

## MODULE ENM3040: METALS/NONMETALS 2 (RECOVERY & PRODUCTION)

**Level:** Advanced

**Theme:** Technology and Applications

**Prerequisite:** ENM2040 Metals/Nonmetals 1 (Resource Exploration)

**Module Description:** Students examine specific recovery and production techniques within the context of a metallic and/or nonmetallic mineral deposit, and they explain related career opportunities.

**Note:** Industry often refers to a third category of minerals called “structural materials”; i.e., minerals used primarily in construction, including sand and gravel, decorative and building stone, cement, clay and limestone. Modules ENM2040 and ENM3040 include structural materials within the broader category of nonmetallic minerals.

**Module Parameters:** Access to industry involved in the recovery and production of metallic and/or non-metallic minerals.

Access to a science laboratory.

This module requires off-campus learning experiences and should be combined with relevant work study, work experience and/or modules from the Career Transitions strand; consultation with the work-site supervisor will ensure that relevant safety considerations are addressed.

See the *Off-Campus Education Guide for Administrators, Counsellors and Teachers* (Alberta Education) for further information regarding off-campus learning.

**Supporting Module:** CTR2210 Workplace Safety (Practices) [Career Transitions Strand]; recommended for off-campus learning

Students must have a general knowledge of potential hazards and accepted safety practices relevant to specific recovery and production sites prior to engaging in off-campus learning experiences. See Planning for Instruction in Section C of this Guide for further information regarding student safety.

**MODULE ENM3040: METALS/NONMETALS 2 (RECOVERY & PRODUCTION)** (continued)

**Curriculum and Assessment Standards**

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> <li>describe techniques used to recover metallic and nonmetallic commodities from mineral deposits</li> </ul>	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> <li>a presentation or report that describes and illustrates:               <ul style="list-style-type: none"> <li>extraction, processing and transportation infrastructures necessary for the recovery of a commodity from a rock or mineral deposit</li> <li>specific mining techniques used to extract a metallic or nonmetallic mineral, including placer mining, surface mining, underground mining and/or drilling/borehole mining</li> <li>environmental assessment and management practices conducted by industry throughout recovery and production operations.</li> </ul> </li> </ul> <p><i>Assessment Tool</i>  <i>Presentations/Reports: Advanced Level, ENMPRE-3</i></p> <p><i>Standard</i>  <i>Achieve a minimum rating of 3 on the rating scale for Presentations/Reports</i></p> <ul style="list-style-type: none"> <li>through laboratory and/or field-based investigations, identifying applications of principles of science and technology involved in separating, cleaning and/or upgrading a metallic or nonmetallic mineral.</li> </ul> <p><i>Assessment Tool</i>  <i>Lab Investigations: Advanced Level, ENMLAB-3</i>  <i>Observation Checklist for Field-based Investigations, ENMOBS</i></p> <p><i>Standard</i>  <i>Conduct lab investigations to a standard of 3 on the rating scale <u>and/or</u> complete all sections of the observation checklist for field-based investigations</i></p> <ul style="list-style-type: none"> <li>a concept test in which the student demonstrates knowledge of surface and underground equipment used in resource extraction.</li> </ul> <p><i>Assessment Tool</i>  <i>Exploring Manufacturing (Instructor’s Manual)</i></p> <p><i>Standard</i>  <i>Response indicating 60% mastery</i></p>	<p>50</p>

