends in the wood (sap wood)

The inner wood is almost
dead the next is living cells
& the outside are growing cells
or wood. The heart wood does
not decay so fast as the
sapwood as the cells are
lined inside with woody
matter while the sap cells
admit water & thus dries
out & soaks in again &
so rots the wood. The
sap ascends partly between
the wood & bark, & forming
cells on both,

which is the reason
of the bark separating so easy
from the wood in spring.



Exmose & endosmosis.
As the thick matter
descends from cell.

to cell the watery ascends from the root from cell to cell & when the thick matter reaches the last cell it contains the least quantity of matter nutritious to the plant and passes into the soil. The watery part carries up everything mixed with it in the soil & the useless kind is either evaporated or sent out by the roots. Cellulose (wood) is composed of C_{12} O_{10} H_{10} The sugar of stems as cane maple &c is composed of the same as cellulose but the sugar of fruit is C^{12} O^{12} H^{12}, Gum and starch are the same as

Cellulose, Cellulose (wood) can easily be changed into glucose into sugar. It is very easy to change starch into glucose.

Chemistry Thursday Jan. 20th 22

Eudiometer and to measure measuring of the proportion of air it will support that this depends on the amount of oxygen it contains. In ordinary there are 4/5 nitrogen & 1/5 oxygen in the atmosphere. (in 2000) Carbonic acid gas is in the air in the proportion of 1 part in 2000 of the air There is more of it on top of mountains than in the valley & at night

than in the day. Carbonate hydrogen is admitted to be always present Ammonia is also present especially after thunder storms. The atmosphere contains also many exhilations sometimes causing epidemics, as flooded by marshes, bogs, &c. Infections smells also cities &c. Ship fever or Irish fever although not atmospheric must have been caught through the atmosphere by breath or otherwise. Portions of air taken from great heights in balloons in crowded theatres, stinky wards &c

differ almost imperceptibly from pure air, but man himself is the best instrument to test them, as the youngest man sinks under a slight almost unmeasurable taint. The atmosphere is only a gaseous mixture not a chemical compound. Protoxyde of nitrogen It is known as Azotus oxyde & Nitrous oxyde It is obtained from nitrate of ammonia. (Is nitric acid and Ammonium) Protoxyde of N. is a coercible at 52 atmospheres. It is a great supporter of of Combustion.

Zoology Friday Jan 21st

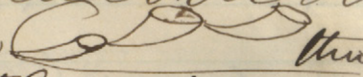
6th Exam. ~~Madrepora~~ Madreporidae. The animals commonly called coral although not so by naturalists. They have the power of secreting a great quantity of carbonate of lime about themselves. Fungia or mushroom coral is much like the anemone having a great number of tentacles or worm like things trailing out & conducting prey to the central mouth

And some madrepores have twelve tentacles and are aggregated together in great masses each part of which is like the mushroom coral

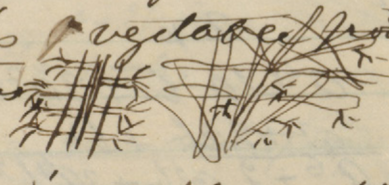
The genus Mad-

repose itself is the branchy
corals  . Millipores are
solid looking corals with little
pores & the whole affair is
covered with a kind of flesh.
Agassiz thinks they ought
to put along with the
Hydroid polyps.
Zoantharia. Aporoe
(without pores) Perfora
Tabulata (v. very ancient
style  with rudimentary
partitions. Perhaps are
like the millepore if they
belong to the H. polyps.
Rugosa  like the mush-
room but have 4 prim
rays instead of 6 as the
modern mushroom

coral: Tubulosa have

to have run over other
surface  thus
Hom. 7th Corallidae
The proper coral. Have
only 8 tentacle instead
of 12 or more as the Madrep
idae. The red coral of
commerce is a good example

Covers the whole surface
with animal matter
the naked stem is
striated, the old form
belong to this also. as well
as many other forms like
calcarius & vegetable, mostly
modifications



And there is a genus which
when taken out of the
water the animal part all
falls off & leaves the skeleton

$a - b - 2c \times a - b$

$a^2 - (2a - c)c + (2(a-c) + b)b$
$- (2(a - c + b) - a)a$

$a^2 - 15 + 8 - 5 -$

$16 - 15 + 8 - 5 = +24$
-20
4 ans

$a^{\frac{1}{2}} b^{\frac{1}{2}} - a^2 b^3 \quad a = 4 \quad b = 8$

$16 \times 5 \cdot 12 - 16 \times 5 \cdot 12 = 0$

1×2^2

ax

$a^4 - 2a^3b + 3a^2b^2 - 2ab^3 + b^4$
$a^2 + 2ab + b^2$

$a^6 + 2a^5b + 3a^4b^2 - 2a^3b^3 + a^2b^4$
$+ 2a^5b - 4a^4b^2 + 6a^3b^3 - 2a^2b^4 +$
$+ a^4b^2 - 2a^3b^3 + 3a^2b^4 -$

$a^6 + 4a^5b \qquad + 2a^3b^3$

$a^3 + 2a^2 - a^4$
a^0

~~$a^4 + 2a^3 - a^5$ Ans~~

$a^3 + 2a^2 - a^4$ Ans

That the result is the same as the original, and therefore a^0 is the same as 1

$a^2 + 2ab$ ~~+ ...~~ $\quad \times a^{-1} \div a$
a^{-1}

$a + 2b$ Ans

$a) a^2 + 2ab$ ~~+ ...~~ $(a + 2b$
a^2
$\quad 2ab$
$\quad 2ab$

$a + 2b$ Ans

$a^{-1} = 1 \div a$

That a sum multiplied by a^{-1} is the same as if the same sum were divided by a

$2ab^5$
$2ab^5 + b^6$
$+ b^6$ Ans

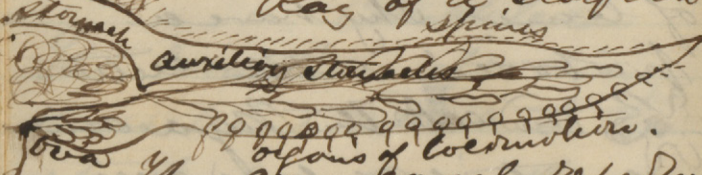
Zoology Monday Jan 24th.
The order Alcyonaria Alcyonaria may be considered higher in the scale than the order Zoantharia. Class V Echinodermata
Order 1 Crinoidea
Fam. Encrinidae
" Comatulidae
The Comatulae after living some time attached to their stalks can swim off and creep about. The encrinidae are fixed all their lives. Only 1 kind now lives in the deepest parts of the southern seas.
In some encrinites there are 150,000 pieces, counting plates joints &c. Cystidea have but two

ums. None live now.
Order 2. Asteroidae. Ambulacral grove is the grove running along the under side of the rays of starfish. The upper ~~ends~~ sides of the rays of the starfish is composed of little pieces of carbonate of lime. They have a proboscis in the center

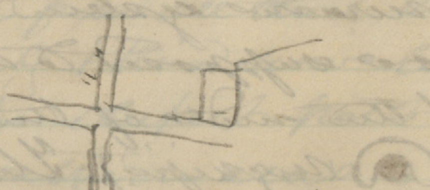
and eat the Mya and all sorts of garbage, very voracious. They have blood and a nervous system. They are also supposed to have eyes at the ends of the rays ( magnified) The madraporic plate is used to filter sea water has a sand bag filled with little grains of calcarious matter.

The young are first like little microscopic eggs covered with cilia. Each animal passes (if it has any metamorphosis) through the lower forms of its own type or sub kingdom

Ray of a starfish

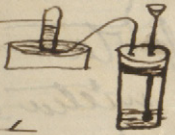


They can easily reproduce injured parts.



Chemistry Monday Jan 24th

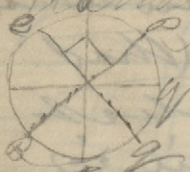
Deutoxyde of nitrogen.

is made in an evolution bottle  by pouring weak nitric acid on clippings of copper (written Cu.)

It is not coercable but a supporter of life specific gravity 1.037. It is not inflamible. It unites with oxygen and forms a brown vapour soluable in water

Hyponitrous acid (that which has the greatest combination heat in it the least in ours. Unites with sulfuric acid & with Iodic acid and forms definite combinations.

nitric acid. NO_3^- is very interesting & is one of the keys of chemistry. Made of nitrate of potassa. sulfuric acid is written $KO \cdot SO_3$ It may exist in the anhydrate or dry state and the hydrate or watery state sulphuric acid may also exist in either of these states.



