

# DEFINITION OF THE EVALUATION DOMAIN

Adult General Education

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Diversified Basic Education Program

Chemistry

CHEMISTRY: GASES AND ENERGY

CHE-5061-2

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## Introduction

The Definition of the Evaluation Domain (DED) ensures consistency between a course and the related evaluation instruments. The DED is used to select, organize and describe the essential and representative elements of the course. The DED is based on the program of study and the course, but should by no means replace them in the planning of instructional activities.

All the DEDs produced after June 30, 2014, by the Ministère de l'Éducation, de l'Enseignement supérieur et de la Recherche (MEESR) are prescriptive. Consequently, they are the reference documents to be used in the development of all examinations, be they ministerial or those developed by adult education centres or by Société GRICS (BIM). The DEDs thus serve as a model for preparing multiple equivalent versions of examinations that are valid across the province.<sup>1</sup>

In addition, as set out in the *Policy on the Evaluation of Learning*, adult learners must know what they will be evaluated on and what is expected of them.<sup>2</sup> The DEDs and the criterion-referenced rubrics (contained in the evaluation instruments) may be used for this purpose.

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<sup>1</sup> Québec, Ministère de l'Éducation du Québec, *Policy on the Evaluation of Learning* (Québec: Gouvernement du Québec, 2003), 47.

<sup>2</sup> *Ibid.*, 9.

## Evaluation Content

General Information			
<p><b>Broad Areas of Learning<sup>3</sup></b></p> <ul style="list-style-type: none"> <li>• Health and Well-Being</li> <li>• Career Planning and Entrepreneurship</li> <li>• Environmental Awareness and Consumer Rights and Responsibilities</li> <li>• Media Literacy</li> </ul> <p><b>Subject Area</b></p> <ul style="list-style-type: none"> <li>• Mathematics, Science and Technology</li> </ul> <p><b>Families of Situations</b></p> <ul style="list-style-type: none"> <li>• Research</li> <li>• Expertise</li> </ul>	<p><b>Program of Study</b></p> <ul style="list-style-type: none"> <li>• Chemistry</li> </ul> <p><b>Course</b></p> <ul style="list-style-type: none"> <li>• Chemistry: Gases and Energy</li> </ul>		
Essential Elements Targeted by the Evaluation			
<p><b>Subject-Specific Competencies</b></p> <ol style="list-style-type: none"> <li>1. Seeks answers or solutions to problems involving chemistry</li> <li>2. Makes the most of his/her knowledge of chemistry</li> <li>3. Communicates ideas relating to questions involving chemistry, using the languages associated with science and technology</li> </ol>	<p><b>Categories of Knowledge</b></p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;"> <p>General concepts:</p> <ul style="list-style-type: none"> <li>• Chemical properties of gases</li> <li>• Physical properties of gases</li> <li>• Energy transfers that occur in reactions</li> </ul> </td> <td style="width: 50%; vertical-align: top;"> <p>Techniques:</p> <ul style="list-style-type: none"> <li>• Laboratory work</li> <li>• Measurement</li> </ul> </td> </tr> </table>	<p>General concepts:</p> <ul style="list-style-type: none"> <li>• Chemical properties of gases</li> <li>• Physical properties of gases</li> <li>• Energy transfers that occur in reactions</li> </ul>	<p>Techniques:</p> <ul style="list-style-type: none"> <li>• Laboratory work</li> <li>• Measurement</li> </ul>
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Evaluation Criteria			
<p><b>Evaluation Criteria for Competencies 1 and 3</b></p> <ol style="list-style-type: none"> <li>1.1 Appropriate representation of the situation</li> <li>1.2 Development of a suitable plan of action</li> <li>1.3 Appropriate implementation of the plan of action</li> <li>1.4 Development of relevant explanations, solutions or conclusions</li> </ol> <p><b>Evaluation Criteria for Competencies 2 and 3</b></p> <ol style="list-style-type: none"> <li>2.1 Accurate interpretation of the problem</li> <li>2.2 Appropriate use of knowledge of chemistry</li> <li>2.3 Suitable production of explanations</li> </ol>	<p><b>Proficiency in Subject-Specific Knowledge</b></p> <p>Proficiency in subject-specific knowledge presupposes its acquisition, understanding, application and mobilization, and is therefore linked with the evaluation criteria for the competencies.</p>		

<sup>3</sup> The broad areas of learning are stated exactly as in the course. However, the person who designs the evaluation instrument may choose other broad areas of learning.

## Explanation of the Evaluation Content

### Evaluation Criteria

The evaluation criteria are stated exactly as in the course, except for Criterion 2.1, which is based on Competencies 2 and 3.

Competency 3 is not specifically evaluated. It is integrated into the other two competencies in evaluation situations designed for certification purposes. The evaluation criteria relating to it are based upon the criteria for the first two competencies in the *Framework for the Evaluation of Learning* in general education in the youth sector.

