
Mechanical and Automotive 10, A20, B20, A30, B30 Curriculum Guide A Practical and Applied Art

**Saskatchewan Education
2001
ISBN: 1-894116-90-9**

Acknowledgements

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Saskatchewan Education wishes to thank many others who contributed to the development of these guidelines:

- Dean Lucyk, contracted/seconded developer/writer, Regina RCSSD #81
- Ron Leontowicz, SIAST Kelsey Campus
- the PAA Program Team
- field test/pilot teachers
- other field personnel.

Saskatchewan Education acknowledges the Canadian Automobile Repair and Service (CARS) National Curriculum Standard project for permission to use and adapt ideas.

This document was completed under the direction of the Science and Technology Unit, Curriculum and Instruction Branch, Saskatchewan Education.

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Introduction

Within Core Curriculum, the Practical and Applied Arts (PAA) is a major area of study that incorporates five traditional areas of Business Education, Computer Education, Home Economics, Industrial Arts and Work Experience Education. Saskatchewan Education, its educational partners, and other stakeholders have collaborated to complete the PAA curriculum renewal. Some PAA curriculum guidelines have been updated; some components have been integrated, adapted, or deleted; some Locally Developed Courses of study have been elevated to provincial status; and some new guidelines have been developed.

A companion *Practical and Applied Arts Handbook* provides background on Core Curriculum philosophy, perspectives, and initiatives. The Handbook articulates a renewed set of goals for PAA. It presents additional information about the PAA area of study, including guidelines about work study and related transition-to-work dimensions. In addition, the *Practical and Applied Arts Information Bulletin* provides direction for administrators and others regarding the implementation of PAA courses. Lists of recommended resources for all guidelines will be compiled into a PAA Bibliography with periodic updates. An initial list of resources for Mechanical and Automotive 10, A20, B20, A30, B30 accompanies the curriculum guide.

Philosophy and Rationale

Automobiles are one of the most significant inventions. They affect the lives of virtually everyone, either directly or indirectly. Automobiles transport people and/or goods that are needed for society to function. Many people engage in automotive service either personally or professionally. This curriculum guideline provides students with the knowledge, skills, and practice to participate in automotive service in either a personal or professional capacity. Learning automotive skills at the Secondary Level may provide students with an opportunity for experience and entry level employment in the private sector. Time credit may be granted if students register as apprentices following high school completion. There may also be an opportunity for advanced placement in a post-secondary training program.

The curriculum is designed in a modular format that provides flexibility in creating a course that meets the needs of the students. In schools where up-to-date equipment and technical training is not available, it is recommended that partnerships with local industries be established to provide a learning environment reflective of current skills and training.

This curriculum is an adaptation of the Canadian Automobile Repair and Service (CARS) National Curriculum Standard. The CARS organization is a group of representatives from the major foreign, and independent automotive manufacturers in collaboration with a separate educational committee. The purpose of the group was to create a national standard for automotive service repair and to promote the trade. All directors of apprenticeship in Canada have approved the CARS curriculum.

In addition, this curriculum has been formally articulated with the Saskatchewan Apprenticeship and Trade Certification Commission curriculum to meet the Level I standards. See Appendix A and B.

Aim, Goals, and Foundational Objectives

Aim

The aim of *Mechanical and Automotive Studies 10, A20, B20, A30, B30* is to provide students with an understanding of how different automotive systems operate and to provide students with a set of skills that enables them to perform introductory service procedures.

Goals

Awareness: To provide students with an awareness of the skills that are necessary to perform tasks within the industry.

Appreciation: To provide students with a knowledge base that will enable them to be more aware of maintenance and service procedures that automobile owners should follow.

Business Environment: To develop an understanding of the policies and procedures that are practiced in the automotive service industry.

Foundational Objectives

Foundational objectives are the major, general statements that guide what each student is expected to achieve in the modules of the PAA curriculum guide. Foundational objectives indicate the most important knowledge, skills, attitudes/values, and abilities for a student to learn in a subject. Both the Foundational Objectives for Mechanical and Automotive and the Common Essential Learnings (CELs) Foundational Objectives to be emphasized are stated in this document. Some of these statements may be repeated or enhanced in different modules for emphasis. The Foundational Objectives of the Core Modules of the Mechanical and Automotive Studies curriculum include:

- To identify health and safety hazards so that the potential for injury and damage to equipment, vehicles, and the environment is minimized.
- To identify, wear, adjust and maintain personal protective equipment such as eye, ear, hand and foot protectors so that the wearer is optimally protected.
- To develop general understanding of the function and operation of automotive systems: power plant (engine), drive train, steering, suspension, electrical, body, and brakes.
- To develop knowledge of automotive service industry practices and procedures.
- To demonstrate safe working practices and procedures for the automotive service industry.
- To demonstrate proper use of the tools and equipment utilized in the automotive service industry.
- To develop workplace skills, knowledge, and attitudes in the automotive service industry that may lead to successful employment.
- To create an awareness of the need for regular maintenance of an automobile through demonstration and practice.
- To provide students with experience in the automotive service industry that will enable them to make informed career decisions.
- To foster employability skills related to the automotive service industry.

Common Essential Learnings (CELs)

The incorporation of the Common Essential Learnings (CELs) into the instruction and assessment of the Practical and Applied Arts (PAA) curriculum offers many opportunities to develop students' knowledge, skills, and abilities. The purpose of the CELs is to assist students with learning concepts, skills, and attitudes necessary to make transitions to career, work, and adult life.

The CELs establish a link between the Transition-to-Work dimensions and Practical and Applied Arts curriculum content. The Transition-to-Work dimensions found in the Handbook and embedded in the PAA curricula are: apprenticeship, career exploration/development, community project(s), employability skills, entrepreneurial skills, occupational skilling, personal accountability, processing of information, teamwork, and work study/experience.

Throughout the PAA curricula, the CELs objectives are stated explicitly at the beginning of each module and are coded in this document, as follows:

COM	=	Communication
NUM	=	Numeracy
CCT	=	Critical and Creative Thinking
TL	=	Technological Literacy
PSVS	=	Personal and Social Values and Skills
IL	=	Independent Learning

Although certain CELs are to be emphasized in each module, as indicated by the CELs Foundational Objectives, other interrelated CELs may be addressed at the teacher's discretion.

Course Components and Considerations

The Mechanical and Automotive Guide may be offered in a variety of learning environments that range from a classroom in a school to an industry work site. It provides a balance between school-based and work-based learning allowing students to keep open options for post-secondary education, training, or employment. This curriculum is part of the Practical and Applied Arts that are specified electives at the Secondary Level in Saskatchewan.

The *Mechanical and Automotive 10, A20, B20, A30, B30 Curriculum Guide* is designed to create an awareness of the automotive service industry and develop introductory service skills. The guide contains sufficient modules for five 100 hours courses with optional work study modules.

If the school division wishes to have students eventually challenge the Trade/Apprenticeship Level I exam, the guidelines outlined in Appendix A and B must be followed.

The decision to offer the Mechanical and Automotive courses is a local one. Facilities, equipment, and personnel will determine the ability of a school to offer these courses. Some modules require prior knowledge and prerequisites.

Note:

Mechanical and Automotive 10 **is** a prerequisite for A20, B20, A30 and B30.

The 20 level courses are **not** a prerequisite for the 30 level courses nor are the A courses a prerequisite for the B courses.

Work Study Component

This module permits the student to apply school-based learning to workplace settings in the community. Students are provided with an opportunity to experience the optional work study component through appropriate placements. If time credit in the workplace is desired, it is required that the student work with a journey person in the trade. For more information regarding time credit, consult *High School to Apprenticeship: Link to the Future* (1999). Module 32: Work Study Preparation and Follow-up Activities must be covered prior to and following the work study module. *The Practical and Applied Arts Handbook* has detailed information in the "Work Study Guidelines". Students who have previously taken a work study module may cover content developed by Saskatchewan Labour found in the *Career and Work Exploration Curriculum Guide* and the PAA Handbook. These content references include:

- Labour Standards
- Occupational Health and Safety Act, and
- Workplace Hazardous Materials Information System (WHMIS).

Creating Partnerships for Work Study

Partnerships are important to the success of the work study component. There are three distinct partners that play an important role: the industry/business, the school, and the student.

Personal contact is the best approach to building partnerships. One should begin by making a presentation to colleagues within the school, to the student body, to school board members, to parents, and to local businesses. It is important to outline the curriculum and the benefits and responsibilities for each of the partners.

See the modules outlined in the curriculum and the “Work Study Guidelines” in the *PAA Handbook* for further information on work study.

Portfolios

A personal career portfolio is a valuable organizer of student projects and assignments. It encourages students to collect examples of their work as they progress through the various activities, labs, and projects. Selecting particular items to include in a portfolio encourages students to reflect on what they have learned or accomplished and what they have yet to learn. Portfolio items may include: journal notes, drafts, photographs, audio or video tapes, computer discs, sketches and drawings, etc. Portfolios may be used for peer, teacher, self- assessment, and as a format to present selected works to parents, post-secondary institutions, or potential employers. In addition, the portfolio can demonstrate the link between home, school and community in the student’s education. Each student should have a portfolio representing his or her work during the course.

The portfolio helps students:

- reflect on personal growth and accomplishment
- see links between home, school and community education and activities
- collect materials to prepare applications for post-secondary education and scholarship program entrance
- collect materials to prepare for employment applications
- focus on career planning.

The portfolio helps teachers:

- provide a framework for independent learning strategies for the student
- communicate student learning from one school year to another in a specific area of study
- identify career planning needs for students
- assess and evaluate the student’s progress and achievement in a course of study.

The portfolio helps post-secondary institutions:

- determine suitable candidates for awards and scholarships
- evaluate candidates for program entrance
- evaluate prior learning for program placement.

The portfolio helps the community:

- reflect on the involvement in a student’s education and the support offered to learners
- demonstrate the link between the home, school, and community in education.

The portfolio helps potential employers:

- identify employable skills desired in future employees
- provide evidence of knowledge and skill development of potential employees.

Working Portfolio

Students collect work over time in a working folder. Each student should also keep a journal of observations, critiques, ideas, and reflections as part of his or her working portfolio. Items in this portfolio

may be used for the purpose of reflection, for ongoing and summative evaluations, peer, teacher, and self evaluations, for documenting skill development and mastery.

Working portfolios may be used for purposes of conferencing between student and teacher, teacher and parent, teacher and teacher, or student and student. When a teacher examines a student's portfolio in order to make a decision regarding student progress, the information it contains may become documented evidence for the evaluation.

A daily journal may also become a part of a working portfolio as a means of tracking the student's use of time and to record progress on ideas that are being developed. This will provide the student with a focus for self-directed or independent learning as well as an anecdotal record for part of the course evaluation.

Presentation Portfolio

To compile a presentation portfolio, students should select items from their working portfolio. The presentation portfolio should cover the range of students' experiences and should display their best efforts. The preparation of a presentation portfolio can be an assessment strategy. It is strongly suggested that students at the 30 level prepare a presentation portfolio suitable for submission to potential employers or post-secondary institutions.

Through collecting, selecting and reflecting, students are able to compile presentation portfolios that display their best collection of work.

Extended Study Modules

The extended study module is designed to provide schools with an opportunity to meet current and future demands that are not addressed by current modules in the renewed PAA curriculum.

The flexibility of this module allows a school/school division to design one new module per credit to complement or extend the study of existing pure core modules and optional modules. The extended study module is designed to extend the content of the pure courses and to offer survey course modules beyond the scope of the selection of PAA modules.

The list of possibilities for topics of study or projects for the extended study module approach is as varied as the imagination of those involved in using the module. These optional extended study module guidelines, found in the PAA Handbook, should be used to strengthen the knowledge, skills, and processes advocated in the Practical and Applied Arts curriculum in which the extended study module is used.

It is recommended that a summary of any extended study module be sent to the Regional Superintendent of Curriculum and Instruction to establish a resource bank of module topics.

For more information on the extended study module, refer to the Practical and Applied Arts Handbook.

Resources

To support the principle of Resource-based Learning, a variety of instructional resources have been evaluated and recommended for the teaching and learning of Mechanical and Automotive 10, A20, B20, A30, B30. See the enclosed *Mechanical and Automotive 10, A20, B20, A30, B30: An Initial List of Implementation Materials* for a list of annotated resources. Teachers should also consult the comprehensive PAA bibliography. The annual *Learning Resource Materials Update* can also provide information about new materials evaluated since the curriculum was printed.

To order materials, except videos, teachers should also consult the department's Learning Resources Distribution Centre (LRDC) catalogue. An on-line ordering service is available at lrdc.sasked.gov.sk.ca.

The on-line version of this Guide is accessible at www.sasked.gov.sk.ca/docs/paa.html. It will be "Evergreened", as appropriate.

Assessment and Evaluation

Student assessment and evaluation is an important part of teaching as it allows the teacher to plan and adapt instruction to meet the specific needs of each student. It also allows the teacher to discuss the current successes and challenges with students and report progress to the parent or guardian. It is important that teachers use a variety of assessment and evaluation strategies to evaluate student progress. Additional information on evaluation of student achievement can be found in the Saskatchewan Education documents *Student Evaluation: A Teacher Handbook*, 1991, and *Curriculum Evaluation in Saskatchewan*, 1991.

Assessment and evaluation throughout the Mechanical and Automotive 10, A20, B20, A30, B30 courses should be based on the learning objectives that are outlined in the curriculum. It is important to use a variety of assessment techniques to ensure accurate student evaluation. The design of an evaluation matrix/scheme should reflect the amount of time devoted to each of the modules taught in the course

Here is a sample evaluation scheme.

Portfolios	10%
Tests (written)	10%
Project work	25%
Information Research	10%
Homework and Assignments	10%
Classroom Presentations	10%
Work Study	25%

If work study was not offered, some time could be used for project development involving larger projects that might include the optional extended study module available in this guide.

For more information about student evaluation refer to the *Practical and Applied Arts Handbook* (Saskatchewan Education, Draft 2001) or *Student Evaluation: A Staff Development Handbook* (Saskatchewan Professional Development Unit, 1999).

For information about program evaluation refer to the *Saskatchewan School-Based Program Evaluation Resource Book* (1989).

For information about curriculum evaluation refer to *Curriculum Evaluation in Saskatchewan* (Saskatchewan Education, 1991).

Module Overview

Module Code	Module	Suggested Time (hours)
MECH01	Module 1: Introduction to the Automobile (Optional)	10-20
MECH02	Module 2: Automotive Processes (Core)	4-10
MECH03	Module 3: Safety Equipment, Hazardous Materials, and Housekeeping Skills (Core)	4-12
MECH04	Module 4: Information Storage (Core)	3-5
MECH05	Module 5: Hand and Power Tools (Core)	15-25
MECH06	Module 6: Fasteners and Gaskets (Core)	5-10
MECH07	Module 7: Cleaning Techniques (Core)	1-4
MECH08	Module 8: Oxy-Acetylene Welding (Optional)	6-10
MECH09	Module 9: Storage Batteries (Core)	4-8
MECH10	Module 10: Oils and Lubricants (Core)	5-10
MECH11	Module 11: Headlights (Core)	2-6
MECH12	Module 12: Tires (Core)	5-10
MECH13	Module 13: Minor Body Service (Core)	15-20
MECH14	Module 14: Fundamentals of Electricity and Electronics (Core)	10-15
MECH15	Module 15: Cooling Fans (Core)	3-5
MECH16	Module 16: Exhaust Systems (Core)	3-5
MECH17	Module 17: Radiators and Coolants (Optional)	15-25
MECH18	Module 18: Pulleys and Belts (Optional)	5-10
MECH19A	Module 19A: Wheel Bearings (Core)	5-10
MECH19B	Module 19B: Brake Systems (Core)	20-25
MECH19C	Module 19C: Wheel Cylinders, Calipers and Master Cylinders (Core)	5-10
MECH19D	Module 19D: Parking Brake Systems (Core)	5-10
MECH20	Module 20: Suspension Control Mechanisms and Steering Linkages (Optional)	10-15
MECH21	Module 21: Alternators (Optional)	10-20
MECH22	Module 22: Starting Systems (Optional)	10-20
MECH23A	Module 23A: Small Engines (Optional)	10-15
MECH23B	Module 23B: Multi-cylinder Engines (Core)	40-50
MECH24	Module 24: Universal Joints and Driveshafts (Core)	15-25
MECH25	Module 25: Clutches and Release Mechanisms (Core)	15-25
MECH26	Module 26: Manual Transmissions (Core)	15-25
MECH27	Module 27: Transfer Case Lubricants, Removal and Installation (Core)	15-25
MECH28	Module 28: Automatic Transmissions (Core)	15-25
MECH29	Module 29: Ignition Systems (Optional)	5-8
MECH30	Module 30: Fuel Systems (Optional)	40-50
MECH31	Module 31: Seat Belt Systems (Optional)	2-4
MECH32A, B, C, D	Module 32 A, B, C, D: Work Study Preparation and Follow-up Activities (Optional)	5-10
MECH33A, B, C, D	Module 33A, B, C, D: Work Study (Optional)	25-50
MECH34	Module 34: Career Opportunities (Core)	2-5
MECH88	Module 88: Apprenticeship in Saskatchewan (Optional)	2-5
MECH99A, B, C, D, E	Module 99A, B, C, D, E: Extended Study (Optional)	5-20

Suggested Course Configuration

Module Code	Modules	Suggested Time (hours)
	Automotive and Mechanical 10 - Introductory	
MECH01	Module 1: Introduction to the Automobile (Optional)	10-20
MECH02	Module 2: Automotive Processes (Core)	4-10
MECH03	Module 3: Safety Equipment, Hazardous Materials, and Housekeeping Skills (Core)	4-12
MECH04	Module 4: Information Storage (Core)	3-5
MECH05	Module 5: Hand and Power Tools (Core)	15-25
MECH06	Module 6: Fasteners and Gaskets (Core)	5-10
MECH07	Module 7: Cleaning Techniques (Core)	1-4
MECH10	Module 10: Oils and Lubricants (Core)	5-10
MECH12	Module 12: Tires (Core)	5-10
MECH23A	Module 23A: Small Engines (Optional)	10-15
MECH 34	Module 34: Career Opportunities (Core)	2-5
MECH99	Module 99: Extended Study (Optional)	5-20
	Minimum	100hrs
	Automotive and Mechanical A20 - Intermediate	
MECH19A	Module 19A: Wheel Bearings (Core)	5-10
MECH19B	Module 19B: Brake Systems (Core)	20-25
MECH19C	Module 19C: Wheel Cylinders, Calipers and Master Cylinders (Core)	5-10
MECH19D	Module 19D: Parking Brake Systems (Core)	5-10
MECH23B	Module 23B: Multi-cylinder Engines (Core)	40-50
MECH32	Module 32: Work Study Preparation and Follow-up Activities (Optional)	5-10
MECH33	Module 33: Work Study (Optional)	25-50
MECH99	Module 99: Extended Study (Optional)	5-20
	Minimum	100hrs
	Automotive and Mechanical B20 - Intermediate	
MECH08	Module 8: Oxy-Acetylene Welding (Optional)	6-10
MECH09	Module 9: Storage Batteries (Core)	4-8
MECH11	Module 11: Headlights (Core)	2-6
MECH13	Module 13: Minor Body Service (Core)	15-20
MECH15	Module 15: Cooling Fans (Core)	3-5
MECH16	Module 16: Exhaust Systems (Core)	3-5
MECH17	Module 17: Radiators and Coolants (Optional)	15-25
MECH18	Module 18: Pulley and Belts (Optional)	5-10
MECH20	Module 20: Suspension Control Mechanisms and Steering Linkages (Optional)	10-15
MECH31	Module 31: Seat Belt Systems (Optional)	2-4
MECH32	Module 32: Work Study Preparation and Follow-up Activities (Optional)	5-10
MECH33	Module 33: Work Study (Optional)	25-50
MECH99	Module 99: Extended Study (Optional)	5-20
	Minimum	100hrs

	Automotive and Mechanical A30 - Advanced	
MECH14	Module 14: Fundamentals of Electricity and Electronics (Core)	10-15
MECH21	Module 21: Alternators (Optional)	10-20
MECH22	Module 22: Starting Systems (Optional)	10-20
MECH29	Module 29: Ignition Systems (Optional)	5-8
MECH30	Module 30: Fuel Systems (Optional)	40-50
MECH32	Module 32: Work Study Preparation and Follow-up Activities (Optional)	5-10
MECH33	Module 33: Work Study (Optional)	25-50
MECH99	Module 99: Extended Study (Optional)	5-20
	Minimum	100 hrs
	Automotive and Mechanical B30 - Advanced	
MECH24	Module 24: Universal Joints and Driveshafts (Core)	15-25
MECH25	Module 25: Clutches and Release Mechanisms (Core)	15-25
MECH26	Module 26: Manual Transmissions (Core)	15-25
MECH27	Module 27: Transfer Case Lubricants, Removal and Installation (Core)	15-25
MECH28	Module 28: Automatic Transmissions (Core)	15-25
MECH 32	Module 32: Work Study Preparation and Follow-up Activities (Optional)	5-10
MECH 33	Module 33: Work Study (Optional)	25-50
MECH99	Module 99: Extended Study (Optional)	5-20
	Minimum	100 hrs

Core and Optional Modules

Module 1: Introduction to the Automobile (Optional)

Suggested time: 10-20 hours

Level: Introductory

Prerequisite: None

Foundational Objectives

- To develop general understanding of the function and operation of automotive systems: power plant (engine), drive train, steering, suspension, electrical, body, and brakes.
- To develop general knowledge of the automotive service industry practices and procedures.

