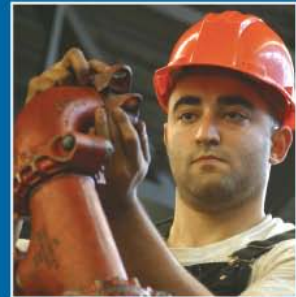


# Automotive Service Technician 1

## Program Outline



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# **AUTOMOTIVE SERVICE TECHNICIAN 1**

## **PROGRAM OUTLINE**

**2008**

**Developed By  
Industry Training Authority  
Province of British Columbia**

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## FOREWORD

This Program Outline is issued by the Automotive Training Standards Organization for use in apprenticeship training classes sponsored by the Automotive Training Standards Organization. Indentured apprentices will be directed to the Apprenticeship Training classes in accordance with the General Regulations made pursuant to the “Industry Training and Apprenticeship Act” of British Columbia.

It is intended as a guide for instructors of apprenticeship. Practical instruction by demonstration and student participation should be integrated with classroom sessions. Safe working practices, even though not always specified in each operation or topic, are an implied part of the program and should be stressed throughout the apprenticeship. It is the responsibility of employers to ensure safety training for the apprentices working on their worksites.

The “Content” portion of each competency is there as a guide only, and is not intended to be exhaustive.

A glossary of verbs is included at the end of the program outline. It is there to clarify the intent of the “learning objective” and “learning task” statements. Also included, at the beginning of the program outline is a competency profile chart and at the end of the program outline is a list of requirements necessary to offer the training.

The Program Outline was prepared with the advice and assistance of representatives of management and labour and in cooperation with the Automotive Training Standards Organization.

## **ACKNOWLEDGEMENTS**

The Program Outline was prepared with the advice and direction of an industry steering committee convened initially by the Automotive Training Standards Organization.

### **Steering Committee:**

Jim Davies

Tim Drewcock

Rob Grosse

Ben Hircock

Mike Howells

Russ Hunter

Robert Lang

Jason Leber

Art Lilley

Mike McPhail

### **SAFETY ADVISORY**

Be advised that references to the WorkSafe BC safety regulations contained within these materials do not/may not reflect the most recent Occupational Health and Safety Regulation (the current Standards and Regulation in BC can be obtained on the following website: <http://www.worksafebc.com>). Please note that it is always the responsibility of any person using these materials to inform him/herself about the Occupational Health and Safety Regulation pertaining to his/her work.

# **SECTION 1**

## **CHARTS**

## Automotive Service Technician 1 Occupational Analysis Chart

<b>Workplace Safety</b>          <b>Line A</b>	Describe Worksafe BC Regulations          A1 <div style="display: flex; justify-content: space-between; border-top: 1px solid black; border-bottom: 1px solid black;"> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> </div>	Describe WHMIS Regulations          A2 <div style="display: flex; justify-content: space-between; border-top: 1px solid black; border-bottom: 1px solid black;"> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> </div>	Demonstrate Safe Vehicle Operation          A3 <div style="display: flex; justify-content: space-between; border-top: 1px solid black; border-bottom: 1px solid black;"> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> </div>	Demonstrate Safe Work Practices          A4 <div style="display: flex; justify-content: space-between; border-top: 1px solid black; border-bottom: 1px solid black;"> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> </div>		
<b>Employability Skills</b>          <b>Line B</b>	Describe Business Practices          B1 <div style="display: flex; justify-content: space-between; border-top: 1px solid black; border-bottom: 1px solid black;"> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> </div>	Demonstrate Communication skills          B2 <div style="display: flex; justify-content: space-between; border-top: 1px solid black; border-bottom: 1px solid black;"> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> </div>				
<b>Tools and Equipment</b>          <b>Line C</b>	Use Hand Tools          C1 <div style="display: flex; justify-content: space-between; border-top: 1px solid black; border-bottom: 1px solid black;"> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> </div>	Use Measuring Instruments          C2 <div style="display: flex; justify-content: space-between; border-top: 1px solid black; border-bottom: 1px solid black;"> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> </div>	Use Power Tools          C3 <div style="display: flex; justify-content: space-between; border-top: 1px solid black; border-bottom: 1px solid black;"> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> </div>	Use Fasteners          C4 <div style="display: flex; justify-content: space-between; border-top: 1px solid black; border-bottom: 1px solid black;"> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> </div>	Use Shop Tools and Equipment          C5 <div style="display: flex; justify-content: space-between; border-top: 1px solid black; border-bottom: 1px solid black;"> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> </div>	Use Reference Resources          C6 <div style="display: flex; justify-content: space-between; border-top: 1px solid black; border-bottom: 1px solid black;"> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> </div>
<b>General Automotive Maintenance</b>          <b>Line D</b>	Select Lubricants and Fluids          D1 <div style="display: flex; justify-content: space-between; border-top: 1px solid black; border-bottom: 1px solid black;"> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> </div>	Describe Belts and Hoses          D2 <div style="display: flex; justify-content: space-between; border-top: 1px solid black; border-bottom: 1px solid black;"> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> </div>	Describe Exterior Lamps          D3 <div style="display: flex; justify-content: space-between; border-top: 1px solid black; border-bottom: 1px solid black;"> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> </div>	Describe Body Trim and Hardware          D4 <div style="display: flex; justify-content: space-between; border-top: 1px solid black; border-bottom: 1px solid black;"> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> </div>	Service Tires and Wheels          D5 <div style="display: flex; justify-content: space-between; border-top: 1px solid black; border-bottom: 1px solid black;"> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> </div>	Service Non Friction Bearings          D6 <div style="display: flex; justify-content: space-between; border-top: 1px solid black; border-bottom: 1px solid black;"> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> <span style="width: 20px; height: 20px;"></span> </div>

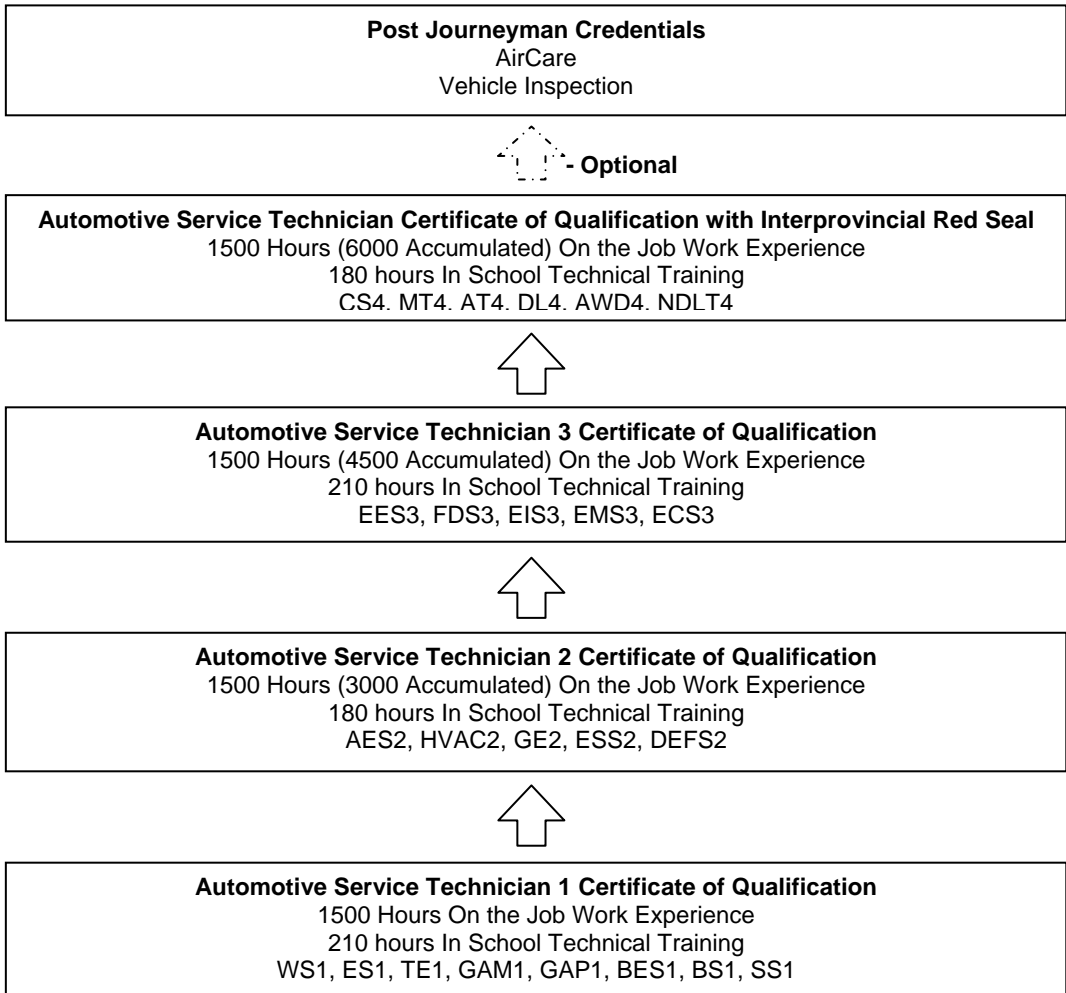
## Automotive Service Technician 1 Occupational Analysis Chart

<b>General Automotive Maintenance (cont.)</b>	Service Spindles and Hubs  <div style="text-align: right;">D7</div>					
<b>General Automotive Practices</b>  <div style="text-align: right;">Line E</div>	Describe Diagnostic Procedures  <div style="text-align: right;">E1</div>	Demonstrate Welding Safety  <div style="text-align: right;">E2</div>				
<b>Basic Electrical Systems</b>  <div style="text-align: right;">Line F</div>	Describe Principles of Electricity  <div style="text-align: right;">F1</div>	Use Electrical Test Equipment  <div style="text-align: right;">F2</div>	Describe Principles of Electronics  <div style="text-align: right;">F3</div>	Service Wiring Systems  <div style="text-align: right;">F4</div>	Service 12 Volt Batteries  <div style="text-align: right;">F5</div>	Use Scan Tools  <div style="text-align: right;">F6</div>
<b>Brake Systems</b>  <div style="text-align: right;">Line G</div>	Service Brake Tubing and Fittings  <div style="text-align: right;">G1</div>	Service Brake Hydraulic Systems  <div style="text-align: right;">G2</div>	Service Drum Brake Systems  <div style="text-align: right;">G3</div>	Service Disc Brake Systems  <div style="text-align: right;">G4</div>	Inspect Power Assist Systems  <div style="text-align: right;">G5</div>	Service Anti-Lock Brake Systems  <div style="text-align: right;">G6</div>

## Automotive Service Technician 1 Occupational Analysis Chart

<b>Steering Systems</b>  <b>Line H</b>	Service Steering Gears  H1	Disarm and Rearm Passenger Restraint Systems  H2	Inspect Steering Columns  H3	Service Steering Linkage  H4	Service Power Steering Systems  H5	Perform Wheel Alignment  H6																																							
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<b>Suspension Systems</b>  <b>Line I</b>	Describe Frame Types  I1	Describe Suspension Geometry  I2	Describe Suspension Components  I3	Service Suspension Systems  I4	Describe Electronic Suspension Systems  I5																																								
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# AUTOMOTIVE SERVICE TECHNICIAN CERTIFICATION FLOWCHART