### Information Clarifying the Evaluation Criteria

#### 1.1 Appropriate representation of the situation

This criterion evaluates the adult learner's ability to develop a representation of the problem related to the properties of gases or to energy transfers that occur in chemical reactions by restating it in his or her own words, drawing a schematic diagram, dividing it into subproblems, etc. This criterion also evaluates the adult learner's ability to formulate a hypothesis related to the problem to be solved, based on the chemical principles to be considered.

#### 1.2 Development of a suitable plan of action

This criterion evaluates the adult learner's ability to develop, following instructions, an experimental protocol in which he or she plans the steps, chooses the resources, determines the constant parameters, the independent variable and the dependent variable, and writes instructions for laboratory work with respect to the hypothesis he or she has formulated.

#### 1.3 Appropriate implementation of the plan of action

This criterion evaluates the adult learner's ability to implement a plan of action by carrying out laboratory activities. It thus evaluates his or her ability to handle the selected materials in accordance with the precision of the instruments or tools, to gather data, taking into account the experimental uncertainty associated with numerical data, to apply the applicable safety rules and to adjust his or her plan of action if necessary.

#### 1.4 Development of relevant explanations, solutions or conclusions

This criterion evaluates the adult learner's ability to analyze experimental data using different means of representation (tables or graphs). It thus evaluates his or her ability to identify a significant trend or relationship; to verify the consistency between the problem, his or her hypothesis and the information obtained; and to come up with explanations, solutions or conclusions based on the data gathered and his or her knowledge of chemistry. It also evaluates the adult learner's ability to draw up a laboratory report, using an outline, and to use the relevant scientific terminology, rules and conventions, as well as mathematical symbolism and formalism, if needed.

#### 2.1 Accurate interpretation of the problem

This criterion evaluates the adult learner's ability to recognize the relevant elements of the problem and the connections between them and to identify the characteristics and principles of chemistry that underlie the phenomena or technological applications they entail.

## 2.2 Appropriate use of knowledge of chemistry

This criterion evaluates the adult learner's ability to use concepts, laws, theories or models associated with chemistry to explain phenomena or technological applications inherent in the problem. It also evaluates the adult learner's ability to identify their interactions, anticipate their impact on the problem and, as needed, use calculations to support his or her explanations.

## 2.3 Suitable production of explanations

This criterion evaluates the adult learner's ability to come up with or justify explanations concerning the properties of gases or energy transfers that occur in chemical reactions in the expression of certain phenomena or the operation of certain applications, while respecting the applicable scientific terminology, rules and conventions. It also evaluates his or her ability to use mathematical formalism.

### Proficiency in Subject-Specific Knowledge

Proficiency in subject-specific knowledge is assessed through the evaluation of competencies, using tasks related to the evaluation criteria.

For this course, certain knowledge is explicitly evaluated. The following measurable cognitive skills were selected for evaluation.

#### Skills

- Knows
  - Provides evidence of knowledge of manifestations or components of a scientific or technical reality  
E.g. defines, describes, distinguishes, associates, names, chooses, connects
- Understands
  - Uses elements of prior learning and draws information from them  
E.g. explains, combines, discusses, justifies, demonstrates
- Applies
  - Uses a scientific or technological model or principle to establish information  
E.g. uses, represents, applies, determines, calculates

#### Weighting

The weighting for the evaluation of the competencies is determined in accordance with the *Framework for the Evaluation of Learning* in general education in the youth sector.

Competency 1, *Seeks answers or solutions to problems involving chemistry*, and Competency 3, *Communicates ideas relating to questions involving chemistry, using the languages associated with science and technology*: 40%

Competency 2, *Makes the most of his/her knowledge of chemistry*, and Competency 3, *Communicates ideas relating to questions involving chemistry, using the languages associated with science and technology*: 40%

The weighting corresponding to the knowledge that is explicitly evaluated is 20%.

The weighting of the evaluation criteria appears in the assessment tools provided in the *Correction and Evaluation Guide*. Adult learners must be made aware of the evaluation criteria used to evaluate them and the corresponding weighting of each criterion.

## Knowledge

Knowledge includes concepts and techniques.

For the examination as a whole, the three general concepts and the two categories of techniques must be covered. It is not necessary to include all the compulsory concepts for the three general concepts; nor is it necessary to include all of the techniques for a given category of techniques.

For the knowledge targeted by the evaluation of the competencies:

- At least two general concepts must be covered, including *Physical properties of gases* and *Energy transfers that occur in reactions*. For these general concepts, a representative sample of compulsory concepts must be covered.
- The two categories of techniques must be covered. For these categories, at least three compulsory techniques must be covered.

For the knowledge targeted by explicit evaluation:

- At least two general concepts must be covered. For these general concepts, priority is given to compulsory concepts that were not covered in the evaluation of the competencies.

