

# Steamfitter-Pipefitter Level 2

## **Steamfitter-Pipefitter**

### **UNIT      B1 TOOLS AND EQUIPMENT II**

**Unit:**            **B1a Tools and Equipment II**

**Level:**          Two

**Duration:**      7 hours

                    Theory:            7 hours

                    Practical:        0 hours

#### **Overview:**

This unit introduces Steamfitter-Pipefitter apprentices to additional procedures for selecting, using, and maintaining tools and equipment in a variety of steamfitting-project settings. The principles and practical methods introduced here are pursued in greater depth and complexity throughout technical training.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
1.    Describe the selection, use, and maintenance of fabrication (power tools) and equipment.	25%
2.    Describe intermediate level techniques for selection, use, and maintenance of fabrication (power tools) and equipment.	25%
3.    Describe the selection, use, and maintenance of additional steel welding tools and equipment.	25%
4.    Describe intermediate level techniques for selection, use, and maintenance of steel welding.	25%

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## Steamfitter-Pipefitter

**Unit:** B1b Advanced Hoisting, Lifting, and Rigging

**Level:** Two

**Duration:** 7 hours

Theory: 7 hours

Practical: 0 hours

### Overview:

This unit is designed to provide the Steamfitter-Pipefitter apprentice with the knowledge and understanding of advanced hoisting, lifting, and rigging.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
<b>1. Identify hazards and describe safe work practices pertaining to advanced hoisting, lifting and rigging operations.</b>	<b>25%</b>
a. Energized power lines	
b. Critical lifts	
c. Weather conditions	
d. Ground conditions	
e. Multi-tag lines	
<b>2. Identify documentation required for engineered lifts.</b>	<b>25%</b>
<b>3. Describe how to do calculations pertaining to hoisting, lifting and rigging.</b>	<b>25%</b>
a. Sling angle	
b. Load/weight	
c. Centre of gravity	
d. Safe working loads (SWL)	
<b>4. Describe how to do advanced lifts.</b>	<b>25%</b>
a. Ball and hook	
b. Multi-lift	
c. Transferring	
d. Unbalanced	
e. Positioning	

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## Steamfitter-Pipefitter

### UNIT      B2 FABRICATION II

**Subunit:**    B2a Spool and Fitting Fabrication

**Level:**        Two

**Duration:**    22 hours

                  Theory:        8 hours

                  Practical:      14 hours

#### Overview:

This unit is designed to provide the Steamfitter-Pipefitter apprentice with the knowledge and understanding of spool and fitting fabrication.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
1. <b>Define terminology associated with spool fabrication.</b>	<b>4%</b>
2. <b>Interpret information pertaining to spool fabrication found on drawings and specifications.</b>	<b>4%</b>
3. <b>Identify tools and equipment relating to spool fabrication and describe their applications and procedures for use.</b>	<b>4%</b>
4. <b>Describe the procedures used to fabricate and assemble pipe spools.</b>	<b>4%</b>
5. <b>Demonstrate the procedures used to fabricate pipe spools.</b>	<b>32%</b>
6. <b>Define terminology associated with fitting fabrication.</b>	<b>4%</b>
7. <b>Interpret codes and regulations pertaining to fitting fabrication.</b>	<b>4%</b>
8. <b>Interpret information pertaining to fitting fabrication found on drawings and specifications.</b>	<b>3%</b>
9. <b>Identify tools and equipment relating to fitting fabrication and describe their applications and procedures for use.</b>	<b>3%</b>
10. <b>Identify types of fittings and describe their characteristics and applications.</b>	<b>3%</b>
a.    Elbow	
b.    Tees	
c.    Flanges	
d.    Laterals	
e.    Crosses	

- |   |            |
|---|------------|
| <b>11. Describe the procedures used to layout and fabricate fittings.</b> | <b>3%</b>  |
| <b>12. Demonstrate the procedures to fabricate pipe fittings.</b>         | <b>32%</b> |

