COURSE PRS1010: OVERVIEW OF ALBERTA GEOLOGY

Level: Introductory

Prerequisite: None

Description: Students examine the nature and origin of Alberta's hydrocarbon and mineral resources, and their significance in society.

Parameters: Access to geological maps available from relevant government agencies and professional associations (e.g., Natural Resources Canada, Alberta Geological Survey, Energy Resources Conservation Board).

Access to samples of hydrocarbon bearing rocks and/or minerals available from local industry.

Access to a science laboratory, an outdoor geological site where earth layers are exposed (e.g., river bank, recovery site) and a museum of natural history (e.g., Tyrrell Museum).

Outcomes: The student will:

1. **describe the nature and origin of Alberta's hydrocarbon and mineral resources within the North American geological context**
   - 1.1 define and compare renewable and nonrenewable hydrocarbon resources
   - 1.2 describe and locate on a map known reserves of nonrenewable hydrocarbon resources in Alberta; e.g., oil, natural gas, bitumen
   - 1.3 describe and locate on a map the major types of metallic and nonmetallic minerals found in Alberta; e.g., coal, copper, iron, limestone, magnesium, uranium, diamonds, sulphur, gold, peat, quartz, salts, sodium sulphates, sand and gravel
   - 1.4 identify and describe the physical characteristics of basic hydrocarbon-bearing rocks; e.g., dolomite, limestone, sandstone and shale
   - 1.5 identify and describe the physical characteristics of metallic and nonmetallic minerals; e.g., coal, copper, iron, limestone, magnesium, uranium, diamonds, sulphur, gold, peat, quartz, salts, sodium sulphates, sand and gravel
   - 1.6 draw or construct a historical representation of the western sedimentary basin that illustrates Alberta's current topographical features
   - 1.7 draw or construct a vertical cross-section of any part of Alberta showing the location of hydrocarbon-bearing formations, mineral deposits and surface resources
2. **explain the social, economic and environmental significance of hydrocarbon and mineral resources in Alberta**
   - 2.1 identify and describe major hydrocarbon and mineral use sectors in society; e.g., residential, commercial, industrial and transportation
   - 2.2 explain how the hydrocarbon and mineral industries influence the local and national economies; e.g., describe trends in hydrocarbon and mineral markets, competition from raw material substitutes
   - 2.3 describe the flow of hydrocarbon and mineral resources between Canada and other nations; e.g., import partners, export partners
   - 2.4 identify and describe environmental issues associated with the development of Alberta's hydrocarbon and mineral resources

3. demonstrate basic competencies

3.1 demonstrate fundamental skills to:
- 3.1.1 communicate
- 3.1.2 manage information
- 3.1.3 use numbers
- 3.1.4 think and solve problems

3.2 demonstrate personal management skills to:
- 3.2.1 demonstrate positive attitudes and behaviours
- 3.2.2 be responsible
- 3.2.3 be adaptable
- 3.2.4 learn continuously
- 3.2.5 work safely

3.3 demonstrate teamwork skills to:
- 3.3.1 work with others
- 3.3.2 participate in projects and tasks

4. make personal connections to the cluster content and processes to inform possible pathway choices

4.1 complete/update a personal inventory; e.g., interests, values, beliefs, resources, prior learning and experiences

4.2 create a connection between a personal inventory and occupational choices

COURSE PRS1020: NONRENEWABLE RESOURCES

Level: Introductory

Prerequisite: None

Description: Students examine exploration, recovery and production, refining, and reclamation technologies within a nonrenewable hydrocarbon or mineral industry.

Parameters: Access to a science laboratory and/or a local hydrocarbon or mineral industry.

Access to resource maps available from government agencies and professional associations (e.g., Natural Resources Canada, Alberta Geological Survey, Energy Resources Conservation Board).

Outcomes: The student will:

1. **describe the formation and development of nonrenewable hydrocarbon or mineral resources in Alberta**
   - 1.1 identify and describe nonrenewable hydrocarbon sources currently used in Alberta
   - 1.2 describe major events in the formation and development of one nonrenewable hydrocarbon or mineral resource in Alberta (e.g., exploration, problems and issues in development, boom and bust cycles, technological advances) and:
     - 1.2.1 locate the resource on a map of Alberta
     - 1.2.2 describe basic geological processes and structures responsible for the resource formation
     - 1.2.3 identify and describe products and by-products derived from the resource; e.g., space and water heating, heat for industrial purposes, fuels for transportation, electricity, petrochemicals, metallic or nonmetallic materials
     - 1.2.4 explore one or more applications; e.g., design and/or construct a model
     - 1.2.5 explain how the resource has influenced both the people and the economy of Alberta; e.g., economic benefits, material products and services, employment
2. **identify and describe impacts resulting from the use of nonrenewable resources**
   - 2.1 describe environmental impacts that result from the use of nonrenewable resources; e.g., greenhouse gases, acid deposition, resource depletion, ozone depletion, smog, ecosystem destruction, water pollution
   - 2.2 identify policies and technologies used to address these environmental impacts; e.g., Kyoto Protocol, Montreal Protocol, catalytic converter, smokestack scrubber, carbon capture, carbon offset, liming, land use policies
   - 2.3 define sustainable energy development and research future impacts on resource supply and demand, and options for ensuring future sustainable development; e.g., social, economic, geological, technological and environmental
3. **explain basic technologies and techniques used within a nonrenewable hydrocarbon or mineral industry in Alberta**
   - 3.1 describe exploration; e.g., topographical features, drilling techniques, seismic operations
   - 3.2 describe recovery and production; e.g., service rigs, chemical processes, strip mining
   - 3.3 describe refining and manufacturing; e.g., cracking and fractionating, smelting and milling
   - 3.4 describe reclamation; e.g., exploration and process area restoration, strip mine restoration

4. demonstrate basic competencies

4.1 demonstrate fundamental skills to:
- 4.1.1 communicate
- 4.1.2 manage information
- 4.1.3 use numbers
- 4.1.4 think and solve problems

4.2 demonstrate personal management skills to:
- 4.2.1 demonstrate positive attitudes and behaviours
- 4.2.2 be responsible
- 4.2.3 be adaptable
- 4.2.4 learn continuously
- 4.2.5 work safely

4.3 demonstrate teamwork skills to:
- 4.3.1 work with others
- 4.3.2 participate in projects and tasks

5. make personal connections to the cluster content and processes to inform possible pathway choices

5.1 complete/update a personal inventory; e.g., interests, values, beliefs, resources, prior learning and experiences

5.2 create a connection between a personal inventory and occupational choices

COURSE PRS1050: RENEWABLE RESOURCES

Level: Introductory

Prerequisite: None

Description: Students examine the general applications of one or more renewable hydrocarbon technologies and the contributions of each technology to sustainable resource development.

Parameters: Access to a science laboratory and a local renewable energy industry.

Access to resource maps available from government agencies and professional associations (e.g., Natural Resources Canada, Energy Resources Conservation Board).

Outcomes: The student will:

1. **describe the development of renewable hydrocarbon resources in Alberta**
   - 1.1 identify and describe renewable hydrocarbon sources currently used; e.g., biomass, biogas, biodiesel
   - 1.2 describe and illustrate the development of one renewable hydrocarbon resource in Alberta, considering:
     - 1.2.1 location
     - 1.2.2 application
     - 1.2.3 effects; e.g., economic benefits, material products and services, employment
2. **describe the impact of renewable hydrocarbons**
   - 2.1 describe economic and environmental impacts that result from the use of renewable resources
   - 2.2 identify policies and technologies used to address these economic and environmental impacts
   - 2.3 define *sustainable resource development* and research future impacts on resource supply and demand, and options for ensuring future sustainable development; e.g., social, economic, geological, technological and environmental
3. **explain current and potential contributions of renewable hydrocarbons to sustainable energy development**
   - 3.1 compare the role of renewable and nonrenewable hydrocarbon technologies in sustainable energy development
   - 3.2 compare and contrast the use of renewable hydrocarbons to supplement energy supplies in Alberta with other parts of the world
4. **demonstrate basic competencies**
   - 4.1 demonstrate fundamental skills to:
     - 4.1.1 communicate
     - 4.1.2 manage information
     - 4.1.3 use numbers
     - 4.1.4 think and solve problems
   - 4.2 demonstrate personal management skills to:
     - 4.2.1 demonstrate positive attitudes and behaviours
     - 4.2.2 be responsible
     - 4.2.3 be adaptable
     - 4.2.4 learn continuously
     - 4.2.5 work safely

4.3 demonstrate teamwork skills to:
    4.3.1 work with others
    4.3.2 participate in projects and tasks

5. make personal connections to the cluster content and processes to inform possible pathway choices

5.1 complete/update a personal inventory; e.g., interests, values, beliefs, resources, prior learning and experiences

5.2 create a connection between a personal inventory and occupational choices

COURSE PRS1060: CONSUMER PRODUCTS & SERVICES

Level: Introductory

Prerequisite: None

Description: Students examine the basic techniques involved in developing consumer products and/or services within a hydrocarbon or mineral industry.