Common Essential Learnings Foundational Objectives

- To enable students to understand and use the terminology associated with the repair procedures of the automotive service industry. (COM)
- To develop students' abilities to access and apply knowledge to automotive services. (CCT)

Note: Other CELs may be emphasized here.

Learning Objectives		Notes
1.1	To explore the history of the automobile. (COM)	<p>Students may create a time line with pictures or diagrams of different inventions integrated into the automobile.</p> <p>Have students discuss methods of transportation before the automobile was developed:</p> <ul style="list-style-type: none">• animal• steam• wind <p>Have students discuss the evolution from early vehicle development to the current automotive technology.</p> <p>Discuss the future vehicle development; students may become involved in research on alternatively powered vehicles:</p> <ul style="list-style-type: none">• hydrogen• electric• solar• fuel cell• gasoline/electrical hybrid

Learning Objectives

Notes

- | | | |
|-----|---|--|
| 1.2 | To identify and explain the major systems of the automobile. | <p>A combination of classroom activities and shop displays provides students with both the theoretical and practical experience to gain a better understanding of the major systems.</p> <p>Refer to modules dealing with auto sub-section systems; e.g., to change a tire refer to the module on tires.</p> <ul style="list-style-type: none">• power plant• power train• suspension• steering• braking• electrical• body• emissions |
| 1.3 | To identify and explain the function of the sub-systems of the power plant. (COM) | <p>A video series dealing with small engines could be used here.</p> <ul style="list-style-type: none">• fuel• ignition• lubrication• cooling• exhaust• emissions |
| 1.4 | To explain the procedures for inspecting and testing new and used vehicles before purchase. (COM) | <p>A technician may be invited as a guest speaker.</p> <p>Students may visit local service stations and question technicians as to what to inspect and test on a used car.</p> <p>Students may use vehicle advertisements to select a used car that is for sale and assess whether the sale price reflects good value. (CCT)</p> <p>Follow an SGI Vehicle Inspection in the shop with the students. (A copy of the form is available at any certified inspection centre.)</p> <p>Refer students to current publications as references, and to websites as appropriate.</p> |
| 1.5 | To demonstrate the ability to perform monthly and yearly inspections. (CCT) | <p>Using a variety of manuals, have students create an inspection and maintenance checklist. This may be used for class, peer, and self-assessment.</p> <p>Create a lab activity and ask students to inspect student or teacher vehicles.</p> <p>Create a maintenance checklist for student or parent vehicles.</p> |

Module 2: Automotive Processes (Core)

Suggested time: 4 - 10 hours

Level: Introductory

Prerequisite: None

Foundational Objectives

- To develop general knowledge of the automotive service industry practices and procedures.
- To foster employability skills related to the automotive service industry.

Common Essential Learnings Foundational Objectives

- To enable students to understand and use the terminology in repair procedures of automotive service industry. (COM)
- To develop students' abilities to access and apply knowledge to automotive service. (CCT)

Note: Other CELs may be emphasized here.

Learning Objectives		Notes
2.1	To describe the processes involved in motor vehicle repair. (COM)	<p>Students may interview in person, by phone, Internet, etc. automotive service shop personnel.</p> <p>Refer to recommended resources.</p> <p>Follow procedures such as those listed in shop manuals. Students will need some help interpreting the shop manuals because service manuals are written by automotive engineers.</p> <p>Have students research recent manufacturer recalls for the cause of the problems encountered.</p>
2.2	To explain the objective and value of each process and describe how to choose the proper process for the task at hand.	<p>Use class presentations, written assignments, guest speakers, work stations, etc to explore the objective and value of the following processes.</p> <ul style="list-style-type: none">• diagnosis of component or system• preventive maintenance• component replacement• component repair• sub-contract to a system specialist (for example an air conditioning technician)• review of production updates
2.3	To describe the processes to identify automotive system faults. (CCT)	<p>Have students role play as a service writer and a customer.</p> <p>Interview service personnel about the procedure that is used in their business to identify automotive system faults.</p> <p>Interviews may be conducted by phone, in person, letter, Internet, etc.</p> <p>Perform a lab activity using a mock interview with a vehicle that has a technical problem.</p>

Learning Objectives

Notes

Fill out a sample work order form:

- interview customer to determine history
- prepare work order
- discuss customer's complaint with service advisor
- perform visual inspection
- identify driver's habits
- verify customer's complaints
- conduct tests/inspections
- compare results with manufactures specifications
- research training regarding product technical changes

Module 3: Safety Equipment, Hazardous Materials, and Housekeeping Skills (Core)

Suggested time: 4 - 12 hours

Level: Introductory

Prerequisite: None

Foundational Objectives

- To identify health and safety hazards in the workplace so that the potential for personal injury, damage to equipment, vehicles and the environment is minimized.
- To identify, wear, adjust and maintain personal protective equipment such as eye, ear, hand and foot protectors so that the wearer is optimally protected.

Common Essential Learnings Foundational Objectives

- To support students' understanding of the personal, moral, and social role regarding safety in the automotive service industry. (PSVS)
- To model safety practices in the automotive industry. (IL)

Note: Other CELs may be emphasized here.

Learning Objectives		Notes
3.1	To identify safety as the first step in any service procedure. (IL)	The first step in any service procedure is to assess the safety issues surrounding the procedure and to take appropriate steps to ensure a safe working environment.
3.2	To identify common safety hazards.	<p>Have students inspect the shop for potential safety problems and recommend solutions.</p> <p>Safety hazards may include:</p> <ul style="list-style-type: none">• noise• burns• chemical hazards• fire and explosions• moving parts• toxic fumes• high pressure air and fluid• airborne particles <p>Refer to print and/or safety videos resources.</p> <p>Note: AIR BAGS are to be disarmed by certified personnel before any work is done on the vehicle.</p>
3.3	To identify hazards specific to automotive repair shops. (CCT)	<p>Demonstrate faulty work habits within the shop followed by correct procedures. Incorporate a lab activity.</p> <p>Note: Gasoline, solvents and acids require special handling and disposal.</p> <p>Emphasize possibility of carbon monoxide poisoning and safety precautions to prevent it.</p> <p>Discuss possible problems that may result from:</p> <ul style="list-style-type: none">• fluid spills• exhaust fumes• electricity

Learning Objectives	Notes
3.4 To describe ways to reduce chances of personal or material damage as a result of faulty work habits or equipment defects. (PSVS)	Resources to use may include safety videos, guest speakers (Occupational Health and Safety, St. John's Ambulance), etc.
3.5 To identify areas of potential personal injury. (CCT)	<p>Assessments could include a quiz and written assignments. Review these points in relation to objectives 3.2 and 3.3 of this guideline.</p> <p>See OH&S and WHMIS modules found on Saskatchewan Labour website and in the <i>Career and Work Exploration Curriculum Guide</i> for more information and resources.</p> <p>Discuss protection for:</p> <ul style="list-style-type: none"> • hands • feet • eyes • ears • hair • clothing
3.6 To list possible causes personal injury:	<p>Tour a shop, examine pictures or a video showing sources of possible hazards and safe work procedures. Possible causes of personal injury:</p> <ul style="list-style-type: none"> • fumes • chemicals • brake dust • sound • work practices
3.7 To list items to reduce personal injury. (CCT)	<p>Reducing personal injury could include:</p> <ul style="list-style-type: none"> • ear plugs • face shields • using recommended equipment correctly <p>Demonstrate to students the proper use of personal safety devices before allowing students to use equipment in the shop.</p>
3.8 To demonstrate knowledge of First Aid practices. (IL)	<p>Have a public health nurse or first aid instructor demonstrate proper first aid procedures, emphasizing the effects of blood poisoning, tetanus and related concerns. Demonstrate the following:</p> <ul style="list-style-type: none"> • eye wash station use • treatment for burns and cuts • basic first aid

Learning Objectives**Notes**

3.9	To demonstrate ability to install, adjust and maintain protective devices. (IL)	<p>Devices include:</p> <ul style="list-style-type: none">• jacks• hold downs• stands• others <p>Protective devices may vary depending on what part of the vehicle is being repaired.</p>
3.10	To explain the importance of knowing how to use all safety equipment correctly. (IL)	Use quiz and/or written assignment to assess student knowledge.
3.11	To explain the classification system for fires.	Different fire sources require different types of extinguishers.
3.12	To select and use the correct fire extinguisher for different types of fires. (CCT)	Contact the local fire department to put on a clinic to demonstrate putting out different types of fires with extinguishers and proper use of school fire extinguishers.
3.13	To list the effects on health when safety equipment is not properly used. (PSVS)	<p>Use videos or invite a guest speaker to discuss accidents and injuries.</p> <p>Invite a speaker from Saskatchewan Labour to explain the Occupational Health and Safety regulations with respect to the automotive service industry.</p>
3.14	To locate and demonstrate safety equipment use.	Create a lab activity where students must demonstrate proper use of all personal protective equipment.
3.15	To explain the necessity of maintaining a clean workplace.	Discuss the benefits of a clean, organized workplace.
3.16	To describe methods used to maintain a clean workplace.	<p>Students create daily cleanup procedures and present them to the rest of the class for assessment.</p> <p>See Occupational Health and Safety and WHMIS modules found on Saskatchewan Labour website and in the Career and Work Exploration Curriculum Guide for more information and resources.</p>
3.17	To identify suitable cleaning methods and equipment for use in various shop areas.	Tour the school automotive facility and determine appropriate methods and equipment for clean up.
3.18	To maintain a clean eye wash station. (PSVS)	Create and post a schedule for all students to inspect and clean, on a regular basis, specific areas of the shop including the eyewash station. This will give students a sense of ownership of the lab.

Learning Objectives**Notes**

- | | | |
|------|---|--|
| 3.19 | To handle chemicals according to Work Hazardous Materials Information System (WHMIS) regulations. | Refer to Saskatchewan Labour website for modules on WHMIS. Invite a speaker from Saskatchewan Labour to speak about WHMIS. |
| 3.20 | To identify hazards associated with each toxic substance found in the shop. | Develop a lab activity whereby students identify potential shop hazards and the correct method to handle these materials. Have students note each of the WHMIS symbols. Provide students with a list of product labels and ask them to identify which WHMIS symbol should be placed on each product. |
| 3.21 | To identify protective clothing to use around potential hazards. | Create a list of approved protective clothing to be worn in the automotive industry and discuss/identify what protection it provides from potential hazards |
| 3.22 | Determine other potential safety hazards in the automotive industry. | Create a safety video about possible hazards that exist in a school shop.

Refer to resources developed by Saskatchewan Labour. |

Module 4: Information Storage (Core)

Suggested time: 3 - 5 hours

Level: Introductory

Prerequisite: None

Foundational Objectives

- To develop workplace skills, knowledge, and attitudes in the automotive service industry that may lead to successful employment.

Common Essential Learnings Foundational Objectives

- To enable students to use a variety of print-based, text-based resources for purposes relevant to automotive service. (IL, COM)

Note: Other CELs may be emphasized here.

Learning Objectives		Notes
4.1	To analyze vehicle identification numbers and compliance labels.	Use service manuals to identify the meaning of each digit of a Vehicle Identification Number (VIN).
4.2	To describe the different types of information sources available.	Possible sources of information include: <ul style="list-style-type: none">• manuals• service bulletins• microfiche (rarely used now)• CD-ROM based materials• on-line systems updates• fax-back retrieval• Internet
4.3	To choose appropriate manuals and technical bulletins for needed information.	Contact SIAST or Regional Colleges to obtain copies of dated shop manuals they might donate to the school as a resource example.
4.4	To locate appropriate information in manuals. (COM)	Use the owner's manual that come with all vehicles.
4.5	To demonstrate the use of computers for information retrieval. (IL)	Use in-school computers or, if possible, tour a dealership to see how a computer is used for automotive information storage and retrieval. (TL)
4.6	To demonstrate care in handling manuals, computers, and scan tools.	Cleanliness is very important when handling these types of tools and resources. Discuss the results of introducing various contaminants.

Module 5: Hand and Power Tools (Core)

Suggested time: 15 - 25 hours

Level: Introductory

Prerequisite: None

Foundational Objectives

- To identify health and safety hazards so that the potential for injury, damage to equipment, vehicles, and the environment is minimized.
- To demonstrate proper use of the tools and equipment utilized in the automotive service industry.

Common Essential Learnings Foundational Objectives

- To strengthen students' understanding of how to compute, measure, estimate and interpret numerical data as it applies to the automotive service industry. (NUM)
- To provide opportunities for students' active involvement in understanding, maintaining, and servicing technological devices in the automotive service industry. (TL)

Note: Other CELs may be emphasized here

Learning Objectives		Notes
5.1	To classify hand tools according to their capabilities, including cutting, striking, and holding.	Divide students into groups. Have the students list as many automotive tools as possible. Group the tools and indicate a service procedure performed by each group. Identify missed tools by questioning how to perform service procedures that require the unidentified tool.
5.2	To demonstrate maintenance of tools and equipment.	Discuss maintenance of tools and equipment used in the school. Develop a weekly maintenance procedure for cleaning tools. Demonstrate how to sharpen and shape tools.
5.3	To become familiar with both metric and imperial measuring tools.	If equipment and tools are available, students should practice using metric and imperial measurement tools. Explain the importance of accuracy in measuring.
5.4	To demonstrate the maintenance of tools.	Demonstrate the process of: <ul style="list-style-type: none">• drill bit sharpening• chisel sharpening• centre/prick punch sharpening• dressing of grinding wheel Create a lab activity with stations that use the tools and equipment available in the shop. Students must demonstrate the accompanying learning objectives throughout the lab. Schools that do not have the appropriate equipment and/or tools may establish a work study component with the local automotive service organization where students can practise use of these tools.
5.5	To identify tool safety hazards. (PSVS)	Emphasize the use of safety shields and selection of proper tool for application.
5.6	To demonstrate the use of hand tools. (TL)	Demonstrate the use of tools such as: hammers, chisels, wrenches, screwdrivers, sockets and rachets, and punches.
5.7	To compare suitable quality tools to substandard tools.	Select a variety of tools from different manufacturers and price ranges that show good and poor manufacture. Discuss how to determine quality in tools.

Learning Objectives	Notes
5.8 To demonstrate required mathematical skills in imperial and SI metric units. (NUM)	Create a measuring exercise that requires mathematical calculations using imperial and metric measurements to solve a problem e.g., sizing a piston ring in a cylinder bore or camshaft lobe tolerances.
5.9 To list common measuring tools and their service uses.	<p>Create written assignments to use imperial and metric units where automotive calculations are used. (NUM) Some examples:</p> <ul style="list-style-type: none"> • dimensional • volume • temperature • electrical • pressure/vacuum gauges • non-precision • scan tools • torque wrenches • horsepower <p>Practise measurements with the “senses”: look, listen, feel. Measuring tools include: micro-meters, dial gauges, vernier calipers, feeler gauges, telescoping gauges, straight edge, torque wrench, plasti-gauge, screw pitch gauge, multi-meter, test light, oil pressure gauge, hydrometer, compression gauge, etc.</p>
5.10 To demonstrate ability to use the recommended tool for the job.	Many tools have instructions included for safe, proper use.
5.11 To demonstrate ability to compare measured values with the manufacturer’s specifications accurately and vice versa. (NUM)	Create a lab activity where students measure parts, then locate appropriate specification and compare.
5.12 To demonstrate care in storage and handling of measuring tools.	Stress the importance of proper handling of measuring tools to avoid creating inaccurate tools through abuse.
5.13 To identify power tools.	Create a lab activity using a variety of compressed air, electric, and hydraulic power tools.
5.14 To classify power tools according to their method of power. (CCT)	Power tools such as compressed air, electrical, and hydraulic should be discussed.
5.15 To maintain power tools by inspecting for need of lubrication or repair.	Demonstrate methods of examination for safe operation and necessary lubrication and repair. Refer to owner’s manuals.
5.16 To identify safety hazards associated with power tools.	<p>Create a list of potential hazards related to the use of power tools.</p> <p>Examine electrical cords or compressed air lines for possible hazards.</p>

Learning Objectives		Notes
5.17	To identify various lifting tools.	Lifting tools may include: <ul style="list-style-type: none">• vehicle hoists• engine hoists/cranes• chair hoists• floor jacks
5.18	To inspect lifting equipment for safe condition.	Vehicle hoist inspection must be done by certified inspectors. Discuss how to identify potential hazards and how often to have equipment inspected for safety. Demonstrate a variety of vehicle hoists and have students note the advantages and disadvantages of each type.
5.19	To raise a vehicle on a hoist.	Use student vehicles to assist students in locating proper hoisting, jacking and blocking points. This activity may be done in an industry location.
5.20	To place a vehicle onto floor stands.	Refer to manuals and manufacturer's specifications.
5.21	To raise large assemblies using hoists and transmission jacks.	Create a lab where students work in groups of two or three to demonstrate proper use of all shop equipment.
5.22	To replace cleaning fluid in cleaning equipment.	Demonstrate how to clean and replace cleaning fluid in cleaning equipment. Review safety requirements where fluids might splash.
5.23	To use shop equipment, as required. (TL)	Demonstrate the safe and proper use of tools using manufacturers' manuals. <ul style="list-style-type: none">• engine/transmission stands• brake dust vacuum cleaner• grinders and drill presses• scanners• battery-starter-alternator testers
5.24	To drain moisture from air lines and compressor.	Discuss the importance of draining moisture and maintaining lubrication in regard to proper care of air tools.

Module 6: Fasteners and Gaskets (Core)

Suggested time: 5 - 10 hours

Level: Introductory

Prerequisite: None

Foundational Objectives

- To develop general understanding of the function and operation of automotive systems: power plant (engine), drive train, steering and suspension, electrical, body, and brakes.
- To develop general knowledge of the automotive service industry practices and procedures.
- To demonstrate proper use of the tools and equipment utilized in the automotive service industry.

Common Essential Learnings Foundational Objectives

- To use a wide range of language experiences for developing students' knowledge of automotive fasteners and gaskets. (COM)
- To strengthen students' understanding of how to compute, measure, estimate, and interpret numerical data as it applies to the automotive service industry. (NUM)
- To develop students' abilities to meet their own learning needs. (IL)

Note: Other CELs may be emphasized here.

	Learning Objectives	Notes
6.1	To categorize common fasteners according to whether they are non-permanent or permanent fasteners.	Different applications require different fastener properties. Have students gather a variety of types and styles and describe possible applications.
6.2	To list qualities of a fastener.	Show students how to determine the hardness of threaded fasteners.
6.3	To identify the different manufacturing qualities of fasteners. (TL)	Include information regarding both Imperial and Metric fasteners.
6.4	To describe fasteners using correct nomenclature. (COM)	Create a lab activity where students identify different fasteners on an automobile then correctly remove and replace them.
6.5	To identify safety considerations used with various fasteners.	Some fasteners can not be re-installed and must be replaced with new fasteners. Discuss the result of over tightening a fastener.
6.6	To demonstrate the ability to use suitable tools to manipulate fasteners. (IL)	Students need to be able to use wrenches, ratchets, air ratchets, and different types of torque tools.
6.7	To demonstrate the ability to utilize torque charts.	Have students read and identify the torque specifications for a particular application.
6.8	To demonstrate torquing procedures using correct type of torque wrenches and/or torque angle meters. (NUM)	Demonstration could be done on a cylinder head or crankshaft main bearing caps. Students should understand the reasons for torquing fasteners in an ordered pattern.

Learning Objectives		Notes
6.9	To demonstrate methods of removing seized fasteners and repairing damaged fastener threads.	Refer to manufacturer's specifications.
6.10	To select the proper locking chemical for a given fastener application.	Display a variety of fasteners used on an automobile and the chemicals that provide the correct locking application according to the manufacturer's specifications.
6.11	To list the purposes of different thread tap styles.	
6.12	To calculate SAE (UNC and UNF) and metric tap drill sizes. (NUM)	SAE: Society of Automotive Engineers; UNC: Unified National Course; UNF: Unified National Fine Perform a lab activity where students break a bolt by over tightening. Then use proper tools and procedures to remove, identify, measure, and install or repair threads.
6.13	To tap SAE (UNC and UNF) and metric holes.	Students can drill and tap 4" x 6" x ¼" thick plate with a variety of hole sizes and then thread the holes.
6.14	To identify SAE (UNC and UNF) and metric thread styles and pitches. (COM)	The above activity, when completed, will provide a method to determine thread sizes of different fasteners.
6.15	To cut external and internal threads on prepared steel stock.	Create lab activity where students build a steering wheel puller.
6.16	To install Helicoil® thread inserts.	Demonstrate how Helicoils® provide a thread repair.
6.17	To outline and demonstrate methods of removing broken threaded fasteners.	Demonstrate how to use extractors to remove a bolt stub.
6.18	To prepare surfaces for seal, O-ring, or gasket installation.	Show how to clean, inspect, and prepare surfaces properly for installing replacements following manufacturers' specifications.
6.19	To demonstrate the recommended method of installing and removing gaskets.	Display a variety of sealants and gaskets. Then have students identify type, purpose, and safety precautions needed to handle various sealants. Discuss service installation procedures and where they are used. (IL)
6.20	To demonstrate the recommended method of installing and removing seals and O-rings.	Develop a lab activity where students remove and install automotive components that require gaskets, sealants, and torque specifications.
6.21	Demonstrate the recommended method of choosing and installing sealing compound.	Glues and sealants must be oxygen sensor compatible. See manufacturer's specifications.