$\sin 90° : \sin 45° :: 15° : x$

$1 : \frac{1}{\sqrt{2}} :: 15 : x$

$x = \frac{15°}{\sqrt{2}}$

sidring time is called mean solar time (24.h) that is the avergl time the earth take to revolve The earth rotate in 23.56+4 by sidrig time but 24 by siderial time. The north polar star is called the pole of the heavens & the equator of the heavens celestial equator is the plane of the equator of the earth produced. There is no star at the south pole produced near enough to be called a polar star. The declination of a star is its distance from the equator or its angular distance and the right ascention of a star is its longitude. Declinatio corresponds to latitude & ascention to lngitude. The longitude of a place on the earth is of course

its angular distance with the equator or the length the arc between the equator and the plane

$4x + 5 = 10x - 16$

$4x - 10x = -16 - 5$

$-6x = -21$

$x = 3\frac{1}{2}$ Ans

$mx + a = nx + d$

$x - x = n + d - m - a$

$mx - nx = -a + d$

$(m - n)x = -a + d$

~~$x = -(m - n) = -a + d$~~

$4x + 9 = 8x - 3$

$4x - 8x = -3 - 9$

$-4x = -12$

$x = 3$ Ans

$3(x - 2) + 4 = 4(3 - x)$

$3x - 6 + 4 = 12 - 4x$

$3x + 4x = 12 + 6 - 4$

$7x = 14$

$x = 2$ Ans.

$$5(a+x) - 2x = 3(a - 5x)$$

$$5a + 5x - 2x = 3a - 15x$$

$$5x + 15x - 2x = 3a - 5a$$

$$18x = -2a$$

$$x = \frac{-2a}{18} \text{ Ans.}$$

$$x = -\frac{a}{9} \text{ Ans}$$

Wednesday all out

27 except 1.3.6.7.10.

Evening

$x = \frac{my + n - a + d}{m - n}$ Ans

Botany Tuesday Jan 25th 1858

Gluten resembles starch but differs in having nitrogen. It may be obtained by washing dough with plenty of water is insoluble in water.

Albumen is also found in potatoes and many other plants. Is soluble in cold water but with

[illegible] not for it coagulates.

asceitic acid or vinegar is formed of $C^8 H^6 O^6$ about the same composition of cellulose & is found in fermenting vegetable matter. Tartaric acid is formed of $C^4 H^2 O^5$. The fruit is the same as the leaf & when young preforms exactly the same functions but soly for its own growth It tastes at that time the same as a leaf later it is sour & finaly sweet.

Citric and Malic acids also exist in plants in their fruits, Oxalic acid in the leaves as of soral & rhubarb. The existance of these acids in certain plants is owing

to the functions of their leaves
to decompose oxygen in
different proportions with carbon
and Hydrogen. The theory of
preserving fruits fresher longer
for a long time is that the
first stage of decay of the
fruit that is when full
grown to happen of ripening
is its changing the Malic
acid into grape sugar. And
this is a wise provision for
the preserving & diffusion of
the seeds for animals
would eat the fruit when
green if it was as sweet
as when ripe & so the
seeds would be lost.
Then sorrel grows well in a
sign of plenty of alcali.

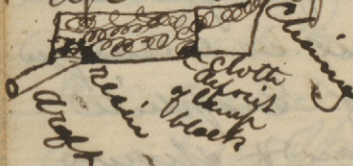
Chemistry Tuesday Jan. 25th

nitric acid is found in combination with potassa in nature and is used for making gunpowder. Nitric acid ought to be quite clear but if exposed to direct solar light it evolves nitrous acid, & oxygen and becomes of an orange color. It is very strong & is vulgarly called aqua fortis. The orange colored evolves much gas which on opening a bottle of it jets out & carries away the liquid which may do damage. It dyes wood and wool ve yellow. If paper be dipped into this acid

and drill it will ~~in the~~ if applied to burn at a low heat & keep burning a kind of very powder
Carbon. The specific gravity of the vapour of carbon is 416. Pure Carbon is the diamond & by far the greater percentage of coal is carbon. It exists largely all over in the form of carbonates as carbonate of lime. Its combining volume is generally taken at 1 whole volume. By a very powerful galvanic battery diamond is changed into a kind of Graphite It is Phosphorescent & shows light in the dark. It is very highly refractory & the most beautiful of gems

Chemistry Wednesday Jan 26

Graphite or plumbago is mixed with fire clay to make crucibles for melting glass metals &c which helps to make glass so cheap. It contains a little iron and also sometimes silicic acid. Lamp black is carbon and is obtain by burning tar and resinous matters of inferior quality & passing their smoke through woolen cloth it is sifted and knocked off & packed up & sold for paint.



Charcoal is made from wood & drives off its hydrogen & leaves only its oxygen. Is good for

purifying water & absorbing stinks but does not itself stop decomposition but the simple fact of the object being surrounded with it, in part excludes the air & so helps to preserve the substance: Animal Charcoal made by distilling in a furnace bones, hoves, horns, &c is used for taking the colour out of vegetable substances as sugar, molasses &c & are rendered white & pure. Black molasses by being passed through a bed of this 2 or 3 feet thick may be made quite clear this is also called Ivory black, bone black, &c.

The first combination of carbon is carbonic acid gas. Is easily obtained by pouring chlorhidric acid or sulfuric acid on carbonate of lime (common limestone) or carb. of soda or any other carbonate in an evolution bottle. Carb. acid gas forms the 2000 part of the atmosphere. Is evolved in vast quantities by volcanoes not only active but extinct & the springs in their vicinities are saturated with it & make pleasant liquid to drink. The so called soda water contains no soda at all but carbonic acid gas.

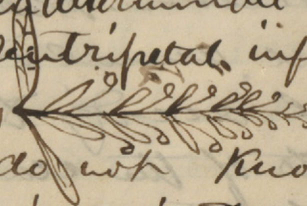
It is a poisonous gas ~~is heavy~~ — is heavy — does not support combustion — is not inflammable — mixes with water — when mixed with lime water makes it milky but if more carbonic acid gas water it again becomes clear. It is this solution that makes stalactites & stalgmites in caves. It is evolved during respiration and will turn lime water milky if the exhaling breath be passed through it (experiment)

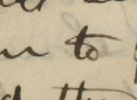
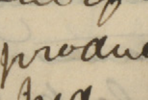
Philosophy Thursday Jan 27th.
The celestial meridian of Montreal is the great circle passing through the poles of the heavens and directly over Montreal called the Zenith of the place. The

poles of the heavens are the north and south points round which all the stars revolve. The position of any heavenly body is found by its declination and right ascension, the same as the latitude of a longitude of a place, its longitude being the angular distance between it and the celestial equator. The longitude of a star is its arc between it and the first point of Aries measured on the celestial equator. The sun rises at a different point in the horizon every morning.
To prove that the earth revolves round the sun it is proved that the motion of light in combination with that of the earth seems to put the stars out of their place by 20". This is called the aberration of the stars.

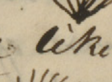
Botany Thursday. Jan 27th.
Plants can dispense with a part of their solar light if well supplied with ammonia, so in green houses ~~at~~ in mines plants become green when they have not enough of light but when they are well supplied with ammonia.
Reproduction. Many plants are annual or biennial according to the length of the season time of planting, quality of soil and many other circumstances. Some annuals, as larkspur, become perennial by becoming double. The coloured leaves of flowers exhale carbonic gas & inhale

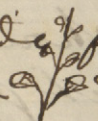
oxygen. Flowers when coming out create heat, which in many plants where there is a great mass of flowers, can be measured by a common thermometer. Inflorescence arrangements of the flower of the stalk. Peduncle of a flower is its stalk

1st Indeterminate Indefinite or Centripetal inflorescence is thus  because we do not know when it is going to end. The whole central stem after it has begun to produce flowers is called the peduncle. corimb

thus   umbel ~~spike~~ thus

receptacle like the dandelion

[illegible]  of this fig it.

is umbell  and the flowers
surrounded by the receptacle or
fruit. 2d. Definite - Determinate
or Centrifugal. In the 1st
the outside of flowers come
out first  & in the 2d.
the inside or upper thus

Chemist Thursday
Jany. 27th

Carbonic acid gas
It is a coercable gas
being reduced to a clear
colorless gas. At 72 [82]
below Zero it evaporates
& somewhat resembles
snow. It will mix with
essential oils and alcohol
but not with fat oils.
A well or cave may con—

tains too much carbonic acid gas to support life & still not too much to destroy combustion. So that people should be very careful about going into such places. This gas may be removed by pouring water out of a garden watering can which particles of water will absorb the gas. It has been proposed to put out fires in ships by means of carb. acid gas. Fires in mines have been successfully put out by this gas. About 4 percent of Carbonic acid gas is evolved in ~~the~~ exhalation exhalation

When we breathe fast, the air does not penetrate to the extremities of the smaller air vessels of the lungs.