## COMPETENCY DESCRIPTIONS

<p><b>Automotive Service Technician 1</b></p> <ul style="list-style-type: none"> <li>• Workplace Safety (WS1)</li> <li>• Employability Skills (ES1)</li> <li>• Tools and Equipment (TE1)</li> <li>• General Automotive Maintenance (GAM1)</li> <li>• General Automotive Practices (GAP1)</li> <li>• Basic Electrical Systems (BES1)</li> <li>• Brake Systems (BS1)</li> <li>• Steering Systems (SS1)</li> </ul>	<p><b>Automotive Service Technician 2</b></p> <ul style="list-style-type: none"> <li>• Advanced Electrical Systems (AES2)</li> <li>• Heating Ventilation and Air Conditioning Systems (HVAC2)</li> <li>• Gasoline Engines (GE2)</li> <li>• Engine Support Systems (ESS2)</li> <li>• Diesel Engine and Fuel Systems (DEFS2)</li> </ul>
<p><b>Automotive Service Technician 3</b></p> <ul style="list-style-type: none"> <li>• Electrical and Electronic Systems (EES3)</li> <li>• Fuel Delivery Systems (FDS3)</li> <li>• Electronic Ignition Systems (EIS3)</li> <li>• Engine Management Systems (EMS3)</li> <li>• Emission Control Systems (ECS3)</li> </ul>	<p><b>Automotive Service Technician 4</b></p> <ul style="list-style-type: none"> <li>• Clutch Systems (CS4)</li> <li>• Manual Transmissions (MT4)</li> <li>• Automatic Transmissions (AT4)</li> <li>• Drive Lines (DL4)</li> <li>• All Wheel and Four Wheel Drive Systems (AWD4)</li> <li>• New Drive Line Technology (NDLT4)</li> </ul>

**SECTION 2**

**AUTOMOTIVE SERVICE TECHNICIAN 1**

**PROGRAM OUTLINE**

## SUGGESTED SCHEDULE OF TIME ALLOTMENT FOR AUTOMOTIVE SERVICE TECHNICIAN 1

		Theory (Hours)	Practical (Hours)	Page
<b>Line A</b>	<b>Workplace Safety</b>	<b>4 % of Time</b>		
A1	Describe WorkSafe BC Regulations	2	0	10
A2	Describe W.H.M.I.S. Regulations	2	0	12
A3	Demonstrate Safe Vehicle Operation	1	0	14
A4	Demonstrate Safe Work Practices	2	2	15
<b>Line B</b>	<b>Employability Skills</b>	<b>1 % of Time</b>		
B1	Describe Business Practices	1	0	17
B2	Demonstrate Communication Skills	1	0	18
<b>Line C</b>	<b>Tools and Equipment</b>	<b>8 % of Time</b>		
C1	Use Hand Tools	1	1	19
C2	Use Measuring Instruments	2	3	20
C3	Use Power Tools	0	1	21
C4	Use Fasteners	2	4	23
C5	Use Shop Tools and Equipment	0	2	25
C6	Use Reference Resources	1	0	26
<b>Line D</b>	<b>General Automotive Maintenance</b>	<b>11 % of Time</b>		
D1	Select Lubricants and Fluids	1	0	27
D2	Describe Belts, and Hoses	2	0	28
D3	Describe Exterior Lamps	1	0	29
D4	Describe Body Trim and Hardware	1	0	30
D5	Service Tires and Wheels	3	8	31
D6	Service Non Friction Bearings	2	2	33
D7	Service Spindles and Hubs	1	2	34
<b>Line E</b>	<b>General Automotive Practices</b>	<b>6 % of Time</b>		
E1	Describe Diagnostic Procedures	1	0	35
E2	Demonstrate Welding Techniques	2	10	36

		Theory (Hours)	Practical (Hours)	Page
<b>Line F</b>	<b>Basic Electrical Systems</b>	<b>19 % of Time</b>		
F1	Describe Principles of Electricity	4	9	37
F2	Use Electrical Test Equipment	1	1	39
F3	Describe Principles of Electronics	2	2	40
F4	Service Wiring Systems	3	4	41
F5	Service 12 Volt Batteries	4	5	42
F6	Use Scan Tools	2	3	44
<b>Line G</b>	<b>Brake Systems</b>	<b>21 % of Time</b>		
G1	Service Brake Tubing and Fittings	1	3	44
G2	Service Brake Hydraulic Systems	3	4	45
G3	Service Drum Brake Systems	3	8	47
G4	Service Disc Brake Systems	3	8	49
G5	Inspect Power Assist Systems	2	1	51
G6	Service Anti-lock Brake Systems	4	4	52
<b>Line H</b>	<b>Steering Systems</b>	<b>20 % of Time</b>		
H1	Service Steering Gears	3	6	53
H2	Disarm and Rearm Passenger Restraint Systems	2	3	55
H3	Inspect Steering Columns	1	1	56
H4	Service Steering Linkage	2	4	57
H5	Service Power Steering Systems	4	4	58
H6	Perform Wheel Alignment	3	8	59
<b>Line I</b>	<b>Suspension Systems</b>	<b>10 % of Time</b>		
I1	Describe Frame Types	1	0	60
I2	Describe Suspension Geometry	3	0	61
I3	Describe Suspension Components	2	0	62
I4	Service Suspension Systems	1	12	64
I5	Describe Electronic Suspension Systems	2	0	65

# **PROGRAM OUTLINE FOR AUTOMOTIVE SERVICE TECHNICIAN 1**

## LINE A: WORKPLACE SAFETY

### Competency: A1 Describe WorkSafe BC Regulations

#### Learning Objectives:

1. The learner will be able to describe the application and parts of the Worker's Compensation Act outlined in the Occupational Health and Safety Regulations.
2. The learner will be able to describe the application of the Occupational Health and Safety Regulations and how to find requirements applicable to the automotive service technician's workplace.

LEARNING TASKS	CONTENT
1. Define terms used in the Worker's Compensation Act	<ul style="list-style-type: none"><li>• Definitions, section 1 of the act</li></ul>
2. Describe the conditions under which compensation will be paid	<ul style="list-style-type: none"><li>• Part 1, division 2 of the act</li></ul>
3. State the general duties of employers, employees and others	<ul style="list-style-type: none"><li>• Part 2, division 3, sections 115-124 of the act</li></ul>
4. State the Workers Compensation Act requirements for the reporting of accidents	<ul style="list-style-type: none"><li>• Part 1, division 5 sections 53 and 54 of the act</li></ul>
5. State the "Core Requirements" of the Occupational Health and Safety Regulation	<ul style="list-style-type: none"><li>• Definitions</li><li>• Application</li><li>• Rights and Responsibilities<ul style="list-style-type: none"><li>– Health and safety programs</li><li>– Investigations and reports</li><li>– Workplace inspections</li><li>– Right to refuse work</li></ul></li><li>• General conditions<ul style="list-style-type: none"><li>– Building and equipment safety</li><li>– Emergency preparedness</li><li>– Preventing violence</li><li>– Working alone</li><li>– Ergonomics</li><li>– Illumination</li><li>– Indoor air quality</li><li>– Smoking and lunchrooms</li></ul></li></ul>
6. State the "General Hazard Requirements" of the Occupational Health and Safety Regulation	<ul style="list-style-type: none"><li>• Chemical and biological substances</li><li>• Substance specific requirements</li><li>• Noise, vibration, radiation and temperature</li><li>• Personal protective clothing and equipment</li><li>• De-energize and lockout</li><li>• Tools, machinery and equipment</li><li>• Cranes and hoists</li><li>• Electrical safety</li></ul>

**Achievement Criteria:**

Given a 10 question quiz on the Worker Compensation Act the Learner will be able to demonstrate knowledge of the trade by correctly answering 7 or more questions.

## LINE A: WORKPLACE SAFETY

### Competency: A2 Describe Workplace Hazardous Materials Information System (WHMIS) Regulations

#### Learning Objectives:

1. The learner will be able to describe the purpose of the Workplace Hazardous Materials Information System (WHMIS) Regulations.
2. The learner will be able to explain the contents of material safety data sheets (MSDS).
3. The learner will be able to explain the contents of a WHMIS label

LEARNING TASKS	CONTENT
1. State the legislation that requires suppliers of hazardous materials to provide MSDS and label products as a condition of sale and importation	<ul style="list-style-type: none"><li>• Hazardous product act</li><li>• Controlled products regulations</li><li>• Ingredient disclosure list</li><li>• Hazardous materials information review act</li><li>• Hazardous materials information review regulations</li></ul>
2. state the purpose of the Workplace Hazardous Materials Information System (WHMIS)	<ul style="list-style-type: none"><li>• Protection of Canadian workers from the adverse effects of hazardous materials through the provision of relevant information while minimizing the economic impact on industry and the discretion of trade<ul style="list-style-type: none"><li>– Recognition of rights</li><li>– Workers</li><li>– Employers</li><li>– Suppliers</li><li>– Regulators</li></ul></li></ul>
3. Describe the key elements of WHMIS	<ul style="list-style-type: none"><li>• Material Safety Data Sheets (MSDS)</li><li>• Labeling of containers of hazardous materials</li><li>• Worker education programs</li></ul>
4. Describe the responsibilities of suppliers under WHMIS	<ul style="list-style-type: none"><li>• Provide<ul style="list-style-type: none"><li>– MSDS</li><li>– Labels</li></ul></li></ul>
5. Describe the responsibilities of employers under WHMIS	<ul style="list-style-type: none"><li>• Provide<ul style="list-style-type: none"><li>– MSDS</li><li>– Labels</li><li>– Work education programs in the workplace</li></ul></li></ul>
6. State the “General Hazard	<ul style="list-style-type: none"><li>• Hazardous ingredients</li></ul>

Requirements” of the Occupational Health and Safety Regulation

- Preparation information
  - Product information
  - Physical data
  - Fire or explosion
  - Reactivity data
  - Toxicological properties
  - Preventive measures
  - First-aid measures
7. Identify symbols found on WHMIS labels and their meaning
- Compressed gases
  - Flammable and combustible materials
  - Oxidizing materials
  - Poisonous and infection materials
    - Acute toxic effects
    - Other toxic effects
    - Bio-hazardous infections materials
  - Corrosive materials
  - Dangerously reactive materials
8. Demonstrate how WHMIS applies to hazardous materials used in the shop
- Use, storage and disposal of;
    - Solvents
    - Caustic cleaners
    - Cleaning solutions
    - Gasoline
    - Diesel fuel
    - L.P.G.
    - C.N.G.
    - Asbestos
    - Battery acid
    - Refrigerants
    - Brake fluid
    - Antifreeze
    - Lubricants
    - Tracer dyes

**Achievement Criteria:**

Given a 10 question quiz on the WHMIS and MSDS the Learner will be able to demonstrate knowledge of the trade by correctly answering 7 or more questions.

## LINE A: WORKPLACE SAFETY

### Competency: A3 Demonstrate Safe Vehicle Operation

#### Learning Objectives:

1. The learner will be able to perform a walk around inspection prior to operating a vehicle.
2. The learner will be able to safely operate a vehicle.