Module 7: Cleaning Techniques (Core)

Suggested time: 1 - 4 hours

Level: Introductory

Prerequisite: None

Foundational Objectives

- To identify health and safety hazards so that the potential for injury and damage to equipment, vehicles, and the environment is minimized.

Common Essential Learnings Foundational Objectives

- To develop students' abilities to apply knowledge to automotive cleaning techniques. (IL)

Note: Other CELs may be emphasized here.

	Learning Objectives	Notes
7.1	To identify the need for component cleaning.	Use old parts to demonstrate the effects of dirty components.
7.2	To list the products used for cleaning components.	Caution is urged as some cleansers are very strong and can cause a variety of problems through skin contact and by inhalation.
7.3	To identify health and safety items relating to cleansers. (PSVS)	Make certain proper precautions are observed.
7.4	To demonstrate proficiency in cleaning components. (IL)	Create cleaning stations throughout the shop that a group of students are required to clean and be responsible for each day. This will give students a sense of ownership of the lab. Follow proper procedures for handling and disposing of all chemicals and disposable tools. <ul style="list-style-type: none">• solvents• steam, hot water• carburetor cleaner• scrapers and wire wheels• hot dip tank

Module 8: Oxy-Acetylene Welding (Optional)

Suggested time: 6 - 10 hours

Level: Intermediate

Prerequisite: Module 3

Foundational Objectives

- To identify health and safety hazards so that the potential for injury and damage to equipment, vehicles, and the environment is minimized.
- To demonstrate proper use of the tools and equipment utilized in the automotive service industry.

Common Essential Learnings Foundational Objectives

- To develop an understanding of the devices use in oxy-acetylene welding and how they apply to automotive repair. (TL)
- To model safety practices in the automotive industry. (IL)

Note: Other CELs may be emphasized here.

Learning Objectives		Notes
		General Note: Several learning objectives in this module will be supported by information contained in the <i>Welding 10, 20, A30, B30 Curriculum Guide</i> . Please refer to Modules 5, 6, 14, 29A, and 30A in the Welding Guide for more information.
8.1	To identify the safety precautions to be observed with welding equipment. (PSVS)	At the Middle Level, this module should be done as demonstration. Several videos on welding information and safety are available through welding suppliers.
8.2	To explain why the observation of safety precautions is an absolute necessity.	A statement that refers to work time lost due to accidents and resulting loss of pay may help students to understand.
8.3	To explain why oxy-acetylene heating and cutting is a required skill for a technician.	See Modules 5 and 6 in the Welding Guide for Oxy-Acetylene cutting.
8.4	To name the parts of an oxy-acetylene welding kit. (TL)	See Module 5 Oxy-Acetylene in the Welding Guide.
8.5	To demonstrate ability to light and shut down a welding torch.	If there is access to a welding lab, one or two welding sessions are recommended with both Oxy-Acetylene welding (Module 5) and an introduction to MIG welding (Module 30A).
8.6	To demonstrate proficiency in simple heating, welding and cutting techniques. (IL)	
8.7	To identify different types of materials and the welding techniques for each.	If possible, have students observe a demonstration of Oxy-Acetylene welding (Module 5) and brazing as well as electric arc welding (Module 14).

Module 9: Storage Batteries (Core)

Suggested time: 4 - 8 hours

Level: Intermediate

Prerequisite: Module 3

Foundational Objective

- To identify health and safety hazards so that the potential for injury and damage to equipment, vehicles, and the environment is minimized.

Common Essential Learnings Foundational Objectives

- To promote ability to evaluate information related to automotive mechanics. (CCT)
- To develop students' abilities to access knowledge. (IL)

Note: Other CELs may be emphasized here.

Learning Objectives		Notes
9.1	To explain battery construction and operation.	A battery shop might donate a cutaway battery demonstrator to the school. A battery that is drained, cleaned, and cut in half can be used to display battery construction (cells, plates, etc.) Make certain that the battery is totally dead before cutting.
9.2	To explain the safety hazards associated with battery acid and hydrogen gas. (COM)	Review safety considerations regarding batteries.
9.3	To list the effects of temperature and battery state-of-charge on battery performance.	Charge two batteries. Let one sit outside overnight, then perform a load test to determine the effects of temperature.
9.4	To outline clean-up procedures used for acid. (CCT)	Review first-aid procedure. Review importance of using safety glasses at all times. Explain the clean-up procedures for acid: <ul style="list-style-type: none">• spilled on the car; or,• splashed into eyes or onto clothes
9.5	To explain the differences between regular, maintenance-free, and special batteries. (CCT)	Demonstrate post types and locations as well as size and dimensional variations. Special batteries include those such as gel filled or deep cycle types.
9.6	To list special battery service tools. (COM)	
9.7	To explain how to perform a visual battery inspection.	
9.8	To explain battery problems and outline how these are manifested.	Use student and staff vehicles, when possible, as subjects for visual inspections, load tests and cleaning cables, posts, and cases.
9.9	To measure battery specific gravity and evaluate cell condition. (NUM)	

Learning Objectives		Notes
9.10	To perform battery load test and evaluate battery condition.	Refer to manufacturer's recommendations. Charge different types of batteries and perform load tests on each to determine the differences.
9.11	To explain battery performance ratings. (COM)	Have students locate and access battery performance ratings.
9.12	To clean battery cables, posts and cases. (IL)	
9.13	To demonstrate ability to boost batteries safely. (IL)	See vehicle owner's manual for correct booster cable connection procedures. Have students document their use of correct procedures in a report
9.14	To explain the effects of fast or slow charging of batteries.	Create a lab where students determine the condition of automobile batteries. Students may use their own vehicles for the tests or teachers may volunteer vehicles. (CCT)
9.15	To service battery hold-down equipment.	Have students create a procedure checklist as a self-guide to ensure proper service. Have the teacher or a peer evaluate each student's performance of skills associated with the procedure.

Module 10: Oils and Lubricants (Core)

Suggested time: 5 - 10 hours

Level: Introductory

Prerequisite: Module 3

Foundational Objectives

- To identify health and safety hazards so that the potential for injury and damage to equipment, vehicles, and the environment is minimized.
- To demonstrate proper use of the tools and equipment utilized in the automotive service industry.
- To foster employability skills related to the automotive service industry.

Common Essential Learnings Foundational Objectives

- To develop students' abilities to maintain lubrication in the different mechanical devices they use. (IL)
- To use a wide range of vocabulary related to the mechanical and automotive industry. (COM)

Note: Other CELs may be emphasized here.

	Learning Objectives	Notes
10.1	To describe oils and their functions. (COM)	Display different types of oils and have students identify the differences between them based on touch, smell, and color.
10.2	To describe oil classification indexes.	Review the meaning for the symbols that identify different types of oils and their applications.
10.3	To describe oil additives and their functions.	
10.4	To explain oil contamination and its forms and effects. (CCT).	Display oils that have been contaminated. Discuss the effects of the contamination.
10.5	To describe engine oil service requirements.	Oil not only lubricates but serves other functions as well: cooling, cleaning, etc.
10.6	To compare the properties and features of petroleum based oils vs. synthetic oils.	Invite a local bulk fuel and oil dealer as a guest speaker.
10.7	To demonstrate ability to read appropriate manuals to choose lubricant types and filter requirements for different vehicles. (COM)	Include information on students' maintenance schedules created for Learning Objective 1.5.
10.8	To demonstrate ability to change engine oil and filter. (IL)	Create a lab where students perform oil changes on student or teacher vehicles. Arrange with students a way to document their skill acquisition for presentation to potential employers. Review the correct procedure for collecting used oil and filters for recycling. Have the students review the website: http://www.usedoilrecycling.com
10.9	To explain the differences in automatic transmission fluids. (CCT)	

Learning Objectives	Notes
10.10 To demonstrate the ability to change automatic transmission fluid and filter.	Demonstrate how to change automatic transmission fluid and filter. It is important to torque oil pan fasteners to recommended manufacturer's specification. Students may perform this task in Module 28.
10.11 To demonstrate the ability to change manual transmission, transfer case, and differential fluids. (IL)	Examine the drained fluid for evidence of damage to internal components.
10.12 To explain the reasons for periodic vehicle greasing. (CCT)	Show old parts that were not adequately lubricated.
10.13 To describe the properties of various chassis greases available.	Assign students the task of finding and explaining the different types of greases available at a local service shop.
10.14 To locate and follow manufacturer's lubrication schedules.	See vehicle owner's manual.
10.15 To maintain a clean environment during and after the grease job. (PSVS)	Explain the problems encountered when too much grease is used.
10.16 To explain the procedures involved in greasable joint damage inspection.	<p>Combine this procedure with an oil change lab. Inspect the entire chassis for lubrication requirements and inspect for worn parts in need of repair. This procedure should be part of routine oil and oil filter changes.</p> <ul style="list-style-type: none"> • ball joint inspection procedures • tie rod end inspection procedures • other areas of leakage • steering rack seals • front drive axle boots • brake hoses and lines • tire wear/leaks
10.17 To demonstrate the ability to lubricate a vehicle. (IL)	<ul style="list-style-type: none"> • suspension components • driveshafts • universal joints. • steering components

Module 11: Headlights (Core)

Suggested time: 2 - 6 hours

Level: Intermediate

Prerequisite: None

Foundational Objectives

- To develop general knowledge of the automotive service industry practices and procedures.
- To demonstrate safe working practices and procedures for the automotive service industry.
- To create an awareness of the need for regular maintenance of an automobile through demonstration and practice.

Common Essential Learnings Foundational Objectives

- To develop students' abilities to meet their own learning needs. (IL)
- To use a wide range of vocabulary related to the mechanical and automotive industry. (COM)

Note: Other CELs may be emphasized here.

Learning Objectives		Notes
11.1	To describe the qualities of the different types and shapes of headlights. (COM)	Walk through parking lot and identify different types of headlights for different types of vehicles. <ul style="list-style-type: none">• seal beam• halogen bulb• round, square headlights• 2, 4 headlights• parabolic reflector• plastic (Lexan)
11.2	To demonstrate ability to select the correct headlight style and type for the vehicle application and the customer's needs. (IL)	The selection will depend on the OEM (Original Equipment Manufacturer's) specifications.
11.3	To demonstrate ability to follow safety precautions associated with headlight replacement.	Create a lab to fulfill learning objectives 11.3 - 11.6.
11.4	To demonstrate ability to replace a headlight. (IL)	See vehicle owner's manual for procedure. Have students document the procedure required to develop the skill.
11.5	To demonstrate ability to service and adjust the headlight aiming equipment.	Have students work out a method to document the development of the procedural skill.
11.6	To demonstrate ability to adjust headlights using the appropriate tools. (TL)	Headlights may be aimed using a wall and following service specifications for vehicle placement and beam focus location.

Module 12: Tires (Core)

Suggested time: 5 - 10 hours

Level: Introductory

Prerequisite: None

Foundational Objectives

- To develop general knowledge of the automotive service industry practices and procedures.
- To demonstrate safe working practices and procedures for the automotive service industry.
- To demonstrate proper use of the tools and equipment utilized in the automotive service industry.
- To create an awareness of the need for regular maintenance of an automobile through demonstration and practice.

Common Essential Learnings Foundational Objectives

- To develop students' understanding of the uses of mathematical concepts in tire service. (NUM)
- To develop the ability to read, understand and use automotive service manuals and documents. (COM)
- To participate in activities that focus on diagnostic skills as they relate to the automotive service industry. (CCT)

Note: Other CELs may be emphasized here.

Learning Objectives		Notes
12.1	To explain why tire condition is important to the vehicle's handling and safety characteristics. (CCT)	Create a lab activity for tire service to include many of these objectives. Discuss tire performance in a variety of weather conditions. Discuss safety in relation to condition of tires.
12.2	To measure and adjust tire pressure and compare it to advised tire pressures. (NUM, CCT)	Have students locate and access sources of tire pressure information.
12.3	To measure tread depth and evaluate it against tire tread wear indicators. (NUM)	Measure the tread depth and determine wear on selected tires from students' and teachers' vehicles. Owner's manuals or vehicle identification information identify proper tire sizes for a vehicle. What is a safe or acceptable tread depth? Check with a local tire retailer to determine how to measure tread depth.
12.4	To read and explain tire side wall information. (COM)	Use student vehicles when possible.
12.5	To rotate tires based on tire type (radial, bias ply, etc.) and vehicle drive method (FWD, RWD, 4WD).	Use student vehicles when possible. Discuss reasons why one should rotate tires and how often should this be done.
12.6	To torque wheel fasteners to manufacturer's specifications.	See manufacturer's recommendations for removal and installation procedures. Discuss the effect of uneven tightening of lug nuts. (CCT)
12.7	To describe tire design and construction.	Discuss the following: <ul style="list-style-type: none">• carcass construction• tread designs and patterns• studding procedures• space saver tire design

	Learning Objectives	Notes
12.8	To discuss the operating characteristics based on tire construction, temperature, pressure, size/weight ratio, etc.	Invite a guest in retail tire sales to discuss tire performance, care, and design.
12.9	To describe the effects of installing over or under-sized tires.	If possible, invite a guest speaker from a local tire shop. Discuss the effects on vehicle performance if the tire sizes are over, under or of different sizes on the vehicle.
12.10	To list the safety precautions to observe while using tire changing machines and balancers. (TL)	Tire changing machines operate under air pressure. Make sure students are aware of the locations where fingers can get trapped. Discuss the additional precautions needed when changing large truck tires.
12.11	To describe and or demonstrate tire dismounting and mounting.	Make certain the wheel rim is in good repair.
12.12	To outline the causes and effects of various forms of tire damage and defects.	Collect representative examples of types of damage and defects to show students.
12.13	To describe and demonstrate tire leak detection methods and tire repair. (IL)	The simplest method would be to use a dunking tank. Have the students demonstrate the replacement of a tire valve stem. Document the skill development.
12.14	To evaluate and choose the correct method of tire repair based on tire type and condition. (CCT)	This operation could include installing an inner tube in the tire.
12.15	To describe and demonstrate methods of tire balancing.	If possible, tour a local tire service shop or use a video. School shops without a tire balance may partner with a local tire shop for a lab activity on tire balancing. Have the students record the skill development and their practice.
12.16	To measure tire and wheel run-out. (NUM)	
12.17	To adjust tire pressure according to tire specifications. (NUM)	
12.18	12.18 To demonstrate the procedures required to change a tire and rim assembly properly on a vehicle.	Review safety procedures required to “block” a vehicle and remove and replace a tire safely. Follow proper vehicle jacking techniques. See vehicle owner’s manual for procedures. (COM) Document practice and track skill development.
12.19	To discuss the importance of	Have students research the collection of and the uses for recycled

recycling worn out tires. tires.

Module 13: Minor Body Service (Core)

Suggested time: 15 - 20 hours

Level: Intermediate

Prerequisite: None

Foundational Objectives

- To develop general understanding of the function and operation of automotive systems: power plant (engine), drive train, steering and suspension, electrical, body, and brakes.
- To provide students with experience in the automotive service industry that will enable them to make an informed decision about a career in this field.
- To foster employability skills related to the automotive service industry.

Common Essential Learnings Foundational Objectives

- To develop students' abilities to access and apply knowledge to automotive service. (CCT)
- To provide opportunities for students' active involvement in understanding, maintaining, and servicing body and trim devices in the automotive service industry. (TL)
- To develop the ability to read, understand, and use automotive service manuals and documents. (COM)

Note: Other CELs may be emphasized here.

Learning Objectives

Notes

General Note: Several learning objectives in this module will be supported by information contained in the Autobody 10, A20, B20, A30, B30 Curriculum Guide. Please refer to Modules 14, 18, and 21 in the guide as appropriate teacher reference information.

13.1	To identify sources of air, water, and dust leaks. (CCT)	This module is primarily an introduction to autobody. Therefore, it is more of an activity module than an instruction module. There is little theory involved and the module can be completed by setting up a lab activity that covers the learning objectives.
13.2	To demonstrate ability to adjust door strikers. (IL)	Consult Module 14 in the Autobody 10, A20, B20, A30, B30 Curriculum Guide for more information.
13.3	To demonstrate ability to replace bolt-on door hinges.	
13.4	To demonstrate ability to replace trunk and hood supports.	
13.5	To demonstrate ability to diagnose causes of squeaks and rattles. (CCT)	If possible, organize a field trip to a local autobody shop. This could cover objectives 5 - 18.
13.6	To demonstrate ability to repair squeaks and rattles not located in welded body panels.	Purchase or use a donated vehicle for students to repair. Cheap vehicles may be purchased from SGI. These vehicles can be used to meet Learning Objective 1.4.
13.7	To demonstrate ability to remove and replace interior trim items.	Consult Module 21 in the Autobody Curriculum Guide for more information. Exercise care when removing trim as adhesives may need to be dissolved.

Learning Objectives	Notes
13.8 To demonstrate ability to remove and replace exterior trim items.	
13.9 To demonstrate ability to replace leaking weather stripping. (IL)	
13.10 To demonstrate ability to adjust trunk and hood alignment. (CCT)	
13.11 To demonstrate ability to replace moveable glass. (IL)	The construction of moveable glass is such that if handled in a careless manner it will shatter. Handle carefully.
13.12 To demonstrate ability to follow safety precautions associated with moveable glass replacement.	Note: If power windows are being serviced disconnect the battery power as some vehicle models have windows that will operate without the ignition being turned on.
13.13 To demonstrate ability to replace door glass and channels.	See Module 18 in the Autobody Curriculum Guide.
13.14 To demonstrate ability to adjust door glass in the frame. (CCT)	
13.15 To demonstrate ability to replace bumpers, trim, ends and impact absorbers.	See Module 21 in the Autobody Curriculum Guide for additional information.
13.16 To demonstrate ability to use special tools, e.g. door panel service tools and pop rivet guns. (TL)	See Module 21 in the Autobody Curriculum Guide for additional information.
13.17 To demonstrate the ability to replace window regulators.	See Module 21 in the Autobody Curriculum Guide for additional information.
13.18 To demonstrate the ability to follow service manual instructions and service bulletins. (COM)	Make frequent links between service manual instructions, the skills being developed and practised, and the assessment and recording of the ability to perform the required task.
13.19 To demonstrate the ability to complete a written service report. (COM)	Have students document the repair procedures followed to remedy a customer concern.

Module 14: Fundamentals of Electricity and Electronics (Core)

Suggested time: 10 - 15 hours

Level: Advanced

Prerequisite: Module 1

Foundational Objectives

- To develop general understanding of the function and operation of automotive systems: power plant (engine), drive train, steering and suspension, electrical, body, and brakes.
- To demonstrate safe working practices and procedures for the automotive service industry.
- To develop workplace skills, knowledge, and attitudes in the automotive service industry that may lead to successful employment.
- To provide students with experience in the automotive service industry that will enable them to make an informed decision about a career in this field.

Common Essential Learnings Foundational Objectives

- To use a wide range of language experiences for developing students' knowledge of electricity. (COM)
- To strengthen students' knowledge and understanding of how to compute, measure, estimate and interpret numerical data, when to apply these skills and techniques, and why these processes apply within the particular framework of the automotive service industry. (NUM)
- To understand how technology influences the automotive industry and affects the workplace. (TL)

Note: Other CELs may be emphasized here.

Learning Objectives		Notes
14.1	To explain the need for electricity in automotive applications.	Reference can be made to the Electrical and Electronics Curriculum Guide Module 2 regarding direct current.
14.2	To know the safety precautions to observe while working with electrical components. (PSVS)	If possible, invite a guest speaker from Saskatchewan Power, a science teacher, or a Saskatchewan Labour representative to speak about electrical safety and recognizing hazards.
14.3	Define volts, ohms, amperes. (COM)	
14.4	To describe the principles of electricity. (COM)	See Electrical and Electronics Curriculum Guide Module 2 and 3.
14.5	To apply Ohm's Law.	
14.6	To relate mathematical problem solving to the automotive service industry and demonstrate the necessary mathematical skills to solve electrical theory calculations. (NUM, CCT)	Create written assignments that require students to solve automotive electrical problems involving calculations of voltage, resistance, and current using Ohm's law.
14.7	To list the three types of electrical circuits and describe their features.	Describe features of series, parallel, and series-parallel circuits.

	Learning Objectives	Notes
14.8	To demonstrate ability to read simple electrical wiring diagrams. (COM)	Examine wiring diagrams. Create written assignments where students identify wiring diagrams of simple electronic circuits.
14.9	To install test meters correctly. (TL)	Create a lab activity where students measure current, resistance, and voltage in different circuits in the automobile.
14.10	To explain why digital meters are preferred over analog type meters.	If possible, demonstrate both types to illustrate the accuracy of each style.
14.11	To demonstrate ability to operate electrical testing equipment such as a multi-meter and a test light. (IL)	A multi-meter measures voltage, current or resistance. This is a standard piece of electronic equipment used to check circuitry.
14.12	To explain the use of other circuit testing devices.	Explore testing devices like short circuit finders
14.13	To demonstrate ability to operate electrical testing equipment. (TL)	Students must be very familiar with the different types and the operation of meters to be able to analyze many mechanical problems. Explore equipment such as analog or digital multi-meters and test lights.
14.14	To list and find the types of damage that may occur in an electrical circuit.	Create lab activity where students must locate faulty fan motors, wiring, or sensors.
14.15	To identify the differences between electrical and electronic components. (COM)	
14.16	To describe the basic principles of electricity.	Refer to Module 3 in Electricity and Electronics Curriculum Guide. Basic elements of electricity include: <ul style="list-style-type: none"> • atomic structure • magnetism • electromagnetism • electron vs. conventional theory • Ohm's Law • semiconductors and solid state devices • transistors and diodes
14.17	To describe circuit testing procedures and diagnostic techniques.	Have students research the effects of: <ul style="list-style-type: none"> • opens, shorts, high resistance • voltage drop • current draw • resistance
14.18	To explain the wire size requirements for current draw variations. (NUM)	Disassemble starter and alternator components to provide learning aids. Refer to Modules 21 and 22.