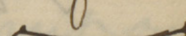
There is a celebrated grotto near Naples which is charged with carbonic acid gas when people put dogs in to show how they are asphixiated & it is one of the wonders of the place. It exists in water — combines with bases to form carbonates. Carbonic oxide is represented CO being equal parts of each

Zoology Friday Jan. 28th

The large starfish or "sea spider" uriaster is of a higher in the scale than the ophiurae or asterias. Order 3rd Echinoidae the plates of the sea urchins are divided into the ambulacral and interambulacral plates. the 1st are the plates with holes through which the feet are protruded. They are the bands of the five in number

ambulacral plates

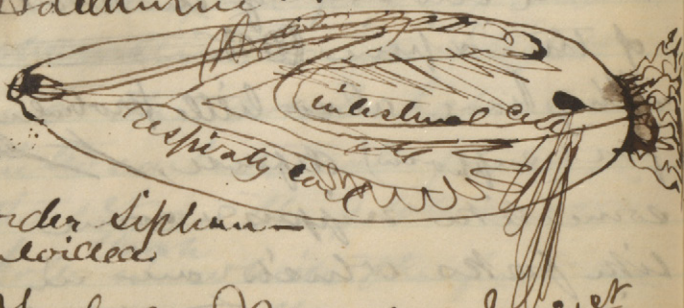
interambulacral do

The feet of the urchin is strengthened with multitudes of little hooks linked together 

& the end of the foot is a complicated pentagonal arrangement.

The end of the spine works on
a ball & has a socket & the
end of the spines are worked with
a series of muscles fastened
round the ball at the root
of the spine 
They have also little protuberances
for (supposed) defense, 
some like nippers & some
like forks which are in
incessant motion. The
eye plates and ovary holes
are in its upper side opposite
the mouth  The
urchins are like a starfish
with the rays all turned back
& meeting on top. 
When young they are like medusae
or acalephes. Order 4th
Holothuridae. They have a

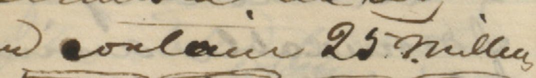
very strange respiratory apparatus. Bifurcating & admitts water for respirts This is found only in the Holothuriae.



& order Siphunculoidea

Zoology Monday Jan 31st

The entozoa have no distinct resporative system or nervous system. They are all parasites, about 18 species of many different genera attack man and live in many different parts of his body. Sterelmintha are solid worms and their

Coelelminthea or hollow worms. Order 1 of Sterelminthea Taenioidea or tape worms. The Cystic parasites are to be found in a kind of bad pork  another kind is found in another part of the human body  the head of the tape worm magnified is thus  The whole of the joints of the tape worm are devoted to reproduction, being filled with eggs they are monstrous & every joint is also so. They sometimes are very long and contain 25 million of eggs. 
The have an opening in each joint altering sides. One

kind lives only in the west of Europe or in the men from there. Order 2nd of the Trematoda a species of these infests the livers of sheep & causes the "rot" & the lives in human livers. The young state of these creatures live in water & are found in the body of snails. & by putting some of these into water the sheep coming out & soon crowd the water. Order 3rd "Acanthocephala" are formidable animals - have darts with which they bore through the intestines of animals. The

live in hogs and other domestic animals

Chemistry Monday Jan 31

Potassium is written K

Boron – has never been found pure in nature – is not widely diffused in nature – comes from the table lands of Tibet

F is for fluorine & Fe iron

Pure crystals of Boron are very hard even rivaling the diamond. Oxide of Boron or boracic acid. It is represented by the letter B. It is also found in Tuscany. It may be obtained from common Borax (white). It is the Bi-borate of soda, or two equivalents of Boron

and one of soda. Silicon
is written Si. It is an element
It has never been found
pure in nature, silicic
acid & not silicon is
the proper name of that
very common earth &
not to be found in nature,
Pure silicon is a powder
of a darker brown than
Boron. It has also ~~found it~~
~~in the~~ been procured in
the crystalline state.
It is ~~only~~ found in ~~but one~~
union with but one
acid namely silicic acid
By drops Chlorhidric acid
on powdered quartz it gives
a kind of starch & when
again becomes as hard

a grain in the amorphus state or dry state. Ash waters contain silicic acid. It can by a chemical process be made to dissolve in water like soap. The only acid that acts on it is fluorhydric acid.

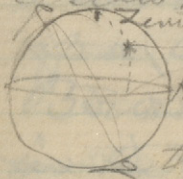
Astronomy Study Feb 1st 11

The sensible horizon is the part of the heavens that we can see & the rational horizon is the plane parallel to this cutting the earth into 2 equal parts & produced divides the heavens into 2 equal parts. The apparent between the rational & sensible horizon is very trifling

The North part of Arius is the part from which the longitude or right ascension of a star is measured

The inclination of the ecliptic to the equator is 23° 28'

The nadir is the point opposite the zenith (vide foot) Zenith (also head) exactly. The first point of Aries is in the celestial equator at the point where the ecliptic and equator cut each other.



Altitude of the star being the arc between the star & the Horizon of a great circle passing through the Zenith and the star. The altitude of a star

Chemistry Tuesday Feb 1st 1858

Silicon can never be thoroughly united with oxygen at a great heat. Sulphur is represented by the letter S.

Its equivalent is 16. The specific
gravity of vapor of sulfur is
6.640. It is a constituent
of gypsum. Is also a con.
of albumen as in hops hair,
It is a bad conductor of heat
or electricity. powdered
or flowers of sulfur or sublim.
or sublimate of sulfur is
condensed on the sides of a
vessel like vapor of water.
S is soluble in oil of
turpentine. When mixed
with iron or copper filings
it unites & burns. Iron
wire burns in its S vapor
as in oxygen. S. acid gas
extinguishes fire and is used
to put out burning chimney
by throwing a handful of

flowers of S into the stove.
The oxidizing combinations of S and O are SO^2 Sulfurous acid SO^3 Sulfuric acid. S^2O^2 Hypo-sulphurous acid S^2O^5 Hypo-sulphuric acid.
S'us acid gas is coercable with water but cold. May be obtained by mixing sulfuric acid with charcoal & collecting the fumes. S'us acid gas with bases form sulfites.

Chemistry Wednesday Feb 2d.
S'us acid gas is SO^2, combining quantity is 32. Is opposed to fermentation and the growth of fungi & parasitic plants in general and is used for stopping deases of the skin.

SO^3 is obtained from sulfate of iron or common copperas.

SO^3 is made of SO^2 in a great vat, some water is put into bottom of vat & steam is sent in and S is made to burn in a furnace & nitrate of potassa to form nasal ~~acid~~ & made to evaporate & enter with it. the air is also let in to supply oxygen the SO^3 is then driven off & concentrated. unites with bases & forms sulfates. It is capable of existing in the anhydrous state. A liquid kind is very strong & black (Lord Hanger) common SO^3 is capable of

being frozen. Boils at about
62° Tested with Sulfate
of Barites which causes
a white powder to be
thrown down. even highly
dilute.

Astronomy Thursday Feb. 3d.

Azimuth of a star is the arc
of the ~~vertical circle~~ horizon
between the N. point of the
horizon and vertical
circle. The vertical circle
is the great circle passing
through the Zenith and
perpendicular to the equator
Lat. of a star is the arc
of the ecliptic between it & the first
point of Aries
If a pole 6 feet high
casts a shadow 10 feet

Log Botany Thursday Feb. 3rd 1858

In a regular flower the parts are placed in alternate order.

sepals, petals, stamens, pistils and thus it may be decided what is which when a flower has but one circle of leaves for sepals & petals. The arrangement of the parts of the flower in the bud is called aestivation in the same manner as that of the leaves is called vernation

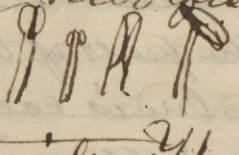
1 Imbrication

2 Valvate

3 Valvular

Leaves grow first from the bud by putting out a point and then pushing this forward the rest of the leaf is developed the the leaf-stalk.

