..CALENDAR..

OF THE

SCHOOL OF MINING

(AFFILIATED TO QUEEN'S UNIVERSITY)

KINGSTON ONTARIO.

SIXTH SESSION.

1898-'99.

KINGSTON:
PRINTED AT THE BRITISH WHIG OFFICE.
1898.

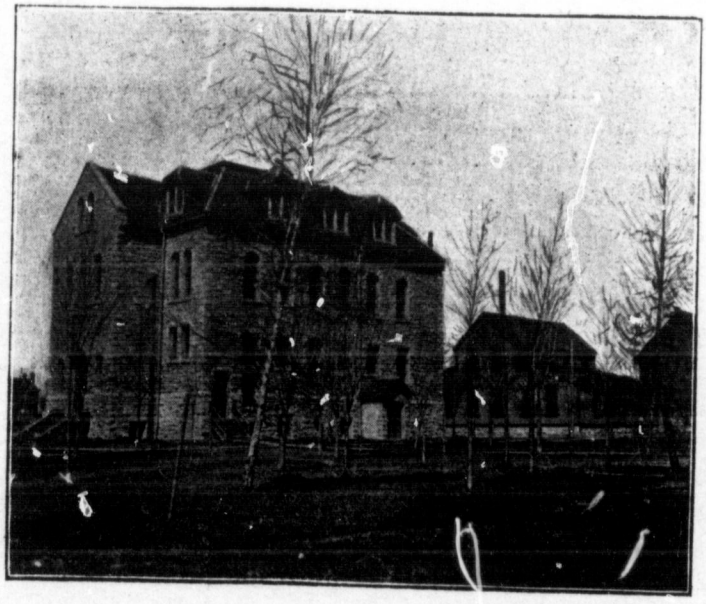
All communications to be addressed to
WILLIAM MASON, Bursar, School of Mining, Kingston, Ont.

For information regarding the Dairy School branch of the School of Mining and Agriculture, which branch is supported by the Ontario Government, address J. RUDDICK, Superintendent, Kingston.

For particulars of Veterinary School course address DR. A. P. KNIGHT, Acting Dean.

SCH

SCHOOL OF MINING.



CALENDAR 1898-9.

VISITOR.

His Honour Sir Oliver Mowat, K.C.M.G., Q.C., Lieutenant-Governor of Ontario.

Chairman of the Board of Governors.....Edw. J. B. Pense
Vice-Chairman..... John McKelvey

E. J. B. Pense..... Kingston
John McKelvey..... Kingston
E. W. Rathbun ..... Kingston
Jas. Swift .....Deseronto
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Robert Crawford .....Camden East
Geo. Y. Chown, B.A .....Kingston
W. Bruce Carruthers .....Kingston
A. Barnet.....Kingston
W. F. Nickle, B.A .....Renfrew
C. Livingston .....Kingston
Thos. Donnelly ..... } Appointed by the City Council
The Warden of the County of Frontenac.
Geo. Y. Chown, B.A.....Treasurer.
A. P. Knight, M.A., M.D.....Secretary.

ADVISORY COMMITTEE.

The President of the Eastern Ontario Dairymen's Association.
W. R. White, Q.C., Pembroke.
D. M. Macpherson, Lancaster.
Jas. Stratton, M.P.P., Peterboro.
W. B. Dalton.
J. Carson.
J. L. Haycock.

TABLE OF CONTENTS.

CALENDAR.

1898.

June 29—Summer School opens.

August 4—Summer School closes.

September 1—Notice of intention to appear at Matriculation or Supplemental Pass Examination to be given in writing to the Registrar of Queen's University. Subjects upon which a candidate intends to write must be stated in his notice.

September 16—Examinations begin. (Held at Queen's University and such other points as may be fixed upon.)

" 19—Surveying Class (second year) begins.

" 26—Classes open. (1st term.)

October 17—Holiday.

December 23—Christmas Holidays begin.

1899.

January 10—Classes re-open. (2nd term.)

" 10—Prospectors' Course begins.

February 15—Holiday.

March 7—Prospectors' Course ends.

April 7—Class work closes.

" 8—Examinations begin.

" 26—Convocation, for distributing prizes, announcing honours, and laureating graduates.

TIME TABLE FOR STUDENTS IN ENGINEERING.

The number before a subject denotes the year of the course in which the subject should be taken.

IX.	X.	XI.	XII.	I.	II.	III.	IV.	V.

TIME TABLE FOR STUDENTS IN ENGINEERING.

The number before a subject denotes the year of the course in which the subject should be taken.

	IX.	X.	XI.	XII.	II.	III.	IV.	V.
MON.	2. Mathematics 1. Mineralogy I. Drawing.	2. Physics. 3. Geology 3. Metallurgy.	1. Chemistry. 3. Sol. Geom. 3. Geology II.	3, 4 } Engineering	2. Exp. Physics. 2. Syst. Min'l'gy.	1. Mathematics. 2. Exp. Physics. 3. Ore Dressing,	4. Metallurgy.	
TUES.	3, 4 } Engineering. Drawing. 3. Descrip. Min.	3. Physics. 3. Geology.	I. Chemistry. 3. Mining.		2. Geology. 3. Organic Chem.	3. Ore Dressing. 1. English.	4. Metallurgy.	3. Math. Inst. 1st term. 1. Prac. Astron. 2nd Term.
WED.	Drawing. 4. Mining.	4. Mining Projet 2. Physics. 3. Geology.	4. Mining Projet 3. Geology II. 1. Chemistry. 3. Metallurgy.	4. Mining Projet	3, 4 } Great Machines. 2. Exp. Physics	1. Mathematics. 2. Exp. Physics. 3. Org. Chem.	1. English. 4. Sol. Geom.	
THUR.	Drawing. 2. Mathematics 4. Milling.	3. Geology. 3. Physics. 4. Milling.	2. Chemistry. 3. Calculus. 4. Milling.	4. Milling.	2. Geology. 3. Org. Chem. 4. Milling.	1. English. 2. Coor. Geom. 4. Milling.	2, 3 } Statics of Construction. 4. Milling.	4. Milling.
FRID.	Drawing. 3, 4 } Engineering. 4. Mining.	4. Mining Projet 2. Physics. 3. Geology.	4. Mining Projet 3. Deter. Min. 2. Chemistry. 3. Geology II.	4. Mining Projet	3, 4 } Heat and Electricity. 1. Blowpiping.	1. Mathematics. 3, 4 } Heat and Electricity. 1. Blowpiping.	1. Constructive Carpentry. 3. Mining.	4. Special Engineering.
SAT.	Assaying beginning at 8 a.m.							

Students must make arrangements to take their drawing and mechanical and other laboratory work during spare hours.

TIME TABLE FOR PROSPECTORS' CLASS.

	IX.	X.	XI.	XII.	II.	III.	IV.
MON.	Geology.	Economic Geology	Prospecting.	Mineralogy.		Blowpiping. Chemistry.	Blowpiping.
TUES.	Prospecting.	Geology.		Mineralogy.		Chemistry.	
WED.		Economic Geology		Mineralogy.	Blowpiping.	Blowpiping. Chemistry.	
THUR.	Prospecting.	Geology.		Mineralogy.		Chemistry.	
FRID.		Economic Geology	Prospecting.	Mineralogy.		Chemistry.	
SAT.	Assaying and Milling beginning at 8 a. m.						

HONOUR

Sept. 19—E
" 20—P
" 21—A
" 22—H
" 23—L
L
" 24—E

PA

Sept. 19—Ju
" 20—Ju
" 21—Ju
" 23—G
" 26—Ba
" 27—Ju

HONOUR AND PASS MATRICULATION EXAMINATIONS.

SEPTEMBER, 1898.

	9. A.M.	2. P.M.
Sept. 19	English Composition	English Grammar.
" 20	Physics	German Grammar, Composition and Authors.
" 21	Arithmetic	Algebra.
" 22	History and Geography	Euclid.
" 23	Latin Authors	French Authors.
	Latin Gram. and Comp	French Gram. and Comp.
" 24	English Literature	Greek.
		Chemistry.

PASS SUPPLEMENTAL EXAMINATIONS.

SEPTEMBER, 1898.

	9 A.M.	2 P.M.
Sept. 19	Junior English.	
" 20	Junior Physics	Senior Physics.
" 21	Junior Mathematics	Senior Mathematics.
" 23	Geology	Mineralogy.
" 26	Botany	Animal Biology.
" 27	Junior Chemistry	Senior Chemistry.

PASS EXAMINATIONS.

APRIL, 1899.

		9. A.M.	2 P.M.
Friday,	7th "	—Descriptive Astronomy	
Saturday,	8th "	—{Palæontology I. and II. / Surveying I.}	Qual. Analysis (Written).
Monday,	18th "	—{Petrography, / Junior English.}	Mineralogy III.
Tuesday,	11th "	—Junior Mathematics	Mineralogy (System.),
Wednesday,	12th "	—Geology of Canada II.	{Senior Mathematics. / Prac. Mathematics.}
Thursday,	13th "	—Mining II.	{Drawing I. / Assaying and Quant. Analysis.}
Friday,	14th "	—{Junior Physics. / Senior Physics.}	{Ore Dressing III. / Drawing II.}
Saturday,	15th "	—{Crystallography. / Junior Chemistry. / General Engineering.}	{Junior Physics. / Senior Physics.} / Surveying III. / Senior Chemistry.
Monday,	17th "	—{Economic Geology. / Mathematical Instruments.}	
Tuesday,	18th "	—{Geology	{Mineralogy. / Co-Ord. Geometry. / Chemistry (Technical.)}
Wednesday,	19th "	—Metallurgy	
Thursday,	20th "	—{Organic Chemistry. / General Engineering.}	{Chemistry (General.) / Calculus.} / Mining III.
Friday,	21st "	—{Surveying II. / Botany.}	
Saturday,	22nd "	—	Animal Biology. / Spherical Trigonometry.

WM. L. GOO

WILLIAM NI

WILLET G.

COURTENAY

*.....

WILLIAM MA

N. F. DUPUIS

NORMAN F. C

JOSEPH BAWI

A. LEHMANN,
R. T. HODGSC
ISAAC WOOD,
WM. MOFFA

*Not yet appoint

FACULTY.

WM. L. GOODWIN, B. Sc. (LOND.), D.Sc. (EDIN.), F.R.S.C.,
DIRECTOR,
Professor of Chemistry.

WILLIAM NICOL, M.A.,
Professor of Mineralogy and Assaying.

WILLET G. MILLER, B.A.,
Professor of Geology and Petrography.

COURTENAY DE KALB,
Professor of Mining Engineering and Metallurgy.

*.....
Professor of General Engineering.

WILLIAM MASON,
Lecturer on Drawing and Surveying.

N. F. DUPUIS, M.A., F.R.S.C.,
Lecturer on Mechanism.

NORMAN F. CARMICHAEL, M.A.,
Lecturer on Electrical Engineering.

JOSEPH BAWDEN, Barrister-at-Law,
Lecturer on the Law of Mines.

A. LEHMANN, Ph. D.,
R. T. HODGSON,
ISAAC WOOD, M.A., M.D.
WM. MOFFAT, M.A., M.D.
} Laboratory Demonstrators.

WILLIAM MASON, BURSAR.

ALFRED DEAN, JANITOR.

*Not yet appointed.

.....Spherical Trigonometry.

LIST OF STUDENTS.

REGULAR STUDENTS.

FIRST YEAR.

Name.	Address.	Branch of Engineering.
Coates, George R.	Toronto	Mining.
Dick, Wm. D.	Kingston	Mining.
Dickson, George H	Kingston	Mining.
Grover, George Alex	Norwood	Mining.
Hargreaves, James	Springhill, N.S.	Mining.
Harrison, Edward F	Actinolite	Mining.
Hinckley, Norman W	Kingston	Mining.
McLennan, Kenneth W	Lindsay	Mechanical.
Middlemiss, Arthur H.	Montreal, Que	Electrical.
Montgomery, Wallace H	Kingston	Mining.
Moore, Wm. W	Kamloops, B.C.	Mining.
Scott, Oswald N	Listowel	Mining.
Sutherland, Eric	Belleville	Electrical.

SECOND YEAR.

Baldwin, Maurice Day, B.A.	London	Mining.
Craig, John D, B.A.	Kingston	Mining.
Fraleck, Ernest L, B.A.	Belleville	Mining.
Holland, Laurier	London, Eng.	Mining.
Huffman, Arthur F.	Gilead	Mining.
Jackson, Francis W.	Kingston	Mechanical.
McLennan, Jonathan D.	Port Hope	Mining.
Murray, John C., B.A.	Halifax, N.S.	Mining.
Newlands, Laurence C	Kingston	Mining.
Rothwell, Chas. Garnett	Kingston	Mining.
Smeeton, Wm. Fras	Oakville	Mining.
Stevens, Francis Geo.	Halifax, N. S.	Mining.

THIRD YEAR.