Learning Objectives		Notes
14.19	Identify connector types, styles, and applications.	Some review of basic electrical theory may be required. (Consult with the Physics or Electricity teacher.)
14.20	To demonstrate ability to splice, solder, tape, and use heat shrink tubing to repair wire.	Create a lab activity where students must splice or repair an old wiring harness, or cut a length of wire and attach solder type and crimp type connectors. <ul style="list-style-type: none">• wires• coaxial and shielded cables• waterproof connectors
14.21	To demonstrate ability to trace radio frequency interference problems. (CCT)	
14.22	To describe the requirements of good quality repairs. (CCT)	Create a lab activity where shop vehicles have been prepared with electrical system problems (short circuits, broken wires, resistance problems, etc.) Students must identify problems and use the correct equipment, tools, and parts to repair the problem.
14.23	To demonstrate ability to select connector terminals in all types of connector styles and applications. (IL)	
14.24	To demonstrate ability to select correct circuit protection devices such as fuses, breakers, fusible links, and maxi-fuses.	Have students examine a variety of circuit protection devices and determine if they are operational.
14.25	To demonstrate ability to replace a fusible link.	
14.26	To demonstrate ability to “make as new” repairs to wiring systems.	It is important that repairs to wiring are neat and “invisible”.
14.27	To identify different types of solder and their applications: e.g., rosin vs. solid vs. acid core.	
14.28	To demonstrate the use of weatherproof connectors.	
14.29	To describe the uses for scan tools to check and clear trouble codes.	

Module 15: Cooling Fans (Core)

Suggested time: 3 - 5 hours

Level: Intermediate

Prerequisite: Module 3

Foundational Objectives

- To demonstrate safe working practices and procedures for the automotive service industry.
- To demonstrate proper use of the tools and equipment utilized in the automotive service industry.
- To create an awareness of the need for regular maintenance of an automobile through demonstration and practice.

Common Essential Learnings Foundational Objectives

- To develop students' appreciation of the value and limitations of technology (cooling system) in the automobile. (TL)
- To use a wide range of vocabulary related of the mechanical and automotive industry. (COM)

Note: Other CELs may be emphasized here.

Learning Objectives		Notes
15.1	To describe different types of cooling fans. (COM)	Display a variety of cooling fans.
15.2	To describe different methods of driving cooling fans.	Explain different methods of driving cooling fans: <ul style="list-style-type: none">• mechanically driven• electric motor driven
15.3	To list the safety precautions to observe when working around cooling fans. (PSVS)	Create lab activity to demonstrate how an electric cooling fan may cut in with the engine shut off.
15.4	To replace defective cooling fans and viscous clutches. (TL)	
15.5	To replace drive belts and align pulleys.	Check for proper belt deflection and tension.

Module 16: Exhaust Systems (Core)

Suggested time: 3 - 5 hours

Level: Intermediate

Prerequisite: Module 3

Foundational Objectives

- To demonstrate safe working practices and procedures for the automotive service industry.
- To demonstrate proper use of the tools and equipment utilized in the automotive service industry.

Common Essential Learnings Foundational Objectives

- To support students in treating themselves, others and the environment with respect by examining the hazards of harmful emissions and demonstrating proper care and handling of emissions. (PSVS)
- To develop students' ability to analyze and solve problems. (CCT)
- To use a wide range of vocabulary related to the mechanical and automotive industry. (COM)

Note: Other CELs may be emphasized here.

Learning Objectives

Notes

16.1	To explain the importance of a reliable exhaust system. (COM)	Safety reminder about carbon monoxide poisoning. Invite a guest speaker from the local RCMP to discuss noise and emissions restrictions. This is also an opportunity to have the officer identify what makes a vehicle road worthy according to the law.
16.2	To list the safety precautions to observe when working around hot metals. (PSVS)	
16.3	To describe the structure and the operating principles of an exhaust system.	
16.4	To demonstrate ability to test exhaust back pressure for restrictions.	Create a lab activity for learning objectives 16.4 – 16.8.
16.5	To demonstrate ability to locate exhaust system noise and leakage. (CCT)	Inspect exhaust system on student vehicles when possible.
16.6	To describe the procedure for removing an exhaust system using a gas cutting torch or air powered cutting tools.	If possible, have students observe this removal during a field trip to a muffler shop and discuss this in class. See Module 5 of the Welding 10, 20, A30, B30 Curriculum Guide. A local muffler shop may donate old mufflers and tail pipes for school lab/shop use.
16.7	To demonstrate ability to install an exhaust system so that it does not rattle or leak.	If small off-cuts and leftovers of new pipe are available through a muffler shop, students can practise assembly skills.
16.8	To demonstrate the ability to replace catalytic converters.	

Module 17: Radiators and Coolants (Optional)

Suggested time: 15 - 25 hours

Level: Intermediate

Prerequisite: None

Foundational Objectives

- To develop general understanding of the function and operation of automotive systems: power plant (engine), drive train, steering and suspension, electrical, body, and brakes.
- To demonstrate safe working practices and procedures for the automotive service industry.
- To foster employability skills related to the automotive service industry.
- To identify health and safety hazards so that the potential for injury and damage to equipment, vehicles, and the environment is minimized.
- To provide students with experience in the automotive service industry that will enable them to make an informed decision about a career in this field.

Common Essential Learnings Foundational Objectives

- To use a wide range of language experiences for developing students' knowledge of cooling systems. (COM)
- To strengthen students' knowledge and understanding of how to compute, measure, estimate and interpret numerical data, when to apply these skills and techniques, and why these processes apply within the particular framework of the automotive service industry. (NUM)
- To develop a contemporary view of technology by identifying the purpose and function of the cooling system in the automobile. (TL)

Note: Other CELs may be emphasized here.

Learning Objectives		Notes
17.1	To identify the cooling system components. (COM)	
17.2	To discuss the need for pressure testing cooling systems.	Do not open radiator pressure cap unless engine and radiator are cold.
17.3	To list the safety precautions to be observed while working around hot liquids and antifreeze.	Refer to Module 3.
17.4	To describe ways in which coolant could escape from the cooling system and match these ways to their associated problems.	Include examples of possible leak locations and pressure problems.
17.5	To perform a visual inspection of the cooling system prior to pressure testing.	

	Learning Objectives	Notes
17.6	To demonstrate ability to pressure test a cooling system using the appropriate special tools and evaluate the results. (IL)	Tool companies may be invited to the class to demonstrate their products.
17.7	To demonstrate the ability to use dye testing equipment to test for leaks.	Review different antifreeze types e.g., gas, diesel, and aluminum compatible.
17.8	To describe cooling media.	
17.9	To explain how an air cooling system operates.	Set up one of the shop vehicles to leak coolant only while under pressure. Demonstrate how coolant will sometimes only leak while the engine is hot and the cooling system is under pressure. If the engine has not been running long, coolant will not leak.
17.10	To define 'specific gravity' as it applies to engine coolant. (TL)	
17.11	To demonstrate the ability to measure pH level of coolants. (NUM)	
17.12	To explain the effects of coolant specific gravity on boiling and freezing points.	
17.13	To demonstrate ability to test and evaluate engine coolant.	Check coolant strength and condition on a variety of student or staff vehicles. Include as part of maintenance schedule created for Learning Objective 1.5.
17.14	To demonstrate ability to adjust coolant strength to be acceptable for local conditions. (CCT)	
17.15	To demonstrate the proper procedures for disposal of used coolants.	Schools without a cooling system flusher could tour a facility, or a lab activity may be created in conjunction with a local service station to demonstrate: <ul style="list-style-type: none"> • use of recovery systems • use of recycling machines
17.16	To explain the environmental concerns associated with antifreeze disposal. (PSVS)	Invite a speaker to discuss the chemical properties of engine coolant and to identify the environmental concerns handling and disposing of coolants. Have the students research the recycling procedure for automotive coolants and identify nearest collection centre.

Learning Objectives		Notes
17.17	To evaluate the condition of the cooling system by inspecting coolant for rust and oils and pH levels. (CCT)	A visual inspection would be appropriate at this time.
17.18	To explain the safety procedures to observe while operating a cooling system flusher. (IL)	If possible, visit a service station that uses a flushing system to see how this operation is done.
17.19	To demonstrate ability to flush a cooling system with a cooling system flusher. (IL)	Create a lab activity for learning objectives that have a demonstration component.
17.20	To demonstrate ability to fill coolant systems and purge air from systems where required. (IL)	
17.21	To describe radiator design features and construction methods. (COM)	A variety of radiator types can be displayed to demonstrate differences.
17.22	Describe the purpose and function of the auxiliary oil cooler located in the radiator of automatic transmission equipped vehicles and some diesel engine equipped vehicles. (COM)	An additional cooler is sometimes installed on vehicles that are used for trailer towing.
17.23	To describe how to determine if the oil cooler is leaking into the radiator or vice versa.	
17.24	To describe coolant recovery systems.	
17.25	To describe the need for radiator shrouding.	
17.26	To demonstrate care in handling radiators.	
17.27	To demonstrate care in removing and replacing components to access heater cores.	Do not have students do 17.27 or 17.28 if the vehicle is equipped with air conditioning. Have demonstration done by a certified technician.

17.28 To demonstrate ability to replace heater cores.

Learning Objectives

Notes

17.29 To describe the features of different styles of radiator and heater hoses. (COM)

17.30 To describe the features of different styles of hose clamps and match the correct installation/removal tool to be used with each style.

Create a display of different hose clamp designs where students can practise proper removal and installation techniques.

17.31 To replace radiator and heater hoses.

17.32 To explain how to repair a radiator. (COM)

This particular job is generally sent to a specialty shop that repairs and rebuilds radiators and heater cores. If possible, tour a radiator shop. Discuss how to repair:

- aluminum core
- brass core
- plastic and brass end tanks

17.33 To demonstrate the ability to remove and install cooling system components.

Include the following components:

- water pumps
- frost plugs
- block heaters
- thermostats
- cooling fans
- thermal clutches

Module 18: Pulleys and Belts (Optional)

Suggested time: 5 - 10 hours

Level: Intermediate

Prerequisite: Module 3

Foundational Objectives

- To develop general understanding of the function and operation of automotive systems: power plant (engine), drive train, steering and suspension, electrical, body, and brakes.
- To create an awareness of the need for regular maintenance of an automobile through demonstration and practice.
- To demonstrate safe working practices and procedures for the automotive service industry.

Common Essential Learnings Foundational Objectives

- To support the development of a positive disposition to lifelong learning by servicing a variety of belts and pulley systems. (IL)
- To work safely and cooperatively with other team workers. (PSVS)

Note: Other CELs may be emphasized here.

	Learning Objectives	Notes
18.1	To list the pulley types and locations and their purpose. (COM)	Brainstorm with students to identify places where pulleys and belts are used on vehicles.
18.2	To list safety precautions to observe while replacing pulleys and belts.	Refer to Modules 3 and 15.
18.3	To demonstrate ability to remove and replace pulleys. (IL)	
18.4	To explain how pulley damage can harm belts and seals.	
18.5	To explain how incorrect pulley size can cause system malfunctions such as overheating, undercharging, bearing failure, etc. (TL)	Replace a pulley with an incorrect size, allow students to observe, and note the problems that are created.
18.6	To diagnose causes of pulley misalignment and perform realignment. (CCT)	
18.7	To list distinguishing features and uses of various belts.	Display examples of each type of belt. <ul style="list-style-type: none">• V-belts• serpentine flat belts• cog type timing belts
18.8	To demonstrate ability to remove, replace, and tighten V-belts and serpentine belts to proper tension. (IL)	Create lab activity where students replace a variety of belt types. (PSVS)

Module 19A: Wheel Bearings (Core)

Suggested time: 5 - 10 hours

Level: Intermediate

Prerequisite: None

Foundational Objectives

- To demonstrate safe working practices and procedures for the automotive service industry.
- To demonstrate proper use of the tools and equipment utilized in the automotive service industry.
- To provide students with experience in the automotive service industry that will enable them to make an informed career decision.

Common Essential Learnings Foundational Objectives

- To enable students to evaluate conditions and determine a repair strategy. (CCT)
- To develop students' abilities to access and apply knowledge to braking systems. (IL)
- To develop a current view of technology in braking systems (ABS, Anti-Locking Brake Systems). (TL)
- To support students in coming to a better understanding of the personal, moral, and social aspects in working with and disposing of harmful substances used in braking systems. (PSVS)

Note: Other CELs may be emphasized here.

Note: It is preferred but not necessary that Module 19A - 19D be completed as a sequence.

Foundational Objectives apply to all four modules.

	Learning Objectives	Notes
19.1	To identify automotive bearing types.	Brainstorm with students where bearings are used in vehicles and why different types are necessary: <ul style="list-style-type: none">• friction types• anti-friction types<ul style="list-style-type: none">• ball• cone (tapered and roller)• needle (torrington)
19.2	To explain how bearings support radial, thrust, and combination loads.	Provide students with samples of different types of bearings to indicate the differences in use and application.
19.3	To explain correct bearing handling procedures.	
19.4	To describe wheel bearing wear patterns and causes.	Collect used bearings to display various wear patterns.
19.5	To demonstrate ability to evaluate wheel bearing and hub condition.	Create a lab activity where students determine the condition of the wheel hub bearing on student or teacher vehicles. (IL)
19.6	To demonstrate ability to clean and repack wheel bearings and hubs.	Demonstrate bearing packing equipment.
19.7	To demonstrate ability to replace wheel bearing cups and seals using special driving tools.	
19.8	To demonstrate the ability to replace one piece press-on bearing assemblies.	

Module 19B: Brake Systems (Core)

Suggested time: 20 - 25 hours

Level: Intermediate

Prerequisite: Module 19A

	Learning Objectives	Notes
19.9	To demonstrate ability to replace wheel studs. (TL)	Create lab activities for learning objectives that require demonstration.
19.10	To demonstrate ability to adjust wheel bearing preload.	Have students locate service information from appropriate service manual for adjusting new and used wheel bearings.
19.11	To demonstrate ability to use a torque wrench for tightening wheels and hubs.	Refer to manufacturer's specifications.
19.12	To describe the testing and diagnostic procedure for braking problems. (TL)	<p>Braking problems may include:</p> <ul style="list-style-type: none">• brake noise• brake pull• brake pedal fade• wheel lock-up• spongy pedal• hard pedal• pulsating pedal• no pedal <p>Invite a guest speaker such as an automotive service technician to discuss diagnosing brake problems.</p>
19.13	To list causes and effects on brake performance.	<p>Causes and effects on brake performance include:</p> <ul style="list-style-type: none">• tire condition• tire size• tire inflation• road surface condition• vehicle weight• steering and suspension condition
19.14	To list the properties of different types of brake fluids.	<p>Include the following:</p> <ul style="list-style-type: none">• regular brake fluid• silicon brake fluid
19.15	To describe various ways brake fluid can be tested.	<p>Visually check for clarity or presence of visible contaminants.</p> <p>Outside lab testing can also be done to determine the presence of chemical contamination.</p>
19.16	To explain why brake fluid must be replaced periodically. (IL)	Test brake fluid for H ₂ O content.

	Learning Objectives	Notes
19.17	To demonstrate flushing and bleeding procedures using manufacturers' recommended methods and tools. (IL)	Set up one of the shop vehicles to let air into the lines and allow students to operate the brakes. This will enable students to identify air in the brake lines as a problem.
19.18	To reset brake pressure warning switches after system service.	Check service manuals for appropriate procedures.
19.19	To describe the construction of brake hoses and brake lines. (CCT)	
19.20	To demonstrate ability to identify causes and characteristics of chafed, cracked, or rusted brake lines and hoses. (CCT)	Brake service should include an inspection of all hoses and brake lines.
19.21	To demonstrate ability to remove, install, and adjust brakes.	Organize several inspections of student or teacher vehicles: <ul style="list-style-type: none"> • hoses and metal lines • disc brake pads • brake shoes
19.22	To demonstrate ability to form ends on brake tubing.	Create lab activity where students cut, bend and flare a short length of brake tubing. Include the following flare types: <ul style="list-style-type: none"> • double flare • ISO flare
19.23	To explain the health hazards associated with breathing asbestos dust. (PSVS)	Invite a guest speaker such as a nurse or doctor to discuss cancer-causing agents like asbestos dust.
19.24	To demonstrate safe use of brake cleaning machines and personal respirators. (PSVS)	Demonstrate proper removal of brake dust.
19.25	To explain basic drum brake and disc brake operation.	Be aware of ABS braking systems. See service manuals for depressurizing procedure.
19.26	To explain hydraulic principles as they apply to brakes.	Two water filled syringes connected by a short length of clear tubing is an excellent demonstration model.
19.27	To evaluate disc rotor and brake drum condition.	Common drum and rotor conditions include: bell mouthing, taper, barrel shape, out-of-round, glazing, over heating, lateral run out, thickness variation, and rust spotting.

Learning Objectives		Notes
19.28	To evaluate brake hardware and shoe adjuster condition and replace as required.	Allow students to perform complete brake jobs on their own vehicles, stress the importance of using new mounting hardware.
19.29	Inspect and service brake backing plate.	
19.30	To demonstrate ability to perform brake shoe and anchor adjustments. (TL)	Saskatchewan Government Insurance may sell drum brake assemblies to schools at a reduced cost. This can be an ideal model that students may work on to learn the principles and components of drum brake systems.
19.31	To demonstrate ability to measure brake drum diameter and out-of-round.	
19.32	To demonstrate ability to measure disc run-out and parallelism using micrometers and dial indicators. (NUM)	Create a lab activity where students do measurements on a brake drum and disc using student or teacher vehicles.
19.33	To demonstrate ability to resurface drums and disc rotors.	<p>The machining process requires special equipment and could be accomplished during a work study or a a visitation to a brake servicing business if the school does not have the equipment.</p> <p>Discarded, unserviceable brake drums and rotors are available from service centres for demonstration and practice purposes.</p>

Module 19C: Wheel Cylinders, Calipers and Master Cylinders (Core)

Suggested time: 5 - 10 hours

Level: Intermediate

Prerequisite: Module 19B

Learning Objectives	Notes
19.34 To demonstrate safe working procedures when working with brake components. (PSVS)	The wearing of the brake system components creates fine particles that may include materials hazardous to the health of the student if they were to breathe them into their lungs. Have students wear appropriate safety equipment when working on brake systems.
19.35 To describe construction and operation of disc brake calipers. (COM)	Display different types of disc calipers. <ul style="list-style-type: none">• floating caliper• fixed caliper• sliding caliper
19.36 To describe construction and operation of brake wheel cylinders and drum brake systems.	Written assignments or labeling diagrams work well in identifying brake components. <ul style="list-style-type: none">• servo action, self-energizing• leading/trailing• dual cylinder
19.37 To demonstrate ability to overhaul calipers and wheel cylinders. (TL)	Remember that particles from brake pads may contain asbestos and therefore particle masks should be worn for any service work.
19.38 To describe the basic principles of friction and hydraulic brakes. (NUM)	Include: <ul style="list-style-type: none">• friction• coefficient of friction• factors affecting friction
19.39 To describe the operation and construction of master cylinders. (TL)	Use models as necessary. <ul style="list-style-type: none">• single• dual – regular and quick take-up
19.40 To describe the operation and construction of brake assist systems.	Assign students to trace brake system components from the foot brake to the brake pad. <ul style="list-style-type: none">• vacuum assist• hydraulic assist• electro-hydraulic assist
19.41 To demonstrate ability to bleed brake systems. (IL)	Note: Keep brake fluid away from painted vehicle surfaces
19.42 To demonstrate ability to remove and install master cylinders and brake boosters.	Create a lab activity for learning objectives that require demonstration.
19.43 To demonstrate ability to overhaul master cylinders and booster mechanisms.	Maintain a clean work area to avoid contamination.

Module 19D: Parking Brake Systems (Core)

Suggested time: 5 - 10 hours

Level: Intermediate

Prerequisite: Module 19C

Learning Objectives		Notes
19.44	To identify different types of parking brakes.	Identify different types of park brake systems; e.g. foot or lever operated, etc. <ul style="list-style-type: none">• drum• drum in disc• disc
19.45	To demonstrate ability to adjust parking brakes. (IL)	Create a lab activity for learning objectives 19.44 and 19.45. This can be included as part of a complete brake job on student or project vehicles.
19.46	To demonstrate ability to remove and replace parking brake actuating mechanisms.	<ul style="list-style-type: none">• foot pedals, hand brake levers• caliper actuating mechanisms• brake shoe actuating mechanisms• park brake cables

Module 20: Suspension Control Mechanisms and Steering Linkages (Optional)

Suggested time: 10 - 15 hours

Level: Intermediate

Prerequisite: Module 5

Foundational Objectives

- To develop general understanding of the function and operation of automotive systems: power plant (engine), drive train, steering and suspension, electrical, body, and brakes.
- To develop general knowledge of the automotive service industry practices and procedures.
- To identify health and safety hazards so that the potential for injury and damage to equipment, vehicles, and the environment is minimized.
- To demonstrate proper use of the tools and equipment utilized in the automotive service industry.

