Mineral Processing Operation (DVS 5923)

Training sector : Mining and site operations

PROGRAMME D’ÉTUDES

Québec

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Introduction to the Program

In vocational training, a program of study presents the competencies required to practise a given trade or occupation at entry level on the job market. The training provided allows students to acquire a degree of versatility that will be useful in their career and personal development.

A program is a coherent set of competencies to be developed. It outlines the knowledge and broad orientations to be favoured during training. The competencies correspond to the tasks of the trade or occupation or to activities related to work, vocational or personal life, depending on the case. Learning is acquired in a specific achievement context and targets the ability to act, succeed and evolve.

According to the Education Act,[1] every program "shall include compulsory objectives and contents and may include optional objectives and contents that shall be enriched or adapted according to the needs of students who receive the services." For behavioural competencies, the compulsory components include the statement of the competency, the elements of the competency, the achievement context and the performance criteria; for situational competencies, they include the corresponding components.

For information purposes, programs also provide a grid of competencies, educational aims, a summary of competency-related knowledge and know-how, and guidelines. They also specify the suggested duration of each competency. All optional components of a program may be enriched or adapted according to the needs of the students, the environment and the workplace.

Program Components

Program Goals

Program goals consist of the expected outcome at the end of training as well as a general description of a given trade or occupation. They also include the four general goals of vocational training.

Educational Aims

Educational aims are broad orientations to be favoured during training in order to help students acquire intellectual or motor skills, work habits or attitudes. Educational aims usually address important aspects of career and personal development that have not been explicitly included in the program goals or competencies. They serve to orient appropriate teaching strategies to contextualize students' learning, in keeping with the dimensions underlying the practice of a trade or occupation. They help guide educational institutions in implementing the program.

Competency

A competency is the ability to act, succeed and evolve in order to adequately perform tasks or activities related to one's working or personal life, based on an organized body of knowledge and skills from a variety of fields, perceptions, attitudes, etc.

A competency in vocational training can be defined in terms of a behaviour or a situation, and includes specific practical guidelines and requirements for learning.

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1 *Education Act*, CQLR, c. I-13.3, s. 461

1. Behavioural Competency

A behavioural competency describes the actions and the results expected of the student. It consists of the following features:

- The *statement of the competency* is the result of the job analysis, the orientations and general goals of vocational training and other *determinants*.

- The *elements of the competency* correspond to essential details that are necessary in order to understand the competency *and* are expressed in terms of specific behaviours. They refer to the major steps involved in performing a task or to the main components of the competency.

- The *achievement context* corresponds to the situation in which the competency is exercised at entry-level on the job market. The achievement context attempts to recreate an actual work situation but does not describe a learning or evaluation situation.

- The *performance criteria* define the requirements to be respected. They may refer to elements of the competency or to the competency as a whole. When associated with a specific element, performance criteria are *used* to judge whether a competency has been acquired. When associated with the competency as a whole, the criteria describe the requirements for performing a task or activity and provide information on the expected level of performance or the overall quality of a product or service.

2. Situational Competency

A situational competency describes the situation in which students are placed to acquire learning, and allows for actions and results to vary from one student to another. It consists of the following features:

- The *statement of the competency* is the result of the job analysis, the orientations and general goals of vocational training and other determinants.

- The *elements of the competency* outline the essential aspects of the competency and ensure a better understanding of the competency with respect to the expected outcome. The elements of the competency are fundamental to the implementation of the learning situation.

- The *learning context* provides a broad outline of the learning situation designed to help the students develop the *required* competency. It is normally divided into three key phases of learning: information, participation and synthesis.

- The *instructional guidelines* provide reference points and means for teachers to ensure that learning takes place and that the context in which it occurs is always the same. These guidelines may include general principles or specific procedures.

- The *participation criteria* describe requirements that the students must meet when participating in learning activities. They focus on how the students take part in the activities rather than on the results obtained. Participation criteria *are* normally provided for each phase of the learning situation.

Competency-Related Knowledge and Know-How

Competency-related knowledge and know-how together with related guidelines, are provided for information purposes. Competency-related knowledge and know-how define the essential and meaningful learning that students must acquire in order to apply and continue to develop the competency. They are in keeping with the job market and are accompanied by guidelines that provide information about the field of application, level of complexity and learning content. They generally encompass learning associated with knowledge, skills, strategies, attitudes, perceptions, etc.

Duration

The total duration of the program is compulsory and must be observed. It consists of teaching time, which includes time for the evaluation of learning and for enrichment or remedial activities, depending on the students' needs. The duration indicated for a given competency refers to the amount of time needed to develop the competency.

The amount of teaching time corresponds to the amount of time allotted to training, which is established during program development as the average amount of time needed to acquire a competency and evaluate learning. This duration is helpful in organizing training.

Credit

A credit is a unit used for expressing the quantitative value of each competency. One credit corresponds to 15 hours of training.

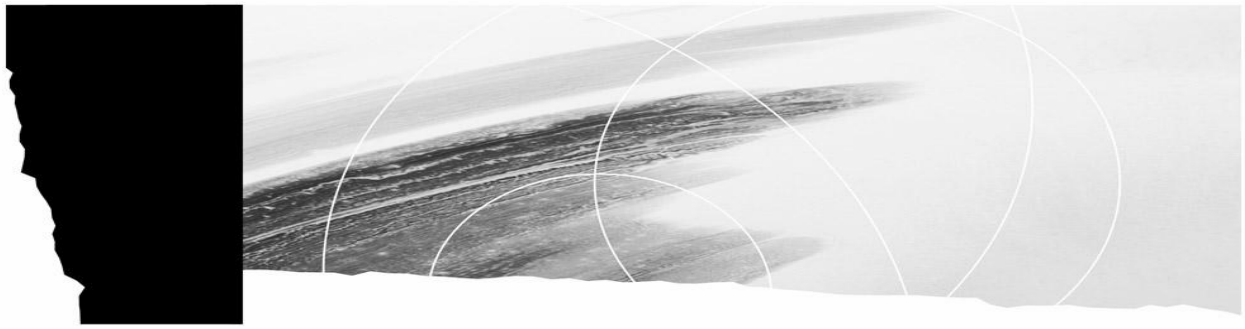
Aspects of Program Implementation

Program-Based Approach

The program-based approach is founded on a comprehensive view of a program of study and its components (e.g. goals, educational aims, competencies). It requires concerted action among all players involved, from the initial stages of program design and development, to program implementation and evaluation. It consists in ensuring that all of the actions and activities proposed are based on the same aims and take into account the same orientations. For students, the program-based approach makes training more meaningful as it presents learning as a coherent whole.

