

**Refrigeration and Air Conditioning Mechanic/
Refrigeration and Air Conditioning Mechanic (Residential)
Common Core - Level 1**

Refrigeration and Air Conditioning Mechanic/ Refrigeration and Air Conditioning Mechanic (Residential)

Unit: A1 Learning About Work

Level: One

Duration: 7 hours

Theory: 7 hours

Practical: 0 hours

Overview:

A sign that an apprentice has become competent in a task or technique is to be asked to share this knowledge. Worksite skills-exchange has long been fundamental to trade-learning. Even trade veterans rely on peers to refine their knowledge and skill. The opportunity to benefit from this process, however, is shaped by complex factors that include worksite 'politics' and job deadlines. As adult trade-learners, apprentices at all levels of training must use their observational, listening and interpersonal skills to benefit from the Journeyperson's knowledge and experience. This requires understanding the trade's dynamics, as well as the roles and responsibilities which determine work-life.

This unit profiles the trade's structure and scope as determined by The Apprenticeship and Certification Act, Apprenticeship and Certification Board, Sector Committees, and Industry Working Groups using the occupational standards from which the technical training is derived. This unit also includes short- and long-term career progression and social competencies. This includes information about major areas of working knowledge, activities and interactions at work, and expansive and restrictive workplaces, stressing their application to apprenticeship on-the-job training.

A sound grasp of the roles, workplace relationships, and possibilities introduced in this unit are part of 'learning to learn' in Manitoba's apprenticeship system. Senior apprentices are later offered information about the transfer of knowledge and skills in this system. Please refer to unit "Journeyperson Trainer" which explores the central and time-honoured foundation of trades journeywork.

Note: No percentage-weightings for test purposes are prescribed for this unit's objectives. Instead, a "Pass/Fail" grade will be recorded for the unit in its entirety.

Objectives and Content:	Percent of Unit Mark (%)
<p>1. Describe the structure and scope of the Refrigeration and Air Conditioning Mechanic and Refrigeration and Air Conditioning Mechanic (Residential) trades.</p> <p>a. The Apprenticeship and Certification Act</p> <ul style="list-style-type: none">• Apprenticeship and Certification Board• Sector Committees and Industry Working Groups (IWG)• General regulation, and specific trade regulations/by-laws• Policies regarding attendance, evaluation procedures, conduct and progression requirements (Apprenticeship Manitoba, training provider) <p>b. Uses of the Red Seal Occupational Standard (RSOS) or Provincial Occupational Standard (POS) (Residential)</p> <ul style="list-style-type: none">• Apprenticeship Manitoba technical training standards	n/a

- On-the-job report of hours
- Examinations (unit tests, final certification examinations)
- c. Opportunities and future career options
 - Generalists and specialists. The move toward specialization is well known to modern tradespeople. Some prefer to specialize and others want to do it all. Supervisory positions require a broad scope
 - Lead-hands and other immediate supervisors. Apprentices need to know how to become a lead-hand as much as they need to know the benefits and pit-falls of leadership between management, journeypersons, tradespersons, and other workers
 - Geographic mobility. What does it mean to a tradesperson to have to travel to find work? Are there more opportunities if they do? What are they? What are the drawbacks to being away from home for several weeks at a time?
 - Job hierarchies and innovations. What trade specific special training opportunities are available in the trade? Is there travel involved? How do these opportunities affect work assignments and career progression?

