

7
"Scope and Plan of the School of Industrial Science," drafts, 1864

MC-0001
B. 15

School of Industrial Science The Institute of Technology

In arranging the plan ~~and course~~ of Instruction ~~of~~ in
the School of Industrial Science provision is made
for two classes of persons — those who may be
expected to resort to the lecture room, & School of
Design for such useful Knowledge as they can
acquire without Methodical Study and in hours,
not occupied by business — and those who enter the
~~School~~ with the view of a progressive Systematic
~~one or more departments, of~~ Training in Applied Science and who have the
preliminary Knowledge as well as time for the
prosecution of its Studies.

On the ~~former~~^{latter} of these division, that a general
more popular instruction will be conducted
~~the method of teaching by means~~
~~alone~~ almost except in the Drawing School
lectures, will be exclusively employed for ~~any~~
~~the Mathematical & Subj.~~ requiring more peculiar
and detailed study will have large class room
modus operandi
teaching will be added & varied. It is the purpose of
these courses, to open the halls of the Institute as
widely as possible to those who ~~do~~, desire to profit
by such teaching, ~~any person~~ ~~whatever~~ who has
~~professed~~ ~~professor~~ studies, will be admitted to
the courses on general & applied science & on drawing
without a preliminary examination, & subject only
to such conditions as are usual in public
lectures. It is to be found best fitted to make
them useful & interesting.

and followed up by a series of smaller
and more scattered patches.
The ground surface is covered with
large irregular stones.

The soil is very thin and
scattered among the stones.
The soil is very thin and
scattered among the stones.

The soil is very thin and
scattered among the stones.

For admission into this department ~~a certain~~
~~degree of preparation~~ the student must give
evidence of suitable preparation.

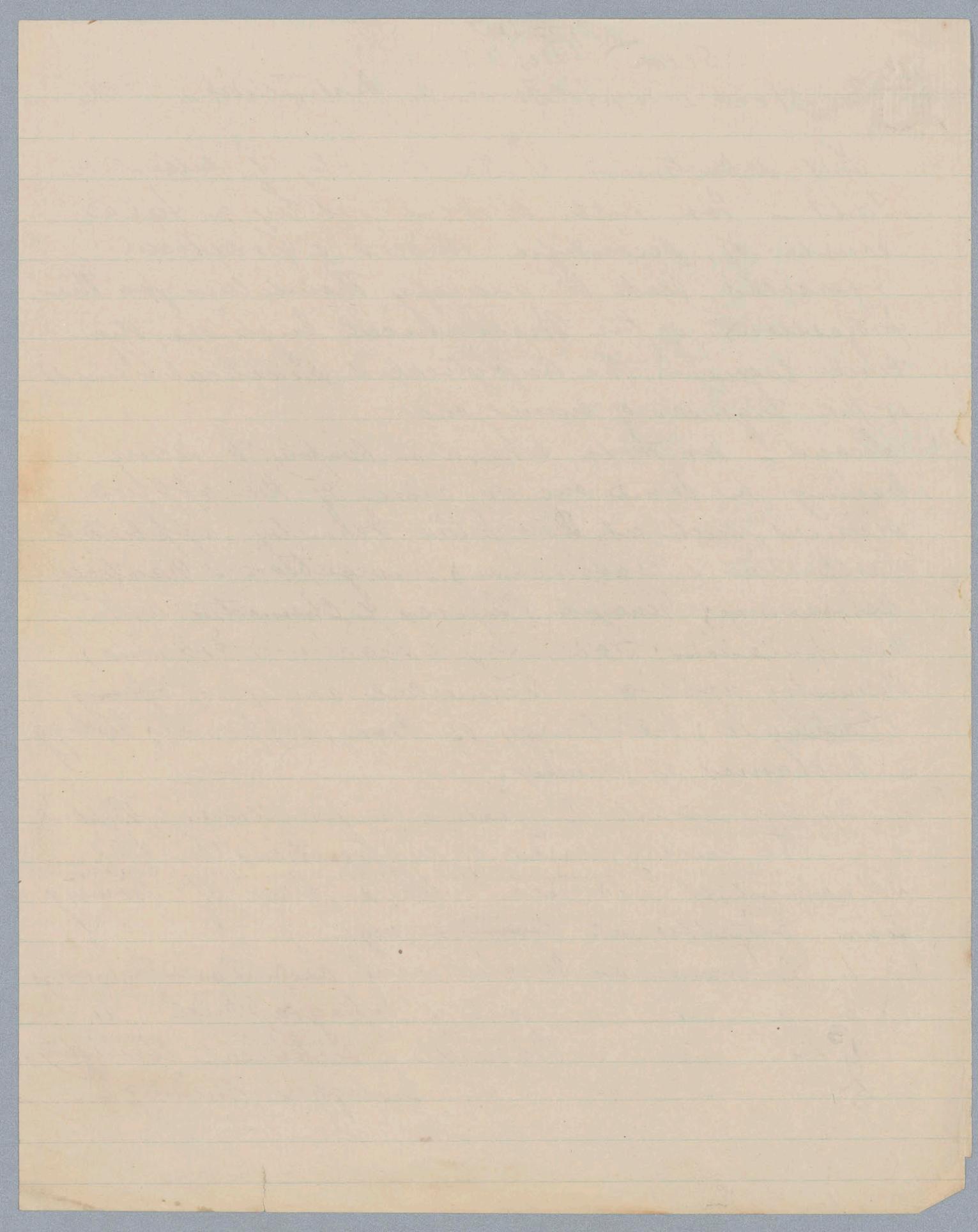
Second Department
Dept. Schedule of professional Instruction

- (2) This department of the School is intended first - for such students as by a full course of scientific studies & practical exercises seek to qualify themselves for the professions of the Mechanical Engineer, the Civil Engineer, the Analytical & practical Chemist & the Engineer of mines and
- (1) Second - for those who aim simply to secure a training in some one or more of the applied sciences, such as Descriptive Geometry applied to perspective & construction, Navigation & Practical Astronomy; General Physics & Chemistry with manipulations; Machinery & Machine Drawing; Chemistry applied to commercial analysis; ~~being~~ bleaching &c; Metallurgy of Iron, Copper &c; Geology & mechanics of mining.

To correspond with the existing lines from Clapier of Proposed Schedule

The entire series of instructions (in this department) is planned with a view of forming four professional courses viz:

1. A course on Mechanical Construction & Engineering.
2. " " " Civil & Topographical "
3. " " " Practical & Analytical Chemistry -
4. " " " Geology & Mining -



The studies of each class are arranged so as to extend over a period of four years including the first or introductory course, but as students will be permitted to enter any of the advanced classes for which they are prepared they will be able in many cases to complete the prescribed course in three or even less than three years.

occur -

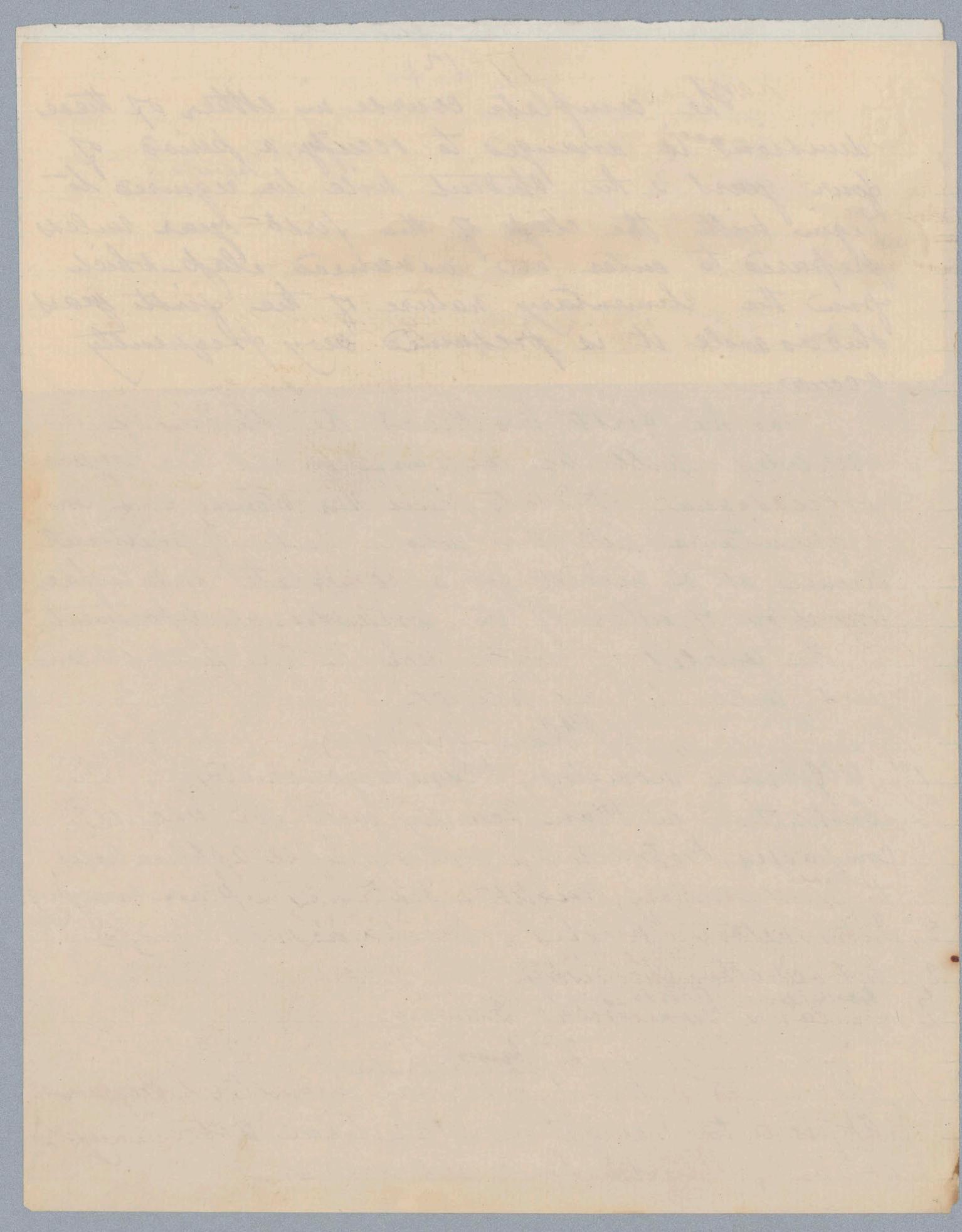
For the first two years the studies & exercises will be the same for all the regular professional students, each thus obtaining such an acquaintance with the whole field of practical science as is needed for a complete & satisfactory study of either of its professional departments.