LEARNING TASKS	CONTENT
1. Describe licensing pre-requirements	<ul style="list-style-type: none"><li>• Drivers license requirements</li><li>• Use of repair plates</li></ul>
2. Perform vehicle safety inspection requirements	<ul style="list-style-type: none"><li>• Walk around<ul style="list-style-type: none"><li>– Tires and wheels</li><li>– Area clear</li><li>– Tools put away</li></ul></li><li>• Brakes</li><li>• Steering</li><li>• Final check on work completed</li></ul>
3. Describe shop driving safety rules	<ul style="list-style-type: none"><li>• Right of ways</li><li>• Etiquette</li></ul>
4. Operate a vehicle in a shop	<ul style="list-style-type: none"><li>• Speed limit</li><li>• Safety considerations</li><li>• Parking on hoist</li><li>• Road tests</li></ul>

#### Achievement Criteria:

Given a written and/or a practical assessment on Workplace Safety the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

## LINE A: WORKPLACE SAFETY

### Competency: A4 Demonstrate Safe Work Practices

#### Learning Objectives:

1. The learner will be able to apply personal safety measures.
2. The learner will be able to identify and use shop emergency equipment
3. The learner will be able to prevent, identify and extinguish various classes of fires.

LEARNING TASKS	CONTENT
1. Apply personal safety precautions and procedures	<ul style="list-style-type: none"><li>• Personal apparel<ul style="list-style-type: none"><li>– Clothing</li><li>– Hair and beards</li><li>– Jewelry</li></ul></li><li>• Personal protection<ul style="list-style-type: none"><li>– Head</li><li>– Hands</li><li>– Lungs</li><li>– Eyes</li><li>– Ears</li><li>– Feet</li></ul></li><li>• Housekeeping</li><li>• Ventilation systems</li><li>• Clear head</li><li>• Horseplay</li><li>• Respect for others safety</li><li>• Constant awareness of surroundings</li><li>• Lifting</li></ul>
2. Locate shop emergency equipment and means of exit	<ul style="list-style-type: none"><li>• Emergency shutoffs</li><li>• Fire control systems</li><li>• Eye wash facilities</li><li>• Emergency exits</li><li>• First aid facilities</li><li>• Emergency contact / phone numbers</li><li>• Outside meeting place</li><li>• Disaster meeting place</li></ul>
3. Describe the conditions and classifications of fires	<ul style="list-style-type: none"><li>• Conditions to support fire<ul style="list-style-type: none"><li>– Air</li><li>– Fuel</li><li>– Heat</li></ul></li><li>• Classes of fires<ul style="list-style-type: none"><li>– A - combustibles</li><li>– B - liquids</li><li>– C - electrical</li><li>– D – metals</li></ul></li><li>• Symbols and colours</li></ul>

## Learning Tasks Continued

4. Describe fire safety precautions when working near, handling or storing flammables
  - Fuels
    - Diesel
    - Gasoline
    - Propane
    - Natural gas
  - Lubricants
  - Oily rags
  - Combustible metals
  - Aerosols
  
5. Describe the considerations and procedures to extinguishing a fire
  - Warning others and fire department
  - Evacuation of others
  - Fire contained and not spreading
  - Method of exit
  - Training
  - P.A.S.S.
    - Point
    - Aim
    - Squeeze
    - Sweep

### **Achievement Criteria:**

Given a written and/or a practical assessment on safe work practices the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

## LINE B: EMPLOYABILITY SKILLS

### Competency: B1 Describe Business Practices

#### Learning Objectives:

1. The learner will be able to describe effective methods of shop management and recycling programs.
2. The learner will be able to describe the career path of an automotive technician.

LEARNING TASKS	CONTENT
1. Describe the hierarchy of control within an automotive repair shop	<ul style="list-style-type: none"><li>• Owner</li><li>• Service manager</li><li>• Foreman</li><li>• Journey person</li><li>• Apprentice</li><li>• Lube person</li><li>• Detailer</li></ul>
2. Describe shop efficiency and shop management methods	<ul style="list-style-type: none"><li>• Flat rate</li><li>• Hourly</li><li>• Salary</li><li>• Personal productivity</li><li>• Incentive programs</li></ul>
3. Describe recycling programs	<ul style="list-style-type: none"><li>• Material costs</li><li>• Minimizing waste</li><li>• Most cost effective method</li><li>• Disposal of hazardous materials</li></ul>

#### Achievement Criteria:

Given a written assessment on basic work practices the Learner will be able to demonstrate knowledge of the trade by correctly answering 70% or more questions.

## LINE B: EMPLOYABILITY SKILLS

### Competency: B2 Demonstrate Communication Skills

#### Learning Objectives:

1. The learner will be able to clearly demonstrate both oral and written communication using trade terminology.

LEARNING TASKS	CONTENT
1. Explain the importance of learning and using correct trade terminology	<ul style="list-style-type: none"><li>• Taking instructions</li><li>• Giving instructions</li><li>• Ordering parts</li><li>• Explaining concepts</li></ul>
2. Use and maintain record keeping	<ul style="list-style-type: none"><li>• Service / work order</li><li>• Parts requisition</li><li>• Purchase order</li><li>• Technical reports</li><li>• Time card</li><li>• Vehicle maintenance log</li><li>• Maintenance schedule</li></ul>
3. Use written reports	<ul style="list-style-type: none"><li>• Service</li><li>• Instructional</li><li>• Technical</li></ul>

#### Achievement Criteria:

Given a written and/or a practical assessment on communication skills the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

## LINE C: TOOLS AND EQUIPMENT

### Competency: C1 Use Hand Tools

#### Learning Objectives:

1. The learner will be able to select the appropriate tool for a task.
2. The learner will be able to demonstrate the safe use of technician's hand tools.

LEARNING TASKS	CONTENT
1. Describe various general hand tools	<ul style="list-style-type: none"><li>• General<ul style="list-style-type: none"><li>– Purchase quality</li><li>– Insurance</li><li>– Orderly storage</li><li>– Cleaning and maintenance</li><li>– Used for intended purpose</li><li>– Proximity to other people</li><li>– Personal protective equipment</li><li>– Ventilation</li></ul></li><li>• Wrenches</li><li>• Socket wrenches</li><li>• Screwdrivers</li><li>• Pliers</li><li>• Hammers</li></ul>
2. Describe special application hand tools	<ul style="list-style-type: none"><li>• Punches</li><li>• Chisels</li><li>• Pry bars</li><li>• Files</li><li>• Saws</li><li>• Vices and clamps</li><li>• Scrapers and brushes</li><li>• Pickup tools and mirrors</li><li>• Pullers and slide hammers</li><li>• Fender / seat covers</li></ul>
3. Use various general hand tools	<ul style="list-style-type: none"><li>• Wrenches</li><li>• Socket wrenches</li><li>• Screwdrivers</li><li>• Pliers</li><li>• Hammers</li></ul>

#### Achievement Criteria:

Given a written and/or a practical assessment on hand tools the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

## LINE C: TOOLS AND EQUIPMENT

### Competency: C2 Use Measuring Instruments

#### Learning Objectives:

1. The learner will be able to select appropriate measuring instruments.
2. The learner will be able to use measuring instruments with required speed and accuracy.

LEARNING TASKS	CONTENT
1. Describe measuring tools	<ul style="list-style-type: none"><li>• Steel rules</li><li>• Tapes</li><li>• Calipers and dividers<ul style="list-style-type: none"><li>– Inside</li><li>– Outside</li><li>– Dividers</li><li>– Vernier</li></ul></li><li>• Micrometers<ul style="list-style-type: none"><li>– Inside</li><li>– Outside</li><li>– Depth</li></ul></li><li>• Telescoping gauges</li><li>• Ball gauges</li><li>• Feeler gauges</li><li>• Dial indicator</li><li>• Torque wrenches and torque sticks</li></ul>
2. Use Measuring Tools	<ul style="list-style-type: none"><li>• Micrometer</li><li>• Vernier</li><li>• Torque wrench</li><li>• Dial indicator</li><li>• Feeler gauge</li></ul>

#### Achievement Criteria:

Given a written and/or a practical assessment on measuring instruments the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

## LINE C: TOOLS AND EQUIPMENT

### Competency: C3 Use Power Tools

#### Learning Objectives:

1. The learner will be able to select and demonstrate the safe use of power tools.

LEARNING TASKS	CONTENT
1. Describe power tools	<ul style="list-style-type: none"><li>• General<ul style="list-style-type: none"><li>– Purchase quality</li><li>– Insurance</li><li>– Orderly storage</li><li>– Cleaning and maintenance</li><li>– Used for intended purpose</li><li>– Proximity to other people</li><li>– Personal protective equipment</li><li>– Ventilation</li></ul></li><li>• Air tools<ul style="list-style-type: none"><li>– Maintenance and safety</li><li>– Water filters</li><li>– Lubricators</li><li>– Pressure regulators</li><li>– Air hose</li><li>– Impact wrenches</li><li>– Ratchets</li><li>– Impact sockets and extensions</li><li>– Air hammers</li><li>– Blow guns</li><li>– Drills</li><li>– Rotary brushes</li><li>– Grinders</li></ul></li><li>• Electric tools<ul style="list-style-type: none"><li>– Grounded or double insulated</li><li>– Maintenance and safety</li><li>– Portable drills</li><li>– Impact wrenches</li><li>– Saws</li><li>– Grinders</li><li>– Work lights</li><li>– Soldering irons and guns</li><li>– Battery chargers</li></ul></li></ul>
2. Use air powered tools	<ul style="list-style-type: none"><li>• Ratchet</li><li>• Gun</li><li>• Butterfly</li><li>• Air grinder</li><li>• Blow nozzle</li><li>• Drill</li></ul>

3. Use electric powered tools

- Lubrication and care
- Hand drill
- Angle grinder
- Heat gun
- Work light

**Achievement Criteria:**

Given a written and/or a practical assessment on power tools the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

## LINE C: TOOLS AND EQUIPMENT

### Competency: C4 Use Fasteners

#### Learning Objectives:

1. The learner will be able to select threaded and non threaded fasteners.
2. The learner will be able to remove and replace fasteners.
3. The learner will be able to identify causes of fasteners failure.
4. The learner will be able to remove broken fasteners and repair threads.