Currie, P. W., B.A.	Niagara Falls	Mining.
Fife, Jas. A., B.A	Peterborough	Mining.
Graham, Stanley	Kingston	Civil.
Instant, Reginald	Emerald	Mining.
Merritt, Chas. P	St. Catherines	Mining.

FOURTH YEAR.

Fortescue, Chas. L. G	Kingston	Electrical.
Spotswood, Geo. McL	Kingston	Mining.
Wells, Jas. Walter	Toronto	Mining.

FIFTH YEAR.

Donnelly, John, Jr	Kingston	Mining.
Mabee, Horace C.	Port Rowan	Mining.

POST GRADUATE.

Lawson, Wm.	Toronto	Mining.

PROSPECTORS' COURSE.

Name.	Address.
Andison, Harry	Lakeside.
Aylmer, Harry B.	Melbourne, Que.
Bayley, Wm. Chas	London.
Bullivant, Francis	St. Catherines.
Cotter, Samuel J.	Northport.
Dawson, Percival G.	Petrolia.
Ferguson, Horace A	Kingston.
Ferguson, Mellis	Kingston.
Gemmell, Lawrence J.	Perth.
Gildersleeve, E. C	Kingston.
Gracey, Arthur H	Gananoque.
Grover, George Alex	Norwood.
McCain, Hugh L.	Port Colborne.
McCullough, John	Columbus.
McIntyre, John	Newry.
McRae, John C.	Port Colborne.
Machar, John M	Kingston.
Montizambert, H. St. J.	Toronto.
Murray, John C.	Halifax, N. S.
Nicholson, Allan McK	Portsmouth.
Nicholson, Chas. F.	Belleville.
O'Brien, Wm. J.	Kingston.
Taylor, Wm. V.	Gananoque.
Thomlison, Wm	New Denver, B.C.
Waters, Abel T.	Toronto.
Wilson, John P.	McDonald's Corners.

OUTSIDE CLASSES.

Places.	Nos. of Students.
Sudbury	31
Sault Ste. Marie	67
Port Arthur	33
Rat Portage	61
Marmora	35
Madoc	33
Bancroft	41
Total	301

ANNOUNCEMENT.

The School of Mining is a branch of the *School of Mining and Agriculture*, incorporated by Act of the Legislature of Ontario.

Objects.—The objects of the School of Mining are to give a thorough scientific education, both theoretical and practical, to men studying for the professions of the mining engineer, the assayer, the consulting geologist, and the metallurgist; and to provide for prospectors, mine foremen and others interested in the discovery and winning of minerals such instruction as shall make their occupations more interesting and less liable to failure.

Situation.—The school has been placed near Queen's University so as to take advantage of the instruction therein provided in English, mathematics, physics, and the biological sciences. It is in this way possible to equip and carry on a good technical school on a much smaller revenue than would otherwise be called for to maintain the high standard of scholarship which the age demands of the engineering profession.

Kingston is well situated as the seat of a Mining School. Geology and mineralogy, two of the fundamental subjects of a mining engineer's education, are studied to best advantage where the minerals can be seen as they lie in nature, and where geological formations can be examined *in situ*. In a few hours a class of students can be taken by carriage to a region so rich in mineral species that about forty different kinds have been secured in an afternoon. There is also a great variety of geological formations within easy access. If to this be added the neighborhood of mines in process of development or in operation, the result is an ideal Mining School city. The German Government has planted its mining schools in just such cities, where the education of the mining engineer can be given that practical turn which not only lends a charm to the period of his study but shortens the time between graduation and thorough efficiency and confidence in the practice of his profession.

The possibilities of the country to the north of us are, in these respects, very great, and a glance at a geological map shows that Kingston itself is situated where the mineral-bearing formations, cutting like a broad wedge through the limestone, reach the St. Lawrence and Lake Ontario. The region of mineral-bearing rocks is thus brought almost to the city. On either side, the water front is bordered by a band of limestone, broadening as it extends east and west.

EMPLOYMENT FOR GRADUATES.—While no engagement is made to secure employment for graduates of the School, those who show themselves capable and industrious will, if possible, be recommended to positions for which they are qualified. It must be distinctly understood, however, that recommendations will not be given to men merely because they have been students at this School. Employers of mining engineers and assayers are requested to note that men who have studied here can produce certificates stating clearly their standing in the School; and that no one is entitled to style himself a graduate of the School unless he has completed either a three years' or a four years' course.

EXPENSES OF A COURSE.—The following statement of expenses is made from information obtained from students who have kept account of their expenditures. The average expense for class fees is taken in this estimate:

FOR EACH SESSION.

Board, lodging and washing	$98 00	to	$115 00
Books and stationery	10 00	"	12 50
Incidentals	8 00	"	15 00
Excursions (geology, mineralogy and mining)	4 00	"	6 00
Class and other fees	57 50	"	57 50
	$177 50		$206 00

These estimates are based on board, &c., at from $3.00 to $3.75 a week, at which rates good board can be had in Kingston.

The fee for graduation ($20.00 or $10.00) is not included in the estimate.

REQUIREMENTS FOR ADMISSION.

The School of Mining is open to all who wish by earnest study to enlarge their knowledge of minerals and mines, or to pursue science for its own sake. The atmosphere of the School is suitable only for those who are fond of steady work.

REGISTRATION.—All students are required to register and pay the registration fee at the beginning of each session. In addition, those who are pursuing degree or diploma courses are required to register in Queen's University and to pay a registration fee of one dollar.

MATRICULATION.—Before being admitted to examination on the work of the course, candidates for a degree must pass the matriculation examination, or otherwise satisfy the Faculty of

their fitness to proceed with their course. Matriculation consists of the Junior Leaving examination for Ontario in the subjects of English and Mathematics. The details of this examination may be found in the Calendars of Ontario Universities, or in the Regulations of the Education Department. The matriculation examination may also be taken in Queen's University in September, (English, Sept. 19th and 24th; Mathematics, Sept. 21st and 22nd.) Other examinations will be accepted so far as they are equivalent. Candidates who have made at least fifty per cent. on the papers in any of the Senior Leaving examination subjects are not required to take the junior classes in those subjects.

While students are admitted upon matriculating in English and Mathematics, it is strongly urged upon them to take the complete matriculation examination with the modern language and science option, (See p, 12, Calendar of Queen's University.) As a good grounding in Mathematics is necessary, it will be found advantageous to have attained the Senior Leaving standard in that subject before entering.

Students who have already taken, in a University Arts or Science Faculty or in a recognized technical or military school, subjects included in a degree course in the School of Mining, will be admitted to the year for which they are qualified, on entering upon a course for the degree of M.E. or B.Sc.

The B.Sc. course in chemistry and mineralogy can be completed in one year after graduation in an honour course in arts, in chemistry, mineralogy and geology.

SPECIAL STUDENTS.—Unmatriculated students may take any classes for which they are prepared. The work in chemistry, mineralogy, geology, drawing, surveying, etc., is so arranged that those who wish to study these subjects, either for their scientific interest or as leading to professions other than mining engineering, may profitably pursue their studies here.

The practical work in assaying, mineralogy, milling, and mining is of such a nature that those who wish to prepare themselves for any special department of work connected with mining and milling may profitably spend a session or two at the school. A two years' course might include junior chemistry, blowpipe analysis, qualitative analysis, systematic mineralogy, and geology, the first year; and chemistry of metals, assaying, descriptive and determinative mineralogy, mining, milling, ore dressing, and ore deposits, the second year.

Special short courses for prospectors and others are conducted during the session. (See page 42.)

EXAMINATIONS.—All examinations are held by Queen's University, and candidates must make application on forms supplied by the Registrar. Examination fees must be paid to the Registrar of the University not later than March 31st for the April examinations, and September 1st for the supplemental examinations.

GRADUATION.—Diplomas for the three years' course are given by the School of Mining and applications for same must be made to the Bursar in writing and the fees paid before convocation day. Candidates for degrees must make application and pay the fees to the Registrar of the University. No candidate can receive his diploma until all fees are paid. If a candidate fails in his examinations the graduation fee will be returned to him.

EXTRAMURAL STUDENTS.—Students who are not able to attend the School may register in the classes of junior and senior chemistry, elementary mineralogy, and geology. Tutors are appointed to assist them by correspondence.

FEES.—Registration and Class fees must be paid annually on or before October 8, and Laboratory fees before students begin work in the laboratories. Examination, degree graduation *ad eundem statum* and University registration fees are payable to the University Registrar. All other fees are payable to the Bursar of the School of Mining.

Registration	$1 00
University Registration	1 00
" " for students not in attendance upon lectures	10 00

FEES FOR A COURSE IN *Mining Engineering, in Analytical Chemistry and Assaying, or in Mineralogy and Geology*..—

These fees cover all class and laboratory fees for the course.

First Year	$45 00
Second Year	50 00
Third Year	55 00
Fourth Year	60 00

FEES FOR SINGLE CLASSES, &C.

Junior and Senior Chemistry, each	$12 00
Any other Course of Lectures	8 00
Drawing	9 00
Surveying, per Session	10 00
Assaying Laboratory, per Session	5 00
Chemical Laboratory, per Session	20 00
Petrographical Laboratory, per Session	5 00
Mechanical and Engineering Laboratory	20 00

Analytical Chemistry (Medical)	12 00
Graduation Fee for Degree	20 00
" " for Diploma	10 00
Admission *ad eundem statum*	10 00
Annual Examination Fee	3 00
Tutor's Fee (Extramural Students), one subject	5 00
" " " more than one subject	10 00

DEPOSITS.—Each student is required to make a deposit of $5.00 each session. At the close of the session the balance of the deposit, remaining after deductions for loss and breakage of apparatus, &c., is returned.

COURSES OF STUDY.

The following courses are offered:

I. Three years' courses for a diploma in

(A.) Mining Engineering.
(B.) Analytical Chemistry and Assaying.

II. Four years' courses for the Degree of Bachelor of Science (B.Sc.) in

(A.) Mining Engineering.
(B.) Chemistry and Mineralogy.
(C.) Mineralogy and Geology.

The degree of Mining Engineer or Engineer of Mines (E.M.) is also conferred. (See p. 19.)

III. Post-graduate courses for the Degree of Doctor of Science (D.Sc.) (For further information see the calendar of Queen's University.)

I.—THREE YEARS' COURSES.

These courses are intended to fit men to enter upon the practice of mining engineering and assaying. The scientific groundwork of these professions is included as completely as the length of the course will permit; and much time is given to those practical studies which best equip the student for the work of exploration, developing, supervision, construction, etc., connected with mining. The courses are so arranged that upon completing them students may, if they wish, by another year's study, complete the course for a degree.

Students are advised to follow the arrangement in years as closely as circumstances will permit. The first four subjects mentioned in the first year form the basis for the work of succeeding

years, and they should be thoroughly mastered. The country needs for its development men of high scientific attainments combined with practical knowledge. It is impossible to reach this without a good preliminary training in Mathematics, English, Physics and Chemistry.

A.—MINING ENGINEERING.

First Year.

First Term.

Junior Mathematics,
Junior English,
Junior Physics,
Junior Chemistry,
Drawing,
Elementary Mineralogy and Blow-pipe Analysis,
Surveying,
Workshop.

Second Term.

Junior Mathematics,
Junior English,
Junior Physics,
Junior Chemistry,
Descriptive Astronomy,
Drawing,
Elementary Mineralogy and Blow-pipe Analysis,
Qualitative Analysis,
Workshop.

Second Year.

First Term.

Senior Mathematics,
Senior Physics,
Senior Chemistry,
Elementary Crystallography,
Qual. Analysis of Minerals,
Systematic Mineralogy,
Geology,
Principles of Engineering,
Drawing and Designing,
Workshop,
Surveying.

Second Term.

Senior Mathematics,
Senior Physics,
Senior Chemistry,
Quantitative Analysis,
Systematic Mineralogy,
Geology,
Principles of Engineering,
Drawing and Designing,
Workshop.

Third Year.

First Term.

*Co-ordinate Geometry,
*Elementary Differential and Integral Calculus,
Spherical Trigonometry,
Descriptive Mineralogy,
Determinative Mineralogy,
Geology and Petrography,
Assaying,
Mining,
Ore Dressing,
Surveying,
Civil Engineering,
Elementary Electrical Engineering.

Second Term.

*Co-ordinate Geometry,
*Elementary Differential and Integral Calculus,
Practical Astronomy,
Technical Chemistry,
Descriptive Mineralogy,
Determinative Mineralogy,
Geology and Petrography,
Assaying,
Economic Geology,
Mining,
Ore Dressing,
Milling.

B.—ANALYTICAL CHEMISTRY AND ASSAYING.

FIRST YEAR.

First Term.

Junior Mathematics,
Junior English,
Junior Physics,
Junior Chemistry,
Drawing,
Blowpipe Analysis,
Surveying.

Second Term.