The courses of instruction in the first & second years will be as follows.

- ^{1st year - Introductory}
- 1st. Algebra, Geometry, Plane Trigonometry
Constructions in Plain Geometry with the use of
Compasses, Protractor & scales Simple Applications,
to Mensuration, Heights & Distances & plain Surveying.
 - 2. Introductory Physics, Mechanics, & Astronomy -
 - 3. Introductory Chemistry.
 - 4. Geometric Drawing.
 - 5. Linear & Geometrical Drawing.

^{2nd year}

- 1 Advanced Algebra, Spherical Geometry & Trigonometry applied to Navigation & Nautical Astronomy
With use of Nautical Scale & Sine &c.



2. ~~Physical~~ Mechanics & Physics.

In this course will be included -

1. The general doctrine of Motion & Force. Statics & Dynamics.
Graphical representation of work. Gravity a Standard of Measure,
& weight. Friction & adhesion.
2. Elements of Machinery, contrivances for modifying Motion & force.
Fly wheels & other regulators. Measurement of power by Dynamometer
Strength of strain. Materials of Materials. Basic work in wood & iron.
Shafts & suspension bridges etc.
3. Mechanics of Fluids. Pressure & flow of Water. Liquid
resistance. Model of Ships. Action of Propellers & paddles.
Pressure & flow of Air. Barometer & aneroid. Water &
air as Motive powers, Mill wheels, Turbines, Pumps, Syst.,
Bellows - Giffard's projector etc.
4. Laws of Sound. Wave motion in general. Water waves, air
waves - Staff & composite, their propagation & reflection. Vibrations
of Sound. Music... Voice. Hearing, construction of Musical
Instruments & Hells, for keeping ~~the~~ music.
5. Laws of Light. Camera & polarized rays. Wave theory.
Refraction - refractive dispersion etc. Spectroscope applied to analysis
Harmonies, Colors in Manufacture & decorative Art. The eye
& vision. ~~Spectacles~~. Compound & Parallel. Compound structures
& action of the Telescope, Microscope, Stereoscope etc.
Illustration of Hells - Lighthouses etc. Suspensions of light by
Photometers.
6. Laws of Heat. Expansion, Thermometer, Change of form in
Structures, Compensating Pendulum. Conduction Radiation
Absorption & Convection. Heat of combustion, melting & freezing,
evaporation boiling. Manufacture of Ice by evap.
Heat & Mechanic force of Steam & other vapors. High,
low & super heated steam. Outlines of the Steam
Engine - the hot air engine etc. Arts of Warming
& Ventilation.
7. Laws of Magnetism & Electricity. Mag: polarity & induction.
the Making of Magnets. Terrestrial force, Venetian & Astrolabe
Forms of the Compass, Conductor of disturbance on ship board.
Motor Electricity - insulation & conduction. Elec. Machinery,
Dynamometer & measure of forces. Induction - discharge
of electricity. Leyden jar.
8. Dynamic Electricity: ~~Pierced~~ Enclosure of currents. action of
single circles - Batteries. Decomposing effects - applied in the
art of Electrolysis. Heating & illumination, electric lamp.
Magnetic properties of Currents - Electric Telegraph
Ruhmkorff's induction Apparatus - Magneto-electric
Machinery and their applications -

1. 2nd day of September 1863. Started at 5 AM
Left camp at 6 AM and crossed the river
and all of us were well dressed up and
prepared for the long march ahead. We all
had our packed traps & saddle bags made. I
had my sword, and revolver, and a gun and all
and off we went across the river. It was
about 10 AM. when we reached the first
station. There we stopped and had some
coffee and biscuits and bacon. After we had
eaten, we started again. We had to go
over a bridge over a stream. And when
we had crossed it, we had to go up a hill.
Afterwards we had to go down a hill and
crossed a bridge over another stream. And then we had

1. Applied Mathematics embracing

applications of Arithmetic, Algebra & Geometry, a.
Trigonometry & descriptive Geometry to business computa-
tions, Weights & measures, Mensuration, Gaaging,
levelling, Projection of maps, Construction of curves
problems in Surveying & Practical Astronomer. Principles
of perspective, Stereotomy &c.

I. Physics & Mechanics

In this Course will be embraced the following Subjects -

- 1 The General Mechanics of Motion & force - the Mechanics of Fluids, ~~and~~^{and} the Laws of Sound & of Light, of Heat & Magnetism & of Electricity - among the other Species topics to be included,
 - 2 Gravity, The Pendulum & its applications, The Elements of Machinery - Estimation of work by Dynamometers - Elastic Strength of Materials - principles of passing -
 - 3 Pressure & flow of Water & Air, Pascals, drainage
Mill wheels, Turbines, Pumps &c Resistance of fluids.
Spins of Ships. Paddles & ~~spiral~~ Screws. Capillary Action.
 - 4 Waves & their propagation - Music - Music Instruments
Voice & Hearing - Holes for Spectres & Music +
+ Sculpture & Pottery etc.
 - 5 Refraction, reflection & dispersion of light - The Spectroscope applied to Analysis - The Microscope - Optical Instruments
Illumination - Comparison of light by a Photometer.
 - 6 ~~Effects of Heat - Respiration & Nutrition~~ Torpedo -
Par. of Corp. & Respiration, Nutr. & Respiration -
Steam - Steam Engine - Art. Air Eng. - Warning &
Resistances -
 - 7 Magnetic polarity & induction - The ~~use~~ Density of Cores
of & Motors - Construction of ships.
 - 8 Motor Mechanism - ~~Electric~~ Machines for producing st. & alternating
& direct. Currents.
 - 9 Dynamomites - ~~Electric~~ Machines for producing st. & alternating
currents. ~~Electric~~ batteries & their char. Magnetic & other
effects. ~~Electric~~ Telegraphs - Electric Lamps.

2

In the Department of Special, professional instruction
the class ~~should~~ ^{Studies & examinations} ~~laboratory~~, exercises ~~would~~
~~be added the study of models~~ ^{as wide as possible to those} ~~it~~ would be added.

And at it is the purpose in these more
general & popular courses of instruction to open the
walls of the Institute ^{as wide as possible to those} ~~to all~~ who may desire to profit
by such elementary practical teaching no preliminary
examination will be necessary for admission.

The regular, Department of General Instruction -

Plan of the ~~I~~ ^{or} Department

(1)

more pursuits, as well as ^{other manufacturing} many whose leisure
& taste lead them to profit by such instructions.

↑

II. Department of Special and professional instruction.

This Dep't of the School is intended, first such students as aim at a systematic training in one or more of the specialties of Applied Science; ^{& second} as well as, those who by a full course of scientific studies and practical exercises seek to qualify themselves for the Professions of the Mechanical Engineer, the Civil Engineer, the Analytical & practical Chemist and the Engineer of Mines.

The Parting Feels ~~before~~ ^{before} opens some days in March and continues ~~every~~ ^{every} week. Students are to determine the courses of study which will be pursued by the department. It is now ^{the} custom for the students to open their work, the building entered by the completion of the bridge and come together at the bridge, now in course over the river having no bridge. Then comes ~~when~~ ^{before} 10 A.M. Prof. R.

The Secretary for Defense will be listed. —

At the close of 11-June term, & will be partly
written & partly Oral - Admitted does his efforts
for ever - This moment, in these moments, the
I The Oral exam, over by the student take the Chair,
with the student, & be called up singly & be cross
examined, & be called up singly & be cross
examined from the rest, & the State I will to present
& the interview, like others over the whole series
of Students, & all be Laboring Lab Oral Blow.

The Lab. Wing of the School will be designed to embrace the following departments -