Competency-Based Approach

In vocational training, the competency-based approach is based on a teaching philosophy that is designed to help students mobilize their own individual sets of resources in order to act, succeed and evolve in different contexts, according to established performance levels with all the required knowledge and know-how (e.g. skills, strategies, attitudes, perceptions). The competency-based approach is carried out in situations that are relevant to the students' working life and personal life.



5923	**Mineral Processing Operations**

Year of approval: 2004

Certification:	Diploma of Vocational Studies
Number of credits:	60
Number of competencies:	17
Total duration:	900 hours

To be admitted to the *Mineral Processing Operations* program, students must meet one of the following conditions:

- For students holding a Secondary School Diploma or a recognized equivalent, no additional conditions are required.

OR

- For students who are at least 16 years of age on September 30 of the school year in which they begin the program, the following condition applies: they must have obtained Secondary III credits in language of instruction, second language and mathematics, or the recognized equivalents.

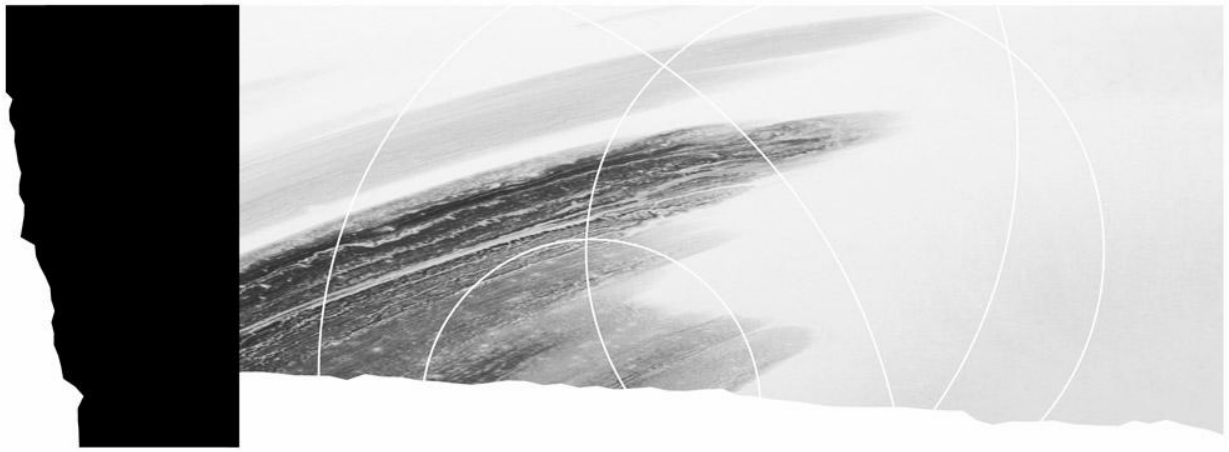
OR

- For students who are at least 18 years of age, successful completion of the General Development Test is prescribed as a functional prerequisite.

NOTE: The condition regarding concurrence does not apply to this category.

The duration of the program is 900 hours, which includes 630 hours spent on the specific competencies required to practise the trade or occupation and 270 hours on general, work-related competencies. The program of study is divided into 17 competencies which vary in length from 15 to 135 hours. The total hours allocated to the program include time devoted to teaching, evaluation of learning and enrichment or remedial activities.

Competency	Code	Number	Hours	Credits
Trade and Training Process	778 411	1	15	1
Occupational Health and Safety	778 421	2	15	1
Applied Physics and Mathematics	778 434	3	60	4
Ore Processing Methods	778 444	4	60	4
Preparing Control Tests	778 453	5	45	3
Machine Maintenance	778 462	6	30	2
Size Reduction Operations	778 479	7	135	9
Preparing Reagents	778 482	8	30	2
Gravity Concentration Methods	778 492	9	30	2
Computer-Based Control Systems	778 503	10	45	3
Flotation Concentration	778 516	11	90	6
Filtering Concentrates	778 522	12	30	2
Filling	778 532	13	30	2
Chemical Concentration Methods	778 547	14	105	7
Agglomeration	778 553	15	45	3
Wastewater Treatment	778 562	16	30	2
Entering the Work Force	778 577	17	105	7



Part I

Program Goals

Educational Aims

Statements of the Competencies

Grid of Competencies

Harmonization

Program Goals

The *Mineral Processing Operations* program prepares students to practise the trade of Mineral and Metal Processing Machine Operator.

Mineral and Metal Processing Machine Operators work in aboveground mineral ore and metal processing plants located at mine sites. In some cases, these people work underground, performing primary processing operations on mineral ores and metals.

Mineral and Metal Processing Machine Operators operate (start, prepare, assemble, adjust, maintain and stop) machines that grind, separate, filter, mix, dissolve soluble products, roll, refine and treat ore. They monitor valves, meters, computer printouts and video screens to ensure that everything is working properly. They perform minor machine maintenance procedures and clean up work areas. Finally, they take appropriate measures when it comes to health, safety and environmental protection.

The program goals of the *Mineral Processing Operations* program are based on the general goals of vocational training. These goals are as follows:

- To help students develop effectiveness in the practice of a trade or occupation, that is:
  - to teach students to perform roles, functions, tasks and activities associated with the trade or occupation upon entry into the job market
  - to prepare students to progress satisfactorily on the job (which implies having the technical and technological knowledge and skills in such areas as communication, problem solving, decision making, ethics, health and safety)

- To help students integrate into the work force, that is:
  - to familiarize students with the job market in general, and with the specific context of their chosen trade or occupation
  - to familiarize students with their rights and responsibilities as workers

- To foster students' personal development and acquisition of occupational knowledge, skills, perceptions and attitudes, that is:
  - to help students develop their autonomy and ability to learn, and acquire effective work methods
  - to help students understand the principles underlying the techniques and the technology used in the trade or occupation
  - to help students develop self-expression, creativity, initiative and entrepreneurial spirit
  - to help students adopt the attitudes required to successfully practise the trade or occupation, and instill in them a sense of responsibility and a concern for excellence

- To promote job mobility, that is:
  - to help students develop positive attitudes toward change
  - to help students develop the means to manage their careers by familiarizing them with entrepreneurship

Educational Aims

The aim of the *Mineral Processing Operations* program is to help students develop attitudes and behaviours that representatives from education and the field deem essential to the practice of the trade or occupation:

- to develop an awareness of the consequences of work quality
- to develop a sense of responsibility and versatility
- to develop a concern for occupational health and safety
- to develop a concern for the environment

Statements of the Competencies

List of Competencies

- To determine their suitability for the trade and the training process.
- To interpret information relating to the handling and transport of hazardous materials.
- To perform mathematical calculations applied to physics.
- To interpret information relating to ore processing methods.
- To prepare control tests.
- To perform preventive maintenance on a machine and a piece of equipment.
- To operate machines and equipment used for size reduction operations.
- To operate machines and equipment used to prepare reagents.
- To operate machines and equipment used to produce ore concentrates using mechanical methods.
- To monitor the parameters of a computer-based ore processing circuit.
- To operate machines and equipment used to produce ore concentrates by flotation.
- To operate machines and equipment used to filter concentrates.
- To operate machines and equipment used for hydraulic backfill and paste backfill.
- To operate machines and equipment used to produce ore concentrates using chemical methods.
- To operate machines and equipment used for the agglomeration of concentrates.
- To operate machines and equipment used to treat wastewater.
- To enter the work force.