Parameters: Access to a relevant processing, refining, manufacturing or service industry. Off-campus learning may support the development of knowledge and skills in processing, refining and/or manufacturing practices.

Outcomes: The student will:

1. **describe the range of consumer products and services derived from hydrocarbon and mineral resources**
   - 1.1 identify and describe a range of consumer products or services derived from nonrenewable hydrocarbon resources; e.g., oil, gas and coal; oil, gas and coal by-products; petrochemicals
   - 1.2 identify and describe a range of consumer products and services derived from mineral resources; e.g., metallic and nonmetallic minerals, art and decorative stone, sand and gravel
   - 1.3 explain the roles of renewable and nonrenewable hydrocarbon resources in producing electricity and heat energy; e.g., space and water heating, heat for industrial processing, fuels for transportation
   - 1.4 investigate reasons for maintaining, increasing or decreasing current production levels of a specific hydrocarbon or mineral resource
   - 1.5 predict factors that may influence hydrocarbon and mineral industries in the future; e.g., alternative energy sources, material substitutes, market competition and change
2. **explain the processes used to develop a consumer product or to provide a related service**
   - 2.1 identify and describe the basic steps, including safety measures, involved in developing a consumer product or providing a related service; e.g., resource exploration, recovery and production, processing and refining, quality control, transportation, storage, marketing
   - 2.2 describe facilities and equipment essential to developing the product or service; e.g., design features, operation and maintenance
3. **demonstrate basic competencies**
   - 3.1 demonstrate fundamental skills to:
     - 3.1.1 communicate
     - 3.1.2 manage information
     - 3.1.3 use numbers
     - 3.1.4 think and solve problems
   - 3.2 demonstrate personal management skills to:
     - 3.2.1 demonstrate positive attitudes and behaviours
     - 3.2.2 be responsible
     - 3.2.3 be adaptable
     - 3.2.4 learn continuously
     - 3.2.5 work safely

3.3 demonstrate teamwork skills to:
    3.3.1 work with others
    3.3.2 participate in projects and tasks

4. make personal connections to the cluster content and processes to inform possible pathway choices

4.1 complete/update a personal inventory; e.g., interests, values, beliefs, resources, prior learning and experiences

4.2 create a connection between a personal inventory and occupational choices

COURSE PRS1910: PRS PROJECT A

Level: Introductory

Prerequisite: None

Description: Students develop project design and management skills to extend and enhance competencies and skills in other CTS courses through contexts that are personally relevant.

Parameters: Introductory project courses must connect with a minimum of two CTS courses, one of which must be at the introductory level and be in the same occupational area as the project course. The other CTS course(s) can be either at the same level or at the intermediate level from any occupational area.

Project courses cannot be connected to other project courses or practicum courses.

All projects and/or performances, whether teacher- or student-led, must include a course outline or student proposal.

Outcomes:

The teacher/student will:

1. **identify the connection between this project course and two or more CTS courses**
   - 1.1 identify the outcome(s) from each identified CTS course that support the project and/or performance deliverables
   - 1.2 explain how these outcomes are being connected to the project and/or performance deliverables
2. **propose the project and/or performance**
   - 2.1 identify the project and/or performance by:
     - 2.1.1 preparing a plan
     - 2.1.2 clarifying the purposes
     - 2.1.3 defining the deliverables
     - 2.1.4 specifying time lines
     - 2.1.5 explaining terminology, tools and processes
     - 2.1.6 defining resources; e.g., materials, costs, staffing
   - 2.2 identify and comply with all related health and safety standards
   - 2.3 define assessment standards (indicators for success)
   - 2.4 present the proposal and obtain necessary approvals

The student will:

3. **meet goals as defined within the plan**
   - 3.1 complete the project and/or performance as outlined
   - 3.2 monitor the project and/or performance and make necessary adjustments
   - 3.3 present the project and/or performance, indicating the:
     - 3.3.1 outcomes attained
     - 3.3.2 relationship of outcomes to goals originally set

3.4 evaluate the project and/or performance, indicating the:
    3.4.1 processes and strategies used
    3.4.2 recommendations on how the project and/or performance could have been improved

4. demonstrate basic competencies

4.1 demonstrate fundamental skills to:
    4.1.1 communicate
    4.1.2 manage information
    4.1.3 use numbers
    4.1.4 think and solve problems
4.2 demonstrate personal management skills to:
    4.2.1 demonstrate positive attitudes and behaviours
    4.2.2 be responsible
    4.2.3 be adaptable
    4.2.4 learn continuously
    4.2.5 work safely
4.3 demonstrate teamwork skills to:
    4.3.1 work with others
    4.3.2 participate in projects and tasks

5. make personal connections to the cluster content and processes to inform possible pathway choices

5.1 complete/update a personal inventory; e.g., interests, values, beliefs, resources, prior learning and experiences
5.2 create a connection between a personal inventory and occupational choices

COURSE PRS2020: CONVENTIONAL OIL/GAS EXPLORATION

Level: Intermediate

Prerequisite: None

Description: Students examine specific exploration techniques and technologies within the context of Alberta's conventional oil and/or gas deposits.

Supporting Course: PRS1020: Nonrenewable Resources

Outcomes: The student will:

1. **demonstrate knowledge of current and emerging technologies used in the exploration of conventional oil and gas deposits**
   - 1.1 define what constitutes conventional oil and gas deposits
   - 1.2 explain basic theories and/or principles regarding the formation and migration of conventional underground oil and gas deposits
   - 1.3 gather information regarding both known and probable reserves of oil and gas in major sedimentary basin areas of Canada
   - 1.4 illustrate subsurface rock structures capable of trapping oil and gas deposits; e.g., anticlinal trap, fault trap, stratigraphic trap, reef trap, salt domes
   - 1.5 research current and emerging applications used to identify sedimentary basins likely to contain petroleum deposits; e.g., aerial surveys and satellite imagery (3-D scanning; measurement of magnetic fields, gravity and radiation) and other technological applications
   - 1.6 describe steps taken to gather further information about subsurface rock formations within a basin prior to seismic and/or drilling operations; e.g., first-hand observation of outcrop geology and surface features, review of existing information such as government reports and other published papers, use of cuttings and cores to determine subsurface rock properties
   - 1.7 research current and emerging theories and applications of seismic technology in mapping potential oil-and gas-bearing formations; e.g., steps taken during seismic exploration, data processing, 2-D and 3-D analysis of sedimentary structures
   - 1.8 research current and emerging applications of drilling technology in determining the composition of subsurface rock and the presence of oil and gas deposits; e.g., drill rig components, drilling techniques (directional, horizontal and underbalanced), logging and testing procedures
   - 1.9 explain environmental assessment and management practices conducted in the industry throughout exploration operations; e.g., Energy Resources Conservation Board policies and guidelines, water, soil and wildlife impact studies, management plans, reclamation techniques, environmental standards and safe operating procedures
   - 1.10 describe technological advances used to address environmental concerns throughout the exploration process; e.g., seismic technology, horizontal drilling, use of helicopters or packhorses, disposal of drilling fluids, and land surface restoration
2. **interpret sample seismic log data and well logs to predict the nature and extent of a hydrocarbon deposit**
   - 2.1 explain basic terminology and methodology used in seismic line analysis
   - 2.2 make predictions regarding the presence of hydrocarbon-bearing rock structures, given sample seismic line data
   - 2.3 explain basic terminology and methodology used in geological log analysis

2.4 make predictions regarding the presence of a hydrocarbon deposit, given sample well log data; e.g., type and thickness of rock layers, speed of penetration

2.5 research the use of wireline tools, seismic line and well log data to estimate the potential volume of a hydrocarbon deposit; e.g., thickness, porosity and permeability, fluid composition of rock formations

3. demonstrate basic competencies

3.1 demonstrate fundamental skills to:
- 3.1.1 communicate
- 3.1.2 manage information
- 3.1.3 use numbers
- 3.1.4 think and solve problems

3.2 demonstrate personal management skills to:
- 3.2.1 demonstrate positive attitudes and behaviours
- 3.2.2 be responsible
- 3.2.3 be adaptable
- 3.2.4 learn continuously
- 3.2.5 work safely

3.3 demonstrate teamwork skills to:
- 3.3.1 work with others
- 3.3.2 participate in projects and tasks

4. identify possible life roles related to the skills and content of this cluster

4.1 recognize and then analyze the opportunities and barriers in the immediate environment

4.2 identify potential resources to minimize barriers and maximize opportunities

COURSE PRS2030: NON-CONVENTIONAL HYDROCARBONS EXPLORATION

Level: Intermediate

Prerequisite: None

Description: Students examine specific exploration techniques and technologies within the context of Alberta's oil sands, heavy oil or non-conventional methane.