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## Steamfitter-Pipefitter

**Subunit: B2b Stainless Steel Piping**

**Level:** Two

**Duration:** 15 hours

Theory: 8 hours

Practical: 7 hours

### Overview:

This unit is designed to provide the Steamfitter-Pipefitter apprentice with the knowledge and understanding of stainless steel piping.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
1. Define terminology associated with stainless steel piping.	3%
2. Identify hazards and describe safe work practices pertaining to stainless steel piping.	3%
3. Interpret codes and regulations pertaining to stainless steel piping.	3%
4. Interpret information pertaining to stainless steel piping found on drawings and specifications.	3%
5. Describe identification systems and methods used for stainless steel piping.	3%
6. Identify tools and equipment related to stainless steel piping and describe their applications and procedures for use.	3%
7. Identify fittings used with stainless steel piping and describe their purpose and applications.	3%
8. Identify stainless steel piping accessories and describe their purpose and applications. a. Supports b. Hangers c. Sleeves	3%
10. Explain the systems of measurement for stainless steel piping. a. Dimension b. Length c. Wall thickness/schedule	3%
11. Describe the procedures used to measure stainless steel piping.	3%
12. Describe the procedures used to inspect stainless steel piping.	3%

- |   |            |
|---|------------|
| <b>13. Identify the methods used to cut stainless steel piping and describe their associated procedures.</b>  | <b>3%</b>  |
| <b>14. Identify the methods used to join stainless steel piping and describe their associated procedures.</b> | <b>3%</b>  |
| a. Threaded   |            |
| b. Grooved  |            |
| a. Welded   |            |
| b. Flanged  |            |
| c. Press-fit  |            |
| d. Compression fittings   |            |
| <b>15. Describe the procedures used to install fittings and accessories for stainless steel piping.</b>       | <b>6%</b>  |
| <b>16. Describe the different types, schedules, uses of stainless steel pipe.</b>                             | <b>5%</b>  |
| <b>17. Demonstrate the procedures used to measure, cut and join stainless steel piping.</b>                   | <b>50%</b> |

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## Steamfitter-Pipefitter

**Subunit:** B2c Specialty Piping

**Level:** Two

**Duration:** 24 hours

Theory: 24 hours

Practical: 0 hours

### Overview:

Steamfitters-Pipefitters require a good, practical grasp of specialty piping. This unit is the program gateway to further learning about these topics.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
1. Define terminology associated with specialty piping.	6%
2. Identify hazards and describe safe work practices pertaining to specialty piping.	6%
3. Interpret codes and regulations pertaining to specialty piping.	6%
4. Interpret information pertaining to specialty piping found on drawings and specifications.	6%
5. Describe the identification systems and methods for specialty piping.	6%
6. Identify tools and equipment relating to specialty piping and describe their applications and procedures for use.	6%
7. Identify specialty piping systems and describe their characteristics and applications.	6%
8. Identify types of specialty piping and describe their properties and characteristics.	7%
a. Duplex	
b. Super duplex	
a. Copper nickel	
b. Chrome molybdenum	
c. Monel	
d. Inconel	
e. Titanium	
f. Aluminum	
g. Fiberglass piping	
h. Other	
9. Identify fittings used with specialty piping and describe their purpose and applications.	7%



10. **Identify specialty piping accessories and describe their purpose and applications.** 7%
  - a. Supports
  - b. Hangers
  - c. Sleeves
  
11. **Explain the systems of measurement for specialty piping.** 7%
  - a. Dimension
  - b. Length
  - c. Wall thickness/schedule
  
12. **Describe the procedures used to measure specialty piping.** 6%
  
13. **Describe the procedures used to inspect specialty piping.** 6%
  
14. **Identify the methods used to cut specialty piping and describe their associated procedures.** 6%
  
15. **Identify the methods used to join specialty piping and describe their associated procedures.** 6%
  
16. **Describe the procedures used to install fittings and accessories for specialty piping.** 6%

