

MODULE CURRICULUM AND ASSESSMENT STANDARDS:

SECTION E: INTERMEDIATE LEVEL

The following pages define the curriculum and assessment standards for the intermediate level of Energy and Mines.

Intermediate level modules help students build on the competencies developed at the introductory level and focus on developing more complex competencies. They provide a broader perspective, helping students recognize the wide range of related career opportunities available within the strand.

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MODULE ENM2010: MANAGING ALBERTA’S RESOURCES

Level: Intermediate

Theme: Social and Cultural Perspectives

Prerequisite: None

Module Description: Students research agencies and structures used to manage the development of Alberta’s energy and mineral resources.

Module Parameters: Access to government agencies responsible for the sustainable management of energy and mineral resources (e.g., Alberta Energy and Utilities Board, Alberta Energy, Environment Canada).

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"> explain how Alberta’s energy and mineral resources are managed 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> completing a research project on the history of energy and mineral development in Alberta. Research to include: <ul style="list-style-type: none"> a historical account of changes that have occurred in the ownership and administration of energy and mineral resources in Alberta an explanation of public (provincial and federal Crown) and private (“freehold”) forms of land ownership that exist in Alberta today. <p><i>Assessment Tool</i> <i>Research Process: Administration of Energy/Mineral Resources, ENM2010–1</i></p> <p><i>Standard</i> <i>Complete all components of research to a standard of 2 on the rating scale</i></p>	20

MODULE ENM2010: MANAGING ALBERTA’S RESOURCES (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> • describe government legislation and policies that influence the development of an energy or mineral resource • explain methods of allocating land and resources for exploration and development • demonstrate basic competencies. 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> • identifying and explaining the role of: <ul style="list-style-type: none"> – important government legislation in managing exploration and development activities within one of Alberta’s energy or mineral industries – regulations and/or guidelines established in association with government legislation for further managing activities within the industry. <p><i>Assessment Tool</i> <i>Relevant government legislation, regulations and/or guidelines available from Alberta Energy</i></p> <p><i>Standard</i> <i>Summarize 3 important government legislation and 5 regulations and/or guidelines</i></p> <ul style="list-style-type: none"> • a presentation or report on five or more different types of approvals (e.g., permits, licences, leases) used to grant exploration and/or development rights within a selected energy or mineral industry. For each approval, presentation/report to provide information regarding: <ul style="list-style-type: none"> – the authority granting approval – criteria for granting the approval – the intent of the approval – responsibilities of the holder. <p><i>Assessment Tool</i> <i>Presentations/Reports: Intermediate Level, ENMPRE–2</i></p> <p><i>Standard</i> <i>Achieve a minimum rating of 2 on the rating scale for Presentations/Reports</i></p> <ul style="list-style-type: none"> • observations of individual effort and interpersonal interaction during the learning process. <p><i>Assessment Tool</i> <i>Basic Competencies Reference Guide and any assessment tools noted above</i></p>	<p>40</p> <p>40</p> <p>Integrated throughout</p>

MODULE ENM2010: MANAGING ALBERTA’S RESOURCES (continued)

Concept	Specific Learner Expectations	Notes
Administration of Energy and Minerals	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • describe major changes that have occurred from past to present in the ownership and administration of energy and mineral resources in Alberta; e.g.: <ul style="list-style-type: none"> – private ownership of mineral rights – federal jurisdiction – provincial status – aboriginal lands and Native rights – <i>Natural Resources Transfer Act</i> • describe the extent to which different types of resource ownership exist in Alberta today; e.g.: <ul style="list-style-type: none"> – public (provincial and federal Crown ownership) – private (“freehold”) ownership. 	<p>Use archives, films and library resources to research the history of energy or mineral development in Alberta.</p> <p>Construct a timeline of historical changes in administrative policies.</p> <p>Contact Alberta Energy to request maps of land ownership areas in Alberta. Construct graphs depicting land ownership distribution.</p>
Government Legislation and Policies	<ul style="list-style-type: none"> • explain the mandate and responsibilities of key government departments and agencies in managing energy and mineral resources within provincial boundaries; e.g.: <ul style="list-style-type: none"> – disposition of mineral rights – regulation of exploration and development – development of conservation practices and environmental standards – collection of fair returns from resource development • explain current and potential opportunities for industry involvement in managing energy and mineral resources within provincial boundaries • research the role of important federal and provincial legislation in managing exploration and development activities within one of Alberta’s energy or mineral industries 	<p>Research and report on the functions of:</p> <ul style="list-style-type: none"> • Alberta Energy and Utilities Board • Natural Resources Conservation Board • Alberta Energy • Alberta Environmental Protection. <p>Contact Alberta Energy to request various legislation, regulations and guidelines; e.g.:</p> <ul style="list-style-type: none"> • <i>Environmental Protection and Enhancement Act</i> • <i>Mines and Mineral Act</i> • <i>Public Lands Act</i> • <i>Surface Rights Act</i> • <i>Fisheries Act</i> • <i>Oil and Gas Conservation Act</i> • <i>Quarries Regulation Act</i> • <i>Small Power Research and Development Act.</i>

MODULE ENM2010: MANAGING ALBERTA’S RESOURCES (continued)

Concept	Specific Learner Expectations	Notes
<p>Government Legislation and Policies (continued)</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • research the role of regulations and guidelines established in association with government legislation in further managing activities within an energy or mineral industry • evaluate the short- and long-term effects of selected government legislation and regulations on one of Alberta’s energy or mineral resources. 	<p>For example:</p> <ul style="list-style-type: none"> • <i>Metallic Minerals Regulation</i> • <i>Environmental Impact Assessment Guidelines</i> • <i>Environmental Operating Guidelines</i> • <i>Waste Water Management Guidelines</i> • <i>Sand, Gravel, Clay and Marl Surface Operations Regulations.</i> <p>Avoid detailed analysis of legislation and regulations – <u>OVERVIEW ONLY.</u></p>
<p>Allocation Procedures</p>	<ul style="list-style-type: none"> • explain how approvals (in the form of permits, licences, leases and other legal agreements) are used to grant exploration and/or development rights • identify factors that determine the nature of approvals required for a development activity; e.g.: <ul style="list-style-type: none"> – resource ownership (public or private) – type of resource to be developed • identify criteria taken into consideration when reviewing development applications and granting project approvals; e.g.: <ul style="list-style-type: none"> – sustainable development – reclamation of land – environmental protection – market demands and fluctuations – estimated returns and production life – integrated use of land • research departments and/or agencies having authority to grant approval for a selected energy or mineral development project 	<p>Explain that although the government leases mineral rights to the private sector for development, it collects a fair share of resource rents through royalty payments, development fees and freehold mineral taxes.</p> <p>Prepare a flow chart outlining procedures followed by an industry to obtain project approval.</p> <p>For example:</p> <ul style="list-style-type: none"> • Alberta Energy and Utilities Board • Alberta Environmental Protection • Alberta Energy • Environment Canada.

MODULE ENM2010: MANAGING ALBERTA'S RESOURCES (continued)

Concept	Specific Learner Expectations	Notes
<p>Allocation Procedures (continued)</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • research the intent of different permits, licences and/or agreements required prior to commencing the development project • research requirements for the renewal and/or extension of different permits, licences and agreements • explain the role of consultation (with other resource users) and public involvement in allocating land and resources for development, and in balancing interests among key stakeholder groups. 	<p>For example:</p> <ul style="list-style-type: none"> • Surface Rights Leases/Agreements • Exploration Approvals/Licences • Development and Reclamation Approvals • Clean Air/Water Permits • Historical Resource Permits • Road Use Agreements. <p>Discuss what happens when particular leases/claims lapse.</p> <p>Involve students in role-playing activities that include negotiation and debate.</p>

MODULE ENM2020: CONVENTIONAL OIL/GAS 1 (RESOURCE EXPLORATION)

Level: Intermediate

Theme: Technology and Applications

Prerequisite: None

Module Description: Students examine specific exploration techniques and technologies within the context of Alberta's conventional oil and/or gas deposits, and they describe related career opportunities.

Module Parameters: Access to government and industry organizations involved in the exploration of conventional oil and gas deposits (e.g., Alberta Energy and Utilities Board, Petroleum Communication Foundation, local industry).

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: ENM1020 Nonrenewable Resources
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 exploration sites prior to engaging in off-campus learning experiences. See Planning for Instruction in Section C for further information regarding student safety.