L. Physic & Mechanical Laboratory

Decca Laboratory for Productive Generation

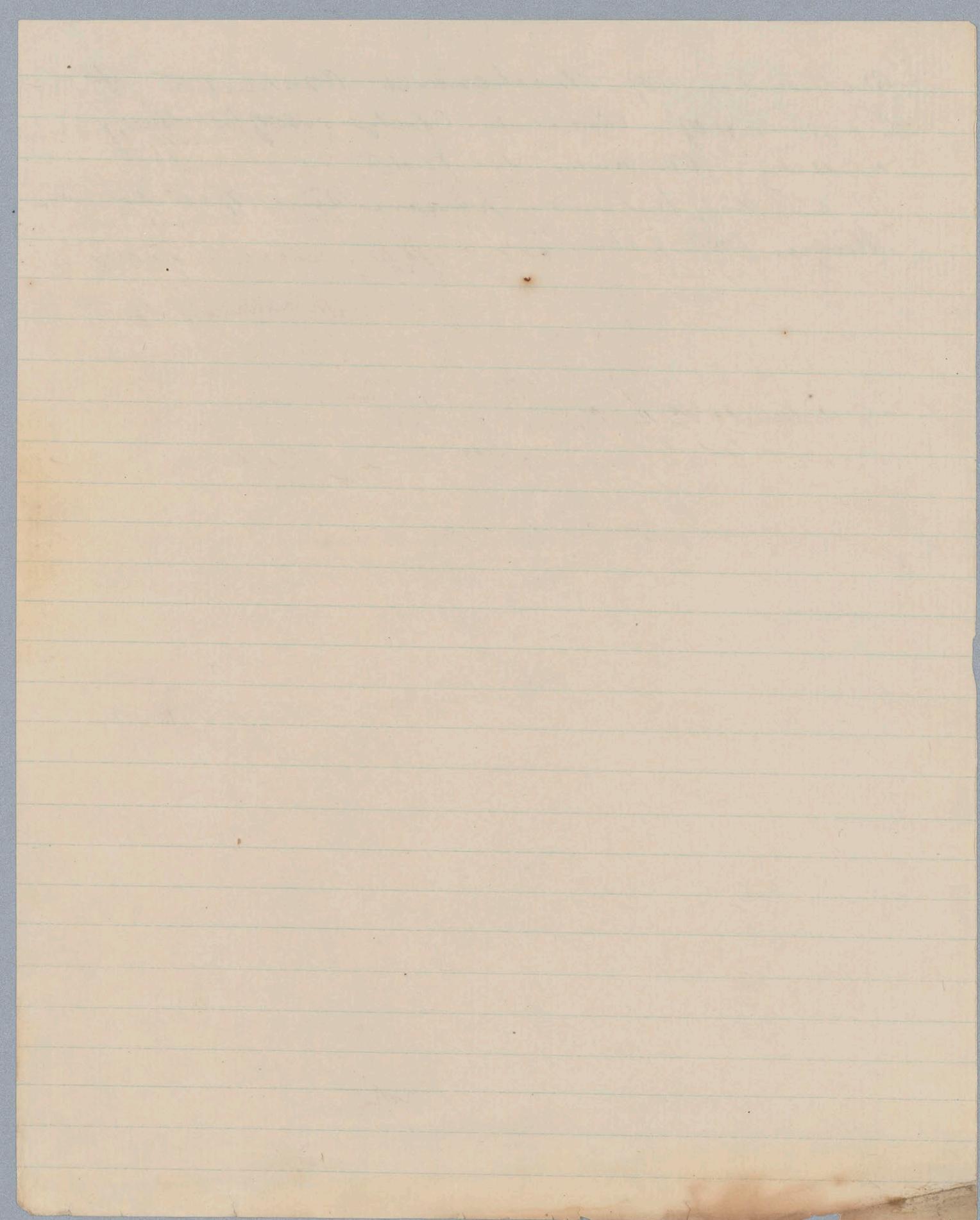
A Chem. Analys.

Q3. - a decision, for deletion,

It is ready to take
place. The Physic & Mechanic Society of
London, ~~has~~^{is} made
little in the way of experiments. Mr. MacLennan's little
power, for repeating & testing their results, as observed
in Physic & Mechanic's Society, for experiments
for testing the effects of "Vibration" by the Dyson and
other girls, for ^{producing} ~~produced~~ a flow of water & air.
The 12th night of November, October, is to be celebrated
as we, the ^{12th} ~~12th~~ ^{the 12th} girls, ^{are} playing in the
Rectory building. To the audience
the Hon. Mrs. ^{and} Dr. Mrs. ^{and} Mr. ^{and}

2

Matteries of Mechanical Construction of
Physics or of Chemical Analysis, or Metallurgy
& Mining - The young students, we find, that
they are duly prepared to pursue such Specieles -
Studies with advantage.



On Diplomat Certificate -

As the object of the Diploma or Certificate is intended
not only to be a reward to the Student for his
diligence and attainment, but an assurance to the
public of his knowledge & skill in the particular
department of Applied Science to which it relates -
it will be confined ~~only~~^{strictly} on such students only as
by their examinations & other exercises ^{and} prove fully
that they possess the prescribed qualifications - but
all students who fulfil ~~the~~^{the} requirements
~~will~~ ^{will} be entitled to these testinomies
of the Institute without regard to the greater
or less number of courses ^{in the institution} they
may have attended.

To limit the case of Students who ~~are~~^{have} at a
general ~~such as my~~^{such as my} desire that he can master
~~general~~ Scientific Education rather than a professed
& especially such as ~~can~~^{can} be teachers
among the Applied Sciences - The ~~for~~^{for} object of my
Studies ~~but~~^{but} afforided embraces the whole of the
two first years & certain parts of the third year's
Course with extensions - ~~but~~^{but} as form the general
Scientific Course, for preparing in which
the Degree of Bachelor of Science will be confer.

Specie Subjects. We must now prepare a
dissertation on some subject in Applied Science

On Diplomas & Certificates -

As the object is, the Diploma or Certificate is intended not only to be a reward to the Student for his diligence and attainment, but an assurance to the public of his knowledge & skill in the particular department of Applied Science to which it relates - it will be confined ~~only~~ ^{mainly} on such students only as by their examinations & other exercises ^{such as drawing} prove ^{to} possess the prescribed qualifications - but all students who fulfil ~~the~~ ^{the} required ~~qualifications~~ ^{qualifications} shall be entitled to these testimonies of the Institute without regard to the greater or less number of courses they may have attended.

The Degree or Diploma course, with its various divisions of the School as before indicated will be as follows -

- | | | |
|---|--------------------------------|-----|
| 1 | The degree Mechanical Engineer | ME |
| 2 | of Civil Engineer | CE |
| 3 | of Topographical Engineer | TE |
| 4 | of Builder & Architect | B&A |
| 5 | of Industrial Chemist | IC |
| 6 | of Geologist & Mining Engineer | GE |

To be entitled to either of these degrees, the Student must pass a satisfactory examination on the whole course of studies ^{& exercises} presented to his department including the elementary & general as well as the advanced & specific subjects. He must moreover before a ^{time for} dissertation on some subject in Applied Science

- (a) To the Admision of Students
Students who are admitted to the
Institution or first year, come up to the
Mark he has attained at age of 15 years &
must give evidence of having in all the
of Education, training in Mathematics
the elements of Algebra; as well as passed
c) In order to enter the 2nd year's course -
they must be at least 16 years of age - and
give evidence by examination of their knowledge
of all subjects of the first year, Studies as would
make a student a recipient of 1st to 1st 2nd
year, and do likewise rule out applying to the course
of Students, leaving admission at the close of the
3rd year of the 4th year.

- (a) The two leading principles governing the admission
of Students, in the Department of the School are
1st That all persons who are qualified to
enter upon any of the full courses of the
several Studies of the School shall receive
the fullest opportunity of doing so - - -
2nd That no Student shall be admitted
to any of the courses of instruction who does not
the previous privilege required for the
Studies fully pursued by the Student proposed.

done or original

Or A Report on some Machine or work of Engineering
 or upon some New or Existing or Chemical Inven-
 tions which shall be Approved by the Faculty of
 Architecture or other Engineering Board - *

Besides the Degrees or Diplomas covering the
 complete course of Proprietary Studies, there will
 be given Certificates of attainment in specific
 subjects to such students as do ~~examination~~
 are found to have attained the required proficiency,
 2. Those - Among the above studies for which
 this testimony may be given - are -

C. Mackoni Drawing

Topography & Construction , }
 Architecture " , }

{ Gen. Chemistry & Physics with Manipulation
 Chemistry Analysis
 Mineralogy & Geology , }
 Descriptive Geometry & its applications
 Mathematics applied to Mechanics;
 & Machinery -

Mathematics applied to Construction -

Methods & Apparatus of Instruction

The Instruction in the Dep. will be given through
the medium of lectures, examinations, the solution of
practical problems, & practice in Physical & Chemical
Manipulations, ⁵Laboratory training in Chemical Analysis
and Metallurgy; ⁶ Drawing & the Construction of Technical
plans & projects of Machines & works of Engineering & Archi-
tecture; ⁷ practical exercises in Land Survey, including
Geodesy & Nautical Astronomy; and ⁸ Examinations
for the Inspection & Study of Machinery, Motors,
works of Manufacture - buildings, works of engineering
Geological section, Quarries & Mines.

Lessons, &c., etc.

As a general rule each lecture (or exposition) will
be preceded by an oral exam. upon the subject of the
previous lecture (or exposition) in which the teacher
will have the opportunity of re-aspecting the instructions
already given as well as of testing the progress of individual
pupils. ^{After the first few} The student will be expected to take
notes of the lecture, as they proceed, and afterwards to
work them out with the necessary changes, or
drawings, etc., as far as possible, in connection with each other, so
as to afford immediate study ^{or reference} & future reference.

- P. In addition to the notes of lectures he will be
expected to study & to consult best books on works
of reference, & whenever such are appointed to be
used, but in view of the value of the Method
of Lectures combined with examination, as a means of
examining the attention & knowledge, the fees of instruction
will be based upon the number of students taught, & the time spent.

This Method will be used whereon practicable, and in no case will there be book Recitation, the ordinary relied upon - ^{using habituation to the work} The Student will take the apostolae of his teacher, & corrects his Notes in accordance, from the Methodic Order.

Where familiar expositions replace the formal lectures, are given as many as the Teacher, Clapse, &c. The instructions connected with Laboratory work, the Student will be called to be interrogated by his teacher from time to time on the progress of this Lecture, as well as at the Conclusion.