Grid of Competencies

The grid of competencies shows the relationship between general competencies, which correspond to work-related activities, and specific competencies, which are required to practise the particular trade, as well as the major steps in the work process.

The general competencies appear on the horizontal axis and the specific competencies, on the vertical axis. The symbol (○) indicates a correlation between a general and a specific competency. The symbol (△) indicates a correlation between a specific competency and a step in the work process. Shaded symbols indicate that these relationships have been taken into account in the acquisition of specific competencies. The logic used in constructing the grid influences the course sequence. Generally speaking, this sequence follows a logical progression in terms of the complexity of the learning involved and the development of the students' autonomy. The vertical axis presents the specific competencies in the order in which they should be acquired and serves as a point of departure for determining how all of the competencies will be taught.

GRID OF COMPETENCIES

MINERAL PROCESSING OPERATIONS	**Competency number**	**Type of objective**	**Duration (in hours)**	**GENERAL COMPETENCIES**							**WORK PROCESS**								**TOTAL**
				Determine their suitability for the trade and the training process	Interpret information relating to the handling and transport of hazardous materials	Perform mathematical calculations applied to physics	Interpret information relating to ore processing methods	Prepare control tests	Perform preventive maintenance on a machine and a piece of equipment	Monitor the parameters of a computer-based ore processing circuit	Read production instructions and share information with the relief shift	Verify machine and equipment operations offline	Start and stop machines and equipment	Verify machine and equipment operations online	Check whether production instructions are being followed	Take and prepare samples	Make any necessary repairs during production	Write up shift reports	
Competency number				1	2	3	4	5	6	10									
Type of objective				S	B	B	B	B	B	B									
Duration (in hours)				15	15	60	60	45	30	45									270
Operate machines and equipment used for size reduction operations	7	B	135	○	●	●	●	●	●	○	▲	▲	▲	▲	▲	▲	▲	▲	
Operate machines and equipment used to prepare reagents	8	B	30	○	●	●	●	●	●	○	▲	▲	▲	▲	△	△	△	▲	
Operate machines and equipment used to produce ore concentrates using mechanical methods	9	B	30	○	●	●	●	●	●	○	▲	▲	▲	▲	▲	▲	▲	▲	
Operate machines and equipment used to produce ore concentrates by flotation	11	B	90	○	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	
Operate machines and equipment used to filter concentrates	12	B	30	○	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	
Operate machines and equipment used for hydraulic backfill and paste backfill	13	B	30	○	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	
Operate machines and equipment used to produce ore concentrates using chemical methods	14	B	105	○	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	
Operate machines and equipment used for the agglomeration of concentrates	15	B	45	○	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	
Operate machines and equipment used to treat wastewater	16	B	30	○	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	
Enter the work force	17	S	105	○	●	●	●	●	●	○	▲	▲	▲	▲	▲	▲	▲	▲	
Total duration			630																900

Links between the general competencies and the specific competencies

○: Existence of a link
●: Application of a link

Links between the work process and the specific competencies

△: Existence of a link
▲: Application of a link

Harmonization

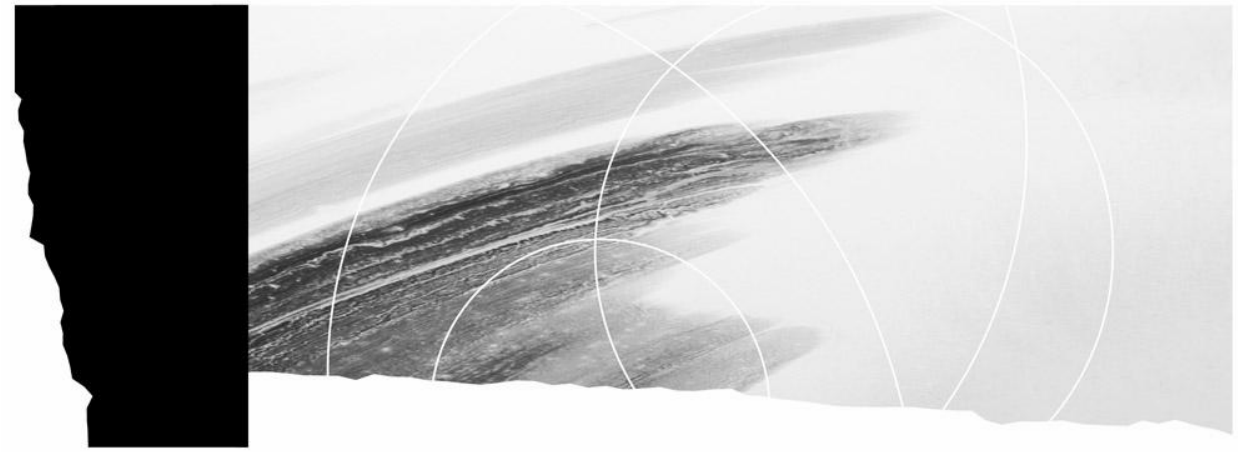
The Ministère de l'Éducation harmonizes its vocational and technical programs by establishing similarities and continuity between secondary- and college-level programs within a particular sector or between sectors in order to avoid overlap in program offerings, to recognize prior learning and to optimize the students' progress.

Harmonization establishes consistency between training programs and is especially important in ensuring that the tasks of a trade or occupation are clearly identified and described. Harmonization makes it possible to identify tasks requiring competencies that are common to more than one program. Even if there are no common competencies, training programs are still harmonized.

Harmonization is said to be "inter-level" when it focuses on training programs at different levels, "intra-level" when it focuses on programs within the same educational level, and "inter-sector" when carried out between programs in various sectors.

An important aspect of harmonization is that it allows the common features of competencies to be identified and updated as needed. Common competencies are those that are shared by more than one program; once acquired in one program, they can be recognized as having been acquired in another. Competencies with exactly the same statement and elements are said to be identical. Common competencies that are not identical but have enough similarities to be of equal value are said to be equivalent.