MODULE ENM2020: CONVENTIONAL OIL/GAS 1 (RESOURCE EXPLORATION) (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"> • demonstrate knowledge of current and emerging technologies used in the exploration of conventional oil and gas deposits 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> • completing a research project on conventional oil and gas exploration in Alberta. Research to address: <ul style="list-style-type: none"> – the formation and migration of conventional underground oil and gas deposits – subsurface rock structures capable of trapping oil and gas deposits – techniques used to identify sedimentary basins likely to contain petroleum – techniques used to estimate recoverable oil and gas reserves. <p><i>Assessment Tool</i> <i>Research Process: Conventional Oil and Gas Exploration, ENM2020–1</i></p> <p><i>Standard</i> <i>Complete all components of research to a standard of 2 on the rating scale</i></p> <ul style="list-style-type: none"> • through field-based investigations, identifying applications of principles of science and technology in seismic and drilling operations. Investigations to address: <ul style="list-style-type: none"> – use of shot hole rig seismology, vibroseis units and 3D scanning – rotary and top-drive drilling systems. <p><i>Assessment Tool</i> <i>Observation Checklist for Field-based Investigations, ENMOBS</i></p> <p><i>Standard</i> <i>Complete all sections of the observation checklist for field-based investigations</i></p>	<p>60</p>

MODULE ENM2020: CONVENTIONAL OIL/GAS 1 (RESOURCE EXPLORATION) (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> • interpret sample seismic log data and well logs in order to predict the nature and extent of a hydrocarbon deposit 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> • a concept test in which the student demonstrates knowledge of: <ul style="list-style-type: none"> – seismic theory, instruments used in a seismic survey and recent innovations in seismic technology – components of a drilling rig, drilling procedures, logging and testing techniques, and recent innovations in drilling technology. <p><i>Assessment Tool</i> Energy Source/Applications/Alternatives (<i>Instructor's Manual</i>)</p> <p><i>Standard</i> Response indicating 60% mastery</p> <ul style="list-style-type: none"> • a summary of environmental assessment and management practices conducted by industry throughout exploration operations. <p><i>Assessment Tool</i> Presentations/Reports: <i>Intermediate Level, ENMPRE-2</i></p> <p><i>Standard</i> Achieve a minimum rating of 2 on the rating scale for Presentations/Reports</p> <ul style="list-style-type: none"> • through field-based investigations: <ul style="list-style-type: none"> – identifying applications of principles of science and technology in collecting and evaluating well data – predicting the presence of hydrocarbon-bearing rock structures from sample seismic log data and sample well log data. <p><i>Assessment Tool</i> Observation Checklist for Field-based Investigations, ENMOBS An Introduction to the Petroleum Industry, Chapter 6</p> <p><i>Standard</i> Complete all sections of the observation checklist for field-based investigations <u>and</u> answer all questions/exercises on Chapter 6 (pp. 6–14)</p>	<p>30</p>

MODULE ENM2020: CONVENTIONAL OIL/GAS 1 (RESOURCE EXPLORATION) (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> describe career opportunities relevant to the exploration sector of the conventional oil and gas industry demonstrate basic competencies. 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> conducting research on technical, professional and/or labour-based careers in conventional oil and gas exploration. <p><i>Assessment Tool</i> <i>Career Search: Intermediate Level, ENMCAR-2</i></p> <p><i>Standard</i> <i>Conduct research to a standard of 2 on the rating scale</i></p> <ul style="list-style-type: none"> observations of individual effort and interpersonal interaction during the learning process. <p><i>Assessment Tool</i> <i>Basic Competencies Reference Guide and any assessment tools noted above</i></p>	<p>10</p> <p>Integrated throughout</p>

Concept	Specific Learner Expectations	Notes
<p>Exploration Technology</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> explain basic theories and/or principles regarding the formation and migration of conventional underground oil and gas deposits gather information regarding probable reserves of oil and gas in major sedimentary basin areas of Canada illustrate subsurface rock structures capable of trapping oil and gas deposits: <ul style="list-style-type: none"> anticlinal trap fault trap stratigraphic trap reef trap explain applications of aerial surveys and satellite imagery in identifying sedimentary basins likely to contain petroleum 	<p>Describe and illustrate:</p> <ul style="list-style-type: none"> theories of origin/formation source rock and migration the difference between porosity and permeability. <p>Contact the Alberta Geological Survey to obtain copies of:</p> <ul style="list-style-type: none"> <i>Atlas of the Western Canadian Sedimentary Basin</i> <i>Edmonton Beneath Our Feet.</i> <p>For example:</p> <ul style="list-style-type: none"> 3-D scanning measurement of magnetic fields, gravity and radiation.

MODULE ENM2020: CONVENTIONAL OIL/GAS 1 (RESOURCE EXPLORATION) (continued)

Concept	Specific Learner Expectations	Notes
<p>Exploration Technology (continued)</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • describe steps taken to gather further information about subsurface rock formations within a basin prior to seismic and/or drilling operations: <ul style="list-style-type: none"> – first-hand observation of outcrop geology and surface features – review of existing information • research current and emerging applications of seismic technology in mapping potential oil and gas-bearing formations: <ul style="list-style-type: none"> – seismic theory – data collection and processing • research current and emerging applications of drilling technology in determining the composition of subsurface rock and the presence of oil and gas deposits: <ul style="list-style-type: none"> – drill rig components – drilling techniques – logging and testing procedures • explain environmental assessment and management practices conducted by industry throughout exploration operations • describe technological advances used to address environmental concerns throughout the exploration process. 	<p>For example:</p> <ul style="list-style-type: none"> • government reports and other published papers (<i>Geological Survey of Canada</i>) • previous exploration results from nearby/similar areas. <p>Research applications of computer-assisted processing in providing 2-D and 3-D analyses of sedimentary structures.</p> <p>Identify general parts of a drilling rig and accompanying equipment.</p> <p>Explain the process of “making hole.”</p> <p>Discuss the use of cuttings and cores in determining the properties of subsurface rock structures.</p> <p>Research directional, horizontal and under-balanced drilling techniques.</p> <p>Research environmental standards and the enforcement of safe operating procedures for seismic and drilling rigs.</p> <p>Gather information about exploration techniques adopted to maintain environmental standards; e.g.:</p> <ul style="list-style-type: none"> • seismic technology • horizontal drilling • use of helicopters/packhorses • disposal of drilling fluids.

MODULE ENM2020: CONVENTIONAL OIL/GAS 1 (RESOURCE EXPLORATION) (continued)

Concept	Specific Learner Expectations	Notes
Data Interpretation	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • explain basic terminology and methodology used in seismic line analysis • given sample seismic line data, make predictions regarding the presence of hydrocarbon-bearing rock structures • explain basic terminology and methodology used in geological log analysis • given sample well log data, make predictions regarding the presence of a hydrocarbon deposit • estimate the potential volume of a hydrocarbon deposit using sample seismic line and well log data. 	<p>Establish links with local industry for first-hand observation of technologies/techniques used in data interpretation. Only a <u>RUDIMENTARY UNDERSTANDING</u> of terminology and methodology need to be developed at this time.</p> <p>Identify types of information recorded in well log records; e.g.:</p> <ul style="list-style-type: none"> • type and thickness of rock layers • speed of penetration. <p>Research the use of wireline logging tools in transmitting data about:</p> <ul style="list-style-type: none"> • thickness, porosity and permeability • fluid composition of rock formations.
Career Opportunities	<ul style="list-style-type: none"> • research careers and the range of occupational opportunities related to the exploration of conventional oil and gas deposits; e.g.: <ul style="list-style-type: none"> – earth science – land survey and access – seismic and drilling service – environmental management • evaluate current employment opportunities based on employment statistics • research trends in the oil and gas exploration industry, and future career opportunities. 	<p>Plan for individual/group research and presentations that address:</p> <ul style="list-style-type: none"> • job description • employment market • education/training • wage expectations. <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"> • information interviews • work study/experience • job shadowing.

MODULE ENM2030: OIL SANDS/HEAVY OIL/COAL 1 (RESOURCE EXPLORATION)

Level: Intermediate

Theme: Technology and Applications

Prerequisite: None

Module Description: Students examine specific exploration techniques and technologies within the context of Alberta's oil sands, heavy oil or coal deposits, and they describe related career opportunities.

Module Parameters: Access to government and industry organizations involved in the exploration of nonconventional hydrocarbon resources (e.g., Fort McMurray Oil Sands Interpretive Centre, Western Research Centre).

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: ENM1020 Nonrenewable Resources
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 exploration 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 ENM2030: OIL SANDS/HEAVY OIL/COAL 1 (RESOURCE EXPLORATION)
(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"> • demonstrate knowledge of current and emerging technologies used in the exploration of oil sands, heavy oil or coal deposits 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> • completing a research project on nonconventional hydrocarbon exploration. Research to address: <ul style="list-style-type: none"> – the origin and formation of oil sands, heavy oil or coal deposits – surface and subsurface rock structures capable of containing oil sands, heavy oil or coal deposits – steps taken in locating potential oil- or coal-bearing formations prior to seismic and/or drilling operations – techniques used to estimate recoverable deposits of bitumen, heavy oil or coal. <p><i>Assessment Tool</i> <i>Research Process: Exploration of Nonconventional Hydrocarbon Deposits, ENM2030-1</i></p> <p><i>Standard</i> <i>Complete all components of research to a standard of 2 on the rating scale</i></p> <ul style="list-style-type: none"> • through field-based investigations: <ul style="list-style-type: none"> – identifying applications of principles of science and technology in one or more areas of resource exploration (e.g., seismology, drilling) – examining the effect of overburden, oil density and viscosity, and/or rock porosity and permeability on recovery potential for an oil sand, heavy oil or coal deposit. <p><i>Assessment Tool</i> <i>Observation Checklist for Field-based Investigations, ENMOBS</i></p> <p><i>Standard</i> <i>Complete all sections of the observation checklist for field-based investigations</i></p>	<p>60</p>