Oral & Written examinations

As frequent & thorough examinations form the best means of inciting Students to diligence (in their studies) as well as of testing their progress, & of finding out those individual needs & difficulties which the teacher should endeavor to obviate - they will constitute a leading feature in every department of instruction in which they can be employed -

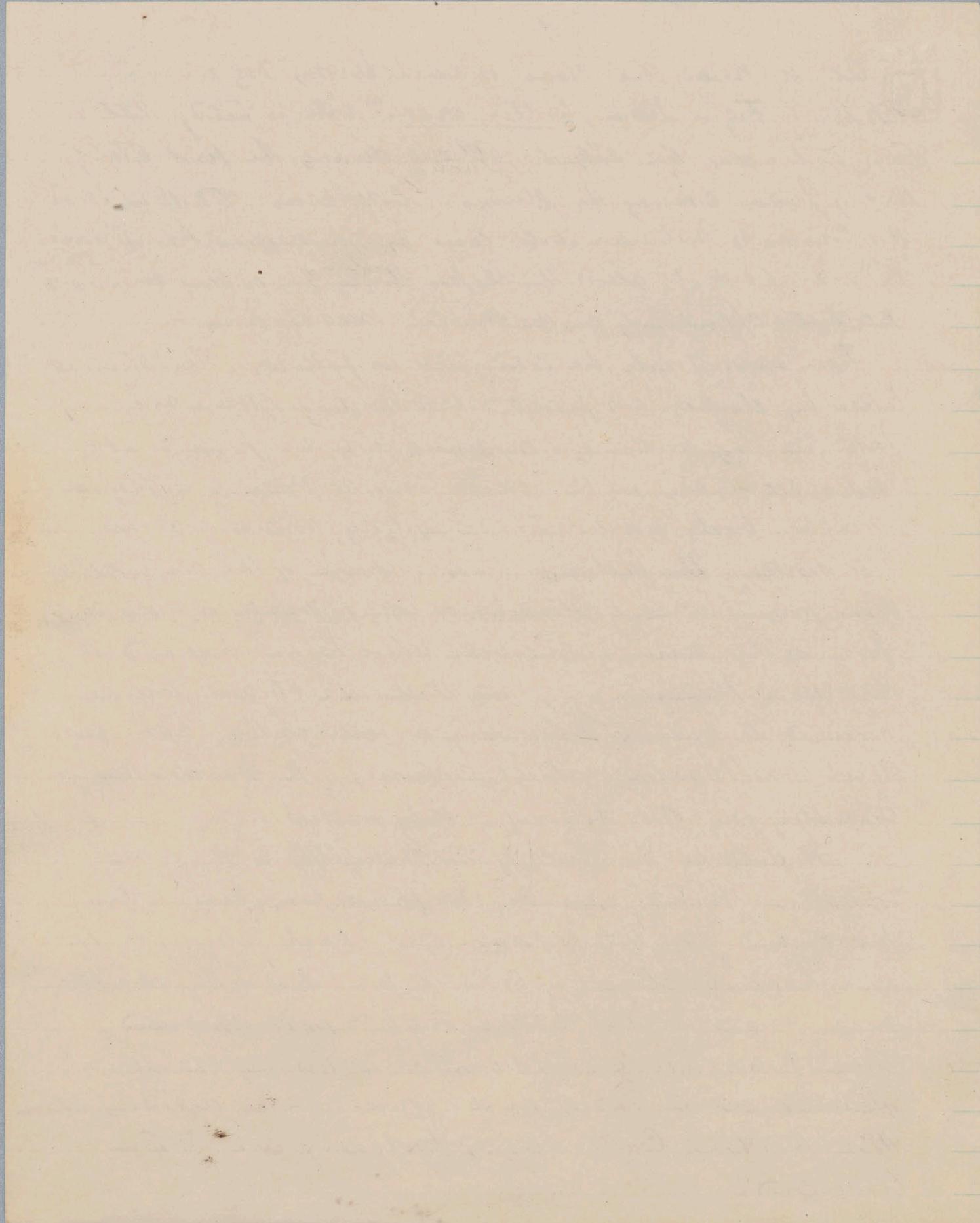
Besides the daily Oral examⁿ already referred to as frequently accompanying the Lectures, Oral examination will be held once every ^{from} ^{month} weeks, separate from the Lectures, on a day set apart for the purpose, at which each entire Class, or, when numerous, parts of it in succession, will be examined & drilled in the subjects best suited for opposition for study since the preceding like examination -

At or near the close of each term, now in the months of Feb & June, written examⁿ will be held, that of Feb embracing the subjects of study during the first term, that of June covering the studies of both terms. On these occasions the course of instruction will cease and a sufficient period will be set apart to allow the classes time for a brief review of ^{Studies} full opportunity for their several exercises.

These exams will be conducted as follows. The student, taken by classes, are provided with writing & where necessary with drawing materials, implements will be placed at separate tables, in the exam room bringing with them neither books, nor memoranda of any kind to aid them in their work. The instructor having charge of the class will then furnish to each student a copy reprinted or written form of the series of questions which he has prepared to test their proficiency, and these the students will be required to answer in writing as well as they can from their own knowledge without consulting with one another or consulting any other source of information.

It shall be the duty of the instructors to keep a numerical record, according to forms hereafter to be prescribed, of the performance of each student in the several classes, both at the ^{monthly} 4-weekly, or at any examⁿ as at the winter examⁿ just described.

These records will form the basis for determining the standing of students at the end of each course & for deciding upon those to whom certificates of proficiency are to be awarded.



The Manner & Time for Degrees will be held at the close of the June Term & will be partly Oral & partly in Writing - In the former each Candidate will be interrogated apart from the rest, & the latter the Method of proceeding will be the same as at the term examinations, above described. In both, the interrogations, will range over the entire series of Studies, or what the Student is required to be prepared.

As part of those ^{above} ~~above~~ The Candidates will be called upon to exhibit the Drawings & Projects, prepared by them for the occasion - And to perform ^{such} Laboratory, Mechanical, & mechanical as the Cases & Circumstances may require.

At the same time the Theses of all the Candidates will be brought forward in order, and where expedient their Authors will be called upon to explain or defend them.

As the Candidates for the Degree of Bachelor of Science will be expected to make most close & keen use of Science, they will each be required to shew their capacity in this respect, by giving an oral explanation or brief lecture on such subject introduced in their Studies, as may be assigned after the return of the papers.

As a means of enforcing the instructions of the lecture room, and of enabling the student to acquire facility in the application of principles to specific cases, problems will be given to the students to work out in the Mathematics & other classes where they are offered, of which written solutions will be required within a specified period. & these solutions the students presenting them may be called upon to explain.

Practical Physics & Chemistry, Manipulation.

It will be the object of these exercises to provide the students practically familiar with the dissection, & washing of the apparatus & agents employed in the more important experiments to proceed in ~~the~~ ^{under the} Natural Philosophy & Chemistry & with this view they will be ^{under the direction of an instructor} called by small classes at a time to execute with their own hands various experiments in Mechanics - Optics - Sound - Electricity & the branch of experimental Physics - and to facilitate chemical reactions, do best up the apparatus for carrying out experiments, to prepare gases & the products of desinvolte their properties by suitable reagents, accompanying these manipulations when required with an explanation of the apparatus used or of the process or operation performed. These exercises will be held in the lecture rooms or where necessary in the appropriate laboratories hereafter to be described, as at the time may be found most expedient.

At or near the close of each term viz in the months of Feb. & June written examinations will be held at 11th of Feb. covering the subjects studied during the first term & 1st of June covering the studies of both terms. At this time the classes will be suspended a number of days the set apart sufficient to give to each class some time for review, & a full opportunity of preparing the examinations.

The examinations will be conducted as follows—
 The students ^{Catered by class} from both winter & summer reciting will divide themselves into separate classes, & will be asked to take their seats at separate tables in the room with the number of seats arranged so as to avoid crowding. The instructor keeps charge of the department with them furnished & seated his or her self at the front of the series of seats, where he can easily perceive his pupils, & keeps the students will be called upon to answer in pairs as well as when called without referring back to each other & what answering done will be of the separate responsibility.

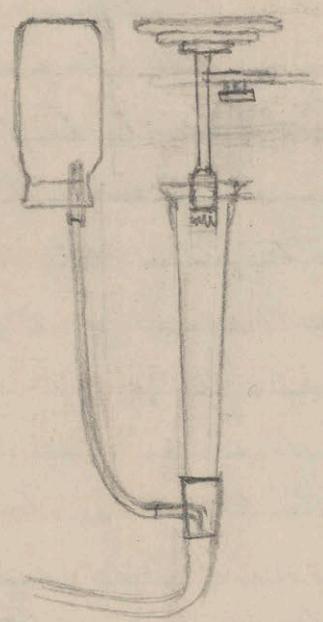
Laboratory & Laboratory Training -

The Laboratory arrangements of the school are designed to embrace the following departments -

1. A Physics & Mechanic Laboratory -
 2. A Laboratory for general Chemical Analysis;
 3. b. Laboratory for Metallurgy & Minerals
 4. a. Laboratory for Industrial Chemistry -

In the Physic & Mechanic laboratory it is proposed
to provide instruments & apparatus, with which the student
may be exercised in ^{a variety of} Practical processes & experiments, how-
ever he may be compelled to practice the methods of Observing Matter,
Sight, by the Dynamometer, will make experiments on
the few objects in his power to test the strength & the
various materials used in construction, ^{with the help of} Accurate tools
be given for practice in the use of the Microscope, -
~~and~~ room will be provided for Photometric observations -
when the student may bear familiar with the theory
especially the light & gas & other elements, Materials -
the value of different kinds of Lenses, burners & their
appendages.

Besides the numerous publications of the Students,
these Laboratories will be used for the prosecution of
experimental & investigatory work subjects referred to them
by the Committee of the Museum or the City
Cemetery, the manufacture & testing of new devices
& materials, & the conducting of Organic research by the
different departments of Applied Science. In these latter
studies & experiments, the advanced students may, when expedient,



114 Laboratories, and Laboratory-training.

The Laboratory arrangements of the School ~~are~~
designed to embrace the following Departments -
1. A ~~Practical~~ ^{Laboratory for Physics & Mechanics} ~~Practical~~ ^{and} ~~theoretical~~ ^{laboratory}

2. A Laboratory for general Chemical Analysis & Manipulation

3.. A Laboratory for Metallurgy & Mining

4 A Laboratory for Industrial Chemistry.

Besides the immediate instruction of the Students these laboratories will be used for the prosecution of experiments & investigations on subjects referred to them by the Committee of the Museum and the Committees of Arts, including the examination & testing of new Machines & processes and the conducting of Original research in the different departments of Applied Science; and in these Critical Studies & experiments the Advanced Student may when expedient be permitted to assist.