Junior Mathematics,
Junior English,
Junior Physics,
Junior Chemistry,
Qualitative Analysis,
Drawing,
Blowpipe Analysis.

SECOND YEAR.

First Term.

Senior Mathematics,
Senior Chemistry,
Elementary Crystallography,
Qualitative Analysis,
Systematic Mineralogy.

Second Term.

Senior Mathematics,
Senior Chemistry,
Qualitative Analysis,
Systematic Mineralogy.

THIRD YEAR.

First Term.

Organic Chemistry,
Crystallography,
Descrip. and Det. Mineralogy,
Geology and Petrography,
Quantitative Analysis,
Assaying,
Metallurgy.

Second Term.

General Chemistry,
Technical Chemistry,
Descrip. and Det. Mineralogy,
Geology and Petrography,
Quantitative Analysis.
Assaying,
Metallurgy,
Ore Deposits.

II.—FOUR YEARS' COURSES.

These courses are arranged so as to give the extended scientific training required for the more highly specialized fields of professional work in mining, assaying, analytical chemistry, mineralogy and geology. Courses A and B may be completed in one year after completing the corresponding three years' course. Course C affords a general education in natural science with special training in mineralogical and geological work and studies. It is intended for those who have in view the profession of consulting geologist or the work of geological surveys.

A.—MINING ENGINEERING.

The first three years of this course are the same as for the Three Years' Course. (See page 17.)

FOURTH YEAR.

First Term.	*Second Term.*
Metallurgy,	Metallurgy,
Mechanism,	Mechanism,
Materials and Construction,	Materials and Construction,
Mining Engineering,	Mining Engineering,
Milling,	Milling,
Mining Law.	Mining Law.

The degree of Bachelor of Science (B.Sc.,) is awarded on the completion of this course, and the production of certificates for not less than three months' work in a mine or mines. The degree of Engineer of Mines (E.M.) is awarded in addition, on the production of certificates of not less than one year's experience in actual mining. These certificates must be signed by mine managers, and must state the character of the work done by the candidate. Candidates may omit the subjects marked * and graduate with the degree of Engineer of Mines only.

B.—CHEMISTRY AND MINERALOGY.

The first three years of this course are the same as for the Three Years' Course. (See p. 18.)

FOURTH YEAR.

I.—Special work in assaying and chemical analysis to give facility and precision in methods in use in mining, furnace, and analytical laboratories.

II.—An original research in Chemistry or Mineralogy, the results of which must be reported in the form of a thesis on or before April 1st.

C.—MINERALOGY AND GEOLOGY.

FIRST YEAR.

First Term.	*Second Term.*
Junior Mathematics,	Junior Mathematics,
Junior English,	Junior English,
Junior Physics,	Descriptive Astronomy,
Junior Chemistry,	Junior Physics,
Drawing,	Junior Chemistry,
Elementary Mineralogy and Blow-pipe Analysis,	Drawing,
Animal Biology.	Elementary Mineralogy and Blow-pipe Analysis,
	Botany.

SECOND YEAR.

First Term.	*Second Term.*
Senior Mathematics,	Senior Mathematics,
Senior Chemistry,	Senior Chemistry,
Elementary Crystallography,	Qualitative Analysis,
Qualitative Analysis,	Systematic Mineralogy,
Systematic Mineralogy,	Geology.
Geology,	
Surveying.	

THIRD YEAR.

First Term.

Crystallography,
Assaying,
Descrip. and Det. Mineralogy,
Geology and Petrography,
Topographical Surveying,
Field Geology.

Second Term.

Spherical Trigonometry,
Assaying,
Simple Quantitative Analysis,
Descrip. and Det. Mineralogy,
Geology and Petrography,
Geological Maps and Sections.

FOURTH YEAR.

First Term.

Petrography,
Economic Geology.

Second Term.

Petrography,
Economic Geology.

Special work along lines to be chosen by the candidate; an original research in Mineralogy or Geology, the results of which must be handed in as a thesis on or before April 1st.

SUBJECTS OF STUDY.

CHEMISTRY.

Professor: William L. Goodwin, D.Sc., Edin.
Demonstrators: A. Lehmann, Ph.D., R. T. Hodgson, I. Wood, M.A., M.D., and Wm. Moffat, M.A., M.D.

JUNIOR.

1. *Lectures* on the principles of Chemistry as follows:
Chemical Species—Crystals and Crystallization—Chemical Change—Laws of Combination—Relation of Heat to Chemical Changes—Notation—Equations—Nomenclature—Volume Relations of Gases in Chemical Change—Volume Formulas—The Atomic Theory—Descriptive Chemistry of the Common Elements and their Compounds—Electrolysis—Spectrum Analysis.

Books—Goodwin's Chemistry.
Remsen's Inorganic Chemistry (Advanced Course).
Mondays and Tuesdays at 11 a.m.

2. *Laboratory practice*, consisting of simple experiments, by means of which the student may become acquainted with the properties of common substances. Wednesdays or Thursdays at 11 a.m.

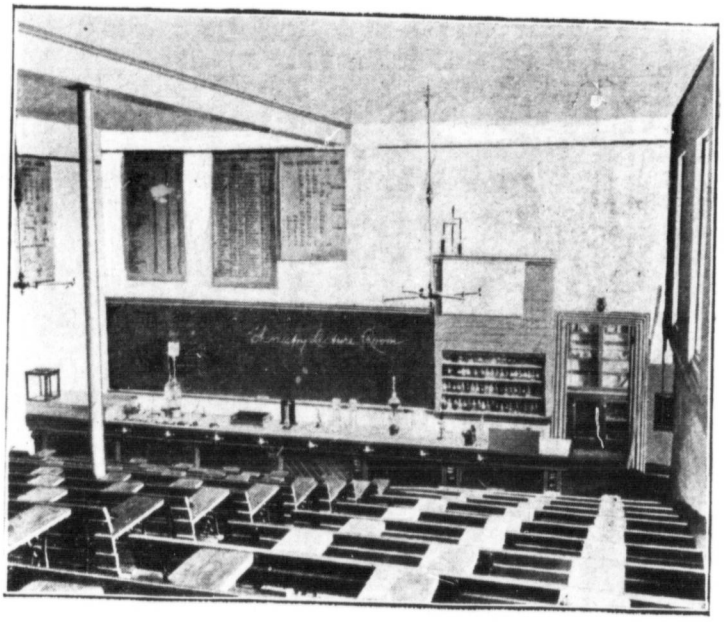
3. *Qualitative Analysis* is begun in the second term.

SENIOR.

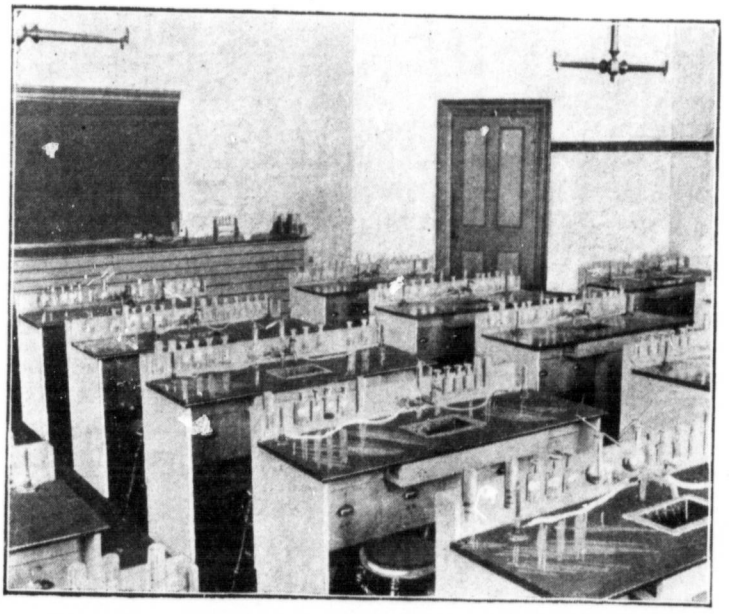
Before taking this class students must have passed in Junior Chemistry.

(**1st TERM**). 1. *Lectures* on the chemistry of the metals, their occurrence in nature, reduction and uses. Thursdays and Fridays at 11 a.m.

2. A course of ten lectures on *Elementary Crystallography*. Mondays, Tuesdays, Wednesdays, Thursdays and Fridays at 8 a.m.



CHEMISTRY LECTURE ROOM.



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3. *Qualitative Analysis* is continued. Notes on systematic qualitative analysis are given by Professor Nicol in a course of fifteen lectures in October.

(**2nd TERM**). 1. *Lectures* on chemical laws and theories. Thursdays and Fridays at 11 a.m.

2. *Qualitative Analysis of Minerals and Simple Quantitative Analysis.* This work may occupy from two to four hours a day. The greater part of the time is spent in the laboratories. *Lectures* on quantitative analysis on Thursdays at 3 p.m. The minimum amount of work in quantitative analysis is comprised in Bolton's *Quantitative Analysis*, Nos. 1, 2, 3, 4, 5, 6, 7, 8 and 13.

Text-books—Dobbin & Walker's Chemical Theory (Macmillan & Co.)
Goodwin's Chemistry and Supplement.
Williams' Crystallography (Henry Holt & Co.)
Thorpe & Muir's Qualitative Analysis (Longmans, Green & Co.)
Bolton's Quantitative Analysis.

THIRD YEAR.

(**1st TERM**). 1. *Lectures and Class Work on Organic Chemistry.* (Course B only.) The student is expected to master the contents of Remsen's Organic Chemistry.

Wednesdays at 3 p.m.

2. *Advanced Crystallography* studied in its relations to chemistry and mineralogy. The student has access to collections of wooden and wire models and mounted crystals.

Mondays, Tuesdays and Thursdays at 3 p.m.

3. *Quantitative Analysis* is continued throughout the third year by students taking the courses in Chemistry and Assaying, or Chemistry and Mineralogy. Special attention is given to the quantitative analysis of minerals.

Text-book—Fresenius' Quantitative Analysis.

(**2nd TERM**). 1. *Lectures* on selected subjects in *Technical Chemistry.* For the session of 1898-1899 the subjects will be the the chemistry of the reduction of gold, silver, copper, nickel, &c., and the manufacture of acids and alkalies.

Mondays at 3 p.m.

2. *Lectures on General Chemistry.* For the session of 1898-1899 the subjects will be Thermochemistry, Electrochemistry, the properties of Solutions and the Kinetic Theory of Gases.

Text-book—Ostwald's Outlines of General Chemistry.

Wednesdays at 3 p.m.

3. *Quantitative Analysis.*

FOURTH YEAR.

The work for the fourth year consists entirely of laboratory work in quantitative analysis. Students taking the M.E. course may extend their acquaintance with analysis of minerals, slags, etc. Those taking the

B.Sc. course in chemistry and mineralogy will, in addition, carry on experimental work in some selected field, such as rock analysis, organic analysis, analysis of water, air, foods, fertilizers, soils, etc.

All students are urged to make daily use of the library, reading along the lines of their laboratory work.

THE CHEMICAL LABORATORIES.

The practical work in Chemistry is carried on in three laboratories: No. 1 for qualitative analysis, No. 2 for quantitative analysis, and No. 3 for experimentation in class, and drill on the subjects treated of in the junior lectures. No. 1 and No. 2 are fitted up with 62 and 42, respectively, locked work places, so that 104 students can be provided each with a set of apparatus under lock and key. These laboratories are open from 8 a.m. to 5 p.m., and students are allowed to carry on their analytical work when not otherwise engaged. The number of hours a day to be spent in the laboratories depends, to some extent, on the aptitude of the student for experimentation. The average is about two and a half hours. No. 3 serves both as a laboratory and a class room. It is fitted up with seats and desks which are at the same time work tables. Besides these larger laboratories there are smaller rooms devoted to special branches of analytical chemistry and to research.

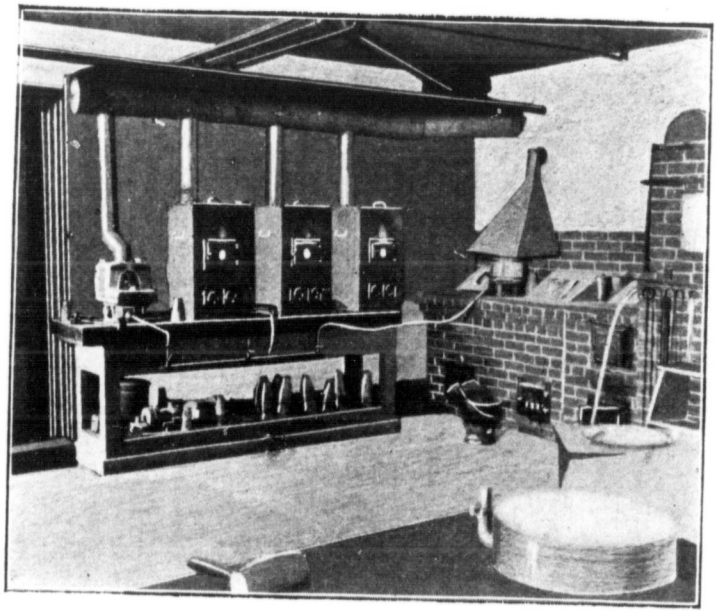
Each student, before entering any practical class, is required to deposit five dollars with the Bursar. On presenting to the instructor of the class the receipt for this and the class ticket, the student receives the key of his place and a set of apparatus. The deposit is returned at the end of the session, breakages, etc., having been deducted.