2. Describe two levels of workplace competency. n/a

- a. Job competencies related to workplace culture
 - Knowledge of workplace equipment and materials
 - Skills and techniques
- b. Social competencies related to workplace culture
 - Language of work
 - Workplace belief systems
 - Rules and meanings
 - Equity, diversity, and inclusion in the workplace

3. Describe accommodation for apprentices with accessibility requirements. n/a

- a. Awareness of the *Accessibility for Manitobans Act*
 - Customer service accessibility standard
 - Employment accessibility standard
 - Information and communications accessibility standard
 - Built environment
 - Transportation
- b. Technical training
 - Requirements
 - Roles and responsibilities
 - Services and information required by persons with accessibility requirements
- c. On-the-job
 - Requirements
 - Roles and responsibilities
 - Services and information required by persons with accessibility requirements

Refrigeration and Air Conditioning Mechanic/ Refrigeration and Air Conditioning Mechanic (Residential)

Unit: A2 Trade Safety Awareness

Level: One

Duration: 7 hours

Theory: 7 Hours

Practical: 0 Hours

Overview:

Safe working conditions, injury prevention and the preservation of health are of primary importance to industry in Canada. These responsibilities are shared and require the joint efforts of government, employers, supervisors and workers. It is imperative to be familiar and apply the Manitoba Workplace Safety and Health Act and Regulations. Safety education is an integral part of apprenticeship training both in school and on-the-job. This unit is an overview of occupational safety and health best practices in Manitoba and covers Personal Protective Equipment, the Workplace Hazardous Materials Information System and Safe Work Procedures. The unit also describes injury prevention and response. Finally, the unit reinforces these best practices by navigating the SAFE Work Manitoba website through each objective to apply Manitoba's most current safety and health standards. Additional trade safety awareness related resources are located on the Apprenticeship Manitoba website link below. Trade specific hazards and safe work practices are supplemented and delivered in-context within technical training units.

- **SAFE Work Manitoba website:** <https://www.safemanitoba.com/>
- **Safety resources:** <http://www.gov.mb.ca/aesi/apprenticeship/generalinfo/instructoreducators.html>

Note: No percentage-weightings for test purposes are prescribed for this unit's objectives. Instead, a "Pass/Fail" grade will be recorded for the unit in its entirety.

Objectives and Content:	Percent of Unit Mark (%)
<p>1. Define and describe Manitoba safety and health requirements.</p> <p>a. Overview of the <i>Workplace Safety and Health Act and Regulations</i></p> <ul style="list-style-type: none"> • Rights and responsibilities of workers under the <i>Act</i> • Rights and responsibilities of supervisors under the <i>Act</i> • Rights and responsibilities of employers under the <i>Act</i> <p>b. Public agencies</p> <ul style="list-style-type: none"> • Workplace Safety and Health (Enforcement) • SAFE Work Manitoba (Prevention) • Other <p>c. Codes of practice, guidelines, policies and standards (differences)</p> <p>d. Worker rights</p> <ul style="list-style-type: none"> • Right to know, participate and refuse • Protection from reprisal <p>e. Workplace safety and health program (worker's involvement)</p> <ul style="list-style-type: none"> • Workplace safety and health committee 	n/a

- Participation in investigation and inspection process

- 2. Identify and describe personal protective equipment (PPE) requirements and standards in the workplace.** n/a
- Employer, supervisor and worker responsibilities
 - Hierarchy of control measures
 - Personal protective equipment (PPE)
 - Eye and face protection
 - Hearing protection
 - Foot, head, hand and skin protection
 - Respiratory protection
 - Protective clothing (including Hi-Visibility/Hi-Vis)
 - Fall protection (trade specific)
- 3. Identify and describe the Workplace Hazardous Material Information System (WHMIS) and procedures.** n/a
- Hazard identification
 - Product labels, symbols and classification
 - Supplier
 - Workplace
 - Safety Data Sheets (SDS)
 - Chemical and biological hazards
 - Emergency washing
 - Transportation of dangerous goods
 - Storage and handling
- 4. Identify and describe Safe Work Procedures (SWP).** n/a
- Hazard identification
 - Uncontrolled risk
 - SWP development
- 5. Identify and describe injury prevention.**
- Hazard recognition, evaluation and control (SAFE acronym)
 - Occupational disease and illness
 - Musculoskeletal
 - Ergonomics
 - Psychological health and safety
 - Harassment and violence
 - Working alone
 - Young workers
 - Physical hazards
 - Chemical and biological hazards and exposures
 - Dust and fibres
 - Fumes, aerosols, gases and vapours
 - Confined space entry
 - Electrical safety
 - Lockout/tagout procedures
 - Fire types, fire extinguisher classifications and applications
- 6. Identify and describe injury response.** n/a
- Control the scene
 - Incident investigation