Laboratory of Physics & Mechanics.

In this Laboratory of Physics & Mechanics it is proposed to provide Implements & Apparatus with which the Student may be exercised in a ^{mechanical & physical} variety of processes & experiments. ^{thus} he may learn practically the methods of estimating Motors & Machines by the Dynamometer, of making experiments on the flow of Water & Air & of testing the strength ^{become} ~~make~~ ^{make} materials used in construction; he may ~~become~~ ^{make} familiar with ~~principles~~ the Adjustments and Applications of the Microscope, ~~be practiced in observation~~ ^{be used for observation} with the Thermometer, Barometer & Hygrometer, and in a room fitted up for Photometry may learn the mode of measuring the light produced by gas & other sources of illumination & the value of different kinds of burners lamps & their appendages.

Concordia *in* *scriptura* *ad* *concordiam* *et* *coenitatem*

Laboratory for General Chemical Analysis (II).

In the Laboratory for General Chemical Analysis provision will be made for (as is designed to provide) a complete & comprehensive course of instruction in qualitative & quantitative analysis embracing organic as well as inorganic substances, and blending frequent lectures with the systematic practice of the laboratory. Student, proposing to take this course will be expected either to have passed through the first two years teaching at the Institute or to be possessed of such knowledge of general Chemistry & physics as these preliminary studies are intended to impart.

Besides this extended course it is proposed to have certain partial courses in which pupils may obtain ~~practical~~ instruction of a more specific kind without going through the entire range of laboratory training - Such would be ~~courses~~ among the following:

- 1 ~~Exercises in Blowpipe Analysis -~~
~~Exercises in Blowpipe Testing -~~
- 2 Household & Confectionary Analysis, including the testing of Water, Detection of Adulterations in foods, Alcalinity & Acidity -
- 3 ~~Medico-legal Analysis. The analysis of Urine &c. &c.~~
Detection of Arsenic & other poisons -
- 4 Analysis of Soils & Manures.

Laboratory for Mining & Metallurgy

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Connected with the general laboratory but forming a distinct department will be a Laboratory of Mining & Metallurgy designed for specific instruction in whatever relates to practical Mineralogy, the chemical valuation of ores and the operations of smelting and other processes for the separation & refining of metals. In this department students already ~~trained~~ to some extent in analytic processes will be exercised in the examination & dissection of rocks & minerals by mechanical & chemical tests, ~~shall~~ be carried through a course of practice with the Blowpipe; ~~and~~ ^{and} be taught the several methods of assaying ~~assay~~ing the Ores & alloys of Copper Iron Lead Tin & other useful metals, as well by the dry as the wet method, and of analyzing the fluxes used in the Smelting furnace & the Slags resulting from the Blast, and of determining the combustible value of the Mineral or other fuel with which ~~are~~ furnaces supplied.

In aid of these instructions the ^{student} will have the opportunity of studying the Modes of Mining & Metallurgical Implements & Machinery & the collection of rocks, fossils, Ores & Minerals provided ^{and arranged} ~~and arranged~~ specially to facilitate his studies in this department.

Laboratory for Industrial Chemistry

It is further proposed to connect with the general laboratory a department of Industrial Chemistry where students may have an opportunity of becoming practically familiar with the materials, implements, and processes of the more important Chemical Art, & Manufacture.

In this department will be provided a collection of Dye stuffs, Standards, Discharges & other ~~Substances~~^{Substances}, used in the operations of Dyeing, Printing & Bleaching, together with such apparatus as may be necessary on a small scale to exemplify these several processes as in actual use. ~~How~~ ^{Specimens} ~~which~~ ~~are~~ ~~to~~ ~~be~~ ~~seen~~ ~~by~~ ~~the~~ ~~student~~ will have access to ~~the~~ ~~center~~ ~~of~~ ~~the~~ ~~operations~~ ^{increase} ~~for~~ ~~the~~ ~~practical~~ ~~examination~~ ~~Specimens~~ ~~of~~ ~~the~~ ~~various~~ ~~Materials~~ ~~&~~ ~~products~~ ~~of~~ ~~the~~ ~~Glass~~ ~~&~~ ~~Pottery~~ ~~Manufacturing~~. ~~The~~ ~~different~~ ~~Soaps~~, ~~Soda~~ ~~Ash~~, ~~Bleaching~~ ~~Salts~~, ~~Acids~~, ~~Salts~~, ~~Products~~, ~~Dyes~~, ~~Pigments~~, ~~Tanning~~ ~~Inks~~, ~~Cements~~, ~~Water~~ ~~Glass~~ & other Materials & products of the Chemical Arts, and will be provided with ~~the~~ ~~use~~ ~~of~~ facilities for studying practically the reactions & processes ~~of~~ ~~the~~ ~~various~~ ~~processes~~ connected with their use or manufacture. Power will also be made for the practical illustration of the Chemical Modes of Engraving & Lithography, and of ~~the~~ ~~use~~ ~~of~~ ~~the~~ ~~various~~ ~~Methods~~ & ~~processes~~ of ~~Electro~~ ~~Metallurgy~~, ~~Electro~~ ~~Metallurgy~~, as applied to Silvering, Golding & the deposition of Copper & Brass.

and all is silent and dark.

around

around a field and meadow

and a field

and about

as far as I can see

nothing

nothing but fields

nothing but

nothing but

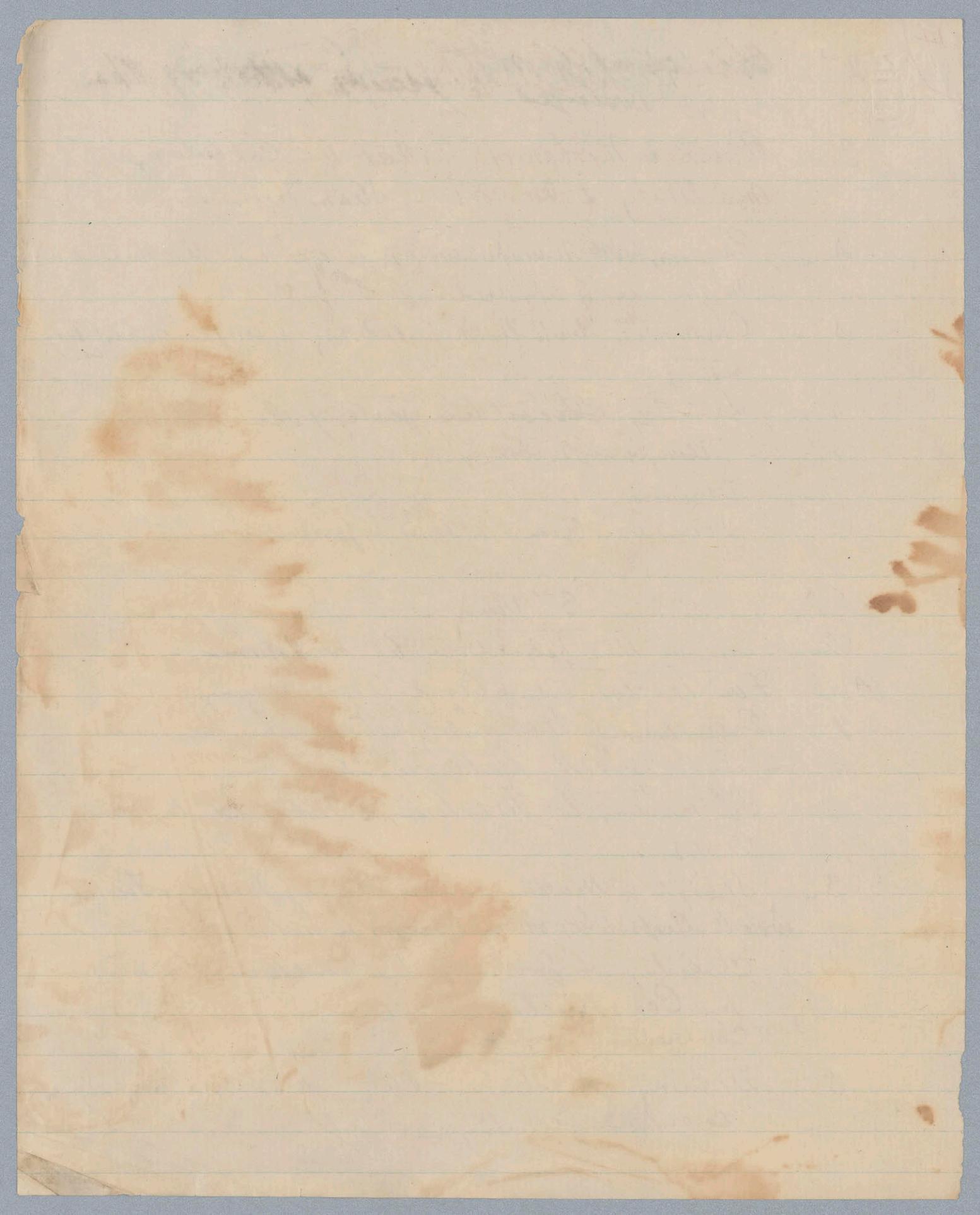
nothing but fields

- 4) 2^o. Analytical Geometry - Curves ³ & Surfaces,
3. Rational Mechanics without the Calculus, after
Machinery & Motors - Steam Engines &c.
4. Physics, with Manipulations to exercise the Student
in the use of apparatus.
5. Chemistry, with Manipulations, & Simple quantitative
testing.
6. ~~Lithology~~ & Descriptive ^{some} Geology.
7. Metamorph. of Rocks
7. Drawing - Descriptive Geom. applied to perspective.