Stamens or collectively called androecium are called monadelphy when all together diadelphous when in 2 bunches triadelphy when in three bunches. The stamen has the anther which has many modifications of two lobes

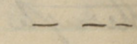


Chemistry Thursday Feb. 3d 11

The SO_3 is expose at a rather low temperature to evaporate its shallow pans after drawing out of the vats # the Boiling point of water is 212 ° of SO_3 62 °.

Green vitriol is sulfate of iron. Solid SO_3 is smelts like asbestos — strait

Hyposulfurous acid — has an intense affinity for water causing great heat nearly 300°
Hyposulfurous acid or might be called thyonus acid S^2O^2. Oxide of natrium or soda NaO. S^2O^2 unites with soda & forms Hyposulfite of soda, used in photography. If S^2O^2 be passed through peroxide of manganese suspended in cold water, it produces Hypo-sulfuric acid. or if it be allowed to heat SO^3 Hypo-sulfuric acid S^2O^5. This with the Greek nomenclature is Thyonic acid. S^3O^5 Trithyonic acid S^4O^5 Tetra — do — S^5O^5 Penta — do —

Zoology Friday Feb 4th 1859
Subclass 2d Coelelmintha.
sexes distinct. Order 4th
Gordiacea minute long hair
like animals - live in insect
part of their lives - stay here
till several inches long - much
longer than the beetle itself -
then they make a hole out
& inhabit the water. Common
name, hair worm - - - g
supposed to originate from
horse hairs which have fallen
into the water. Genus Gordius
of this order are the hair worms
Genus Trichina are little worms
which inhabit flesh - of man
curled up in a cyst or cell 
sometimes very numerous. are.
Order 5th Nematoidea
Genus ~~Filobria~~ Filaria inhabits

directly under the skin of man and many other animals in the south.
Genus Strongylus very formidable parasite inhabits the kidneys of man & sometimes grows to the length of 3 feet destroying the kidney and its functions.
Genus Ascaris round common round worm in the human intestines. 4 longitudinal band pass all along the body.
Mouth is a round hole opened by the muscels running down the body. A female of this sub class sometimes contains 64,000,000 of ova. It is characteristic of the radiates that the whole yolk turn into the young animal, of the articulates to have it fastened into the back the vertebrates to the belly

Zoology Monday Feb 7th 1858
Class 7 Rotifera or wheel
animalcules. Many tribes of
them have a tail like a telescope
which can be drawn out.
They all have a lot of cilia
which are used to row the
animal along and to create
currents of water setting to
their mouths. The are sometimes
fixed and incased in a cell
or shell. They have a crop,
sometimes a gizzard and behind
these a true digestive stomach.
The sexes are distinct. Females
are far larger than males, and
much more complex in their
structure. Have an alimentary
canal. Circulation is carried
on by a pulsatory sac.

1 Attached, 2 Attached or movable 3 always ~~[illegible]~~ Here longitudinal and sometimes transverse set of muscles a stg common among ~~those~~ lower animals

Fixed rotifer. Have ze spikes. ova few and large. a generation of them lives a vy short time but 16,000,000 of them may be produced by 1 female in 12 days. In twenty four hours one may be made by a female & in 24 more is itself reproductive. They are able to lay summer and winter eggs. the latter having a strong outer shell. When frozen into ice they keep a small space of open water round them. They will stand drying up and recover 4 years

afterwards and recover 15 times of dried up and moistened again, from a 20th & 30th of an inch. Some of them have powers on their tail to hitch onto an object and move on again when it pleases. They are a kind of link between the articulata from them resemblance to the crustacea in some points they also resemble the ciliated pollyps also the mollusks very naturally.

Chemistry Monday Feb. 7th

SO_3 is easily recognized by chloride of barium the white precipitate being insoluble, even boiling nitric acid.

Celiumite or more proper

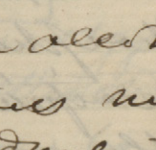
celen, or Celeneon. Metals are made to end in um & ium. Is hard to procure artificially. It reflects light well when not melted. When exposed to 212 it is semisolid & a few degrees more quite liquid. Modern chemists are inclined to regard it as a non metalic ~~substance~~ element. Boils at ~~650~~ 665°. In a new book these figures are nearly double. When selenum is burned in a given space of air it gives a very fetid odor like decaying horse raddish and so may may be dedected in very small quantity. Selenic acid when concentrated is said to dissolve gold. Selenic

acid unites with bases
and forms selenates.
Phosphorous is written
P. combing quantity is
31.44 never found native
nor pure. In small
quantity but universally
distributed in nature —
in apatite wavarites.
found in almost all the
tissues of the animal
& also in the vegetable
The reason of its lighting is
its burning slowly or uniting
with the oxygen of the air
It is extracted from bones
& my also be from urine
bones are first calcined or
burned & reduced to powder
& mixed with dilute

sulfuric acid. It is then
filtered & the small amt
of lime that passes through
with the liquid. Then it
is ~~mixed with powd.~~ then
evaporated rapid to the
consistency of syrup & mixed
with charcoal and dipped
to a high heat in a large
retort, decomposing the lime
and the Phosphoric acid
with the Charcoal are expelled
& passed through a pipe which
dips under water, and the

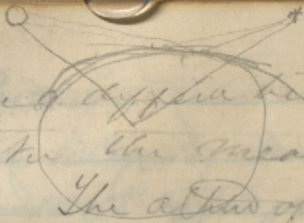
Phosphorus is
precipitated & sinks
& flows off into
the bottom of the water while
the gas bubbles off the water.
It is soft & like wax above

40 but below this is brittle
should be kept under water
melts at 108°. specific gravity
of solid P. is ~~[illegible]~~ 1.77
is clear when melted burns
at 128° or 130°. If it falls on
the flesh when burning it
keeps burning in if not put
out with water. When
exposed to light under
water it turns brick or
carmine red colour. It
is soluable in oil & essential
oils & ether &c but not in
water or alcohol, Boys
sometimes mix it with
oil & daub their faces
with it & make figures &c.

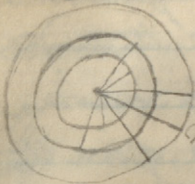


Astronomy Tuesday Feb 8th 1838

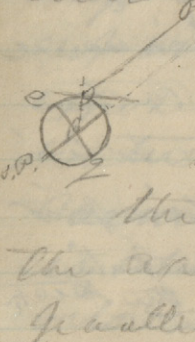
To find the meridian of a place set up a stick & mark the end of it at any time before noon and watch when it is again the same length afternoon and bisect the angle made by those two arcs this will be the meridian. It is usual to place a piece of lead on the end of the stick with a hole in it which gives a well defined point in the shadow. It is best to describe a circle with the stick for the centre & when the point is gained the circle draw the arcs & bisect them. It is customary to have several marks of the stick and describe several circles for checks and



of there be a differ betw
them late the moons.



The altitude of the
celestial pole is
the latitude of the
place & its altitude is
the same angle as the angular
distance from the equator.



The celestial pole
being infinitely distant
the altitude from
the sensible horizon and
the axis of the earth are
parallel so that these elevation
angles are equal taking any
other ~~common~~ right angles from which
the remaining angle & the angular
distance from the equator are
the altitude of the star and the
pole.