MODULE ENM2030: OIL SANDS/HEAVY OIL/COAL 1 (RESOURCE EXPLORATION)
(continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> explain applications of low-depth drilling and log analysis in predicting the nature and extent of an oil sands, heavy oil or coal deposit 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> a concept test in which the student demonstrates knowledge of: <ul style="list-style-type: none"> the characteristics and distinguishing features of three or more different oil- or coal-bearing formations seismic, drilling and/or other technology used in establishing the presence of nonconventional hydrocarbon deposits. <p><i>Assessment Tool</i> Energy Sources/Applications/Alternatives (Instructor's Manual)</p> <p><i>Standard</i> Response indicating 60% mastery</p> <ul style="list-style-type: none"> a summary of environmental assessment and management practices conducted by industry throughout exploration operations. <p><i>Assessment Tool</i> Presentations/Reports: Intermediate Level, ENMPRE-2</p> <p><i>Standard</i> Achieve a minimum rating of 2 on the rating scale for Presentations/Reports</p> <ul style="list-style-type: none"> through field-based investigations, analyzing assays/core samples and sample log data to predict the nature and extent of an oil sands, heavy oil or coal deposit. <p><i>Assessment Tool</i> Observation Checklist for Field-based Investigations, ENMOBS</p> <p><i>Standard</i> Complete all sections of the observation checklist for field-based investigations</p>	<p>20</p>

MODULE ENM2030: OIL SANDS/HEAVY OIL/COAL 1 (RESOURCE EXPLORATION)
(continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> describe career opportunities relevant to the exploration sector of the oil sands, heavy oil or coal industry demonstrate basic competencies. 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> conducting research on technical, professional and/or labour-based careers within the exploration sector of an oil sands or coal industry. <p><i>Assessment Tool</i> <i>Career Search: Intermediate Level, ENMCAR-2</i></p> <p><i>Standard</i> <i>Conduct research to a standard of 2 on the rating scale</i></p> <ul style="list-style-type: none"> observations of individual effort and interpersonal interaction during the learning process. <p><i>Assessment Tool</i> <i>Basic Competencies Reference Guide and any assessment tools noted above</i></p>	<p>20</p> <p>Integrated throughout</p>

Concept	Specific Learner Expectations	Notes
Exploration Technology	<p><i>The student should:</i></p> <ul style="list-style-type: none"> explain basic theories and/or principles regarding the origin and formation of oil sands, heavy oil or coal deposits in Alberta; e.g.: <ul style="list-style-type: none"> theories of origin/formation surface and subsurface geology identify major geographical areas of Alberta in which oil sands, heavy oil or coal deposits are located, and relate geographic patterns to theories of origin compare and contrast physical and chemical characteristics of oil sands, heavy oil, conventional oil and coal compare known reserves of energy stored in oil sands and coal to known reserves of energy available through other fossil fuels; e.g.: <ul style="list-style-type: none"> in Alberta in Canada in the world 	<p>Describe and illustrate:</p> <ul style="list-style-type: none"> theories of origin/formation source rock and migration the difference between porosity and permeability. <p>For example:</p> <ul style="list-style-type: none"> Why are oil sands and heavy oils in arc-like distribution patterns? Does this help to include/exclude areas for exploration? <p>Identify major oil sands deposits in Alberta:</p> <ul style="list-style-type: none"> Athabasca Cold Lake Peace River Wabasca.

MODULE ENM2030: OIL SANDS/HEAVY OIL/COAL 1 (RESOURCE EXPLORATION)
(continued)

Concept	Specific Learner Expectations	Notes
<p>Exploration Technology (continued)</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • describe techniques used to estimate Alberta’s recoverable heavy oil, bitumen and coal • illustrate surface and subsurface rock structures capable of containing oil sands, heavy oil or coal deposits • explain applications of aerial surveys and satellite imagery in locating nonconventional hydrocarbon deposits • describe steps taken to gather further information about potential oil- or coal-bearing formations prior to seismic and drilling operations; e.g.: <ul style="list-style-type: none"> – first-hand observation of outcrop geology and surface features – review of geological reports and other published papers • research current and emerging applications of seismic technology in the mapping and analysis of potential oil- or coal-bearing formations; e.g.: <ul style="list-style-type: none"> – seismic theory – data collection and processing • research current and emerging applications of drilling or other exploration technology in determining the composition of subsurface rock and establishing the presence of nonconventional hydrocarbon deposits 	<p>Compare the concepts of “proved reserve,” “probable reserve” and “established reserve.”</p> <p>Compare coals from different regions of Alberta; e.g.:</p> <ul style="list-style-type: none"> • mountain coals • foothills coals • plains coals. <p>For example:</p> <ul style="list-style-type: none"> • 3-D scanning • measurement of magnetic fields, gravity and radiation. <p>Discuss information included in geological reports available from:</p> <ul style="list-style-type: none"> • Alberta Geological Survey • Alberta Oil Sands Technology and Research Authority. <p>Research applications of computer-assisted processing in providing 2-D and 3-D analyses of subsurface rock structures.</p> <p>Identify the general parts of a drilling rig and accompanying equipment.</p> <p>Explain the process of “making hole.”</p> <p>Discuss the use of cuttings and cores in determining the properties of subsurface rock structures.</p> <p>Research directional drilling.</p>

MODULE ENM2030: OIL SANDS/HEAVY OIL/COAL 1 (RESOURCE EXPLORATION)
(continued)

Concept	Specific Learner Expectations	Notes
Exploration Technology (continued)	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • explain environmental assessment and management practices conducted by industry throughout exploration operations; e.g.: <ul style="list-style-type: none"> – AEUB policies and guidelines – water, soil and wildlife impact studies – management plans – reclamation techniques • describe technological advances used to address environmental concerns throughout the exploration process. 	<p>Research environmental standards and the enforcement of safe operating procedures throughout exploration activities.</p> <p>Gather information regarding exploration procedures followed to maintain environmental standards; e.g.:</p> <ul style="list-style-type: none"> • horizontal drilling • disposal of drilling fluids • land surface restoration.
Data Interpretation	<ul style="list-style-type: none"> • explain basic terminology and methodology used in low-depth drilling and core analysis • given assays or samples, make predictions regarding the extent and grade of an oil sands, heavy oil or coal deposit • explain basic terminology and methodology used in geological log analysis; e.g.: <ul style="list-style-type: none"> – electric logs – sonic logs • given sample log data from a bore hole, make predictions regarding the extent and grade of an oil sands, heavy oil or coal deposit • describe hydrocarbon content necessary to make a nonconventional hydrocarbon deposit economically viable; e.g.: <ul style="list-style-type: none"> – percentage of bitumen – rank of coal. 	<p>Establish links with local industry for first-hand observation of technologies/techniques used in data interpretation. Only a <u>RUDIMENTARY UNDERSTANDING</u> of terminology and methodology needs to be developed at this time.</p> <p>Discuss types of information recorded in well log records.</p>

MODULE ENM2030: OIL SANDS/HEAVY OIL/COAL 1 (RESOURCE EXPLORATION)
(continued)

Concept	Specific Learner Expectations	Notes
Career Opportunities	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • research careers and the range of occupational opportunities related to the exploration of nonconventional hydrocarbon deposits; e.g.: <ul style="list-style-type: none"> – earth science: <ul style="list-style-type: none"> • geologist • geophysicist • geochemist • paleontologist – survey and land access: <ul style="list-style-type: none"> • surveyor • land agent – seismic and drilling service: <ul style="list-style-type: none"> • contractor • mechanic • rig worker – engineering: <ul style="list-style-type: none"> • reservoir • mining – environmental management: <ul style="list-style-type: none"> • environmental auditor • environmental engineer • evaluate current employment opportunities in exploration based on employment statistics • research recent changes in prospecting and exploration technology, and resulting career opportunities and trends. 	<p>Plan for individual/group research and presentations that address:</p> <ul style="list-style-type: none"> • job description • employment market • education/training • wage expectations. <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"> • information interviews • work study/experience • job shadowing.

MODULE ENM2040: METALS/NONMETALS 1 (RESOURCE EXPLORATION)

Level: Intermediate

Theme: Technology and Applications

Prerequisite: None

Module Description: Students examine specific exploration techniques and technologies within the context of a metallic and/or nonmetallic mineral deposit, and they describe 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 government and industry organizations involved in the exploration of metallic and/or non-metallic minerals.

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: ENM1020 Nonrenewable Resources
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 exploration sites prior to engaging in off-campus learning experiences. See Planning for Instruction in Section C for further information regarding student safety.