3^o. Year

The Studies, of this year will be as follows -

- (A) For Mechanical & Civil Engineering.
1. Extension of Rational Mechanics, the use of
& the Diff. & Int. Calculus, etc. ^{Principles of Machines & Motors -}
2. Application to Machinery & Motors, & Hydromechanics.
3. Strength of Materials - Properties of Iron, & Steel
Brick, Rags, Wooden, Boxes, etc. &c.
4. Chemistry & Test of the Materials used
in Construction -
Combustion & Fuel -
5. Drawing of Machinery - Plans, Projects, of Descriptions,
Descriptive Geometry -



3rd Year.

(C) For practical & manufacturing Chemistry -

1. Lectures on Concrete & fine wire -
1. Chemical Analyses qualitative and quantitative
by lectures & Laboratory exercises -
^{including 15 Polymerization Method}
2. Description & Determination Mineralogy - Way of
1. Use of Blowpipe - Lectures & exercises
3. Lectures and illustrations on Industrial Chemistry -
The Manufacture of Glass Pottery. Tiles - Soaps. Bleach
^{Salts Soaps Glazing &c}
4. Drawing of Apparatus, Plans & Projects for
Chemical Works &c

3rd Year

(D) For practical Geology & Mining -

1. General Lectures on Concrete & fine
1. Chemical Analyses qualitative & quantitative - &c
by lectures & laboratory exercises -
2. Description & determination Min. Blowpipe Methods
by lectures &c
3. Lectures on Sheet Geology - of Coal & Iron
Copper. Lead &c.
4. Drawing - Machinery of Mines - Scams. &c projects
Descriptive Geometry

E. For Practical Metallurgy

The course will be the same as that for Pract. Geol. & Mining
except that the ~~Geology~~^{more} in Drawing will be specially directed
to Metallurgical Office. Plans & Projects of Iron furnaces, Copper
works &c.



(5)
4th Year

for Mechanical Engineering

1. Construction of Machines Continued -

Engineering Drawing -

Mechanics &c

2. Motors & Locomotives, Steam & Steam Engines - Stationary - Locomotives & Marine - An Engine is Engines & Shuttles

3. Construction & Arrangement of Manufactories ~~Wool Factories~~ - In Grain Mills - Mills for Textile Manufacture - Rolling Mills &c &c

4. Descriptive Geometry Machine Drawing

4th Year

Civil Engineer -

- Survey & Ordnance Survey - with Practise
1. Location & Construction of Roads, Pavements &
Canals.
2. Water Works. Supply & Distribution of Water
Estuaries, Rivers & Canals, Pumping Stations,
3. Mason work. Arches, Bridges, &c of Stone.

Structures in Iron - Iron Columns, roofs, -

Timbered bridges - Timbered bridges -

4. Descriptive Geometry -
Topographical Drawing -

4th Topographical Eng.

Descript. & Ordnance Survey -

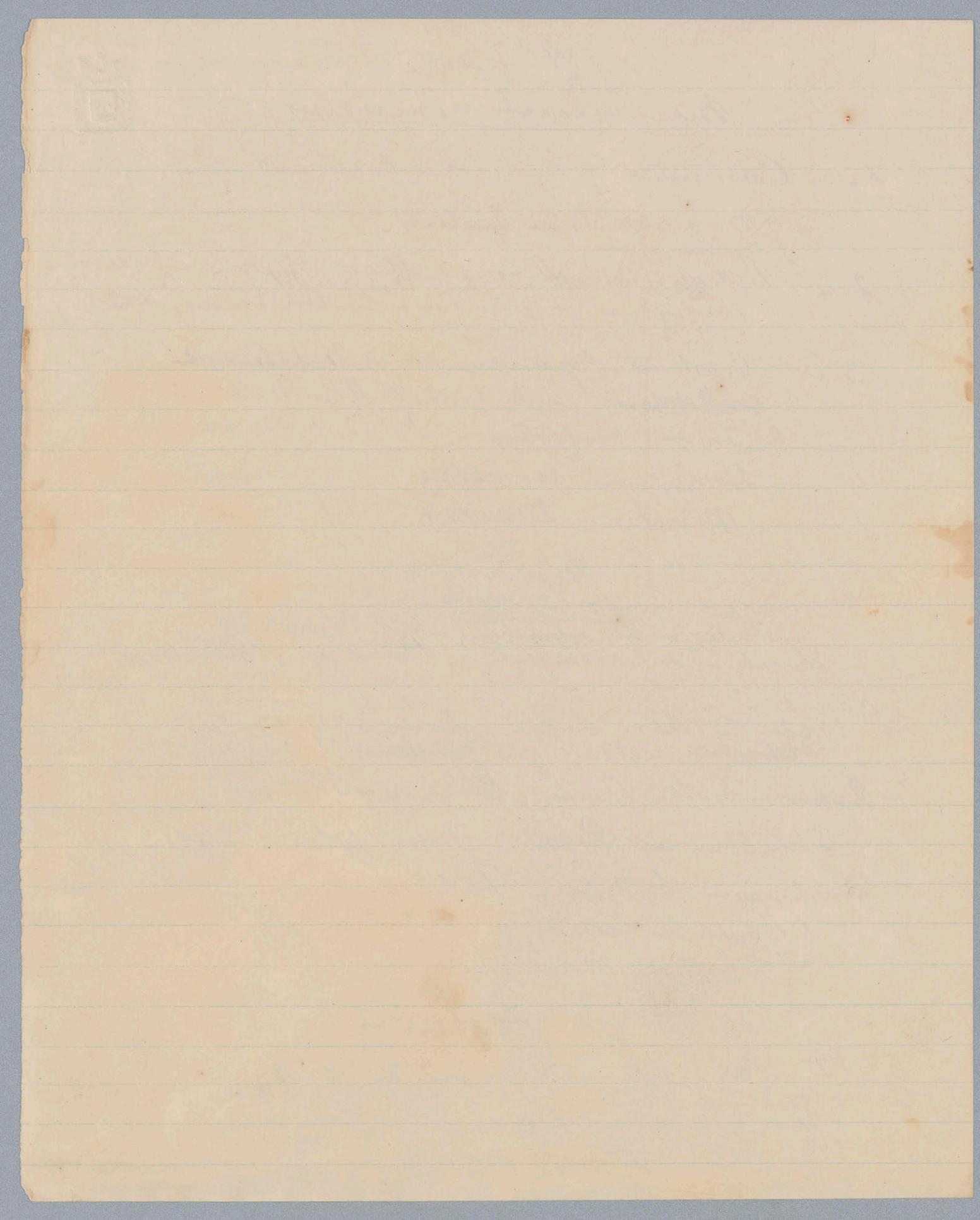
Practical Civil -

Survey, Drawing, - Construction

Practical Geodesy -

Topographical

Map of



4 year (6)

Practical & Industrial Chemistry

1. Analysis & Commercial Testing of

- (a) of Ores. Slates, Clays & other Mineral Materials,
- (b) of Cast-Iron Copper Lead &c Sulphur Alloys -
- (c) of Soda Ash, Bleaching Salts - Common Salt - Salt-petre, Indigo Paints - Drugs & Guano & other Minerals, Gunpowder &c
- (d) of Drinking Water, Mineral Waters, Biscuits, & Seawater &c.

2. Analysis of Gases by Uptake

Commercial testing of Illuminants for -

3. Lectures on Industrial Chemistry - The Arts of Dyeing - Print-making - Tanning - Boiling Distillation &c.

Electro-metallurgy -

The Manufacture, Illuminants, for -

3. Photography - Theory & Practice -

4th year

4. Drawing of Laboratory Apparatus &c - Chemical work &c.

3rd year -

For Practical Chemistry & Metallurgy -

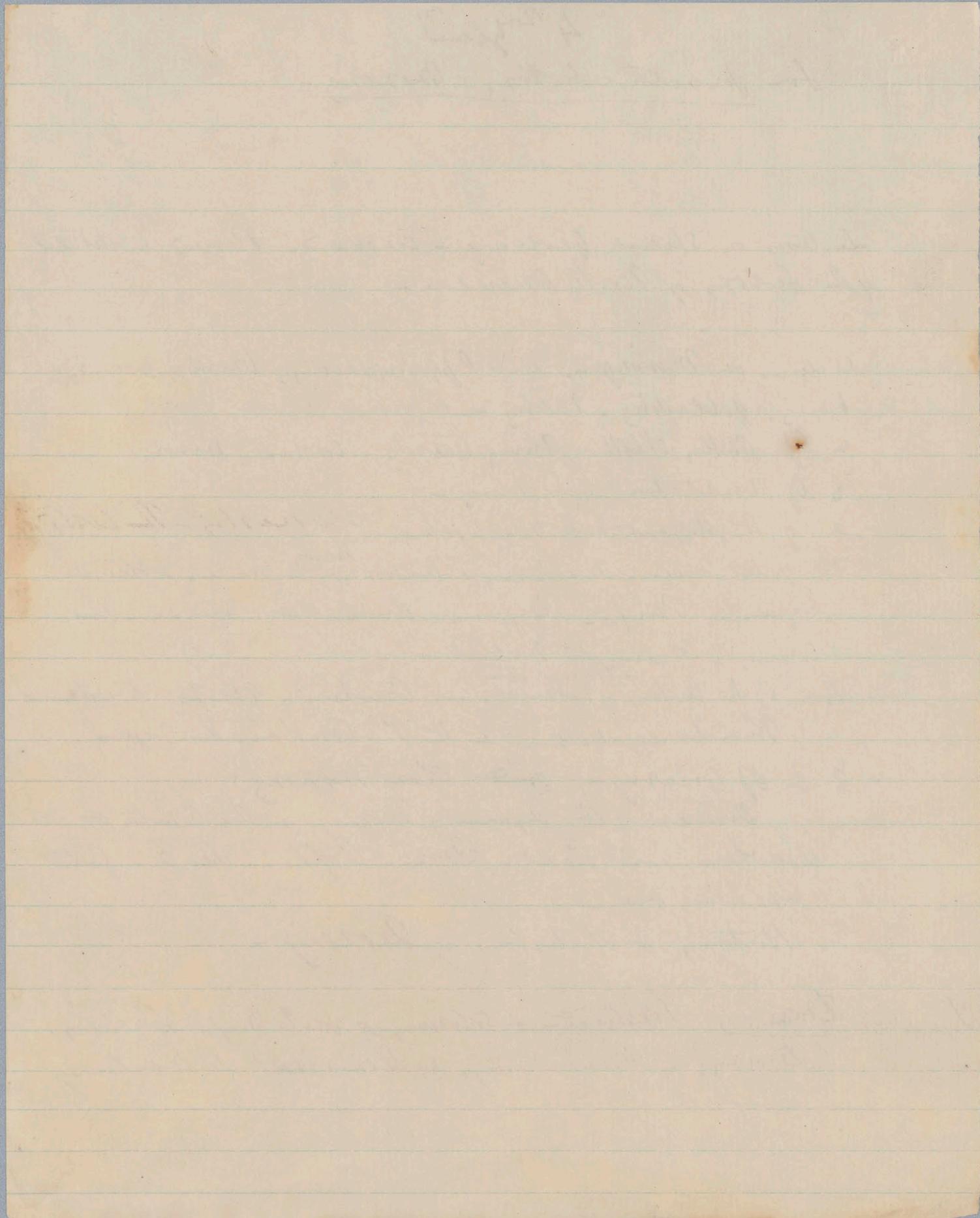
Same as D... except that the Drawing shall be directed
more specially to Metallurgical Apparatus - Furnaces,
forges -