BLOWPIPE ANALYSIS.

Professor: William Nicol, M.A.

The work in this class for mining students extends over two sessions. It should be taken along with junior chemistry and junior physics, and as an aid to qualitative analysis and systematic mineralogy in the following session.

The blowpipe laboratory is arranged to accommodate forty-eight students, working twenty-four at one time. Students must supply their own blowpipe apparatus, but a locker and key are provided for each student. For junior students, the class meets on Friday afternoon, 2–4 o'clock. For senior students, the hours are arranged so as not to conflict with other classes. The work



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of the fall term consists in learning the use of the blowpipe, the various operations and the reagents employed ; the winter term is occupied in applying the knowledge acquired during the fall term, in the determination of minerals. The work of the primary class is continued during the following session in connection with the classes of descriptive and determinative mineralogy. The quantitative assay of gold and silver ores forms part of the work.

Text-books—Chapman's Blowpipe Practice, 2nd ed. (Copp-Clark Co.)
Kolbeck's 6th ed. of Plattner's *Probirkunst mit dem Lothrohre.*

Books for reference :

Brush and Penfield's Manual of Determinative Mineralogy and Blowpipe Analysis. (Wiley & Sons.)
Endlich's Manual of Qualitative Blowpipe Analysis.
Moses & Parson's Mineralogy, Crystallography and Blowpipe Analysis.
Landauer's Blowpipe Analysis.

ASSAYING.

Professor: William Nicol, M.A.

Before taking this class students must have passed in junior and senior chemistry and in qualitative analysis.

The work of the Assaying Class is carried on partly in the assaying laboratory and partly in the quantitative chemical laboratory, as assaying is a branch of quantitative analysis. The laboratory is furnished with the plant necessary for conducting assays of gold, silver, copper, iron, nickel, zinc and lead ores by furnace, titration and electrolytic methods. The examination of coal, in order to ascertain its commercial value, forms part of the work. With the various furnaces students are taught the use of hard coal, soft coal, coke, gasoline and illuminating gas as fuel. The laboratory is well supplied with ore-bins, and samples of pulverized ore from the mining laboratory, so that practice may be had with a variety of ores. The mineral cabinets contain typical examples of the commonly occurring ores of the various metals treated in the course ; these are used for illustrating the lectures which supplement the text-books used.

In the limited time, it cannot be expected that students taking part in the work of this class will become expert assayers, but they can learn methods and the manipulation of apparatus, so that later in practice, they will be able to make an intelligent use of the text-books and manuals on the subject.

The work of the class is progressive and students will not be permitted to go on with the later parts of the work till the earlier

parts have been satisfactorily performed. The standing of the members of the class is determined by the practical work performed during the session. There is no final practical examination held. This class should be taken along with quantitative analysis, ore-deposits and metallurgy. Students taking it must make arrangements to spend the greater part of each Saturday of the session in the laboratory. Lectures are delivered at periods convenient for the members of the class.

Text-books—Chapman's Assay Notes, 2nd ed. (Copp-Clark Co.)
Brown's Manual of Assaying, 7th ed. (Sargent & Co.)
Blair's Chemical Analysis of Iron, 2nd ed. (Lippincott Co.)

Books for reference :

Furman's Manual of Assaying. (Wiley & Sons.)
Ricketts and Miller's Notes on Assaying. (Wiley & Sons,)
Beringer's Text-book on Assaying. (C. Griffin & Son.)
Bodemann & Kerl's Assaying.
Lord's Notes on Metallurgical Analysis.
Kerl's *Probirkunde.*
Ledebur's *Probirkunde.*

MINERALOGY.

Professor : William Nicol, M.A.

The work of this department for mining students extends over three years, and is divided into four parts : (*a*) Elementary Mineralogy ; (*b*) Systematic Mineralogy ; (*c*) Descriptive Mineralogy ; (*d*) Determinative Mineralogy.

(*A*) *Elementary Mineralogy.*

The work in this class is intended as a preparation for those entering upon the studies of geology, petrography and metallurgy. The class should be taken along with the classes of junior chemistry and junior physics, as a knowledge of chemistry and physics is necessary for a proper comprehension of the subject. The regular work consists of lectures on the physical, optical and other properties of minerals, the description of forty or fifty prominent Canadian minerals, followed by practical work in the determination of these. (See under blowpipe analysis.) The practical work of the class is conducted in the mineralogical and blowpipe laboratory, where cabinets containing specimens of commonly occurring minerals are arranged for use. Students are taught to recognize minerals by simple field tests, such as form, color, streak, hardness, specific gravity, etc. For this work students must provide themselves with a pocket-lens, knife, streak-plate, and magnet. The class meets at 9 a.m. on Mondays, and at 8 a.m. three days per week during the last month of the session.

Text-books—Dana's Minerals and How to Study Them.
Crosby's Tables for the Determination of Minerals.

(*B*) *Systematic Mineralogy.*

Before taking this class, students must have passed in elementary mineralogy and junior chemistry. The work is preparatory to that in petrography, geology and descriptive mineralogy, which should be taken in the session following.

The regular work consists of a course of lectures, two hours per week, dealing with the physical, optical and other properties of minerals, illustrated by specimens from the lecture-cabinet, microscopic slides, thin sections, models and charts, supplemented by a course of evening lectures, illustrated by lantern slides, and intended as a review of the work in the day classes. Students taking this class must attend the course of lectures on crystallography delivered early in the fall term, in connection with the senior chemistry class, and those intending to do advanced work in mineralogy must attend the lectures on crystallography delivered in connection with first honour chemistry, during the fall term. Essays on prescribed subjects are required. The class meets at 2 p.m. on Mondays and at another hour convenient for the members.

Text-books.—Bauerman's Systematic Mineralogy. (Longmans, Green & Co.)
Tschermak's *Mineralogie.*
Williams' Crystallography. (Henry Holt & Co.)

Books for reference :

Dana's Text-book of Mineralogy, 17th ed., 1897. (Wiley & Sons.)
Naumann-Zirkel's *Mineralogie.*

(*C*) *Descriptive Mineralogy.*

Before taking this class students must have passed in elementary and systematic mineralogy.

The work of this class consists in the exhibition and description of the mineral specimens contained in the museum collection. Special attention is given to ores, gangue minerals, those having a commercial value and those of importance as rock-forming minerals, in geology. The specimens are constantly being increased by collection, donation, exchange and purchase, the aim being to make the museum as complete and representative as possible. Dana's *System of Mineralogy* is used as the text-book. No attempt is made to learn the minerals mechanically, the desire being rather to acquire a practical working knowledge, such as would be useful to the assayer, consulting geologist or mining engineer.

(D) Determinative Mineralogy.

Before taking this class students must have passed in elementary and systematic mineralogy.

As far as possible the work of this class is carried on parallel with that in descriptive mineralogy, as the pyrognostic characters are of importance in the description of minerals.

The objects of the class are to assist students in acquiring a knowledge of the chemical properties of minerals and to enable them to test and recognize minerals in the field by simple tests such as streak, specific gravity, etc., or more leisurely at home, by means of the blowpipe and chemical reagents. (See under blowpipe analysis).

Cabinets filled with mineral specimens are provided for use. Students are permitted to handle and examine these, under supervision. The advantage that this class affords to the prospector and field geologist will be at once apparent. During the fall term excursions are made to interesting mineral localities. In this way the nucleus of a collection may be secured at a small cost.

Text-book—Crosby's Tables for the Determination of Common Minerals.

GEOLOGY AND PETROGRAPHY.

Professor: Willet G. Miller, B.A.

The instruction in this department is adapted to the needs of the prospector, the mining engineer, and the professional geologist. Provision is also made for persons who desire a knowledge of the subject as part of a general education. Graduates and others who wish to pursue some special line of investigation, or to have the use of the laboratories and apparatus, in order to work up material collected by themselves, will have every facility placed at their disposal.

Students have access to the museum of Queen's University, which contains a large number of specimens illustrative of the geology of Canada, as well as to the collections of the school.

A course in field geology, lasting about three weeks, is given during September in each year. Particulars concerning the course may be obtained from the Bursar.

Second Year.

GEOLOGY.

Before taking this class students must have passed in elementary mineralogy and in junior chemistry.

The object of this course is to give a general knowledge of the subject as an introduction to the work of the third and fourth years.

The following themes will be treated of in the lectures :— The planetary relations of the earth ; the atmosphere ; waters ; solid crust ; probable nature of the earth's interior ; rocks, their general megascopic and microscopic characters and classification ; volcanic action ; earthquakes ; upheaval ; subsidence ; geological effects produced by heat, air, water, and life; bosses ; dykes ; veins ; stratification ; dip ; strike ; anticline and syncline ; faults; foliation ; nature and uses of fossils ; stratigraphical geology ; outline of the geological history of the globe, etc.

The lectures are illustrated by means of maps, diagrams and lantern views.

The laboratory work will consist of the examination of typical specimens of the different groups of fossil plants and animals, and of hand specimens of the more common rocks

During the months of October and November excursions will be made to places of geological interest in the vicinity of Kingston.

Students are expected to take part in all of these excursions. The cost will not exceed five dollars. Each student should provide himself with a suitable hammer, specimen bag and note-book.

W. B. Scott's "An Introduction to Geology" (The Macmillan Co., price $1.90,) is recommended as a Text-book.

Books for reference :

Kemp's " Hand-book of Rocks " (price $1.50.)
LeConte's Compend of Geology.
Dana's Manual of Geology (last edition).
Chapman's Minerals and Geology of Ontario and Quebec.

Third Year.

GEOLOGY.

Before taking this class, students must have passed in geology of the second year.

In this course special attention will be given to stratigraphical geology and the geology of Canada. Type fossils of the different formations will be studied.

Text-books and books for reference:

Chapman's Minerals and Geology of Ontario and Quebec.
Dawson's Geology of Canada.
Dana's Manual of Geology.
Wood's Elementary Palæontology.
Geological Survey Reports of Canada.

PETROGRAPHY.

This course will consist of lectures on the use of the petrographical microscope and accessories in the determination of the rock-forming minerals, together with the determination of some of the more common igneous rocks.

The lectures will be illustrated by means of microscopic projections of thin sections of minerals and rocks, and will be supplemented by a large amount of laboratory work.

A considerable variety of dyke rocks occurs in the Kingston district. These will be studied in the field, and specimens will be collected by each student for examination in the laboratory.

Boxes for holding slides and material used in the preparation of thin sections may be obtained from the Bursar.

Each student is expected to provide himself with a copy of Kemp's Hand-book of Rocks (price $1.50.)

Text-books and books for reference :

Rosenbusch's Iddings' Miscroscopical Physiography of Rock-Forming Minerals.
Lœwinson-Lessing's Tables for the Determination of the Rock-Forming Minerals.
Hatch's Petrology.
Harker's Petrology for Students.

ORE DEPOSITS.

Lectures on the origin, modes of occurrence and uses of metalliferous minerals, with mention of the chief localities. The characters by which ore bodies are sometimes indicated to the prospector will be described. A sketch will be given of the geology of some of the leading mining districts.

Text-books and books for reference :

Phillips' Ore Deposits.
Kemp's Ore Deposits of the United States.
Mineral Statistics, Geological Surveys of Canada and the United States.
Rothwell, The Mineral Industry. Vols. I, II, III, IV and V.

Fourth Year.

GEOLOGY.

A study will be made of structural and dynamical geology in connection with their bearings on economic problems.

Opportunities will be offered for those wishing to prosecute any special line of investigation.

Students are advised to devote as much time as possible to field work during the preceding long vacation, and to collect material for study in the laboratory during the winter.

Text-books—Geikie's Text-Book of Geology.
Dana's Manual of Geology.

PETROGRAPHY.

A course of lectures will be given on the microscopic characters and classification of the igneous rocks and on the characters, origin and classification of the pre-Cambrian formations.

Special attention will be paid to the metamorphic series of the Kingston district, as exceptional opportunities are here offered for the study of the field relations of these rocks, and for attacking those problems as to their origin which are now attracting the attention of geologists.

The *petrographical laboratory* is supplied with electric power and provided with diamond saws and other apparatus needed in the preparation of thin sections of minerals and rocks for examination with the microscope.

Laboratory facilities are also provided for micro-chemical tests, and for the use of heavy solutions in separating the constituents of rocks.

The school owns several petrographical microscopes of the latest and most improved designs.