Parameters: Access to government and industry organizations involved in the exploration of non-conventional hydrocarbon resources.

Supporting Course: PRS1020: Nonrenewable Resources

Outcomes: The student will:

1. demonstrate knowledge of current and emerging technologies used in the exploration of non-conventional hydrocarbons

1.1 define *non-conventional hydrocarbons* and give examples; e.g., oil sands (bitumen), heavy oil, or non-conventional methane deposits (coalbed methane, methane hydrates, tight gas sands, shale gas)

1.2 explain basic theories and/or principles regarding the origins and formation of one or more non-conventional hydrocarbon deposits in Alberta; e.g., theories of origin and formation, surface and subsurface geology, source rock and migration, the difference between porosity and permeability

1.3 identify major geographical areas of Alberta in which bitumen, heavy oil, non-conventional methane and coal deposits are located, and relate these geographic patterns to theories of origin

1.4 compare and contrast physical and chemical characteristics of bitumen, heavy oil, conventional oil and coal

1.5 compare known reserves of non-conventional hydrocarbons to known reserves of other fossil fuels; e.g., in Alberta, in Canada, in the world

1.6 describe the types of reserves (proved, probable and established) and techniques used to estimate Alberta's recoverable bitumen, heavy oil, non-conventional methane or coal; e.g., volumetric method, materials balance method, production decline curve method

1.7 illustrate surface and subsurface rock structures capable of containing oil sands, heavy oil or coal deposits

1.8 examine and describe current and emerging applications used to locate non-conventional hydrocarbon deposits; e.g., aerial surveys and satellite imagery (3-D scanning; measurement of magnetic fields, gravity and radiation) and other technological applications

1.9 describe the steps taken to gather further information about potential oil- or coal-bearing formations prior to seismic and drilling operations; e.g., first-hand observation of outcrop geology and surface features, review of geological reports and other published papers, use of cuttings and cores

1.10 examine and describe current and emerging theories and applications of seismic technology in the mapping and analysis of potential oil- and coal-bearing formations; e.g., steps taken during seismic exploration, data processing, 2-D and 3-D analysis of sedimentary structures

1.11 examine and describe current and emerging applications of drilling or other exploration technologies in determining the composition of subsurface rock and establishing the presence of non-conventional hydrocarbon deposits; e.g., drill rig components, drilling techniques (directional, horizontal and underbalanced), logging and testing procedures

1.12 explain environmental assessment and management practices conducted by industry throughout exploration operations; e.g., Energy Resources Conservation Board policies and guidelines, water, soil and wildlife impact studies, management plans, reclamation techniques, environmental standards and safe operating procedures

1.13 describe technological advances used to address environmental concerns throughout the exploration process; e.g., seismic technology, horizontal drilling, use of helicopters or packhorses, disposal of drilling fluids and land surface restoration

2. explain applications of low-depth drilling and log analysis in predicting the nature and extent of an oil sands, heavy oil, non-conventional methane deposit

2.1 explain basic terminology and methodology used in low-depth drilling and core analysis

2.2 predict the extent and grade of an oil sands, heavy oil, methane or coal deposit based on a given assay or sample; e.g., combustibility, sulfur content, toxic chemical content, coal hardness

2.3 explain basic terminology and methodology used in geological log analysis; e.g., wireline logs, seismic logs

2.4 make predictions regarding the extent and grade of an oil sands, a heavy oil or a methane, given sample log data from a bore hole

2.5 describe the hydrocarbon content necessary to make a non-conventional hydrocarbon deposit economically viable; e.g., percentage of bitumen, percentage of methane

3. demonstrate basic competencies

3.1 demonstrate fundamental skills to:

- 3.1.1 communicate
- 3.1.2 manage information
- 3.1.3 use numbers
- 3.1.4 think and solve problems

3.2 demonstrate personal management skills to:

- 3.2.1 demonstrate positive attitudes and behaviours
- 3.2.2 be responsible
- 3.2.3 be adaptable
- 3.2.4 learn continuously
- 3.2.5 work safely

3.3 demonstrate teamwork skills to:

- 3.3.1 work with others
- 3.3.2 participate in projects and tasks

4. identify possible life roles related to the skills and content of this cluster

4.1 recognize then analyze the opportunities and barriers in the immediate environment

4.2 identify potential resources to minimize barriers and maximize opportunities

COURSE PRS2040: METALS/NONMETALS EXPLORATION

Level: Intermediate

Prerequisite: None

Description: Students examine specific exploration techniques and technologies within the context of a metallic and/or nonmetallic mineral deposit.

Parameters: Access to government and industry organizations involved in the exploration of metallic and/or nonmetallic minerals.

Supporting Course: PRS1020: Nonrenewable Resources

Outcomes: The student will:

1. demonstrate knowledge of current and emerging technologies used in the exploration of economic mineral deposits

- 1.1 describe which mineral deposits in Alberta may have economic value and explain why
- 1.2 explain basic theories and/or principles regarding the origin and formation of metallic and nonmetallic minerals and structural materials in Alberta
- 1.3 illustrate surface and subsurface rock structures in which metallic and industrial minerals are commonly found
- 1.4 describe the mineral potential of major geological areas of Alberta; e.g., Southwestern, Southeastern, Central and Eastern, Northwestern, North Central, Northeastern, Rocky Mountains, Foothills
- 1.5 identify geographical areas of Alberta in which occurrences of specific minerals are known to exist, and relate geographic and distribution patterns to theories of origin
- 1.6 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
- 1.7 examine and describe current and emerging applications used in prospecting, mapping and analyzing metallic and nonmetallic mineral deposits; e.g., aerial surveys and satellite imagery (3-D scanning; electromagnetics; measurement of magnetic fields, gravity and radioactivity), seismic surveys, geochemical analysis of soils and other technological applications
- 1.8 describe steps taken to gather further information about potential mineral-bearing formations prior to seismic mapping and/or drilling operations; e.g., first-hand observation of outcrop geology and surface features, review of geological reports and other published papers
- 1.9 examine and describe current and emerging applications of drilling technology in determining the composition of subsurface rock and establishing the presence of mineral deposits; e.g., drill rig components, drilling techniques (directional, horizontal and underbalanced), logging and testing procedures
- 1.10 summarize recent developments in Alberta regarding gold, diamonds and base metals
- 1.11 explain environmental assessment and management practices conducted by industry throughout exploration operations; e.g., legislative policies and guidelines, water, soil and wildlife impact studies, management plans, reclamation techniques, environmental standards and safe operating procedures

1.12 describe technological advances used to address environmental concerns throughout the exploration process; e.g., seismic technology, horizontal drilling, use of helicopters or packhorses, disposal of drilling fluids, and land surface restoration

2. interpret geological logs to predict the nature and extent of a metallic or nonmetallic mineral deposit

2.1 explain basic terminology and methodology used in core analysis
2.2 predict the extent and grade of a mineral deposit base on a given assay or sample
2.3 explain basic terminology and methodology use in geological log interpretation; e.g., wireline logs, seismic logs
2.4 predict the extent and grade of a mineral deposit based on sample log data from a bore hole

3. demonstrate basic competencies

3.1 demonstrate fundamental skills to:
- 3.1.1 communicate
- 3.1.2 manage information
- 3.1.3 use numbers
- 3.1.4 think and solve problems

3.2 demonstrate personal management skills to:
- 3.2.1 demonstrate positive attitudes and behaviours
- 3.2.2 be responsible
- 3.2.3 be adaptable
- 3.2.4 learn continuously
- 3.2.5 work safely

3.3 demonstrate teamwork skills to:
- 3.3.1 work with others
- 3.3.2 participate in projects and tasks

4. identify possible life roles related to the skills and content of this cluster

4.1 recognize then analyze the opportunities and barriers in the immediate environment
4.2 identify potential resources to minimize barriers and maximize opportunities

COURSE PRS2060: REFINING HYDROCARBONS

Level: Intermediate

Prerequisite: None

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

Parameters: Access to a hydrocarbon refining industry.