LEARNING TASKS	CONTENT
1. Describe threaded fastener terminology	<ul style="list-style-type: none"><li>• Nominal sizes</li><li>• Major and minor diameter</li><li>• Head markings and tensile strength</li><li>• Pitch and thread angle</li><li>• Thread series<ul style="list-style-type: none"><li>– UNC</li><li>– UNF</li><li>– NPT</li><li>– Metric</li></ul></li><li>• Right and left hand threads</li><li>• Classes or fits</li></ul>
2. Select and use threaded fasteners	<ul style="list-style-type: none"><li>• Fastener materials</li><li>• Bolts</li><li>• Studs</li><li>• Nuts<ul style="list-style-type: none"><li>– Hex</li><li>– Castle</li><li>– Slotted hex</li><li>– Self locking</li><li>– Wing</li><li>– Speed</li></ul></li><li>• Self tapping screws</li><li>• Sheet metal screws</li><li>• Set screws</li></ul>
3. Torque fasteners to specifications	<ul style="list-style-type: none"><li>• Torque definition</li><li>• Tension</li><li>• Elastic limit</li><li>• Distortion</li><li>• Tensile strength</li><li>• Torque wrenches<ul style="list-style-type: none"><li>– Extensions</li></ul></li><li>• Torque to yield</li></ul>

- Torque sequence
  - Torquing in steps
4. Repair damaged threads
- Taps and wrenches
    - Taper
    - Plug
    - Bottoming
  - Drill and tap size charts
  - Tapping internal threads
  - Broken tap removal
  - Dies and stocks
  - Cutting external threads
  - Thread chasers
  - Helicoils
5. Select and use non threaded fasteners
- Washers
    - Flat
    - Bevel
    - Lock
  - Pins
    - Cotter clevis
    - Spring or roll
    - Shear
    - Taper
    - Dowel
  - Keys
    - Woodruff
    - Tapered
  - Spines
  - Locking plates
  - Safety wire
  - Snap rings
  - Pop rivets
6. Remove damaged nuts, bolts or studs
- Shaping a protruding end for grip
  - Broken stud extractors
  - Use of nut splitters
  - Use of chisels or punches
  - Use of hacksaws
  - Use of penetrating oil
  - Use of heat

**Achievement Criteria:**

Given a written and/or a practical assessment on fasteners the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

## LINE C: TOOLS AND EQUIPMENT

### Competency: C5 Use Shop Tools and Equipment

#### Learning Objectives:

1. The learner will be able to select, use and maintain shop tools and equipment.

LEARNING TASKS	CONTENT
1. Select and use lifting and jacking equipment	<ul style="list-style-type: none"><li>• Mechanical jacks</li><li>• Hydraulic jacks</li><li>• Transmission jacks</li><li>• Hoists</li><li>• Stands</li><li>• Portable cranes</li><li>• Care and inspection of lifting and blocking equipment</li><li>• Creepers</li></ul>
2. Select and use presses and pullers	<ul style="list-style-type: none"><li>• Hydraulic presses and pullers</li><li>• Arbor press</li><li>• Slide hammers</li><li>• Pullers<ul style="list-style-type: none"><li>– Bearing</li><li>– Steering component</li></ul></li></ul>
3. Maintain air compressors	<ul style="list-style-type: none"><li>• Construction</li><li>• Tank</li><li>• Compressor</li><li>• Motor / engine</li><li>• Drives, belts, couplings</li><li>• Water filter / traps</li><li>• Lubricators</li><li>• Pressure regulators</li><li>• Piping and hoses</li></ul>
4. Select and use cleaning equipment	<ul style="list-style-type: none"><li>• Solvent and chemical cleaning facilities</li><li>• Pressure washers</li><li>• Steam cleaners</li><li>• Abrasive blast machines</li><li>• Brake cleaning equipment</li></ul>

#### Achievement Criteria:

Given a written and/or a practical assessment on shop tools and equipment the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

## LINE C: TOOLS AND EQUIPMENT

### Competency: C6 Use Reference Resources

#### Learning Objectives:

1. The learner will be able to locate information from a variety of sources necessary to maintain, troubleshoot and service vehicles.

LEARNING TASKS	CONTENT
1. Use service manuals to locate information	<ul style="list-style-type: none"><li>• Maintenance</li><li>• Repair procedures</li><li>• Torque requirements</li><li>• Technical service bulletins</li><li>• Vacuum diagrams</li><li>• Wiring diagrams</li></ul>
2. Use parts manuals to locate information	<ul style="list-style-type: none"><li>• Exploded diagrams</li><li>• Part number</li><li>• Part quantity</li><li>• Superseding of parts</li><li>• Labour estimating guides</li></ul>
3. Use computers to locate information	<ul style="list-style-type: none"><li>• Vehicle Identification Number (VIN)</li><li>• Vehicle identification information<ul style="list-style-type: none"><li>– Paint codes</li><li>– Gross vehicle weight</li><li>– options</li></ul></li><li>• Maintenance</li><li>• Repair procedures</li><li>• Torque requirements</li><li>• Technical service bulletins</li><li>• Vacuum diagrams</li><li>• Wiring diagrams</li></ul>

#### Achievement Criteria:

Given a written and/or a practical assessment on reference resources the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

## LINE D: GENERAL AUTOMOTIVE MAINTENANCE

### Competency: D1 Select Lubricants and Fluids

#### Learning Objectives:

1. The learner will be able to select the correct lubricants and fluids necessary to maintain and service automobiles.

LEARNING TASKS	CONTENT
1. Describe and identify lubricants	<ul style="list-style-type: none"><li>• Synthetic or mineral</li><li>• Additives</li><li>• Greases and other lubricants</li><li>• Aerosols</li></ul>
2. Describe and identify fluids	<ul style="list-style-type: none"><li>• Replacement intervals</li><li>• Antifreeze<ul style="list-style-type: none"><li>– Ethylene glycol</li><li>– Propylene glycol based</li><li>– Additives</li></ul></li><li>• Brake fluid</li><li>• Power steering fluid</li><li>• Windshield washer fluid</li></ul>
3. Describe and identify shop fluids	<ul style="list-style-type: none"><li>• Engine shampoo</li><li>• Floor cleaner</li><li>• General cleaners</li><li>• Solvent</li><li>• Wheel acid</li><li>• Car wash</li></ul>
4. Select lubricants and fluids for specific purposes	<ul style="list-style-type: none"><li>• Greases</li><li>• Antifreeze</li><li>• Brake fluid</li><li>• Power steering fluid</li><li>• Windshield washer fluid</li><li>• Shop fluids</li></ul>

#### Achievement Criteria:

Given a written and/or a practical assessment on lubricants and fluids the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

## LINE D: GENERAL AUTOMOTIVE MAINTENANCE

### Competency: D2 Describe Belts and Hoses

#### Learning Objectives:

1. The learner will be able to select the correct belts and hoses necessary to maintain and service automobiles.
2. The learner will be able to describe how to inspect belts and hoses.

LEARNING TASKS	CONTENT
1. Describe and identify drive belts	<ul style="list-style-type: none"><li>• Non metallic<ul style="list-style-type: none"><li>– V</li><li>– Serpentine</li><li>– Gilmer (toothed)</li></ul></li></ul>
2. Describe drive belt inspection and replacement	<ul style="list-style-type: none"><li>• Diagnose wear and defects</li><li>• Replacement</li><li>• Tension adjustment</li><li>• Pulley alignment</li><li>• Bearings</li><li>• Manufacturer's specifications</li></ul>
3. Describe and identify hoses and clamps	<ul style="list-style-type: none"><li>• Construction<ul style="list-style-type: none"><li>– Pressure</li><li>– Vacuum</li><li>– Reinforced</li><li>– Material compatibility<ul style="list-style-type: none"><li>▪ Fuel</li><li>▪ Oil</li><li>▪ Coolant</li><li>▪ Air / vacuum</li><li>▪ Turbo</li><li>▪ Brake</li></ul></li><li>– Flexibility</li><li>– Molded</li></ul></li></ul>

#### Achievement Criteria:

Given a written and/or a practical assessment on belts and hoses the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

## LINE D: GENERAL AUTOMOTIVE MAINTENANCE

### Competency: D3 Describe Exterior Lamps

#### Learning Objectives:

1. The learner will be able to describe the types of exterior lamps.

LEARNING TASKS	CONTENT
1. Describe exterior lamps	<ul style="list-style-type: none"><li>• Headlamps<ul style="list-style-type: none"><li>– Xenon</li><li>– Halogen</li><li>– Sealed beam</li></ul></li><li>• Driving lights</li><li>• Tail lights</li><li>• Brake lights</li><li>• Marker lights</li><li>• Turn signals</li><li>• License plate lights</li><li>• Reverse lights</li><li>• Government regulations</li></ul>

#### Achievement Criteria:

Given a written and/or a practical assessment on exterior lights the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

## LINE D: GENERAL AUTOMOTIVE MAINTENANCE

### Competency: D4 Describe Body Trim and Hardware

#### Learning Objectives:

1. The learner will be able to describe how to identify body trim and hardware.
2. The learner will be able to describe the design and operation of body trim and hardware.

LEARNING TASKS	CONTENT
1. Describe components of body trim and hardware	<ul style="list-style-type: none"><li>• Windows</li><li>• Mirrors</li><li>• Bumpers</li><li>• Moldings and trim</li><li>• Door hardware</li><li>• Body panels</li><li>• Windshield wiper systems<ul style="list-style-type: none"><li>– Blades</li><li>– Linkage</li></ul></li><li>• Interior components<ul style="list-style-type: none"><li>– Seats</li><li>– Carpet</li><li>– Dashboard</li><li>– headliners</li></ul></li></ul>
2. Describe the design and operation of body trim and hardware	<ul style="list-style-type: none"><li>• Wind noise<ul style="list-style-type: none"><li>– Basic aerodynamics</li></ul></li><li>• Water leaks</li><li>• Sealants</li><li>• Noise vibration and harshness (NVH)</li></ul>

#### Achievement Criteria:

Given a written and/or a practical assessment on body trim and hardware the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

## LINE D: GENERAL AUTOMOTIVE MAINTENANCE

### Competency: D5 Service Tires and Wheels

#### Learning Objectives:

1. The learner will be able to select and install tires and wheels.
2. The learner will be able to inspect tires and wheels for defects or damage.
3. The learner will be able to repair tires.

LEARNING TASKS	CONTENT
1. Describe radial tire construction	<ul style="list-style-type: none"><li>• Materials</li><li>• Belts</li><li>• Side walls</li><li>• Sizing</li><li>• Department of Transportation (DOT) number</li><li>• Ratings<ul style="list-style-type: none"><li>– UTQG</li><li>– Load</li><li>– pressure</li></ul></li><li>• Tread design<ul style="list-style-type: none"><li>– Directional</li><li>– Asymmetric</li><li>– Conventional</li></ul></li><li>• Space saver spare</li></ul>
2. Service Tires	<ul style="list-style-type: none"><li>• Inspection<ul style="list-style-type: none"><li>– Wear patterns</li><li>– Damage</li></ul></li><li>• Rotation</li><li>• Mounting</li><li>• Balance</li><li>• Road force</li></ul>
3. Repair tires	<ul style="list-style-type: none"><li>• Rubber Manufacturer's Association guidelines<ul style="list-style-type: none"><li>– Plug patches</li><li>– Plugs</li><li>– Patches</li></ul></li><li>• Sealing tires</li></ul>
4. Describe wheel construction	<ul style="list-style-type: none"><li>• Alloy</li><li>• Steel</li><li>• Directional</li><li>• Offset</li><li>• Sizing</li></ul>

5. Inspect wheels

- Bolt pattern
- Curb damage
- Run out
- Fatigue damage
- Lug nut torque

**Achievement Criteria:**

Given a written and/or a practical assessment on service tires and wheels the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

## LINE D: GENERAL AUTOMOTIVE MAINTENANCE

### Competency: D6 Service Non Friction Bearings

#### Learning Objectives:

1. The learner will be able to identify and select non friction bearings.
2. The learner will be able to remove, replace and adjust non friction bearings.
3. The learner will be able to identify causes of non friction bearing failure.