Text-books and books for reference:

Rosenbusch—*Die Massige Gesteine.*
Zirkel—*Lehrbuch der Petrographie.* Vols. I, II and III.
Levy and Lacroix—*Les Mineraux des Roches.*
Rosenbusch-Iddings—Microscopical Physiography of Rock-Forming Minerals.
Iddings—The Origin of Igneous Rocks.
Van Hise—Correlation Papers, Archæan and Algonkian.

ECONOMIC GEOLOGY.

Lectures on the origin, modes of occurrence and uses of the metals and their ores; materials used in the production of light and heat; minerals used in chemical manufactures; fertilizers; mineral pigments; salt, brine and mineral waters; building materials; cements; refractory materials; abrasive materials; gems and precious stones; miscellaneous.

MINING ENGINEERING AND METALLURGY.

Professor: Courtenay De Kalb.

These courses are given by lectures and text-book work, supplemented by models, drawings, photographs, the actual examination of mines and works, and practical work in gold milling, ore dressing, and sampling, in the mining laboratory.

The Course in Mining.

The lectures on the art of mining are designed to make the student familiar with the operations in vogue in this and other countries for finding, developing, extracting and mechanically treating minerals of economic value. It brings to a practical issue the information acquired by the lectures on mathematics, mechanics, surveying and physics. A knowledge of chemistry and mineralogy is also necessary to give a satisfactory appreciation of the character of the ores searched for or extracted. Connected with the mining of the ore, its geological association is considered.

The topics discussed are the following :—

Ore Deposits. A brief review of the manner of occurrence of economic minerals, and their relations to the enclosing country rocks, so far as such relations can be generally stated. Also the influence of ore deposits under certain conditions upon topography, and connections between topographic forms dependent upon geological structure and the probability of the existence of veins of ore. This discussion is merely supplementary to the more extended treatment of the subject in the Department of Geology, being designed to further emphasize circumstances of practical moment to the prospector and miner.

Prospecting. Systematic methods of rapid geological and mineralogical reconnoissance for the purpose of discovering mineral deposits. Gossan and "float" phenomena fully discussed. Minerals found in gravel beds in water courses, and their importance as indices of near-by deposits of valuable ores. Systematic mothods for locating an indicated vein. Application of pits and trenches for discovery of deposits.

Mine Development. Preliminary consideration of conditions affecting the probable success or failure of mining operations in any particular locality; fuel, water, food, supplies, transportation facilities and costs. Location of development workings. Choice of method of approach. Blocking out the ore for measurement. Systematic methods of obtaining accurate samples of ore "in place" and on the dump. Methods of estimating the value of the mine.

Boring. Use of bore holes. Methods of boring. Boring by percussion. Methods by rods and by ropes. Boring tools; casing; loss and recovery of tools; etc. Rotary boring. Earth augers. Diamond drills worked by hand and by machinery.

Excavation. Tools for breaking ground. Hand tools; machine tools; steam excavators and dredgers. Hand drilling. Power drills,—types, management and maintenance. Theory and

practice of blasting. Kinds and effects of explosives. Location of holes. Charging and firing holes, singly, simultaneously and in series. Precautions in blasting. Substitutes for explosives.

Mining Methods. Works for approach and underground communication. Shaft sinking. General principles. Protection of shaft mouth. Methods of sinking, blasting, ventilating, hoisting and unwatering during sinking. Winzes,—location, and methods of sinking and upraising. Tunnels, drifts, gangways, adits, slopes, contour levels. Advancing by single breast, and by benches. Trimming up and maintaining alignment.

Works for winning minerals. Stoping. Overhand and underhand stoping methods; their application and limitations. Cross-cut methods for wide veins. Contouring, and application of cross-cut method to masses. Stripping. Methods suitable for soft ore bodies. Pillar and breast methods, and their variations. Longwall advancing and withdrawing methods. Methods applicable to steeply inclined coal seams. Chutes; "ore mills"; loading bins; staging for overhand work; storage of "deads"; gob walls; robbing of pillars, etc.

Hydraulic Mining. Methods of breaking down banks. Bringing water under high pressure, and delivery by monitors. Flumes; sluices; cleaning up, etc.

Supports. Timber; kinds of timber used for supporting excavations; dry rot; processes used for the preservation of timber; modes of timbering levels, shafts, winzes, slopes and other excavations; masonry and iron or steel supports for similar purposes; special methods of support in the cases of watery and running strata; compressed air, freezing and other processes; saving of timber resulting from the adoption of caving and filling methods.

Transportation. Underground. Wheelbarrows, their limit of efficiency. Cars,—types, capacity, and maintenance. Tracks,—gage; weight of rail; ballasted and unballasted and paved; turnouts; turn-tables and plates; cross-ties; sectional portable track. Haulage; man and animal power; rope traction by single, main and tail, and endless rope; gravity roads; chain traction; underground locomotives; electric traction. Surface transportation; Decauville railroads; electric, and endless cable traction; aerial wire rope tramways,—single and double rope systems.

Hoisting. Head frames, temporary and permanent. Winding drums and engines,—types, and efficiency. Koepe endless rope system of hoisting. Cables,—kinds, efficiency, maintenance

and inspection. Buckets; kibbles; cages; skips. Safety appliances,—to prevent fall of cage or skip; to prevent over-winding. Signalling.

Loading and Unloading Works. Dumping frames or chairs; tipples; elevating and conveying machinery for handling ores and coal; terminal facilities.

Drainage. Preventing access of surface water; adits or drainage tunnels; siphons; removal of water by winding machinery; pumping plant; Cornish system; steam, compressed air and electrical pumping; dams.

Ventilation. Composition of air; gases met with underground; causes of the deterioration of air; dangers of dust; natural ventilation, its advantages; ventilation by furnaces; mechanical ventilators of various kinds; distribution of air through the workings; methods of testing the purity of the air; fire-damp detectors; methods of measuring and recording the volume of air passing through the workings.

Lighting. Candles; lamps fed by tallow, and by animal, vegetable or mineral oils; safety lamps; gas and electric lamps; expense of lighting.

Descent and Ascent. Steps and slides; ladders; winding machinery; safety appliances; man-engine.

Principles of Employment. Day wages; contract work by weight or measure; contracts in which men have an interest in the value of the minerals extracted; administration, organization and business management; mine accounts.

Legislation. Special acts relating to mining properties and their operation.

Accidents. In hoisting, traction, roof falls, blasting, sudden ingress of waters, explosion, mine fires; rescuing of miners under various conditions; fire extinguishment, etc.

Mine Examination and Valuation.

Ore Dressing. Picking and cobbing; crushing methods, and comparative effects in liberation of valuable mineral from gangue; sizing by screens and trommels; theory of fall of bodies in water; classification by the spitzkasten and spitzlutte; jigging, theory of; types of jigs; the jig indicator; sizing *versus* classification in the preparation of ores for jigging; contact-surface concentrators; magnetic separators,—types, and application; special modifications of concentrators, etc., for coal washing; schemes of practical working plants for all classes of ores.

Gold and Silver Milling. Free milling plants; types of stamp mills, their efficiency and limitations. Construction and maintenance of stamp mills. Other methods of crushing for amalgamation. Principles and practice of amalgamation. Treatment of tailings; concentration, roasting, and chlorinating; cyaniding. Washoe process for silver ores; Boss continuous pan amalgamation. Lixiviation methods. Retorting amalgam; treatment of gold and silver precipitates; melting; refining; sampling bullion.

THE COURSE IN METALLURGY.

The subject of metallurgy is treated mainly by lectures, but students are required to do parallel reading in certain manuals, and to be prepared to be questioned upon the matter given in these as well as in the lectures.

Introduction. A thorough drilling in fuels, the special metallurgical uses of each kind; determination of calorific power experimentally and by calculation from composition; charcoal manufacture; coals, coke, coking methods, physical and chemical tests of coke, by-product coking; producer gas and its manufacture in modern approved appliances; liquid fuels, etc., constitutes the introduction to the course. This is followed by a discussion of the physical properties of the common metals, the effects of different impurities, and the constitution and character of the more important alloys; methods of pyrometry.

Furnaces. Furnaces, their kinds and development; special uses; principles of construction. The modern iron blast furnace; low shaft furnaces for lead and copper,—types and relative efficiency; reverberatories for solid fuel; regenerative furnaces; retort furnaces; etc.

Slags. Types of slags; functions of slags; properties of fluxes; calculation of slags.

Supplying Air to Furnaces. Blowers, and blowing engines; chimneys and chimney construction; hot blast stoves; resistance of column of fusion; regulation of blast; causes and effects of irregularity of blast pressure.

Roasting and Calcination. The preparation of ores for smelting by roasting in heaps, kilns, reverberatories, revolving, and various mechanical roasters, is fully explained.

Metallurgy of Special Metals. After the introductory course, the metallurgy of iron and steel, copper, lead, zinc, tin, aluminium, bismuth, antimony, cobalt, nickel, mercury, arsenic, platinum, and matte smelting for gold and silver, are taken up in detail.

MINE SURVEYING.

As a continuation of the work in general surveying, the special conditions met with underground, and the methods of dealing with them, are discussed in a short series of lectures.

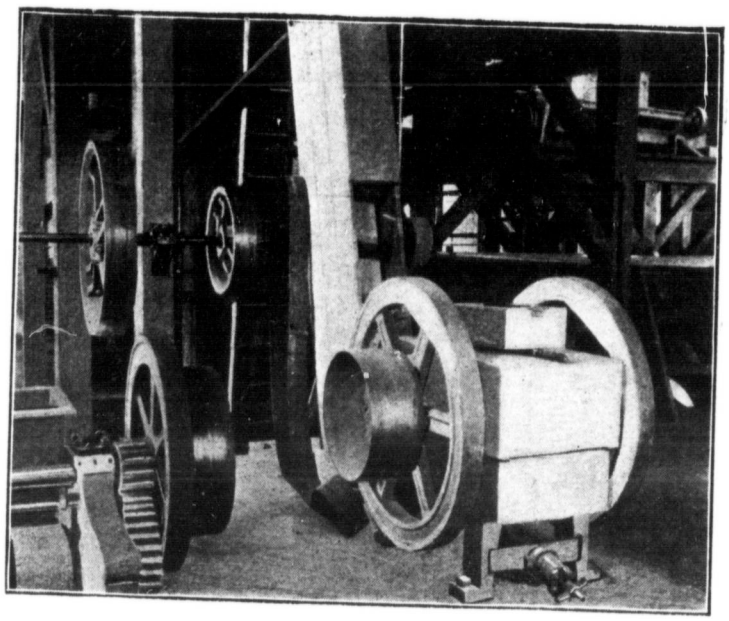
LITERATURE ON MINING AND METALLURGY.

Books recommended to students:

A Manual of Mining. M. C. Ihlseng. (Wiley & Sons, New York.)
The Coal and Metal Miners' Pocket-Book. (Colliery Engineer Co., Scranton, Pa.)
A Key to Mine Ventilation. A. A. Atkinson. (Colliery Engineer Co., Scranton, Pa.)
An Introduction to the Study of Metallurgy. W. C. Roberts-Austen. (Charles Griffin & Co., London.)
Elementary Iron and Steel Metallurgy. A. H. Hiorns. (Macmillan & Co., London.)
Steel: A Manual for Steel Users. William Metcalf. (Wiley & Sons, New York.)
Modern Copper Smelting. E. D. Peters. (Scientific Publishing Co., New York.)
The Metallurgy of Lead. H. O. Hofman. (Scientific Publishing Co., New York.)

Books of Reference.

Ore and Stone Mining. C. Le Neve Foster. (Chas. Griffin & Co., London.)
Coal Mining. H. W. Hughes. (Chas. Griffin & Co., London.)
Miner's Hand-book. John Milne. (Crosby, Lockwood & Son, London.)
A Treatise on Mine Surveying. Bennett H. Brough. (Chas. Griffin & Co., London.)
Manual of Mining. Arnold Lupton. (Longmans Green & Co., London.)
Hand-book of Gold Milling. H. Louis. (Macmillan & Co., London.)
Stamp Milling of Gold Ores. T. A. Rickard. (Scientific Publishing Co., New York.)
Trautwine's Engineers' Pocket-book. (Wiley & Sons., New York.)
Kent's Mechanical Engineers' Pocket-book.
Fuels: The Calorific Power of. Herman Poole. (Wiley & Sons, New York.)
Fuels. John Percy. (John Murray, London)
Metallurgy of Steel. H. M. Howe. (Scientific Publishing Co., New York.)
Notes on Lead and Copper Smelting. H. W. Hixon. (Scientific Publishing Co., New York.)
Cyanide Processes for the Extraction of Gold. M. Eissler. (Crosby, Lockwood & Son, London.)
A practical Treatise on Hydraulic Mining. Aug. J. Bowie, Jr. (D. Van Nostrand & Co., New York.)