- Near miss
- Incident
- Serious incident
- c. Corrective actions
- d. Follow-up
- e. Reporting an injury (Workers Compensation Board of Manitoba (WCB))

7. **Demonstrate navigation and retrieval of key content areas from SAFE Work Manitoba's website and apply resources directly to unit objectives.** n/a
- a. Legislation
 - b. Bulletins
 - c. Templates
 - d. Shop Talk
 - e. Other resources

Refrigeration and Air Conditioning Mechanic/ Refrigeration and Air Conditioning Mechanic (Residential)

Unit: A3 Tools and Equipment

Level: One

Duration: 35 hours

Theory: 25 hours

Practical: 10 hours

Overview:

This unit is designed to provide the apprentice with the knowledge and skills for using and maintaining tools and equipment. Beginning with terminology, hazards and safe work practices, the unit will include tool and equipment jurisdictional regulations and manufactures' specifications. Topics will include: hand and portable/stationary power tools, specialized tools, diagnostic and measuring tools, hoisting, lifting, rigging equipment, access equipment, electronic and digital technology, and their selection, application, maintenance and procedures for use. Apprentices will demonstrate communication signals during hoisting, rigging, and lifting operations. Finally, apprentices will perform various practice activities to increase tool and equipment awareness and better understand their safe work procedures.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Define terminology associated with tools and equipment.	5%
2. Identify hazards and safe work practices and procedures pertaining to tools and equipment, hoisting, rigging, lifting and access equipment. <ul style="list-style-type: none">a. Regulationsb. Locationc. Surroundingsd. Loads	5%
3. Interpret jurisdictional codes and manufacturers' specifications pertaining to tools and equipment. <ul style="list-style-type: none">a. Manufactures' codes and instructions on tool and equipment useb. Manitoba Ozone Protection Industry Association (MOPIA) regulations on recovery equipment	5%
4. Identify types of tools and equipment and describe their selection, application, limitations and procedures for use. <ul style="list-style-type: none">a. Standard hand toolsb. Portable and stationary power toolsc. Brazing and soldering tools and equipmentd. Recovery, charging and evacuation equipmente. Diagnostic and measuring toolsf. Electronic and digital technology<ul style="list-style-type: none">• Computers and smartphones	35%

- Direct digital control and programmable logic controller (PLC)

5. **Describe and demonstrate the procedures to communicate during hoisting, lifting, and rigging operations.** 10%
- a. Standard crane and hoist hand signals
 - b. Electronic communications
6. **Describe and demonstrate the procedures used to inspect, clean, maintain and store tools and equipment.** 10%
- a. Standard hand tools
 - b. Portable and stationary power tools
 - c. Specialized tools
 - d. Diagnostic and measuring tools
 - e. Access equipment
 - f. Hoisting, lifting, and rigging equipment
7. **Perform various practice activities using tools and equipment to increase awareness and better understand their safe work procedures.** 30%
- a. Standard hand tools
 - b. Portable and stationary power tools
 - c. Specialized tools
 - d. Diagnostic and measuring tools
 - e. Access equipment
 - f. Hoisting, lifting and rigging equipment

Refrigeration and Air Conditioning Mechanic/ Refrigeration and Air Conditioning Mechanic (Residential)

Unit: A4 Equipment and Service Documents

Level: One

Duration: 14 hours

Theory: 14 hours

Practical: 0 hours

Overview:

This unit is designed to provide the apprentice with the knowledge and skills of equipment and service documents. Beginning with terminology, jurisdiction codes and manufactures' specifications, the unit introduces types of service documents used in the heating, ventilation, air conditioning and refrigeration (HVAC/R) industry and their application for use. Apprentices will describe and demonstrate the procedures to interpret and apply information found in equipment and service documentation. Finally, apprentices will interpret trade related documents and reference materials using various worksite applications. Equipment and service documents will also be used throughout future units of instruction and applied during activities such as estimation and coordination, installation, commissioning, retrofit and service work.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Define terminology associated with equipment and service documents.	5%
2. Interpret jurisdictional codes and manufacturers' specifications pertaining to equipment and service documents.	10%
3. Identify types of equipment and service documents and describe their applications.	25%
a. Manufacturers' specifications	
b. Manuals	
• Safety	
• Installation	
• Startup/commissioning	
• Service/troubleshooting	
• Operation	
c. Drawings and specifications	
d. Codes and standards	
e. Preventive/predictive maintenance sheets	
f. Technical bulletins	
g. Service records	
h. Refrigerant management records	
• MOPIA refrigerant forms	
i. Employer-specific forms and reports	
• Work orders	
• Incident reports	

- Permits
 - Timesheets/cards
 - Estimates
 - Warranty claim forms
- j. Manufacturers' and wholesaler catalogs

4. Describe and demonstrate the procedures to interpret and apply information found in equipment and service documentation. 25%

- a. Residential work
- b. Commercial work
- c. Institutional and industrial work

5. Interpret trade related documents and reference materials using various worksite applications. 35%

- a. Manufacturers' specifications
- b. Manuals
- c. Codes and standards
- d. Preventive/predictive maintenance sheets
- e. Technical bulletins
- f. Service records
- g. Refrigerant management records
- h. Employer-specific forms and reports
- i. Manufacturers' and wholesaler catalogs

Refrigeration and Air Conditioning Mechanic/ Refrigeration and Air Conditioning Mechanic (Residential)

Unit: A5 Trade Related Communications

Level: One

Duration: 7 hours

Theory: 7 hours

Practical: 0 hours

Overview:

This unit is designed to provide the apprentice with the knowledge and skills required to elevate trade related communications. Beginning with the ability to recognize effective verbal and non-verbal communication practices, apprentices will describe how they are applied differently to multiple stakeholders. This unit continues to build on these skills by applying learned techniques to various digital platforms used on the worksite. Finally, apprentices will perform these various communication skills while practicing active listening and response.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Identify and describe effective verbal and non-verbal communication practices. <ul style="list-style-type: none"> a. Customers b. Co-workers c. Site management d. Suppliers e. Journeypersons/apprentices f. Authorities having jurisdiction (AHJ) 	15%
2. Identify and describe types of communication devices and their operating procedures for worksite tasks and directions.	20%
3. Apply communication techniques using various digital platforms used on the worksite.	25%
4. Demonstrate and perform various communication skills and practice active listening and response. <ul style="list-style-type: none"> a. Verbal b. Non-verbal (body language) c. Personal responsibilities and attitudes d. Discrimination e. Diversity 	40%

Refrigeration and Air Conditioning Mechanic/ Refrigeration and Air Conditioning Mechanic (Residential)

Unit: A6 Trade Related Mathematics

Level: One

Duration: 24 hours

Theory: 24 hours

Practical: 0 hours

Overview:

This unit provides a review of foundational math concepts in the Refrigeration and Air Conditioning Mechanic trade. The application of these concepts will help apprentices develop problem solving and critical thinking skills. Finally, this unit will prepare students to apply math concepts, problem solving and critical thinking skills to solve trade related problems in future units of technical training in the Refrigeration and Air Conditioning Mechanic trade.