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## Steamfitter-Pipefitter

**Subunit: B2d Industrial Drawings I**

**Level:** Two

**Duration:** 15 hours

Theory: 15 hours

Practical: 0 hours

### Overview:

This unit of is designed to provide the Steamfitter-Pipefitter apprentice with the knowledge and understanding of industrial drawings.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
<b>1. Define terminology associated with industrial drawings and specifications.</b>	<b>25%</b>
<b>2. Identify types of industrial drawings and describe their applications.</b> a. Process and instrumentation drawings (PandID) b. Spool sheets c. Isometric (ISO) drawings d. Revisions e. Vendor	<b>25%</b>
<b>3. Identify symbols relating to industrial drawings and describe their characteristics and applications.</b>	<b>25%</b>
<b>4. Identify industrial drawing-related documentation and describe their applications.</b>	<b>25%</b>

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## Steamfitter-Pipefitter

**Subunit:** B2e GTAW Welding

**Level:** Two

**Duration:** 25 hours

Theory: 5 hours

Practical: 20 hours

### Overview:

Steamfitter-Pipefitter's require a good, practical grasp of Tungsten inert gas (TIG) welding. This unit is the program gateway to further your welding skills.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
1. Define terminology associated with TIG welding.	4%
2. Identify hazards and describe safe work practices pertaining to TIG welding. a. Personal b. Workplace	4%
3. Interpret codes and regulations pertaining to TIG welding. a. Certification requirements	4%
4. Interpret information pertaining to TIG welding found on drawings and specifications. a. Symbols and abbreviations	4%
5. Describe the properties and characteristics of metals.	4%
6. Identify types of TIG welding equipment and describe their associated components, accessories and consumables.	4%
7. Identify basic weld joints and describe their applications.	4%
8. Describe the procedures used to set up, adjust, maintain and store TIG welding equipment, their components, accessories and consumables.	4%
9. Describe the procedures used to tack weld.	4%
10. Demonstrate the procedures used to set up, adjust, maintain and store TIG welding equipment, their components, accessories and consumables.	32%
11. Demonstrate Gas tungsten arc welding.	32%

## Steamfitter-Pipefitter

**UNIT      B3 LAYOUT II**

**Subunit:    B3a Industrial Drawings II**

**Level:**     Two

**Duration:** 15 hours

    Theory:        15 hours

    Practical:     0 hours

**Overview:**

Upon completion of this unit of instruction apprentices will be able to show understanding of intermediate level industrial drawings related to steamfitter-pipefitter situations.

<b>Objectives and Content:</b>	<b>Percent of</b>
1. Interpret and extract information from industrial drawings and specifications.	50%
2. Generate drawings.	50%

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## Steamfitter-Pipefitter

**Subunit: B3b Template Development**

**Level:** Two

**Duration:** 15 hours

Theory: 15 hours

Practical: 0 hours

**Overview:**

This unit is designed to provide the Steamfitter-Pipefitter apprentice with the knowledge and understanding of template development.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
1. Define terminology associated with template development.	20%
2. Interpret information pertaining to template development found on drawings and specifications.	20%
3. Identify tools and equipment relating to template development and describe their applications and procedures for use.	20%
4. Identify the methods used for template development. a. Simple b. Parallel line c. Radial line d. Triangulation	20%
5. Describe the procedures used to develop templates.	20%

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## Steamfitter-Pipefitter

### UNIT B4 HYDRONIC SYSTEMS

**Subunit:** B4a Hydronic Systems

**Level:** Two

**Duration:** 56 hours

Theory: 40 hours

Practical: 16 hours

#### Overview:

Steamfitters-Pipefitters require a good, practical grasp of hydronic systems. This unit is the program gateway to further learning about these topics.

