

INFORMATION DOCUMENT

COMPLEMENTARY EXAMINATION

CHEMISTRY

Secondary V
551-570

June 2002

Québec 

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INTRODUCTION

This document provides the information needed to understand the guidelines for the evaluation of student learning in *Chemistry 534* and to administer the Secondary V complementary examination in June 2002.

The Ministère de l'Éducation (MEQ) will develop a written examination as part of the summative evaluation process. School boards and private schools may decide to administer this examination or a locally-prepared one. Note that if school boards or private schools choose the MEQ's complementary examination, they must follow the timetable set for this examination.

School boards and private schools are responsible for developing laboratory examinations. To ensure a certain measure of province-wide uniformity, it is important that laboratory examinations take into account the information found in this document.

1 ASPECTS OF THE CURRICULUM

1.1 SKILLS

The following skills will be taken into account in designing evaluation items: mastery of concepts, mastery of applications and the ability to solve written problems.

1.1.1 Mastery of Concepts

The student will be able to carry out a written task which shows that he or she knows and understands a concept (element, operation, relationship, model) related to science and technology.

The evaluation items related to this skill may be presented as multiple-choice or constructed-response questions and may involve one of the following:

- identifying or explaining a concept
- identifying or describing examples and counter-examples related to a given concept

1.1.2 Mastery of Applications

The student will be able to carry out a specific written task by applying a combination of scientific and technological concepts (elements, operations, relationships, models) that he or she has already learned.

The evaluation items related to this skill may be presented as multiple-choice or constructed-response questions and may involve one of the following:

- choosing and applying a known combination of concepts
- explaining or justifying a known combination of concepts

1.1.3 Problem Solving

The student will be able to carry out a laboratory task by applying the principles of the scientific method as well as the scientific and technological concepts he or she has learned in this course.

The evaluation items related to this skill ask the student to give a written explanation of all the steps in the scientific procedure he or she has used to achieve the required result.

The student's work must be evaluated according to the following criteria:

- the definition of the problem (recognition of the problem, statement of the hypothesis, identification of the variables, choice of experiments)
- processing of data (choice and presentation of data, inference, and plausibility of the data)
- conclusion (statement and justification)

2 CONTENT OF THE WRITTEN EXAMINATION (551-570)

The written examination is developed by the MEQ and comprises 25 questions. The following table shows the distribution of the number of questions taking into account the relative importance given to the various components of the curriculum.

SKILL	MODULE			
	Gases 28%	Energy 28%	Kinetics 16%	Equilibrium 28%
Mastery of Concepts 28%	1	2	2	2
Mastery of Applications 40%	3	3	1	3
Solving Written Problems 32%	3	2	1	2

The examination consists of the following types of questions:

- 17 multiple-choice questions that test the student's mastery of concepts and applications
- 8 constructed-response questions that test the student's ability to solve written problems

3 DURATION OF THE WRITTEN EXAMINATION (551-570)

The written examination lasts two and one-half hours.

4 AUTHORIZED MATERIALS FOR THE WRITTEN EXAMINATION (551-570)

Only the following materials may be used during the examination:

- drawing instruments
- graph paper
- scientific calculator with or without a graphic display
- sheet of formulas and quantities included in the examination booklet (see Appendix I)
- periodic table of the elements included in the examination booklet (see Appendix II)
- if necessary, a table of standard reduction potentials included in the examination booklet (see Appendix III)

5 CORRECTION OF THE WRITTEN EXAMINATION (551-570)

School boards and private schools correct the entire examination according to the instructions in the MEQ-prepared marking guide, which includes a marking scale for scoring the constructed response questions. This scale is presented in Appendix IV. It is suggested that this scale be used throughout the school year.

Each question is worth four (4) marks, and the examination is out of 100 marks.

6 CONTENT OF THE LABORATORY EXAMINATION (551-580)

This involves assessing the student's knowledge and skills by means of summative laboratory examinations. Students will be evaluated on an individual basis. The school boards and private schools are totally responsible for this evaluation.

The marking scale to be used for scoring the answers to questions in summative laboratory examinations is presented in Appendix V. The student's version of this scale is found in Appendix VI. It is suggested that these scales be used throughout the school year.

7 CORRECTION OF THE LABORATORY EXAMINATION (551-580)

The laboratory examination, which is a local responsibility, is out of 100 marks, but it is worth 25% of the student's final mark. School boards and private schools will score this examination.