4th year
for practice factors, & Mining -

Lectures on Shearie Geology - concluded. Review & detail
of R. Geology of North America -

- Lectures on Mining -
1. Of prospecting, breaking down -
boiling, fulminating. Taking & replacing walls.
2. Of Shaking Shift - Drilling tunnels - Constructing frames.
3. Of ventilation & lighting -
4. Of the different methods of working
5. Of the mining machinery & tools - Horses, hydraulic & steam
Engines - Pumps - Wagons - drum chais - rope - for
carrying, raising & moving -
6. Of the uses of minerals - Cutters - steps - wedges
Machinery, tools & the P. & C. Local Regs.
7. Of quarrying ~~and~~^{or} Open Mining -
Dolomites of the Limestone, Manganese & the Comby &
elsewhere for Coal - Iron - Copper - Lead - Gold
Silica &c -
Hunting & gathering of Minerals -

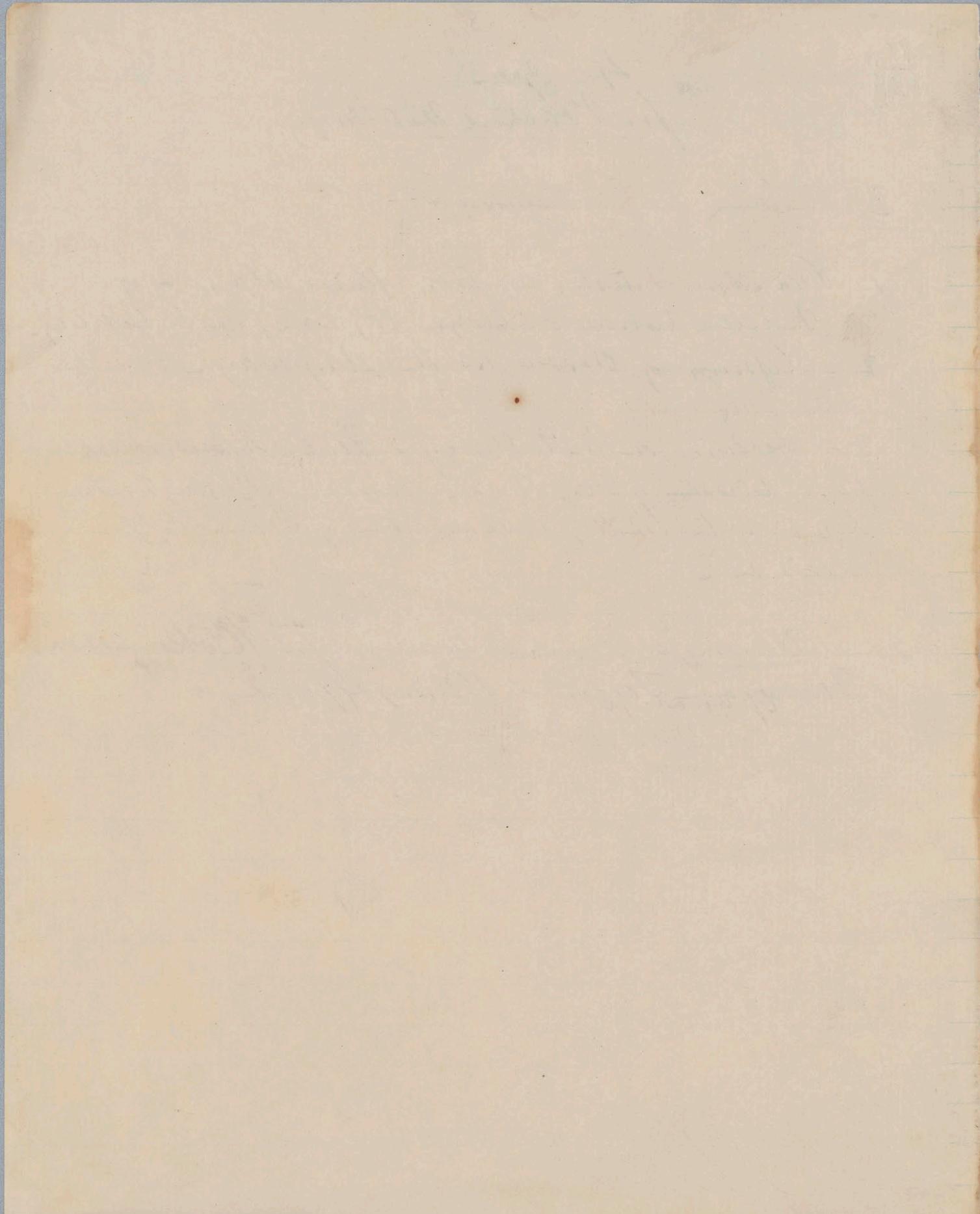
Toff the ~~first~~ Draughts. Construction & coloring of Soil, Deep & Shallow.
C. Draughts of mine Survey & Mine work, & Maching.



4th
Year
for Bachelor Metallurgy.

2. Lectures on Metallurgy -

1. Analysis & Testing of Ores, Fluxes, Slags &c of Various products & alloys. (a) as (b) wet way.
- 2 - Uptoys of Ores, wet & dry way, &c &c
- 3 - Lecture on Metallurgy - Fuel - Infernal chamber, for Reducing Ores. Smelting - Furnaces - Blowing Practices - Details of the Melting & Refining of Iron - Copper - Lead &c.
- 4 - Drawing - Projects & Drawings for Coke-making Ovens, Furnaces - Forges - Blowing apparatus -



1 Gen

Building & Architecture

To this year serve as Engineering -
enough. The 1st Drawing will be directed more
especially to subjects of building & architecture -
4th year.

- 1 - Places Sheds, & buildings Materials -
- 2 - Heating & Ventilation
- 3 - Lectures On Architecture Ancient & Modern
Illustrated by drawings & Models.
- 4 - Modelling in Plaster, Wood
- 5 - Architectural Drawings. Projects for Models.
School House Chapel, etc.

6

Engineering is taught
- mechanics - mathematics
- work / 4

3. Chemistry.

This course will embrace the following subjects—
General Doctrines of Chemical forces.

Demonstration of the properties of the principal elements & their combinations most useful in the arts & domestic economy, including especially the Chemistry of Water & air, of the Mineral Acids & from Copper, Lead, Tin, Silver &c. ~~of the Alkalies~~

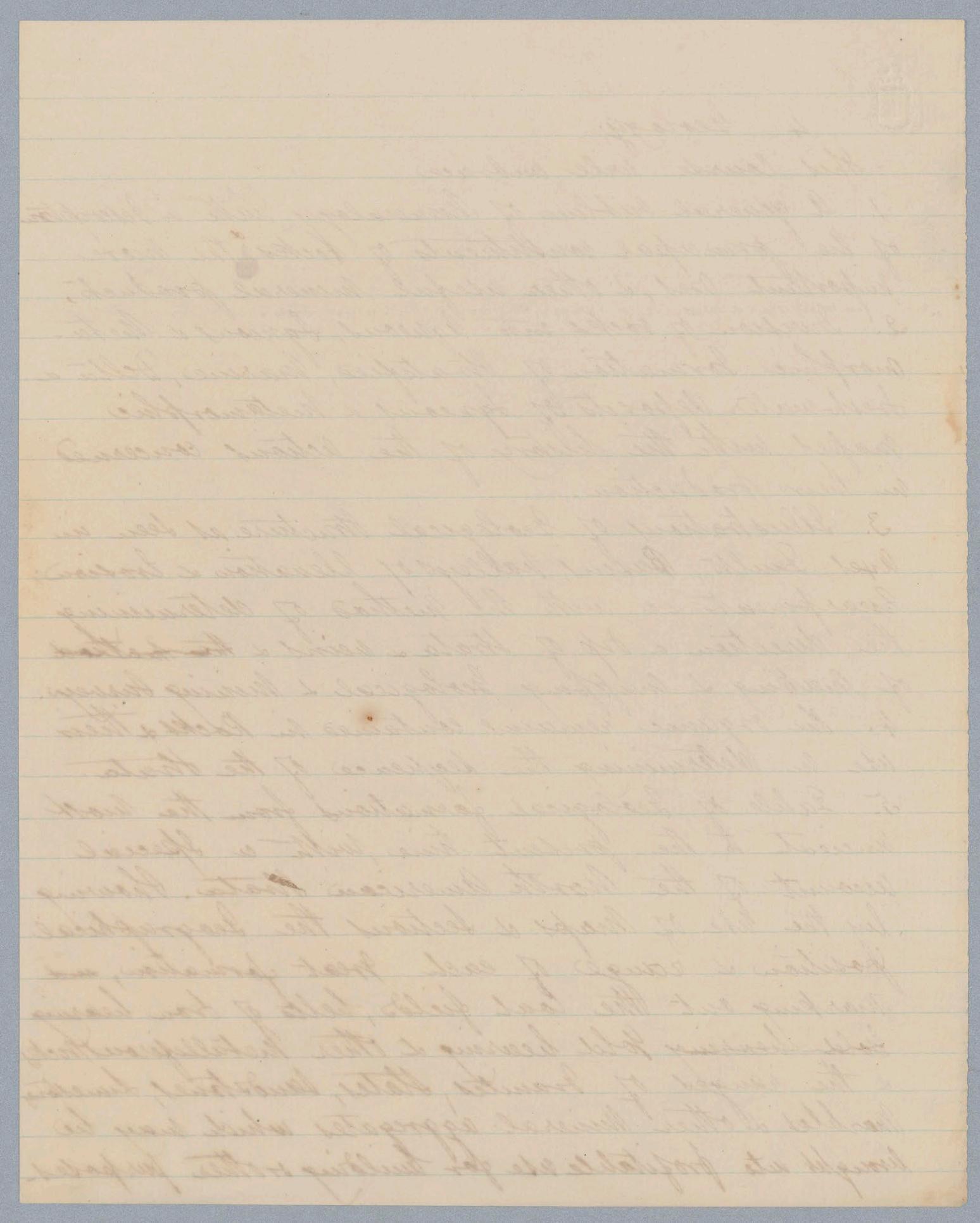
Chemical History of Sugars & Starches the principle Organic Groups ^{other} Sugars, Starches, Alcohols, Oils & fatty bodies of the chief constituents of the vegetable & animal organisms, with the chemistry of food respiration & nutrition.