The *Mineral Processing Operations* program does not share any competencies with other programs at this time.



Part II

Program Competencies

Trade and Training Process	Code: 778411

Competency 1 Duration 15 hours Credits 1

Situational Competency

Statement of the Competency

To determine their suitability for the trade and the training process.

Elements of the Competency

- Become familiar with the nature of the trade.
- Understand the training process.
- Confirm their career choice.

Learning Context

Information Phase

- Learning about the job market in the mineral and metal processing industry, in particular, job requirements, employment prospects and remuneration.
- Learning about the nature and requirements of the job: work schedules, main tasks, working conditions, main performance criteria, etc.
- Presenting the information gathered during a group discussion and sharing their perceptions of the trade.
- Learning about mineral and metal processing.

Participation Phase

- Discussing the skills, aptitudes, habits and knowledge necessary to practise the trade.
- Learning about the training experience: program of study, the training process, evaluation methods and certification of studies.
- Discussing the program of study and its relation to the operations to be performed in an ore processing plant.
- Sharing their initial reactions to the program of study and the training process.

Synthesis Phase

- Producing a report in which they specify their preferences, aptitudes and interests with respect to mineral and metal processing machine operations.
- Justifying their career choice by comparing various aspects and requirements of the trade with their personal preferences, aptitudes and interests.

Instructional Guidelines

- Create a climate that favours the students' personal development and entry into the work force.
- Encourage all students to engage in discussions and express their opinions.
- Motivate students to participate in the proposed activities.
- Help students arrive at an accurate perception of the trade.
- Provide students with the means to assess their career choice honestly and objectively.
- Organize visits to businesses representative of the field.
- Provide students with reference materials: information on the trade, program of study, the certification of studies process, general information on the mining industry and ore processing activities, etc.
- Organize a discussion group with students and specialists in the field.
- Provide students with guidelines and a sample of the report required in Phase 3.

Participation Criteria

- Gather information on most of the topics to be covered.
- Appropriately express their views on the trade during a group discussion, relating these views to the information they have gathered.

- Give their opinions on the main requirements they will have to meet in order to practise the trade.
- Carefully review the documents provided.
- Listen attentively to the explanations given.
- Appropriately express their views on the training program during a group discussion.
- Clearly express their reactions to the trade and the training program.

- Produce a report in which they:
  - sum up their preferences, interests, aptitudes and personal qualities
  - explain their career choice by clearly relating these preferences, interests and personal qualities to the practice of the trade
  - explain why they choose to continue or withdraw from the training program

Occupational Health and Safety	Code: 778421

Competency 2 Duration 15 hours Credits 1

Behavioural Competency

Statement of the Competency	**Achievement Context**
To interpret information relating to the handling and transport of hazardous materials.	• Working alone • Working with instructions and technical sheets • Using personal protective equipment; technical documentation; and hazardous products that are packaged and labelled

Elements of the Competency	**Performance Criteria**
1. Interpret the information contained in the WHMIS.	• Accurate recognition of types of information listed on sheets • Accurate recognition of risks associated with handling hazardous materials • Accurate interpretation of symbols, codes and abbreviations on sheets
2. Interpret the information relating to the transport of hazardous materials.	• Accurate interpretation of symbols, codes and abbreviations on labels • Accurate recognition of risks associated with transporting hazardous materials
	For the competency as a whole: • Appropriate use of terminology • Accurate interpretation of information on the safe handling and transport of hazardous materials

Applied Physics and Mathematics	Code: 778434

Competency 3 Duration 60 hours Credits 4

Behavioural Competency

Statement of the Competency	**Achievement Context**
To perform mathematical calculations applied to physics.	• Working alone • Working with a questionnaire; instructions; procedures; examples; learning contexts; and ore samples • Using a calculator; charts; technical data; and ore processing flow sheets

Elements of the Competency	**Performance Criteria**
1. Calculate: – weight and volume – density – the percentage of solids – dilution	• Use of appropriate formulas • Accuracy of calculations • Neatness and clarity of presentation
2. Calculate materials balances.	• Selection of appropriate formulas • Accuracy of calculations • Accurate determination of the quantity of inputs and outputs
3. Calculate metallurgical balances.	• Selection of appropriate formulas • Accuracy of calculations • Precise determination of the quantity of inputs and outputs
4. Determine the density of a mineral.	• Selection of appropriate formula • Compliance with the method for determining density • Accuracy of calculations
5. Present data in the form of a chart.	• Appropriate choice of chart • Accuracy of chart
	For the competency as a whole: • Use of appropriate terminology • Selection of appropriate formulas • Methodical work and attention to detail • Compliance with occupational health and safety regulations

Ore Processing Methods	Code: 778444

Competency 4 Duration 60 hours Credits 4

Behavioural Competency

Statement of the Competency

To interpret information relating to ore processing methods.

Achievement Context

- Working alone
- Working with a questionnaire; flow sheets and instrumentation diagrams; chemical products; and samples of rocks, minerals and concentrates
- Using technical documentation; plans; and drawings

Elements of the Competency	**Performance Criteria**
1. Identify the major types of minerals and concentrates.	• Accurate recognition of minerals and concentrates
2. Distinguish the principal ore processing methods.	• Correct association between principal minerals and corresponding processing methods • Accurate determination of processing circuits for each method • Accurate listing of the steps involved in each processing method
3. Associate machines and equipment with the various steps of ore processing.	• Correct association between machines and equipment and corresponding processing steps
4. Interpret the flow sheets and instrumentation diagram of an ore processing circuit.	• Accurate determination of: – the path of the ore, water, reagents, compressed air and forced air – inputs and outputs
5. Interpret the chemical reactions associated with ore processing methods.	• Accurate interpretation of the chemical reactions involved in mineral and metal processing • Clear explanation of the interaction between solutions and minerals

For the competency as a whole:

- Taking into account the characteristics of the various minerals and mineral concentrates
- Accurate interpretation of symbols, codes and abbreviations
- Appropriate use of terminology
- Appropriate organization of work area
- Appropriate use of materials, instruments and reagents
- Compliance with occupational health and safety regulations
- Compliance with environmental standards