### Concepts

General Concepts	Compulsory Concepts
Chemical properties of gases	<ul style="list-style-type: none"> <li>• Reactivity</li> </ul>
Physical properties of gases	<ul style="list-style-type: none"> <li>• Kinetic theory of gases</li> <li>• General gas law</li> <li>• Ideal gas law</li> <li>• Dalton's law</li> <li>• Avogadro's hypothesis</li> <li>• Molar volume of a gas</li> </ul>
Energy transfers that occur in reactions	<ul style="list-style-type: none"> <li>• Endothermic and exothermic reactions</li> <li>• Energy diagram</li> <li>• Activation energy</li> <li>• Enthalpy change</li> <li>• Molar heat of reaction</li> <li>• Relationship between thermal energy, specific heat capacity, mass and temperature variation</li> </ul>

### Techniques

Categories of Techniques	Techniques
Laboratory work	<ul style="list-style-type: none"> <li>• Safely using laboratory materials and equipment</li> <li>• Preparing solutions</li> </ul>
Measurement	<ul style="list-style-type: none"> <li>• Checking the reliability, accuracy and sensitivity of measuring instruments</li> <li>• Interpreting measurement results (significant figures, measurement errors)</li> </ul>

## Specifications for the Evaluation Instruments

### Examination: Number of Parts, Sections, Procedure and Duration

The examination consists of two parts that must be administered during different evaluation sessions. Adult learners are responsible for managing the time available to them for each part of the examination.

Total duration: 300 minutes

Practical part:\* Evaluation of Competencies 1 and 3

Duration: 180 minutes

Theory part: Evaluation of Competencies 2 and 3 and Explicit evaluation of knowledge

Duration: 120 minutes

\* All competency evaluation sessions for the practical part are carried out in a laboratory or other appropriate location.

### Examination Content

#### Practical part

This part involves a situation from the *Research* family of situations designed to evaluate the development of Competencies 1 and 3 using Criteria 1.1, 1.2, 1.3 and 1.4. Adult learners must do an experiment to solve a chemistry problem concerning the properties of gases or energy transfers that occur in chemical reactions. The tasks to be carried out include autonomously developing a procedure, handling laboratory materials, analyzing the problem, discussing the problem and reaching a conclusion concerning the initial problem. Using an outline, adult learners must draw up a report summarizing these tasks.

#### Theory part

This part has two sections. One section is designed to evaluate the development of Competencies 2 and 3 using Criteria 2.1, 2.2 and 2.3. Adult learners must examine one to three situations from the *Expertise* family of situations involving a problem concerning technological phenomena or applications related to the properties of gases or energy transfers that occur in chemical reactions. The tasks to be carried out include demonstrating the principles of chemistry and using concepts, laws and models to explain the phenomena or applications and transfer the explanations to other phenomena or applications involving the same principles. The other section is devoted to the explicit evaluation of knowledge.

### Information-Gathering Tools

#### Evaluation of the competencies

##### Practical part

- The adult learner carries out an experiment in a laboratory or other appropriate location.

##### Theory part

- The adult learner examines one to three problems.

#### Explicit evaluation of knowledge in the theory part

- The adult learner answers short- or long-answer questions.

## Authorized Materials

For the two parts of the examination

- Periodic table
- Additional blank sheets of paper
- Ordinary or scientific calculator

Information about the calculator:

- The data and programs stored in the calculator's memory must be erased before and after the examination. Before the day of the examination, students must have been given the opportunity to learn how to reset their calculator's memory to zero.

For the practical part of the examination

- Materials and equipment needed to carry out the experiment
- Computer, if necessary

## Assessment Tools

For the evaluation of the competencies, the criterion-referenced rubric is the assessment tool used by the teacher. In criterion-referenced interpretation, the information gathered is compared with the outcomes expected of the adult learner.<sup>4</sup> The rubrics are appended to the *Correction and Evaluation Guide* and include the following rating scale:

- *Excellent*
- *Very good*
- *Good*
- *Weak*
- *Very weak*

Checklists may also be provided to make it easier for markers. These checklists can be found in the *Correction and Evaluation Guide*.

Each checklist and rubric focuses on the evaluation of specific competencies:

- checklist and rubric for the evaluation of Competencies 1 and 3, practical part
- checklist and rubric for the evaluation of Competencies 2 and 3, theory part

For the explicit evaluation of knowledge in the theory part, a correction key is provided in the *Correction and Evaluation Guide*.

## Pass Mark

The pass mark is 60% for the examination as a whole.

## Retakes

The adult learner must retake each part (practical or theory) of the examination separately.

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<sup>4</sup> Québec, Ministère de l'Éducation, *Policy on the Evaluation of Learning* (Québec: Gouvernement du Québec, 2003), 28-29.

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