LEARNING TASKS	CONTENT
1. Describe non friction bearings	<ul style="list-style-type: none"><li>• Conrad (ball)</li><li>• Tapered roller</li><li>• Needle</li><li>• Ball thrust</li><li>• Dimensions</li><li>• Load capacity</li></ul>
2. Service non friction bearings	<ul style="list-style-type: none"><li>• Causes of failure</li><li>• Removal and installation techniques</li><li>• Lubrication / repacking<ul style="list-style-type: none"><li>– Cleaning</li></ul></li><li>• Adjustment</li><li>• Selection</li><li>• Axial and radial play</li></ul>

#### Achievement Criteria:

Given a written and/or a practical assessment on servicing of non friction bearings the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

## LINE D: GENERAL AUTOMOTIVE MAINTENANCE

### Competency: D7 Service Spindles and Hubs

#### Learning Objectives:

1. The learner will be able to identify spindles, hubs and related components.
2. The learner will be able to remove, replace and adjust spindles, hubs and related components.
3. The learner will be able to diagnose spindle and hub problems.

LEARNING TASKS	CONTENT
1. Describe spindle and hub design and construction	<ul style="list-style-type: none"><li>• Front wheel drive</li><li>• Rear wheel drive</li><li>• Construction materials</li><li>• Bearing types</li><li>• Disc or drum brake system</li></ul>
2. Inspect and service spindles and hubs	<ul style="list-style-type: none"><li>• Lubrication</li><li>• Inspection<ul style="list-style-type: none"><li>– Visual</li><li>– Audible</li><li>– Measurements</li></ul></li><li>• Bearing adjustment</li><li>• Alignment</li><li>• Removal and installation</li><li>• Axial and radial play</li></ul>

#### Achievement Criteria:

Given a written and/or a practical assessment on spines and hubs the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

## LINE E: GENERAL AUTOMOTIVE PRACTICES

### Competency: E1 Describe Diagnostic Procedures

#### Learning Objectives:

1. The learner will be able to describe the importance of following a diagnostic process.
2. The learner will be able to describe diagnostic procedures used for troubleshooting.

LEARNING TASKS	CONTENT
1. Describe the importance of following a diagnostic process	<ul style="list-style-type: none"><li>• Cost of improper diagnosis</li><li>• Unhappy customers</li><li>• Lost business</li><li>• Time management</li><li>• Efficiency</li><li>• Damage to components</li></ul>
2. Describe general diagnostic procedures	<ul style="list-style-type: none"><li>• Understand system</li><li>• Understand complaint<ul style="list-style-type: none"><li>– Communicate with operator</li><li>– Operational test</li><li>– Visual inspection</li></ul></li><li>• Form all possible conclusions</li><li>• Test conclusions</li><li>• System component isolation</li></ul>
3. Describe the importance of following manufacturer's diagnostic procedures where available	<ul style="list-style-type: none"><li>• Time saving</li><li>• Warranty requirement</li><li>• Diagnosis may not be possible any other way</li></ul>
4. Describe the importance of failure analysis	<ul style="list-style-type: none"><li>• Repeat failure</li><li>• Extended life</li><li>• Cost</li><li>• Customer satisfaction</li></ul>

#### Achievement Criteria:

Given a written and/or a practical assessment on diagnose procedures the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

## LINE E: GENERAL AUTOMOTIVE PRACTICES

### Competency: E2 Demonstrate Welding Safety

#### Learning Objectives:

1. The learner will be able to demonstrate welding safety procedures.
2. The learner will be able to demonstrate basic welding and cutting.

LEARNING TASKS	CONTENT
1. Describe oxy-acetylene components	<ul style="list-style-type: none"><li>• Safety</li><li>• Gases</li><li>• Tanks, regulators and hoses</li><li>• Torches</li></ul>
2. Demonstrate oxy-acetylene procedures	<ul style="list-style-type: none"><li>• Set up</li><li>• Lighting</li><li>• Welding and cutting</li><li>• Shut down</li><li>• Storage</li><li>• Maintenance</li><li>• Inspection</li></ul>
3. Describe MIG (GMAW) welding components and methods	<ul style="list-style-type: none"><li>• Gas Metal Arc Welding (GMAW)</li><li>• Safety</li><li>• Gas</li><li>• Tank, regulator and hose</li><li>• Ground terminal</li></ul>
4. Demonstrate MIG (GMAW) welding procedures	<ul style="list-style-type: none"><li>• Set up</li><li>• Weld</li><li>• Shut down</li><li>• Storage</li><li>• Maintenance</li><li>• Inspection</li></ul>

#### Achievement Criteria:

Given a written and/or a practical assessment on welding procedures the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

## LINE F: BASIC ELECTRICAL SYSTEMS

### Competency: F1 Describe Principles of Electricity

#### Learning Objectives:

1. The learner will be able to describe the principles of electricity and magnetism.
2. The learner will be able to describe circuit components and their operation.
3. The learner will be able to describe the use of electrical test equipment

LEARNING TASKS	CONTENT
1. Define electrical terminology	<ul style="list-style-type: none"><li>• Electrical quantities and their<ul style="list-style-type: none"><li>– units and prefixes</li><li>– Voltage</li><li>– Current</li><li>– Resistance</li><li>– Power</li></ul></li><li>• Types of circuits<ul style="list-style-type: none"><li>– Series circuit</li><li>– Parallel circuit</li><li>– Series parallel circuit</li></ul></li><li>• Circuit terminology</li><li>• Open circuit</li><li>• Closed circuit</li><li>• Short circuit</li><li>• Continuity</li><li>• Ground</li><li>• Ground fault</li></ul>
2. Explain basic circuit concepts	<ul style="list-style-type: none"><li>• Electron theory</li><li>• Conventional theory</li><li>• Basic circuit construction<ul style="list-style-type: none"><li>– Power source</li><li>– Load</li><li>– control</li><li>– Complete path</li></ul></li><li>• Electrical relationships</li><li>• Ohm's law</li><li>• Watts law</li><li>• Series circuits</li><li>• Parallel circuits</li><li>• Series parallel circuits</li></ul>
3. Describe electrical components and their purpose	<ul style="list-style-type: none"><li>• Wire</li><li>• Devices</li><li>• Protective devices</li><li>• Actuators</li></ul>

- Resistors
  - Switches
  - Conductors
  - Insulators
4. Describe magnetic theory
- Properties of magnetic lines of force
  - Terminology
    - Flux
    - Flux density
    - Reluctance
    - Permeability
  - Relationship to electrical current
    - Left hand rule for conductors
    - Left hand rule for coils
    - Electromagnetic induction
    - Relative motion
    - Speed
    - Angle
  - Effect of magnetic core on coils
  - Signal interference

**Achievement Criteria:**

Given a written and/or a practical assessment on principles of electricity the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

## LINE F: BASIC ELECTRICAL SYSTEMS

### Competency: F2 Use Electrical Test Equipment

#### Learning Objectives:

1. The learner will be able to describe the types of electrical test equipment.
2. The learner will be able to select and use electrical test equipment to measure electrical signals.

LEARNING TASKS	CONTENT
1. Describe the different types of electrical test equipment	<ul style="list-style-type: none"><li>• Digital Volt Ohm Meter (DVOM)</li><li>• Test light</li><li>• Logic probe</li><li>• High impedance test light</li></ul>
2. Use DVOM to test electrical circuits	<ul style="list-style-type: none"><li>• Measure electrical signals<ul style="list-style-type: none"><li>– Voltage</li><li>– Amperage</li><li>– Resistance</li><li>– Frequency</li></ul></li><li>• Auto range feature</li><li>• Units of measurement</li><li>• Sample rate</li><li>• Internal fuse</li></ul>

#### Achievement Criteria:

Given a written and/or a practical assessment on electrical test equipment the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

## LINE F: BASIC ELECTRICAL SYSTEMS

### Competency: F3 Describe Principles of Electronics

#### Learning Objectives:

1. The learner will be able to describe the principles of electronics.
2. The learner will be able to describe electronic circuit components and their operation.
3. The learner will be able to describe the use of test equipment.

LEARNING TASKS	CONTENT
1. Describe semiconductor theory	<ul style="list-style-type: none"><li>• Semiconductor doping</li><li>• PN junction</li></ul>
2. Describe electronic components	<ul style="list-style-type: none"><li>• Diodes</li><li>• Zener diodes</li><li>• Light emitting diodes</li><li>• Capacitors</li></ul>
3. Describe microprocessor systems	<ul style="list-style-type: none"><li>• Microprocessor</li><li>• Inputs / outputs</li><li>• Programs</li></ul>

#### Achievement Criteria:

Given a written and/or a practical assessment on principles of electronics the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

## LINE F: BASIC ELECTRICAL SYSTEMS

### Competency: F4 Service Wiring Systems

#### Learning Objectives:

1. The learner will be able to interpret wiring diagrams and symbols.
2. The learner will be able to diagnose wiring harness problems.
3. The learner will be able to repair or remove and replace wiring harnesses.

LEARNING TASKS	CONTENT
1. Describe wiring harnesses	<ul style="list-style-type: none"><li>• Purpose</li><li>• Shielding</li><li>• Routing</li><li>• Support</li><li>• Wire<ul style="list-style-type: none"><li>– Gauge</li><li>– Identification</li><li>– Composition</li><li>– Connectors</li><li>– Twisted pairs</li></ul></li></ul>
2. Interpret electrical wiring diagrams	<ul style="list-style-type: none"><li>• Symbols</li><li>• Conventions</li><li>• Abbreviations</li><li>• Power flow</li><li>• Connectors</li></ul>
3. Inspect and repair wiring harnesses	<ul style="list-style-type: none"><li>• Visual</li><li>• Connectors</li><li>• Soldering</li><li>• Crimping</li><li>• Insulation</li><li>• Supports</li><li>• Removal and installation</li><li>• Testing</li></ul>

#### Achievement Criteria:

Given a written and/or a practical assessment on wiring systems the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

## LINE F: BASIC ELECTRICAL SYSTEMS

### Competency: F5 Service 12 Volt Batteries

#### Learning Objectives:

1. The learner will be able to describe battery design and operation.
2. The learner will be able to select, test and maintain batteries.
3. The learner will be able to diagnose causes of battery failure.
4. The learner will be able to remove and replace batteries.

LEARNING TASKS	CONTENT
1. Describe safety considerations when working with automotive batteries	<ul style="list-style-type: none"><li>• Hydrogen gassing</li><li>• Acid</li><li>• Personal protective equipment</li><li>• Frozen batteries</li><li>• Short circuit capacity</li><li>• Environmental considerations</li></ul>
2. Describe the design and construction of a lead acid battery	<ul style="list-style-type: none"><li>• Plates</li><li>• Plate straps</li><li>• Separators</li><li>• Electrolyte</li><li>• Case</li><li>• Terminals</li></ul>
3. Describe the chemical action that takes place in a lead acid battery during charging and discharging	<ul style="list-style-type: none"><li>• Charging cycle</li><li>• Discharging cycle</li></ul>
4. Describe the various types of automotive batteries	<ul style="list-style-type: none"><li>• Low maintenance</li><li>• Maintenance free</li><li>• Deep cycle</li><li>• Recombination</li><li>• Gel cell</li></ul>
5. Select automotive batteries	<ul style="list-style-type: none"><li>• Battery rating methods</li><li>• Physical dimensions</li></ul>

#### Achievement Criteria:

Given a written and/or a practical assessment on 12 volt batteries the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

## LINE F: BASIC ELECTRICAL SYSTEMS

### Competency: F6 Use Scan Tools

#### Learning Objectives:

1. The learner will be able to use a scan tool to retrieve diagnostic fault codes from a vehicle computer.
2. The learner will be able to use a scan tool to access vehicle data stream information from a vehicle computer.
3. The learner will be able to use a scan tool to clear diagnostic fault codes from a vehicle computer.

