

# DEFINITION OF THE EVALUATION DOMAIN

Adult General Education

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Diversified Basic Education Program

Science and Technology

WASTE MANAGEMENT

TSC-4064-2

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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., p. 9.

## Evaluation Content

General Information	
<b>Broad Areas of Learning</b> <ul style="list-style-type: none"> <li>• Health and Well-Being</li> <li>• Environmental Awareness and Consumer Rights and Responsibilities</li> <li>• Career Planning and Entrepreneurship</li> <li>• Media Literacy</li> <li>• Citizenship and Community Life</li> </ul> <b>Subject Area</b> <ul style="list-style-type: none"> <li>• Mathematics, Science and Technology</li> </ul> <b>Families of Situations</b> <ul style="list-style-type: none"> <li>• Research</li> <li>• Expertise</li> </ul>	<b>Program of Study</b> <ul style="list-style-type: none"> <li>• Science and Technology</li> </ul> <b>Course</b> <ul style="list-style-type: none"> <li>• Waste Management</li> </ul>
Essential Elements Targeted by the Evaluation	
<b>Subject-Specific Competencies</b> <ol style="list-style-type: none"> <li>1. Seeks answers or solutions to scientific or technological problems</li> <li>2. Makes the most of his or her knowledge of science and technology</li> <li>3. Communicates in the languages used in science and technology</li> </ol>	<b>Categories of Knowledge</b> <p><b>General Concepts:</b></p> <ul style="list-style-type: none"> <li>• Ecology</li> <li>• Biogeochemical cycles</li> <li>• Lithosphere</li> <li>• Hydrosphere</li> <li>• Atmosphere</li> <li>• Organization of matter</li> <li>• Physical properties of solutions</li> <li>• Chemical changes</li> <li>• Nuclear transformations</li> <li>• Biotechnology</li> </ul> <p><b>Techniques:</b></p> <ul style="list-style-type: none"> <li>• Experimentation</li> <li>• Measurement</li> </ul>
Evaluation Criteria	
<b>Evaluation Criteria for Competencies 1 and 3</b> <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> <b>Evaluation Criteria for Competencies 2 and 3</b> <ol style="list-style-type: none"> <li>2.1 Accurate interpretation of the problem</li> <li>2.2 Relevant use of scientific and technological knowledge</li> <li>2.3 Appropriate formulation of explanations or solutions</li> </ol>	<b>Proficiency in Subject-Specific Knowledge</b> <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>

## 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 a problem related to waste management by restating it in his or her own words, drawing schematic diagrams, dividing it into simpler subproblems, etc. It also evaluates the adult learner's ability to formulate a hypothesis related to the problem to be solved.

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

This criterion evaluates the adult learner's ability to develop a simple procedure in order to determine what actions to take, what safety rules to follow, what resources to use and what variables to control with respect to his or her hypothesis.

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

This criterion evaluates the adult learner's ability to carry out the steps in the procedure safely, use measuring instruments precisely, record data and observations, and make corrections or changes to the plan of action when 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) in order to identify trends, to verify the consistency between the problem, his or her hypothesis and the information obtained, and to come up with explanations or arguments to support his or her solution. It also evaluates the adult learner's ability to use 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, the connections between them and the scientific and technological principles needed to illustrate the environmental impact of chemical changes caused by domestic and industrial waste.

##### 2.2 Relevant use of scientific and technological knowledge

This criterion evaluates the adult learner's ability to use scientific and technological concepts, laws, theories or models 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 Appropriate formulation of explanations or solutions

This criterion evaluates the adult learner's ability to explain a phenomenon related to a problem, discuss the effect of certain chemical compounds or nuclear waste on the environment, take a position concerning waste production or elimination, or propose a solution for limiting the environmental impact of domestic or industrial waste and justify his or her position or solution based on his or her scientific and technological knowledge. It also evaluates the adult learner's ability to use scientific terminology, rules and conventions, as well as mathematical symbolism and formalism, if needed.

### 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 scientific or technological problems*, and Competency 3, *Communicates in the languages used in science and technology*: 40%

Competency 2, *Makes the most of his or her knowledge of science and technology*, and Competency 3, *Communicates in the languages used in 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.