Common Essential Learnings Foundational Objectives

- To enable students to understand and use the vocabulary, structures, and forms of expression that characterize steering and suspension systems. (COM)
- To provide opportunities for students' active involvement in understanding, maintaining, and servicing mechanical/electrical devices in steering and suspension systems. (TL)
- To gain experience and demonstrate skills through active participation in automotive repair experiences. (IL)
- To promote the ability to select the appropriate strategy and equipment needed to perform a repair task. (CCT)

	Learning Objectives	Notes
20.1	To explain the need for torsion bars, springs and shock absorbers.	Remove the shock absorbers and/or springs and demonstrate automobile suspension without them.
20.2	To explain the need for other types of suspension control mechanisms.	Also review manual and automatic suspension controls, independent, semi-dependant, non-independent, and electronic active suspension components. <ul style="list-style-type: none">• stabilizer (sway) bars• Panhard (track) rods• control arms• struts
20.3	To describe different types of spring construction and operating methods. (COM)	Use different vehicles to display a variety of different types of springs. These include: <ul style="list-style-type: none">• coil spring• leaf spring• torsion bar• air suspension• twin I-beam• solid axle• independent suspension• auto ride control
20.4	To describe the construction and operation of shock absorbers. (TL)	Either cut outs of old shock absorbers or commercial models can be used to display the internal components and operation of a shock absorber such as: <ul style="list-style-type: none">• telescoping double acting• strut type arrangement• air over hydraulic shocks• electrically adjustable or manual

	Learning Objectives	Notes
20.5	To describe the effects of revised springing and damping action on the vehicle's stability.	Note: Safety Considerations: Gas shock absorbers are pressurized; cutting to create models is dangerous .
20.6	To demonstrate ability to follow manufacturers' service manual instructions.	Following the service manual, students can complete learning objectives 20.6 – 20.9.
20.7	To demonstrate ability to lift and support vehicles in specified locations. (IL)	Emphasize the need for safety precautions when lifting vehicles.
20.8	To demonstrate the ability to inspect springs, shock absorbers, and other components for abnormalities and suggest possible causes for the problems. (CCT)	Present the students with vehicle type and diagnostic information. Assign students to investigate and suggest the appropriate shock absorber application.
20.9	To demonstrate ability to measure and adjust (where possible) vehicle ride height.	Explain the importance of ride height and procedures used to adjust height.
20.10	To explain why springs and shock absorbers should be replaced in pairs.	
20.11	To select shock absorbers best suited for the application. (CCT)	Use a variety of types as examples of possible selections.
20.12	To demonstrate the ability to replace shock absorbers and springs using safe procedures and special tools. (IL)	
20.13	To demonstrate ability to service strut type suspensions such as MacPherson, modified MacPherson, Chapman struts, etc.	Follow Service Manual procedures when working with spring compressors.
20.14	To demonstrate ability to replace suspension components such as control arms, sway bars and bushings. (IL)	
20.15	To identify steering linkage components. (COM)	

	Learning Objectives	Notes
20.16	To explain why the steering linkage is an important safety item. (CCT)	Have two vehicles available -- one with properly operating steering linkage and one without. Have students measure the steering play on each vehicle and determine the cause and the components that need repair or replacement.
20.17	To explain different steering arrangements.	Use a variety of vehicles to show the following steering mechanisms and arrangements. <ul style="list-style-type: none"> • rack and pinion • parallelogram • haltenberger
20.18	To describe the purpose and operation of steering linkage components.	Follow through with a lab designed to remove and install necessary components.
20.19	To describe how steering linkage component malfunctions will affect handling, steering control and alignment geometry. (NUM)	Arrange a field trip to a wheel alignment centre to have students observe the proper methods, tools, and procedures used to replace worn parts.
20.20	To demonstrate ability to perform a ball joint and tie rod end inspection.	These inspections are done with the vehicle on a hoist with the components installed.
20.21	To state the necessity of torquing and locking linkage components.	
20.22	To explain the dangers of welding or heating steering linkage components. (PSVS)	Demonstrate affects of welding on heat-treated steel by performing a destructive welding test. Emphasize that welding of steering components should not be done. (Refer to Welding Curriculum, Module 25)
20.23	To demonstrate ability to use special tools used for linkage repair.	
20.24	To demonstrate ability to replace linkage components.	
20.25	To demonstrate ability to make a preliminary toe adjustment.	

Module 21: Alternators (Optional)

Suggested time: 10 - 20 hours

Level: Advanced

Prerequisite: Module 14

Foundational Objectives

- To develop general understanding of the function and operation of automotive systems: power plant (engine), drive train, steering and suspension, electrical, body, and brakes.
- To develop general knowledge of the automotive service industry practices and procedures.
- To demonstrate safe working practices and procedures for the automotive service industry.

Common Essential Learnings Foundational Objectives

- To develop a contemporary view of technology as it applies to the electrical charging systems in an automobile. (TL)
- To use a wide range of language experiences for developing students' knowledge of charging systems. (COM)
- To develop a skill to diagnose and determine how to repair charging systems. (CCT)

Note: Other CELs may be emphasized here.

Learning Objectives		Notes
21.1	Demonstrate ability to select appropriate servicing manuals and bulletins. (CCT)	Number the charging system components on one of the shop vehicles and have students identify the name and operation of each.
21.2	To identify the components of the charging system. (COM)	
21.3	To describe the safety hazards associated with charging system repair.	These include: <ul style="list-style-type: none">• sparks at battery• battery charging procedures• objects getting caught in fan and belts• objects contacting battery terminals
21.4	To describe inspection and minor repair procedures of items that could cause an inoperative charging system.	Ask students from where the automobile electricity comes. Does a car run with or without a battery in it? Why? Ask students to identify possible causes for inoperative charging: <ul style="list-style-type: none">• battery connections• battery drain (parasitic drain)• fuses and wiring• belts (tension or wear)• alternator damage or improper operating environment for alternator noise (COM)• computer controlled
21.5	To describe the operation and function of charging systems.	Display different tools used in charging system repair. <ul style="list-style-type: none">• alternator• regulator• battery• computer controlled charging systems

	Learning Objectives	Notes
21.6	To identify the special tools used to test charging systems.	Caution needed for computer controlled charging systems. Disable the charging system of a vehicle (e.g., open or shorted diodes in the alternator) and demonstrate how it affects charging system operation. Tools that may be required include: <ul style="list-style-type: none"> • Alternator-Voltage Regulator tester • DVOM (digital-volt-ohm-milliammeter) • oscilloscope (TL) • scan tools
21.7	To explain the common symptoms associated with charging system malfunctions. (COM)	
21.8	Demonstrate the ability to perform alternator service tests. (IL)	Tests should include: <ul style="list-style-type: none"> • parasitic draw (battery drain) test • output test • voltage regulator test • regulator by-pass test • circuit resistance (voltage drop) tests
21.9	To evaluate the charging system as inspected in comparison to manufacturers' specifications. (CCT)	Have students or teachers bring in their vehicles and test the charging systems identifying which systems have stronger and weaker charging systems and why this occurs.
21.10	Demonstrate knowledge of electrical and electronic fundamentals. (IL)	Refer to Module 14.
21.11	To demonstrate the safety procedures used when testing electronic components.	Refer to Module 3
21.12	Explain the principles of electromagnetic induction as they apply to alternators.	
21.13	To explain the operation of an alternator.	Alternator cores and rebuild kits are available through SGI or local service stations that can provide students with equipment to study alternator components and repair. Most rebuild kits come with extensive instructions and information. <ul style="list-style-type: none"> • Wye circuit • Delta circuit • internally regulated • externally regulated • phase tap alternators • computer controlled

Learning Objectives**Notes**

- | | | |
|-------|--|--|
| 21.14 | To explain the operation of voltage and current regulation device. | Discuss the following voltage regulation systems: <ul style="list-style-type: none">• internal regulator• external regulator• computer controlled regulator |
| 21.15 | To trace and interpret circuit schematic diagrams. (TL) | Include the following: <ul style="list-style-type: none">• alternator internal circuitry• charge indicator light/gauge• coil type regulator• transistorized regulator |

Module 22: Starting Systems (Optional)

Suggested time: 10 - 20 hours

Level: Advanced

Prerequisite: Module 14

Foundational Objectives

- To develop general understanding of the function and operation of automotive systems: power plant (engine), drive train, steering and suspension, electrical, body, and brakes.
- To demonstrate safe working practices and procedures for the automotive service industry.
- To demonstrate proper use of the tools and equipment utilized in the automotive service industry.
- To develop workplace skills, knowledge, and attitudes in the automotive service industry that may lead to successful employment.

Common Essential Learnings Foundational Objectives

- To support the development of a positive disposition to life-long learning by examining a variety of starter systems. (IL)
- To enable students to use language (listening, speaking, reading, writing, viewing, and representing) for differing audiences and purposes which are relevant to the students and starting systems. (COM)
- To develop students' appreciation of the value and limitations of technology in starter systems. (TL)

Note: Other CELs may be emphasized here.

	Learning Objectives	Notes
22.1	To identify the components of the starting system. (COM)	Number starting system components on one of the shop vehicles and have students identify the name and purpose of each.
22.2	To describe the safety hazards associated with starting system repair.	List safety hazards associated with starting system repair such as: <ul style="list-style-type: none">• safety switches• gear lever position.
22.3	To describe inspection procedures of items that could cause an inoperative starting system. (CCT)	Students can create a written checklist showing the proper order of system checks for a starter system diagnosis. Some causes of inoperative starting include: <ul style="list-style-type: none">• battery• cables and grounds• ring gear• starter motor damage• neutral safety and clutch safety switches• theft deterrent systems• remote starting systems
22.4	To explain wound motor construction and operation.	
22.5	To describe the operation of starter activation and drive mechanisms. (TL)	Display a disassembled starter motor and have students identify names and functions of each part. <ul style="list-style-type: none">• solenoids• magnetic pole shoe• Bendix® drives

	Learning Objectives	Notes
22.6	To demonstrate the ability to follow safety procedures required when working with starter motors. (IL)	Hand out starter system electronic diagrams and have students identify and label the different circuits in the system.
22.7	To demonstrate ability to understand and follow wiring schematics.	See the manufacturer's specifications.
22.8	To explain a starting circuit system operation. (COM)	See the manufacturer's specifications.
22.9	To demonstrate ability to use electrical test meters.	Refer to the Electrical and Electronics Curriculum Guide, Module 19, Measuring Instruments, for information regarding meters.
22.10	To list common symptoms associated with starter system malfunctions.	
22.11	To demonstrate ability to perform starter tests.	<p>Create a lab activity for learning objectives 22.11 – 22.19.</p> <p>Warning: A locked armature current draw test should not be performed. It would be better to do a "no load" test.</p> <p>The tests should include the following:</p> <ul style="list-style-type: none"> • starter current draw • circuit voltage drop • armature and field windings • no-load spin • full load test
22.12	To demonstrate the ability to perform visual checks of all starter system components. (IL)	
22.13	To demonstrate the ability to replace starter motor assemblies. (IL)	
22.14	To indicate which starter circuit components may be cleaned in solvent safely.	Use electrical contact cleaner for all other components. Refer to Module 7, Cleaning Techniques.
22.15	To demonstrate ability to check all starter internal components for electrical integrity and explain how problems in these areas could affect starter operation.	<p>Create lab activity with students working in pairs to disassemble, check components, repair, reassemble, and test starter operation, as follows: (TL)</p> <ul style="list-style-type: none"> • armature • commutator • field windings • solenoids • brushes • bushings and bearings <p>Used starters or cores can be purchased from SGI or automotive service centres.</p>

Learning Objectives		Notes
22.16	To demonstrate ability to replace and fit a bearing and bushings.	Refer to Module 19A, Wheel Bearing Service for general information regarding care of bearings.
22.17	To demonstrate ability to refinish the commutator.	
22.18	To demonstrate ability to rebuild starter motors.	Discuss the re-manufacturing operations required to service armatures and fields (re-winding).
22.19	To demonstrate ability to test and replace starter drive mechanisms.	
22.20	To be able to diagnose a ring gear problem and provide a replacement.	As it will be necessary to remove the transmission, observe proper safety techniques.

Module 23A: Small Engines (Optional)

Suggested time: 10 - 15 hours

Level: Introductory

Prerequisite: None

Foundational Objectives

- To develop general understanding of the components and operation of a small engine.
- To demonstrate knowledge of engine design and operation.
- To inspect, evaluate, repair, and replace lubrication system components.
- To develop general understanding of the function and operation of automotive systems: power plant (engine), drive train, steering and suspension, electrical, body, and brakes.
- To demonstrate proper use of the tools and equipment utilized in the automotive service industry.

Common Essential Learnings Foundational Objectives

- To strengthen students' knowledge and understanding of how to compute, measure, estimate, and interpret numerical data, when to apply these skills and techniques, and why these processes apply within the particular framework of the internal combustion engine. (NUM)
- To promote both intuitive and imaginative thought and the ability to evaluate ideas, processes, experiences, and objects in engine design. (CCT)
- To use a wide range of language experiences for developing students' knowledge of engines. (COM)
- To provide opportunities for students' active involvement in the use of technological equipment related to engine repair. (TL)

Note: Other CELs may be emphasized here.

	Learning Objectives	Notes
23.1	To explain the principles of the internal combustion engine. (COM)	See recommended resources for resource supports.
23.2	To describe the 2 stroke cycle and 4 stroke cycle principles of operation. (COM)	Demonstrate with a cut away model or a single cylinder that has been "torn down".
23.3	To explain the construction and function of major engine sub-assemblies, including the cylinder block, head, and valve train. (TL)	
23.4	To demonstrate how a repair manual is used to help tear down, repair, and reassemble an engine.	All small engine manufacturers have published service manuals for their product.
23.5	To explain the relationship and operation of all engine components.	Create an assignment where students label a parts diagram and explain the function and operation of each part.
23.6	To demonstrate the ability to use measuring tools. (NUM)	Use tools such as vernier calipers, micrometers and torque wrenches to perform measurements. Make certain the surfaces being measured are free of contaminants to protect the measuring surfaces.

	Learning Objectives	Notes
23.7	To define and calculate engine measurements.	<p>Horsepower = (Bore x # of cylinders x Stroke x RPM) ÷ 1100</p> <ul style="list-style-type: none"> • bore • stroke • displacement • compression ratio • power – measured in horsepower or Watts
23.8	To state the purposes of engine oil.	Refer to Module 10.
23.9	To demonstrate the ability to interpret oil container labeling information.	
23.10	To explain why oil leakage and loss of pressure can cause engine failure. (CCT)	
23.11	To define oil contamination forms.	Contaminants include sludge, water, cleaning agents, anticorrosive agents, etc.
23.12	To assess oil condition.	
23.13	To demonstrate the ability to disassemble and reassemble a one cylinder engine. (IL)	<p>Create a project where students start a small engine, disassemble, inspect, measure components, reassemble, and run engine again. Before removing camshaft, valves, and piston, have students observe the relationship and operation of the components.</p> <p>Students should also be able to use repair manuals to help with the lab activity that they are doing.</p>

Module 23B: Multi-cylinder Engines (Core)

Suggested time: 40 - 50 hours

Level: Intermediate

Prerequisite: Module 14, 23A

Learning Objectives		Notes
23.14	To describe the 2 stroke cycle and 4 stroke cycle principles of operation. (COM)	See recommended resource list.
23.15	To explain the construction and function of major engine sub-assemblies.	Include the following sub-assemblies: <ul style="list-style-type: none">• cylinder block assembly• cylinder head assembly• camshaft timing mechanism
23.16	To list the engine auxiliary systems and explain their purpose.	Use shop vehicles for students to identify components of each auxiliary system. <ul style="list-style-type: none">• cooling• exhaust• fuel• ignition• lubrication• emissions
23.17	To explain engine design variations.	Include: <ul style="list-style-type: none">• in-line• V-type• flat• radial• rotary <p>Students may contact local dealerships to identify which engine type was used in different vehicle models and why it was used.</p> <p>Create a lab that incorporates objectives 23.16 – 23.21.</p>
23.18	To explain valve train design variations.	Incorporate these measurement activities into a lab where students disassemble and assemble a multi-cylinder engine. <ul style="list-style-type: none">• cam in block• SOHC (Single Over Head Cam)• DOHC (Double Over Head Cam)• non-poppet valve design
23.19	To explain the purpose and operation of all engine components.	Electronic fuel injection types should be examined.
23.20	To demonstrate the ability to use measuring tools. (TL)	Emphasize care when handling measuring tools to maintain accuracy.

	Learning Objectives	Notes
23.21	To define and calculate engine measurements. (NUM)	<ul style="list-style-type: none"> • bore • stroke • throw • displacement • compression ratio • power in horsepower or Watts • camshaft measurements
23.22	To describe the construction and operation of the lubrication system.	<ul style="list-style-type: none"> • splash • pressure • by-pass lubrication • full flow lubrication
23.23	To demonstrate the ability to evaluate engine oil level and oil pressure measurements. (CCT)	Students can gather information on the different types of oil sold in local service stations and make a presentation to the class on the different oil ratings.
23.24	To explain how oil leakage and loss of oil pressure contribute to engine failure.	Bring in vehicles with oil leaks and have students diagnose where the leak is occurring. (IL)
23.25	To explain why loss of oil pressure can cause engine failure.	
23.26	To demonstrate the ability to identify leak sources using leak detection methods. (IL)	Include: <ul style="list-style-type: none"> • visual • black light • colour • air pressure • smoke detection
23.27	To demonstrate ability to repair external oil leaks.	Repair leaks as located in Objective 23.26. <ul style="list-style-type: none"> • seals • gaskets • form-in-place gasket materials • sealants
23.28	To suggest possible areas of internal oil leakage and their associated symptoms.	
23.29	To inspect the engine's internal lubrication system.	Have students explain how oil galleries provide access to moving internal parts.
23.30	To demonstrate the ability to replace gallery plugs.	
23.31	To demonstrate the ability to clean out all oil galleries.	Caution: using air pressure to clear oil galleries can create airborne pollutants and particles.

Learning Objectives		Notes
23.32	To demonstrate the ability to repair or replace oil pumps and pump drive mechanisms.	
23.33	To demonstrate the ability to replace pump and screen gaskets and O-rings.	Arrange a field trip to an engine rebuilding shop to observe machining operations.
23.34	To demonstrate the ability to select and install engine bearings correctly so that oil holes are not blocked.	
23.35	To demonstrate the ability to adjust or replace oil pressure relief valves.	
23.36	To perform an oil and filter change.	Select correct oil and filter for current weather and application. Dispose of oil in the correct, environmentally safe manner.
23.37	To demonstrate the ability to torque fasteners to the correct specification and in the correct order.	Check manufacturer's specifications for torque sequence for all parts as required.
23.38	To perform a variety of engine tests to access performance and diagnose or trouble-shoot engine problems.	
23.39	To make performance adjustments to engine components.	Tests to include for this objective are: <ul style="list-style-type: none">• compression tests• wet and dry test• cylinder leak down test• vacuum testing

Module 24: Universal Joints and Driveshafts (Core)

Suggested time: 15 - 25 hours

Level: Advanced

Prerequisite: Modules 3, 5

Foundational Objectives

- To identify health and safety hazards so that the potential for injury and damage to equipment, vehicles, and the environment is minimized.
- To develop general understanding of the function and operation of automotive systems: power plant (engine), drive train, steering and suspension, electrical, body, and brakes.
- To demonstrate proper use of the tools and equipment utilized in the automotive service industry.
- To develop workplace skills, knowledge, and attitudes in the automotive service industry that may lead to successful employment.

Common Essential Learnings Foundational Objectives

- To provide opportunities for students' active involvement in understanding, maintaining, and servicing technological devices in the automotive service industry. (TL)
- To enable students to use language (listening, speaking, reading, writing, viewing, and representing) for differing audiences and purposes that are relevant to the students and drive-line systems. (COM)
- To develop students' understanding of the uses of mathematical concepts in drive-line service. (NUM)
- To strengthen students' ability to diagnose and repair automotive problems. (CCT)

Note: Other CELs may be emphasized here.

Learning Objectives		Notes
24.1	To describe the construction and operation of universal joints.	Display different types of universal joints. <ul style="list-style-type: none">• Cardan joint• Constant velocity joint• Ball and trunnion• Rzeppa joint• Tripod joint (TL) Review safety practices and procedures for vehicles lifted off the floor.
24.2	To identify causes of universal joint failure. (COM)	Display damaged or worn universal joints.
24.3	To describe universal and constant velocity joint inspection procedures.	Create a lab activity for learning objectives 24.3 – 24.5.
24.4	To demonstrate the ability to replace universal joints and constant velocity joints using appropriate tools. (TL)	Use a project vehicle and have students remove driveshaft and change universal joints, following service manual procedures.
24.5	To demonstrate the ability to lubricate universal joints. (IL)	Use a project vehicle and have students remove half-shafts, disassemble, clean, and repack Rzeppa and tripod universal joints.