Objectives and Content:	Percent of Unit Mark (%)
1. Solve trade related foundational math problems.	20%
a. Proper, improper or mixed fractions	
b. Multiply, divide, reduce and expand common fractions	
c. Decimal and common fractions, standard operations and conversions	
d. Roots and exponents	
e. Order of operations	
f. Tolerances and margins of error	
g. Percentage	
2. Solve trade related problems between metric and customary measurement systems.	20%
a. Linear measures	
b. Area	
3. Solve trade related problems using calculations for simple and complex geometric shapes.	25%
a. Perimeter, circumference and area of polygons	
• Triangle	
• Rectangle	
• Circle	
• Quadrilateral and parallelogram	
b. Pythagorean theorem	
c. Volume	

4. **Solve trade related problems using ratio and proportion.** **25%**
a. Direct
b. Indirect
5. **Solve trade related algebraic problems involving simple equations and formulas.** **10%**

Refrigeration and Air Conditioning Mechanic/ Refrigeration and Air Conditioning Mechanic (Residential)

Unit: A7 Thermodynamic and Heat Fundamentals

Level: One

Duration: 28 hours

Theory: 28 hours

Practical: 0 hours

Overview:

This unit is designed to provide the apprentice with the knowledge and skills of thermodynamic and heat fundamentals. Beginning with terminology, the unit introduces the applications of thermodynamics, heat and gas laws. Apprentices will plot a refrigeration cycle using a pressure enthalpy diagram while performing associated calculations. Finally, apprentices will solve trade related problems for thermodynamics, heat and gas laws.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Describe terminology associated with thermodynamic and heat fundamentals.	10%
a. Thermodynamics	
b. Temperature scales	
c. Heat scale	
d. Gas Laws	
e. Pressure	
f. Pressure enthalpy	
g. States of matter	
h. Volume	
i. Energy, work, and power	
j. Enthalpy and entropy	
2. Identify and describe trade applications of thermodynamics and heat.	15%
a. Thermodynamics	
• First law of thermodynamics	
• Second law of thermodynamics	
b. Temperature conversion	
• Converting standard temperature scales (Celsius to Fahrenheit)	
• Converting from absolute temperature scales to standard temperature scales	
c. Specific, sensible, and latent heat	
• Heat measurement	
• Heat transfer	
• Heat production	
d. Gas Laws	
• Specific gravity	
• Specific volume	

- Density
 - e. Pressure and vacuum
 - Pressure drop
 - f. Pressure enthalpy charts
 - Saturated discharge temperature
 - Saturated suction temperature
 - Liquid sub-cooling
 - Vapor superheat
- 3. Demonstrate problem-solving techniques of thermodynamics and heat and plotting of a pressure enthalpy chart. 25%**
- a. Thermodynamics
 - b. Temperature conversion
 - c. Heat
 - d. Gas laws
 - e. Pressure
 - f. Volume
 - g. Energy, work and power
- 4. Plot a refrigeration cycle using a pressure enthalpy diagram and perform the associated calculations. 20%**
- a. Net refrigeration effect
 - b. Total heat of rejection
 - c. Heat of compression
 - d. Coefficient of performance
 - e. Fluid flow rate and velocity
 - f. Compressor displacement
- 5. Solve trade related problems for thermodynamics and heat. 30%**
- a. Thermodynamics
 - First law of thermodynamics
 - Second law of thermodynamics
 - b. Temperature conversion
 - Converting standard temperature scales (Celsius to Fahrenheit)
 - Converting from absolute temperature scales to standard temperature scales
 - c. Specific, sensible, and latent heat
 - Heat measurement
 - Heat transfer
 - Heat production
 - d. Gas Laws
 - Specific gravity
 - Specific volume
 - Density
 - e. Pressure and vacuum

Refrigeration and Air Conditioning Mechanic/ Refrigeration and Air Conditioning Mechanic (Residential)

Unit: A8 HVAC/R Activities I

Level: One

Duration: 63 hours

Theory: 33 hours

Practical: 30 hours

Overview:

This unit is designed to provide the apprentice with the knowledge and skills to perform HVAC/R activities. Beginning with terminology, hazards, and safe work practices, the unit will include jurisdictional codes and manufactures' specifications of industry products. Topics will include: brazing and soldering, refrigerants, gases, oil types, insulation, sealants and adhesives. Apprentices will demonstrate the procedures associated with HVAC/R activities. Finally apprentices will perform HVAC/R activities using various projects and techniques.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Define terminology associated with HVAC/R activities.	5%
2. Identify hazards and describe safe work practices of HVAC/R activities.	15%
a. Handling materials and supplies	
b. Disposing of waste materials	
c. Job hazard assessment	
d. Maintaining a safe work environment	
3. Interpret jurisdictional codes and manufacturers' specifications pertaining to HVAC/R activities.	5%
a. Refrigeration code for recovery, reclaim and recycle	
4. Identify and describe HVAC/R activities and their associated procedures.	20%
a. Brazing and soldering	
b. Leak types and pressure tests	
c. Refrigerants, gases and oil types	
d. Recovery, evacuation and charging tools and equipment	
e. Refrigerant training and certification requirements	
f. Insulation, sealants and adhesives	
5. Describe and demonstrate the procedures associated with HVAC/R activities.	15%
a. Cutting, bending, brazing, soldering, and assembling piping, tubing, and fittings	
b. Leak and pressure testing an HVAC/R system	
c. Refrigerants, gases, and oil	
d. Recovery, evacuating and charging an HVAC/R system	

e. Applying insulation, sealants, and adhesives

6. Perform HVAC/R activities using various projects and techniques.

40%

- a. Preparing the worksite
- b. Material handling and storage
- c. HVAC/R Activities
 - Soldering and brazing
 - Leak and pressure tests
 - Evacuation and charging refrigerants
 - Recovering and recycling

Refrigeration and Air Conditioning Mechanic/ Refrigeration and Air Conditioning Mechanic (Residential)

Unit: A9 HVAC/R System Fundamentals

Level: One

Duration: 42 hours

Theory: 32 hours

Practical: 10 hours

Overview:

This unit is designed to provide the apprentice with fundamental knowledge of HVAC/R systems. Beginning with terminology, hazards and safe work practices, the unit will include jurisdictional codes and manufactures' specifications pertaining to HVAC/R system fundamentals. Topics will include HVAC/R systems, components, placement factors and the procedures to place and secure. Apprentices will also demonstrate the procedures to inspect, test and perform maintenance on HVAC/R systems and components. Finally apprentices will perform fundamental HVAC/R system projects using various equipment, components and accessories.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Define terminology associated with HVAC/R system fundamentals.	5%
2. Identify hazards and safe work practices pertaining to HVAC/R system fundamentals.	5%
3. Interpret jurisdictional codes and manufacturers' specifications pertaining to HVAC/R system fundamentals.	5%
4. Identify and describe HVAC/R systems, components, placement factors and the procedures to place and secure.	25%
a. HVAC systems	
• Package and split units	
• Heat pumps	
• Gas, electric and hydronic heating	
• Heat reclaim	
• Humidifiers and dehumidifiers	
• Energy recovery ventilation (ERVs) and heat recovery ventilation (HRVs)	
b. Refrigeration systems	
• Coolers, and freezers	
• Industrial ultralow temperature	
• Ice machines and plate freezers	
• Chillers	
c. Placement factors and environmental considerations	
d. Anchors and supports	

- e. Isolation components

- 5. Identify and describe types of HVAC/R components and describe their characteristics and applications. 10%**
 - a. Compressors
 - b. Metering device
 - c. Heat exchangers
 - d. Valves and regulators
 - e. Pressure vessels

- 6. Describe the factors affecting system capacity. 10%**
 - a. Saturated discharge temperature
 - b. Saturated suction temperature
 - c. Liquid sub-cooling
 - d. Suction superheat
 - e. Suction to liquid heat exchanger
 - f. High and low side pressure drops
 - g. Temperature sensors
 - h. Transducers

- 7. Describe HVAC/R system fundamental operation and procedures. 5%**
 - a. Sequence of operation

- 8. Describe and demonstrate the procedures to inspect, test and perform maintenance on HVAC/R systems and components. 15%**
 - a. Tools and test equipment
 - b. System requirements
 - c. Electrical components
 - d. Mechanical components and accessories
 - e. Capacity and performance
 - f. Superheat and subcooling