Access to a science laboratory.

Supporting Course: PRS1060: Consumer Products & Services

Outcomes: The student will:

1. explain techniques used to process natural gas, refine crude oil, upgrade heavy oils and bitumen, or process coal

- 1.1 describe relatively simple field facilities used to prepare a raw hydrocarbon for further processing and/or refining in the upstream sector; e.g., cleaning, separating, upgrading
- 1.2 investigate current 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., removal of contaminants and/or impurities, conversion into saleable products, manufacture of petrochemicals
- 1.3 explain reasons for sulphur recovery throughout processing, refining and/or upgrading processes; e.g., to sweeten product for industrial and residential use, to produce elemental sulphur, to maintain environmental standards
- 1.4 create a simplified representation of a processing, refining or upgrading facility
- 1.5 investigate the physical and/or chemical properties of a hydrocarbon, and relate these properties to technologies used for processing, refining or upgrading; e.g., molecular structure; heat content; temperature, pressure and volume relationships; catalytic reaction
- 1.6 examine and describe basic fractionating, cracking and/or reforming processes used within the industry
- 1.7 explain how the hydrocarbon industry uses technology in monitoring, processing, refining or upgrading operations; e.g., Canada as a world leader in developing technologies for recovering and safely handling sulphur
- 1.8 describe storage facilities and distribution systems within the industry and their impacts on industry location and product costs; e.g., flow charts of storage and distribution systems
- 1.9 explain how management practices conducted by industry throughout processing, refining or upgrading operations are influenced by environmental standards, environmental assessment and the enforcement of safe operating procedures
- 1.10 describe industry initiatives that respond to environmental concerns; e.g., advances in sulphur recovery technology, development of clean coal technology, water treatment, waste treatment, emission control
- 1.11 describe industry initiatives that address occupational health and safety requirements; e.g., odour scrubbers, noise suppressants, water purification, personal protective equipment, safety courses, emergency response strategies

2. describe commodity inputs and consumer products characteristic of the hydrocarbon processing industry

- 2.1 describe the range of products and/or services provided as a result of processing natural gas, refining crude oil, upgrading heavy oils and bitumen or processing coal
- 2.2 describe inputs to processing within an oil, gas, oil sands or coal industry, including raw materials (feedstocks), financial, human and natural resources, and technology requirements
- 2.3 identify factors that influence the nature of a processing or refining industry; e.g., supply of feedstocks and/or other materials, allowable production volumes, access to markets
- 2.4 explain how the mix of products produced may vary according to market demand; e.g., asphalt for road paving in summer, home heating fuels in winter
- 2.5 identify environmental and safety concerns that influence practices within a processing or refining industry; e.g., workers and nearby residents, air, crops and livestock, forests and wildlife, soil and water quality

3. demonstrate basic competencies

- 3.1 demonstrate fundamental skills to:
  - 3.1.1 communicate
  - 3.1.2 manage information
  - 3.1.3 use numbers
  - 3.1.4 think and solve problems
- 3.2 demonstrate personal management skills to:
  - 3.2.1 demonstrate positive attitudes and behaviours
  - 3.2.2 be responsible
  - 3.2.3 be adaptable
  - 3.2.4 learn continuously
  - 3.2.5 work safely
- 3.3 demonstrate teamwork skills to:
  - 3.3.1 work with others
  - 3.3.2 participate in projects and tasks

4. identify possible life roles related to the skills and content of this cluster

- 4.1 recognize then analyze the opportunities and barriers in the immediate environment
- 4.2 identify potential resources to minimize barriers and maximize opportunities

COURSE PRS2070: REFINING ROCKS & MINERALS

Level: Intermediate

Prerequisite: None

Description: Students examine the principles and processes involved in refining an industrial (nonmetallic) mineral or a metallic mineral.

Parameters: Access to a rock or mineral processing facility.

Access to a science laboratory.

Supporting Course: PRS1060: Consumer Products & Services

Outcomes: The student will:

1. **describe commodity inputs and consumer products characteristic of the mineral processing industry**
   - 1.1 explain the social, economic and environmental significance of Alberta's rocks and minerals
   - 1.2 describe applications of Alberta's industrial (nonmetallic) and metallic minerals; e.g., sand and gravel, cement and lime, peat moss, building stone, gypsum, clay products, sulphur, salt, gold and copper, iron ore, lead and zinc
   - 1.3 describe inputs to processing within a mineral industry; e.g., mineral ores or aggregates; financial, human and natural resources; technology requirements
   - 1.4 identify factors that influence the nature of a mineral processing industry; e.g., supply of raw materials, allowable production volumes, access to markets
   - 1.5 identify environmental and safety concerns that influence practices within a mineral processing industry; e.g., workers and nearby residents, air, crops and livestock, forests and wildlife, soil and water quality
2. **explain techniques used to refine an industrial (nonmetallic) mineral or a metallic mineral**
   - 2.1 explain the stages, steps and technologies used in processing an industrial (nonmetallic) or metallic mineral; e.g., milling, dressing and cleaning; smelting, refining and upgrading
   - 2.2 describe basic extractive technologies used in the mineral industry; e.g., thermal, mechanical, chemical, electrical
   - 2.3 research and/or investigate the physical and chemical properties of a mineral substance, and relate these properties to technologies used for processing and refining; e.g., molecular structure, mass and density, magnetic characteristics, elasticity and stress
   - 2.4 explain how industry uses technology in monitoring and controlling various refining processes
   - 2.5 describe storage facilities and distribution systems within the industry and their impact on industry location and product costs; e.g., flow charts
   - 2.6 explain how management practices conducted by industry throughout refining operations are influenced by environmental standards, environmental assessment and the enforcement of safe operating procedures
   - 2.7 describe industry initiatives that respond to environmental concerns; e.g., advances in sulphur recovery technology, management of reactive rock wastes, water treatment, waste treatment, emission control

2.8 describe industry initiatives that address occupational health and safety requirements; e.g., odour scrubbers, noise suppressants, water purification, personal protective equipment, safety courses, emergency response strategies

2.9 describe industry initiatives in reprocessing and recycling mineral products to ensure a life cycle approach to resource management; e.g., waste and by-products

3. demonstrate basic competencies

3.1 demonstrate fundamental skills to:

- 3.1.1 communicate
- 3.1.2 manage information
- 3.1.3 use numbers
- 3.1.4 think and solve problems

3.2 demonstrate personal management skills to:

- 3.2.1 demonstrate positive attitudes and behaviours
- 3.2.2 be responsible
- 3.2.3 be adaptable
- 3.2.4 learn continuously
- 3.2.5 work safely

3.3 demonstrate teamwork skills to:

- 3.3.1 work with others
- 3.3.2 participate in projects and tasks

4. identify possible life roles related to the skills and content of this cluster

4.1 recognize then analyze the opportunities and barriers in the immediate environment

4.2 identify potential resources to minimize barriers and maximize opportunities

COURSE PRS2910: PRS PROJECT B

Level: Intermediate

Prerequisite: None

Description: Students develop project design and management skills to extend and enhance competencies and skills in other CTS courses through contexts that are personally relevant.

Parameters: Intermediate project courses must connect with a minimum of two CTS courses, one of which must be at the intermediate level and be in the same occupational area as the project course. The other CTS course(s) can be at any level from any occupational area.

Project courses cannot be connected to other project courses or practicum courses.

All projects and/or performances, whether teacher- or student-led, must include a course outline or student proposal.