MODULE ENM2040: METALS/NONMETALS 1 (RESOURCE EXPLORATION) (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"> • demonstrate knowledge of current and emerging technologies used in the exploration of economic mineral deposits 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> • completing a research project on the exploration of economic mineral deposits. Research to address: <ul style="list-style-type: none"> – the origin and formation of metallic and nonmetallic minerals – surface and subsurface rock structures capable of containing metallic and nonmetallic minerals and structural materials – steps taken in locating potential mineral-bearing formations prior to seismic mapping and/or drilling operations – techniques used to estimate recoverable mineral deposits. <p><i>Assessment Tool</i> <i>Research Process: Exploration of Mineral Deposits, ENM2040–1</i></p> <p><i>Standard</i> <i>Complete all components of research to a standard of 2 on the rating scale</i></p> <ul style="list-style-type: none"> • through field-based investigations: <ul style="list-style-type: none"> – identifying applications of principles of science and technology in one or more areas of resource exploration (e.g., seismology, drilling) – examining factors that affect the recovery potential for a mineral deposit (e.g., depth of overburden, size/nature of deposit). <p><i>Assessment Tool</i> <i>Observation Checklist for Field-based Investigations, ENMOBS</i></p> <p><i>Standard</i> <i>Complete all sections of the observation checklist for field-based investigations</i></p>	<p>60</p>

MODULE ENM2040: METALS/NONMETALS 1 (RESOURCE EXPLORATION) (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> • interpret geological logs in order to predict the nature and extent of a metallic or nonmetallic mineral deposit 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> • a concept test in which the student demonstrates knowledge of: <ul style="list-style-type: none"> – the characteristics and distinguishing features of six or more different metallic or nonmetallic minerals found in Alberta – seismic, drilling and/or other technology used in establishing the presence of economic mineral deposits. <p><i>Assessment Tool</i> Exploring Manufacturing (<i>Instructor's Manual</i>)</p> <p><i>Standard</i> <i>Response indicating 60% mastery</i></p> <ul style="list-style-type: none"> • a summary of environmental assessment and management practices conducted by industry throughout exploration operations. <p><i>Assessment Tool</i> <i>Presentations/Reports: Intermediate Level, ENMPRE-2</i></p> <p><i>Standard</i> <i>Achieve a minimum rating of 2 on the rating scale for Presentations/Reports</i></p> <ul style="list-style-type: none"> • through field-based investigations, analyzing assays/core samples and sample log data to predict the nature and extent of a metallic and/or nonmetallic mineral deposit. <p><i>Assessment Tool</i> <i>Observation Checklist for Field-based Investigations, ENMOBS</i></p> <p><i>Standard</i> <i>Complete all sections of the observation checklist for field-based investigations</i></p>	<p>20</p>

MODULE ENM2040: METALS/NONMETALS 1 (RESOURCE EXPLORATION) (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> describe career opportunities relevant to the exploration sector of the mineral industry demonstrate basic competencies. 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> conducting research on technical, professional and/or labour-based careers within the exploration sector of a mineral industry. <p><i>Assessment Tool</i> <i>Career Search: Intermediate Level, ENMCAR-2</i></p> <p><i>Standard</i> <i>Conduct research to a standard of 2 on the rating scale</i></p> <ul style="list-style-type: none"> observations of individual effort and interpersonal interaction during the learning process. <p><i>Assessment Tool</i> <i>Basic Competencies Reference Guide and any assessment tools noted above</i></p>	<p>20</p> <p>Integrated throughout</p>

Concept	Specific Learner Expectations	Notes
Exploration Technology	<p><i>The student should:</i></p> <ul style="list-style-type: none"> explain basic theories and/or principles regarding the origin and formation of metallic and nonmetallic minerals and structural materials in Alberta illustrate surface and subsurface rock structures in which metallic and industrial minerals are commonly found describe the mineral potential of major geological areas of Alberta; e.g.: <ul style="list-style-type: none"> Precambrian Shield Interior Plains Foothills Rocky Mountains identify geographical areas of Alberta in which occurrences of specific minerals are known to exist, and relate geographic patterns to theories of origin 	<p>Describe and illustrate:</p> <ul style="list-style-type: none"> theories of origin/formation surface and subsurface geology. <p>Contact the Alberta Geological Survey to obtain <i>Edmonton Beneath Our Feet</i>.</p> <p>Request the current <i>Mineral Deposits and Occurrences in Alberta</i> map and data base from the Alberta Geological Survey.</p> <p>For example:</p> <ul style="list-style-type: none"> Why is a mineral found in a particular distribution pattern? Does this help to include/exclude areas for exploration?

MODULE ENM2040: METALS/NONMETALS 1 (RESOURCE EXPLORATION) (continued)

Concept	Specific Learner Expectations	Notes
<p>Exploration Technology (continued)</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • explain possible reasons why the potential of the minerals industry in Alberta has not been fully established, nor have known deposits of industrial and metallic minerals been fully developed • explain applications of aerial surveys and satellite imagery in prospecting for metallic and nonmetallic minerals • describe steps taken to gather further information about potential mineral-bearing formations prior to seismic mapping and/or drilling operations; e.g.: <ul style="list-style-type: none"> – first-hand observation of outcrop geology and surface features – review of geological reports and other published papers • research current and emerging applications of technology in the mapping and analysis of potential mineral-bearing formations • research current and emerging applications of drilling technology in determining the composition of subsurface rock and establishing the presence of mineral deposits • summarize recent developments in Alberta regarding gold, diamonds and base-metals • explain environmental assessment and management practices conducted by industry throughout exploration operations • describe technological advances used to address environmental concerns throughout the exploration process 	<p>Contact Natural Resources Canada for its map (produced annually) of energy and mineral developments in Canada.</p> <p>Discuss information included in geological reports available from:</p> <ul style="list-style-type: none"> • Alberta Geological Survey (industrial and structural materials, metals) • Geological Survey of Canada (metals). <p>For example:</p> <ul style="list-style-type: none"> • air and ground magnetics • electromagnetics • gravity • radioactivity • geochemistry of soils and other overburden. <p>Gather information on rig components, drilling techniques and logging/testing procedures.</p> <p>Research environmental standards and the enforcement of safe operating procedures throughout exploration activities.</p> <p>Gather information regarding exploration procedures followed to maintain environmental standards; e.g.:</p> <ul style="list-style-type: none"> • horizontal drilling • disposal of drilling fluids • land surface restoration.

MODULE ENM2040: METALS/NONMETALS 1 (RESOURCE EXPLORATION) (continued)

Concept	Specific Learner Expectations	Notes
Data Interpretation	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • explain basic terminology and methodology used in core analysis • given assays or samples, make predictions regarding the extent and grade of a mineral deposit • explain basic terminology and methodology used in geological log interpretation; e.g.: <ul style="list-style-type: none"> – electric logs – sonic logs • given sample log data from a bore hole, make predictions regarding the extent and grade of a mineral deposit. 	<p>Establish links with local industry for first-hand observation of technologies/ techniques used in data interpretation. Only a <u>RUDIMENTARY UNDERSTANDING</u> of terminology and methodology needs to be developed at this time.</p> <p>Discuss types of information recorded in log data from bore holes.</p>
Career Opportunities	<ul style="list-style-type: none"> • research careers and the range of occupational opportunities related to the exploration of metallic and nonmetallic mineral deposits; e.g.: <ul style="list-style-type: none"> – earth science: <ul style="list-style-type: none"> • geologist • geophysicist • geochemist – technologists and technicians: <ul style="list-style-type: none"> • field • laboratory – computer analysis: <ul style="list-style-type: none"> • data base • data entry • Geographic Information Systems – survey and land access: <ul style="list-style-type: none"> • surveyor • land agent – seismic and drilling service: <ul style="list-style-type: none"> • contractor • mechanic • rig worker – environmental management: <ul style="list-style-type: none"> • environmental auditor • environmental engineer • evaluate current employment opportunities in mineral exploration based on employment statistics 	<p>Plan for individual/group research and presentations that address:</p> <ul style="list-style-type: none"> • job description • employment market • education/training • wage expectations. <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>

MODULE ENM2040: METALS/NONMETALS 1 (RESOURCE EXPLORATION) (continued)

Concept	Specific Learner Expectations	Notes
Career Opportunities (continued)	<i>The student should:</i> <ul style="list-style-type: none">• research recent changes in prospecting and exploration technology, and resulting career opportunities and trends.	Arrange/facilitate: <ul style="list-style-type: none">• information interviews• work study/experience• job shadowing.

MODULE ENM2050: RENEWABLE ENERGY TECHNOLOGY

Level: Intermediate

Theme: Technology and Applications

Prerequisite: ENM1050 Renewable Resources

Module Description: Students define and explain the need for sustainable energy development, research one or more renewable energy technologies; e.g., hydro, wind, solar, tidal, biomass, geothermal, nuclear, hydrogen, ethanol, blended fuel, fuel cell, and construct a model of a renewable energy system.

Module Parameters: Access to a construction, fabrication, mechanics and/or science laboratory.

Access to relevant government, industry and community resources (e.g., Alberta Energy, Alberta Environmental Protection, Energy Efficiency Association of Alberta, Pincher Creek Development and Information Centre, Biomass Energy Institute, Canadian Wind Energy Association, Solar Energy Society of Canada, Small Power Producers Association of Alberta).