- 9. Perform HVAC/R system fundamental projects using various equipment, components and accessories. 20%**
 - a. Measure temperatures at various system locations
 - b. Calculate superheat and subcooling
 - c. Measuring pressure readings at various system locations
 - d. Verify system operation mechanically and electrically

Refrigeration and Air Conditioning Mechanic/ Refrigeration and Air Conditioning Mechanic (Residential)

Unit: A10 Electrical and Control Fundamentals

Level: One

Duration: 63 hours

Theory: 43 hours

Practical: 20 hours

Overview:

This unit is designed to provide the apprentice with knowledge of electrical and control fundamentals, and concepts of electricity. Beginning with terminology, hazards and safe work practices, the unit will identify and describe electrical controls, components and accessories. Apprentices will demonstrate the procedures used to diagnose and troubleshoot basic electrical control circuit systems and components using schematic wiring diagrams. Apprentices will also calculate voltage, current, resistance and power in series, parallel and combination circuits. Finally, apprentices will perform the procedures to measure, diagnose and troubleshoot basic electrical control circuit systems and components using schematic wiring diagrams on various projects.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Define terminology associated with electrical and control fundamentals.	5%
2. Identify hazards and safe work practices pertaining to electrical and control fundamentals.	5%
a. Electricity	
b. Controls	
3. Identify and describe electrical fundamentals.	20%
a. Matter, energy, elements and molecules	
b. Current/electron flow, voltage, resistance and power	
c. Units of electrical measure	
• Single phase	
• Three phase	
d. Symbols	
e. Circuits	
• Series	
• Parallel	
• Series parallel combination	
f. Conductors	
g. Overload, grounded, open, and shorts	
h. Wiring diagrams	
i. Open and closed control loops	

4. **Identify and describe electrical control components and accessories.** **10%**
- a. Over current and overload devices
 - b. Distribution panels
 - c. Relays, switches, actuators, and contactors
 - Normally open and closed
 - Analog
 - Direct and reverse acting
 - d. Transformers
 - e. Thermostatic controls and sensors
 - f. Motors
5. **Identify types of monitoring/sensing controls and describe their applications and operation.** **15%**
- a. Temperature
 - b. Humidity
 - c. Pressure
 - d. Flow
 - e. Liquid level
 - f. Gas detection
6. **Describe and demonstrate the procedures used to diagnose and troubleshoot basic electrical control circuit systems and components using schematic wiring diagrams.** **15%**
7. **Calculate voltage, current, resistance and power in series, parallel and combination circuits.** **15%**
8. **Perform the procedures to measure, diagnose and troubleshoot basic electrical control circuit systems and components using schematic wiring diagrams on various projects.** **15%**
- a. Voltage
 - b. Current
 - c. Resistance
 - d. Power

Refrigeration and Air Conditioning Mechanic/ Refrigeration and Air Conditioning Mechanic (Residential)

Unit: A11 Gas Code I

Level: One

Duration: 25 hours

Theory: 20 hours

Practical: 5 hours

Overview:

This unit of instruction is designed to provide the apprentice with the basic knowledge and understanding of gas code. After completing this unit, apprentices will be able to learn the following objectives and content, amongst other skills, to:

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Define terminology associated with gas code.	10%
2. Identify hazards and safe work practices pertaining to gas code.	10%
3. Interpret codes and regulations pertaining to gas.	10%
4. Interpret information pertaining to gas found on drawings and specifications.	10%
5. Describe the identification systems and methods for gas.	10%
6. Identify tools and equipment relating to gas and describe their applications and procedures for use.	10%
7. Identify gas systems and describe their characteristics and applications.	10%
8. Identify types of gas and describe their properties and characteristics.	10%
9. Explain the system of measurement for gas.	10%
10. Describe the procedures used to install fittings and accessories for steel piping.	10%