Outcomes:

The teacher/student will:

1. **identify the connection between this project course and two or more CTS courses**
   - 1.1 identify the outcome(s) from each identified CTS course that support the project and/or performance deliverables
   - 1.2 explain how these outcomes are being connected to the project and/or performance deliverables
2. **propose the project and/or performance**
   - 2.1 identify the project and/or performance by:
     - 2.1.1 preparing a plan
     - 2.1.2 clarifying the purposes
     - 2.1.3 defining the deliverables
     - 2.1.4 specifying time lines
     - 2.1.5 explaining terminology, tools and processes
     - 2.1.6 defining resources; e.g., materials, costs, staffing
   - 2.2 identify and comply with all related health and safety standards
   - 2.3 define assessment standards (indicators for success)
   - 2.4 present the proposal and obtain necessary approvals

The student will:

3. **meet goals as defined within the plan**
   - 3.1 complete the project and/or performance as outlined
   - 3.2 monitor the project and/or performance and make necessary adjustments
   - 3.3 present the project and/or performance, indicating the:
     - 3.3.1 outcomes attained
     - 3.3.2 relationship of outcomes to goals originally set

3.4 evaluate the project and/or performance, indicating the:
    3.4.1 processes and strategies used
    3.4.2 recommendations on how the project and/or performance could have been improved

4. demonstrate basic competencies

4.1 demonstrate fundamental skills to:
    4.1.1 communicate
    4.1.2 manage information
    4.1.3 use numbers
    4.1.4 think and solve problems
4.2 demonstrate personal management skills to:
    4.2.1 demonstrate positive attitudes and behaviours
    4.2.2 be responsible
    4.2.3 be adaptable
    4.2.4 learn continuously
    4.2.5 work safely
4.3 demonstrate teamwork skills to:
    4.3.1 work with others
    4.3.2 participate in projects and tasks

5. identify possible life roles related to the skills and content of this cluster

5.1 recognize and then analyze the opportunities and barriers in the immediate environment
5.2 identify potential resources to minimize barriers and maximize opportunities

COURSE PRS2920: PRS PROJECT C

Level: Intermediate

Prerequisite: None

Description: Students develop project design and management skills to extend and enhance competencies and skills in other CTS courses through contexts that are personally relevant.

Parameters: Intermediate project courses must connect with a minimum of two CTS courses, one of which must be at the intermediate level and be in the same occupational area as the project course. The other CTS course(s) can be at any level from any occupational area.

Project courses cannot be connected to other project courses or practicum courses.

All projects and/or performances, whether teacher- or student-led, must include a course outline or student proposal.

Outcomes:

The teacher/student will:

1. **identify the connection between this project course and two or more CTS courses**
   - 1.1 identify the outcome(s) from each identified CTS course that support the project and/or performance deliverables
   - 1.2 explain how these outcomes are being connected to the project and/or performance deliverables
2. **propose the project and/or performance**
   - 2.1 identify the project and/or performance by:
     - 2.1.1 preparing a plan
     - 2.1.2 clarifying the purposes
     - 2.1.3 defining the deliverables
     - 2.1.4 specifying time lines
     - 2.1.5 explaining terminology, tools and processes
     - 2.1.6 defining resources; e.g., materials, costs, staffing
   - 2.2 identify and comply with all related health and safety standards
   - 2.3 define assessment standards (indicators for success)
   - 2.4 present the proposal and obtain necessary approvals

The student will:

3. **meet goals as defined within the plan**
   - 3.1 complete the project and/or performance as outlined
   - 3.2 monitor the project and/or performance and make necessary adjustments
   - 3.3 present the project and/or performance, indicating the:
     - 3.3.1 outcomes attained
     - 3.3.2 relationship of outcomes to goals originally set

3.4 evaluate the project and/or performance, indicating the:
    3.4.1 processes and strategies used
    3.4.2 recommendations on how the project and/or performance could have been improved

4. demonstrate basic competencies

4.1 demonstrate fundamental skills to:
    4.1.1 communicate
    4.1.2 manage information
    4.1.3 use numbers
    4.1.4 think and solve problems
4.2 demonstrate personal management skills to:
    4.2.1 demonstrate positive attitudes and behaviours
    4.2.2 be responsible
    4.2.3 be adaptable
    4.2.4 learn continuously
    4.2.5 work safely
4.3 demonstrate teamwork skills to:
    4.3.1 work with others
    4.3.2 participate in projects and tasks

5. identify possible life roles related to the skills and content of this cluster

5.1 recognize and then analyze the opportunities and barriers in the immediate environment
5.2 identify potential resources to minimize barriers and maximize opportunities

COURSE PRS2950: PRS INTERMEDIATE PRACTICUM

Level: Intermediate

Prerequisite: None

Description: Students apply prior learning and demonstrate the attitudes, skills and knowledge required by an external organization to achieve a credential/credentials or an articulation.

Parameters: This practicum course, which may be delivered on- or off-campus, should be accessed only by students continuing to work toward attaining a recognized credential/credentials or an articulation offered by an external organization. This course must be connected to at least one CTS course from the same occupational area and cannot be used in conjunction with any advanced (3XXX) level course. A practicum course cannot be delivered as a stand-alone course, cannot be combined with a CTS project course and cannot be used in conjunction with the Registered Apprenticeship Program or the Green Certificate Program.

Outcomes: The student will:

1. perform assigned tasks and responsibilities, as required by the organization granting the credential(s) or articulation

- 1.1 identify regulations and regulatory bodies related to the credential(s) or articulation
- 1.2 describe personal roles and responsibilities, including:
  - 1.2.1 key responsibilities
  - 1.2.2 support functions/responsibilities/expectations
  - 1.2.3 code of ethics and/or conduct
- 1.3 describe personal work responsibilities and categorize them as:
  - 1.3.1 routine tasks; e.g., daily, weekly, monthly, yearly
  - 1.3.2 non-routine tasks; e.g., emergencies
  - 1.3.3 tasks requiring personal judgement
  - 1.3.4 tasks requiring approval of a supervisor
- 1.4 demonstrate basic employability skills and perform assigned tasks and responsibilities related to the credential(s) or articulation

2. analyze personal performance in relation to established standards

- 2.1 evaluate application of the attitudes, skills and knowledge developed in related CTS courses
- 2.2 evaluate standards of performance in terms of:
  - 2.2.1 quality of work
  - 2.2.2 quantity of work
- 2.3 evaluate adherence to workplace legislation related to health and safety
- 2.4 evaluate the performance requirements of an individual who is trained, experienced and employed in a related occupation in terms of:
  - 2.4.1 training and certification
  - 2.4.2 interpersonal skills
  - 2.4.3 technical skills
  - 2.4.4 ethics

3. demonstrate basic competencies

- 3.1 demonstrate fundamental skills to:
  - 3.1.1 communicate
  - 3.1.2 manage information
  - 3.1.3 use numbers
  - 3.1.4 think and solve problems
- 3.2 demonstrate personal management skills to:
  - 3.2.1 demonstrate positive attitudes and behaviours
  - 3.2.2 be responsible
  - 3.2.3 be adaptable
  - 3.2.4 learn continuously
  - 3.2.5 work safely
- 3.3 demonstrate teamwork skills to:
  - 3.3.1 work with others
  - 3.3.2 participate in projects and tasks

4. identify possible life roles related to the skills and content of this cluster

- 4.1 recognize and then analyze the opportunities and barriers in the immediate environment
- 4.2 identify potential resources to minimize barriers and maximize opportunities

COURSE PRS3020: CONVENTIONAL OIL/GAS RECOVERY & PRODUCTION

Level: Advanced

Prerequisite: PRS2020: Conventional Oil/Gas Exploration

Description: Students examine specific recovery and production techniques within the context of Alberta's conventional oil and/or gas industry.

Parameters: Access to conventional oil or gas recovery and production industry.

Access to a science laboratory.