$xy \left| \frac{axy + xy^2}{axy} \right| \quad \frac{a+y}{a} \qquad \frac{cx + x^2}{a^2c + a^2x}$

$\frac{11m^2 + 22mx}{3(m^2 - 4x^2)} \qquad \frac{(c+x)x}{(c+x)a^2}$

$\frac{m^2 + 22mx}{3m^2 - 12x^2} \qquad 11 \overline{)13^2 y^2}$

$\frac{m(m + 2x)}{3(m - 4x)^2} \qquad \frac{14x^2 - 7xy}{10ax - 5ay} \qquad \frac{7(2x^2 - xy)}{5(2ax - ay)}$

$\frac{5a^3b - 15a^2b^2}{20ab^3 + 10a^2b^2} \qquad \frac{7(2x - y)}{5(2ax - y)}$

$\frac{5(a^3b - 3a^2b^2)}{10(2ab^3 + a^2b^2)} \qquad \frac{6x^3 - 18xy^2}{6x^2y - 12xy^2}$

$\frac{5(a - 3b)}{10(2b + a)} \qquad \frac{-b}{2}$ ans

$\frac{-3b}{+2b}$ $(-b)$ $\qquad \frac{3(x^3 - 3xy^2)}{(x^2y - 2xy^2)}$

$\frac{4m^3n^2}{2m^2}$

$\frac{x^2 - 3y^2}{x - 2y} \quad x - 3y$

Botany Tuesday Feb 8th.

stamens are collectively called androecia. Monandrous, one stamen diandrous 2 triandrous 3 &c. In the ~~[illegible]~~ Pollen are two coats the outer & inner, called the extine and intine, layers. In the interior of the cell is a liquid with grains floating in it  . When moistened the Pollen grain opens out thus  The affair to which the seeds are attached is the placenta.  The outer cell or envelope is the carpel some botanists regard this as a bud developed in an altered leaf others that it is same as the pea or

bean by attached to the
inturned edges of a leaf.
The gymnosperms as pine
& have no proper carpel
but the seeds lie in between
the leaves of the cone which
are called ovary leaves.
often furnished with
wings to travel in air
ovule in its earliest
stages is known as
into these parts
The tip is foramen
first layer is
primine 2d
secundine then
comes the nucleus and
at the bottom where they
all unite is the chalaza
& the stem that brings the
nourishment the funiculus

Chemistry Tuesday Feb. 8th/59

P is about 4 times heavier than water. Impurities in P add to its inflamability.

Oxide of P is written P^2O
~~Hypophosphoric~~ Phosphorus acid PO is equal parts of P, & O. Phosphorus acid is obtain by putting sticks of it into a funnel and letting it unite with the O of the air & P us acid trickles down into a receiver. Phosphoric acid HO, PO^5 Hydrate state anhydrous state. P. is not Poison

Clorine. Cl. Its specific gravity is 2 Combing vol. of this gas is 1 whole vol. Clorine was formerly called oxy-muriatic acid. It is an element never found free in nature.

Combustion of P. are used as medicine for consumption.

found in combination with metals. Immense quantity in the sea. Cl. is necessity to digestion & Cloride of sodium is written NaCl vast quantities are required in the arts.

Chemistry Wednesday Feb 10th

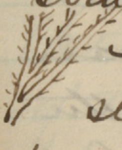
ClO^3 is Clorous acid is of a yellow colour, as the other combinations of O and Cl – Combinations of Cl. and Hydrogen. ~~Hydro cloric acid~~ HCl. Clorhydric acid gas is not a supporter of combustion nor will it burn is coercable with 40 atmospheres or 600 lbs to a square inch. Commonly called muriatic acid made with NaCl (salt)

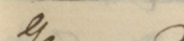
2 equivalents HO (water) & SO_3 (sulphuric acid) The HCl. acid of commerce contains but 1 equivalent of the acid & 16 — as — of water.

Zoology Friday Feb 11th "

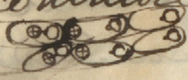
Polypoda are by some considered as low mollusks others as high radiates. Rev Mr. Carpenter lectures on the distribution of the Mollusks. Boreal shells go all round the north pole & come down to Britain and cape Cod but no further. British fauna go south (in the deep) sea to the Canary Islands. The fauna of the West Indies goes north to cape Cod. The tropical

fauna of of the west coast
goes north to the peninsula
of California. The fauna
of the Indian ocean
goes east as far as
the group of islands west
of the Isthmus of Panama
& no further & extends west
to the head of the Red Sea.
The distribution
of the shells of the ocean
does not depend on the
latitude but on the shape
of the land and the
currents of the ocean.
Some shells as Crepidula
which live both in deep
shallow wyh & smooth
water differ expendy in
their shape & colour.

Zoology Monday Feb 14th
Class 8 Bryozoa or Polyzoa. External form of some of them not unlike that of sea weed but the surface is covered with small cells in which the animals live  others something like the outward structure of the Hydroid polyps 
Some stick to shells sea weed stones &c and form patches of cells and one genus Bowerbankia is like a thread running over the surface with a cell at intervals for the animals. These have tentacles which determine currents of water to them

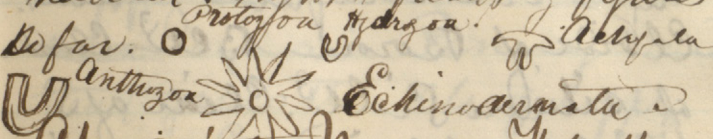
& in other respects resemble
rotifers but when examined
have more intelligence and
more complex structure.
The hard cell is surmounted
by a skiny membrane on
which the tentacles are set
& this is an improvement on
the hydroid polyps. This can be
turned in like the finger of a glove
 Order 1 Infundibulata
marine Bryozoa Order 2
Hippocrepia Freshwater do
— example of order 1 Serialaria —
tube covered with groups of cells
 . Fam. Tubilipora.
Genus Membranipora is the
one which spreads over the
Gulf weed which floats in gulf
stream & also over stones, shells
&c. The genus Lepralia is

common in the Gulf of St. Lawrence



The ovicapsules are developed on them in certain seasons & stick on either above or below the opening & quite alter the looks of them at the season. The name Bryozoa or moss animals was given in England & about the same period the name Polyzoa in Ireland They are placed by some or most naturalists at the base of the Mollusca & by others at the head of the Radiata Rotifera, Entozoa, and Bryozoa are three classes that we are at a loss to know where to place. The Entozoa exhibit in themselves grades from the lowest to the

nighest radiates & run
parallel with them as
it were, but are put into
one class on account of their
habitat. Might represent by figures
so far.



Chemistry Monday Feb. 14

Chloride of nitrogen NCl^3
specific gravity 1/2 heavier than
water or 1.65. Formula of
Alcohol $C^4H^6O^2$. Olefiant
gas $C^4H^3, Cl + HCl$. Dutch
liquid is obtained by ~~exposing~~
the law of substitution by
Cl substituting itself for
H and O. written C^4Cl^6
is a solid substance was
called protochloride of C but
is ~~an~~ analogous to perchloride.

The word radicle means of a set of elements and compounds which seem to form other compounds as if they were simple elements. Cloride of Boron BCl^3. Cloride of silicon $SiCl^3$. Cloride of S S^2Cl. obtained by the direct action of Chlorine on S. is a liquid. There are 2 combinations of P. & Clorine. Terchloride of P. PCl^3. Perchloride of P. PCl^5.

Bromine. The next member of the family to which Cl belongs. is an element. written Br. comb. vol. 1. full no. not found pure in nature. exists in small

quantities in saline springs & in the sea & notably in the Dead Sea. Our spring in Europe used to supply the world but it is ~~now~~ our in Pennsylvania that gives the chief supply now. Salts are some more soluble in hot than cold water & others equally so, & when a water contains a number of salts of diffent kind some (as soda) are thrown down & taken out with a colander when hot then it is let cool & the other kind is taken out, & by alternately this process all salts are taken out & mother water left. It is in this

mother water that both Bromine and Iodine are found. Daguerreotypists use it in putting on the thin stratum of salts of Silver on the plate. Br. is poison. — has a strong affinity for the Metals & forms salts called Bromides. Unites with H & forms Bromhydrates HBr. — & with O & forms an acid called Bromic acid — with P, — with Si Bromides may be tested by putting in Nitrate of Ag. (silver) which causes a precipitate to be thrown down.

Botany Tuesday Feb. 15th 1858

Dividing of the pod or fruit when ripe ~~are~~ is called dehiscence. Fruits as the grape or apple are indehiscent. Carpels or pods are divid into the following kinds 1 Follicle, as the columbine
2 Legume, pod splits on both sides. 3 Drupe same a plum cherry &c. 4 Achenium pericarp closely attached to the proper seed as the seed of the sunflower growing on a receptacle, strawberry is another example, many of these have wings or beads for transportation attached to them. 5 Cremocarp found in the umbellifers as the carrot, parsnip 
6 Caryopsis as wheat
7 Utricle, 8 Nut

9 Samara nuts provided with wings as maple seeds
10 Berry pulpy mass with the fruits inside as currant grape goosebery orange lemon. 11 Pome, as the apple which is the calix with a true carpel within containing the seeds.
12 Pepo cucumber mellon pumpkin &c, in elementry state is a simple three lobed carpel. 13 Capsule all others not included in the other four kinds
14 Silique pod two oarsed with a partition across. 15 Pyxidium when the pod splits transversely as portalaca.