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"> explain the role of renewable energy sources in sustainable energy development 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> a presentation or report on the role of alternative sources of energy in sustainable energy development. Report to provide: <ul style="list-style-type: none"> a definition of sustainable energy development based on social, economic and environmental perspectives a comparison of nonrenewable and renewable energy resources with respect to technological/geological requirements, cost, environmental impact and sustainability a survey of alternative sources of energy available in Alberta and Canada forecasts regarding future energy supply and demand, and options for sustainability in the energy sector. <p><i>Assessment Tool</i> <i>Presentations/Reports: Intermediate Level, ENMPRE-2</i></p> <p><i>Standard</i> <i>Achieve a minimum rating of 2 on the rating scale for Presentations/Reports</i></p>	<p>25</p>

MODULE ENM2050: RENEWABLE ENERGY TECHNOLOGY (continued)

Concept	Specific Learner Expectations	Notes
Sustainable Development	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • compare and contrast nonrenewable and renewable sources of energy • identify environmental issues resulting from the use of nonrenewable energy • define and explain the need for sustainable energy development • research forecasts regarding future energy supply and demand, and options for ensuring a sustainable future • identify and describe renewable sources of energy supply; e.g.: <ul style="list-style-type: none"> – hydro production – wind and solar – biomass – geothermal – nuclear – hydrogen fuel • identify social, economic and environmental issues resulting from the use of renewable energy. 	<p>Research/debate the statement – “there is no such thing as renewable energy.”</p> <p>For example:</p> <ul style="list-style-type: none"> • greenhouse gases • acid deposition • resource depletion. <p>Discuss the meaning of the phrase “soft energy path”; e.g.:</p> <ul style="list-style-type: none"> • least-cost energy strategy • efficient energy use • sustainable energy path. <p>Consider options such as:</p> <ul style="list-style-type: none"> • using less • finding alternative sources. <p>Which alternative energy sources have the greatest potential for use in Alberta? Why?</p> <p>Consider impacts of dam construction on:</p> <ul style="list-style-type: none"> • agriculture • aesthetics • wildlife.
Renewable Energy Technology	<ul style="list-style-type: none"> • research the use of a renewable energy source in Canada and, if possible, use Alberta examples • construct diagrams and models of an energy system that involves use of a renewable energy source 	<p>Investigate and report on:</p> <ul style="list-style-type: none"> • the technologies used • production methods • efficiency and power coefficient. <p>Models/diagrams should clearly illustrate:</p> <ul style="list-style-type: none"> • component parts • principles of operation • energy conversion • feedback systems.

MODULE ENM2050: RENEWABLE ENERGY TECHNOLOGY (continued)

Concept	Specific Learner Expectations	Notes
Renewable Energy Technology (continued)	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • describe current and potential applications of renewable energy technology in Alberta and Canada • compare the renewable energy source/technology with conventional energy sources/technologies. 	<p>Research government policies supporting the development of renewable energy technology; e.g.:</p> <ul style="list-style-type: none"> • Southwest Alberta Renewable Energy Initiative • Alberta Small Power Research and Development Program. <p>Consider advantages and disadvantages of the renewable energy technology, and its potential for use.</p>
Career Opportunities	<ul style="list-style-type: none"> • research careers and the range of occupational opportunities that involve the development of renewable energy; e.g.: <ul style="list-style-type: none"> – engineering – technical and support services – environmental management • evaluate current employment opportunities based on employment statistics • research trends in renewable energy development, and future career opportunities. 	<p>Plan for individual/group research and presentations that address:</p> <ul style="list-style-type: none"> • job description • employment market • education/training • wage expectations. <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"> • information interviews • work study/experience • job shadowing.

MODULE ENM2060: REFINING HYDROCARBONS

Level: Intermediate

Theme: Technology and Applications

Prerequisite: None

Module Description: Students examine the principles and technologies involved in processing natural gas, refining crude oil, upgrading heavy oils and bitumen, or processing coal. Students also describe related career opportunities.

Module Parameters: Access to a hydrocarbon refining 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 of this Guide for further information regarding student safety.

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"> describe commodity inputs and consumer products characteristic of the hydrocarbon processing industry 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> identifying and describing the range of products provided as a result of processing natural gas, refining crude oil, upgrading heavy oil/bitumen and processing coal. <p><i>Assessment Tool</i> Our Petroleum Challenge: Into the 21st Century, <i>Petroleum Communication Foundation</i></p> <p><i>Standard</i> <i>Identify 50 products, their derivatives, and general application/use</i></p>	20

MODULE ENM2060: REFINING HYDROCARBONS (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> • explain techniques used to process natural gas, refine crude oil, upgrade heavy oils and bitumen, or process coal 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> • given a specific hydrocarbon processing industry, identifying: <ul style="list-style-type: none"> – inputs to processing, refining or upgrading within the industry – economic, environmental, safety and other factors that influence industry practices. <p><i>Assessment Tool</i> <i>Research Process: Hydrocarbon Processing, ENM2060-1</i></p> <p><i>Standard</i> <i>Complete all components of research to a standard of 2 on the rating scale</i></p> <ul style="list-style-type: none"> • through laboratory and/or field-based investigations: <ul style="list-style-type: none"> – identifying the physical and chemical properties of a hydrocarbon – relating properties of a hydrocarbon to techniques used for processing, refining or upgrading. <p><i>Assessment Tool</i> <i>Lab Investigations: Intermediate Level, ENMLAB-2</i> <i>Observation Checklist for Field-based Investigations, ENMOBS</i></p> <p><i>Standard</i> <i>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</i></p> <ul style="list-style-type: none"> • a flow chart that outlines major steps and processes used by the upstream sector to process natural gas, refine crude oil, upgrade heavy oil/bitumen or process coal. <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 2 on the rating scale</i></p>	<p>60</p>

MODULE ENM2060: REFINING HYDROCARBONS (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> • describe career opportunities relevant to the processing or refining sector of a hydrocarbon industry • demonstrate basic competencies. 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> • a summary of environmental assessment and management practices conducted by industry throughout processing, refining or upgrading operations. <p><i>Assessment Tool</i> <i>Presentations/Reports: Intermediate Level, ENMPRE-2</i></p> <p><i>Standard</i> <i>Achieve a minimum rating of 2 on the rating scale for Presentations/Reports</i></p> <ul style="list-style-type: none"> • conducting research on technical, professional and/or labour-based careers that involve processing natural gas, refining crude oil, upgrading heavy oils and bitumen, or processing coal. <p><i>Assessment Tool</i> <i>Career Search: Intermediate Level, ENMCAR-2</i></p> <p><i>Standard</i> <i>Conduct research to a standard of 2 on the rating scale</i></p> <ul style="list-style-type: none"> • observations of individual effort and interpersonal interaction during the learning process. <p><i>Assessment Tool</i> <i>Basic Competencies Reference Guide and any assessment tools noted above</i></p>	<p>20</p> <p>Integrated throughout</p>

Concept	Specific Learner Expectations	Notes
<p>The Processing Industry</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • describe the range of products and/or services provided as a result of: <ul style="list-style-type: none"> – processing natural gas – refining crude oil – upgrading heavy oils and bitumen – processing coal 	<p>Prepare posters and displays of products and services derived from different types of hydrocarbons (e.g., natural gas, crude oil, heavy oil/bitumen, coal).</p>

MODULE ENM2060: REFINING HYDROCARBONS (continued)

Concept	Specific Learner Expectations	Notes
<p>The Processing Industry (continued)</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • describe inputs to processing within an oil, gas, oil sands or coal industry: <ul style="list-style-type: none"> – raw materials/feedstocks – financial, human and natural resources – technology requirements • identify factors that influence the nature of a processing or refining industry • explain how the mix of products produced may vary according to market demand • identify environmental and safety concerns that influence practices within a processing or refining industry. 	<p>Consider the sour gas industry and production of elemental sulphur used in the manufacture of fertilizers, paper, pharmaceuticals, etc.</p> <p>Given a specific industry, research the influence of factors such as:</p> <ul style="list-style-type: none"> • supply of feedstocks and/or other materials • allowable production volumes • access to markets. <p>For example:</p> <ul style="list-style-type: none"> • asphalt for road paving in summer • home heating fuels in winter. <p>Discuss industry impact on:</p> <ul style="list-style-type: none"> • workers and nearby residents • crops, forests, livestock and wildlife • air, soil and water quality.
<p>Processing/Refining Techniques</p>	<ul style="list-style-type: none"> • describe relatively simple field facilities used to prepare a raw hydrocarbon for further processing and/or refining in the upstream sector • research more sophisticated techniques and technologies used in the upstream sector to process natural gas, refine crude oil, upgrade heavy oil and bitumen, or process coal; e.g.: <ul style="list-style-type: none"> – removal of contaminants/impurities – conversion into saleable products 	<p>Consider recovery-site or satellite facilities used for:</p> <ul style="list-style-type: none"> • cleaning • separating • upgrading. <p>Consider both sweet and sour facilities in the upstream sector. If studying crude oil, distinguish between the refining of crude oil (ENM2060) and the manufacture of petrochemicals (ENM3060).</p>

MODULE ENM2060: REFINING HYDROCARBONS (continued)

Concept	Specific Learner Expectations	Notes
<p>Processing/Refining Techniques (continued)</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • explain reasons for sulphur recovery throughout processing, refining and/or upgrading processes • create a simplified model of a processing, refining or upgrading facility • research the physical and/or chemical properties of a hydrocarbon, and relate these to technologies used for processing, refining or upgrading • research basic fractionating, cracking and/or reforming processes used within the industry • explain industry use of electronic equipment and computer technology in monitoring processing, refining or upgrading operations • describe storage facilities and distribution systems within the industry, and their impact on industry location and product costs • explain environmental assessment and management practices conducted by industry throughout processing, refining or upgrading operations 	<p>For example,</p> <ul style="list-style-type: none"> • to sweeten product for industrial/residential use • to produce elemental sulphur • to maintain environmental standards. <p>Give examples of hydrocarbons that exist in their natural state as solids, liquids and gases. For a given hydrocarbon, conduct laboratory investigations of:</p> <ul style="list-style-type: none"> • molecular structure • heat content • temperature/pressure/volume relationships • catalytic reaction. <p>Assemble and use a simple fractionating column to separate two or more liquids through the process of fractional distillation.</p> <p>Research sulphur-recovery technology. Discuss Canada as a world leader in developing technologies for recovering and safely handling sulphur.</p> <p>Construct flow charts that illustrate storage and distribution systems.</p> <p>Research environmental standards and the enforcement of safe operating procedures throughout processing, refining or upgrading operations.</p>

MODULE ENM2060: REFINING HYDROCARBONS (continued)

Concept	Specific Learner Expectations	Notes
Processing/Refining Techniques (continued)	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • describe industry initiatives that respond to environmental concerns • describe industry initiatives that address occupational health and safety requirements. 	<p>For example:</p> <ul style="list-style-type: none"> • advances in sulphur-recovery technology • development of clean-coal technology • waste treatment/emission control. <p>For example,</p> <ul style="list-style-type: none"> • odour scrubbers • noise suppressants • water purification • personal protective equipment • emergency response strategies.
Career Opportunities	<ul style="list-style-type: none"> • research careers and the range of occupational opportunities within the processing and refining sector of a hydrocarbon industry; e.g.: <ul style="list-style-type: none"> – engineering – technical and support services – apprenticeship trades – environmental management • explain the personnel structure within the refining department of a hydrocarbon industry • evaluate current employment opportunities based on employment statistics • research trends in hydrocarbon processing and refining, and future career opportunities; e.g.: <ul style="list-style-type: none"> – upgrading heavy oil and bitumen – increased use of low ranked coals. 	<p>Plan for individual/group research and presentations that address:</p> <ul style="list-style-type: none"> • job description • employment market • education/training • wage expectations. <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"> • information interviews • work study/experience • job shadowing.