The marking scale to be used to evaluate laboratory work is presented in Appendix V. The student's version of this scale is found in Appendix VI. It is suggested that these scales be used throughout the school year.

8 DETERMINING THE FINAL MARK (551-584)

The student's final mark is broken down as follows:

Written work (551-570)	75%
Laboratory work (551-580)	<u>25%</u>
Final mark (551-584)	100%

SHEET OF FORMULAS AND QUANTITIES

FORMULAS
$Q = mc\Delta T$
$pV = nRT$
$\frac{P_1V_1}{n_1T_1} = \frac{P_2V_2}{n_2T_2}$

QUANTITIES		
NAME	SYMBOL	VALUE
Specific heat capacity of water	-----	4190 J/(kg• C) or 4.19 J/(g• C)
Density of water	,	1.00 g/MI
Molar gas constant	R	8.31 L•kPa/(mol•K)

PERIODIC TABLE OF THE ELEMENTS

Appendix II

I A 1		Key										VIII A 18					
1 H 1.01		Element Symbol										Atomic number					
2 He 4.00		Atomic Mass															
3 Li 6.94		4 Be 9.01		5 B 10.81		6 C 12.01		7 N 14.01		8 O 16.00		9 F 19.00		10 Ne 20.18			
11 Na 22.99		12 Mg 24.31		13 Al 26.98		14 Si 28.09		15 P 30.97		16 S 32.07		17 Cl 35.45		18 Ar 39.95			
19 K 39.10		20 Ca 40.08		21 Sc 44.96		22 Ti 47.90		23 V 50.94		24 Cr 52.00		25 Mn 54.94		26 Fe 55.85			
37 Rb 85.47		38 Sr 87.62		39 Y 88.91		40 Zr 91.22		41 Nb 92.91		42 Mo 95.94		43 Tc 98.91		44 Ru 101.07			
55 Cs 132.91		56 Ba 137.33		57-71 La-Lu		72 Hf 178.49		73 Ta 180.95		74 W 183.85		75 Re 186.21		76 Os 190.20			
87 Fr (223)		88 Ra (226)		89-103 Ac-Lr		104 Rf (261)		105 Ha (262)									

Standard Reduction Potentials

(Ion Concentration of 1 mol/L at 25 °C and 101.3 kPa)