**MODULE ENM3040: METALS/NONMETALS 2 (RECOVERY & PRODUCTION) (continued)**

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> <li>• describe field gathering facilities and distribution systems used in the mineral industry</li> <li>• explain current and emerging applications of technology in enhancing recovery methods for mineral deposits</li> <li>• explain career opportunities relevant to the recovery and production sector of a mineral industry</li> </ul>	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> <li>• a flow chart that traces the movement of a mineral commodity from recovery-site to market (or refinery). Flow chart to illustrate (as appropriate):               <ul style="list-style-type: none"> <li>– separation, cleaning and/or upgrading facilities</li> <li>– field storage techniques</li> <li>– distribution networks.</li> </ul> </li> </ul> <p><i>Assessment Tool</i>  <i>Assessment Criteria: Flow Charts, ENMFLO</i></p> <p><i>Standard</i>  <i>Complete the flow chart to a standard of 3 on the rating scale</i></p>	<p>10</p>
	<ul style="list-style-type: none"> <li>• completing a research project on techniques used to maximize resource recovery. Research to address:               <ul style="list-style-type: none"> <li>– factors that affect the recovery potential for a mineral deposit</li> <li>– applications of enhanced recovery technology, including drilling and blasting techniques, rock bolting and screening machines, video technology and remote control, and innovations in separation technology</li> <li>– techniques used to estimate recoverable mineral deposits in Alberta.</li> </ul> </li> </ul> <p><i>Assessment Tool</i>  <i>Research Process: Enhanced Mineral Recovery, ENM3040-1</i></p> <p><i>Standard</i>  <i>Complete all components of research to a standard of 3 on the rating scale</i></p>	<p>20</p>
	<ul style="list-style-type: none"> <li>• conducting research on technical, professional and labour-based careers within the recovery and production sector of a mineral industry.</li> </ul> <p><i>Assessment Tool</i>  <i>Career Search: Advanced Level, ENMCAR-3</i></p> <p><i>Standard</i>  <i>Conduct research to a standard of 3 on the rating scale</i></p>	<p>20</p>

**MODULE ENM3040: METALS/NONMETALS 2 (RECOVERY & PRODUCTION) (continued)**

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> <li>demonstrate basic competencies.</li> </ul>	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> <li>observations of individual effort and interpersonal interaction during the learning process.</li> </ul> <p><i>Assessment Tool</i>  <i>Basic Competencies Reference Guide and any assessment tools noted above</i></p>	<p>Integrated throughout</p>

Concept	Specific Learner Expectations	Notes
<p>Recovery Techniques</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> <li>describe infrastructures necessary in the recovery of commodities from rock and mineral deposits                             <ul style="list-style-type: none"> <li>extraction</li> <li>processing</li> <li>transportation</li> </ul> </li> <li>research basic techniques used to extract metallic and nonmetallic mineral deposits; e.g.:                             <ul style="list-style-type: none"> <li>placer mining</li> <li>surface mining</li> <li>underground mining</li> <li>other extraction methods</li> </ul> </li> <li>describe surface and/or underground equipment used in resource extraction</li> <li>research technologies used to process a metallic, nonmetallic or structural mineral:                             <ul style="list-style-type: none"> <li>crushing/screening</li> <li>separating/dressing</li> <li>cleaning/roasting</li> <li>upgrading/smelting</li> </ul> </li> </ul>	<p>Discuss safety considerations relevant to the recovery-site; e.g.:</p> <ul style="list-style-type: none"> <li>first aid</li> <li>clothing and equipment</li> <li>government/industry regulation</li> <li>lifting/hoisting techniques.</li> </ul> <p>Obtain a copy of <i>Edmonton Beneath Our Feet</i> from the Alberta Geological Survey.</p> <p>For example:</p> <ul style="list-style-type: none"> <li>drilling</li> <li>borehole mining.</li> </ul> <p>Research the use of:</p> <ul style="list-style-type: none"> <li>heavy machinery (e.g., excavators, scrapers, bulldozers and draglines)</li> <li>blasting, drilling and cutting equipment</li> <li>augers, conveyor belts and trucks</li> <li>hand tools and safety equipment.</li> </ul> <p>Encourage student to make links with concepts studied in the core science courses.</p>