Chemistry Tuesday Feb 13

Br is about 3 times heavier than water – is almost black. Unites with bases and forms Bromides. Iodine is the next element written I. Soda used to be procured from burning sea weeds the same as land plants to form Kallaxsa unites with bases to form Iodides. Is said to be a constituent of the air & all waters. Is found in meats in plants &c. I is derived from sea weeds exists in sea water. Weeds are burned over a hole & the ashes collected – must be burned at a low temperature The ashes are leached and

the lye evaporated, and the salts of soda ~~and~~ sodium, potassa &c are obtained in crystals & by density. These process all these are taken out & mother water left which is rich in Iodine, and by a process of drying with SO^3 and peroxide of Manganese solid I is blue black, or dark steel grey & is heavy, has a metallic lustre. Gives the finger yellow. Vapour of I is about $8\frac{3}{4}$ times heavier than air. I is known by starch. If boiled starch & I will be mixed with

a little I. mixed with alcohol a fine blue is produced. Iodide of lead is a beautiful yellow. Morphia is a test of I & reciprocally the I of Morphia

X. Chemistry Wed. Feb 16th

When I is made to boil it gives of a dup red vapour, sp. grav 8 3/4 more so than air. Iodide of sulphur is used for skin diseases. obtained by mixing S and I.

Fluorine — elementy condition is supposed to be a gas. Combing vol. 1 whole number. Found in nature chiefly in a fluoride of Calcium

fluor-spar. or derbyspar
exist in fossil bones
in teeth — in milk cream
cheese &c. & also exists
in blood, bones &c. and
in some plant com-
bined with silicon. Is
of all bodies the least
apt to be met pure
as it desolves ~~silicon~~
in the silica acid in
glass also desolves
platinum. It is very
difficult to get pure F
from fluorides, It partly
succeeded with the gal-
vanic battery. Hydrofluo-
ric or fluohydric acid
HF — is now called fluorhydric
acid & is obtained by the action

of Fluride of Calcium and
$HOSO^3$ (sulphuric acid)
It decomposes glass by disolving
the silicon & leaves a white
powder - the other constituents
of the glass - as soda &
potash. May be used for
etching on glass - is covered
with wax (on which it
has no effect) then scratch
the letters on the wax &
pour on the H F. ought
to be kept in lead, gold,
or platina bottles or by
coating the inside of
a glass bottle with wax.
3 Ca F (the equivalents of F & Ca / Si)
SiO^3 (1 do silicic acid)
3 $HOSO^3$ (3 do Su. acid) to
produce fluoride of Si

Sil.). There is also a
comb. of Boron & H.
(other compounds of H. which
will finish this section
of the course) Sulf-hydric
acid (HS) when animal
substances are undergoing
decomposition this gas
is evolved. obtained
by SO^3 & pyrite - sulphuret
of Iron. Is coercable
gas. does not support
life - but is poison.
Is inflamable burns with
a pale blue flame.
Detonates when mixed
with oxygen.

Astronomy Tuesday Feb 15

To find the latitude of a place take a circumpolar star, & find its least and greatest altitude ÷ by 2 which gives it mean altitude. In day time take altitude of sun when on meridian & refer to a table where we find the altitude of the sun with the plane [illegible] the plane of the equator on that day and add when he is on the south of equator & subtract when north. Sun crosses equator on 21st March & 21 Sept. The sun is not on the meridian at 12 o'clock (real) time by a

Stroll clock. Sun goes over
1 degree in 4 minutes
or 15 degrees in an hour,
so we can tell the longitude
of a place if we know
the difference of time & if
we know this we can
tell the difference of time
of two places.

Ashore Thursday Feb 17

The difference of real & mean
solar time is called the
equation of time. As 1
hour of time corresponds to
15° of longitude 1 minute will
correspond to 15′ & 1 second
of time to 15″ of longitude. To
to convert time into longitude
& multiply by 15 to convert longitude
to time by 4 observe that

depras in the pictures [illegible] de Beome
[illegible] & [illegible] words.

Exercise 160 French

Pouvez vous comprehende ce mo frere vous dit. Il parle si vite que je ne peut pas ~~les~~ lui dative le accusative comprendre. Vous eleves peut-til vous vous compend. Il me comprendre nne quand je parle lentement, car pour etre compris ~~on doit~~ il faut parler lentement. Faut il parler haut pour append le françois Il faut parler haut. Votre maitre parle-t-il haut. Il parle haut et lentement. Pour quoi n'achetez vous ~~pas~~ ~~rien~~ quelque chose de cet machand. Il vends si cherre que je ne peu rien acheter de lui.

Botany Thursday Feb 17

In all seeds is a mucous coat called primine in the pea seed & testa when adult. The cottony fiber attached to seeds is polygala of parts of this. Secundine next under the primine Hilum is the scar left by the funicles fall of. Caruncle is the loss wy or extension of the outer coat found in some seeds. Nucleus composed of the embryo and albumen, which is not a proper name as it applies to an organic substance containing N. Some seeds will keep more than one year owing to this [illegible]

changing in their chemical properties or becoming so dried up as to be unfit to nourish the embryo. Some seeds are exalbuminous or containing no albumen the whole seed of the interior of the ovule filled by the cotiledons of the embryo or the young future plant containing in itself the nourishment. There is no essential difference between those plants which have but a very small embryo & much nutriment & make sure & those with it already made. The embryo is divided into the radicle, plumule, & cotiledons.

germination of seed requires heat, (55° to 82°) is sufficient to start seeds of the temperate zone, those of the torrid greater heat + those of the frigid a very little above the freezing point) moisture and exclusion of light is best for germination, and accession to air. As soon as the seed germinates & the radicle is pushed forth, the albumen is converted to grape sugar. Some seeds germinate while still on the parent plant others buy forth seed under ground as the peanut.

Chemistry Thursday Feb 17
mix silex gound, or sand,
fluor spar or fluoride of
Calcium and sulfuric
acid and heat the whole
in a florence flask by a
spirit lamp and pass
the gas evolved through
meaning thin water &
the fluorhydric acid is
~~evolved~~ evolved.

Sulf-hydric acid gas
HS when breathed
brings on a series
of symptoms resembling
typhus fever. Bi-~~sulfuret~~ sulfide
or sulfuretted of hydrogen HS^2. There is
some analogy between S and
O. Bisulfide or bisulfuret
of potassium KS^2.

Selenuretted H. HSe is another compnd of H. Selenium has some analogy to S forming a series of compounds somewhat analogous to those of S. Amidogen NH^2 NH^2 a comp. of Nitrogen & H. The compounds of amidogen are called amides. Oxamide is $NH^2C^2O^2$. Sulfamide NH^2SO^2. Carbamide NH^2CO. The mode of preparing the gaseous metallic substance ammonium is as follows. In the Galvanic battery Muriatical gas of ammonia is slightly inflamable shows a

green flame of stytor.
The liquor ammonia is
ammoniacal gas dissolved
in water. Amoniaum
looks something like mercury
& is more brilliant.
& is of the consistancy
of soft butter. Ammonia
is about ½ heavier
than air or .5-91.
Can be obtained from
animal substances is
procured from manufactories
of ivory black &c. hence the old name hartshorn
Ammonia is alcoline.

Zoology Friday Feb 18th

The intestinal canal of the Bryozoans is thus

given is placed a good way down (o) Their nervous system is a ganglion just below the mouth (x) The tentacles are covered with cilia to determine currents of water to them. A group of Bryozoa is called a Coenoecium, the animal a polypide. The animal of the Hydroza is called a polyp & the whole structure a polypary. Directions for collecting the Radiata. To collect the minute animals in a phial & the ends of a

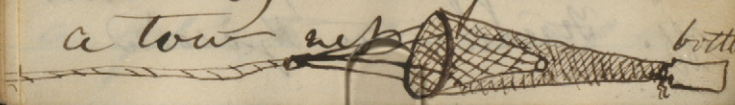
stuff & put it down up
side down till nearly the
point at which you want
to take the water, then
turn it up & it runs the
water & animals. Sponges—
sticky to blades of grass &c
in ponds—gelatinous looking
another species several inches
long, green finger shaped
dry these & immerse in
Canada balsam. Marine
sponges. dredge & dry.
Foraminifera in mud sticky
to oysters & in sponges. dredge
in mud. sometimes in the
sand of the shore, dry the
mud & put it in water
when they float up & skim
off. Fresh water Hydrozoa

polyps may be looked for in the same places as Polyzoa &c. Marine ones will often die of their own accord in a small quantity of salt water. Fly on them protrudes from their cells, when take out & put on a slide prepared for the reception of the preserving fluid (Goadby's solution is good. Recipt.