Learning Objectives		Notes
24.6	To explain why noise and vibration are often a source of annoyance and an indication of a pending problem. (COM)	
24.7	To describe types of vibration. (COM)	<p>Include:</p> <ul style="list-style-type: none"> • first order • second order • balance
24.8	To list sources of drive-line vibration.	<p>If possible, find someone who is experiencing drive-line noise and use his or her vehicle for demonstration purposes.</p> <p>Demonstrate methods to safely locate drive-line noise from the following:</p> <ul style="list-style-type: none"> • driveshafts • mounting systems • bearing looseness • transmission or axle damage
24.9	To describe types of drive-line noise.	<p>Types of drive-line noise may include:</p> <ul style="list-style-type: none"> • whines • hum • clunk • clicking on turns
24.10	To list sources of drive-line noise.	<p>Possible sources of drive-line noise may include:</p> <ul style="list-style-type: none"> • universal and constant velocity joints • gears • seals
24.11	To describe the significance of driveshaft correct running angle.	
24.12	To demonstrate safety procedures when working under a running vehicle and around moving drive-line components. (PSVS)	A drill bit put into a drill chuck off-centre will demonstrate the effects of improper drive-line angle or a 3/8's extension with a universal in a drill will also demonstrate vibration during improper drive-line angle. (NUM)
24.13	To evaluate noise and vibration found and suggest repair options. (CCT)	
24.14	To describe the construction and operation of driveshafts including steel, aluminum and composite.	

Learning Objectives	Notes
24.15 To explain how driveshaft faults can lead to vibration, noise and damage.	Have students list causes of drive-line noise. Display a variety of driveshaft types. <ul style="list-style-type: none"> • run-out • phase difference • worn support bearing • dry seals • worn splines
24.16 To demonstrate safe working procedures around driveshafts and components.	Create a lab activity for objectives 24.16 – 24.25. Students may list the personal and mechanical safety equipment needed to maintain personal safety and reduce possible damage to drive shaft and components
24.17 To demonstrate the ability to use special driveshaft service tools. (TL)	Tools may include: <ul style="list-style-type: none"> • presses • strobe lights • pullers • heaters • vibration analyzer
24.18 To demonstrate the ability to replace a driveshaft.	
24.19 To demonstrate the ability to measure run-out and bend. (NUM)	
24.20 To demonstrate the ability to replace centre support (shaft hanger) bearings. (IL)	
24.21 Explain why excessive drive-line angles affect vibration. (NUM)	
24.22 To demonstrate the ability to read and interpret manufacturers' service manuals. (CCT)	
24.23 To demonstrate the ability to use drive-line angle meters and protractors. (TL)	Students are reminded that measuring tools should be handled carefully to maintain accuracy.
24.24 To identify methods for correcting excess angularity. (CCT)	
24.25 To demonstrate the ability to adjust transmission and rear axle position to change angularity.	

Module 25: Clutches and Release Mechanisms (Core)

Suggested time: 15 - 25 hours

Level: Advanced

Prerequisite: Modules 3, 5

Foundational Objectives

- To develop general understanding of the function and operation of automotive systems: power plant (engine), drive train, steering and suspension, electrical, body, and brakes.
- To provide students with experience in the automotive service industry that will enable them to make an informed career decision.

Common Essential Learnings Foundational Objectives

- To enable students to understand and use the vocabulary, structures and forms of expression that characterize clutch service. (COM)
- To develop students' abilities to meet their own learning needs. (IL)
- To develop students' appreciation of the value and limitations of technology. (TL)

Note: Other CELs may be emphasized here.

Learning Objectives		Notes
25.1	To describe the construction and operation of clutches.	
25.2	To explain the implications of slipping and excessive free play in a clutch.	
25.3	To demonstrate the ability to remove and replace transmissions or trans-axles. (IL)	
25.4	To demonstrate the ability to follow manufacturer's service manual instructions. (COM)	Use proper mechanical lifts and assists.
25.5	To demonstrate the ability to follow safety precautions dealing with clutch replacement.	
25.6	To demonstrate the ability to measure and evaluate face wear of a flywheel. (CCT)	Stress safety precautions for handling asbestos.
25.7	To demonstrate the ability to replace pilot bearings and bushings.	
25.8	To demonstrate the ability to use appropriate tools to install clutches. (TL).	Tools could include: <ul style="list-style-type: none">• pilot shaft alignment tools• torque wrench• lifting tools
25.9	To demonstrate the ability to adjust and service clutch linkages. (IL)	Follow manufacturer's recommendations.

	Learning Objectives	Notes
25.10	To explain the operation and construction of a clutch assembly.	This can be done as a demonstration. Note the following components: <ul style="list-style-type: none"> • release mechanism • clutch members • pilot bearings and bushings
25.11	To explain why proper clutch adjustment is critical to long clutch life and "driveability."	
25.12	To describe the effects of clutch misadjustment.	The following will affect the performance and premature wear of the clutch: <ul style="list-style-type: none"> • too little free play • too much free play • too much pedal travel
25.13	To demonstrate the ability to lubricate release forks.	The lubrication is only done as part of the assembly procedure.
25.14	To diagnose internal clutch problems.	
25.15	To describe the construction and operation of clutch release mechanisms.	Display a variety of vehicles to demonstrate each type of linkage: <ul style="list-style-type: none"> • cable • link and bellcrank • hydraulic system • levers and pivot release bearings (TL)
25.16	To demonstrate the ability to adjust clutch pedal height and free play.	
25.17	To demonstrate the ability to replace clutch cable.	Create a lab activity for objectives 25.16 - 25.22. Use student vehicles when possible to demonstrate proper pedal height and free-play adjustments.
25.18	To demonstrate the ability to replace or repair clutch links and bellhousing. (IL)	
25.19	To explain hydraulic principles as required for clutch operation.	Remind students of safety considerations when handling hydraulic fluid.
25.20	To demonstrate the ability to replace clutch slave cylinders and master cylinders.	Observe precautions for the use of hydraulic fluid.
25.21	To demonstrate the ability to overhaul clutch slave cylinders and master cylinders.	Consider various ways to record skill development so that students have "evidence" of their ability to "do" or perform a task. Students should observe and assess each other's skill development.
25.22	To demonstrate the ability to bleed hydraulic lines.	Remind students that hydraulic fluids can harm painted surfaces.

Module 26: Manual Transmissions (Core)

Suggested time: 15 - 25 hours

Level: Advanced

Prerequisite: Module 3, 5

Foundational Objectives

- To develop general understanding of the function and operation of automotive systems: power plant (engine), drive train, steering and suspension, electrical, body, and brakes.
- To develop general knowledge of the automotive service industry practices and procedures.
- To create an awareness of the need for regular maintenance of an automobile through demonstration and practice.

Common Essential Learnings Foundational Objectives

- To develop students' abilities to access and apply knowledge to automotive service. (IL)
- To develop the ability to read, understand and use automotive service manuals and documents. (COM)
- To provide opportunities for students' active involvement in the use of technological equipment related to transmissions. (TL)

Note: Other CELs may be emphasized here.

Learning Objectives		Notes
26.1	To explain the purpose of transmission vents.	
26.2	To demonstrate the ability to inspect and clear transmission vents. (IL)	Reminder: used oil must be disposed of in an approved manner for re-cycling.
26.3	To demonstrate the ability to select the proper gear oil for the transmission.	
26.4	To demonstrate the ability to drain and fill transmissions safely.	
26.5	To explain how gear oil will affect transmission operation and life. (CCT)	Contact transmission re-builders to obtain a manual transmission that has been damaged due to lack of or inappropriate lubrication.
26.6	To explain the flat towing instructions for the vehicle. (COM)	Prepare a checklist of steps to follow before flat towing a vehicle. Have students use the checklist to observe and assess one another.
26.7	To demonstrate the ability to follow manufacturer's service manual instructions.	Refer to 25.3.
26.8	To explain the procedure for removing a transmission or trans-axle from a vehicle. (COM)	

Learning Objectives		Notes
26.9	To explain the safety precautions to observe when removing a transmission or trans-axle.	Students might write down the procedures for removing a transmission then contact a journey technician to review the procedure described. This would give the students an opportunity to make contact with a local technician.
26.10	To demonstrate the ability to use lifting and supporting equipment. (TL)	
26.11	To explain the procedure to install a transmission or trans-axle.	
26.12	To demonstrate the ability to follow safety procedures associated with transmission or trans-axle installation. (IL)	Use project vehicles to remove and reinstall transmission or trans-axle.
26.13	To demonstrate the ability to follow manufacturer's service manual instructions. (COM)	
26.14	To demonstrate the ability to align the transmission or trans-axle through the clutch to the engine.	Create a lab activity for learning objectives 26.12 – 26.18.
26.15	To demonstrate the ability to add and adjust transmission or trans-axle fluids.	
26.16	To demonstrate the ability to adjust external shift linkage. (TL)	

Module 27: Transfer Case Lubricants, Removal and Installation (Core)

Suggested time: 15 - 25 hours

Level: Advanced

Prerequisite: Modules 3, 5

Foundational Objectives

- To develop general knowledge of the automotive service industry practices and procedures.
- To demonstrate safe working practices and procedures for the automotive service industry.
- To provide students with experience in the automotive service industry that will enable them to make informed career decisions.

Common Essential Learnings Foundational Objectives

- To support the development of a positive disposition to life-long learning. (IL)
- To provide opportunities for students' active involvement in understanding, maintaining, and servicing technological devices in transfer cases. (TL)
- To understand and use the vocabulary that characterizes knowledge of transfer cases. (COM)

Note: Other CELs may be emphasized here.

Learning Objectives		Notes
27.1	To demonstrate the ability to select the proper gear oil for the transfer case. (CCT)	
27.2	To demonstrate the ability to drain and fill transfer cases safely.	Recycle oil in the correct manner. Have the students review the website: http://www.usedoilrecycling.com
27.3	To demonstrate the ability to dispose of used oil safely. (PSVS)	Recycle oil in the correct manner. Have the students develop a checklist to guide the correct practice.
27.4	To explain how gear oil will affect transfer case operation and life. (COM)	
27.5	To evaluate transfer case condition based on oil contamination. (CCT)	Contact transmission re-builders to see if you can obtain a transfer case that has been damaged due to lack of or inappropriate oil usage.
27.6	To explain the flat towing instructions for the vehicle. (COM)	Refer to 26.6.
27.7	To demonstrate the ability to follow manufacturer's service manual instructions.	
27.8	To explain the procedure for removing transfer cases. (COM)	Use the correct mechanical assists and hoists.
27.9	To demonstrate the ability to observe safety precautions associated with transfer case removal.	Create a lab activity for objectives 27.9 - 27.17. Objectives, 27.9 - 27.17, may only be completed if four wheel drive vehicles are available for the students to use. The processes required are similar to those completed in Module 25.

Learning Objectives		Notes
27.10	To demonstrate the ability to use special tools for transfer case removal. (TL)	Special tools used for transfer case removal include: <ul style="list-style-type: none">• lifting tools• transmission jacks• engine cradles and supports
27.11	To demonstrate the ability to mark shift mechanisms for ease of installation.	
27.12	To demonstrate the ability to follow safety precautions associated with transfer case installation.	Follow manufacturers' recommendations for all lifting or hoisting tools.
27.13	To explain the procedure for installing the transfer case.	
27.14	To demonstrate the ability to use lifting tools. (IL)	Review procedures.
27.15	To demonstrate the ability to install the transfer case.	
27.16	To demonstrate the ability to install driveshafts correctly.	
27.17	To demonstrate the ability to install and adjust transfer case shifting mechanisms.	

Module 28: Automatic Transmissions (Core)

Suggested time: 15 - 25 hours

Level: Advanced

Prerequisite: Modules 3, 5

Foundational Objectives

- To develop general understanding of the function and operation of automotive systems: power plant (engine), drive train, steering and suspension, electrical, body, and brakes.
- To develop general knowledge of the automotive service industry practices and procedures.
- To demonstrate safe working practices and procedures for the automotive service industry.
- To foster employability skills related to the automotive service industry.

Common Essential Learnings Foundational Objectives

- To develop a current view of technology and its application to automatic transmission construction (electronic transmissions). (TL)
- To enable students to use language (listening, speaking, reading, writing, viewing, and representing) for differing audiences and purposes that are relevant to the students and the automatic transmissions. (COM)
- To develop students' abilities to meet their own learning needs. (IL)
- To develop an awareness of personal responsibility for safety. (PSVS)

Note: Other CELs may be emphasized here.

Learning Objectives		Notes
28.1	To demonstrate the ability to follow manufacturer's service manual instructions.	
28.2	To describe the types of automotive transmission fluids (ATF) currently in production based on friction qualities. (COM)	Display a variety of ATF types.
28.3	To describe the importance of using the correct ATF for the transmission.	Contact transmission re-builders to see if you can obtain an automatic transmission that has been damaged due to lack of ATF or inappropriate ATF usage.
28.4	To outline the factors affecting ATF life.	
28.5	To demonstrate the ability to inspect and evaluate ATF based on smell, colour and texture. (CCT)	
28.6	To explain why ATF level should always be checked according to manufacturer's directions. (COM)	
28.7	To demonstrate the ability to measure and adjust ATF level. (NUM)	Create a lab activity for learning objectives 28.7– 28.26. Use student or staff vehicles to perform ATF changes. Staff pulling trailers can often be enticed to have fluid changed before holidays.

	Learning Objectives	Notes
28.8	To demonstrate the ability to select the proper ATF.	See manufacturer's recommendations as well as information that is packaged with the product.
28.9	To demonstrate the ability to use special tools.	Observe proper precautions when using the following: <ul style="list-style-type: none"> • lifting equipment • oil drain equipment (TL)
28.10	To demonstrate the ability to follow safety precautions associated with ATF changing.	Proper transmission flushing equipment is recommended.
28.11	To demonstrate the ability to remove the fluid pan and gasket.	Dispose of used ATF in the approved manner for re-cycling. Have students review the website: http://www.usedoilrecycling.com
28.12	To demonstrate the ability to dispose of ATF safely. (IL)	
28.13	To inspect the deposits in the ATF pan and assess the degree of internal transmission wear.	
28.14	To demonstrate ability to replace the ATF filter.	
28.15	To demonstrate ability to install the ATF pan and gasket.	
28.16	To explain why it is critical to torque oil pan fasteners correctly. (COM)	Demonstrate over torquing to show how gaskets can split.
28.17	To demonstrate the ability to refill the transmission and adjust the fluid level.	Have students suggest ways that they can record or document their skill development, for purposes of future employment.
28.18	To explain the purpose of an external transmission inspection.	Display an automatic transmission and have students label all the potential leak points including: <ul style="list-style-type: none"> • seals and O-rings • porous case • blocked vent • pan gaskets • wiring pass-through (TL) • switches
28.19	To describe sources of leaks.	
28.20	To demonstrate the ability to unblock vents and replace seals and components not requiring transmission removal.	Vents may be located behind the torque converter. Check the appropriate service manual.

Learning Objectives		Notes
28.21	To explain the procedure for removing an automatic transmission.	Assign students the task of creating a checklist for automatic transmission removal. Several students can present their lists to the class. Compare the lists to see if they have covered all the steps.
28.22	To demonstrate the ability to follow safety procedures associated with automatic transmission removal. (PSVS)	Create a lab activity for learning objectives 28.22 – 28.45. Requirements can be met while completing objectives with school project or student vehicles. Arrange a field trip to a transmission shop. Transmission shops may be willing to take students for a “Work Study” placement
28.23	To demonstrate the ability to use special tools. (TL)	Tools may include: <ul style="list-style-type: none">• lifting equipment• transmission jacks• engine support fixtures (IL)
28.24	To demonstrate the ability to mount a transmission firmly on the workbench.	
28.25	To explain the procedure for installing a transmission.	
28.26	To demonstrate the ability to follow safety procedures associated with transmission installation. (PSVS)	Use proper lifting equipment.
28.27	To demonstrate the ability to install the transmission. (IL)	Warn students about the necessity of being positive that the torque converter is fully engaged in the pump drive.
28.28	To demonstrate the ability to install and adjust all linkages.	Display a broken transmission case or use an old transmission and engine to demonstrate.
28.29	To demonstrate the ability to road test the vehicle to verify the repair.	It is recommended that the teacher accompany student for road tests.

Module 29: Ignition Systems (Optional)

Suggested time: 5 - 8 hours

Level: Advanced

Prerequisite: Module 14

Foundational Objectives

- To demonstrate safe working practices and procedures for the automotive service industry.
- To provide students with experience in the automotive service industry that will enable them to make an informed career decision.

Common Essential Learnings Foundational Objectives

- To enable students to understand and use the vocabulary, structures and forms of expression that characterize automotive service. (COM)
- To develop students' abilities to meet their own learning needs. (IL)

Note: Other CELs may be emphasized here.

	Learning Objectives	Notes
29.1	To explain the construction and operation of a simple ignition system.	Start with an ignition system on a small engine. Use a cut away of an ignition coil to show the primary and secondary circuit: <ul style="list-style-type: none">• primary circuit• secondary circuit (COM)
29.2	To explain the construction and operation of a distributorless ignition system.	Display a vehicle that has a distributorless ignition system and have students identify the parts.
29.3	To describe the construction and operation of spark plugs.	Display different types of spark plugs. Have students describe the following: <ul style="list-style-type: none">• types and styles• heat range• implications of installing incorrect heat range plugs• service precautions with platinum tipped plugs (TL)
29.4	To remove, inspect, adjust and install spark plugs.	Torque spark plugs to manufacturers specifications.
29.5	To describe methods used to modify spark timing.	
29.6	To explain why visual inspections can often lead to quick problem diagnosis.	A variety of engine problems may be diagnosed by examining the condition of the spark plugs.
29.7	To demonstrate the ability to identify ignition system problems. (IL)	Set up a vehicle to reflect several of the ignition system problems such as: <ul style="list-style-type: none">• loose or dirty connections• poor contact point condition• air gap out of adjustment• broken crank/cam sensors• cracked or wet cap• spark plug gap and fouling• broken coil• leaking spark plug wires• no-spark condition (IL)
		Have students diagnose the problems.

Module 30: Fuel Systems (Optional)

Suggested time: 40 - 50 hours

Level: Advanced

Prerequisite: Module 14

Foundational Objectives

- To demonstrate proper use of the tools and equipment utilized in the automotive service Industry.
- To develop workplace skills, knowledge, and attitudes in the automotive service industry that may lead to successful employment.
- To create an awareness of the need for regular maintenance of an automobile through demonstration and practice.
- To identify health and safety hazards so that the potential for injury and damage to equipment, vehicles, and the environment is minimized.
- To provide students with experience in the automotive service industry that will enable them to make informed career decisions.

Common Essential Learnings Foundational Objectives

- To develop students' abilities to access and apply knowledge to automotive service. (IL)
- To provide opportunities for students' active involvement in understanding, maintaining, and servicing technological devices in the automotive service industry. (TL)
- To enable students to use language (listening, speaking, reading, writing, viewing, and representing) for differing audiences and purposes that are relevant to the students and fuel systems. (COM)
- To strengthen students' understanding of how to compute, measure, estimate, and interpret numerical data as it applies to the automotive service industry. (NUM)

Note: Other CELs may be emphasized here.

Learning Objectives		Notes
30.1	To demonstrate the ability to follow safety precautions associated with fuel handling and storage. (PSVS)	See recommended resource list.
30.2	To explain the construction and operation of fuel storage and delivery systems. (COM)	Assign each student one of the storage or delivery systems and have students do a written report on it. These systems include: <ul style="list-style-type: none">• tanks• filters• pumps• lines• spill control devices• caps• emission-related components
30.3	To explain the dangers of fuel line leaks.	Have students analyze the risks and environmental impacts associated with their chosen system. (CCT)
30.4	To demonstrate the ability to identify sources of fuel line leaks and fuel line restrictions. (IL)	
30.5	To demonstrate the ability to inspect fuel filters for	

signs of rust and water.

Learning Objectives

Notes

30.6	To describe the construction and operation of low and high pressure fuel filters. (COM)	<p>Display different types of filters and vehicles that use them.</p> <p>Build a test stand using a hydraulic hand pump and pressure gauge to demonstrate the burst pressure of different fuel filters and types of lines.</p> <p>Caution: Wear proper safety shields Do not pressure test with gasoline</p>
30.7	To demonstrate the ability to use special fuel line disconnect tools. (TL)	
30.8	To demonstrate the ability to replace fuel filters.	<p>Create a lab activity for learning objectives 30.8 – 30.14. Demonstrate or have students do the procedure for:</p> <ul style="list-style-type: none">• inline• carburetor mounted• screw-on replaceable element• in-tank filters
30.9	To describe the construction and applications of fuel line materials.	<p>Materials used for fuel line may include:</p> <ul style="list-style-type: none">• steel• plastic• nylon and rubber <p>Explain why these materials are used and how they differ in application.</p>
30.10	To demonstrate the ability to manufacture a double lip flare on a fuel line. (IL)	See module 19.13.
30.11	To demonstrate the ability to replace fuel lines as required.	Display fuel lines that have been contaminated.
30.12	To describe symptoms relating to contaminated fuel caused by corroded fuel tanks. (COM)	
30.13	To demonstrate the ability to drain and refill fuel tanks safely. (IL)	<p>Create a lab activity for learning objectives 30.13 – 30.15.</p> <p>Caution: A fuel tank that is full can be very heavy.</p> <p>Caution: Review safety issues whenever students work with gasoline.</p>
30.14	To demonstrate the ability to drain, remove, and replace a fuel tank safely.	Use proper equipment to drain the fuel tank.
30.15	To demonstrate the ability to make a temporary patch on a leaking fuel tank.	Set criteria with students about what constitutes a good/adequate temporary patch. Use the criteria to evaluate students' ability to make a temporary patch.