<b>Objectives and Content</b>	<b>Percent of Unit Mark (%)</b>
1. Identify piping arrangements used with hydronic cooling systems and describe their characteristics and applications.	5%
2. Describe the procedures used to layout and install piping for hydronic systems.	5%
3. Describe the procedures used to install hydronic system components.	5%
4. Describe the procedures used to maintain and repair hydronic system components.	10%
5. Describe the procedures used to test and troubleshoot hydronic system components.	10%
6. Describe the procedures used to install heat transfer equipment.	10%
7. Describe the procedures used to protect heat transfer equipment.	10%
8. Describe the procedures used to maintain and repair heat transfer equipment.	10%
9. Describe the procedures used to test and troubleshoot heat transfer equipment.	10%
10. Demonstrate the procedures used to install, maintain, repair, test and Troubleshoot hydronic systems.	25%

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## Steamfitter-Pipefitter

**Subunit: B4b Hydronic System Controls**

**Level:** Two

**Duration:** 18 hours

Theory: 14 hours

Practical: 4 hours

### Overview:

This unit is designed to provide the Steamfitter-Pipefitter apprentice with the additional knowledge and understanding of hydronic system controls. After completing this unit, apprentices will be able to learn, amongst other skills, the following objectives.

<b>Objectives and Content: .</b>	<b><u>Percent of Unit Mark (%)</u></b>
1. Describe the procedures used to install hydronic systems control components.	15%
2. Describe the procedures used to protect hydronic systems control components.	15%
3. Describe the procedures used to set and adjust hydronic systems control components.	15%
4. Describe the procedures used to maintain and repair hydronic systems control components.	15%
5. Describe the procedures used to test and troubleshoot hydronic systems control components.	20%
6. Demonstrate the procedures used to install, maintain, repair, test and troubleshoot hydronic system controls.	20%

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## Steamfitter-Pipefitter

**SubUnit: B4c Cross Connection Controls Awareness**

**Level:** Two

**Duration:** 7 hours

Theory: 7 hours

Practical: 0 hours

### Overview:

This uni is designed to provide the Steamfitter-Pipefitter apprentice with the knowledge and understanding of cross connection control. After completing this unit, apprentices will be able to learn, amongst other skills, the following objectives.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
1. Define terminology associated with cross connection control.	10%
2. Identify hazards and describe safe work practices pertaining to cross connection control.	10%
3. Interpret codes and regulations pertaining to cross connection control: training and certification requirements.	10%
4. Interpret information pertaining to cross connection control found on drawings and specifications.	10%
5. Identify tools and equipment relating to cross connection control and describe their applications and procedures for use.	10%
6. Explain backflow and its causes.	10%
7. Identify types of cross connection control devices and describe their characteristics, operation and applications.	10%
8. Describe the requirements used to install cross connection control devices.	10%
9. Describe the requirements used to maintain and repair cross connection control devices.	10%
10. Describe the requirements used to test and troubleshoot cross connection control devices.	10%

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# Apprenticeship Manitoba

## Steamfitter-Pipefitter

### UNIT B5 HEAT TRACING SYSTEMS (INCLUDES LIQUID)

**Subunit:** B5a Hydronic Heat Trace Systems I

**Level:** Two

**Duration:** 25 hours

Theory: 16 hours

Practical: 9 hours

#### Overview:

Steamfitters-Pipefitters require a good, practical grasp of hydronic heat trace systems. This unit is the program gateway to further learning about these topics.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
1. Define terminology associated with hydronic heat trace systems.	6%
2. Identify hazards and describe safe work practices pertaining to hydronic heat trace systems.	6%
3. Interpret codes and regulations pertaining to hydronic heat trace systems.	6%
4. Interpret information pertaining to hydronic heat trace systems found on drawings and specifications.	6%
5. Identify tools and equipment relating to hydronic heat trace systems and describe their applications and procedures for use.	6%
6. Explain the principles of heat transfer.	5%
a. Radiation	
b. Conduction	
c. Convection	
7. Identify sources of heat used in hydronic heat trace systems.	5%
a. Oil	
b. Gas	
c. Solid fuel	
d. Geothermal	
e. Solar	
f. Electric	
8. Identify sources of cooling used in hydronic heat trace systems.	5%
a. Ground source	
b. Cooling	
c. Direct expansion	

