

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.

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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>

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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>

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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.

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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.

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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.