LEARNING TASKS	CONTENT
1. Describe scan tool types	<ul style="list-style-type: none"><li>• Generic</li><li>• Manufacturer specific</li><li>• Types of fault codes<ul style="list-style-type: none"><li>– Hard</li><li>– Soft</li><li>– Pending</li><li>– Intermittent</li></ul></li></ul>
2. Describe On Board Diagnostics (OBD)	<ul style="list-style-type: none"><li>• Generic</li><li>• Manufacturer specific</li><li>• OBD I</li><li>• OBD II</li><li>• OBD III</li></ul>
3. Describe data stream information	<ul style="list-style-type: none"><li>• Purpose</li><li>• Fault tracing application</li><li>• Sample rate</li><li>• Frozen values</li><li>• Movies</li><li>• Snap shots</li></ul>
4. Use scan tool to access computer data	<ul style="list-style-type: none"><li>• Code retrieval</li><li>• Access data stream information</li><li>• Clear fault codes</li></ul>

#### Achievement Criteria:

Given a written and/or a practical assessment on scan tools the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

## LINE G: BRAKE SYSTEMS

### Competency: G1 Service Brake Tubing and Fittings

#### Learning Objectives:

1. The learner will be able to select tubing and fittings.
2. The learner will be able to cut, bend and flare brake tubing.

LEARNING TASKS	CONTENT
1. Select and use tubing and fittings	<ul style="list-style-type: none"><li>• Tubing<ul style="list-style-type: none"><li>– Sizing</li><li>– Material</li><li>– Application</li></ul></li><li>• Fittings</li><li>• Flare</li><li>• 45 degree</li><li>• ISO</li><li>• Cutting</li><li>• Flaring<ul style="list-style-type: none"><li>– Double lap<ul style="list-style-type: none"><li>▪ SAE = 45 degree</li><li>▪ ISO = bubble</li></ul></li></ul></li><li>• Bending</li></ul>

#### Achievement Criteria:

Given a written and/or a practical assessment on brake tubing and fitting the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

## LINE G: BRAKE SYSTEMS

### Competency: G2 Service Brake Hydraulic Systems

#### Learning Objectives:

1. The learner will be able to identify brake hydraulic system components.
2. The learner will be able to remove and replace brake hydraulic system components.
3. The learner will be able to diagnose causes of brake hydraulic system failure.

LEARNING TASKS	CONTENT
1. Describe hydraulic principles	<ul style="list-style-type: none"><li>• Pascal's law<ul style="list-style-type: none"><li>– Force</li><li>– Pressure</li><li>– Area</li></ul></li></ul>
2. Describe components of the brake hydraulic system	<ul style="list-style-type: none"><li>• Master cylinder</li><li>• Wheel cylinder</li><li>• Calipers</li><li>• Valves</li><li>• Residual pressure<ul style="list-style-type: none"><li>– Metering</li><li>– Proportioning</li><li>– Pressure differential</li><li>– Combination</li></ul></li><li>• Hoses</li><li>• Hardware</li><li>• Fluid</li></ul>
3. Service the brake hydraulic system	<ul style="list-style-type: none"><li>• Inspect</li><li>• Diagnose</li><li>• Repair / replace<ul style="list-style-type: none"><li>– Master cylinder</li><li>– Wheel cylinder</li><li>– Calipers</li><li>– Valves</li><li>– Hoses</li><li>– Tubing</li></ul></li><li>• Flush</li><li>• Bleed<ul style="list-style-type: none"><li>– Pressure</li><li>– Manual</li><li>– gravity</li></ul></li></ul>

**Achievement Criteria:**

Given a written and/or a practical assessment on brake hydraulic systems the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

## LINE G: BRAKE SYSTEMS

### Competency: G3 Service Drum Brake Systems

#### Learning Objectives:

1. The learner will be able to identify drum brake system components.
2. The learner will be able to remove and replace and adjust drum brake system components.
3. The learner will be able to diagnose causes of drum brake system failure.

LEARNING TASKS	CONTENT
1. Describe friction principle	<ul style="list-style-type: none"><li>• Coefficient of friction</li><li>• Factors affecting friction<ul style="list-style-type: none"><li>– Material composition</li><li>– Surface area</li><li>– Heat</li><li>– Applied pressure</li></ul></li></ul>
2. Describe drum brake components	<ul style="list-style-type: none"><li>• Drum</li><li>• Shoes</li><li>• Springs</li><li>• Attaching hardware</li><li>• Backing plate</li><li>• Adjusters</li><li>• parking brake mechanism</li><li>• wheel cylinder</li></ul>
3. Describe drum brake design and operation	<ul style="list-style-type: none"><li>• Non energizing and self energizing</li><li>• Parking</li><li>• Full floating axles</li></ul>
4. Inspect and overhaul drum brakes	<ul style="list-style-type: none"><li>• Inspection<ul style="list-style-type: none"><li>– Measurement</li><li>– Fluid leakage</li><li>– Wheel seals</li><li>– Hardware condition</li><li>– Parking brake cable and mechanism</li></ul></li><li>• Shoe replacement / adjustment</li><li>• Drum service<ul style="list-style-type: none"><li>– Machining<ul style="list-style-type: none"><li>▪ On car</li><li>▪ Off car</li></ul></li></ul></li><li>• Parking brake adjustment</li><li>• Road test</li></ul>

**Achievement Criteria:**

Given a written and/or a practical assessment on drum brake systems the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

## LINE G: BRAKE SYSTEMS

### Competency: G4 Service Disc Brake Systems

#### Learning Objectives:

1. The learner will be able to identify disc brake system components.
2. The learner will be able to remove and replace and adjust disc brake system components.
3. The learner will be able to diagnose causes of disc brake system failure.

	<b>LEARNING TASKS</b>	<b>CONTENT</b>
1.	1. Describe friction principle	<ul style="list-style-type: none"><li>• Coefficient of friction</li><li>• Factors affecting friction<ul style="list-style-type: none"><li>– Material composition</li><li>– Surface area</li><li>– Heat</li><li>– Applied pressure</li></ul></li></ul>
2.	2. Describe disc brake components	<ul style="list-style-type: none"><li>• Rotor</li><li>• Caliper</li><li>• Pistons</li><li>• Pads</li><li>• Parking brake mechanism</li></ul>
3.	3. Describe disc brake design and operation	<ul style="list-style-type: none"><li>• Rotor<ul style="list-style-type: none"><li>– Solid</li><li>– Vented</li><li>– Cross drilled</li><li>– Grooved</li></ul></li><li>• Caliper<ul style="list-style-type: none"><li>– Fixed</li><li>– Floating</li></ul></li><li>• Parking brake<ul style="list-style-type: none"><li>– Drum in hat</li><li>– Caliper style</li></ul></li><li>• Pads</li></ul>
4.	4. Inspect and overhaul disc brakes	<ul style="list-style-type: none"><li>• Inspection<ul style="list-style-type: none"><li>– Measurement</li><li>– Fluid leakage</li><li>– Wheel seals</li><li>– Hardware condition</li><li>– Parking brake cable and mechanism</li></ul></li><li>• Pad replacement</li><li>• Rotor service</li></ul>

- Machining
  - On car
  - Off car
- Parking brake adjustment
- Road test

**Achievement Criteria:**

Given a written and/or a practical assessment on disc brake systems the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

## LINE G: BRAKE SYSTEMS

### Competency: G5 Inspect Power Assist Systems

#### Learning Objectives:

1. The learner will be able to identify power assist system components.
2. The learner will be able to diagnose causes of power assist system failure.

LEARNING TASKS	CONTENT
1. Describe the components of power assist systems	<ul style="list-style-type: none"><li>• Hydro boost<ul style="list-style-type: none"><li>– Power steering fluid</li><li>– Brake fluid</li></ul></li><li>• Vacuum booster layout</li><li>• Common control valve designs</li><li>• Vacuum pumps<ul style="list-style-type: none"><li>– Electrical</li><li>– Mechanical</li></ul></li></ul>
2. Describe the design and operation of power assist systems	<ul style="list-style-type: none"><li>• Vacuum booster layout</li><li>• Common control valve designs</li><li>• Vacuum pumps<ul style="list-style-type: none"><li>– Electrical</li><li>– Mechanical</li></ul></li><li>• Emergency brake assist</li></ul>
3. Inspect power assist systems	<ul style="list-style-type: none"><li>• Test vacuum circuit</li><li>• Test power assist function</li></ul>

#### Achievement Criteria:

Given a written and/or a practical assessment on inspecting power assist systems the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

## LINE G: BRAKE SYSTEMS

### Competency: G6 Service Anti-Lock Brake Systems

#### Learning Objectives:

1. The learner will be able to identify anti-lock brake system components.
2. The learner will be able to remove, replace and adjust anti-lock brake system components.
3. The learner will be able to diagnose causes of power assist system failure.

LEARNING TASKS	CONTENT
1. Describe the benefits and limitations of anti-lock braking systems	<ul style="list-style-type: none"><li>• History of ABS</li><li>• Improved steering control while braking</li><li>• Improved braking in most situations</li><li>• Foundation for traction control</li><li>• Foundation for dynamic stability control</li></ul>
2. Describe the design and construction of anti-lock braking systems	<ul style="list-style-type: none"><li>• Two wheel Vs four wheel</li><li>• Three / four channel</li><li>• Hydraulic<ul style="list-style-type: none"><li>– Pump</li><li>– Valves</li><li>– Accumulators</li><li>– Fluid</li></ul></li><li>• Electrical<ul style="list-style-type: none"><li>– Sensors</li><li>– Computer</li><li>– Controller</li></ul></li><li>• Electronic brake force distribution</li></ul>
3. Inspect and repair of anti-lock braking systems	<ul style="list-style-type: none"><li>• Safety</li><li>• Diagnostic fault codes</li><li>• Bleeding procedures</li><li>• System self check</li><li>• Pinpoint testing</li><li>• Speed sensor signal testing</li><li>• Road testing</li><li>• Component replacement</li><li>• Diagnostic flow chart</li></ul>

#### Achievement Criteria:

Given a written and/or a practical assessment on electrical test equipment the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

## LINE H: STEERING SYSTEMS

### Competency: H1 Service Steering Gears

#### Learning Objectives:

1. The learner will be able to identify steering gear components.
2. The learner will be able to remove, replace and adjust steering gears.
3. The learner will be able to diagnose causes of steering gear failure.
4. The learner will be able to describe the components of the rack and pinion steering gears.
5. The learner will be able to describe the design and operation of the rack and pinion steering gears

LEARNING TASKS	CONTENT
1. Describe the components of conventional steering gears	<ul style="list-style-type: none"><li>• Recirculating ball steering box design<ul style="list-style-type: none"><li>– Ball nut assembly</li><li>– Sector shaft</li><li>– Trust bearings</li><li>– Seals</li><li>– Lubrication</li></ul></li></ul>
2. Describe the design and construction of conventional steering gears	<ul style="list-style-type: none"><li>• Steering box ratio</li><li>• Materials</li><li>• Mounting</li></ul>
3. Service conventional steering gears	<ul style="list-style-type: none"><li>• Seal leakage</li><li>• Shaft wear</li><li>• Gear tooth wear</li><li>• Pitman arm spine wear or damage</li><li>• Sequence of adjustments<ul style="list-style-type: none"><li>– Bearing preload</li><li>– Gear tooth lash</li><li>– Over centre adjustment</li></ul></li></ul>
4. Describe the components of rack and pinion steering gears	<ul style="list-style-type: none"><li>• Housing and seals</li><li>• Rack and pinion</li><li>• Bearings</li><li>• Tie rod ends</li><li>• Bellows (boots)</li></ul>
5. Describe the design and operation of rack and pinion steering	<ul style="list-style-type: none"><li>• Steering gear ratio</li><li>• Materials</li><li>• Lubrication</li><li>• Mounting</li></ul>

6. Service rack and pinion steering gears

- Tie rod ends
- Pinion shaft and bearing wear
- Leaks
- Mounting
- Condition of bellows

**Achievement Criteria:**

Given a written and/or a practical assessment on service steering gears the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

## LINE H: STEERING SYSTEMS

### Competency: H2 Disarm and Rearm Passenger Restraint Systems

#### Learning Objectives:

1. The learner will be able to identify passenger restraint system components.
2. The learner will be able to safely disarm and rearm passenger restraint systems.
3. The learner will be able to remove and replace passenger restraint system components.