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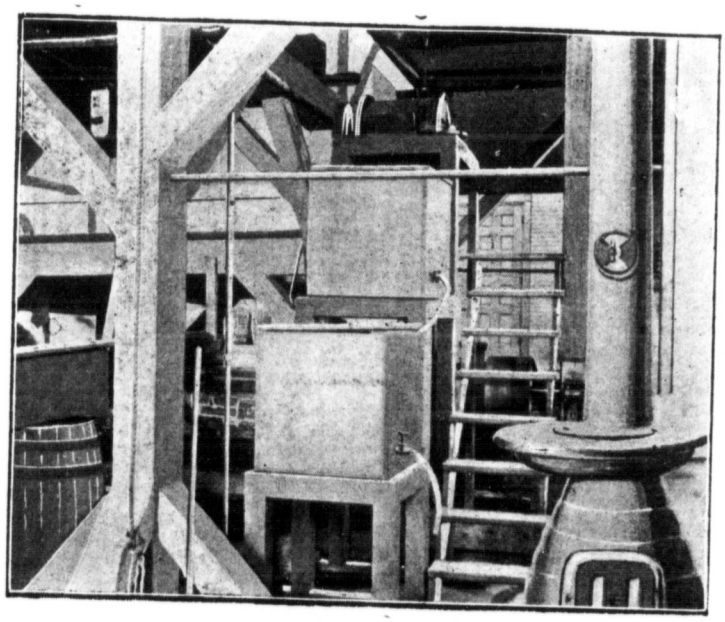
MINING LABORATORY.



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The library of the School of Mining contains a complete set of the Transactions of the American Institute of Mining Engineers, and numerous modern works bearing upon all departments of mining, metallurgy, and allied subjects.

THE MINING LABORATORY AND ORE TESTING WORKS.

The School is now provided with a *mining laboratory* and experimental reduction works, furnished with a stamp mill, concentrators, a sample grinder, rolls and other machines with which ores are treated at the mines; also a reverberatory roasting furnace, a chlorination plant and a cynanide plant. In selecting these machines, local and provincial as well as general conditions have been kept in view. The machines are of sufficient size to operate upon large quantities of ore (a ton or two can be easily handled). To test the suitability of processes, by getting such tests made, costly mistakes may be avoided. The value of the mill in this respect has already been shown in several instances.

The mining laboratory is a distinctive feature of well-equipped mining schools. The various operations of crushing, stamping, grinding, amalgamating, concentrating, chlorinating, sampling, and assaying are, by its aid, studied in such a way as to give the student a lively appreciation of the difficulties to be overcome and the care necessary in these operations.

The plant has been greatly augmented during the past year, and now includes a Blake jaw crusher; rolls; stamp battery; automatic sampler; Sturtevant exhauster and blower, with dust tower; Frue vanner; inlet-discharge hydraulic classifier; vertical line hydraulic separator; 3-compartment Hartz jig; buddle; Wetherill magnetic concentrator; barrel chlorination plant; reverberatory roasting furnace; cyanide plant; gyratory screen shaker; Heald and Sisco centrifugal pump; Northey mine pump; Ingersoll rock drill; 20 H.P. boiler and engine. As will appear from this, the range of operations possible in the mining laboratory is now very great, admitting of an extensive practical drilling of students in ore dressing and gold milling.

MECHANISM.

Lecturer: N. F. Dupuis, M.A., F.R.S.C.
Workshop Instructors: A. Williamson and

The instruction in mechanism is both theoretical and practical.

The theoretical part consists in lectures, with numerous illustrations, upon the nature and actions of the various mechanical elements, and upon their aggregations into machines.

Particular attention will be given to the relative velocities of moving parts, and thence to the ratios between power and resistance. Important machines, such as the clock, the lathe, the steam engine, &c., will be considered in some detail.

Exercises in the theory of mechanism will be given from time to time.

A good knowledge of Algebra and plane Geometry and Trigonometry, with a competent knowledge of perspective, of conics and of the differential calculus, is necessary to a full understanding of the subject.

The practical part of the subject is obtained in the mechanical and physical laboratories.

In the mechanical laboratories the student constructs, under competent direction, pieces of mechanism *ab-initio*, making his own drawings and patterns, and working the crude material into complete form. In this way he is introduced to the actual use of tools, both simple and complex, such as saws, chisels, files, lathes, planers, shapers, gear cutters, drills, borers, &c.

Every student will have his work allotted to him, which he is required to do, and his standing in the work will depend upon the quality of the work done, and the spirit in which it is done rather than upon quantity.

CIVIL AND GENERAL ENGINEERING.

Professor:

SECOND YEAR.

Before this class is taken the examination in junior mathematics must be passed.

PRINCIPLES OF ENGINEERING.—This course is intended to be introductory to mining engineering and to the higher study of civil and mechanical engineering.

THIRD AND FOURTH YEARS.

The sections marked (3) will form the principal subjects for the third year, and those marked (4) for the fourth; but in neither year will the work of the class be confined to the subjects thus indicated.

(3) Construction of coffer dams and caissons aud sinking foundations under water.

(3) Nature, production, and use of materials of construction, building stones, limes, cements, mortars, woodworks.

(3) Cross-sectioning for contours and cross-sectioning for quantities.

(3) Estimating quantities of excavation and embankments and structures; common roads.

(3) Location and drainage and construction.

(3) Tramways; curvature and gradients and trestle works.

(3) Profile sections and plans.

(4) Elementary machines and moduli.

(4) Work of an expanding gas or steam.

(4) Hydraulic principles and hydraulic structures.

(4) Hydraulic machines and motors.

(4) Construction of reservoirs, flumes and aqueducts.

(4) Masonwork specifications and construction of stoneworks and of brickworks.

(4) Principles of designing structures.

(4) Strength of materials.

(4) Stresses on framed structures, bridges and roofs.

Books for reference:

Dictionary of Engineering: Spon.
Civil Engineering: Rankine.
Treatise on Foundations: Paton.
Highway Construction: Bryne.

ELECTRICAL ENGINEERING.

Lecturer: N. R. Carmichael, M.A.

The course taken by students of Mining Engineering includes lectures and experiments illustrating the fundamental laws of electricity and magnetism, the construction and management of typical electrical machines, and the ordinary methods of transmitting and using electrical energy. Students should read Silvanus P. Thompson's *Elementary Lessons in Electricity and Magnetism*, latest edition. (The Macmillan Co., New York).

DRAWING.

Lecturer: Wm. Mason.

In each year attendance of at least eight hours a week is required.

At the beginning of each session all students are required to have in possession sets of drawing instruments and materials of approved standard. Students must supply their own drawing paper, which must be of an approved quality.

The lectures and practical work in the second year are arranged with a view to the contemplated pursuits of students in the several branches of engineering. Working drawings of portions of machinery, with details, dimensions, etc., will be frequently assigned as exercises outside of class hours.

FIRST YEAR.

Drawing methods, instruments and materials; linear drawing; blackboard practice in freehand geometrical figures; descriptive geometry; projection of solids; elementary machine drawing; elementary perspective; isometric drawing; tinting and lettering; tracing; blue printing.

Text-books:—Davidson's Linear Drawing and Projection; Davidson's Practical Perspective; Low's Introduction to Machine Drawing.

The work comprised in the above books is the minimum expected of students in the first year; and no student will be admitted to examination who has not satisfactorily completed this work.

SECOND YEAR.

Freehand drawing; advanced problems in perspective; elementary and advanced machine design, involving mining, electrical and other machinery; elementary architecture; working designs for the erection of framed structures in wood, iron and steel, hoists, mills, ore tipples, etc.; ornament; freehand sketching of machinery.

Text-books:—Warren's Perspective; Cryer and Jordan's Machine Construction and Mechanical Drawing; Low and Bevis' Machine Drawing and Design.

Books for reference:—MacCord's Mechanical Drawing; Unwin's Elements of Machine Design, vols. I. and II.; Smith and Slater's Classic and Early Christian Architecture.

SURVEYING.

Lecturer: Wm. Mason.

The grounds of Queen's University and vicinity afford favourable features for topographical instruction. The earlier weeks of the session are chiefly occupied with outdoor work, the field notes thus collected being then plotted. The important subject of mine surveying receives full consideration.

Students about to take second year's work are required to be present at the School of Mining on the 19th September, 1898, to begin field work.

FIRST YEAR.

Elementary methods of plane and topographical surveying; use and adjustment of instruments; elementary field work with tape, chain, compass, transit, level, etc.; drawing methods; maps and scales; plotting; lettering; calculations.

Text-book—Gillespie's Treatise on Surveying.

SECOND YEAR.

Advanced field work, viz., triangulation, topography, geodesy; elementary mine surveying; elementary railway surveying; topographical drawing and contouring.

Text-books—Gillespie's Treatise on Surveying; Raymond's Plane Surveying; Brough's Mine Surveying; Trautwine's Engineer's Pocket-Book; Reed's Topographical Drawing and Sketching.

THIRD YEAR.

Advanced railway surveying (for civil engineering students only); mine surveying with underground work; plans, profiles and cross sections; estimates of quantities. (For details of Mine Surveying see under *Mining Engineering*.)

Text-books—As for second year.

The Classes in English, Mathematics, Physics and Animal Biology are taken in Queen's University.

ENGLISH LANGUAGE AND LITERATURE.

Professor: James Cappon, M.A.

Tutor: Thurlow Fraser.

JUNIOR CLASS.

1. Practical course in Rhetoric and Composition.
2. Analysis of style in connection with the study of passages from Bacon, Jeremy Taylor, Sir Thomas Browne, Addison, Johnson, Burke, Macaulay.
3. A detailed study (in class) of the following works:
   Chaucer, Prologue to Canterbury Tales.
   Shakespeare, Julius Cæsar.
   Carlyle, Essay on Burns.
   Tennyson, Morte d'Arthur.

MATHEMATICS.

Professor: N. F. Dupuis, M.A., F.R.S.C.

Assistant: N. R. Carmichael, M.A.

FIRST YEAR.

The theory and practice of *Algebra* to the Binomial theorem inclusive. Dupuis' Algebra—the first thirteen chapters, omitting chapters XI and XII.

Geometry of the point, line, and circle in the plane. Parts I and II of Dupuis' Plane Geometry.

Besides numerous class-exercises, weekly written exercises will be required.

Mondays, Wednesdays and Fridays at 3 p.m.

SECOND YEAR.

Algebra—Dupuis' Algebra, from the twelfth chapter to the end.

Geometry—Part III of Dupuis' Plane Geometry, and the first 131 pages of Dupuis' Solid Geometry.

Trigonometry—Preceding De Moivre's theorem.

The work of the class will deal with the practical side of the subjects as far as possible, and some attention will be given to perspective and other kinds of projection.

Besides numerous class-exercises, periodical written exercises will be required.

THIRD YEAR.

Elementary Co-ordinate Geometry.

Thursdays at 3 p.m.

Elementary Differential and Integral Calculus.

Thursdays at 11 a.m.

Spherical Trigonometry and Astronomy.

Wednesdays at 4 p.m.

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PHYSICS.

Professor: D. H. Marshall, M.A., F.R.S.E.

Demonstrator: W. C. Baker, M.A.

JUNIOR AND SENIOR CLASSES.

Lectures and Experiments are given in the following subjects:

Properties of Matter.

Extension—Inertia—Mass—Density—Gravitation—Specific weight—Weight of gases—Molecular forces—Energy.

Dynamics.

Kinematics—Statics of solids and fluids—Kinetics of solids and fluids.

Heat.

Thermometry—Calorimetry (Specific and Latent Heats)—Hygrometry—Transference of Heat (Conduction and Radiation)—Dynamical theory of heat.

Magnetism.

With special reference to terrestial magnetism.

Electricity.

Frictional Electricity—Voltaic Electricity—Electro-Magnetism—Dia-Magnetism — Magneto-Electricity — Thermo-Electricity—Electro-Dynamics.

Light.

General Laws of Radiant Energy — Geometrical Optics — Physical Optics—Construction and use of Optical Instruments—Spectrum analysis.

Acoustics.

Propagation of Waves—Physical Theory of Music.

Algebra, Geometry and Trigonometry are applied to the solution of problems, and weekly exercises are given throughout the session.

In the Junior Class the following subjects are principally studied: Properties of matter, dynamics, heat, magnetism, and frictional electricity. In the Senior: dynamics, voltaic electricity, electro-magnetism, magneto-electricity, thermo-electricity, light, and sound.

Text-book—Marshall's *Introduction to the Science of Dynamics*, new edition, published by R. Uglow & Co., Kingston, price $1.50.

The following books should be consulted in connection with the lectures:

Gage's Elements of Physics.
Tait's Properties of Matter.
Balfour Stewart's Heat.
Silvanus Thompson's Electricity and Magnetism.
Taylor's Sound and Music.
Deschanel's Natural Philosophy or Ganot's Physics.
Clerk Maxwell's Matter and Motion.
Chambers' Mathematical Tables.