9. **Identify types of hydronic heat trace systems and describe their characteristics and operation.** 5%
- a. High pressure (awareness of)
  - b. Low pressure
10. **Identify hydronic heating heat trace system components and describe their purpose and operation.** 5%
- a. Piping
  - b. Boilers : low mass and high mass
  - c. Boiler trim
  - d. Heat pumps
  - e. Expansion tanks
  - f. Heat exchangers
  - g. Circulating pumps
  - h. Mixing components
  - i. Valves
11. **Explain forces that impact on pipe and tubing in hydronic heat trace systems and their associated calculations.** 5%
- a. Thermal expansion
  - b. Thermal contraction
  - c. Weight
  - d. Friction loss
  - e. Turbulence
  - f. Galvanic action
12. **Identify types of heat transfer equipment and describe their characteristics and operation** 5%
- a. Radiators
  - b. Convectors
  - c. Pipe coils
  - d. Horizontal and vertical unit heaters
  - e. Radiant panels
  - f. Heat exchangers, others, panels
13. **Identify fluids used in hydronic heat trace systems and describe their characteristics and applications.** 5%
- a. Water
  - b. Glycol
  - c. Methyl hydrate
14. **Identify additives used in hydronic heat trace systems and describe their purpose and applications.** 5%
15. **Identify piping arrangements used with hydronic heat trace systems and describe their characteristics and applications.** 5%
- a. Reverse return
  - b. Direct return
  - c. Monoflow
  - d. Series loop
  - e. Primary/secondary

- 16. Identify hydronic cooling system components and describe their purpose and operation. 10%**
- a. Piping
  - b. Cooling towers
  - c. Expansion tanks
  - d. Chillers
  - e. Circulating pumps
  - f. Valves
  - g. Panels, coils, etc.
- 17. Demonstrate the procedures used to install, maintain, repair, test and troubleshoot hydronic heat trace systems. 10%**

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## Steamfitter-Pipefitter

**Subunit: B5b Hydronic Heat Trace Systems Controls I**

**Level:** Two

**Duration:** 9 hours

Theory: 7 hours

Practical: 2 hours

### Overview:

Steamfitters-Pipefitters require a good, practical grasp of hydronic heat trace systems control. This unit is the program gateway to further learning about these topics.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
1. Define terminology associated with hydronic heat trace systems control.	15%
2. Identify hazards and describe safe work practices pertaining to hydronic heat trace systems control.	15%
3. Interpret codes and regulations pertaining to hydronic heat trace systems control.	10%
4. Interpret information pertaining to hydronic heat trace systems control found on drawings and specifications.	10%
5. Identify tools and equipment relating to hydronic heat trace systems controls and describe their applications and procedures for use.	10%
6. Identify types of hydronic heat trace systems controls and describe their characteristics, applications and operation	8%
a. Operating and temperature controls	
b. Safety controls	
7. Identify hydronic heat trace systems control components and describe their purpose and operation.	10%
8. Demonstrate the procedures used to install, maintain, repair, test and troubleshoot heat trace controls.	22%

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## Steamfitter-Pipefitter

### UNIT      B6 MATHEMATICS II

**Subunit:**    B6a Mathematics II

**Level:**      Two

**Duration:** 20 hours

    Theory:          20 hours

    Practical:        0 hours

**Overview:**

Upon completion of this unit of instruction apprentices will be able to show understanding of intermediate mathematics fundamentals related to steamfitter-pipefitter situations which includes electricity

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
1.    Describe by reviewing level one contents relating to elevations and grades.	10%
2.    Describe rolling offsets.	10%
3.    Describe jumper offsets.	10%
4.    Describe special case of 45° offset.	10%
5.    Describe water pressure: head and force.	10%
6.    Describe air pressure and air chambers.	10%
7.    Describe ratio of pipe capacities.	10%
8.    Describe ratio and proportion.	10%
9.    Describe by reviewing any problem contents.	20%

