MODULE ENM2070: REFINING ROCKS & MINERALS

Level: Intermediate

Theme: Technology and Applications

Prerequisite: None

Module Description: Students examine the principles and processes involved in refining an industrial (nonmetallic) mineral or a metallic mineral, and they describe related career opportunities.

Module Parameters: Access to a rock/mineral processing industry.

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 Modules: ENM1060 Consumer Products & Services
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 processing sites prior to engaging in off-campus learning experiences. See Planning for Instruction in Section C for further information regarding student safety.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will: • describe commodity inputs and consumer products characteristic of the mineral processing industry	*Assessment of student achievement should be based on:* • identifying and describing the range of products provided as a result of processing and/or refining Alberta's industrial (nonmetallic) and/or metallic minerals. *Assessment Tool* Exploring Manufacturing *Standard* *Identify 50 products, their derivatives and general application/use*	20

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:* • given a specific mineral processing industry, identifying: – inputs to processing and/or refining within the industry – economic, environmental, safety and other factors that influence industry practices. *Assessment Tool* *Research Process: Mineral Processing, ENM2070–1* *Standard* *Complete all components of research to a standard of 2 on the rating scale*	
• explain techniques used to refine an industrial (nonmetallic) mineral or a metallic mineral	• through laboratory and/or field-based investigations: – identifying the physical and chemical properties of a mineral substance – relating properties of a mineral substance to techniques used for processing and/or refining. *Assessment Tool* *Lab Investigations: Intermediate Level, ENMLAB–2* *Observation Checklist for Field-based Investigations, ENMOBS* *Standard* *Conduct lab investigations to a standard of 2 on the rating scale <u>and/or</u> complete all sections of the observation checklist for field investigations*	60

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
The student will:	*Assessment of student achievement should be based on:* • a flow chart that outlines major steps and processes used to refine an industrial (nonmetallic) or metallic mineral. *Assessment Tool* *Assessment Criteria: Flow Charts, ENMFLO* *Standard* *Complete the flow chart to a standard of 2 on the rating scale* • a summary of environmental assessment and management practices conducted by industry throughout processing and refining operations. *Assessment Tool* *Presentations/Reports: Intermediate Level, ENMPRE–2* *Standard* *Achieve a minimum rating of 2 on the rating scale for Presentations/Reports*	
• describe career opportunities relevant to the processing sector of a rock or mineral industry	• conducting research on technical, professional and/or labour-based careers within the processing or refining sector of a rock or mineral industry. *Assessment Tool* *Career Search: Intermediate Level, ENMCAR–2* *Standard* *Conduct research to a standard of 2 on the rating scale*	20
• demonstrate basic competencies.	• observations of individual effort and interpersonal interaction during the learning process. *Assessment Tool* *Basic Competencies Reference Guide and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
The Processing Industry	*The student should:* • explain the social, economic and environmental significance of Alberta's rocks and minerals	Obtain copies of: • *Edmonton Beneath Our Feet* (Alberta Geological Survey) • *Canadian Minerals Yearbook* (Natural Resources Canada) • *Aggregates* (Alberta Sand and Gravel Association).
	• describe applications of Alberta's industrial (nonmetallic) and metallic minerals • describe inputs to processing within a mineral industry: – mineral ores/aggregates – financial, human and natural resources – technology requirements	Prepare posters/displays of products and services derived from Alberta's minerals; e.g.: • sand and gravel • cement and lime • peat moss • building stone • gypsum • clay products • sulphur • salt • gold and copper • iron ore • lead and zinc.
	• identify factors that influence the nature of a mineral processing industry	Given a specific industry, research the influences of factors such as: • supply of raw materials • allowable production volumes • access to markets.
	• identify environmental and safety concerns that influence practices within a mineral processing industry.	Discuss industry impact on: • workers and nearby residents • crops, forests, livestock and wildlife • air, soil and water quality.

Concept	Specific Learner Expectations	Notes
Processing and Refining Techniques	*The student should:* • explain the stages, steps and technologies used in processing an industrial (nonmetallic) or metallic mineral; e.g.: – milling, dressing and cleaning – smelting, refining and upgrading	Contact Natural Resources Canada to obtain posters available on mineral processing and refining.
	• demonstrate basic extractive technologies used in the mineral industry; e.g.: – thermal – mechanical – chemical – electrical	Conduct laboratory investigations that demonstrate: • heat application • grinding/pulverizing • leaching • electrolysis • floatation.
	• create a simplified model of a mineral processing/ refining facility	
	• research the physical and chemical properties of a mineral substance, and relate these to technologies used for processing and refining	For a given mineral substance, conduct laboratory investigations of: • molecular structure • mass and density • magnetic characteristics • elasticity and stress. Encourage students to link experimental outcomes to studies in the core science program.
	• explain industry use of electronic equipment and computer technology in monitoring and controlling refining processes	Research the development of new materials for specific environments and applications.
	• describe storage facilities and distribution systems within the industry, and their impact on industry location and product costs	Construct flow charts that illustrate storage and distribution systems.
	• explain environmental assessment and management practices conducted by industry throughout refining operations	Research environmental standards and the enforcement of safe operating procedures throughout refining operations.

Concept	Specific Learner Expectations	Notes
Processing and Refining Techniques (continued)	*The student should:* • describe industry initiatives that respond to environmental concerns	For example: • advances in sulphur-recovery technology • management of reactive rock wastes • waste treatment/ emission control.
	• describe industry initiatives that address occupational health and safety requirements	For example: • odour scrubbers • noise suppressants • water purification.
	• describe industry initiatives in reprocessing and recycling mineral products to ensure a life-cycle approach to resource management.	Obtain the brochure entitled *Aggregates and Our Environment* from the Alberta Sand and Gravel Association.
Career Opportunities	• research careers and the range of occupational opportunities within the processing and refining sector of a mineral industry; e.g.: – engineering – technical and support services – apprenticeship trades – environmental management	Plan for individual/group research and presentations that address: • job description • employment market • education/training • wage expectations.
	• explain the personnel structure within a mineral processing industry	Contact the "Career Information Hotline" (Alberta Advanced Education and Career Development).
	• evaluate current employment opportunities based on employment statistics	See the National Occupational Profiles (NOC) in Section H: Linkages/Transitions.
	• research trends in mineral processing and refining, and future career opportunities; e.g.: – mineral upgrading – recycling and utilization – waste management.	Arrange/facilitate: • information interviews • work study/experience • job shadowing.