Students who have not studied the Ontario High School Physics are recommended to do so, as questions from this work will be given at the monthly examinations.

Students in the Junior and Senior Classes are offered the privilege of experimenting in the Physical Laboratory under regulations to be explained at the beginning of each session.

ANIMAL BIOLOGY.

Professor: A. P. Knight, M.A., M.D.
Tutors: W. Moffatt, M.A., M.D., E. C. Watson, M.A.

PASS CLASS.

The course in this subject begins on the 1st of October and lasts until the end of January. Lectures or demonstrations will be given tri-weekly at 9 a.m. For laboratory work the class will be divided into two sections, one of which will be taken on Thursdays from 10 to 12 a.m., and the other Fridays, 10 to 12 a.m.

The lectures treat of protoplasm, cells, cell division, reproduction, early stages of development, tissues, organs, differences between animals and plants, general view of invertebrata and of vertebrata, organic evolution.

The laboratory work consists of such dissections and demonstrations as will elucidate the subject of the lectures. The lectures are illustrated by diagrams, charts, and lantern transparencies.

The senior leaving examination in Biology of the Educational Department is accepted in lieu of attendance and examination in this class.

Text-book—Campbell's Introduction to the Study of Elementary Biology (Macmillan & Co.)

PROSPECTORS' COURSE.

The School offers to mine foremen, assayers, prospectors, and mining men generally, special courses of instruction, beginning January 19th, 1899, and continuing for eight weeks, as follows :

1. CHEMISTRY.—A short course of lectures illustrated by experiments, introductory to the courses in mineralogy and assaying.—DR. GOODWIN.

2. MINERALOGY.—Lectures illustrated by specimens, dealing with the general principles of mineralogy, and accompanied by practice in identifying minerals by field tests.—PROF. NICOL.

3. GEOLOGY.—Lectures on the elements of Geology, with illustrations from the geology of Ontario. *Ore Deposits* will claim special attention.—PROF. MILLER.

4. LITHOLOGY.—The character and modes of occurrence of rocks generally—Examination of hand specimens—Special attention will be given to the crystalline rocks of Ontario, the more typical mineral-bearing rocks being well represented by specimens in the collection.—PROF. MILLER.

5. DISCOVERY AND WINNING OF ORES.—This course will be of particular interest to mining men and prospectors, as it will deal with the application of the principles of chemistry, mechanics, mineralogy and geology to the discovery and winning of valuable minerals, and to the usual methods and machinery in vogue to open up the deposits and exploit and prepare the ore. The use of the miner's pan is practised.—PROF. DE KALB.

6. MILLING.—The class will have opportunities of learning in the *mining laboratory* the use of crushers, stamp mill, roasting furnace, chlorination apparatus, and other machinery.—PROF. DE KALB.

7. BLOWPIPING.—A practical course intended to give facility in the use of the blowpipe for the identification of minerals.—PROF. NICOL.

8.—ASSAYING.—Opportunities will be given for practice in field methods, particularly in the pan amalgamation assay.—PROF. NICOL.

9. DRAWING.—The elements of mechanical and free-hand drawing as applied to surveys of mining claims and mines, to mining plant, &c.—MR. MASON.

10. ADVANCED WORK.—Those who are prepared for such work may attend (without charge) lectures on *technical chemistry*, and on *advanced mineralogy and geology*.

FEES.—Every student must pay a registration fee of one dollar. For all the elementary courses (No. 1 to 8 inclusive) a fee of ten dollars will be charged; for any one of them two dollars. Fees for the use of the laboratories for advanced work will be in proportion to the number of hours a week; but not to exceed eight dollars.

OTHER EXPENSES.—Good board can be had in the city at from $3.00 to $4.00 a week. The other items of expense (for books, etc.,) need not be large.

The work is made thoroughly practical; and those who wish to enter upon it can do so with advantage, even though they may have had no previous scientific education. Those who wish may, upon payment of an extra fee, continue the work for another month.

EXTRAMURAL CLASSES FOR PROSPECTORS AND MINING MEN.

The School of Mining sends lecturers to mining centres to conduct classes in Elementary Chemistry, Mineralogy, and Geology as applied to the discovery and testing of economic minerals. Sets of apparatus and chemicals are provided, and those attending these classes have an opportunity of learning to use the blowpipe for the detection of minerals, and to make silver and gold assays with the blowpipe and by pan amalgamation.

SUMMER CLASSES.

The object of these Classes is to assist teachers and others who cannot attend the University during the Winter session in completing a University course. For the Summer of 1898 the subjects will be Latin, Greek, Animal Biology and Chemistry. Laboratories open June 29th and lectures begin on July 2nd. Persons proposing to attend should apply for prospectus to the Registrar of Queen's University.

FIELD CLASSES IN GEOLOGY AND PROSPECTING.

The attention of students and others is called to the annual tour of three weeks for the practical study of geology, mineralogy and prospecting methods. Some of the chief mineral localities of the Kingston district are visited each session, and abundant opportunities are offered for collecting specimens and studying the modes of occurrence of substances of economic value. All students in geology and mineralogy are expected to take advantage of these excursions.

MINERAL AND GEOLOGICAL SPECIMENS.

It is desired to make the collections of this School as complete and representative as possible of the mineral resources of Canada. Specimens sent to the School will be named free of charge. Good specimens presented to the School will be labelled with the name of the donor and the locality, and will be preserved for reference.

Samples under 25 lbs. in weight may be sent by express; over that weight, by freight.

Specimens should be addressed to the Professor of Mineralogy, or to the Professor of Geology, School of Mining, Kingston, Ont.

THE BRUCE CARRUTHERS SCHOLARSHIP.

The following are the conditions upon which this scholarship (of the value of $200) is awarded and held:

1. The candidate must have sufficient practical knowledge to give efficient help in the mining laboratory. It is particularly required that he be acquainted with amalgamating.

2. The candidate must have entered upon, or be prepared to enter upon, one of the courses of study as at page 16.

3. The scholar must run the machinery in the mining laboratory when required, must take care of the machinery and see that it is kept in good repair. It is understood that these duties are to be so arranged as to interfere as little as possible with the studies of the scholar.

4. The scholarship may be held for more than one session.

5. Applications will be received up to April 1st.

SCHOLARSHIP IN CHEMISTRY.

This scholarship, of the value of $50, the gift of a graduate, is open to all who have not yet begun the honour course in chemistry. The holder must enter upon and complete the honour course in chemistry (see Calendar of Queen's University). An examination will be held on September 27th, on the syllabus of the senior chemistry class.

DONATIONS OF MINERALS, &c.

1. Native Gold. J. C. McDonald, Crystal Mine.

2. Sand, containing Platinum and Palladium: Gersdorffite Crystal. D. P. Shuler, Copper Cliff.

3. Free Gold in Quartz. E. J. Townsend, Sudbury.

4. Free Gold: La Mascotte Mine. J. G. Carroll, Rat Portage.

5. Gold Ore: Belmont Mine, Marmora. Cuprite. A. W. Carscallen, M. P.

6. Garnets, Pyroxene, and Cassiterite. J. L. Aunger, Blairton.
7. Pyrite and Chalcodite. P. Kirkegaarde, Deloro.
8. Pyrite. Joseph Davidson, Deloro.
9. Native Silver and Native Arsenic. J. W. Cross, Port Arthur.
10. Molybdenite. J. Bremner, Bancroft.
11. Native Gold: Neepewa Mine. Jas. Mackenzie, Rat Portage.
12. Cinnabar: Cinnabar Mining Co., of B.C., Ltd., Savonas Station. Acton Burrows, per D. McNicoll, C. P. R., Montreal.
13. Scapolite. T. J. Barnett, Cobden.
14. African Asbestos (blue, fine sample). R. H. Jones, per B. T. A. Bell, "*Mining Review*," Ottawa.
15. Celestite. Joshua Legge, Gananoque.
16. Bornite. F. A. Cheney, Thessalon.
17. Native Silver: Thunder Bay District. Logie Macdonell.
18. Auriferous Pyrrhotite. T. B. Caldwell, Lanark.
19. Garnet Crystals: Alaska. T. S. Scott, B.A., B.Sc.
20. Asbestos: Quebec. Prof. R. Carr-Harris.
21. Numerous Mineral Specimens. W. N. Wylie, Sault Ste. Marie.
22. Collection of Iron Ores. W. F. Ferrier, Ottawa.
23. Native Copper and associated Rock-Calcite and Chrysocolla; Red Calcite: Cobokonk District. R. W. Leonard, C. E.
24. Jasper Conglomerate, Argentite, Steatite, &c. Jas. Cozens, M.E.
25. Free Gold in Mispickel. F. Derry, Malone.
26. Cobalt bloom. R. T. Gray, Madoc.
27. Large mass of Calcite Crystals. Paul Kingston, Godfrey.
28. Gold in Mispickel. John Cross, Deloro.
29. Welsh Anthracite Coal. W. F. Torrance, Montreal.
30. Petroleum Products; complete and handsome set. Queen City Oil Co. (Ltd.), Toronto, per M. P. Firth, Principal, Pickering College.

DONATIONS OF MACHINERY, &c.

1. Heald & Sisco centrifugal pump, No. 1, 5-inch suction, 2-inch delivery pipe. Presented by the Morris Machine Works, Baldwinsville, New York. An important addition to the laboratory, for the elevation of pulp in the concentration of ores.

2. Sturtevant exhauster and blower, 15 inches diam. Presented by the B. F. Sturtevant Co., Jamaica Plain, Massachusetts. Used to draw off dust from the crushing machines, and, in connection with a dust tower, to effect a gradation of dust according to size and mass.

3. Wetherill Magnetic Concentrator. Loaned by the Wetherill Concentrating Co., New York City. The most recent type of magnetic separator, with very powerful magnet, and strong field. Capable of separating not only magnetic iron, but ordinary hematite and limonite, and even

common iron garnets, from their accompanying gangue. Its presence in the laboratory permits tests to be made upon the mechanical purification of iron ores.

4. No. 1 Automatic Acetylene Gas Apparatus, 5 lights. Niagara Falls Acetylene Gas Machine Co., Ltd.

5. Samples of all grades of Wire Rope used in mining operations. Trenton Iron Co., Trenton, New Jersey.

DONATIONS OF BOOKS, &c.

1. Annual Report (new series) Vol. VIII., with Reports A, D, J, L, R, S, 1895. From Geological Survey Department of Canada.

2. Seventeenth Annual Report, 1895-96, parts 1, 2, 3 and 3 continued; Bulletins 87, 127, 130, 135 to 148; Monograms 25 to 28, incl. (with Atlas). From United States Geological Survey Department, Washington, D.C.

3. The Geological and Natural History Survey of Minnesota, 1892-96, Vol. III., part II., Paleontology. From State Geologist, Minnesota.

4. Proceedings of Society, Vol. 28, No. 5, pp. 111 to 115; No. 6, pp. 117 to 156; No. 7, pp. 157 to 235. From Boston Society of Natural History, Boston, Mass.

5. University circulars, Vol. XVI., No. 131, Vol. XVII, No. 134. Hospital Bulletin, Vol. VIII, No. 76. From Johns Hopkins University, Baltimore, Md.

6. Statistical Year Book of Canada for 1896. From Statistical Division, Department of Agriculture, Ottawa.

7. Bulletins No. 49 (Fertilizers as sold); No. 52 (Malt Liquors); No. 54 (Condensed Milk). From Inland Revenue Department, Ottawa.

8. Report of the Auditor General for year ended 30th June, 1897. From Auditor General, Ottawa.

9. Ogilvie's "Klondike Guide." From the Department of the Interior, Ottawa.

10. Report of Provincial Instructor in Road-making, 1896. From Ontario Department of Agriculture, Toronto.

11. Sixth Report of the Bureau of Mines (25 copies). From Bureau of Mines, Toronto.

12. Bulletins LXI., LXIII., LXIV., and Special, Dec., 1897. From Bureau of Industries, Toronto.

13. Papers read before Engineering Society, No. 10, 1896-7. From School of Practical Science, Toronto.

14. Transactions of Canadian Institute for October, 1896; Proceedings of the Canadian Institute for Feb. 1897 (new series), Vol. I., No. 1; Do. Vol. I., No. 2, May, 1897. From Canadian Institute, Toronto.

15. Annual Report for 1896; Transactions No. 49 and 50 (in duplicate). From the Historical and Scientific Society of Manitoba.

16. Proceedings and Transactions, Session 1896-7, Vol. IX. (Vol. II., 2nd series) part 3. From the Nova Scotian Institute of Science, Halifax, N.S.

17. "Wire Rope Transportation in all its branches," 1897, together with seven large photographs mounted on card. From the Trenton Iron Co., Trenton, New Jersey, U.S.