Preparing Control Tests	Code: 778453

Competency 5 Duration 45 hours Credits 3

Behavioural Competency

Statement of the Competency	**Achievement Context**
To prepare control tests.	• Working alone • Working with instructions; ore samples; test procedures; and learning contexts • Using personal protective equipment; materials; instruments; and reagents
Elements of the Competency	**Performance Criteria**
1. Prepare the work area and materials.	• Correct association between types of test and corresponding samples required • Appropriate organization of the work area • Appropriate preparation of materials
2. Take test samples.	• Selection of appropriate instruments • Use of appropriate sampling method
3. Prepare the samples for testing.	• Selection of appropriate materials • Use of appropriate preparation method
4. Record the test results.	• Pertinence and accuracy of data recorded • Accurate recognition of differences between expected results and observed results • Clarity of data
5. Clean the work area and store all materials.	• Order and cleanliness of work area • Appropriate cleaning of work area and materials • Appropriate storage of materials
	For the competency as a whole: • Appropriate use of terminology • Methodical work • Compliance with occupational health and safety regulations • Compliance with environmental standards

Machine Maintenance	Code: 778462

Competency 6 Duration 30 hours Credits 2

Behavioural Competency

Statement of the Competency	**Achievement Context**
To perform preventive maintenance on a machine and a piece of equipment.	• Working alone • Working with assemblies; appropriate industrial equipment and machines; instructions; diagrams or illustrations; and technical data • Using the tools necessary; personal protective equipment; and pertinent documentation (manufacturer's manual, diagram, sketch, etc.)

Elements of the Competency	**Performance Criteria**
1. Interpret the functional block diagrams of a machine or piece of equipment.	• Accurate identification of all components and parts • Correct interpretation of manufacturer's specifications
2. Check the operation of a machine or piece of equipment.	• Accurate reading of physical parameters (pressure, flow, temperature, etc.) • Accurate detection of a potential operational problem • Compliance with techniques for inspecting the machine or piece of equipment • Accurate interpretation of functional parameters: – working order – necessary maintenance – necessary repairs
3. Lubricate a machine or piece of equipment.	• Compliance with the lubrication procedure • Compliance with instructions provided in the manufacturer's maintenance manual • Correct use of lubricants
4. Adjust or replace a gland seal on a pump.	• Compliance with the method for adjusting and replacing a gland seal
5. Inspect and replace a pipe or hose.	• Thorough inspection of a pipe or hose • Compliance with methods for replacing a pipe or hose

For the competency as a whole:

- Compliance with preventive maintenance methods
- Accurate detection of operational problems
- Appropriate use of tools
- Use of appropriate work methods
- Compliance with occupational health and safety regulations
- Compliance with environmental standards

Size Reduction Operations	Code: 778479

Competency 7 Duration 135 hours Credits 9

Behavioural Competency

Statement of the Competency

To operate machines and equipment used for size reduction operations.

Achievement Context

- Working alone
- On machine and equipment used for grinding, crushing and sizing
- With operating instructions for ore processing and production machines
- Using operational data for ore processing and production machines; measuring instruments; tools; personal protective equipment; a communications system; technical documentation including flow sheets; and rocks, water, minerals and reagents
- Field of application
- Grinding and crushing circuits

Elements of the Competency	**Performance Criteria**
1. Interpret the information contained in production reports.	• Identification of pertinent data • Accurate interpretation of information gathered
2. Start or stop machines, equipment and circuits.	• Proper inspection of machines before starting them • Compliance with procedure for starting and stopping machines, equipment and circuits
3. Conduct a tour of inspection.	• Compliance with the inspection schedule • Thorough inspection of functional parameters of machines and equipment • Accurate interpretation of functional parameters of circuits • Accurate detection of operational problems
4. Adjust the crushing chamber opening of a: – jaw crusher – cone crusher – gyratory crusher	• Proper inspection of the chamber opening • Compliance with the procedure for adjusting the chamber opening
5. Inspect and replace the screen cloth.	• Proper inspection of the cloth's condition • Appropriate choice of replacement parts • Compliance with the replacement procedure

6. Conduct control tests.	• Compliance with the sampling and testing schedule • Compliance with the sampling method • Proper preparation of samples • Compliance with the testing method relating to: – the percentage of solids – particle size – humidity – ore density • Accurate interpretation of results • Soundness of the decision relating to whether it is necessary to repeat a test
7. Monitor production.	• Proper supervision of the functional parameters of machines and circuits • Compliance with the scheduling of steel addition • Compliance with the method for checking and adjusting the chamber openings of crushers • Appropriate choice of maintenance operations and repairs to be done
8. Clean the work area and store all materials and equipment.	• Appropriate use of washing materials • Appropriate cleaning of work area and equipment • Appropriate storage of materials and equipment
9. Write up a production report.	• Pertinence of data gathered • Comprehensive inclusion of all data • Accuracy of data • Neatness of report
	For the competency as a whole: • Compliance with instructions relating to production and machine operations • Compliance with methods relating to circuit and machine operations • Appropriate solutions to operational problems affecting circuits and machines • Use of appropriate work methods • Appropriate use of machines, equipment and materials • Appropriate communication with other specialists • Continuous monitoring of equipment and machine operations • Compliance with occupational health and safety regulations • Compliance with environmental standards

Preparing Reagents	Code: 778482

Competency 8 Duration 30 hours Credits 2

Behavioural Competency

Statement of the Competency	**Achievement Context**
To operate machines and equipment used to prepare reagents.	• Working alone • On machine and equipment used to prepare reagents • With operating instructions for ore processing and production machines • Using operational data for ore processing and production machines; measuring instruments; tools; personal protective equipment; a communications system; technical documentation, including flow sheets; and liquid or solid reagents

Elements of the Competency	**Performance Criteria**
1. Interpret the information contained in production reports.	• Identification of data • Accurate interpretation of information gathered
2. Start or stop machines, equipment and circuits.	• Proper inspection of machines before starting them • Compliance with the procedure for starting and stopping machines, equipment and circuits
3. Conduct a tour of inspection.	• Compliance with the inspection schedule • Thorough inspection of functional parameters of machines and equipment • Accurate interpretation of functional parameters of circuits • Accurate detection of operational problems
4. Conduct control tests.	• Compliance with the sampling and testing schedule • Compliance with the sampling method • Proper preparation of samples • Compliance with the testing method relating to: – particle size – humidity – the concentration of the solution • Accurate interpretation of results • Soundness of the decision relating to whether it is necessary to repeat a test

5. Monitor production.	• Proper supervision of the functional parameters of machines and circuits • Monitoring of the reagent formulation as it is being prepared • Careful monitoring of reagents as they are transferred to distribution points • Appropriate choice of maintenance operations and repairs to be done
6. Clean the work area and store all materials and equipment.	• Appropriate use of washing materials • Appropriate cleaning of work area and equipment • Appropriate storage of materials and equipment
7. Write up a production report.	• Pertinence of data gathered • Comprehensive inclusion of all data • Accuracy of data • Neatness of report
	For the competency as a whole: • Compliance with instructions relating to production and machine operations • Compliance with methods relating to circuit and machine operations • Appropriate solutions to operational problems affecting circuits and machines • Use of appropriate work methods • Appropriate use of machines, equipment and materials • Appropriate communication with other specialists • Continuous monitoring of equipment and machine operations • Compliance with occupational health and safety regulations • Compliance with environmental standards

Gravity Concentration Methods	Code: 778492

Competency 9 Duration 30 hours Credits 2

Behavioural Competency

Statement of the Competency

To operate machines and equipment used to produce ore concentrates using mechanical methods.