Appendix III

Reduction Half-reaction	Reduction Potential (V)
$\text{F}_2(\text{g}) + 2\text{e}^- \rightarrow 2\text{F}^-(\text{aq})$	$E^\circ = +2.87$
$\text{Au}^{3+}(\text{aq}) + 3\text{e}^- \rightarrow \text{Au}(\text{s})$	$E^\circ = +1.50$
$\text{Cl}_2(\text{g}) + 2\text{e}^- \rightarrow 2\text{Cl}^-(\text{aq})$	$E^\circ = +1.36$
$\text{Br}_2(\text{aq}) + 2\text{e}^- \rightarrow 2\text{Br}^-(\text{aq})$	$E^\circ = +1.09$
$\text{Br}_2(\text{l}) + 2\text{e}^- \rightarrow 2\text{Br}^-(\text{aq})$	$E^\circ = +1.07$
$\text{Ag}^+(\text{aq}) + \text{e}^- \rightarrow \text{Ag}(\text{s})$	$E^\circ = +0.80$
$\text{Hg}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Hg}(\text{l})$	$E^\circ = +0.78$
$\text{Fe}^{3+}(\text{aq}) + \text{e}^- \rightarrow \text{Fe}^{2+}(\text{aq})$	$E^\circ = +0.77$
$\text{I}_2(\text{s}) + 2\text{e}^- \rightarrow 2\text{I}^-(\text{aq})$	$E^\circ = +0.53$
$\text{Cu}^+(\text{aq}) + \text{e}^- \rightarrow \text{Cu}(\text{s})$	$E^\circ = +0.52$
$\text{Cu}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Cu}(\text{s})$	$E^\circ = +0.34$
$2 \text{H}^+(\text{aq}) + 2\text{e}^- \rightarrow \text{H}_2(\text{g})$	$E^\circ = 0.00$
$\text{Pb}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Pb}(\text{s})$	$E^\circ = -0.13$
$\text{Sn}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Sn}(\text{s})$	$E^\circ = -0.14$
$\text{Ni}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Ni}(\text{s})$	$E^\circ = -0.26$
$\text{Co}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Co}(\text{s})$	$E^\circ = -0.28$
$\text{Fe}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Fe}(\text{s})$	$E^\circ = -0.44$
$\text{Cr}^{3+}(\text{aq}) + 3\text{e}^- \rightarrow \text{Cr}(\text{s})$	$E^\circ = -0.74$
$\text{Zn}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Zn}(\text{s})$	$E^\circ = -0.76$
$\text{Cr}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Cr}(\text{s})$	$E^\circ = -0.91$
$\text{Mn}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Mn}(\text{s})$	$E^\circ = -1.18$
$\text{Al}^{3+}(\text{aq}) + 3\text{e}^- \rightarrow \text{Al}(\text{s})$	$E^\circ = -1.66$
$\text{Be}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Be}(\text{s})$	$E^\circ = -1.85$
$\text{Mg}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Mg}(\text{s})$	$E^\circ = -2.37$
$\text{Na}^+(\text{aq}) + \text{e}^- \rightarrow \text{Na}(\text{s})$	$E^\circ = -2.71$
$\text{Ca}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Ca}(\text{s})$	$E^\circ = -2.87$
$\text{Sr}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Sr}(\text{s})$	$E^\circ = -2.89$
$\text{Ba}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Ba}(\text{s})$	$E^\circ = -2.91$
$\text{Cs}^+(\text{aq}) + \text{e}^- \rightarrow \text{Cs}(\text{s})$	$E^\circ = -2.92$
$\text{K}^+(\text{aq}) + \text{e}^- \rightarrow \text{K}(\text{s})$	$E^\circ = -2.93$
$\text{Rb}^+(\text{aq}) + \text{e}^- \rightarrow \text{Rb}(\text{s})$	$E^\circ = -2.98$
$\text{Li}^+(\text{aq}) + \text{e}^- \rightarrow \text{Li}(\text{s})$	$E^\circ = -3.04$

MARKING SCALE FOR CONSTRUCTED-RESPONSE QUESTIONS

- 4 marks – The student chose an appropriate procedure and applied it correctly; the final answer is correct.
- 3 marks – The student chose an appropriate procedure, but made minor errors in applying it (calculation or transcription errors, incorrect or missing unit of measurement, number rounded off incorrectly); the final answer is incorrect, or it is correct purely by chance.
- 2 marks – The student chose an appropriate procedure, but made major errors in applying it (errors relating to methods, rules, laws, systems or theories); the final answer is incorrect, or it is correct purely by chance.
- 1 mark – The student's procedure was partially appropriate (i.e. it does not lead to the correct answer, but at least one of the steps is relevant and presented correctly); the answer is missing or incorrect, or it is correct purely by chance
- 0 marks – The student showed no work or chose an inappropriate procedure; the answer is missing or incorrect, or it is correct purely by chance.

Note: If for any reason this scale cannot be applied in its entirety to a particular question, the relevant changes will be described in the marking guide.

MARKING SCALE FOR LABORATORY WORK

(Teacher's Version)

STEP		RATING				
		Very Good	Good	Average	Poor	Very Poor
Definition of the Problem /40	Specification of the Scope of the Problem /12	12	9 to 11	8	5 to 7	0 to 4
	Procedure /28	25 to 28	21 to 24	17 to 20	12 to 16	0 to 11
Processing of Data /48	Organization of Data /24	22 to 24	18 to 21	15 to 17	10 to 14	0 to 9
	Interpretation of Data /24	22 to 24	18 to 21	15 to 17	10 to 14	0 to 9
Conclusion /12	Statement and Justification	12	9 to 11	8	5 to 7	0 to 4

MARKING SCALE FOR LABORATORY WORK

(Student's Version)

STEP	ELEMENT	MARK
Definition of the Problem	Specification of the Scope of the Problem – Recognition of the problem – Statement of the hypothesis	/12
	Procedure – Choice of variables – Choice of experiments	/28
Processing of Data	Organization of Data – Choice of data – Presentation of data	/24
	Interpretation of Data – Inference (logical and valid) – Plausibility of results	/24
Conclusion	Statement and Justification	/12
		Total /100