Salt 4 oz
Alum 2 "
Cor. Sublimate 2 grs.
Rain water 1 quart

another
Salt ½ lb
Arsenic 20 grs.
Cor. Sub. 2 grs
Boiling water 1 pt.

another Spirit 30 under proof 1 quart, Creosote 40 drops. Animals (fleshy & marine) are caught with a tow net

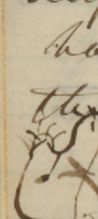


or a hoop with a net across loaded with lead & floated with cork, but the other is best & has a vial attached to its end & a coarse & fine net inside of each other. Star fish are best dropped into hot water & taken out and dried. Small ones are put on stiff paper & pressed with blotting paper after having been dipped in hot water. Holothurian & c are best preserved in spirits or in Goadby's solution. ~~Latest~~ edition of Owen's lectures on the invertebrates is the best ~~text~~ book for this part of Zoology.

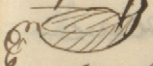
Zoology Monday Feb 21st

<u>Class</u> Mollusca - no skeleton have very complete intestinal canal and digestive system - and nervous system ~~many~~ all of them have a mantle which is peculiar to the mollusca. Their typecharacteristic is bilateral symmetry, that of the radiates Radiate strides. (a). acephala (b) encephala, first have no distinct head & 2d have a distinct head.

Acephela class 1 Tunicata have the mantle lining the inside of the tunic



Class 2 Brachiopoda have two shells & are

always attached either by
a valve or by a fleshy
pedicle. The valves are
placed ventrally & dorsally

have arms to throw
out. Class 3 Lamellibranchiata
valves attached laterally
as the scallop.
(b) Encephala Class
4 Pteropoda have two
wings on side of head

Class 5 Gasteropoda
as the snail
sometimes naked.
Class 6 Cephalopoda
cuttle fishes as the
Nautilus, sometimes naked
but in this class have
internal calcareous sup-
port or rudimentary shell.

Ascidia

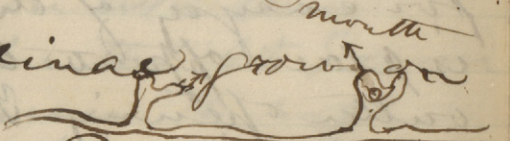
Tunicates, is partly composed of cellulose. form sometimes separate & sometimes grouped Fam. 1 Ascidiadae of order 1 Ascidia some of them are sack & bodon like them found in the St Lawrence others seem to roll about loosely

others have a stalk attached to the bottom which enables it to sit about. They have respiratory and pulsating apparatus The mouth is internal The outer hole is not the mouth but entrance

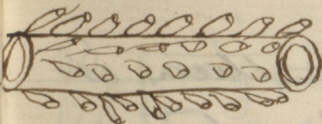
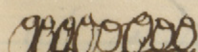
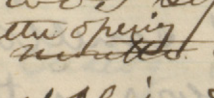
for water which first
bathe the respiratory appar[atus]
then collect to a focus
at the mouth. The
heart sends the fluid
one way the reverses
the motion. The tube
for carrying of the excrem[ent]
is placed opposite the other
outlet opening. The outer
tunic is not muscular
but elastic, but the
inner is muscular,
which when drawn in
~~[illegible]~~ forces out the
water then the elastic
tube tunic expand
& in runs the water
are numerous.

Fam. 2 Botryllidae
grow in star like clusters
each individual has
a hole for taking in
water & have a com-
mon vent

Fam 3
Clavellinae grow on
strips



Fam 4 Pyrosomidae
swim on surface
and are attached round
a common tube &
have a common vent
live in southern seas
each has a leaf like
lip to direct better
the current going in
to the mouth.

 Nervous system
is but one
ganglion. Spake forges
near outter hole (supposedly)
Order Biphora
Fam. Salpidae
only one form. The animals
are aggregated side by side
and ~~disperse~~ look like
bands floating (luminous)
 , but this is only
the young state.
They afterwards separate &
have a ~~mouth~~ outter opening like a
pair of lips & vent
behind  . They
take in the water by these
lips, they then shut & it
passes round inside for
respiration, then goes

to the mouth & then is ejected by a posterior opening. When in the band form each produces an egg which grows to a productive parent which produces the young band of aggregated individuals — thus they are of alternating generations.

Chemistry. Monday Feb 21

Cloride of lime is a destroyer of smells. Clorine being gaseous is the best thing for decomposing smell. H. may be obtained by galvanism from water the O goes to the positive & the H to the negative.

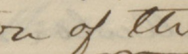
By pouring sulphuric acid on limestone carbonic acid gas is evolved
By pouring chlorhydric acid on the same substance is the same gas is evolved for both set free the ~~same~~ carbonic acid gas of the carbonate of lime but the residues are different. In the latter case the chloride of calcium is the salt produced.

Botany Tuesdy Feb. 22d "
In the present world the phenogamous plants are by far the most numerous & large: The Cryptogamous. The highest class of these are the Acrogens which

includes the Equisetaceae
or horse tails, Club mosses
& the ferns - then class
Anophytes includes the mosses
- the class Thallophytes
includes the lichens, the
fungi & the Algae.
In these cryptogamous plants
there is no proper seed
but only spores or cells
which contain no
trace of the future plant -
one of them of the hyphae
of these (an equisetum)

when these
protuberans of
the outer covery
comes in contact with
moisture down up root
it and it can travel in

more but if this
plan dries up it may
blow away. The dust
of the puff ball is a
great number of spores.
The organs which correspond
to Anthers of Phanerogamous
plants are called Antheridia
& the pistils - pistillidia
The mother cells develops
to 4 spores which develops
into Proembryo. Mosses
prosper have a stem
& leaves - these are
cellular not fibrous. The
antheridium of the moses
sends out a great number
of pollen grains as it were
which penetrate into the
sporangia by the neck
spores

where they become spores & then
getting loose send down a
radicle like the pollen
grain of the seed bearing
plant which then forms
a kind of frond which
ultimately grows to the perfect
moss  . In the
~~class~~ group Anophytes
there is a group of plants
which live in the water
~~& contain~~ a good deal
of lime with jointed tubes called the
Charmaceae. The pollen
or spermatozoon of the
moss is thus  of
which the fork is said to be
provided with moveable
cilia. Some sea weeds
~~produce~~ spores with

Moveable cilia which swim about (not unlike the zoosperms of some of the lower radiata) till they fix themselves either to the bottom or some submerged object when they develope cells and finally grow to perfect algae like their parents.

Chemistry Tuesday Feb 22d 11.

Ammonia received its name from the fact of its having formerly been obtained from Libia in Africa near the vicinity of a temple of Jupiter Ammon. Its equivalent is 17. 14 for N and 3 for H. Salts of Ammonia are numerous. 1st "

Chloride of Ammonia or the old Sal-ammoniac was first found in the chimnies where camels dung was burnd. The Ammoniacal gas from manufacturies of coal gas is what chiefly supplies the substance. The salts of impure salt or Muriate of Ammonia are put into an iron pot & subsimed or melted & crystalized the vapour is condensed in a cold iron pot by just on it top

Sesque carb. of Ammo is ~~carbon~~ $2NH^3 + 2HO + 3CO^2 =$ is a combination of Ammonia & three of Carbonic

$NH^3, CO^2 + HOCO^2 + NH^3, HO, CO^2$

Bicarbonate of Amonia is used by biscuit and cake makers to raise the dough & make it very light. Sulfate of Amonia is another salt of Amonia. The first comb. of H & P is Phosphurett of H. the next is Phosphuretted of Hydrogen may be obtained from Phos acid and ——— Another way is into a strong solution of potassa water & P. This gas is evolved by heating the retort & letting out the gas under water, it is spontaneously inflamable & consists of Phosphorus and H. both inflamable (Experiment)

light
Carbon & Hydrogen or
Carburetted H. — may be
obtained from the bottom
of pond by poking up
the mud & holding a funnel
connected to a bottle over
the place & catching them
we obtain this gas.
is what is called fire
damp, arising from
decaying organic substances
in connection with water.
is inflamable — is the
chief constituent of
common coal gas, does
not support ~~combustion~~
life — is not poisonous
— it exists in Mines
& is the cause of all
those explosions in

coal mines. Is evolved from many springs & sometimes collected for economic purposes.