**MODULE ENM3040: METALS/NONMETALS 2 (RECOVERY & PRODUCTION) (continued)**

Concept	Specific Learner Expectations	Notes
<p>Recovery Techniques (continued)</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> <li>• explain environmental assessment and management practices conducted by industry throughout recovery and production operations</li>   <li>• describe technological advances used to address environmental concerns throughout recovery and production</li>   <li>• describe basic reclamation activities undertaken by industry.</li> </ul>	<p>Research environmental standards and the enforcement of safe operating procedures throughout recovery and production activities.</p> <p>Identify specific environmental problems related to recovery/production. Encourage students to propose solutions.</p> <p>Research and discuss:</p> <ul style="list-style-type: none"> <li>• recovery/production area restoration</li> <li>• strip-mine restoration.</li> </ul>
<p>Gathering and Distribution</p>	<ul style="list-style-type: none"> <li>• describe recovery-site and satellite facilities used for separation, cleaning and upgrading processes</li> <li>• describe different types of field storage facilities</li>   <li>• research distribution networks used to move metallic or industrial minerals from recovery-site to market (or refinery).</li> </ul>	<p>Obtain the brochures <i>Aggregates</i> and <i>Aggregates and Our Environment</i> from the Alberta Sand and Gravel Association.</p> <p>For example:</p> <ul style="list-style-type: none"> <li>• rail systems</li> <li>• trucking systems</li> <li>• tankers and barges.</li> </ul>
<p>Applications of Technology</p>	<ul style="list-style-type: none"> <li>• explain the current and potential significance of Alberta's mineral resources</li>   <li>• identify factors that affect the recovery potential for a mineral deposit</li> </ul>	<p>Discuss the current and future economic, social and environmental significance.</p> <p>Explain how recovery potential may be affected by:</p> <ul style="list-style-type: none"> <li>• depth of overburden</li> <li>• size and nature of the deposit</li> <li>• economic viability</li> <li>• environmental impact.</li> </ul>

**MODULE ENM3040: METALS/NONMETALS 2 (RECOVERY & PRODUCTION) (continued)**

Concept	Specific Learner Expectations	Notes
Applications of Technology (continued)	<p><i>The student should:</i></p> <ul style="list-style-type: none"> <li>• explain applications of technology in enhanced recovery methods; e.g.:               <ul style="list-style-type: none"> <li>– drilling and blasting techniques</li> <li>– rock bolting and screening machines</li> <li>– video technology and remote control</li> <li>– innovations in separation technology</li> </ul> </li> <li>• identify methods used for the exploration of “hidden” or “blind” deposits</li> <li>• research public and private agencies responsible for developing new technology to assist in the recovery of Alberta’s mineral resources</li> <li>• describe techniques used to estimate recoverable mineral deposits in Alberta.</li> </ul>	<p>Discuss reasons for making production as efficient as possible.</p> <p>Subscribe to <i>Rock Chips</i> (a newsletter published by the Alberta Geological Survey).</p> <p>Discuss methods used both in existing mines and for new developments.</p> <p>For example:</p> <ul style="list-style-type: none"> <li>• Alberta Research Council</li> <li>• National Research Council.</li> </ul> <p>Consider applications of:</p> <ul style="list-style-type: none"> <li>• computing techniques</li> <li>• assays</li> <li>• mathematical modelling.</li> </ul>
Career Opportunities	<ul style="list-style-type: none"> <li>• research careers and the range of occupational opportunities within the recovery and production sector of a mineral industry; e.g.:               <ul style="list-style-type: none"> <li>– earth science</li> <li>– engineering</li> <li>– technical and support services</li> <li>– apprenticeship trades</li> <li>– environmental management</li> </ul> </li> <li>• evaluate current employment opportunities based on employment statistics</li> <li>• research recovery and production trends and future career opportunities.</li> </ul>	<p>Plan for individual/group research and presentations that address:</p> <ul style="list-style-type: none"> <li>• job description</li> <li>• employment market</li> <li>• education/training</li> <li>• wage expectations.</li> </ul> <p>Contact the “Career Information Hotline” (Alberta Advanced Education and Career Development).</p> <p>See the National Occupational Profiles (NOC) in Section H: Linkages/Transitions.</p> <p>Arrange/facilitate:</p> <ul style="list-style-type: none"> <li>• information interviews</li> <li>• work study/experience</li> <li>• job shadowing.</li> </ul>