Learning Objectives	Notes
30.16 To describe the operation of fuel tank venting systems.	Label fuel tank venting parts on the shop vehicle and have students name parts and functions including: <ul style="list-style-type: none"> • charcoal canister • vented caps • vapor traps • rollover protection
30.17 To demonstrate the ability to diagnose and repair problems associated with incorrect vent operation.	
30.18 To demonstrate the ability to test fuel pump operation.	Display different styles of fuel pumps. <ul style="list-style-type: none"> • pressure • vacuum • volume
30.19 To describe the construction and operation of fuel pumps.	Create a lab activity for learning objectives 30.20 – 30.22. Examples of fuel pump types may include: <ul style="list-style-type: none"> • engine mounted diaphragm type • tank mounted electric • outside mounted electric • transfer pumps • vacuum operated pumps (TL)
30.20 To demonstrate the ability to test and repair fuel pump electrical circuitry. (IL)	
30.21 To demonstrate the ability to replace fuel pumps.	Create a lab activity where impact switches, oil pressure switches, or open circuits have been created for students to trace and repair fuel pump faults. (CCT)
30.22 To demonstrate the ability to replace a worn mechanical fuel pump drive mechanism. (IL)	
30.23 To describe the construction and operation of dual tank switching mechanisms.	Display vehicles with dual tanks; have students trace the fuel line from either tank. Review the following: <ul style="list-style-type: none"> • hand controlled valve • electric valve with dual sender units • transfer pump system with main and secondary tank • gauge circuitry • pump circuitry
30.24 To demonstrate the ability to isolate problems related to dual tank switching.	
30.25 To describe the operation and construction of fuel indicator devices.	Include the following: <ul style="list-style-type: none"> • tank sender units • dash gauge units • driver information centres • low fuel warning devices (COM)

Learning Objectives	Notes
30.26 To demonstrate the ability to replace tank sender units.	Create a lab activity for learning objectives 30.26 – 30.27.
30.27 To demonstrate the ability to replace dash fuel gauge units.	
30.28 To describe problems associated with fuel pressure problems.	Assign each student one of the following problems associated with fuel pressure problems. Have students research and present their findings to the class: <ul style="list-style-type: none"> insufficient pressure excess pressure erratic pressures lack of pump vacuum. insufficient volume
30.29 To trace sources of vapor lock.	Applies only to older model vehicles.
30.30 To describe the tests that can be made on the fuel delivery system. (COM)	Create a lab activity for learning objectives 30.30 – 30.32.
30.31 To demonstrate the ability to conduct a fuel pump condition test.	Include the following tests: <ul style="list-style-type: none"> pressure vacuum volume
30.32 To demonstrate the ability to test and, where possible, adjust fuel pressure regulators. (NUM)	
30.33 To outline factors affecting fuel economy. (COM)	Assign each student either a family member's vehicle or a teacher's vehicle to monitor and calculate fuel economy. Have them interview the driver. Include the following as points to cover in the interview: <ul style="list-style-type: none"> driving habits engine condition tire style and size vehicle mass and body design road conditions weather conditions engine rpm fuel quality rear axle ratio
30.34 To explain factors affecting fuel quality. (CCT)	Learning objectives 30.34 – 30.35 may be part of the previous fuel economy assignment. Some factors that affect fuel quality are: <ul style="list-style-type: none"> grade of fuel sources of contamination fuel additives - methanol/ethanol
30.35 To evaluate fuel economy based on road test data.	Student reports might: <ul style="list-style-type: none"> suggest methods of improving economy

(NUM)

- communicate findings to driver

Module 31: Seat Belt Systems (Optional)

Suggested time: 2 - 4 hours

Level: Intermediate

Prerequisite: None

Foundational Objectives

- To develop workplace skills, knowledge, and attitudes in the automotive service industry that may lead to successful employment.
- To create an awareness of the need for regular maintenance of an automobile through demonstration and practice.

Common Essential Learnings Foundational Objectives

- To develop students' abilities to meet their own learning needs. (IL)
- To develop the ability to read, understand and use automotive service manuals and documents. (COM)

Note: Other CELs may be emphasized here.

Learning Objectives		Notes
31.1	To explain the construction and operation of a variety of seat belt systems and retractor mechanisms.	Use students' or teachers' vehicles to display the different types of seat belt systems. <ul style="list-style-type: none">• lap belts• lap shoulder belts• pendulum retractors• solenoid type retractors (COM)
31.2	To explain why seat belts should be tested after an accident.	See recommended resource list.
31.3	To explain local laws regarding seat belt use. (TL)	Link this activity to driver education coursework on mandatory seat belt use. Invite the driver education instructor or local RCMP officer to visit the class.
31.4	To demonstrate the ability to follow manufacturer's service manual instructions. (COM)	Create a lab activity for learning objectives 31.4 – 31.8.
31.5	To demonstrate the ability to test seatbelt systems as required.	
31.6	To demonstrate the ability to inspect seat belts and mounts for damage.	Always ensure that the restraining system is operating correctly.
31.7	To demonstrate the ability to replace faulty seat belts and retractors. (IL)	
31.8	To demonstrate the ability to install child restraint mounting fasteners.	Invite a guest from the police, Emergency Measures Organization (EMO), or SGI to talk about and demonstrate safe and unsafe child restraint systems.

Module 32A, B, C, D: Work Study Preparation and Follow-up Activities (Optional)

Note: Module 32 Work Study Preparation and Follow-up Activities is 5 - 10 hours. If students have participated in a work study module in a previous Practical and Applied Arts course, a review of this module is still required but less time is needed.

Suggested time: 5 - 10 hours

Prerequisite: None

Module Overview

Students will prepare for work study in the community. Expectations for the student, the teacher, and the employer should be discussed. During follow-up, students will reflect on work study experiences.

Foundational Objectives

- To develop workplace skills, knowledge, and attitudes in the automotive service industry that may lead to successful employment.
- To understand how skills acquired in school may transfer to the workplace.

Common Essential Learnings Foundational Objective(s)

- To demonstrate skills and attitudes that contribute to the development of positive human relationships. (IL, PSVS)

Note: Other CELs may be emphasized.

Learning Objectives	Notes
32.1 To be aware of the expectations of each of the partners in the work study component.	In order to establish a successful working relationship with all of the partners involved in the workplace, it is important to define the expectations of each partner. For a list of roles and responsibilities of the business, personnel, manager, teacher monitor, school, parent, and student, see the Work Study Guidelines for the Practical and Applied Arts included in the <i>Practical and Applied Arts Handbook (2000)</i> .
32.2 To determine the factors that may affect the student's contribution in the workplace. (CCT)	Brainstorm a list, then verify through experience. The list may include previous work experience, volunteer work, teamwork activities, and extra-curricular participation within the school.
32.3 To build good communication skills for the workplace. (COM, PSVS)	<p>Discuss verbal and non-verbal communication. List some ways in which negative and positive non-verbal communication may be displayed. Encourage students to role play ways of demonstrating effective techniques of verbal communication on the job when giving or receiving instructions and resolving conflict. Use case studies, and divide the students into groups to role play how effective communication may be used to resolve conflict on the job.</p> <p>Emphasize the Employability Skills (from the Conference Board of Canada) and compare them to the Common Essential Learnings of Saskatchewan's curriculum. Make the direct link between skill development in this course, and the needs of employers. Development of skills and documentation of the skills leads to employment using those skills.</p>

Learning Objectives	Notes
32.4 To develop a resumé that may be forwarded to a potential employer.	<p>The student will develop a resumé using the correct format. (IL)</p> <p>The resumé may be used to introduce the student to the employer of a workplace site prior to an interview. Teachers are encouraged to work with other staff members to ensure resumé preparation is taught. Resumé writing is covered in <i>English Language Arts 20 and A30</i>, <i>Information Processing 10, 20, 30</i>, and <i>Career and Work Exploration 20</i> curriculum guides.</p> <p>Students should save the resumé and update it as changes need to be made and references are added. Skills that have been developed can also be added to the updated resumé.</p>
32.5 To create a student guide in preparation for an interview.	<p>Students should develop their resúmes and update them during the course, as work placement references are accumulated. A discussion with students about the benefits of a portfolio of sample work is appropriate at this time.</p> <p>A personal website that highlights the student’s skills and training might be created and referred to in the resumé.</p> <p>If students have already completed a resumé and cover letter in another course, the teacher may do a review and encourage students to update their information. Each student should submit a resumé for teacher approval prior to going to an interview or directly to the workplace.</p>
32.6 To determine student guidelines in preparation for an interview. (COM)	<p>Through a classroom discussion or in groups, students should compile a “guide” for job interviews. After the students formulate their guide, the teacher may prompt them for missing items.</p> <p>Outline and describe the three stages of an interview. Point out to the students at what stage of the interview each of the guidelines previously discussed will be used.</p> <p>The greeting involves an introduction between the student and employer. Discuss or demonstrate how this should be done.</p> <p>The exchange is the longest part of the interview where the employer asks a series of questions and engages in a dialogue with the student about information on the resumé and other matters relating to the job. A student’s portfolio may be examined by the employer as part of the exchange.</p> <p>The parting provides closure to the interview and may be just as important as the greeting. Explain how this may be done.</p> <p>Provide the students with a list of questions frequently asked by employers or ask students to make a list. Students may role play the stages of the interview.</p>
32.7 To discuss the post interview.	<p>After the student has completed the interview with the employer, do a follow-up activity. Review the interview with the student using the three stages above as points for discussion.</p>

Learning Objectives	Notes
32.8 To develop a procedural guide for the work site.	<p>Discuss the following work site items with students:</p> <ul style="list-style-type: none"> • transportation • hours of work • absence and tardiness • procedures for conflict resolution • role of the student, teacher, and workplace supervisor • dress code • job description • school and employer expectations
32.9 To relate feedback from the work placement.	<p>Students provide feedback about work placement including: location, type of business, duties, most rewarding experience, most difficult situation and how they handled it.</p> <p>Note: It is recommended that each student send a thank you note or card to the employer upon the completion of each work placement. If more than one placement has been made in the course, follow-up activities must be completed after each placement.</p> <p>Ensure that students understand these guidelines by asking students to describe each of these items.</p> <p>Note: Look for opportunities to introduce and reinforce ideas about Labour Standards, Occupational Health and Safety, and WHMIS. Use the <i>Career and Work Exploration Curriculum Guide</i>, the <i>PAA Handbook</i>, the Saskatchewan Labour website (www.readyforwork.sk.ca), and other recommended resources in the accompanying bibliography.</p>

Module 33A, B, C, D: Work Study (Optional)

Suggested time: 25 - 50 hours

Prerequisite: Module 32

Module Overview

Students will be placed in the community working with a mentor and/or a supervisor. They may have the opportunity to learn to use software, to practise previously learned skills, and to learn skills for which training is not available at their school. Students will be engaged in experiential activities in the workplace.

Foundational Objectives

- To provide students with experience in the automotive service industry that will enable them to make informed career decisions.
- To foster employability skills related to the automotive service industry.
- To integrate classroom learning with work-based learning.

Common Essential Learnings Foundational Objectives

- To engage in a work study experience and develop entry level workplace skills that may lead to sustainable employment. (PSVS)
- To expand career research beyond the classroom setting. (IL)

For more information about implementing work study in schools, see the Work Study Guidelines for the Practical and Applied Arts included in the Practical and Applied Arts Handbook. Teachers need to use or design appropriate learning objectives for this module; for instance, to demonstrate ability to follow a “Training Plan”. The training plan for the student should be designed to relate to the objectives of the course modules chosen in collaboration with the cooperating employer. See Appendix B in this guide.

Note: *Career and Work Exploration 10, 20, A30, B30 Curriculum Guide* will be released in fall 2001. Consult Saskatchewan Labour for content about Labour Standards, Occupational Health and Safety, and WHMIS. If several work study opportunities are offered, they will add more depth to the next experience.

Module 34: Career Opportunities (Core)

Suggested time: 2 - 5 hours

Level: Introductory

Prerequisite: None

Foundational Objectives

- The student will develop an awareness of some career opportunities in the automotive service industry.
- To provide students with experience in the automotive service industry that will enable them to make informed career decisions.

Common Essential Learnings Foundational Objectives

- To develop students' abilities to access knowledge. (IL)
- To promote both intuitive, imaginative thought and the ability to evaluate ideas, processes, experiences and objects in meaningful contexts. (CCT)

Learning Objectives	Notes
34.1 To explore the designated trades.	Students will define apprenticeship. Generate a list with students of apprenticeship trades and a definition of an apprentice. Outline the advantages and disadvantages of apprenticeship.
34.2 To explore how the secondary level curriculum articulates with Level I of the trade. (COM)	Show students the training plan. Explain how completing all the objectives and covering the appropriate modules can prepare them to challenge the Level One exam.
34.3 To generate a list of career opportunities related to the mechanical and automotive service industry. (COM)	Students will create a list of different career opportunities in the mechanical and automotive industry. Encourage students to use a variety of sources for information: guidance counsellors, libraries, community resources, career software packages, personal interviews, government resources, websites, etc.
34.4 To identify personal skills and interests that may lead to career exploration. (CCT)	<p>Ask each student to create an inventory of personal interests and skills. Have each student examine his or her list to determine how these interests and skills may be combined with career opportunities in the mechanical and automotive industry in the community.</p> <p>Websites that will be of interest when conducting research include the following: "Essential Skills" (also available as a compact disc): http://www15.hrdc-drhc.gc.ca/english/es.asp "Authentic Workplace Materials": http://www15.hrdc-drhc.gc.ca/awm/default.asp.</p>
34.5 To determine skills and interests that enhance career decisions. (CCT)	<p>From the list created, ask the students to select two choices of possible occupations for further research. Investigate the choices including:</p> <ul style="list-style-type: none">• description of work duties• what personal qualities individuals should possess• how their personal interests and skills correspond to this choice• process to become certified within the trade/career• length of education and training• school locations

Learning Objectives**Notes**

- cost of education and upgrading
- trends within the business or career
- the best and worst parts of the job
- beginning salary
- opportunities for advancement

If a student engages in work study, he or she may investigate career links within the community for possible work study placements. The student may conduct an interview of the professional/tradesperson as part of his or her experience.

Refer to Appendix D, Career Research Interview Questions.

Module 88: Apprenticeship in Saskatchewan (Optional)

Suggested time: 2-5 hours

Level: Introductory

Prerequisite: None

Module Overview

Students will be introduced to the apprenticeship and trade certification process and the role of the Saskatchewan Apprenticeship and Trade Certification Commission. Students will also explore a variety of opportunities that apprenticeship offers, and the relationship between Secondary Level and apprenticeship training.

This module is available for all Practical and Applied Arts curricula related to a designated trade, but should be taught from the perspective of the specific trade involved. In this case, the perspective reflects the trade of machining.

Foundational Objective

- To create an awareness of apprenticeship programs and opportunities in Saskatchewan.

Common Essential Learnings Foundational Objectives

- To broaden students' understanding of the apprenticeship program and the role it plays in the trade industries. (CCT)
- To examine particular trade opportunities that are appropriate for themselves. (IL, PSVS)

Learning Objectives	Notes
88.1 To understand and describe the process and benefits of apprenticeship.	<p>Students should recognize that apprenticeship is a process of training and certifying workers in specific trades.</p> <p>Students could perform research to determine which trades are designated in Saskatchewan and how those compare to those in other provinces.</p> <p>Students should brainstorm reasons why a person would become an apprentice. Alternatively, they could interview journeypersons or apprentices to find out what they feel the advantages of the apprenticeship program were for them.</p> <p>Students should be able to describe the difference between a provincial certification and the Interprovincial Standards "Red Seal" program.</p>
88.2 To understand and use the appropriate terminology related to apprenticeship.	<p>Students should be able to use a wide variety of terms appropriately including, but not limited to, the following:</p> <ul style="list-style-type: none">• journeyperson• indenture• joint training committee• pre-employment training• designated trade and sub-trade• advanced standing.

Learning Objectives	Notes
88.3 To determine the steps involved in becoming an apprentice.	<p>Students need to be aware that the applicant must be working in the trade, must sign a formal contract with the employer and the Saskatchewan Apprenticeship and Trade Certification Commission, and must be prepared to attend technical training, typically once per year.</p> <p>Students could interview a journeyperson or an apprentice to learn about their experience.</p>
88.4 To determine the relationship between the ATCC and the various trade boards.	<p>Students should be aware of how a trade board becomes established and how a trade becomes designated in Saskatchewan.</p> <p>Each student could contact a trade board and find out the role it plays in the apprenticeship process. They should also determine the relationship between the trade board and the ATCC. Students could share and compare their findings with other students in the class.</p>
88.5 To develop an understanding of the programs available to help make the transition from Secondary Level to apprenticeship.	<p>Students should be aware of the recognition of time that is available. Students should also be aware of the opportunity for challenging the Level I examination in a given trade, providing certain conditions are met.</p>
88.6 To determine the length of apprenticeship and the annual training required in a particular trade that may be of interest to the student.	<p>Students should explore the requirements of one or more specific trades including years and hours required, location of annual training, and the duration of annual training. Students could also explore employability and expected wages for those trades. They could share their findings with the rest of the class.</p>
88.7 To explore the qualities of a successful apprentice.	<p>Students could interview employers to determine personal characteristics that will help make an apprentice in a particular trade successful. Students could also brainstorm a list of qualities and discuss them. With these qualities in mind, the students could perform a peer or self-assessment to gauge their own suitability for a career in that trade.</p>

Module 99A, B, C, D, E: Extended Study (Optional)

Note: The extended study module may be used only once in a pure or survey course. It is important to record the title of the extended study module on the recordkeeping chart. Record 99A for the first extended study module offered in the course series, 99B for the second extended study module offered, etc.

Suggested time: 5 - 20 hours

Level: Introductory/Intermediate/Advanced

Module Overview

Evolving social and personal needs of society, advances in technology, and demands to solve current problems require a flexible curriculum that can accommodate new ways and means to support learning in the future. The extended study module is designed to provide schools with an opportunity to meet current and future demands that are not provided for in current modules in the renewed PAA curriculum.

The flexibility of this module allows a school/school division to design **one new module per credit to complement or extend the study of pure, core and optional modules** configured to meet the specific needs of students or the community. The extended study module is designed to extend the content of the pure courses and to offer survey course modules (see page 9) beyond the scope of the available selection of PAA modules.

The list of possibilities for topics of study or projects for the extended study module approach is as varied as the imagination of those involved in using the module. These optional extended study module guidelines should be used to strengthen the knowledge, skills, and processes advocated in the Practical and Applied Arts curriculum.

For more information on the guidelines for the Extended Study module see the *Practical and Applied Arts Handbook*.

References

- Alberta Education. (1994 Interim). *Career and technology studies. Mechanics (strand)*. Edmonton, AB: Author.
- Briggs and Stratton (1998). *Single cylinder "L" head repair manual*. Milwaukee, WI: Author
- CARS Network. *Canadian Automobile Repair and Service (CARS) Knowledge Network Training Standards Branch*. (1995). National Curriculum Standard. Toronto, ON: Author
- Crouse, W. (1996). *Automotive mechanics*. (10th Ed).Columbus, OH: .Glencoe/McGraw-Hill
- Human Resources Canada. *Occupational Analysis Service*. (1995). Automotive service technician.
- Misener, J. and Butler, S. (2000). *Horizons 2000+ career studies*. Toronto, ON: McGraw-Hill Ryerson Limited.
- Saskatchewan Education. (Draft 2000). *Practical and applied arts handbook*. Regina, SK: Author.
- Saskatchewan Education. (1999). *Autobody 10, A20, B20, A30, B30 curriculum guide. A practical and applied art*. Regina, SK: Author.
- Saskatchewan Education. (1999). *Welding 10, 20, A30, B30 curriculum guide. A practical and applied art*. Regina, SK: Author.
- Saskatchewan Education. (1998). *Tourism, hospitality, and entrepreneurship A30, B30 curriculum guide. A Practical and Applied Art*. Regina, SK: Author.
- Saskatchewan Education. (1991). *Instructional approaches: A framework for professional practice*. Regina, SK: Author.
- Saskatchewan Education. (1991). *Student evaluation: A teacher handbook*. Regina, SK: Author.
- Saskatchewan Education. (1988). *Understanding common essential learnings: A handbook for teachers*. Regina, SK: Author.
- Saskatchewan Education. (1984). *Technical education. mechanics 12-23-33. a curriculum guide for division IV*. Regina, SK: Author.
- Schuster, W. A. (1999) *Small engine technology*. Albany, NY. Delmar Publishers.
- Saskatchewan Post-secondary Education and Skills Training. (1999). *High school to apprenticeship: Linking to the future. A handbook for high school administrators and student counsellors*. Regina, SK: Author.
- Stockel, W. and Stockel, T. (1996). *Auto service and repair*. Goodheart-Willcox. Tinley Park, IL.
- Saskatchewan Institute of Applied Science and Technology. (n.d.) Wascana Campus. *Fire extinguishers. Module A1*. Regina, SK: Author.
- Saskatchewan Institute of Applied Science and Technology. (n.d.) Wascana Campus. *Use of Manuals and Resources. Module A20*. Regina, SK: Author.
- Saskatchewan Institute of Applied Science and Technology. (n.d.) Wascana Campus. *Maintaining shop safety. Module A6*. Regina, SK: Author.
- Saskatchewan Institute of Applied Science and Technology. (n.d.) Wascana Campus. *Selecting proper equipment. Module A3*. Regina, SK: Author.