~~Throughout the course~~ Especial attention will be given to the applications of Chemistry, ~~at~~ ^{especially} to the manufacture of pottery, Glass, soap, Illuminating gas, Mortars & cements, alum, bleaching salts &c. in Dyeing, ~~bleach~~ Color printing, bleaching & other Chemical Arts, the actual process wherever practicable will be experimentally shown & the analyses of materials & products contained in the Museum ^{will} be employed in aid of the teachings. In the course of the lectures examples will be ~~introduced~~ ^{given} of such simple methods of volumetric analysis or other chemical testing as can be usefully shown in the lecture room.

4 Geology.

This course will embrace

1. A general outline of Mineralogy, ^{followed by} with a description of the principal constituents of rocks, the more important Ores, & other useful mineral products;
2. Division of rocks into Aqueous, Igneous & Metamorphic. Formation of Stratified, Marine, Delta & Fresh-water deposits of Igneous & Metamorphic masses with the history of the actions concerned in their production.
3. Illustrations of Geological Structure as seen in Ayes, Faults, Basins, Valleys of elevation & Erosion, Escarpments &c with the method of determining the direction & dip of strata & veins & the method of making & mapping Geological & Mining Surveys.
4. The organic remains contained in Rocks & their use in determining the sequence of the strata.
5. Table of Geological formations from the most ancient to the present time, with a special account of the North American Strata. Showing by the use of maps & sections the geographical position & range of each great formation, and marking out the coal fields, belts of iron bearing Gold bearing Gold bearing & other metalliferous rocks & the ranges of Granites, Slates, Sandstones, Limestones, Marbles & other mineral aggregates which may be brought into profitable use for building or other purposes.





Botany & Zoology.

This course will embrace .

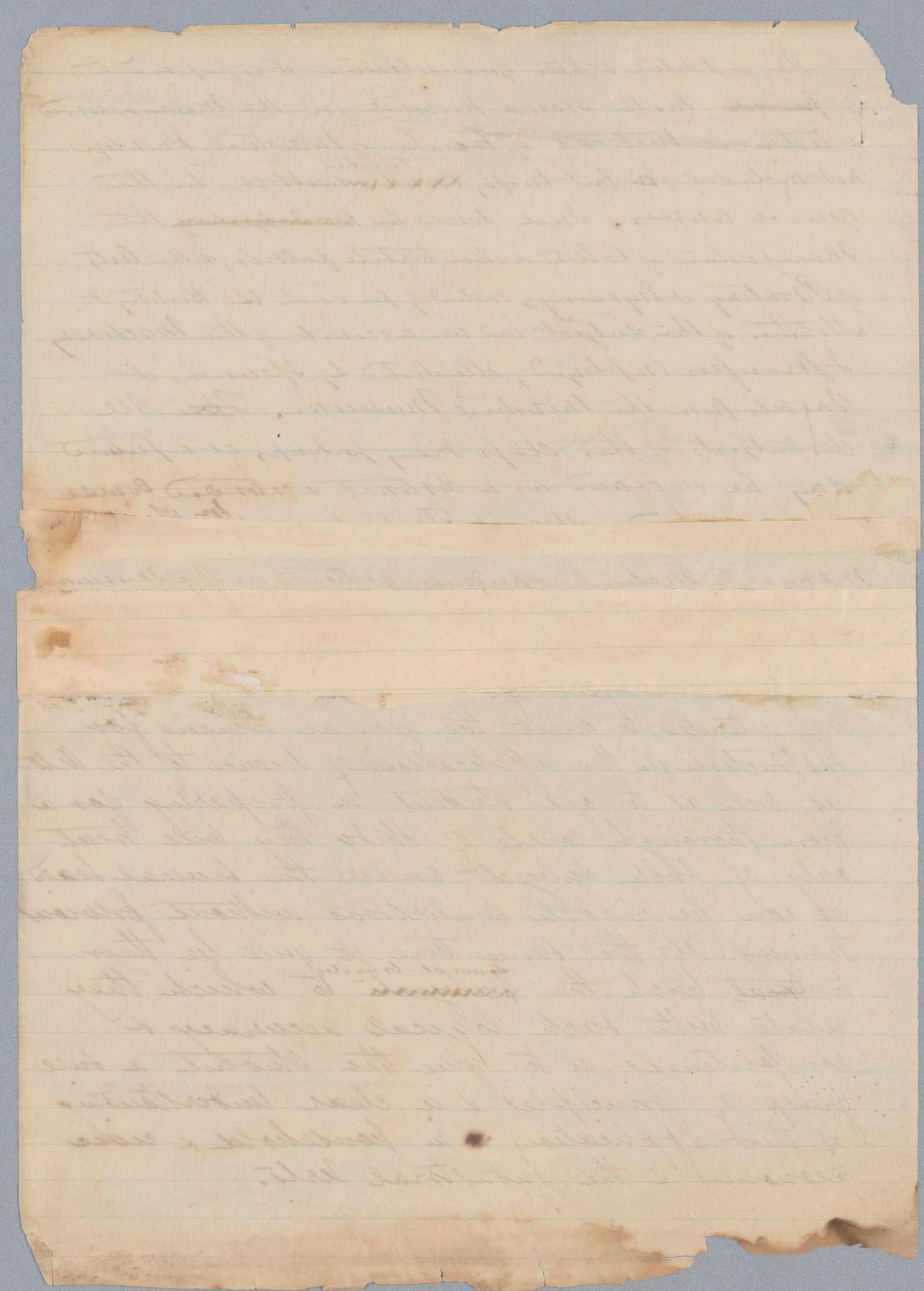
- { 1. A general outline of Botany, including
 the growth - Morphology, Structure & Classification
 of Plants.
- 2. Economic Botany - Plants useful for food & in the
 arts - &c -
- 3. A general outline of Nat. History, including
 the Structure - Physiology, & Classification
 of Animals -
- 4. Economic Zoology - Animals, useful for food &
 in the arts - &c - Culture &c.

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In addition to these general lectures it is proposed to
to ~~provide~~ make special provision for the more extended
& technical treatment of branches of industrial knowledge
not included so far briefly ~~as~~ ^{touched} as in the
general courses, such as in ~~the~~ ^{for} ~~and~~ ^{the} Manufacture of Cotton & other textile fabrics, & the Arts
of Printing & Dyeing, including the History &
Statistics of the subject and an account of the Machinery
& processes employed, illustrated by Specimens &
Models from the Industrial Museum. ~~These~~ All
the subjects of this class may perhaps, at a future
day be embraced as a distinct & colored course
under the head of Special Technology - ~~for which~~

Many of the materials & products gathered in the Museum
would ~~form~~ their most useful medium of interpretation

At the courses of lectures above described
are intended to meet the general demand for
instruction in the application of science to the arts
as well as to aid students in preparing for a
more thorough course of study they will treat
only of such subjects ~~under~~ ^{under} the several heads
as can be readily understood without previous
training. At the same time it will be their aim
to ~~teach~~ teach the ^{several branches} ~~principles~~ to which they
relate with such logical accuracy &
completeness as to give the student a full
grasp of principles & a clear ^{broad & full} understanding
of their application in household & civic
economy & the Industrial Arts.



Admission of Students

The leading principles governing the admission of Students into this Department are

- 1^o. That all persons who are qualified to enter upon any one of the full courses of the special studies of the school shall have the greatest opportunity of doing so and
- 2^o. That no students shall be admitted to any of the courses of instruction who have not the preliminary knowledge needed for a satisfactory pursuit of the studies proposed.

Students to be admitted to the introductory or first years course must have attained the age of 15 yrs & must give evidence by examination or otherwise of such training in elementary Mathematics & in three other subjects taught in the Common Schools as state hereafter in this memorandum.

In order to enter the second years course, the student must be at least 16 years of age & must give evidence by examination or otherwise of such knowledge of the first years studies as would enable a student of the first year to teach informally the second, and "on like rule will apply to the case of students seeking admission into the classes of the third & of the fourth years.

To make the opportunities of instruction as widely available as possible students will be allowed to enter special divisions of either of the courses after the first year as far ^{any of} inside the classes of i