LEARNING TASKS	CONTENT
1. Describe passenger restraint systems	<ul style="list-style-type: none"><li>• Regulations</li><li>• Construction</li><li>• Passive<ul style="list-style-type: none"><li>– Air bags</li><li>– Shoulder belts</li><li>– Whiplash protection</li><li>– Side impact</li><li>– Passenger detection</li><li>– Crash avoidance</li></ul></li><li>• Active<ul style="list-style-type: none"><li>– Pyrotechnical Seat belts</li></ul></li></ul>
2. Disarm and rearm air bag system	<ul style="list-style-type: none"><li>• Safety</li><li>• Diagnostic codes</li><li>• Visual inspection</li><li>• Functional testing</li><li>• Repair / replacement procedures<ul style="list-style-type: none"><li>– Centre clock spring</li></ul></li><li>• Liability</li><li>• Tampering</li><li>• System disabling</li></ul>

#### Achievement Criteria:

Given a written and/or a practical assessment on electrical test equipment the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

## LINE H: STEERING SYSTEMS

### Competency: H3 Inspect Steering Columns

#### Learning Objectives:

1. The learner will be able to identify steering columns and related components.
2. The learner will be able to describe the removal, replacement and adjustment of steering columns and related components.
3. The learner will be able to diagnose causes of steering column and related component failure.

LEARNING TASKS	CONTENT
1. Describe the components of steering columns	<ul style="list-style-type: none"><li>• Mounting</li><li>• Bearings</li><li>• Coupling assemblies</li><li>• Collapsing function</li><li>• Dust seals</li><li>• Steering wheel security systems</li><li>• Master splines for steering wheel</li><li>• Noise suppression and sealing</li><li>• Air bag precautions and procedures</li></ul>
2. Describe the design and construction of steering columns	<ul style="list-style-type: none"><li>• Tilting and telescoping function</li><li>• Collapsing function</li><li>• Noise transmission</li><li>• Vibration suppression</li><li>• Supplementary restraint systems (SRS)</li><li>• Shift linkage</li></ul>
3. Describe the inspection and replacement of steering columns	<ul style="list-style-type: none"><li>• SRS safety awareness</li><li>• Steering wheel alignment</li><li>• Alignment for noise and vibration</li><li>• Electrical connections</li><li>• Mounting procedures and hardware</li><li>• Shift linkage adjustment</li><li>• Collapsing feature</li></ul>

#### Achievement Criteria:

Given a written and/or a practical assessment on steering columns the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

## LINE H: STEERING SYSTEMS

### Competency: H4 Service Steering Linkage

#### Learning Objectives:

1. The learner will be able to identify steering linkage components.
2. The learner will be able to remove, replace and adjust steering linkage components.
3. The learner will be able to diagnose steering linkage wear or damage.

LEARNING TASKS	CONTENT
1. Describe the components of steering linkage	<ul style="list-style-type: none"><li>• Tie rod ends and sockets</li><li>• Pitman arm</li><li>• Idler arm</li><li>• Centre (drag) link</li><li>• Associated hardware</li></ul>
2. Describe the design and construction of steering linkage	<ul style="list-style-type: none"><li>• Parallelogram linkage</li><li>• Haltenberger</li></ul>
3. Inspect and repair steering linkage	<ul style="list-style-type: none"><li>• Wear</li><li>• Ball joint play</li><li>• Axial</li><li>• Radial</li><li>• Idler arm</li><li>• Lubrication and boot condition</li><li>• Ball joint and clamp alignment</li><li>• Torque of hardware</li><li>• Cotter pin of castellated nuts</li></ul>

#### Achievement Criteria:

Given a written and/or a practical assessment on steering linkage the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

## LINE H: STEERING SYSTEMS

### Competency: H5 Service Power Steering Systems

#### Learning Objectives:

1. The learner will be able to identify power steering system components.
2. The learner will be able to remove, replace and adjust power steering system components.
3. The learner will be able to diagnose causes of power steering system problems.
4. The learner will be able to describe the operation of four wheel steering systems.

LEARNING TASKS	CONTENT
1. Describe the components of a power steering system	<ul style="list-style-type: none"><li>• Pump</li><li>• Associated hoses</li><li>• Spool valve</li><li>• Power cylinder</li><li>• Fluid types</li><li>• Electric supply to steering gear</li></ul>
2. Describe the design and construction of a power steering system	<ul style="list-style-type: none"><li>• Pump pressure and flow regulation</li><li>• Spool valve operation</li><li>• Power cylinder operation</li><li>• Speed control and variable assist</li><li>• Electric power steering</li></ul>
3. Diagnose causes of power steering system problems.	<ul style="list-style-type: none"><li>• Fluid level and condition</li><li>• Leaks<ul style="list-style-type: none"><li>– Internal</li><li>– External</li></ul></li><li>• Pump replacement</li><li>• Pump mounting and belt adjustment</li><li>• Pressure and flow testing</li><li>• Bleeding</li><li>• Road test</li><li>• Turning effort test</li></ul>
4. Describe the operation of four wheel steering systems.	<ul style="list-style-type: none"><li>• Overview<ul style="list-style-type: none"><li>– Electrical systems</li><li>– Mechanical systems</li></ul></li></ul>

#### Achievement Criteria:

Given a written and/or a practical assessment on power steering systems the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

## LINE H: STEERING SYSTEMS

### Competency: H6 Perform Wheel Alignment

#### Learning Objectives:

1. The learner will be able to describe wheel alignment angles.
2. The learner will be able to measure and adjust wheel alignment angles.
3. The learner will be able to diagnose wheel alignment problems.

LEARNING TASKS	CONTENT
1. Describe steering geometry	<ul style="list-style-type: none"><li>• Caster</li><li>• Camber</li><li>• Toe</li><li>• Steering axis inclination</li><li>• Scrub radius</li><li>• Toe out on turns</li><li>• Thrust angle</li><li>• Two wheel versus four wheel alignment</li><li>• Collision damage</li></ul>
2. Describe methods of adjusting steering geometry	<ul style="list-style-type: none"><li>• Pre-checks</li><li>• Factory adjustment methods</li><li>• Aftermarket adjustment methods</li></ul>
3. Adjust wheel alignment	<ul style="list-style-type: none"><li>• Four wheel alignment procedures</li><li>• Rear wheels<ul style="list-style-type: none"><li>– Thrust angle</li><li>– camber</li><li>– Toe</li></ul></li><li>• Front wheels<ul style="list-style-type: none"><li>– Camber</li><li>– Caster</li><li>– Toe</li></ul></li><li>• Check toe out on turns</li><li>• Check steering axis inclination</li><li>• Check steering wheel centre</li></ul>

#### Achievement Criteria:

Given a written and/or a practical assessment on performing wheel alignments the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

## LINE I: SUSPENSION SYSTEMS

### Competency: I1 Describe Frame Types

#### Learning Objectives:

1. The learner will be able to identify frame types.  
The learner will be able to describe the advantages and disadvantages of unit body and
2. conventional frame designs.

LEARNING TASKS	CONTENT
1. Describe unit body frame design	<ul style="list-style-type: none"><li>• Advantages</li><li>• Disadvantages<ul style="list-style-type: none"><li>– Welding construction</li><li>– Rivet construction</li><li>– Material selection</li><li>– Strength</li><li>– Accident crush zones</li></ul></li></ul>
2. Describe conventional frame design	<ul style="list-style-type: none"><li>• Advantages</li><li>• Disadvantages<ul style="list-style-type: none"><li>– Perimeter</li><li>– Ladder</li><li>– Hydro-formed</li><li>– Material selection</li><li>– Strength</li><li>– Accident crush zones</li></ul></li></ul>

#### Achievement Criteria:

Given a written and/or a practical assessment on frame types the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

## LINE I: SUSPENSION SYSTEMS

### Competency: I2 Describe Suspension Geometry

#### Learning Objectives:

1. The learner will be able to describe the design and operation of suspension systems.
2. The learner will be able to describe the forces acting upon a suspension system.

LEARNING TASKS	CONTENT
1. Describe suspension types	<ul style="list-style-type: none"><li>• Front<ul style="list-style-type: none"><li>– Rigid</li><li>– Independent<ul style="list-style-type: none"><li>▪ McPherson strut</li><li>▪ Short and long arm</li><li>▪ Multi link</li><li>▪ Twin I beam</li></ul></li></ul></li><li>• Rear<ul style="list-style-type: none"><li>– Rigid</li><li>– Independent<ul style="list-style-type: none"><li>▪ Chapman strut</li><li>▪ Short and long arm</li><li>▪ Multi link</li><li>▪ Semi - rigid</li></ul></li></ul></li></ul>
2. Describe suspension dynamics	<ul style="list-style-type: none"><li>• Forces<ul style="list-style-type: none"><li>– Lateral</li><li>– Acceleration</li><li>– Braking</li></ul></li><li>• Body roll</li><li>• Suspension travel</li><li>• Weight shifting</li></ul>

#### Achievement Criteria:

Given a written and/or a practical assessment on suspension geometry the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

## LINE I: SUSPENSION SYSTEMS

### Competency: I3 Describe Suspension Components

#### Learning Objectives:

1. The learner will be able to identify components of suspension systems.
2. The learner will be able to describe the design and operation of suspension components.