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
<p><i>The student will:</i></p> <ul style="list-style-type: none">describe commodity inputs and consumer products characteristic of the mineral processing industry	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none">identifying and describing the range of products provided as a result of processing and/or refining Alberta's industrial (nonmetallic) and/or metallic minerals. <p><i>Assessment Tool</i> Exploring Manufacturing</p> <p><i>Standard</i> Identify 50 products, their derivatives and general application/use</p>	20

MODULE ENM2070: REFINING ROCKS & MINERALS (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> • explain techniques used to refine an industrial (nonmetallic) mineral or a metallic mineral 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> • given a specific mineral processing industry, identifying: <ul style="list-style-type: none"> – inputs to processing and/or refining within the industry – economic, environmental, safety and other factors that influence industry practices. <p><i>Assessment Tool</i> <i>Research Process: Mineral Processing, ENM2070-1</i></p> <p><i>Standard</i> <i>Complete all components of research to a standard of 2 on the rating scale</i></p> <ul style="list-style-type: none"> • through laboratory and/or field-based investigations: <ul style="list-style-type: none"> – identifying the physical and chemical properties of a mineral substance – relating properties of a mineral substance to techniques used for processing and/or refining. <p><i>Assessment Tool</i> <i>Lab Investigations: Intermediate Level, ENMLAB-2</i> <i>Observation Checklist for Field-based Investigations, ENMOBS</i></p> <p><i>Standard</i> <i>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</i></p>	<p>60</p>

MODULE ENM2070: REFINING ROCKS & MINERALS (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> • describe career opportunities relevant to the processing sector of a rock or mineral industry • demonstrate basic competencies. 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> • a flow chart that outlines major steps and processes used to refine an industrial (nonmetallic) or metallic mineral. <i>Assessment Tool</i> <i>Assessment Criteria: Flow Charts, ENMFLO</i> <i>Standard</i> <i>Complete the flow chart to a standard of 2 on the rating scale</i> • a summary of environmental assessment and management practices conducted by industry throughout processing and refining operations. <i>Assessment Tool</i> <i>Presentations/Reports: Intermediate Level, ENMPRE-2</i> <i>Standard</i> <i>Achieve a minimum rating of 2 on the rating scale for Presentations/Reports</i> • conducting research on technical, professional and/or labour-based careers within the processing or refining sector of a rock or mineral industry. <i>Assessment Tool</i> <i>Career Search: Intermediate Level, ENMCAR-2</i> <i>Standard</i> <i>Conduct research to a standard of 2 on the rating scale</i> • observations of individual effort and interpersonal interaction during the learning process. <i>Assessment Tool</i> <i>Basic Competencies Reference Guide and any assessment tools noted above</i> 	<p>20</p> <p>Integrated throughout</p>

MODULE ENM2070: REFINING ROCKS & MINERALS (continued)

Concept	Specific Learner Expectations	Notes
<p>The Processing Industry</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • explain the social, economic and environmental significance of Alberta’s rocks and minerals • describe applications of Alberta’s industrial (nonmetallic) and metallic minerals • describe inputs to processing within a mineral industry: <ul style="list-style-type: none"> – mineral ores/aggregates – financial, human and natural resources – technology requirements • identify factors that influence the nature of a mineral processing industry • identify environmental and safety concerns that influence practices within a mineral processing industry. 	<p>Obtain copies of:</p> <ul style="list-style-type: none"> • <i>Edmonton Beneath Our Feet</i> (Alberta Geological Survey) • <i>Canadian Minerals Yearbook</i> (Natural Resources Canada) • <i>Aggregates</i> (Alberta Sand and Gravel Association). <p>Prepare posters/displays of products and services derived from Alberta’s minerals; e.g.:</p> <ul style="list-style-type: none"> • sand and gravel • cement and lime • peat moss • building stone • gypsum • clay products • sulphur • salt • gold and copper • iron ore • lead and zinc. <p>Given a specific industry, research the influences of factors such as:</p> <ul style="list-style-type: none"> • supply of raw materials • allowable production volumes • access to markets. <p>Discuss industry impact on:</p> <ul style="list-style-type: none"> • workers and nearby residents • crops, forests, livestock and wildlife • air, soil and water quality.

MODULE ENM2070: REFINING ROCKS & MINERALS (continued)

Concept	Specific Learner Expectations	Notes
<p>Processing and Refining Techniques</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • explain the stages, steps and technologies used in processing an industrial (nonmetallic) or metallic mineral; e.g.: <ul style="list-style-type: none"> – milling, dressing and cleaning – smelting, refining and upgrading • demonstrate basic extractive technologies used in the mineral industry; e.g.: <ul style="list-style-type: none"> – thermal – mechanical – chemical – electrical • 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 • explain industry use of electronic equipment and computer technology in monitoring and controlling refining processes • describe storage facilities and distribution systems within the industry, and their impact on industry location and product costs • explain environmental assessment and management practices conducted by industry throughout refining operations 	<p>Contact Natural Resources Canada to obtain posters available on mineral processing and refining.</p> <p>Conduct laboratory investigations that demonstrate:</p> <ul style="list-style-type: none"> • heat application • grinding/pulverizing • leaching • electrolysis • floatation. <p>For a given mineral substance, conduct laboratory investigations of:</p> <ul style="list-style-type: none"> • molecular structure • mass and density • magnetic characteristics • elasticity and stress. <p>Encourage students to link experimental outcomes to studies in the core science program.</p> <p>Research the development of new materials for specific environments and applications.</p> <p>Construct flow charts that illustrate storage and distribution systems.</p> <p>Research environmental standards and the enforcement of safe operating procedures throughout refining operations.</p>

MODULE ENM2070: REFINING ROCKS & MINERALS (continued)

Concept	Specific Learner Expectations	Notes
<p>Processing and Refining Techniques (continued)</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • describe industry initiatives that respond to environmental concerns • describe industry initiatives that address occupational health and safety requirements • describe industry initiatives in reprocessing and recycling mineral products to ensure a life-cycle approach to resource management. 	<p>For example:</p> <ul style="list-style-type: none"> • advances in sulphur-recovery technology • management of reactive rock wastes • waste treatment/ emission control. <p>For example:</p> <ul style="list-style-type: none"> • odour scrubbers • noise suppressants • water purification. <p>Obtain the brochure entitled <i>Aggregates and Our Environment</i> from the Alberta Sand and Gravel Association.</p>
<p>Career Opportunities</p>	<ul style="list-style-type: none"> • research careers and the range of occupational opportunities within the processing and refining sector of a mineral industry; e.g.: <ul style="list-style-type: none"> – engineering – technical and support services – apprenticeship trades – environmental management • explain the personnel structure within a mineral processing industry • evaluate current employment opportunities based on employment statistics • research trends in mineral processing and refining, and future career opportunities; e.g.: <ul style="list-style-type: none"> – mineral upgrading – recycling and utilization – waste management. 	<p>Plan for individual/group research and presentations that address:</p> <ul style="list-style-type: none"> • job description • employment market • education/training • wage expectations. <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"> • information interviews • work study/experience • job shadowing.

MODULE ENM2080: SUPPLY & DISTRIBUTION

Level: Intermediate

Theme: Technology and Applications

Prerequisite: None

Module Description: Students research marketing and distribution networks within an energy or mineral industry; examine regulatory structures and policies that influence supply of a commodity, product or service; and describe related career opportunities.

Module Parameters: Access to relevant distribution and marketing facilities.