Outcomes: The student will:

1. **describe techniques used to complete and service a conventional oil or gas well**
   - 1.1 outline steps that are taken to prepare a successful oil or gas well for production; e.g., installation of production casing and tubing, cementing, installation of wellhead, well perforation; safety considerations such as first aid, clothing and equipment, government and industry regulation, lifting and hoisting techniques
   - 1.2 describe well site production equipment and surface facilities and their functions in production, maintenance and safety; e.g., service rig (blowout preventers, rig tank, tongs, wellhead), flare line, accumulators
   - 1.3 describe and compare natural flowing wells with wells that depend upon artificial lift
   - 1.4 explain well stimulation treatments used to ensure underground movement of conventional oil or gas to the well bore; e.g., acidizing, fracturing
   - 1.5 describe primary methods used to extract conventional oil or gas; e.g., naturally occurring water displacing oil, expansion of natural gas and gravity drainage resulting from the movement of oil within the reservoir from the upper to the lower parts
   - 1.6 explain environmental assessment and management practices conducted in the industry throughout recovery and production operations
   - 1.7 describe technological advances used to address environmental concerns throughout recovery and production; e.g., directional wells, land reclamation, control of sulphur, emissions
   - 1.8 investigate well completion practices and production equipment used in frontier operations; e.g., arctic, off-shore
2. **explain applications of enhanced oil recovery technology in maximizing recovery rates for conventional oil or gas**
   - 2.1 identify physical factors that determine the portion of oil in a reservoir that can be produced naturally through primary recovery methods; e.g., density and viscosity of the oil, porosity and permeability of the rock, pressure in the reservoir
   - 2.2 explain applications of infill drilling to improve oil or gas recovery rates; e.g., directional wells
   - 2.3 explain secondary methods of enhanced oil recovery; e.g., water injection, natural gas reinjection, gas lift, beam pumps, electrical submersible pumps
   - 2.4 explain tertiary methods of enhanced oil recovery; e.g., carbon dioxide flooding, miscible flooding, steam injection, fire flooding, horizontal drilling
   - 2.5 identify social and economic factors that influence the life of an oil and/or gas well
   - 2.6 describe techniques used to estimate recoverable oil and gas reserves (proved reserve, probable reserve and established reserve)

2.7 describe future sources of oil and gas supplies; e.g., unrecovered oil in existing reservoirs, frontier production, oil sands, coalbed methane
2.8 consider factors that determine estimates of recoverability and producibility; e.g., reservoir characteristics, economic considerations, regulatory limitations

3. describe field gathering facilities and distribution systems used in the conventional oil or gas industry

3.1 describe well site and satellite facilities used for dehydration, separation, heating and measurement processes; e.g., surface and underground
3.2 describe different types of field storage facilities; e.g., pipeline systems, tankers and barges
3.3 examine and describe distribution networks used to move conventional oil or gas from the well site to market (or refinery); e.g., rail systems, trucking systems, tanker systems
3.4 illustrate the layout of a pipeline system used for transporting conventional oil or gas; e.g., gathering lines, trunk lines, gas transmission systems
3.5 explain the functions of pump stations, compressor stations and electronic inspection devices in moving oil or gas along transmission lines

4. demonstrate basic competencies

4.1 demonstrate fundamental skills to:
- 4.1.1 communicate
- 4.1.2 manage information
- 4.1.3 use numbers
- 4.1.4 think and solve problems

4.2 demonstrate personal management skills to:
- 4.2.1 demonstrate positive attitudes and behaviours
- 4.2.2 be responsible
- 4.2.3 be adaptable
- 4.2.4 learn continuously
- 4.2.5 work safely

4.3 demonstrate teamwork skills to:
- 4.3.1 work with others
- 4.3.2 participate in projects and tasks

5. create a transitional strategy to accommodate personal changes and build personal value

5.1 identify short-term and long-term goals
5.2 identify steps to achieve goals

COURSE PRS3030: NON-CONVENTIONAL HYDROCARBONS RECOVERY & PRODUCTION

Level: Advanced

Prerequisite: PRS2030: Non-conventional Hydrocarbons Exploration

Description: Students examine specific recovery and production techniques within the context of Alberta's oil sands, heavy oil or coal deposits.

Parameters: Access to industry involved in the recovery and production of non-conventional hydrocarbon resources.

Access to a science laboratory.

Outcomes: The student will:

1. **describe techniques used to recover a non-conventional hydrocarbon resource**
   - 1.1 describe infrastructures necessary in the recovery and production of a non-conventional hydrocarbon resource; e.g., extraction, processing, transportation and safety considerations such as first aid, clothing and equipment, government and industry regulations, lifting and hoisting techniques
   - 1.2 examine and describe techniques used to extract the hydrocarbon; e.g., surface mining (strip, open pit), underground mining (shaft, slope), in situ ("in place") techniques (steam injection, solvent injection, firefloods)
   - 1.3 describe surface and underground equipment used in resource extraction; e.g., heavy machinery (including excavators, scrapers, bulldozers and draglines); blasting, drilling and cutting equipment; augers, conveyor belts and trucks; hand tools and safety equipment
   - 1.4 identify factors that affect the recovery potential for heavy oil, oil sands or coalbed methane; e.g., nature and depth of the overburden, density and viscosity of oil, porosity and permeability of rock structures, economic viability
   - 1.5 investigate technologies used to process the hydrocarbon; e.g., separating, cleaning, upgrading
   - 1.6 explain environmental assessment and management practices conducted by industry throughout recovery and production operations; e.g., environmental standards, enforcement of safe operating procedures
   - 1.7 describe technological advances used to address environmental concerns throughout recovery and production; e.g., tailing ponds, sulphur emission, water drawdown
   - 1.8 describe basic reclamation activities undertaken by industry; e.g., recovery and production, area restoration, strip mine restoration
2. **describe field gathering facilities and distribution systems used in the oil sands, heavy oil or coal industries**
   - 2.1 describe recovery site and satellite facilities used for separation, cleaning and upgrading processes
   - 2.2 describe different types of field storage facilities
   - 2.3 examine and describe distribution networks used to move bitumen, heavy oil or coal from the recovery site to market (or refinery); e.g., pipeline systems, tankers and barges, rail and trucking systems
   - 2.4 identify and describe challenges associated with the gathering and transmission of bitumen and heavy oil, and technologies developed to assist in these processes

3. **explain current and emerging applications of technology in maximizing the recovery of heavy oil, bitumen or coalbed methane in Alberta**
   - 3.1 explain technologies used to maximize resource recovery; e.g., horizontal drilling, extraction and separation processes
   - 3.2 describe special drilling techniques, core description and geophysical logging for oil sands deposits
   - 3.3 research public and private agencies responsible for developing new technology to assist in the recovery of non-conventional hydrocarbon resources; e.g., Alberta Research Council, Alberta Oil Sands Technology and Research Authority
   - 3.4 explain the economic, social and environmental significance of Alberta's non-conventional hydrocarbon resources
4. **demonstrate basic competencies**
   - 4.1 demonstrate fundamental skills to:
     - 4.1.1 communicate
     - 4.1.2 manage information
     - 4.1.3 use numbers
     - 4.1.4 think and solve problems
   - 4.2 demonstrate personal management skills to:
     - 4.2.1 demonstrate positive attitudes and behaviours
     - 4.2.2 be responsible
     - 4.2.3 be adaptable
     - 4.2.4 learn continuously
     - 4.2.5 work safely
   - 4.3 demonstrate teamwork skills to:
     - 4.3.1 work with others
     - 4.3.2 participate in projects and tasks
5. **create a transitional strategy to accommodate personal changes and build personal value**
   - 5.1 identify short-term and long-term goals
   - 5.2 identify steps to achieve goals

COURSE PRS3040: METALS/NONMETALS RECOVERY & PRODUCTION

Level: Advanced

Prerequisite: PRS2040: Metals/Nonmetals Exploration

Description: Students examine specific recovery and production techniques within the context of a metallic and/or nonmetallic mineral deposit.

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. PRS2040 and PRS3040 include structural materials within the broader category of nonmetallic minerals.

Parameters: Access to industry involved in the recovery and production of metallic and/or nonmetallic minerals.

Access to a science laboratory.

Outcomes: The student will:

1. describe techniques used to recover metallic and nonmetallic commodities from mineral deposits

- 1.1 describe infrastructures necessary in the recovery of commodities from rock and mineral deposits; e.g., extraction, processing, transportation and safety considerations such as first aid, clothing and equipment, government and industry regulations, lifting and hoisting, techniques
- 1.2 examine and describe basic techniques used to extract metallic and nonmetallic mineral deposits; e.g., placer mining, surface mining, underground mining and other extraction methods (drilling, borehole mining)
- 1.3 describe surface and/or underground equipment used in resource extraction; e.g., heavy machinery (including excavators, scrapers, bulldozers and draglines); blasting, drilling and cutting equipment; augers, conveyor belts and trucks; hand tools and safety equipment
- 1.4 identify factors that affect the recovery potential for a mineral deposit; e.g., depth of overburden, size and nature of the deposit, economic viability, environmental impact
- 1.5 investigate technologies used to process a metallic, nonmetallic or structural mineral; e.g., crushing and screening, separating and dressing, cleaning and roasting, upgrading and smelting
- 1.6 explain environmental assessment and management practices conducted by industry throughout recovery and production operations; e.g., environmental standards, enforcement of safe operating procedures
- 1.7 describe technological advances used to address environmental concerns throughout recovery and production
- 1.8 describe basic reclamation activities undertaken by industry; e.g., recovery and production area restoration, strip mine restoration