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## Steamfitter-Pipefitter

### UNIT B7 SCIENCE II

**Subunit: B7a Science II**

**Level: Two**

**Duration: 15 hours**

Theory: 15 hours

Practical: 0 hours

#### Overview:

This unit is designed to provide the Steamfitter-Pipefitter apprentice with additional knowledge and understanding of mathematics. After completing this unit, apprentices will be able to learn, amongst other skills, the following objectives.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
<b>1. Describe at an intermediate level with respect to sciences metals and alloys:</b>	<b>50%</b>
a. Define metals, alloys, conduction, melting point, specific heat, linear expansion, ductility, shear strength, tensile strength, compressive strength, working(safe) strength, malleable, ferrous, non-ferrous ,anneal, harden, temper.	
b. Identify the most common metals	
c. Identify the most common alloys	
d. Define cost effectiveness	
e. Identify and describe properties of metals	
f. Identify and describe problems in linear expansion	
g. Identify and describe bi-metal strip and its uses	
h. Identify and describe various solder	
i. Identify and describe wrought iron	
j. Identify and describe corrosion (oxidation): chemical and electrochemical	
k. Identify and describe methods in preventing corrosion	
l. Identify and describe galvanic series	
m. Identify and describe factors aiding corrosion	
n. Identify and describe corrosion resistant materials	
<b>2. Describe at an intermediate level with respect to sciences hydrodynamics, hydrostatics and pneumatics:</b>	<b>30%</b>
a. Define hydrodynamics, hydrostatics, pneumatics, fluids, viscosity, adhesion, cohesion, capillary action, relative density, pressure (psi, psia, pascals, head).	
b. Total pressure, transmission of pressure, vacuum, partial vacuum, siphon, manometer, buoyancy, laminar flow, turbulent flow, pitot tube, velocity head, venturi, bernoulli's theorem, hydraulic ram, water hammer, cavitation.	
c. Identify and describe plumbing systems	
d. Identify and describe flow of liquids and gases	
e. Identify and describe pressurized systems	
f. Identify and describe hydraulic jacks and presses	

- g. Identify and describe thrust blocks
- h. Identify and describe air chambers
- i. Identify and describe pumps
- j. Identify and describe syphons
- k. Identify and describe velocity head
- l. Identify and describe bourdon type pressure gauge
- m. Identify and describe uses of buoyance
- n. Identify and describe conversion of fps to gpm and gpm to fps, m/s to i/s and i/s to m/s
- o. Identify and describe flow in venturis
- p. Identify and describe Bernoulli's theorem applied
- q. Identify and describe Charle's. and Boyle's gas laws

**3. Describe heat load calculations, fan laws and pumps.**

**20%**

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## Steamfitter-Pipefitter

### UNIT      B8 ELECTRICAL II

**Subunit:**    B8a Electrical II

**Level:**      Two

**Duration:** 20 hours

    Theory:      20 hours

    Practical:    0 hours

#### Overview:

Steamfitter-Pipefitters require a good, practical grasp of electricity. This unit of instruction is the program gateway to further learning about this topic. Electrical theory is presented in a manner that is relevant and useful. The apprentice will learn a basic overview of the fundamentals of electricity.

<b>Objectives and Content:</b>	<b><u>Percent of Unit Mark (%)</u></b>
<b>1. Describe basic electricity.</b>	<b>33%</b>
a. Electron theory	
b. Ohm's Law	
c. Basic series circuits	
d. Parallel circuit	
e. Millivoltage	
f. 24 volt circuit	
g. 110 volt circuit	
h. Open and closed circuits (controls)	
i. Relay circuit	
j. Voltage drops in circuit	
<b>2. Describe electrical devices.</b>	<b>33%</b>
a. Thermopile and thermocouple	
b. Transformer	
c. Gas valves	
d. Thermostats	
e. Safety controls	
f. Connectors and connections	
g. Wire sizes and types	
h. Identify and explain meters	
i. Code requirements	
j. Motors	
<b>3. Describe gas appliances, sequence of operation.</b>	<b>34%</b>
a. Basic wiring systems	



- b. Circuit wiring systems
- c. Wiring diagrams of the appliances
- d. Troubleshooting controls and circuits
- e. Electronic ignition systems

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