Supporting Module: ENM1060 Consumer Products & Services

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"> • explain marketing and distribution systems used within an energy or mineral industry 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> • a presentation or report that describes the application of general marketing principles within an energy or mineral industry, and factors/variables that influence marketing and distribution systems within the industry. Report to address: <ul style="list-style-type: none"> – goals of marketing – laws of supply and demand – market competition – barriers/restrictions to free trade – sources of market information – distribution systems. <p><i>Assessment Tool</i> <i>Presentations/Reports: Intermediate Level, ENMPRE-2</i></p> <p><i>Standard</i> <i>Achieve a minimum rating of 2 on the rating scale for Presentations/Reports</i></p> <ul style="list-style-type: none"> • a flow chart that traces movement of a commodity or product from recovery-site to consumer. Flow chart to illustrate: <ul style="list-style-type: none"> – recovery and production – processing and refining – product brokering – transport and distribution. <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 2 on the rating scale</i></p>	<p>50</p>

MODULE ENM2080: SUPPLY & DISTRIBUTION (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> • describe regulatory structures and policies that influence supply of a commodity, product or service • describe career opportunities relevant to the marketing and distribution of an energy or mineral resource • demonstrate basic competencies. 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> • a concept test in which the student demonstrates knowledge of regulatory structures and policies that influence supply of a commodity, product or service. Concept test to address: <ul style="list-style-type: none"> – supply management, and the differences between open and closed marketing systems – the role and impact of existing regulatory systems and policies – specific marketing structures used to exchange the product or provide the service. <p><i>Assessment Tool</i> <i>Current marketing policy available from provincial/national agencies (e.g., Alberta Petroleum Marketing commission, National Energy Board)</i></p> <p><i>Standard</i> <i>Response indicating 60% mastery</i></p> <ul style="list-style-type: none"> • conducting a research project on technical, professional and/or labour-based careers within the marketing sector of an energy or mineral industry. <p><i>Assessment Tool</i> <i>Career Search: Intermediate Level, ENMCAR–2</i></p> <p><i>Standard</i> <i>Conduct research to a standard of 2 on the rating scale</i></p> <ul style="list-style-type: none"> • observations of individual effort and interpersonal interaction during the learning process. <p><i>Assessment Tool</i> <i>Basic Competencies Reference Guide and any assessment tools noted above</i></p>	<p>30</p> <p>20</p> <p>Integrated throughout</p>

MODULE ENM2080: SUPPLY & DISTRIBUTION (continued)

Concept	Specific Learner Expectations	Notes
<p>Marketing and Distribution Systems</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • identify key markets and destinations for an energy or mineral resource • explain major functions of marketing within an energy or mineral industry: <ul style="list-style-type: none"> – market survey and research – product/service planning – advertising and promotion – price determination – sales • identify basic stages through which a product moves en route to market: <ul style="list-style-type: none"> – recovery and production – processing and refining – product brokering – transport • explain the laws of supply and demand, and factors that cause changes in supply and demand for a commodity, product or service • identify basic price determinants for a commodity, product or service: <ul style="list-style-type: none"> – product characteristics – balance between supply and demand – inflation and dollar value – storage/distribution costs • research one or more distribution networks used to move a commodity or product to market; e.g.: <ul style="list-style-type: none"> – pipeline systems – tankers and barges – rail and trucking systems • explain the function of intermediate stops in moving a commodity or product to market 	<p>Consider domestic, national and global markets and destinations.</p> <p>Explore potential links with the Management and Marketing strand.</p> <p>Draw posters/flow charts that depict the sequence of events from recovery-site to consumer.</p> <p>Discuss factors that may influence supply and demand; e.g.:</p> <ul style="list-style-type: none"> • trade regulations • economic conditions • environmental concerns • consumer trends • new technology. <p>Use weekly marketing reports to develop a graph of price trends. Identify factors causing changes in commodity pricing.</p> <p>Prepare flow charts/diagrams. Explain the effect of transportation factors on:</p> <ul style="list-style-type: none"> • product price • market extent. <p>For example:</p> <ul style="list-style-type: none"> • terminals • bulk stations.

MODULE ENM2080: SUPPLY & DISTRIBUTION (continued)

Concept	Specific Learner Expectations	Notes
Marketing and Distribution Systems (continued)	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • identify safety and environmental standards and emergency response plans relevant to transporting an energy or mineral product. 	<p>Note links with ENM2100 (Environmental Safety).</p>
Regulatory Structures and Policies	<ul style="list-style-type: none"> • explain the concept of supply management, and differences between nonregulated (open) and regulated (closed) market systems • explain the role and impact of regulatory systems and strategies used in marketing a commodity, product or service • describe marketing structures used to facilitate commodity exchange and establish benchmark prices • evaluate the impact of government policies and legislation on marketing activities within an energy or mineral industry • describe the mandates of provincial, national and foreign agencies in regulating exchange of a commodity, product or service • identify and evaluate viable alternatives for marketing within an energy or mineral industry. 	<p>Identify industry examples of open and closed market systems.</p> <p>For example:</p> <ul style="list-style-type: none"> • marketing boards • cooperatives • quota systems • monopolies. <p>Cite local examples.</p> <p>Consider the influences of:</p> <ul style="list-style-type: none"> • provincial/national/international trade agreements • deregulation and free trade • transportation policies • safety/environmental standards. <p>For example:</p> <ul style="list-style-type: none"> • Alberta Petroleum Marketing Commission • National Energy Board • California Gas Transmission Commission. <p>Consider opportunities/obstacles related to:</p> <ul style="list-style-type: none"> • direct producer marketing • open markets • marketing boards • cooperatives.

MODULE ENM2080: SUPPLY & DISTRIBUTION (continued)

Concept	Specific Learner Expectations	Notes
Career Opportunities	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • research careers and the range of occupational opportunities related to marketing an energy or mineral resource; e.g.: <ul style="list-style-type: none"> – market survey – advertising and sales – transportation and distribution – product development – apprenticeship trades – support services <ul style="list-style-type: none"> • legal • consulting • environmental • engineering • identify career opportunities and trends based on employment statistics • research trends in the marketing sector of an energy or mineral industry, and resulting career opportunities. 	<p>Plan for individual/group research and presentations that address:</p> <ul style="list-style-type: none"> • job description • employment market • education/training • wage expectations. <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"> • information interviews • work study/experience • job shadowing.

MODULE ENM2090: ENERGY DESIGNS/SYSTEMS 1 (BASIC PRINCIPLES)**Level:** Intermediate**Theme:** Management and Conservation**Prerequisite:** None**Module Description:** Students investigate the basic principles of energy conservation and efficiency and relate them to energy designs and systems used in the residential, commercial or transportation sector.**Module Parameters:** Access to a construction, fabrication, mechanics or science laboratory.**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"> explain basic principles of energy conservation and efficiency 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> through laboratory investigations, identifying practical applications of: <ul style="list-style-type: none"> laws of energy conservation basic principles of energy efficiency. <p><i>Assessment Tool</i> <i>Lab Investigations: Intermediate Level, ENMLAB-2</i></p> <p><i>Standard</i> <i>Conduct lab investigations to a standard of 2 on the rating scale</i></p> <ul style="list-style-type: none"> a concept test in which the student demonstrates knowledge of energy forms, energy conversion, energy conservation and energy efficiency. <p><i>Assessment Tool</i> Transportation, Energy and Power Technology</p> <p><i>Standard</i> <i>Response indicating 60% mastery</i></p>	<p>50</p>

MODULE ENM2090: ENERGY DESIGNS/SYSTEMS 1 (BASIC PRINCIPLES) (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> • demonstrate applications of energy technology in the residential, commercial or transportation sector 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> • given a specific residential/commercial structure or transportation system, preparing: <ul style="list-style-type: none"> – a flow chart and/or diagram that traces energy flow and conversion throughout the structure or system – a model of the structure or system incorporating design elements that address energy conservation and efficiency – a comparison of energy input and energy output for one or more individual components with the structure or system. <p><i>Assessment Tool</i> <i>Assessment Criteria: Flow Charts, ENMFLO</i> <i>Assessment Criteria: Diagrams and Technical Drawings, ENMDRA</i> <i>Project Assessment: Technology Design, ENMTEC</i></p> <p><i>Standard</i> <i>Complete the flow chart/diagram, model and comparison to a standard of 2 on the rating scale</i></p>	<p>40</p>
<ul style="list-style-type: none"> • describe career opportunities relevant to low energy design and technology 	<ul style="list-style-type: none"> • completing a research project on one or more career opportunities in low energy design and technology. <p><i>Assessment Tool</i> <i>Career Search: Intermediate Level, ENMCAR–2</i></p> <p><i>Standard</i> <i>Conduct research to a standard of 2 on the rating scale</i></p>	<p>10</p>
<ul style="list-style-type: none"> • demonstrate basic competencies. 	<ul style="list-style-type: none"> • observations of individual effort and interpersonal interaction during the learning process. <p><i>Assessment Tool</i> <i>Basic Competencies Reference Guide and any assessment tools noted above</i></p>	<p>Integrated throughout</p>

MODULE ENM2090: ENERGY DESIGNS/SYSTEMS 1 (BASIC PRINCIPLES) (continued)

