

MODULE ENM3060: PETROCHEMICALS

Level: Advanced

Theme: Technology and Applications

Prerequisite: ENM2060 Refining Hydrocarbons

Module Description: Students investigate the conversion of hydrocarbons into consumer products within a petrochemical industry, and they explain related career opportunities.

Module Parameters: Access to a petrochemical 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 Module: CTR2210 Workplace Safety (Practices) [Career Transitions Strand]; recommended for off-campus learning

Students must have a general knowledge of potential hazards and accepted safety practices relevant to specific 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.

MODULE ENM3060: PETROCHEMICALS (continued)

Module Learner Expectations	Assessment Criteria and Conditions	Suggested Emphasis
<p><i>The student will:</i></p> <ul style="list-style-type: none"> demonstrate basic competencies. 	<p><i>Assessment of student achievement should be based on:</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>Integrated throughout</p>

Concept	Specific Learner Expectations	Notes
<p>Petrochemical Products</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> describe the social, economic and environmental significance of Canada's petrochemical industries identify and describe important petroleum feedstocks used in the petrochemical industry identify the primary groups of petrochemicals obtained from petroleum feedstocks and subsequently processed into intermediate and finished products identify and describe intermediate and finished products that are derived from petrochemicals 	<p>Prepare a poster/display of consumer and industrial products (or services) derived from the petrochemical industry.</p> <p>Research the use of:</p> <ul style="list-style-type: none"> crude oil natural gas ethane, propane and butane naphtha gas oil. <p>For example:</p> <ul style="list-style-type: none"> methanol benzene, toluene and xylene butadiene and butylene propylene ethylene. <p>For example:</p> <ul style="list-style-type: none"> plastics synthetic clothing fibres medicines paints detergents fertilizers and pesticides.

MODULE ENM3060: PETROCHEMICALS (continued)

Concept	Specific Learner Expectations	Notes
<p>Petrochemical Products (continued)</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • identify and describe major consuming industries for Canada's petrochemical products. 	<p>Research the use of petrochemicals in:</p> <ul style="list-style-type: none"> • forest products • transportation • textiles • electronics • cosmetics and pharmaceuticals • agriculture.
<p>Changing Petroleum Molecules</p>	<ul style="list-style-type: none"> • describe petroleum molecules as strings and rings of carbon and hydrogen atoms • construct models of simple and more complex hydrocarbon molecules • research basic fractionating processes used to sort petroleum molecules • explain how petroleum molecules are broken apart, reassembled and blended through the processes of cracking, polymerization and isomerization • research the role of temperature, pressure and catalysts in sorting and rearranging petroleum molecules. 	<p>For example:</p> <ul style="list-style-type: none"> • methane • paraffin. <p>Assemble and use a simple fractionating column to separate and sort molecules through the process of fractional distillation.</p> <p>Conduct laboratory investigations. Encourage students to relate experimental outcomes to studies in the core science program.</p>
<p>Refining and Manufacturing Processes</p>	<ul style="list-style-type: none"> • research the conversion of a hydrocarbon into a petrochemical product within one of Canada's petrochemical industries; e.g.: <ul style="list-style-type: none"> – plastic – polyethylene – detergent – fertilizer • identify specific hydrocarbon feedstocks used in the manufacturing process • describe techniques employed to sort, break apart, reassemble and/or blend petroleum molecules 	<p>Distinguish between the refining of crude oil (ENM2060) and the manufacture of petrochemicals (ENM3060).</p> <p>For example,</p> <ul style="list-style-type: none"> • fractionating • cracking • polymerization • isomerization.

MODULE ENM3060: PETROCHEMICALS (continued)

Concept	Specific Learner Expectations	Notes
<p>Refining and Manufacturing Processes (continued)</p>	<p><i>The student should:</i></p> <ul style="list-style-type: none"> • construct a flow chart outlining the path of a hydrocarbon from recovery-site to finished product • explain applications of electronic equipment and computer technology in monitoring and controlling manufacturing 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 manufacturing operations • describe industry initiatives that respond to environmental concerns • describe industry initiatives that address occupational health and safety requirements • describe industry initiatives in re-refining and reprocessing to ensure a life-cycle approach to chemicals management. 	<p>Draw/construct a simplified model of a petrochemical facility.</p> <p>Construct flow charts that illustrate storage and distribution systems.</p> <p>Research environmental standards and the enforcement of safe operating procedures throughout manufacturing operations.</p> <p>For example:</p> <ul style="list-style-type: none"> • waste treatment • emission control. <p>For example:</p> <ul style="list-style-type: none"> • odour scrubbers • noise suppressants • water purification. <p>Research the development of recycled materials for specific environments and applications.</p>

MODULE ENM3060: PETROCHEMICALS (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 within the petrochemical industry; e.g.: <ul style="list-style-type: none"> – engineering – technical and support services – apprenticeship trades – environmental management • explain the personnel structure within a petrochemical industry • evaluate current employment opportunities based on employment statistics • research trends in the refining and manufacturing of petroleum-based products, 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.