Achievement Context

- Working alone
- On machines and equipment used for gravity concentration and sizing
- With operating instructions for ore processing and production machines
- Using operational data for ore processing and production machines; measuring instruments; tools; personal protective equipment; a communications system; technical documentation including flow sheets; and rocks, water, minerals and reagents
- Field of application
- Particle sizing and gravity concentration circuits

Elements of the Competency	**Performance Criteria**
1. Interpret the information contained in production reports.	• Identification of pertinent data • Accurate interpretation of information gathered
2. Start or stop machines, equipment and circuits.	• Proper inspection of machines before starting them • Compliance with procedure for starting and stopping machines, equipment and circuits
3. Conduct a tour of inspection.	• Compliance with the inspection schedule • Thorough inspection of functional parameters of machines and equipment • Accurate interpretation of functional parameters of circuits • Accurate detection of operational problems
4. Conduct control tests.	• Compliance with the sampling and testing schedule • Compliance with the sampling method • Proper preparation of samples • Compliance with the testing method relating to: – particle size – the percentage of solids • Accurate interpretation of results • Soundness of the decision relating to whether it is necessary to repeat a test

5. Monitor production.	• Proper supervision of the functional parameters of machines and circuits • Appropriate choice of maintenance operations and repairs to be done
6. Clean the work area and store all materials and equipment.	• Appropriate use of washing materials • Appropriate cleaning of work area and equipment • Appropriate storage of materials and equipment
7. Write up a production report.	• Pertinence of data gathered • Comprehensive inclusion of all data • Accuracy of data • Neatness of report
	For the competency as a whole: • Compliance with instructions relating to production and machine operations • Compliance with methods relating to circuit and machine operations • Appropriate solutions to operational problems affecting circuits and machines • Use of appropriate work methods • Appropriate use of machines, equipment and materials • Appropriate communication with other specialists • Continuous monitoring of equipment and machine operations • Compliance with occupational health and safety regulations • Compliance with environmental standards

Computer-Based Control Systems	Code: 778503

Competency 10 Duration 45 hours Credits 3

Behavioural Competency

Statement of the Competency

To monitor the parameters of a computer-based ore processing circuit.

Achievement Context

- Working alone
- At a work-station
- With appropriate hardware; learning contexts; operating instructions for ore processing and production machines; and safety instructions
- Using operational data for ore processing and production machines; control software; technical documentation; appropriate machines and materials; flow sheets and instrumentation diagrams; personal protective equipment; a communications system; and rocks, water, minerals and reagents
- Field of application
- Crushing, grinding and flotation circuits

Elements of the Competency	**Performance Criteria**
1. Experiment with all the features of the workstation.	• Recognition of computer system components and control software features • Appropriate use of computer hardware • Compliance with the method for inputting data and commands
2. Interpret the plan for the computer-based control system: – flow sheet – instrumentation diagram – control loop	• Proper use of the software's help function • Precise location of sensors and target computers • Accurate description of the role and operation of the control loop • Recognition of the variables measured and controlled by the instruments
3. Run the control software for the ore processing circuit.	• Compliance with the software's procedure call • Appropriate selection of functions and commands according to established parameters
4. Adjust the parameters of the machines used in the computer-based ore processing circuit and verify the circuit's operation.	• Proper adjustment of operational and safety set points • Appropriate use of the computer-based control system's functions • Accurate detection of operational problems • Appropriate choice of control mode: – automatic – manual • Proper use and care of machines and materials

For the competency as a whole:

- Compliance with instructions relating to production and machine operations
- Compliance with methods relating to circuit and machine operations
- Appropriate solutions to operational problems affecting circuits and machines
- Use of appropriate work methods
- Appropriate use of machines, equipment and materials
- Appropriate communication with other specialists
- Continuous monitoring of equipment and machine operations
- Compliance with occupational health and safety regulations
- Compliance with environmental standards

Flotation Concentration	Code: 778516

Competency 11 Duration 90 hours Credits 6

Behavioural Competency

Statement of the Competency

To operate machines and equipment used to produce ore concentrates by flotation.

Achievement Context

- Working alone
- On flotation cells
- With operating instructions for ore processing and production machines
- Using operational data for ore processing and production machines; measuring instruments; a computer-based control system for ore processing machines; tools; personal protective equipment; a communications system; technical documentation including flow sheets; and rocks, water, minerals and reagents

Elements of the Competency	**Performance Criteria**
1. Interpret the information contained in production reports.	• Identification of pertinent data • Accurate interpretation of information gathered
2. Start or stop machines, equipment and circuits.	• Proper inspection of machines before starting them • Compliance with procedures for starting and stopping machines, equipment and circuits
3. Conduct a tour of inspection.	• Compliance with the inspection schedule • Thorough inspection of functional parameters of machines and equipment • Accurate interpretation of functional parameters of circuits • Accurate detection of operational problems
4. Conduct control tests.	• Compliance with the sampling and testing schedule • Compliance with the sampling method • Proper preparation of samples • Compliance with the testing method relating to: – the percentage of solids – reagent capacity – the pH value – the froth level • Accurate interpretation of results • Soundness of the decision relating to whether it is necessary to repeat a test

5. Monitor production.	• Proper supervision of the functional parameters of machines and circuits • Appropriate choice of maintenance operations and repairs to be done
6. Clean the work area and store all materials and equipment.	• Appropriate use of washing equipment • Appropriate cleaning of work area and equipment • Appropriate storage of materials and equipment
7. Write up a production report.	• Pertinence of data gathered • Comprehensive inclusion of all data • Accuracy of data • Neatness of report
	For the competency as a whole: • Compliance with instructions relating to production and machine operations • Compliance with methods relating to circuit and machine operations • Appropriate solutions to operational problems affecting circuits and machines • Use of appropriate work methods • Appropriate use of machines, equipment and materials • Appropriate communication with other specialists • Continuous monitoring of equipment and machine operations • Compliance with occupational health and safety regulations • Compliance with environmental standards

Filtering Concentrates	Code: 778522

Competency 12 Duration 30 hours Credits 2

Behavioural Competency

Statement of the Competency

To operate machines and equipment used to filter concentrates.