Astronomy Tuesday Feb. 22

The zenith distance of a star is the distance between it and the zenith. The refraction of the atmosphere makes a star appear too high therefore the allowance for refraction must be subtracted from the altitude as taken with the sextant. The zenith distance of a star is diminished by refraction therefore it must be added to it to give the true zenith distance

The altitude of a star at its lowest culmination is 50° „ 0' „ 8".49 the refrac
is 0 „ 0 „ 48.08 its upper

49° „ 59'„ 20".41

culmination is

52° „ 58' „ 38".31 refraction is 0 „ 0 „ 42.16

52° „ 57' „ 96.15
49 „ 59 „ 20.41

2 | 102 „ 57 „ 16.56

51° „ 28' „ 38.28 = its mean altitude Ans.

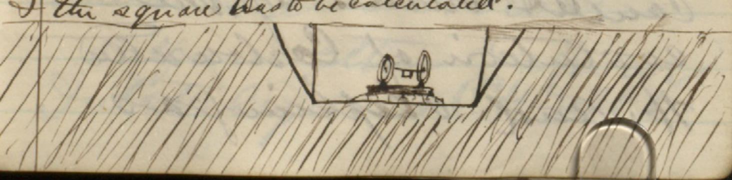
Engineering Wednesday Feb 23d.

To estimate the solid content of a railroad cutting. Rule a set of collums thus, and if a ~~cut~~ grade a a & the rise b b are in these relation to each other at the point it is 0 at 50 feet 4 feet at 100 6 feet

0/4 4/6 6/5

H	h	L	L	(H+h)L
0	4	200	55	200
4	6	300	50	500
6	5	600	50	550
5	7	600	50	600
7	3	340	50	300
3	0	150		150

Mr. Neal's tables give the content of these slopes & the square was to be calculated.



Chemestry Wednesday Feb 23d.
If Carburetted Hydrogen be washed with liquor potassæ or with lime water pure H will be the consequence. If the Carb. H be mixed with twice its vol. of air it detonates best. The means of preventing accidents in coal mines &c. where this gas is evolved. Up to 1814 flint & steel sparks used to be used to light the miner. Geo. Simpson invented & the safety lamp the same time as Sir Humphry Davy. A tallow candle burns by the evolution of Carburetted H. and Olephian gas

which meeting the sheet
of flame ignites & produces more heat and so it con-
tinues. To prevent flame
passing through gauze
there ought to be 900
holes to the square inch,
By holding a tube in the
~~bottom~~ of a flame.
the gas escapes unburned
olefiant gas contains *
$C^4 H^4$ 4 equivalents of
each). sometimes called
bicarbonate of H - is
relatively dense. Can
be obtained by mixing
1 part of alcohol &
3. of sulphuric acid
There is also evolved
sulfuric ether vapour
Dutch liquid is $C^4H^4 + 2Cl$

produced by mixing equal
parts of olefiant gas and
Cl. It is also known
as coal gas. Is obtained
from decomposing oils
Give carb. H requires 2
vols of O to render it
completely combustable
Sulphurett of C. is mix
Iron pyrytes & powdered
charcoal. & distil
Cyanogen is the chief
constituent of Prussian
blue consists 1 eq. of
N & 2 of C written
NC^2. Cyanogen is
written Cy.
Bichloride of mercury is
common Corrosive
sublimate written $Hg\,Cl^2$

salts of cyanogen are called Cyanides. Cy is dissolvent in water & also in alcohol — is inflamable burns with a purple flame Another radicle allied to this is

* If cotton steeped in alcohol be placed on wire gauze & held over a flame the gas escaping from the heated alcohol burns under the gauze but the flame does not pass through till the gauze becomes quite red hot. If Coal Gas be passed through the gauze it burns above but not through under. If Air be introduced into a pipe conducting Coal

gas to the burner the mixture
burns with a blue flame
& emits no smoke because
it is totally consumed but
the same amount of
heat as if it had been
allowed to burn without
being mixed with air—
This is very good for
heating retorts &c instead
of a spirit lamp. It was
George Simpson who invented
the locomotive, and the
saftey lamp almost con-
temporaneous with Sir
Humphry Davy. The
cause of accidents in mines
is most probably owing to the
miners taking out the burner
to dress it or the gauze becoming
accidently pierced. 

Chemestry Thursday Feb. 24th

Flame. The inner part of the flame is called the reducing & the bottom the oxidating flame.

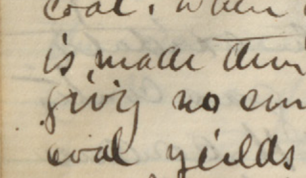
Olefiant gas contains 4 vols of C & 4 of H condensed into 2. Is the best part of all gases usually used for illumination.

Cy so called from its being the generator of blue (Prussian) is a radical. is a poison gas. is soluble in water but the solution is not stable. & so in alcohol is condensable at 3 1/2 atmospheres obtained from the Cyanide of mercury — which is a bicyanide apply heat to this in a

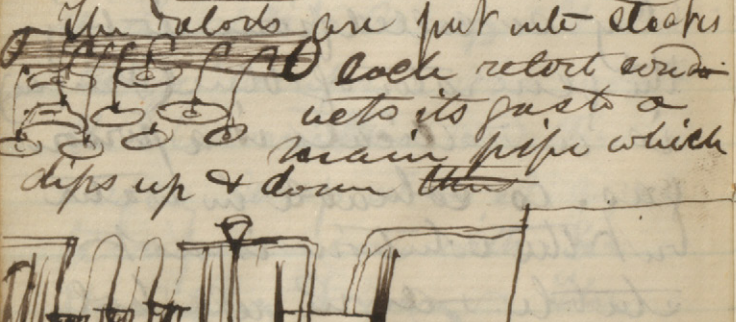
flask & heat with a spirit lamp. A mixture of tar, rosin, or fat of any kind with wood yields a very good gas equal or better than that from coal. when the flame of the gas is made thin it is better burned giving no smoke. 1 lb of common coal yields 4½ cubic feet of gas. Some col will yield 7 feet of gas if it is purified

It is not more than 30 years since coal gas was used for illumination

The retorts are put into stoops



each retort conducts its gas to a main pipe which dips up & down ~~thus~~



fitting it in water which is kept cold by a stream running in. The gas is then purified by passing through a box of lime & water. We judge of the goodness of a gas by its weight.

For Thursday procure case to hold
a small circular protractor
a pasteboard rule. Ruled
paper for plans.
78½ German Street

Shell with long curved tooth
Pholas Crispata
The little shells of which such
enormous numbers was
found in our kidooc at St.
Anne is Tellina Tenera.
The Buccinum from Bay
Chaleurs is B. trivittatum.
Margarita Arctica is the littoral
one. The Scaly cucumber is
Psolus —? & the smooth
Cucumaria —?

List of Fish in stone
jar to go to the States
in the first layer on the
bottom are 3 Capeling from
Mr. Dunne Ae's Woods
in the 2d. 3 more do
from the same place
in the 3d. are 1 Capeling 1
Lance 1, kind of ling &
three small fish look
about an inch & half long
in the 4th. are 4 fry salmon
& 5 or 6 small fish all from
the Ristigouche with our
label. two small fish tied together with
with a label from Metis River
And 4 fish from Rimouski
viz 1 Sardine & three
stickle backs.
In the 5th. are 1 smelt

& two sardines from Green Island and one big dredged in 60 fathoms from Marsoni. (labelled)

In the 6th are 6 fish from Loojnal

In the 7th are 5 small fish from Loojnal

meanings. Spermaty. Ammoniacal gas. Notation. proboscis allotropic coercable gas. Porpary (cyst, cist) is a kind of cell. Synopsis.

Dairy under Professor Hamilton
1 to 3 every day
Mathematics 12 to 1 do
Chemistry 7 to 8 do
French 3 to 4 do
English Literature Two hours
each week 10 to 11
Botany & Zoology 4 to 6 every
day except Thursday & Saturday
criptogamous & Phanogamous
Paranchymatous & Prosenchyma
[illegible]
[illegible] dynamics [illegible]
~~[illegible]~~
~~[illegible]~~
~~[illegible]~~
~~[illegible]~~ [illegible]
Cuticle [illegible]
Collocation Gravitation
Multiple Dynamic or Dynamical
Sublimate [illegible]

Bougière.