Eight to ten general concepts, including the organization of matter and chemical changes, and the two categories of techniques are covered in the examination. It is not necessary, however, to include all the compulsory concepts for a given general concept. Similarly, it is not necessary to include all the techniques for a given category of techniques.

For the knowledge targeted by the evaluation of the competencies:

- Four to six general concepts must be covered. For these general concepts, a representative sample of the compulsory concepts must be covered.
- The two categories of techniques must be covered. For these two categories, at least four of the techniques must be covered, including safely using materials and equipment.

For the knowledge targeted by explicit evaluation:

- Four to six general concepts must be covered, including those not covered in the evaluation of competencies. For these general concepts, priority is given to compulsory concepts that were not covered in the evaluation of competencies.

### Concepts

General Concepts	Compulsory Concepts
Ecology	<ul style="list-style-type: none"> <li>• Ecological footprint</li> <li>• Ecotoxicology</li> </ul>
Biogeochemical cycles	<ul style="list-style-type: none"> <li>• Phosphorus cycle</li> </ul>
Lithosphere	<ul style="list-style-type: none"> <li>• Contamination</li> <li>• Soil depletion</li> <li>• Buffering capacity of the soil</li> </ul>
Hydrosphere	<ul style="list-style-type: none"> <li>• Contamination</li> <li>• Catchment area</li> <li>• Eutrophication</li> </ul>
Atmosphere	<ul style="list-style-type: none"> <li>• Contamination</li> <li>• Atmospheric circulation</li> </ul>
Organization of matter	<ul style="list-style-type: none"> <li>• Periodic table</li> <li>• Simplified atomic model</li> <li>• Atomic number</li> <li>• Relative atomic mass</li> <li>• Periodicity of the properties</li> <li>• Isotopes</li> <li>• Lewis notation</li> <li>• Polyatomic ions</li> <li>• Nomenclature and notation rules</li> <li>• Concept of mole</li> <li>• Avogadro's number</li> </ul>

General Concepts	Compulsory Concepts
Physical properties of solutions	<ul style="list-style-type: none"><li>• Solubility</li><li>• Strength of electrolytes</li><li>• Concentration in mole/L</li></ul>
Chemical changes	<ul style="list-style-type: none"><li>• Precipitation</li><li>• Oxidation</li><li>• Decomposition and synthesis</li><li>• Stoichiometry</li><li>• Acid-base neutralization reaction</li><li>• Salts</li><li>• Types of bonds</li></ul>
Nuclear transformations	<ul style="list-style-type: none"><li>• Nuclear stability</li><li>• Fission and fusion</li><li>• Radioactivity</li></ul>
Biotechnology	<ul style="list-style-type: none"><li>• Wastewater treatment</li><li>• Biodegradation of pollutants</li></ul>

### Techniques

Categories of Techniques	Techniques
Experimentation	<ul style="list-style-type: none"><li>• Safely using materials and equipment</li><li>• Preparing solutions</li></ul>
Measurement	<ul style="list-style-type: none"><li>• Using measuring instruments</li><li>• Checking the reliability, accuracy and sensitivity of measuring instruments</li><li>• Interpreting measurement results</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, which is 120 minutes for each part.

Total duration: 240 minutes

Practical part\*: Evaluation of Competencies 1 and 3

Duration: 120 minutes

Theory part: Evaluation of Competencies 2 and 3, and Knowledge that is explicitly evaluated

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 solve a problem involving the physical properties of solutions or chemical changes using the experimental method. They must develop an experimental procedure or part of a procedure, handle laboratory materials and equipment, analyze the problem and draw a conclusion.

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 examine one to three situations from the *Expertise* family of situations involving a problem related to the production or elimination of waste produced during the processing of natural resources, and consider the environmental impact. The problems inherent in these situations require that the adult learner provide explanations, take a position, justify that position, etc. The other section is designed for the explicit evaluation of certain knowledge.

### Information-Gathering Tools

Evaluation of 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, adult learners 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 required for the experiment
- Computer, if necessary

## Assessment Tools

The assessment tool for the evaluation of competencies is the criterion-referenced rubric. Criterion-referenced interpretation involves comparing the information gathered with the expected outcomes.<sup>3</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>3</sup> Québec, Ministère de l'Éducation du Québec, *Policy on the Evaluation of Learning* (Québec: Gouvernement du Québec, 2003), 28-29.