Appendix A: Determining a Trade Pathway for Students

During the renewal of the Practical and Applied Arts (PAA), Saskatchewan Education signed an articulation agreement for Mechanical and Automotive with Saskatchewan Post-Secondary Education and Skills Training (SPEST), the Apprenticeship and Trade Certification Commission (ATCC), and the Saskatchewan Institute of Applied Science and Technology (SIASST).

School divisions should be aware that although Mechanical and Automotive content requires a certain level of maturity, some modules are recommended for Middle Level grades 7 - 9. These are listed in the PAA *Survey Curriculum Guidelines for the Practical and Applied Arts*.

Pure courses, one hundred hours long, are available beginning at the grade 10 Level. Students may take Mechanical and Automotive with no intent to pursue the Automotive Service Technician apprenticeship route.

Articulation

Saskatchewan Education, in consultation with the PAA Reference Committee, agreed to develop adequate hours of provincial curriculum in the designated trade areas that, combined with limited practical experienced, will meet the Level I requirements (or their equivalent), as outlined by the Apprenticeship and Trade Certification Commission (ATCC). Articulation agreements have been established to accommodate students who have met the Level I requirements and who have followed the procedures specified by the ATCC's *High School to Apprenticeship: A Link to the Future (2001)*. Such students may challenge the Level I trade exam and if successful receive Level 1 technical training credit and verifiable time credit in Apprenticeship. Verifiable time credit refers to: time accrued under the supervision of a journeyperson; a course taught by a teacher holding a journey status in the designated trade; or a course taught by a teacher who has taken an approved accreditation course.

Training plans included in Appendix B have been designed to provide direction for Level I skill development in the classroom and in the workplace.

School divisions or schools seeking to register students who wish to challenge the Automotive Service Technician Level 1 exam, must meet the following criteria:

- Review and understand procedures outlined in *High School to Apprenticeship: A Link to the Future (2001)*. (Apprenticeship Work Placement Program, Apprenticeship Recognition for Practical and Applied Arts Courses, Additional Practical and Applied Arts Courses in the Designated Trades)
- The Level I theory identified below as required modules in the Mechanical and Automotive must be covered thoroughly by the journey status or accredited teacher and students.
- Practical experiences must be offered in the school setting or through the optional work study modules used in partnership with local businesses and journeypersons.
- Only a teacher who is a **journeyperson** or who has completed an **approved accreditation course in the designated trade** may recommend students for a Level I challenge exam. This will ensure that the teacher has the necessary background skills to evaluate Level I theory and practice in the school.
- Time credit is granted when time is accrued under a journeyperson or when the course is taught by a teacher who either holds journey status in the designated trade or who has taken an approved accreditation course in the designated trade.
- Accreditation courses, approved by the ATCC and Saskatchewan Education, are delivered by SIASST through the STF Summer Short Course mechanism.

- Only those students who have successfully completed the Level I content in the Secondary Level courses and whose marks have been submitted to Saskatchewan Education student records may challenge the Level I exam. Students without aspirations of pursuing further training in the trade(s) should not consider this route. To be successful, students challenging the Level 1 apprenticeship theory exam must attain a mark of 70%. The Level I exam may not replace any portion of the evaluation for Secondary Level credit.
- Certified teachers are responsible for assigning a mark for submission to student records for Secondary Level students.
- The students must successfully complete all the courses in the series before challenging the Level I exam and should be nearing completion of the last course in the series when they indicate their intent to challenge the Level I exam.
- The school division or school must notify ATCC at least 2 months prior to the writing of the Level I exam, stating their intention to recommend a student or students. Verification of the marks for the completed course (official transcript), a statement of preliminary marks for courses underway if applicable, and the examination fee must be submitted for each student eligible to write. Registration for the Level I exam is managed by ATCC.
- The ATCC will administer the Level I exams to Secondary Level students during the January and June Departmental Examination writing sessions. ATCC will evaluate the exams, record the results and notify student(s) of results at school. The dates for the writing sessions are established annually and published in the *Registrar's Handbook for School Administrators* that is distributed to the schools. (Available from Student Records at Saskatchewan Education).
- Saskatchewan Education will distribute information to inform schools of changes to the Level I apprenticeship requirements in the trade.
- Successful students will receive Level 1 technical training credit and verifiable time credit in Apprenticeship.
- Advanced standing in the Automotive Service Technician program at SIAST will be awarded to students who are successful in the challenge of the Level I exam and/or who have completed verifiable time credit for Level I in the designated trade.
- Upon registration in the trade, a Secondary Level student who was unsuccessful in the Level I challenge will not receive credit for Level I theory, but will receive time credit recognition for time spent in practical experience under the supervision of a journeyman. Documentation of this experience must be confirmed using "Form 6: Verification of Trade Experience", available from the ATCC. It must be signed by the supervising journeyman. A sample Form 6 is part of this appendix.

For more information about trade articulation see the *High School to Apprenticeship: A Link to the Future(2001)* document distributed by ATCC.

- The following Saskatchewan Education PAA Mechanical and Automotive modules must be successfully completed in order to meet the Level I requirements in the trade:

MODULE	TITLE
Module 02	Automotive Processes
Module 03	Safety Equipment, Hazardous Materials and Housekeeping Skills
Module 04	Information Storage Systems
Module 05	Hand and Power Tools
Module 06	Fasteners and Gaskets
Module 07	Cleaning Techniques

Module 09	Storage Batteries
MODULE	TITLE
Module 10	Oils and Lubricants
Module 11	Headlight Service
Module 12	Tires
Module 13	Minor Body Service
Module 14	Fundamentals of Electricity, Electricity and Electronics
Module 15	Cooling Fans
Module 16	Exhaust Systems
Module 17	Radiators and Coolants
Module 18	Pulleys and Belts
Module 19A	Wheel Bearings
Module 19B	Brake Systems
Module 19C	Wheel Cylinders, Calipers and Master Cylinders
Module 19D	Parking Brake Systems
Module 23B	Multi-Cylinder Engines
Module 24	Universal Joints and Driveshafts
Module 25	Clutches and Release Mechanisms
Module 26	Manual Transmissions
Module 27	Transfer Case Lubricants, Removal and Installation
Module 28	Automatic Transmissions

The modules have fidelity with the following SIAST modules:

ATMC 100 Body and Trim

BRAK 100 Brake Systems

DRTR 100 Drive lines and Final Drives

ELEC 104 Automotive Electronics

ENG 107 Engines

TRNM 101 Manual, Automatic Transmissions and Clutches

SHOP 100 General Shop Procedures

The modules above in the Mechanical and Automotive have been identified as core modules required for a Level I exam challenge. The content in these modules is similar enough to be considered as equal with the SIAST modules that follow.

SAMPLE FORM – Obtain full document from address below



Saskatchewan
Apprenticeship and
Trade Certification
Commission

2140 Hamilton Street
Regina, Saskatchewan
S4P 3V7

Tel (306) 787-2444
Fax (306) 787-5105

Form 6

Verification of Trade Experience Letter

This letter is to verify the type of work a person performs in a specific trade.

**Use one verification letter per employer.*

Social Insurance Number

Please check one of the following:

- | | |
|--|---------------------------------|
| <input type="checkbox"/> New Apprenticeship Contract | (must be accompanied by Form 1) |
| <input type="checkbox"/> Placement on Apprenticeship File | (updating hours) |
| <input type="checkbox"/> Examination | (must be accompanied by Form 2) |
| <input type="checkbox"/> Request for Journeyperson Certificate | (must be accompanied by Form 3) |
| <input type="checkbox"/> Entry into Upgrading Course | (must be accompanied by Form 4) |

Trade

Name of Apprentice/Tradesperson (last/first)

Address

City/Town

Postal Code

Telephone

Name of Company (Employer) for Which Trade Experience is Being Verified

Address

Telephone

City/Town

Postal Code

Company Stamp
If Available

Period of Employment

From

D/M/Y

to

D/M/Y

Please refer to Period of Employment instructions on reverse.

Work Performed At

City/Town

Document only the time spent actually working the trade, using the tools of the trade.

Please refer to Trade Experience instructions on reverse.

Description of Work Performed	Trade Experience in Hours
Total Hours	

FOR COMMISSION USE ONLY

Time Assessed

Hours

Date

Assessed by

If the work was supervised by a Journeyperson:

Name of Journeyperson

Certificate #

Trade

Signed this

day of

200__

Signature of Witness*

Signature of Appropriate Person*

Name of Witness (Please Print)

Name of Appropriate Person (Please Print)

Address

Position

Telephone

Address

Telephone

*The witness may not be the subject (apprentice or tradesperson applying) of this letter.

*An Appropriate Person: employer, employer's representative or journeyperson supervising the work

Instructions

- a) **Period of Employment:** When you submit the *first* Form 6, the period of employment *starts with the day you started with the employer and ends with the day you fill out the form*. The period of employment on the *second* Form 6 you submit, starts the day after the day listed on the first Form 6 and ends the day you fill out the form.

Example: First Form 6: 15/01/99 to 15/06/00
Second Form 6: 16/06/00 to 30/12/00

- b) **Trade Experience in Hours:**

Refers to the number of hours you worked in the period of employment.

Example:

Description of Work Performed	Trade Experience in Hours
Gears	40 hours
Transmissions	75 hours
Total Hours	115 hours

Affidavit for Verification of Trade Time

An Affidavit is to be used only when confirming trade time in the following instances:

- a business is no longer in existence;
- self-employment. (Attach copy of business license or letter from: town clerk, municipal secretary, or person in authority in the community acknowledging that during the period in question, the tradesperson was known to be an owner/operator of a business.)

Before proceeding, please ensure that the reverse side of this form is fully completed.

Canada
Province of Saskatchewan

To Wit:

In the matter of the verification of trade time in the _____

trade, I _____ of _____
Address/ Postal Code

do solemnly declare that said verification of trade time as stated on the reverse side of this document is accurate and I make this solemn declaration conscientiously believing it to be true and knowing that it is of the same force and effect as if made under oath and by virtue of the *Canada Evidence Act*.

Declared before me at the

_____ of
City/Town

_____ in

the Province of Saskatchewan

this _____ day

of _____ A.D., 200_.

Signature of Tradesperson

Commissioner of Oaths in and
For the Province of Saskatchewan
My Commission expires:

Appendix B: Sample Training Plan Checklists

Mechanical and Automotive 10

- To be used in the school at the 10 level, with possibility for Work Study beginning at the 20 Level.
- Recordkeeping documents should be copied on school letterhead.

Student's name (print)_____

Workplace name (print)_____

Assessor's name and qualification (print)_____

Module Component	Observed	Assisted	Demonstrated	Checked by
Module 1: Introduction to the Automobile: <i>describe and explain the major and sub-systems of the automobile</i>				
Module 2: Automotive Processes: <i>describe the processes involved in repairing a vehicle</i>				
Module 3: Safety Equipment, Hazardous Materials and Housekeeping Skills: <i>be able to identify potential safety hazards and demonstrate the safe use of appropriate tools and equipment</i>				
Module 4: Information Storage: <i>choose appropriate resource materials (manuals, service bulletins CD-ROMs, etc.)</i>				
Module 5: Hand and Power Tools: <i>demonstrate safety and proper use and care of tools</i>				
Module 6: Fasteners and Gaskets: <i>describe and demonstrate a variety of fastener, and the appropriate installation and removal procedures</i>				
Module 7: Cleaning Techniques: <i>demonstrate the safe use of chemical cleaning materials</i>				
Module 10: Oils and Lubricants: <i>describe oil classifications and change vehicle lubricants</i>				
Module 12: Tires: <i>evaluate the condition of tires and safe and correct method of installation</i>				
Module 23A: Small Engines: <i>demonstrate disassembly, overhaul and re-assembly of a single cylinder engine</i>				

Sample Training Plan Checklists

Mechanical and Automotive A20

Student's name (print)_____

Workplace name (print)_____

Assessor's name and qualification (print)_____

Module Component	Observed	Assisted	Demonstrated	Checked by
Module 19A: Wheel Bearings: <i>demonstrate the ability to service wheel bearings and related parts</i>				
Module 19B: Brake Systems: <i>remove and replace brake fluid and brake shoes and pads</i>				
Module 19C: Wheel Cylinders, Calipers and Master Cylinders: <i>service and repair wheel and master cylinders</i>				
Module 19D: Parking Brake Systems: <i>adjust and repair mechanical braking system</i>				
Module 23B: Multi-cylinder Engines: <i>able to follow procedures to complete an engine disassembly, inspection, parts identification, measurement and re-assembly</i>				

Sample Training Plan Checklists

Mechanical and Automotive B20

Student's name (print)_____

Workplace name (print)_____

Assessor's name and qualification (print)_____

Module Component	Observed	Assisted	Demonstrated	Checked by
Module 8: Oxy-Acetylene Welding: <i>demonstrate knowledge of safety and procedures for basic practices</i>				
Module 9: Storage Batteries: <i>test and service batteries</i>				
Module 11: Headlights: <i>demonstrate ability to replace and adjust headlights</i>				
Module 13: Minor Body Service: <i>make minor adjustments to doors, lids and moveable glass</i>				
Module 15: Cooling Fans: <i>describe and identify different types of cooling fans</i>				
Module 16: Exhaust Systems: <i>demonstrate the ability to diagnose and repair exhaust systems</i>				
Module 17: Radiators and Coolants: <i>demonstrate proper inspection and ability to flush and make minor repairs to cooling systems</i>				
Module 18: Pulleys and Belts: <i>demonstrate removal and replacement of belts and pulleys</i>				
Module 20: Suspension Control Mechanisms and Steering Linkages: <i>diagnose and solve problems with suspension systems</i>				
Module 31: Seat Belts: <i>inspect and test restraint systems</i>				

Sample Training Planning Checklists

Mechanical and Automotive A30

Student's name (print)_____

Workplace name (print)_____

Assessor's name and qualification (print)_____

Module Component	Observed	Assisted	Demonstrated	Checked by
Module 14: Fundamentals of Electricity and Electronics: <i>diagnose wiring circuits and carry out repairs</i>				
Module 21: Alternators: <i>diagnose electrical charging systems</i>				
Module 22: Starting Systems: <i>disassemble, diagnose, and repair starters</i>				
Module 29: Ignition Systems: <i>demonstrate replacement and operation of spark plugs and high-tension wiring</i>				
Module 30: Fuel Systems: <i>diagnose and service fuel tanks, filters and pumps</i>				

Sample Training Planning Checklists

Mechanical and Automotive B30

Student's name (print)_____

Workplace name (print)_____

Assessor's name and qualification (print)_____

Module Component	Observed	Assisted	Demonstrated	Checked by
Module 24: Universal Joints and Driveshafts: <i>adjust, diagnose, and repair drive-line components</i>				
Module 25: Clutches and Release Mechanisms: <i>demonstrate repair to flywheel-clutch components</i>				
Module 26: Manual Transmissions: <i>show procedures necessary to remove and replace manual transmissions and replace fluids.</i>				
Module 27: Transfer Cases: <i>change fluid in transfer case</i>				
Module 28: Automatic Transmissions: <i>remove and replace automatic transmissions and service fluids and filters in automatic transmissions.</i>				

Appendix C: Sample Module Recordkeeping Charts

Mechanical and Automotive 10

Student name: _____

School name: _____

Module code	Modules	Core or Optional	Date	Teacher Initial
MECH01	Module 1: Introduction to the Automobile	O		
MECH02	Module 2: Automotive Processes	C		
MECH03	Module 3: Safety Equipment, Hazardous Materials and Housekeeping Skills	C		
MECH04	Module 4: Information Storage	C		
MECH05	Module 5: Hand and Power Tools	C		
MECH06	Module 6: Fasteners and Gaskets	C		
MECH07	Module 7: Cleaning Techniques	C		
MECH10	Module 10: Oils and Lubricants	C		
MECH12	Module 12: Tires	C		
MECH23A	Module 23A: Small Engines	O		
MECH99	Module 99: Extended Study	O		

Sample Module Recordkeeping Charts Mechanical and Automotive A20

Student name: _____

School name: _____

Module Code	Modules	Core or Optional	Date	Teacher Initial
MECH19A	Module 19A: Wheel Bearings	C		
MECH19B	Module 19B: Brake Systems	C		
MECH19C	Module 19C: Wheel Cylinders, Calipers and Master Cylinders	C		
MECH19D	Module 19D: Parking Brake Systems	C		
MECH23B	Module 23B: Multi-cylinder Engines	C		
MECH32A	Module 32A: Work Study Preparation and Follow-up Activities	O		
MECH33A	Module 33A: Work Study	O		
MECH99	Module 99: Extended Study	O		

Note: When the Extended Study, Work Study Preparation and Follow-up Activities, and Work Study modules are studied for the first time, record the module number and the letter A (Extended Study Module 99A). If the module is used at another level, the module is recorded using the letter B (Extended Study Module 99B).

All recordkeeping charts should be copied to school letterhead.

Sample Module Recordkeeping Charts

Mechanical and Automotive B20

Student name: _____

School name: _____

Module code	Modules	Core or Optional	Date	Teacher Initial
MECH08	Module 8: Oxy-Acetylene Welding	O		
MECH09	Module 9: Storage Batteries	C		
MECH11	Module 11: Headlights	C		
MECH13	Module 13: Minor Body Service	C		
MECH15	Module 15: Cooling Fans	C		
MECH16	Module 16: Exhaust Systems	C		
MECH17	Module 17: Radiators and Coolants	O		
MECH20	Module 20: Suspension Control systems and Steering Linkages	O		
MECH31	Module 31: Seat Belts	O		
MECH32B	Module 32B: Work Study Preparation and Follow-up Activities	O		
MECH33B	Module 33B: Work Study	O		
MECH99	Module 99: Extended Study	O		

Sample Module Recordkeeping Charts

Mechanical and Automotive A30

Student name: _____

School name: _____

Module code	Modules	Core or Optional	Date	Teacher Initial
MECH14	Module 14: Fundamentals of Electricity and Electronics	C		
MECH21	Module 21: Alternators	C		
MECH22	Module 22: Starting Systems	C		
MECH29	Module 29: Ignition Systems	O		
MECH30	Module 30: Fuel Systems	C		
MECH32C	Module 32C: Work Study Preparation and Follow-up Activities	O		
MECH33C	Module 33C: Work Study	O		
MECH99	Module 99: Extended Study	O		

Note: When the Extended Study, Work Study Preparation and Follow-up Activities, and Work Study modules are studied for the first time, record the module number and the letter A (Extended Study Module 99A). If the module is used at another level, the module is recorded using the letter B (Extended Study Module 99B).

All recordkeeping charts should be copied to school letterhead.

Sample Module Recordkeeping Charts

Mechanical and Automotive B30

Student name: _____

School name: _____

Module code	Module Title	Core or Optional	Date	Teacher Initial
MECH24	Module 24: Universal Joints and Driveshafts	C		
MECH25	Module 25: Clutches and Release Mechanisms	C		
MECH26	Module 26: Manual Transmissions	C		
MECH27	Module 27: Transfer Cases	C		
MECH28	Module 28: Automatic Transmissions	C		
MECH32D	Module 32D: Work Study Preparation and Follow-up Activities	O		
MECH33D	Module 33D: Work Study	O		
MECH99	Module 99: Extended Study	O		

Note: When the Extended Study, Work Study Preparation and Follow-up Activities, and Work Study modules are studied for the first time, record the module number and the letter A (Extended Study Module 99A). If the module is used at another level, the module is recorded using the letter B (Extended Study Module 99B).

All recordkeeping charts should be copied to school letterhead.

Appendix D: Career Research Interview Questions

Adapted from *Business Education A Curriculum Guide for the Secondary Level Accounting 10, 20, 30* (Saskatchewan Education 1992).

Interview someone who currently works in this career.

The assignment may be completed independently, in pairs, in small groups, or by whichever method is chosen by the student(s) and teacher. The teacher should encourage students to use a variety of resources to gather information about the career that they are researching. The student may use resources listed in the bibliography, letters, the Internet, phone or a personal interview to gather information.

After the students have discussed different career paths, students may prepare a short journal writing explaining why they are interested in the career area they are about to investigate.

Students may proceed to develop a list of questions to collect the information they require to help them understand more about the career area they have chosen.

The following list of questions may be included in the students' interview project.

1. What is the title of your job?
2. What are your normal duties on the job?
3. What are some of the things that you enjoy about your job?
4. Are there any things about your job that you dislike? What are those things?
5. Does your company have a dress code for employees? What is considered suitable?
6. How often is working overtime required in your job?
7. Do you have to work nights or weekends?
8. What aptitudes and abilities are needed to succeed in your career?
9. What are the post-secondary education and training requirements to enter and advance in your career?
10. Can you give an approximate starting salary for someone just starting out in your occupation? How much does the average person earn after five years? After ten years? What types of employee benefits, such as sick leave or dental plans, do workers in your career usually receive?
11. Do you think the demand for workers in your career will increase or decrease over the next five years? Why?
12. What changes have you seen over the past 5 - 10 years in this career?
13. What are the advantages and disadvantages of entering and being in your career?
14. Is there any advice you would give to a young person just making a career choice?

After the interview session, students may summarize the information they received and draw a conclusion as to whether they would like to learn more about this career. They may also determine whether they would like to join that organization based on their experience.

Students may brainstorm different ways to present their career research to the class. Presentation ideas may include:

- Oral presentation
- Power point presentation
- Written report
- Creating a website with links to career information
- Role playing a student interviewing a career professional
- Role playing a professional promoting his/her career at a career fair