2. describe field gathering facilities and distribution systems used in the mineral industry

- 2.1 describe recovery site and satellite facilities used for separation, cleaning and upgrading processes
- 2.2 describe different types of field storage facilities
- 2.3 examine and describe distribution networks used to move metallic or industrial minerals from recovery site to market (or refinery); e.g., tankers and barges, rail and trucking systems

3. explain current and emerging applications of technology in enhancing recovery methods for mineral deposits

- 3.1 explain applications of technology in enhanced recovery methods; e.g., drilling and blasting techniques, rock bolting and screening machines, video technology and remote control, innovations in separation technology
- 3.2 identify methods used for the exploration of "hidden" or "blind" deposits
- 3.3 describe techniques used to estimate recoverable mineral deposits in Alberta; e.g., computing techniques, assays, mathematical modelling
- 3.4 examine public and private agencies responsible for developing new technologies to assist in the recovery of Alberta's mineral resources; e.g., Alberta Research Council, National Research Council
- 3.5 explain the current and potential significance of Alberta's mineral resources

4. demonstrate basic competencies

- 4.1 demonstrate fundamental skills to:
  - 4.1.1 communicate
  - 4.1.2 manage information
  - 4.1.3 use numbers
  - 4.1.4 think and solve problems
- 4.2 demonstrate personal management skills to:
  - 4.2.1 demonstrate positive attitudes and behaviours
  - 4.2.2 be responsible
  - 4.2.3 be adaptable
  - 4.2.4 learn continuously
  - 4.2.5 work safely
- 4.3 demonstrate teamwork skills to:
  - 4.3.1 work with others
  - 4.3.2 participate in projects and tasks

5. create a transitional strategy to accommodate personal changes and build personal values

- 5.1 identify short-term and long-term goals
- 5.2 identify steps to achieve goals

COURSE PRS3060: PETROCHEMICALS

Level: Advanced

Prerequisite: PRS2060: Refining Hydrocarbons

Description: Students investigate the conversion of hydrocarbons into consumer products within a petrochemical industry.

Parameters: Access to a petrochemical industry.

Access to a science laboratory.

Outcomes: The student will:

1. **explain how petroleum molecules are sorted, broken apart and reassembled at petrochemical plants**
   - 1.1 describe and model petroleum molecules as strings and rings of carbon and hydrogen atoms; e.g., methane, paraffin
   - 1.2 describe basic fractionating processes used to sort petroleum molecules
   - 1.3 explain how petroleum molecules are broken apart, reassembled and blended through the processes of cracking, polymerization and isomerization
   - 1.4 address the role of temperature, pressure and catalysts in sorting and rearranging petroleum molecules
2. **describe technologies used to manufacture a petrochemical product**
   - 2.1 identify specific hydrocarbon feedstocks used in the manufacturing process
   - 2.2 describe techniques employed to sort, break apart, reassemble and/or blend petroleum molecules
   - 2.3 research the conversion of a hydrocarbon into a petrochemical product within one of Canada's petrochemical industries (such as plastic, polyethylene, detergent or fertilizer); e.g., fractionating, cracking, polymerization, isomerization
   - 2.4 explain applications of electronic equipment and computer technology in monitoring and controlling manufacturing operations
   - 2.5 describe storage facilities and distribution systems within the industry and their impacts on industry location and product costs
   - 2.6 describe and illustrate the path of a hydrocarbon from recovery site to finished product
   - 2.7 explain environmental assessment and management practices conducted by industry throughout manufacturing operations; e.g., environmental standards and the enforcement of safe operating procedures throughout the manufacturing operations
   - 2.8 describe industry initiatives that respond to environmental concerns, that address occupational health and safety requirements, and in re-refining and reprocessing to ensure a life cycle approach to chemicals management; e.g., waste treatment, emission control, odour scrubbers, noise suppressants, water purification
3. **identify consumer and industrial products made available through petrochemical processes**
   - 3.1 identify and describe important petroleum feedstocks used in the petrochemical industry; e.g., crude oil, natural gas, ethane, propane, butane, naphtha gas oil
   - 3.2 identify the primary groups of petrochemicals obtained from petroleum feedstocks and subsequently processed into intermediate and finished products; e.g., methanol, benzene, toluene and xylene, butadiene and butylene, propylene, ethylene

3.3 identify and describe intermediate and finished products that are derived from petrochemicals; e.g., plastics, synthetic clothing fibres, medicines, paints, detergents, fertilizers and pesticides
3.4 identify and describe major industries that consume Canada's petrochemical products; e.g., forestry, transportation, textiles, electronics, cosmetics, pharmaceuticals and agriculture
3.5 describe the social, economic and environmental significance of Canada's petrochemical industries

4. demonstrate basic competencies

4.1 demonstrate fundamental skills to:
- 4.1.1 communicate
- 4.1.2 manage information
- 4.1.3 use numbers
- 4.1.4 think and solve problems

4.2 demonstrate personal management skills to:
- 4.2.1 demonstrate positive attitudes and behaviours
- 4.2.2 be responsible
- 4.2.3 be adaptable
- 4.2.4 learn continuously
- 4.2.5 work safely

4.3 demonstrate teamwork skills to:
- 4.3.1 work with others
- 4.3.2 participate in projects and tasks

5. create a transitional strategy to accommodate personal changes and build personal values

5.1 identify short-term and long-term goals
5.2 identify steps to achieve goals

COURSE PRS3070: INDUSTRIAL MATERIALS

Level: Advanced

Prerequisite: PRS2070: Refining Rocks & Minerals

Description: Students investigate technologies used to convert petroleum and mineral resources into industrial (stock) materials used in secondary manufacturing processes.

Parameters: Access to a primary manufacturing industry.

Access to a science, construction or fabrication laboratory.

Outcomes: The student will:

1. **describe the relationships between the molecular structure, properties and applications of an industrial (stock) material**
   - 1.1 describe and model the molecular structure of a metallic, polymeric, ceramic and composite material; e.g., atoms and molecules, molecular arrangement, attractions and connections
   - 1.2 determine the properties of an industrial (stock) material through investigation and/or observation; e.g., mechanical (strength, elasticity and plasticity, malleability and ductility, hardness), chemical and thermal (conductivity, melting and freezing points, combustibility, rate of expansion), electrical and magnetic (conductivity, resistivity, permeability), optical (opacity, reflectivity, colour)
   - 1.3 relate the properties of an industrial (stock) material to its molecular structure
   - 1.4 explain how the properties of an industrial (stock) material determine its applications in product design and secondary manufacturing processes
2. **describe industrial (stock) materials produced through primary manufacturing processes**
   - 2.1 describe primary manufacturing and the major categories of nonrenewable resources (raw materials) used in primary manufacturing; e.g., petroleum, natural gas, metallic ores, nonmetallic ores
   - 2.2 identify and describe major types of industrial (stock) materials produced through primary manufacturing processes; e.g., metallic (ferrous, nonferrous), structural (sand, gravel, crushed stone), polymeric (thermoplastic, thermoset), ceramic (clay-based, refractory, glass, abrasive), composite (layered, fibre-reinforced, particle)
   - 2.3 describe standard forms for each type of industrial (stock) material; e.g., plate, bar and rod; sheet, roll and film; pellet and powder
   - 2.4 describe major industries that consume stock materials produced in Canada; e.g., secondary manufacturing, construction, consumer and domestic use
3. **explain technologies used to manufacture a metallic, polymeric, ceramic or composite material**
   - 3.1 identify specific mineral ores and/or petroleum feedstocks and describe techniques employed to manufacture the stock material; e.g., thermal, chemical, mechanical, electrical
   - 3.2 describe and illustrate the major stages in the manufacturing process, including inputs, processes, outputs and feedback systems
   - 3.3 examine and describe the conversion of a nonrenewable resource into an industrial (stock) material within one of Canada's primary manufacturing industries
   - 3.4 explain applications of electronic equipment and computer technology in monitoring and controlling manufacturing operations

3.5 describe storage facilities and distribution systems within the industry and their impacts on industry location and product costs
3.6 explain environmental assessment and management practices conducted by industry during the manufacturing operations; e.g., environmental standards and the enforcement of safe operating procedures
3.7 describe industry initiatives that respond to environmental concerns (waste treatment, emission control) that address occupational health and safety requirements (odour scrubbers, noise suppressants water purification) and in reprocessing and recycling to ensure a life-cycle approach to chemicals management

4. demonstrate basic competencies

4.1 demonstrate fundamental skills to:
- 4.1.1 communicate
- 4.1.2 manage information
- 4.1.3 use numbers
- 4.1.4 think and solve problems

4.2 demonstrate personal management skills to:
- 4.2.1 demonstrate positive attitudes and behaviours
- 4.2.2 be responsible
- 4.2.3 be adaptable
- 4.2.4 learn continuously
- 4.2.5 work safely

4.3 demonstrate teamwork skills to:
- 4.3.1 work with others
- 4.3.2 participate in projects and tasks

5. create a transitional strategy to accommodate personal changes and build personal values

5.1 identify short-term and long-term goals
5.2 identify steps to achieve goals

COURSE PRS3910: PRS PROJECT D

Level: Advanced

Prerequisite: None

Description: Students develop project design and management skills to extend and enhance competencies and skills in other CTS courses through contexts that are personally relevant.