Concept	Specific Learner Expectations	Notes
<p>Energy Conservation and Efficiency</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • provide a rationale for energy conservation and efficiency based on economic and environmental factors • identify basic forms of energy and describe applications of each: <ul style="list-style-type: none"> – radiant – chemical – thermal – mechanical – electrical – nuclear • cite examples of energy technology used to convert one form of energy into another useful form • explain applications of the laws of energy conservation: <ul style="list-style-type: none"> – <i>First Law of Thermodynamics</i> – <i>Second Law of Thermodynamics</i> • define energy efficiency and explain its application in determining how well a technology converts energy from one form to another. 	<p>Research/discuss the statement – “Our society wastes approximately 50% of all its available energy.”</p> <p>Explain how the sun is the original source of all energy. Trace various forms of energy back to the sun.</p> <p>Distinguish between:</p> <ul style="list-style-type: none"> • energy and power • kinetic and potential energy. <p>For example:</p> <ul style="list-style-type: none"> • turbines • generators • motors • electric bulbs. <p>“Energy cannot be created or destroyed. The total energy in any system is considered to be constant.”</p> <p>“A natural process always takes place in such a direction as to cause an increase in the randomness (entropy) of the universe.”</p> <p>Distinguish between the efficiency of component parts and that of a total energy system.</p>
<p>Applications of Technology</p>	<ul style="list-style-type: none"> • identify energy sources for an existing residential/commercial structure or transportation system 	<p>Prepare flow charts that illustrate energy sources, energy conversion and energy transfer throughout a structure or system.</p>

MODULE ENM2090: ENERGY DESIGNS/SYSTEMS 1 (BASIC PRINCIPLES) (continued)

Concept	Specific Learner Expectations	Notes
<p>Applications of Technology (continued)</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • explain functions of technology in converting energy into useful forms within the structure or system • illustrate, by example, applications of energy conservation and efficiency evident in structure or system design • explain design principles incorporated to transfer energy throughout the structure or system • research methods used to measure energy within the structure or system • perform simple calculations and compare energy input/output for components within a structure or system • evaluate energy use within the structure or system based on: <ul style="list-style-type: none"> – total system efficiency – cost of operation – environmental and social effect. 	<p>Prepare diagrams of energy technologies that illustrate component parts and principles of operation.</p> <p>Consider:</p> <ul style="list-style-type: none"> • mechanical efficiency • volumetric efficiency • thermal efficiency. <p>Design principles and applications will vary according to the structure or system investigated.</p> <p>For structures investigate:</p> <ul style="list-style-type: none"> • British thermal unit and calorie • joules, kilojoules and gigajoules. <p>For transportation devices investigate:</p> <ul style="list-style-type: none"> • horsepower • torque. <p>For example:</p> <ul style="list-style-type: none"> • windows • lighting • wall structure • insulation. <p>Consider land use, atmospheric emissions, health, convenience, aesthetics.</p>
<p>Career Opportunities</p>	<ul style="list-style-type: none"> • research careers and the range of occupational opportunities in low energy design and technology; e.g.: <ul style="list-style-type: none"> – engineering – technical and support services – environmental management 	<p>Plan for individual/group research and presentations that address:</p> <ul style="list-style-type: none"> • job description • employment market • education/training • wage expectations. <p>Contact the “Career Information Hotline” (Alberta Advanced Education and Career Development)</p>

MODULE ENM2090: ENERGY DESIGNS/SYSTEMS 1 (BASIC PRINCIPLES) (continued)

Concept	Specific Learner Expectations	Notes
Career Opportunities (continued)	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • identify career opportunities and trends based on employment statistics • research trends in low energy designs and systems, and resulting career opportunities. 	<p>See the National Occupational Profiles (NOC) in Section H: Linkages/Transitions.</p> <p>Arrange/facilitate:</p> <ul style="list-style-type: none"> • information interviews • work study/experience • job shadowing.

MODULE ENM2100: ENVIRONMENTAL SAFETY

Level: Intermediate

Theme: Management and Conservation

Prerequisite: None

Module Description: Students identify environmental hazards that result from activities within an energy or mineral industry, and describe specific environmental monitoring and management practices adopted by the industry.

Module Parameters: Access to relevant government, industry and community resources.

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"> identify environmental hazards and issues relevant to one of Alberta’s energy or mineral industries 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> given a specific energy or mineral industry in Alberta: <ul style="list-style-type: none"> identifying a range of current environmental hazards/issues of relevance to the industry gathering and reporting data regarding a specific environmental hazard preparing a flow chart that outlines an environmental planning process that might be used to address one environmental concern. <p><i>Assessment Tool</i> <i>Assessment Criteria: Flow Charts, ENMFLO</i> <i>Lab Investigations: Intermediate Level, ENMLAB–2</i></p> <p><i>Standard</i> <i>Identify five environmental hazards/issues; conduct lab investigations on one environmental hazard to a standard of 2 on the rating scale; complete a flow chart of the planning process to a standard of 2 on the rating scale</i></p>	<p>30</p>

MODULE ENM2100: ENVIRONMENTAL SAFETY (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> • describe career opportunities relevant to environmental assessment and management • demonstrate basic competencies. 	<p><i>Assessment of student achievement should be based on:</i></p> <ul style="list-style-type: none"> • completing a research project on one or more career opportunities in environmental assessment and management. <p><i>Assessment Tool</i> <i>Career Search: Intermediate Level, ENMCAR–2</i></p> <p><i>Standard</i> <i>Conduct research to a standard of 2 on the rating scale</i></p> <ul style="list-style-type: none"> • observations of individual effort and interpersonal interaction during the learning process. <p><i>Assessment Tool</i> <i>Basic Competencies Reference Guide and any assessment tools noted above</i></p>	<p style="text-align: center;">10</p> <p>Integrated throughout</p>

Concept	Specific Learner Expectations	Notes
<p>Environmental Hazards</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • identify environmental hazards relevant to an energy or mineral industry; e.g.: <ul style="list-style-type: none"> – air and water pollution – blowouts, spills and fires – emission of sulphur dioxide, carbon dioxide and nitrogen oxide – noise level – disposal of waste – land disturbance – degradation of wildlife habitat • research current theories regarding: <ul style="list-style-type: none"> – global climate change and the emission of greenhouse gases – acid deposition and the burning of fossil fuels – the effects of chemical spills on food chains • collect and report data on a specific environmental hazard 	<p>Research hazards relevant to the Alberta context. For example, a number of factors minimize the formation and effects of sulphur dioxide in Alberta.</p> <p>Gather information using a variety of current sources (e.g., talk to specialists, search the Internet). Distinguish between facts and theories.</p>

MODULE ENM2100: ENVIRONMENTAL SAFETY (continued)

Concept	Specific Learner Expectations	Notes
<p>Environmental Hazards (continued)</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • explain how specific environmental concerns relevant to one of Alberta’s energy or mineral industries are addressed through the process of environmental planning. 	<p>Explain applications of environmental planning in:</p> <ul style="list-style-type: none"> • land use management • waste management • spill containment/recovery • maintaining air and water quality • rehabilitation and reclamation.
<p>Policy and Legislation</p>	<ul style="list-style-type: none"> • explain how industry and government work together to resolve environmental concerns • research provincial and federal legislation regarding protection of the environment • identify specific legislative requirements that relate to operations within an energy or mineral industry • describe construction and operating approvals required for specific operations • outline strategies for public involvement in environmental law making • propose changes to existing legislation or suggest new legislation regarding an environmental concern; e.g.: <ul style="list-style-type: none"> – sulphur dioxide/carbon dioxide emissions – water treatment – toxic waste management. 	<p>Research the intent/function of the <i>Environmental Protection Enhancement Act</i>.</p> <p>Discuss specific requirements of industry with respect to:</p> <ul style="list-style-type: none"> • exploration • recovery/production • processing/refining • distribution. <p>Cite local examples of public involvement in persuading government to act on an environmental issue; e.g.:</p> <ul style="list-style-type: none"> • Friends of the Oldman River Association • Alberta Wilderness Society. <p>Request pamphlets from the Canadian Environmental Network.</p> <p>Research the <i>Federal Green Plan</i>.</p>

MODULE ENM2100: ENVIRONMENTAL SAFETY (continued)

Concept	Specific Learner Expectations	Notes
<p>Monitoring and Management Practices</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • describe the goals and techniques of environmental monitoring within an energy or mineral industry • explain operating practices and guidelines within the industry that relate to specific legislative requirements • describe major aspects of land management within the industry • research spill containment and recovery techniques • describe the mandates and responsibilities of association, industry and government organizations in spill control • explain the planning process for pipeline facilities • research theories and techniques relevant to waste management within the industry • research current and emerging technologies that address environmental issues and promote sustainable development within the industry. 	<p>For example:</p> <ul style="list-style-type: none"> • environmental audits • impact assessments. <p>Investigate land management practices with respect to:</p> <ul style="list-style-type: none"> • land acquisition • soils engineering • waste management • abandonment and reclamation. <p>Gather information on:</p> <ul style="list-style-type: none"> • spill equipment and usage • spill site assessment • contingency planning. <p>Consider:</p> <ul style="list-style-type: none"> • route selection • public consultation • permits/approvals • impact assessment • topsoil/timber salvage • reclamation techniques. <p>For example:</p> <ul style="list-style-type: none"> • treatment • disposal. <p>Possible research topics:</p> <ul style="list-style-type: none"> • reduction of emissions, odours and noise • water treatment and purification • sulphur recovery • efficient use of energy • recycling systems.

MODULE ENM2100: ENVIRONMENTAL SAFETY (continued)

Concept	Specific Learner Expectations	Notes
Career Opportunities	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • research careers and the range of occupational opportunities relevant to environmental management and safety; e.g.: <ul style="list-style-type: none"> – science and research – industry – government – legal and consulting • evaluate current employment opportunities based on employment statistics • research trends in environmental monitoring and management, and future career opportunities. 	<p>Plan for individual/group research and presentations that address:</p> <ul style="list-style-type: none"> • job description • employment market • education/training • wage expectations. <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"> • information interviews • work study/experience • job shadowing.