Achievement Context

- Working alone
- On machines and equipment used for filtration
- With operating instructions for ore processing and production machines
- Using operational data for ore processing and production machines; measuring instruments; a computer-based control system for ore processing machines; tools; personal protective equipment; a communications system; technical documentation including circuit flow diagrams; and rocks, water, minerals and reagents

Elements of the Competency	**Performance Criteria**
1. Interpret the information contained in production reports.	• Identification of pertinent data • Accurate interpretation of information gathered
2. Start or stop machines, equipment and circuits.	• Proper inspection of machines before starting them • Compliance with the procedure for starting and stopping machines, equipment and circuits
3. Conduct a tour of inspection.	• Compliance with the inspection schedule • Thorough inspection of functional parameters of machines and equipment • Accurate interpretation of functional parameters of circuits • Accurate detection of operational problems
4. Conduct control tests.	• Compliance with the sampling and testing schedule • Compliance with the sampling method • Proper preparation of samples • Compliance with the testing method relating to: – the percentage of solids – humidity – the pH value – density • Accurate interpretation of results • Soundness of the decision relating to whether it is necessary to repeat a test

Filtering Concentrates	Code: 778522
5. Monitor production.	• Proper supervision of the functional parameters of machines and circuits • Appropriate choice of maintenance operations and repairs to be done
6. Inspect and replace a filter cloth.	• Proper inspection of the cloth's condition • Compliance with the replacement procedure
7. Clean the work area and store all materials and equipment.	• Appropriate use of washing materials • Appropriate cleaning of work area and equipment • Appropriate storage of materials and equipment
8. Write up a production report.	• Pertinence of data gathered • Comprehensive inclusion of all data • Accuracy of data • Neatness of report
	For the competency as a whole: • Compliance with instructions relating to production and machine operations • Compliance with methods relating to circuit and machine operations • Appropriate solutions to operational problems affecting circuits and machines • Use of appropriate work methods • Appropriate use of machines, equipment and materials • Appropriate communication with other specialists • Continuous monitoring of equipment and machine operations • Compliance with occupational health and safety regulations • Compliance with environmental standards

Filling	Code: 778532

Competency 13 Duration 30 hours Credits 2

Behavioural Competency

Statement of the Competency

To operate machines and equipment used for hydraulic backfill and paste backfill.

Achievement Context

- Working alone
- On machines and equipment used for filling and filtering
- With operating instructions for ore processing and production machines
- Using operational data for ore processing and production machines; measuring instruments; tools; personal protective equipment; a communications system; technical documentation including flow sheets; and rocks, water, minerals and reagents

Elements of the Competency	**Performance Criteria**
1. Interpret the information contained in production reports.	• Identification of pertinent data • Accurate interpretation of information gathered
2. Start or stop machines, equipment and circuits.	• Proper inspection of machines before starting them • Compliance with the procedure for starting and stopping machines, equipment and circuits
3. Conduct a tour of inspection.	• Compliance with the inspection schedule • Thorough inspection of functional parameters of machines and equipment • Accurate interpretation of functional parameters of circuits • Accurate detection of operational problems
4. Conduct control tests.	• Compliance with the sampling and testing schedule • Compliance with the sampling method • Proper preparation of samples • Compliance with the testing method relating to: – the percentage of solids – reagent capacity – the pH value – cyanide titration – subsidence • Accurate interpretation of results • Soundness of the decision relating to whether it is necessary to repeat a test

Filling	Code: 778532
5. Monitor production.	• Proper supervision of the functional parameters of machines and circuits • Appropriate choice of maintenance operations and repairs to be done
6. Clean the work area and store all materials and equipment.	• Appropriate use of washing materials • Appropriate cleaning of work area and equipment • Appropriate storage of materials and equipment
7. Write up a production report.	• Pertinence of data gathered • Comprehensive inclusion of all data • Accuracy of data • Neatness of report
	For the competency as a whole: • Compliance with instructions relating to production and machine operations • Compliance with methods relating to circuit and machine operations • Appropriate solutions to operational problems affecting circuits and machines • Use of appropriate work methods • Appropriate use of machines, equipment and materials • Appropriate communication with other specialists • Continuous monitoring of equipment and machine operations • Compliance with occupational health and safety regulations • Compliance with environmental standards

Chemical Concentration Methods	Code: 778547

Competency 14 Duration 105 hours Credits 7

Behavioural Competency

Statement of the Competency

To operate machines and equipment used to produce ore concentrates using chemical methods.

Achievement Context

- Working alone
- On machines and equipment used for chemical concentration methods and filtration
- With operating instructions for ore processing and production machines
- Using operational data for ore processing and production machines; measuring instruments; tools; personal protective equipment; a communications system; technical documentation including flow sheets; and rocks, water, minerals and reagents
- Field of application
- Leaching, absorption, desorption, filtering and precipitating circuits for precious metals

Elements of the Competency	**Performance Criteria**
1. Interpret the information contained in production reports.	• Identification of pertinent data • Accurate interpretation of information gathered
2. Start or stop machines, equipment and circuits.	• Proper inspection of machines before starting them • Compliance with the procedure for starting and stopping machines, equipment and circuits
3. Conduct a tour of inspection.	• Compliance with the inspection schedule • Thorough inspection of functional parameters of machines and equipment • Accurate interpretation of functional parameters of circuits • Accurate detection of operational problems

4. Conduct control tests.	• Compliance with the sampling and testing schedule • Compliance with the sampling method • Proper preparation of samples • Compliance with the testing method relating to: – the percentage of solids – colorimetric determination – carbon concentration – reagent capacity – the pH value – cyanide titration • Accurate interpretation of results • Soundness of the decision relating to whether it is necessary to repeat a test
5. Monitor production.	• Proper supervision of the functional parameters of machines and circuits • Compliance with the carbon transfer method • Compliance with the carbon desorption method • Compliance with the method for preparing new carbon • Compliance with the method for using acid to clean the carbon and filter • Appropriate choice of maintenance operations and repairs to be done
6. Clean the work area and store all materials and equipment.	• Appropriate use of washing materials • Appropriate cleaning of work area and equipment • Appropriate storage of materials and equipment
7. Write up a production report.	• Pertinence of data gathered • Comprehensive inclusion of all data • Accuracy of data • Neatness of report

For the competency as a whole:

- Compliance with instructions relating to production and machine operations
- Compliance with methods relating to circuit and machine operations
- Appropriate solutions to operational problems affecting circuits and machines
- Use of appropriate work methods
- Appropriate use of machines, equipment and materials
- Appropriate communication with other specialists
- Continuous monitoring of equipment and machine operations
- Compliance with occupational health and safety regulations
- Compliance with environmental standards

Agglomeration	Code: 778553

Competency 15 Duration 45 hours Credits 3

Behavioural Competency

Statement of the Competency

To operate machines and equipment used for the agglomeration of concentrates.