LEARNING TASKS	CONTENT
1. Describe common automotive spring designs	<ul style="list-style-type: none"><li>• Coil</li><li>• Leaf</li><li>• Mono leaf</li><li>• Air</li><li>• Torsion bar</li><li>• Anti sway bar</li><li>• Modification<ul style="list-style-type: none"><li>– Ride height<ul style="list-style-type: none"><li>▪ Towing</li><li>▪ Off road</li><li>▪ Performance</li></ul></li></ul></li></ul>
2. Describe the construction and operation of shock absorbers and struts	<ul style="list-style-type: none"><li>• Purpose</li><li>• Components</li><li>• Types</li><li>• Conventional<ul style="list-style-type: none"><li>– Gas</li><li>– Low pressure</li><li>– High pressure</li></ul></li><li>• Adjustable<ul style="list-style-type: none"><li>– Mechanical</li><li>– Electrical</li><li>– Pneumatic</li></ul></li><li>• Modification<ul style="list-style-type: none"><li>– Towing</li><li>– Off road</li><li>– Performance</li></ul></li></ul>
3. Describe suspension components design and construction	<ul style="list-style-type: none"><li>• Ball joints<ul style="list-style-type: none"><li>– Loaded</li><li>– Follower</li></ul></li><li>• King pins</li><li>• Rubber bushings</li><li>• Frame and body mounting points</li><li>• Construction materials</li></ul>

**Achievement Criteria:**

Given a written and/or a practical assessment on suspension components the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

## LINE I: SUSPENSION SYSTEMS

### Competency: I4 Service Suspension Systems

#### Learning Objectives:

1. The learner will be able to remove, replace and adjust suspension system types.
2. The learner will be able to diagnose suspension system problems.

LEARNING TASKS	CONTENT
1. Inspect and service shock absorbers and struts	<ul style="list-style-type: none"><li>• Visual inspection</li><li>• Functional test</li><li>• Bounce and rebound test</li><li>• Leaks</li><li>• corrosion</li><li>• Safety</li><li>• Removal and replacement</li><li>• Alignment</li></ul>
2. Inspect and service ball joints and bushings	<ul style="list-style-type: none"><li>• Safety</li><li>• Lubrication</li><li>• Visual</li><li>• Measurements</li><li>• Removal and replacement</li><li>• Torquing sequence and procedures</li></ul>
3. Inspect and service suspension systems	<ul style="list-style-type: none"><li>• Ride height measurements</li><li>• Damaged / worn components</li><li>• Safety<ul style="list-style-type: none"><li>– Unloading springs</li><li>– Compressing springs</li></ul></li><li>• Removal and replacement</li><li>• Torquing sequence and procedures</li></ul>

#### Achievement Criteria:

Given a written and/or a practical assessment on service suspension systems the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

## LINE I: SUSPENSION SYSTEMS

### Competency: I5 Describe Electronic Suspension Systems

#### Learning Objectives:

1. The learner will be able to identify electronic suspension system components.
2. The learner will be able to describe the removal, replacement and adjustment of electronic suspension system components.

LEARNING TASKS	CONTENT
1. Describe electronic suspension systems	<ul style="list-style-type: none"><li>• Basic</li><li>• Electrically controlled shocks</li><li>• Load leveling system</li><li>• Advanced</li><li>• Air springs / struts</li><li>• Electronic / computer controlled dynamic systems</li></ul>
2. Describe the inspection and repair of electronic suspension systems	<ul style="list-style-type: none"><li>• Safety</li><li>• Visual inspection</li><li>• Function test</li><li>• Electrical test</li><li>• Diagnostic codes</li><li>• Removal and replacement</li><li>• Alignment</li></ul>

#### Achievement Criteria:

Given a written and/or a practical assessment on electronic suspension systems the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

# **SECTION 3**

## **TRAINING PROVIDER STANDARDS**

# AUTOMOTIVE SERVICE TECHNICIAN 1 TOOL LIST

## Standard Tools

1. air drills/tools
2. air hammer/chisel
3. air ratchet
4. antifreeze tester
5. axle boot clamp tool
6. battery post service and reshape tool
7. belt tension release tool
8. blow gun
9. bolt extractor set (easy outs)
10. brake service tools (adjusters, spring removal, installation and caliper tools)
11. caulking gun
12. centre punch
13. chisels, punches
14. creeper/fender covers
15. crowfoot wrenches (flare and std, SAE and Metric)
16. dial indicator set (flare and std, SAE and Metric)
17. die grinder
18. drill and bits
19. drill gauge
20. feeler gauges – SAE and metric
21. files – bastard cut/half round/mill cut/square and thread file
22. filter wrenches
23. flare nut wrenches – SAE and metric
24. flaring tool (SAE, metric and ISO)
25. flash lights
26. fuel line disconnect set
27. hacksaw
28. hammers – ball peen/dead blow/rubber
29. mallet/softface
30. hex keys – SAE and metric
31. impact driver and bits
32. impact wrench and impact socket set – SAE and metric
33. inspection mirror
34. jumper lead
35. magnetic pick up tool
36. mechanic's pick set
37. multimeter (DVOM)
38. nut driver set – SAE and metric
39. pliers – slip joint, needle nose, adjustable, wheel weight, side cutter, snap ring, locking, hog ring and battery types
40. pry bar
41. pullers – gear, pulley, battery terminal and steering wheel
42. ratchet and sockets – ¼, 3/8 and ½ drive – SAE and metric, swivel, spark plug, extensions and adapters
43. rivet gun
44. scraper (gasket and carbon)

45. screwdriver set
46. seal drivers and extractors
47. soldering tools
48. standard test leads and probes
49. steel rule
50. stethoscope
51. straight edge
52. stud extractor
53. tamper-proof torx set
54. tap and die set – SAE and metric
55. tap extractor
56. tape and ruler
57. terminal remover tools
58. test lamp –electronics safe (powered and non-powered)
59. thermometer
60. thread files
61. thread pitch gauge
62. tin snips – centre, left and right cut
63. tire pressure gauge
64. tool box
65. torque angle meter/indicator
66. torque limited sockets (torque sticks)
67. torque wrenches – various sizes and ranges
68. torx bits
69. tread depth gauge (for tires and brakes)
70. trouble light
71. tube bending tool
72. tube cutters
73. upholstery tools – trim panel tools, hog ring pliers
74. utility knife
75. vacuum pump
76. vacuum/pressure gauge
77. vernier caliper – SAE and metric
78. vise grips
79. wire brush
80. wire stripper/crimping tool
81. wrench set – SAE and metric/various designs

### **Shop Tools and Equipment**

1. acetylene torches
2. air bag for alignment adjustments
3. airbag removal tools
4. airbag simulators
5. air buffer
6. air compressor – hoses – inline filter and water separators
7. alignment lift
8. and equipment- 4 wheel
9. angle grinder
10. anti-static devices
11. arbor press

12. ball joint press and adapters
13. battery charger/boosting equipment
14. battery hydrometer
15. battery tester/alternator and starter tester (AVR)
16. bearing remover
17. belt tension gauge
18. bench grinders
19. bench vises
20. bottle jacks (2)
21. brake adjustment calipers
22. brake bleeder wrenches
23. brake cylinder hone
24. brake fluid moisture tester
25. lathe
26. brake pedal depressor
27. brake pressure tester
28. brake rotor gauge/micrometer
29. brake system bleeder
30. calibrated vessel
31. caliper tools for rear-wheel disc
32. chassis ears
33. brake washer system (for 2 and 4 post hoists)
34. computer – PC
35. drill press
36. electrical short detector
37. floor jack
38. funnels
39. grease gun and fluid suction pump
40. heat gun
41. heli-coil kits
42. hub service kit
43. hydraulic press
44. jack stands and supports
45. leak detection equipment (refrigerants)
46. leak detection tank (tires)
47. oil drain barrels and disposal system
48. parts washers
49. pickle-fork tool set
50. Pitman arm pullers
51. power steering pressure tester
52. presses
53. pressure washer
54. reamer
55. vacuum
56. slide hammer
57. smoke machine
58. spreaders (tire)
59. spring compressors – coil spring and strut
60. spring
61. steering wheel holder
62. steering wheel puller set

63. steering lock plate removal tool
64. steering tilt pin removal tool
65. tie-rod end puller
66. tie-rod sleeve tools
67. tire changing machine (run-flat capable)
68. tire balancer equipment (road force type recommended)
69. tire repair equipment
70. TPMS system service tools
71. transmission fixtures
72. u-joint press
73. door trim tools
74. vehicle lifts
75. vehicle service information system
76. water hose
77. welding equipment – GMAW welder and oxy fuelled

### **Measuring Tools and Equipment**

1. ABS pressure tester
2. ball joint dial indicator set
3. brake drum gauge (for brake shoe adjusting)
4. brake drum micrometer
5. battery tester (electronic)
6. DVOM (Digital Volt Ohm Meter)
7. headlight aiming equipment
8. infrared thermometer
9. lab scope or graphing multimeter; 8 per class of 6 ( channel, digital, curser function with time capture capability)
10. lab scope accessories (shielded cables and back probes)
11. low amp probe
12. logic probe
13. micrometer – SAE and metric
14. power steering pressure tester
15. pressure gauges
16. scan tools; 8 per class of 6 (CAN bus capable with appropriate software no older than 5 years of current MY vehicles)
17. spring scale

## INSTRUCTOR REQUIREMENTS

### **Trade Qualification**

- Automotive Service Technician with an Inter-provincial “Red Seal” endorsement
- A recognized “Advanced Automotive Electrical” certification

### **Work Experience**

- Must have a minimum of 5 years experience as a journeyman
- Must have diverse industry experience including that which would cover all the competencies in this program

### **Training Qualifications**

- Instructors Certificate (minimum 30hr course)
- Instructors must have or be registered in a Instructor’s Diploma Program, to be completed within a five year period.
- Or, hold a Bachelors or Masters degree in Education.

## FACILITY REQUIREMENTS

### **CLASSROOM AREA**

- Comfortable seating and tables suitable for training, teaching, lecturing
- Compliance with all local and national fire code and occupational safety requirements
- Lighting controls to allow easy visibility of projection screen while also allowing students to take notes
- Windows must have shades or blinds to adjust sunlight
- Heating / Air conditioning for comfort all year round
- In-room temperature regulation to ensure comfortable room temperature
- In-room ventilation sufficient to control training room temperature
- Acoustics in the room must allow audibility of the instructor
- White marking board with pens and eraser (optional: flipchart in similar size)
- Projection screen or projection area at front of classroom
- Overhead projector and/or multi-media projector

### **SHOP AREA (fixed properties)**

- Ceiling shall be a minimum height of 16' or as varied by good engineering practices and code
- Appropriate lifting devices (hoists) used in industry
- Suitable demonstration area
- Lighting appropriate for good vision in ambient light
- Compliance with all local and national fire code and occupational safety requirements
- Must meet Municipal and Provincial bylaws in regards to waste water management and environmental laws
- Adequate hoist to student ratio

## SUGGESTED TEXTS

### Alberta Learning Guides

7850001029	Measuring Tools
7850001030	Specialty Hand Tools
7850001031	Fastening Devices
7850001868	Introduction to Scan Tools
7850001034	Oxy-Acetylene Heating and Cutting
7850001867	Gas Metal Arc Welding
7850001047	Hydraulic System Components
7850001050	Power Brakes
7850001044	Steering Columns
7850001037	Frames
7850001041	Power Steering
7850001042	Steering Angles
7850001039	Wheels, Hubs and Tires

Erjavec	Automotive Technology + Workbook	0-17-610439-9
American Lift Institute	Lifting It Right	ALI SMO1-2

### Additional Texts

Halderman	Automotive Electricity and Electronics	0-13-084224-9
CDX Global		

## ADDITIONAL REFERENCES

- *Automotive Fundamentals*  
By Martin W. Stockel/Martin T. Stockel  
Goodheart-Wilcox, publishers
- *Automotive Steering Suspension and Alignment*  
By Check-Chart, H.M. Gousha Company  
Harper and Row, publishers