Parameters: Advanced project courses must connect with a minimum of two CTS courses, one of which must be at the advanced level and be in the same occupational area as the project course. The other CTS course(s) must be at least at the intermediate level from any occupational area.

Project courses cannot be connected to other project courses or practicum courses.

All projects and/or performances, whether teacher- or student-led, must include a course outline or student proposal.

Outcomes:

The teacher/student will:

1. **identify the connection between this project course and two or more CTS courses**
   - 1.1 identify the outcome(s) from each identified CTS course that support the project and/or performance deliverables
   - 1.2 explain how these outcomes are being connected to the project and/or performance deliverables
2. **propose the project and/or performance**
   - 2.1 identify the project and/or performance by:
     - 2.1.1 preparing a plan
     - 2.1.2 clarifying the purposes
     - 2.1.3 defining the deliverables
     - 2.1.4 specifying time lines
     - 2.1.5 explaining terminology, tools and processes
     - 2.1.6 defining resources; e.g., materials, costs, staffing
   - 2.2 identify and comply with all related health and safety standards
   - 2.3 define assessment standards (indicators for success)
   - 2.4 present the proposal and obtain necessary approvals

The student will:

3. **meet goals as defined within the plan**
   - 3.1 complete the project and/or performance as outlined
   - 3.2 monitor the project and/or performance and make necessary adjustments
   - 3.3 present the project and/or performance, indicating the:
     - 3.3.1 outcomes attained
     - 3.3.2 relationship of outcomes to goals originally set

3.4 evaluate the project and/or performance, indicating the:
    3.4.1 processes and strategies used
    3.4.2 recommendations on how the project and/or performance could have been improved

4. demonstrate basic competencies

4.1 demonstrate fundamental skills to:
    4.1.1 communicate
    4.1.2 manage information
    4.1.3 use numbers
    4.1.4 think and solve problems
4.2 demonstrate personal management skills to:
    4.2.1 demonstrate positive attitudes and behaviours
    4.2.2 be responsible
    4.2.3 be adaptable
    4.2.4 learn continuously
    4.2.5 work safely
4.3 demonstrate teamwork skills to:
    4.3.1 work with others
    4.3.2 participate in projects and tasks

5. create a transitional strategy to accommodate personal changes and build personal values

5.1 identify short-term and long-term goals
5.2 identify steps to achieve goals

COURSE PRS3920: PRS PROJECT E

Level: Advanced

Prerequisite: None

Description: Students develop project design and management skills to extend and enhance competencies and skills in other CTS courses through contexts that are personally relevant.

Parameters: Advanced project courses must connect with a minimum of two CTS courses, one of which must be at the advanced level and be in the same occupational area as the project course. The other CTS course(s) must be at least at the intermediate level from any occupational area.

Project courses cannot be connected to other project courses or practicum courses.

All projects and/or performances, whether teacher- or student-led, must include a course outline or student proposal.

Outcomes:

The teacher/student will:

1. **identify the connection between this project course and two or more CTS courses**
   - 1.1 identify the outcome(s) from each identified CTS course that support the project and/or performance deliverables
   - 1.2 explain how these outcomes are being connected to the project and/or performance deliverables
2. **propose the project and/or performance**
   - 2.1 identify the project and/or performance by:
     - 2.1.1 preparing a plan
     - 2.1.2 clarifying the purposes
     - 2.1.3 defining the deliverables
     - 2.1.4 specifying time lines
     - 2.1.5 explaining terminology, tools and processes
     - 2.1.6 defining resources; e.g., materials, costs, staffing
   - 2.2 identify and comply with all related health and safety standards
   - 2.3 define assessment standards (indicators for success)
   - 2.4 present the proposal and obtain necessary approvals

The student will:

3. **meet goals as defined within the plan**
   - 3.1 complete the project and/or performance as outlined
   - 3.2 monitor the project and/or performance and make necessary adjustments
   - 3.3 present the project and/or performance, indicating the:
     - 3.3.1 outcomes attained
     - 3.3.2 relationship of outcomes to goals originally set

3.4 evaluate the project and/or performance, indicating the:
    3.4.1 processes and strategies used
    3.4.2 recommendations on how the project and/or performance could have been improved

4. demonstrate basic competencies

4.1 demonstrate fundamental skills to:
    4.1.1 communicate
    4.1.2 manage information
    4.1.3 use numbers
    4.1.4 think and solve problems
4.2 demonstrate personal management skills to:
    4.2.1 demonstrate positive attitudes and behaviours
    4.2.2 be responsible
    4.2.3 be adaptable
    4.2.4 learn continuously
    4.2.5 work safely
4.3 demonstrate teamwork skills to:
    4.3.1 work with others
    4.3.2 participate in projects and tasks

5. create a transitional strategy to accommodate personal changes and build personal values

5.1 identify short-term and long-term goals
5.2 identify steps to achieve goals

COURSE PRS3950: PRS ADVANCED PRACTICUM

Level: Advanced

Prerequisite: None

Description: Students apply prior learning and demonstrate the attitudes, skills and knowledge required by an external organization to achieve a credential/credentials or an articulation.

Parameters: This practicum course, which may be delivered on- or off-campus, should be accessed only by students continuing to work toward attaining a recognized credential/credentials or an articulation offered by an external organization. This course must be connected to at least one CTS course from the same occupational area and cannot be used in conjunction with any introductory (1XXX) level course. A practicum course cannot be delivered as a stand-alone course, cannot be combined with a CTS project course and cannot be used in conjunction with the Registered Apprenticeship Program or the Green Certificate Program.

Outcomes: The student will:

1. perform assigned tasks and responsibilities, as required by the organization granting the credential(s) or articulation

- 1.1 identify regulations and regulatory bodies related to the credential(s) or articulation
- 1.2 describe personal roles and responsibilities, including:
  - 1.2.1 key responsibilities
  - 1.2.2 support functions/responsibilities/expectations
  - 1.2.3 code of ethics and/or conduct
- 1.3 describe personal work responsibilities and categorize them as:
  - 1.3.1 routine tasks; e.g., daily, weekly, monthly, yearly
  - 1.3.2 non-routine tasks; e.g., emergencies
  - 1.3.3 tasks requiring personal judgement
  - 1.3.4 tasks requiring approval of a supervisor
- 1.4 demonstrate basic employability skills and perform assigned tasks and responsibilities related to the credential(s) or articulation

2. analyze personal performance in relation to established standards

- 2.1 evaluate application of the attitudes, skills and knowledge developed in related CTS courses
- 2.2 evaluate standards of performance in terms of:
  - 2.2.1 quality of work
  - 2.2.2 quantity of work
- 2.3 evaluate adherence to workplace legislation related to health and safety
- 2.4 evaluate the performance requirements of an individual who is trained, experienced and employed in a related occupation in terms of:
  - 2.4.1 training and certification
  - 2.4.2 interpersonal skills
  - 2.4.3 technical skills
  - 2.4.4 ethics

3. demonstrate basic competencies

3.1 demonstrate fundamental skills to:

- 3.1.1 communicate
- 3.1.2 manage information
- 3.1.3 use numbers
- 3.1.4 think and solve problems

3.2 demonstrate personal management skills to:

- 3.2.1 demonstrate positive attitudes and behaviours
- 3.2.2 be responsible
- 3.2.3 be adaptable
- 3.2.4 learn continuously
- 3.2.5 work safely

3.3 demonstrate teamwork skills to:

- 3.3.1 work with others
- 3.3.2 participate in projects and tasks

4. create a transitional strategy to accommodate personal changes and build personal values

4.1 identify short-term and long-term goals

4.2 identify steps to achieve goals