18. Geological and Natural History Survey of Canada; Reports, Plans of Lakes and Rivers, Maps, etc., from 1853 to 1893 (21 Vols.); Census of Canada, 1870-71 (4 Vols.); Documentary History of Education in Upper Canada, 1841-43 (1 Vol.); Photographs (5) of Tropical Industries; Lantern slides illustrating sugar, cocoa and ginger manufactures. From M. P. Firth, Esq., Principal, Pickering College.

19. Photographs of Mining Camps, etc. From B. T. A. Bell, "Mining Review," Ottawa.

20. "The Canadian Ice Age," edition 1894, by Sir J. W. Dawson, C. M.G. From W. Tomlinson, New Denver, B.C.

21. Magazines, etc: "Canadian Engineer," Toronto; "The News," Rat Portage, Ont.; "The Star," Sault Ste. Marie, Ont.; "The Standard," Pembroke, Ont.; "Mining News," Montreal, Que.; "The Military Gazette," Montreal, Que.; "The Mining Bulletin," State College, Pa.; "Mining," Spokane, Wash.; "Cement and Engineering News," Chicago, Ill.; "Mining and Scientific Press," San Francisco, Cal.

22. Calendars (8) of Universities, Colleges and Mining Schools.

SPECIMENS EXAMINED AND REPORTED ON FREE OF CHARGE.

1. John Bey, Mazinaw Lake. Bismuthinite and native bismuth.

2. G. R. Monds, Arden. Feldspar, with scales of golden mica,—no value. Quartz carrying graphite.

3. C. H. Spencer, Roblin. Hornblende with magnetite, calcite; barite; garnet crystal; quartz; sand.

4. Walter Yuill, Calabogie. Quartz with pyrite (3), two might be further prospected, if in vein; hornblende, no value; feldspar with iron rust; granite with much feldspar; micaceous rock with green hornblende; gneiss with pyrite; iron and copper pyrites and siliceous dolomite, may be of value if in sufficient quantity; quartz; quartz with schorl (black tourmaline).

5. Wm. Fairbairn, Calabogie. Corundum; quartz, with fahl ore containing, copper, antimony, bismuth and arsenic; quartz and pyrite; quartz and pyrite with fahl ore; tourmaline; rusty quartz; quartz and mica; calk schist; quartz and pyrite, traces of fahl ore; limestone; altered scapolite (?).

6. Alex. Macdonald, Olden Tp., Frontenac. Syenite with pyrite,—no value.

7. T. R. Taggart, Godfrey. Feldspar with pyrite,—no value.

8. R. H. Klock & Co., Klock's Mills. Hornblende and tremolite,—no value.

9. W. D. Black, Parham. Quartz with hornblende; mica and pyrite.

10. E. H. Perry, Centreville. Quartzite with copper and iron pyrites.

11. Chesley Tomlinson, Norland. Pure white quartz; hornblende with quartz and garnet; partly decomposed feldspar with pyrites; pyrite in hornblendic rock.

12. Narcisse Birdman, Griffith. Gneiss, with black mica and pyrite,—no value.

13. Wm. Harris, Day Mills. Quartz stained with hæmatite,—no value.

14. R. W. Leonard, C.E., Beauharnois, Que. Serpentine; red serpentine, green serpentine, pyrite and mica.

15. Silas O'Brien, Norland. Pyrite in hornblende; pyrite in calcite; quartz with pyrite; pyrite with quartz, scapolite and tourmaline; rusty quartz and pyrite; calcite, scapolite and feldspar with pyrite,—no value.

16 Edward Bartlett, Hybla. Quartz, graphite and actinolite; graphite with feldspar, quartz and calcite; pyrite with scapolite, hornblende and feldspar.

17. A. W. Clarke, Wellington. Pyroxene,—no value.

18. George Martin, Fenelon Falls. Quartz with pyrite,—no value.

19. E. L. Fraleck, Bannockburn. Slimes said to interfere with amalgamation,—pyrite and clayey matter.

20. James McCauley, Lonsdale. Gneiss with golden mica,—no value.

21. E. T. Lumb, Fort Stewart. Weathered gneiss,— no value.

22. D. N. McArthur, Calabogie. Pyrite, hæmatite or specularite.

23. A. P. Knight, M.D., Kingston. Specularite from British Columbia.

24. Chas. Scott, Hinchinbrooke. Actinolite schist; mineralized quartz.

25. P. C. Macnee, B.A., Picton. Fossiliferous limestone.

26. John McKerrow, McDonald's Corners. Quartz; tourmaline; mica; —no value.

27. Robt. McGregor, Calabogie. Trap rock; decomposed quartzite; and yellow ochre; garnetiferous rock with pyrite.

28. Thomas McConville, Sunbury. Mineralized and decomposed actinolite schist,—no value.

29. C. H. Billings, Cloyne. Magnetite.

30. Franklin Crandell, Lindsay. Pyroxene-marble and tremolite.

31. John McNulty, Esmond. Pyrite in schistose rock.

32. Colin Crow, Battersea. Granitic rock with pyrite.

33. C. Lamb, Toronto. Calcite with pyrite.

34. W. W. Stammer, Palmerston Tp. Galenite in blue limestone; magnetite in quartz: chalcopyrite in quartz; pyrite in schistose rock; pyrite in granitic rock.

35. Duncan Ferguson, Oso. Quartz.

36. John H. Smith, Feversham. Quartz; oxide of iron and tourmaline,—no value.

37. C. Cole, Colbourne. Hornblende; hornblendic rock with pyrite; native copper.

38. George Jackson, Gananoque. Feldspar.
39. John J. Gorman, Calabogie. Black tourmaline.
40. Carswell and Mackay, Calabogie. Titanic iron ore,—ilmenite; pyrite; pyrrhotite and graphite.
41. Wm. Dockrill, Brewer's Mills Ferruginous clay; graphite in feldspar.
42. W. W. Hudgins, Madoc. Calcareous marl.
43. S. J. Dempsay, Calabogie. Bog iron ore.

I.—PASS LISTS.

Junior English—K. R. McLennan, E. Sutherland, G. H. Dickson, J. Hargreaves, G. R. Coates.

Junior Mathematics—C. P. Merritt, J. Hargreaves.

Senior Mathematics—W. F. Smeeton, F. G. Stevens, M. D. Baldwin, B.A., F. W. Jackson.

Honours I. (Conics)—S. N. Graham, F. W. Jackson

Solid Geometry (Synthetic)—M. D. Baldwin, B.A., W. F. Smeeton, F. G. Stevens, J. W. Wells.

Solid Geometry (Analytic)—C. L. Fortescue.

Thermo-Dynamics—C. L. Fortescue.

Electrical Machines—C. L. Fortescue.

Electric Theory—C. L. Fortescue.

Alternating Currents—C. L. Fortescue.

Mathematical Instruments—S. N. Graham, F. W. Jackson, C. L. Fortescue.

Descriptive Astronomy—(*Div. I.*) S N. Graham. (*Div. II.*) J. D. Craig, B.A., F. G. Stevens, E. Sutherland, G. H. Dickson. (*Div. III.*) C. P. Merritt, M. D. Baldwin, B.A., W. H. Montgomery, K. R. McLennan, J. D. McLennan, W. F. Smeeton, J. Hargreaves, O. N. Scott, A. H. Middlemiss, E. L. Fraleck, B.A.

Workshops (Completed First Year)—S. N. Graham, K. R. McLennan, J. D. McLennan, E. Sutherland, J. D. Craig, B A., W. D. Dick, J. Hargreaves, A. F. Huffman, O. N. Scott, F. G. Stevens, W. H. Montgomery. (*Partial Attendance*) L. Holland, A. H. Middlemiss, G. H. Dickson, N. W. Hinckley, W. W. Moore.

Junior Physics—(*Div. II.*) F. G. Stevens. (*Div. III.*) K. R. McLennan, H. C. Mabee, F. W. Jackson, G. H. Dickson.

Senior Physics—(*Div. II.*) S. N. Graham. (*Div. III.*) W. F. Smeeton.

Junior Chemistry—(*Div. II*) E. Sutherland, G. A. Grover, W. H. Montgomery, O. N. Scott. (*Div. III.*) J. Hargreaves, K. R. McLennan, W. W. Moore, G. R. Coates, G. H. Dickson.

Senior Chemistry—(*Div. II.*) W. F. Smeeton, A. F. Huffman, L. Holland. (*Div. III.*) F. G. Stevens, M.D. Baldwin, B.A., E. L. Fraleck, B.A.

Chemistry of Metals—(*Div. III.*) F. W. Jackson, C. L Fortescue.

Technical Chemistry—(*Div. II.*) W. F. Smeeton, R. Instant, L. Holland, M. D. Baldwin, B.A.

General Chemistry—(*Div. II.*) J. W. Wells.

Crystallography—(*Div. II.*) P. W. Currie, B.A , J. W. Wells.

Organic Chemistry—(*Div. III.*) J. W. Wells.

Qualitative Analysis—(*Div. I.*) J. A. Fife, B.A. (*Div II.*) J. D. Craig, B.A., A. F. Huffman, J. D. McLennan.

Quantitative Analysis and Assaying—(*Div. II.*) R. Instant.

Mineralogy (*Systematic*)—(*Div. I.*) A. F. Huffman, F. G. Stevens. (*Div. II.*) W. F. Smeeton, M. D. Baldwin, B.A., C. P. Merritt. (*Div. III.*) J. D. Craig, B.A.

Blowpipe Analysis—(*Div. I.*) J. D. Craig, B.A., F. G. Stevens. (*Div. II.*) J. C. Murray, G. A. Grover, L. Holland. (*Div. III.*) M. D. Baldwin, B.A., G. R. Coates.

Descriptive Mineralogy—(*Div.* II) R. Instant, (*Div.* III.) C. P. Merritt.

Determinative Mineralogy. (*Div.* II.) R. Instant, C. P. Merritt.

Geology (*First Year*)—(*Div.* I) W. F. Smeeton, J. D. Craig, B.A. (*Div.* II.) M. D. Baldwin, B.A., F. G. Stevens. (*Div.* III.) J. C. Murray, B.A., L. Holland, E. L. Fraleck, B.A.

Petrography (*Div.* II.)—P. W. Currie, B.A.

Economic Geology (*Div.* II.)—P. W. Currie, B. A., R. Instant, J. D. McLennan, W. F. Smeeton, C. P. Merritt.

Geology of Canada—P. W. Currie, B.A., R. Instant.

Mining (*Second Year*)—J. D. Craig, A. F. Huffman, F. G. Stevens, E. L. Fraleck, B. A., L. Holland.

Mining (*Third Year*)—C. P. Merritt, R. Instant, L. Holland.

Ore Dressing—C. P. Merritt, R. Instant, L. Holland.

Metallurgy—J. W. Wells, R. Instant, L. Holland, C. P. Merritt.

Junior Civil Engineering (*Nature, production and use of materials of construction*)—(*Div. I.*) J. D. Craig, B.A., A. F. Huffman, R. Instant, F. W. Jackson, L. Holland. (*Surveys of railways and common roads*)—(*Div. I.*) S. N. Graham, J. D. Craig, B.A., A. F. Huffman, L. Holland, R. Instant. (*Strength of materials*)—(*Div. I.*) A. F. Huffman, S. N. Graham, R. Instant, L. Holland, C. L. Fortescue, J. D. Craig, B.A., F. W. Jackson.

Senior Civil Engineering—(*Div. I.*) S. N. Graham, J. D. Craig, B.A., A. F. Huffman, L. Holland, R. Instant.

Drawing (*First Year*)—(*Div. I.*) J. A. Fife, B.A., J. D. Craig, B.A., K. R. McLennan. (*Div. II.*) O. N. Scott, W. H. Montgomery, J. D. McLennan, W. W. Moore, E Sutherland, A. F. Huffman. (*Div. III.*) J. Hargreaves, W. D. Dick, G. H. Dickson, N. W. Hinckley, A. H. Middlemiss.

Drawing (*Second Year*)—(*Div. I.*) F. G. Stevens.

Surveying (*First Year*)—(*Div. I.*) J. D. Craig, B.A., F. G. Stevens, K. R. McLennan, A. F. Huffman, L. Holland, O. N. Scott, R. Instant. (*Div. II.*) J. Hargreaves, J. D. McLennan, E. Sutherland, W. W. Moore, W. H. Montgomery, G. H. Dickson, A. H. Middlemiss. (*Div. III.*) W. D. Dick, N. W. Hinckley.

Surveying (*Second Year*)—(*Div.* II.) C. P. Merritt, W, F. Smeeton, R. Instant.

II. GRADUATES.

BACHELORS OF SCIENCE.

In Chemistry and Mineralogy—Horace C. Mabee, Port Hope; James Walter Wells, Toronto.

In Electrical Engineering—Charles L. Fortescue, Kingston.

MINING ENGINEERS.

John Donnelly, Jr., Kingston; Guy H. Kirkpatrick, B.Sc., Toronto.

III. BRUCE CARRUTHERS SCHOLARSHIP FOR 1898-99.

Horace C. Mabee, Port Hope; Reginald Instant, Emerald.