Achievement Context

- Working alone
- On machines and equipment used for agglomeration and filtration
- With operating instructions for ore processing and production machines
- Using operational data for ore processing and production machines; measuring instruments; tools; personal protective equipment; a communications system; technical documentation including flow sheets; and rocks, water, minerals and reagents

Elements of the Competency	**Performance Criteria**
1. Interpret the information contained in production reports.	• Identification of pertinent data • Accurate interpretation of information gathered
2. Start or stop machines, equipment and circuits.	• Proper inspection of machines before starting them • Compliance with procedure for starting and stopping machines, equipment and circuits
3. Conduct a tour of inspection.	• Compliance with the inspection schedule • Thorough inspection of functional parameters of machines and equipment • Accurate interpretation of functional parameters of circuits • Accurate detection of operational problems
4. Conduct control tests.	• Compliance with the sampling and testing schedule • Compliance with the sampling method • Proper preparation of samples • Compliance with the testing method relating to: – the percentage of solids – particle size – humidity – waste • Accurate interpretation of results • Soundness of the decision relating to whether it is necessary to repeat a test

Agglomeration	Code: 778553
5. Monitor production.	• Proper supervision of the functional parameters of machines and circuits • Appropriate choice of maintenance operations and repairs to be done
6. Clean the work area and store all materials and equipment.	• Appropriate use of washing materials • Appropriate cleaning of work area and equipment • Appropriate storage of materials and equipment
7. Write up a production report.	• Pertinence of data gathered • Comprehensive inclusion of all data • Accuracy of data • Neatness of report
	For the competency as a whole: • Compliance with instructions relating to production and machine operations • Compliance with methods relating to circuit and machine operations • Appropriate solutions to operational problems affecting circuits and machines • Use of appropriate work methods • Appropriate use of machines, equipment and materials • Appropriate communication with other specialists • Continuous monitoring of equipment and machine operations • Compliance with occupational health and safety regulations • Compliance with environmental standards

Wastewater Treatment	Code: 778562

Competency 16 Duration 30 hours Credits 2

Behavioural Competency

Statement of the Competency	**Achievement Context**
To operate machines and equipment used to treat wastewater.	• Working alone • On machines and equipment used to treat wastewater • With operating instructions for ore processing and production machines • Using operational data for ore processing and production machines; measuring instruments; tools; personal protective equipment; a communications system; technical documentation including flow sheets; wastewater; and reagents • Field of application • Neutralization circuits using lime, hydrogen peroxide, sulphur dioxide and polymers

Elements of the Competency	**Performance Criteria**
1. Interpret the information contained in production reports.	• Identification of pertinent data • Accurate interpretation of information gathered
2. Start or stop machines, equipment and circuits.	• Proper inspection of machines before starting them • Compliance with the procedure for starting and stopping machines, equipment and circuits
3. Conduct a tour of inspection.	• Compliance with the inspection schedule • Thorough inspection of functional parameters of machines and equipment • Accurate interpretation of functional parameters of circuits • Accurate detection of operational problems
4. Conduct control tests.	• Compliance with the sampling and testing schedule • Compliance with the sampling method • Proper preparation of samples • Compliance with the testing method relating to: – the pH value – reagent capacity – cyanide titration • Accurate interpretation of results • Soundness of the decision relating to whether it is necessary to repeat a test

5. Monitor production.	• Proper supervision of the functional parameters of machines and circuits • Appropriate choice of maintenance operations and repairs to be done
6. Clean the work area and store all materials and equipment.	• Appropriate use of washing materials • Appropriate cleaning of work area and equipment • Appropriate storage of materials and equipment
7. Write up a production report.	• Pertinence of data gathered • Comprehensive inclusion of all data • Accuracy of data • Neatness of report
	For the competency as a whole: • Compliance with instructions relating to production and machine operations • Compliance with methods relating to circuit and machine operations • Appropriate solutions to operational problems affecting circuits and machines • Use of appropriate work methods • Appropriate use of machines, equipment and materials • Appropriate communication with other specialists • Continuous monitoring of equipment and machine operations • Compliance with occupational health and safety regulations • Compliance with environmental standards

Entering the Work Force	Code: 778577

Competency 17 Duration 105 hours Credits 7

Situational Competency

Statement of the Competency

To enter the work force.

Elements of the Competency

- Look for a practicum position.
- Learn about the workplace by performing certain trade-related tasks.
- Pursue their personal and professional development in the workplace.

Learning Context

Information Phase

- Finding information about mineral and metal processing plants that offer practicums.
- Writing their résumé.
- Applying for a practicum position.

Participation Phase

- Learning about the plant's organization and operations.
- Learning about the practicum position and the tasks to be performed.
- Performing specific tasks in accordance with current health rules, safety measures and the manager's expectations.
- Sharing information and talking with plant personnel.
- Determining whether the manager is satisfied with their work.
- Keeping a logbook.

Synthesis Phase

- Producing a practicum report.
- In class, sharing their experience in the workplace with their classmates.
- Participating in the practicum evaluation.
- Producing a report in which they state their observations about the work environment and the tasks performed during the practicum.

Instructional Guidelines

- Provide students with the means to properly select their practicum position.
- Ensure the regular support and supervision of students.
- Ensure close cooperation between the school and the ore processing plants.
- Intervene in the event of difficulties or problems.
- Encourage students to critically appraise the practicum.
- Make sure that students are supervised by a responsible plant employee.
- Provide students with a sample practicum report.

Entering the Work Force — Code: 778577

Participation Criteria

Information Phase

- Gather information about companies that offer practicums.
- Prepare for their interview and compose a well-written résumé.
- Be prepared to explain their choice and present their findings.

Participation Phase

- Perform assigned tasks in accordance with health and safety rules, as per the agreement with the plant and/or the practicum coordinator.
- Take an active, positive role in all meetings with the practicum coordinator.
- Write in their logbook daily.
- For the duration of the practicum, adopt the attitudes and behaviour expected of a mineral and metal processing machine operator.
- Talk with plant personnel.

Synthesis Phase

- Write and present their practicum report according to the instructions received.
- Indicate specific aspects of the workplace and the tasks performed that they noted during the practicum.
- Take an active role in evaluating their practicum.

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